Appendices

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Appendix 1	List of Submissions and Issues Raised (10 pages)
Appendix 2	Environment Protection Licence Number 1879 (26 pages)
Appendix 3*	Social Impact Assessment Update and Response to Submissions – Key Insights Pty Ltd – December 2017 (96 pages)
Appendix 4	Additional Intersection Analysis and Response to Submissions – Intersect Traffic – May 2018 (30 pages)
Appendix 5*	Updated Noise & Vibration Impact Assessment – Vipac Engineers & Scientists Ltd – September 2018 (138 pages)
Appendix 6*	Updated Amended Air Quality Assessment – Vipac Engineers & Scientists Ltd – September 2018 (102 pages)
Appendix 7*	Updated Blast Impact Assessment – Vipac Engineers & Scientists Ltd – September 2018 (16 pages)

Appendix 8*	Biodiversity Assessment Report - Updated Final Report – Biosis Pty Ltd – November 2017 (200 pages)
Appendix 9	Correspondence with RMS – dated 31 May 2018 and 8 August 2018 (6 pages)
Appendix 10*	Drivers Code of Conduct – Brandy Hill Quarry (16 pages)
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* A colour version of this Appendix is available on the digital version of this document

Appendix 1

List of Submissions and Issues Raised

(Total No. of pages including blank pages = 10)

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Table A
Government Agency Submissions

Agency	**Issues**
Department of Planning & Environment	1, 2, 3, 4, 5, 6, 7, 16, 17
Department of Primary Industries	6, 7, 11, 12, 15
Environment Protection Authority	2, 3, 4, 11, 16, 17
Hunter New England Local Health District	2, 3, 4, 11, 16
Heritage Council	8
Maitland City Council	1, 2, 9
Office of Environment & Heritage	6, 8, 10
Port Stephens Council	1, 5, 6, 11, 13
Rural Fire Service	14
Roads & Maritime Services	1

Issue Reference Numbers – OBJECTION & COMMENTS (Table A)		
1. Traffic and Transport	7. Rehabilitation	13. Economic Impact
2. Noise	8. Heritage	14. Bush Fire Protection
3. Blasting	9. Health	15. Erosion & Sediment Control
4. Air Quality	10. Flooding / Floodplain Management	16. Waste and Wastewater
5. Social Impacts	11. Surface Water and Potable Water	17. Hours of Operation
6. Ecology and Biodiversity	12. Groundwater	

Table B
Non-Confidential Public Submissions – Objection

Name	**Location**	**Issues**
Website Submissions – Organisations		
Kate Washington MP, NSW Parliament	Raymond Terrace, NSW	1, 2, 3, 12
Brandy Hill and Seaham Action Group	Brandy Hill, NSW	1, 2, 3, 4, 5, 6, 9, 12, 13, 14
John Redman Voice of Wallalong and Woodville Inc.	Morpeth, NSW	1, 2, 5, 7, 9
MCQAG	Paterson, NSW	15
Public Submissions		
Aaron Sherritt	Glen Oak, NSW	1, 2, 4, 12
Alan Lawrence	Bolwarra Heights, NSW	1, 2, 4, 5, 12
Andreas Krieger	Brandy Hill, NSW	1
Anne Kitchener	Seaham, NSW	2, 3, 6
Anthony Cincotta	Brandy Hill, NSW	1, 3, 4, 12
Astrid Godwin	Nelsons Plains, NSW	1, 2
Belinda Cincotta	Brandy Hill, NSW	1, 2, 12
Brandy Hill Holiday Pet Care	Brandy Hill, NSW	1, 4, 5
Brent Caukwell	Brandy Hill, NSW	1, 5
Bronwyn White	Seaham, NSW	1, 2, 3, 4, 5, 9, 11, 14
Bruce Perkins	Brandy Hill, NSW	1, 2, 4, 5, 6
Carl Mackaway	Seaham, NSW	1, 2, 3, 4, 6, 7, 13
Catherine Kilpatrick	Brandy Hill, NSW	1, 4, 9, 12
Chris Wokes	Paterson, NSW	2, 4
Christopher Dobija	Seaham, NSW	2, 4
Christopher Graham	Nelsons Plains, NSW	1, 2, 7
Claudia Stockenhuber	Bolwarra Heights, NSW	1, 2, 4
Darren Gilmour	Seaham, NSW	1, 2, 3, 4, 5, 7, 12, 14
Darryl Hetherington	Bolwarra Heights, NSW	1, 2, 4, 5, 6, 11, 12
David Jarrett	Brandy Hill, NSW	1
David Kitchener	Seaham, NSW	1, 2, 3, 4, 5, 6, 7, 11, 15
David Rakus	Brandy Hill, NSW	10
Dean Rayfield	Seaham, NSW	1, 2, 3, 12
Geoffrey Pettett	Wingham, NSW	1, 2, 3, 4, 5, 12, 13
Gina Sherritt	Glen Oak, NSW	1, 2, 3, 4, 12
Glenn Albrecht	Duns Creek, NSW	1, 2, 4, 5, 11, 12

Issue Reference Numbers – OBJECTION & COMMENTS (Tables B, C & D)		
1. Traffic and Transport	6. Biodiversity	11. Economic Impact
2. Noise	7. Rehabilitation	12. Hours of Operation
3. Blasting	8. Heritage	13. Planning Issues
4. Air Quality	9. Health	14. Visual / Lighting
5. Social Amenity	10. Surface Water	15. Cumulative Impacts

Table B (Cont'd)
Non-Confidential Public Submissions – Objection

Name	**Location**	**Issues**
Public Submissions		
Graham Parr	Seaham, NSW	1, 2, 3, 5, 7, 11, 12
Helen Hising	Brandy Hill, NSW	1, 2, 3, 4, 5, 9, 11, 12
Ian Betts	Brandy Hill, NSW	1, 2, 4, 9, 12
Ian Docherty	Woodville, NSW	1, 2, 4, 11
Ian Wilkinson	Brandy Hill, NSW	1, 2, 3, 4, 5, 14
James Moore	Brandy Hill, NSW	1, 2, 5, 9, 12
James Sherritt	Glen Oak, NSW	1, 2, 3, 4, 12
Janette Dobija	Seaham, NSW	2, 4
Jill Cronin	Brandy Hill, NSW	1, 2, 3, 4, 5, 6
John Beesley	Seaham, NSW	1, 2, 3, 4, 5, 6, 7, 11
John Dobija	Seaham, NSW	2, 4
John Middleton	Woodville, NSW	1, 2
Johnny Dobija	Seaham, NSW	2, 4
Julie Taylor	Black Hill, NSW	1, 2, 4, 5, 12
Karolyn Walker	Seaham, NSW	1, 2, 4, 5, 6, 9
Kasimir Jankowski	Brandy Hill, NSW	1, 2, 3
Kathleen Moore	Brandy Hill, NSW	1, 12
Katia Holland	Medowie, NSW	1, 2, 3, 4, 5, 12
Ken Wilson	Nelsons Plains, NSW	1, 2, 4
Kim Streat	Brandy Hill, NSW	1, 2, 5, 12
Leanne Griffiths	Seaham, NSW	12
Leslie & Vicki Parkes	Seaham, NSW	1, 4, 7, 12
Linda Harold	Bolwarra Heights, NSW	1, 2, 3
Louise Cowan	Nelsons Plains, NSW	1, 4
Marcella Dobija	Seaham, NSW	2, 4
Maxine Zerafa	Warabrook, NSW	1, 2, 4
Melanie Meredith	Brandy Hill, NSW	1, 2, 4, 5, 12
Melissa Richens	Brandy Hill, NSW	1, 4, 9
Michael Freund	Brandy Hill, NSW	1, 2, 4, 5
Michael O'Brien	Nelsons Plains, NSW	1, 2
Nathanaial Godwin	Nelsons Plains, NSW	1, 2
Neil Ritchie	Brandy Hill, NSW	1, 2, 5, 9, 12

Issue Reference Numbers – OBJECTION & COMMENTS (Tables B, C & D)		
1. Traffic and Transport	6. Biodiversity	11. Economic Impact
2. Noise	7. Rehabilitation	12. Hours of Operation
3. Blasting	8. Heritage	13. Planning Issues
4. Air Quality	9. Health	14. Visual / Lighting
5. Social Amenity	10. Surface Water	15. Cumulative Impacts

Table B (Cont'd)
Non-Confidential Public Submissions – Objection

Name	Location	Issues
Public Submissions		
Nicole Clark	Seaham, NSW	1, 2, 3, 4, 12, 13
Norman Sage	Lorn, NSW	1, 5, 12
Olivia Freund	Brandy Hill, NSW	1, 2, 12
Patricia Betts	Brandy Hill, NSW	1, 2, 3, 4, 5, 9, 12
Paul Kerkhof	Seaham, NSW	1, 2, 12
Paul O'Donohue	Bolwarra Heights, NSW	1, 2, 4
Penny Dunstan	Brandy Hill, NSW	1, 5, 7, 12
Peta Mason	Brandy Hill, NSW	1, 2, 4
Peter Bush	Brandy Hill, NSW	1, 2, 4, 5, 6, 9, 12
Peter Manuel	Nelsons Plains, NSW	1
Peter Rees	Woodville, NSW	1, 2
Philip Shaw	Brandy Hill, NSW	1, 4
Rhonda Docherty	Woodville, NSW	1, 2, 4, 11
Richard Frost	Seaham, NSW	1, 2, 4
Ron Woodrow	Brandy Hill, NSW	1, 2, 4, 5, 9, 12
Sally Pollinelli	Brandy Hill, NSW	1, 2, 3, 4, 12
Sandra O'Donohue	Bolwarra Heights, NSW	1, 2, 4
Scott & Michelle Thompson	Brandy Hill, NSW	1, 2, 4, 5, 9, 12
Shaun Raymond	Bolwarra Heights, NSW	1, 2, 4, 5, 9, 12
Simon White	Seaham, NSW	1, 2, 3, 6, 9
Steve Matthews	Brandy Hill, NSW	1, 2, 12
Sue Graham	Brandy Hill, NSW	1, 2
Susan Frew	Brandy Hill, NSW	1, 2, 6
Tracy Wilkinson	Brandy Hill, NSW	1, 2, 4, 6, 12, 13
William Frew	Brandy Hill, NSW	1, 4, 6

Issue Reference Numbers – OBJECTION & COMMENTS (Tables B, C & D)		
1. Traffic and Transport	6. Biodiversity	11. Economic Impact
2. Noise	7. Rehabilitation	12. Hours of Operation
3. Blasting	8. Heritage	13. Planning Issues
4. Air Quality	9. Health	14. Visual / Lighting
5. Social Amenity	10. Surface Water	15. Cumulative Impacts

Table C
Confidential Public Submissions – Objection

DPE Ref. No.	Location	Issues
195233	Bolwarra Heights, NSW	1, 2, 5
197319	Bolwarra Heights, NSW	1, 2, 4, 5, 6, 12
200740	Bolwarra Heights, NSW	1, 4, 5, 6, 7, 9, 12
195268	Brandy Hill, NSW	1, 6, 12
196077	Brandy Hill, NSW	1, 2, 5, 12
196895	Brandy Hill, NSW	1, 5, 12
197029	Brandy Hill, NSW	1, 2, 5, 6
197132	Brandy Hill, NSW	1, 4
197187	Brandy Hill, NSW	1, 2, 12
197671	Brandy Hill, NSW	1, 2, 6
197778	Brandy Hill, NSW	1, 2, 4, 6, 9
197823	Brandy Hill, NSW	1, 12
198140	Brandy Hill, NSW	1, 2, 4, 5
198299	Brandy Hill, NSW	1, 2, 4, 12
199038	Brandy Hill, NSW	1
199187	Brandy Hill, NSW	1, 2, 4, 5, 7, 9, 12
199704	Brandy Hill, NSW	1, 2
199973	Brandy Hill, NSW	1, 2, 4, 12
199979	Brandy Hill, NSW	1, 2, 4
200108	Brandy Hill, NSW	1, 5, 6, 9
200142	Brandy Hill, NSW	1, 2, 4, 5, 6, 9
200205	Brandy Hill, NSW	1, 2, 3, 4, 7, 11, 12
200207	Brandy Hill, NSW	1, 2, 3, 4, 7, 11, 12
200217	Brandy Hill, NSW	1, 2, 4, 5, 9
200452	Brandy Hill, NSW	1, 2, 4, 5, 6, 7
200470	Brandy Hill, NSW	1, 2, 5
200563	Brandy Hill, NSW	1, 12
200581	Brandy Hill, NSW	1, 5, 12
200585	Brandy Hill, NSW	1, 2, 5, 12
200595	Brandy Hill, NSW	1, 2, 4, 5, 7, 12
200611	Brandy Hill, NSW	1, 2, 3, 4, 9, 12
200654	Brandy Hill, NSW	1, 2, 5, 12

Issue Reference Numbers – OBJECTION & COMMENTS (Tables B, C & D)		
1. Traffic and Transport	6. Biodiversity	11. Economic Impact
2. Noise	7. Rehabilitation	12. Hours of Operation
3. Blasting	8. Heritage	13. Planning Issues
4. Air Quality	9. Health	14. Visual / Lighting
5. Social Amenity	10. Surface Water	15. Cumulative Impacts

Table C (Cont'd)
Confidential Public Submissions – Objection

DPE Ref. No.	Location	Issues
200682	Brandy Hill, NSW	1, 2
200710	Brandy Hill, NSW	1, 2, 5, 6
200724	Brandy Hill, NSW	1, 2, 4, 12
200742	Brandy Hill, NSW	1, 2, 4, 5, 6, 7
200744	Brandy Hill, NSW	1, 2, 4, 5, 6, 7
200748	Brandy Hill, NSW	1, 2, 4, 5, 6, 7
200752	Brandy Hill, NSW	1, 2, 4, 5, 6, 7
200754	Brandy Hill, NSW	1, 2, 9, 12
201030	Brandy Hill, NSW	1, 2, 3, 4, 5
200617	Hinton, NSW	1, 2, 5
200549	Kotara, NSW	1, 10, 14
200694	Lorn, NSW	1, 2, 4, 5
197174	Maryland, NSW	1
194856	Nelsons Plains, NSW	1, 2, 3, 4, 9, 12
200706	Nelsons Plains, NSW	1
200642	Paterson, NSW	1, 2, 5
200644	Paterson, NSW	1, 5, 12
200156	Raworth, NSW	1
196722	Raymond Terrace, NSW	1
200567	Raymond Terrace, NSW	1, 2, 5, 7, 12, 14
200593	Raymond Terrace, NSW	1, 2, 4, 9, 11, 15
195673	Seaham, NSW	1
196486	Seaham, NSW	1, 12
199770	Seaham, NSW	1, 2, 4, 6, 12
200029	Seaham, NSW	1, 2, 6, 7, 12
200110	Seaham, NSW	1, 12
200184	Seaham, NSW	1, 2, 3, 4, 5, 6, 9, 12, 13
200468	Seaham, NSW	1, 2, 4, 9
200472	Seaham, NSW	1, 2, 3, 4, 5, 6, 9, 12
200482	Seaham, NSW	1, 2, 3, 4, 5, 6, 7, 12
200583	Seaham, NSW	1, 2, 3, 12
200599	Seaham, NSW	1, 2, 3, 4, 5, 9, 12
200601	Seaham, NSW	1, 2, 3, 4, 5, 6, 9, 10, 12

Issue Reference Numbers – OBJECTION & COMMENTS (Tables B, C & D)		
1. Traffic and Transport	6. Biodiversity	11. Economic Impact
2. Noise	7. Rehabilitation	12. Hours of Operation
3. Blasting	8. Heritage	13. Planning Issues
4. Air Quality	9. Health	14. Visual / Lighting
5. Social Amenity	10. Surface Water	15. Cumulative Impacts

Table C (Cont'd)
Confidential Public Submissions – Objection

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DPE Ref. No.	Location	Issues
200619	Seaham, NSW	1, 14
200670	Seaham, NSW	2, 3, 4, 5, 9
200674	Seaham, NSW	1, 2
200676	Seaham, NSW	1, 2, 4, 5, 6, 12
200680	Seaham, NSW	2, 3, 4, 6, 9, 12
200686	Seaham, NSW	1, 2, 3, 4, 6, 12
200688	Seaham, NSW	1, 2, 4, 6, 9, 15
200690	Seaham, NSW	1, 2, 4
200692	Seaham, NSW	1, 2, 4, 5
200698	Seaham, NSW	2, 6, 9
200700	Seaham, NSW	2, 6
200702	Seaham, NSW	1, 4, 9
200704	Seaham, NSW	2, 4, 9
200708	Seaham, NSW	4, 6, 9
201026	Seaham, NSW	1, 2, 4, 6, 12
201028	Seaham, NSW	1, 12
200112	Not Supplied	1, 5

Table D
Non-Confidential Public Submissions – Comments

Name	Location	Issues
Website Submissions – Organisations		
Dave Feeney Karuah Indigenous Corporation,	Karuah, NSW	8
Public Submissions		
Donna Lidbury	Nelsons Plains, NSW	1, 2, 4, 5, 8, 13
Geoff & Elizabeth Foot	Nelsons Plains, NSW	1, 2, 4, 12
Jeff Ford	Brandy Hill, NSW	1
Robert Palmer	Seaham, NSW	1, 2, 12

Issue Reference Numbers – OBJECTION & COMMENTS (Tables B, C & D)		
1. Traffic and Transport	6. Biodiversity	11. Economic Impact
2. Noise	7. Rehabilitation	12. Hours of Operation
3. Blasting	8. Heritage	13. Planning Issues
4. Air Quality	9. Health	14. Visual / Lighting
5. Social Amenity	10. Surface Water	15. Cumulative Impacts

Table E
Non-Confidential Public Submissions – Support

Name	Location	Issues
Website Submissions – Organisations		
James Garvey RLJ Land Pty Ltd	Dunns Creek, NSW	1
James Garvey Delta 5 Land Pty Ltd,	Seaham, NSW	1
Public Submissions		
Andrew Nicholas	Brandy Hill, NSW	1, 2, 3
Chris Nicholas	Brandy Hill, NSW	1

Table F
Confidential Public Submissions – Support

DPE Ref. No.	Location	Issues
200399	Anna Bay, NSW	4, 5, 6
195768	Glen Oak, NSW	1, 2, 3, 4
195812	Granville, NSW	1, 3
195633	St Ives, NSW	1

Issue Reference Numbers - SUPPORT		
1. Employment	3. Economic stability	5. Care for environment
2. Institutional value	4. Community relationship	6. Safe operations

Appendix 2

Environment Protection Licence Number 1879

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Environment Protection Licence

Licence Details	
Number:	1879
Anniversary Date:	15-June

Licensee
HANSON CONSTRUCTION MATERIALS PTY LTD
LOCKED BAG 5260
PARRAMATTA NSW 2124

Premises
HANSON CONSTRUCTION MATERIALS PTY LTD
OFF SEAHAM ROAD
SEAHAM NSW 2324

Scheduled Activity
Crushing, grinding or separating
Extractive activities

Fee Based Activity	**Scale**
Crushing, grinding or separating	> 500000-2000000 T annual processing capacity
Land-based extractive activity	> 500000-2000000 T annual capacity to extract, process or store

Region
North - Hunter Ground Floor, NSW Govt Offices, 117 Bull Street NEWCASTLE WEST NSW 2302
Phone: (02) 4908 6800
Fax: (02) 4908 6810
PO Box 488G NEWCASTLE NSW 2300

Environment Protection Licence

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Information about this licence

Dictionary

A definition of terms used in the licence can be found in the dictionary at the end of this licence.

Responsibilities of licensee

Separate to the requirements of this licence, general obligations of licensees are set out in the Protection of the Environment Operations Act 1997 (“the Act”) and the Regulations made under the Act. These include obligations to:

- ensure persons associated with you comply with this licence, as set out in section 64 of the Act;
- control the pollution of waters and the pollution of air (see for example sections 120 - 132 of the Act);
- report incidents causing or threatening material environmental harm to the environment, as set out in Part 5.7 of the Act.

Variation of licence conditions

The licence holder can apply to vary the conditions of this licence. An application form for this purpose is available from the EPA.

The EPA may also vary the conditions of the licence at any time by written notice without an application being made.

Where a licence has been granted in relation to development which was assessed under the Environmental Planning and Assessment Act 1979 in accordance with the procedures applying to integrated development, the EPA may not impose conditions which are inconsistent with the development consent conditions until the licence is first reviewed under Part 3.6 of the Act.

Duration of licence

This licence will remain in force until the licence is surrendered by the licence holder or until it is suspended or revoked by the EPA or the Minister. A licence may only be surrendered with the written approval of the EPA.

Licence review

The Act requires that the EPA review your licence at least every 5 years after the issue of the licence, as set out in Part 3.6 and Schedule 5 of the Act. You will receive advance notice of the licence review.

Fees and annual return to be sent to the EPA

For each licence fee period you must pay:

- an administrative fee; and
- a load-based fee (if applicable).

The EPA publication “A Guide to Licensing” contains information about how to calculate your licence fees. The licence requires that an Annual Return, comprising a Statement of Compliance and a summary of any monitoring required by the licence (including the recording of complaints), be submitted to the EPA. The Annual Return must be submitted within 60 days after the end of each reporting period. See condition R1 regarding the Annual Return reporting requirements.

Usually the licence fee period is the same as the reporting period.

Transfer of licence

The licence holder can apply to transfer the licence to another person. An application form for this purpose is available from the EPA.

Public register and access to monitoring data

Part 9.5 of the Act requires the EPA to keep a public register of details and decisions of the EPA in relation to, for example:

- licence applications;
- licence conditions and variations;
- statements of compliance;
- load based licensing information; and
- load reduction agreements.

Under s320 of the Act application can be made to the EPA for access to monitoring data which has been submitted to the EPA by licensees.

This licence is issued to:

HANSON CONSTRUCTION MATERIALS PTY LTD
LOCKED BAG 5260
PARRAMATTA NSW 2124

subject to the conditions which follow.

1 Administrative Conditions

A1 What the licence authorises and regulates

A1.1 This licence authorises the carrying out of the scheduled activities listed below at the premises specified in A2. The activities are listed according to their scheduled activity classification, fee-based activity classification and the scale of the operation.

Unless otherwise further restricted by a condition of this licence, the scale at which the activity is carried out must not exceed the maximum scale specified in this condition.

Scheduled Activity	Fee Based Activity	Scale
Crushing, grinding or separating	Crushing, grinding or separating	> 500000 - 2000000 T annual processing capacity
Extractive activities	Land-based extractive activity	> 500000 - 2000000 T annual capacity to extract, process or store

A1.2 Production at the premises must not exceed 700,000 tonnes per annum (measured over the licensing reporting period) of material obtained.

Note:

During 2011 the licensee made application to increase production to 700,000 tpa. The licensee obtained legal advice that the development consent for the quarry does not limit production. Port Stephens Council Development Advisory Panel confirmed that the development consent does not limit the extraction volume from the quarry. The 700,000 tpa limit is based on the 2011 application.

A2 Premises or plant to which this licence applies

A2.1 The licence applies to the following premises:

Premises Details
HANSON CONSTRUCTION MATERIALS PTY LTD
OFF SEAHAM ROAD
SEAHAM
NSW 2324
LOT 1 DP 264033, LOT 100 DP 712886, LOT 101 DP 712886, LOT 1 DP 737844, LOT 2 DP 737844, LOT 19 DP 752487, LOT 20 DP 752487, LOT 21 DP 752487, LOT 36 DP 752487, LOT 56 DP 752487, LOT 57 DP 752487, LOT 58 DP 752487, LOT 59 DP 752487, LOT 236 DP 752487, LOT 1 DP 1006516, LOT 2 DP 1006516, LOT 3 DP 1006516

A3 Information supplied to the EPA

A3.1 Works and activities must be carried out in accordance with the proposal contained in the licence application, except as expressly provided by a condition of this licence.

In this condition the reference to "the licence application" includes a reference to:
a) the applications for any licences (including former pollution control approvals) which this licence replaces under the Protection of the Environment Operations (Savings and Transitional) Regulation 1998; and
b) the licence information form provided by the licensee to the EPA to assist the EPA in connection with the issuing of this licence.

2 Discharges to Air and Water and Applications to Land

P1 Location of monitoring/discharge points and areas

P1.1 The following points referred to in the table below are identified in this licence for the purposes of monitoring and/or the setting of limits for the emission of pollutants to the air from the point.

Air

EPA identi-fication no.	Type of Monitoring Point	Type of Discharge Point	Location Description
1	Dust monitoring		Dust deposition gauge, shown as "Giles Road" on Figure titled "Hanson Construction Materials - Brandy Hill Quarry - Dust Monitoring Locations - September 2010" (on EPA file LIC10/854).
2	Dust monitoring		Dust deposition gauge, shown as "Front Gate" on Figure titled "Hanson Construction Materials - Brandy Hill Quarry - Dust Monitoring Locations - September 2010" (on EPA file LIC10/854).
3	Dust monitoring		Dust deposition gauge, shown as "Cattleyards" on Figure titled "Hanson Construction Materials - Brandy Hill Quarry - Dust Monitoring Locations - September 2010" (on EPA file LIC10/854).

P1.2 The following utilisation areas referred to in the table below are identified in this licence for the purposes of the monitoring and/or the setting of limits for any application of solids or liquids to the utilisation area.

P1.3 The following points referred to in the table are identified in this licence for the purposes of the monitoring and/or the setting of limits for discharges of pollutants to water from the point.

Water and land

EPA Identi-fication no.	Type of Monitoring Point	Type of Discharge Point	Location Description

4	Discharge and Monitoring Point	Discharge and Monitoring Point	Discharge point from "North Sediment Dam 2" as identified on Figure Two from report titled 'Water Management System Works - Brandy Hill Quarry, Brandy Hill' dated 24 September 2012. Copy of report is kept on EPA file LIC10/854-03
5	Discharge and Monitoring Point	Discharge and Monitoring Point	Discharge point from "Polishing Dam 3" as identified on 'Figure Three from report titled 'Water Management System Works - Brandy Hill Quarry, Brandy Hill' dated 24 September 2012. Copy of report is kept on EPA file LIC10/854-03
6	Discharge and Monitoring Point	Discharge and Monitoring Point	Discharge point from "North Sediment Dam 1" as identified on Figure Two from report titled 'Water Management System Works - Brandy Hill Quarry, Brandy Hill' dated 24 September 2012. Copy of report is kept on EPA file LIC10/854-03

P1.4 The following points referred to in the table below are identified in this licence for the purposes of weather and/or noise monitoring and/or setting limits for the emission of noise from the premises.

Noise/Weather

EPA identi-fication no.	Type of monitoring point	Location description
7	Air blast overpressure & ground vibration peak particle velocity monitoring	"Blast Location 7" on the quarry driveway identified on map titled "Brandy Hill Quarry" and stored as DOC16/416773 on EPA file EF13/3039.
8	Air blast overpressure & ground vibration peak particle velocity monitoring	"Blast Location 8" identified on map titled "Brandy Hill Quarry" and stored as DOC16/416773 on EPA file EF13/3039.

3 Limit Conditions

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L2 Concentration limits

L2.1 For each monitoring/discharge point or utilisation area specified in the table\s below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.

L2.2 Water and/or Land Concentration Limits

POINT 4,5,6

Pollutant	Units of Measure	50 percentile concentration limit	90 percentile concentration limit	3DGM concentration limit	100 percentile concentration limit
Oil and Grease	Visible				non-visible
pH	pH				6.5 - 8.5
Total suspended solids	milligrams per litre				50

L2.3 Where a pH quality limit is specified in the table, the specified percentage of samples must be within the specified ranges.

L2.4 To avoid any doubt, this condition does not authorise the pollution of waters by any pollutant other than those specified in the table\s.

L3 Waste

L3.1 The licensee must not cause, permit or allow any waste generated outside the premises to be received at the premises for storage, treatment, processing, reprocessing or disposal or any waste generated at the premises to be disposed of at the premises, except as expressly permitted by the licence.

L3.2 This condition only applies to the storage, treatment, processing, reprocessing or disposal of waste at the premises if it requires an environment protection licence.

L4 Noise limits

L4.1 Noise generated at the premises must not exceed the noise limits in the table below. The locations referred to in the table below are indicated by "Figure 1 - Monitoring Locations" in the report titled '*Hanson Quarry, Brandy Hill - Background Noise Monitoring*' dated March 2011. This report is filed on EPA file LIC10/854.

Locality	Location	NOISE LIMITS dB(A)	NOISE LIMITS dB(A)
		Day / Evening / Night LAeq(15 minute)	Night LA1(1 minute)
R1	13B Giles Road, Seaham	36	45
R2	115 Brandy Hill Drive, Seaham	36	45
R3	13 Mooghin Road, Seaham	36	45
All other noise receiver locations		36	45

L4.2 For the purpose of the table above;
a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sunday and Public Holidays;
b) Evening is defined as the period 6pm to 10pm; and
c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sunday and Public Holidays.

L4.3 The noise limits set out in the Conditions above, apply under all meteorological conditions except for the following:
a) Wind speed greater than 3 metres/second at 10 metres above ground level; or
b) Stability category F temperature inversion conditions and wind speeds greater than 2 metres/second at 10 metres above ground level; or
c) Stability category G temperature inversion conditions.

L4.4 For the purposes of the condition above, data recorded by the meteorological station identified as the Bureau of Meteorology (BoM) Tocal Automatic Weather Station must be used to determine meteorological conditions.

L4.5 To determine compliance with the LAeq(15 minute) noise limits referred to above, the noise measurement equipment must be located;
a) at the most effected point at a location where there is no dwelling at the location; or
b) approximately on the property boundary, where any dwelling is situated 30 metres or less from the property boundary closest to the premises; or
c) within 30 metres of a dwelling fascade, but not closer than 3 metres, where any dwelling on the property is situated more than 30 metres from the property boundary closest to the premises; or
d) where applicable, within approximately 50 metres of the boundary of a National Park or a Nature Reserve.

L5 Blasting

L5.1 Blasting in or on the premises must only be carried out between 0900 hours and 1700 hours, Monday to Saturday. Blasting in or on the premises must not take place on Sundays or Public Holidays without the prior approval of the EPA.

L5.2 The airblast overpressure level from blasting operations in or on the premises must not exceed:
115 dB (Lin Peak) for more than 5% of the total number of blasts during each reporting period;
at either monitoring point 7 or 8 in Condition P1.4.

L5.3 The airblast overpressure level from blasting operations in or on the premises must not exceed:
120 dB (Lin Peak) at any time;
at either monitoring point 7 or 8 in Condition P1.4.

L5.4 The ground vibration peak particle velocity from blasting operations carried out in or on the premises must not exceed:
5 mm/second for more than 5% of the total number of blasts during each reporting period;
at either monitoring point 7 or 8 in Condition P1.4.

L5.5 The ground vibration peak particle velocity from blasting operations carried out in or on the premises must not exceed:
10 mm/second at any time;
at either monitoring point 7 or 8 in Condition P1.4.

L5.6 Offensive blast fume must not be emitted from the premises.

Definition:

Offensive blast fume means post-blast gases from the detonation of explosives at the premises that by reason of their nature, duration, character or quality, or the time at which they are emitted, or any other circumstances:
1. *are harmful to (or likely to be harmful to) a person that is outside the premises from which it is emitted, or*
2. *interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted.*

4 Operating Conditions

O1 Activities must be carried out in a competent manner

O1.1 Licensed activities must be carried out in a competent manner.
This includes:
a) the processing, handling, movement and storage of materials and substances used to carry out the activity; and
b) the treatment, storage, processing, reprocessing, transport and disposal of waste generated by the activity.

O2 Maintenance of plant and equipment

O2.1 All plant and equipment installed at the premises or used in connection with the licensed activity:
a) must be maintained in a proper and efficient condition; and
b) must be operated in a proper and efficient manner.

O3 Dust

O3.1 The premises must be maintained in a condition which minimises or prevents the emission of dust from the premises.

O4 Effluent application to land

O4.1 Any waste material removed from the sewage treatment system must be disposed of appropriately having regard to public health and the environment.

O4.2 The quantity of effluent/solids applied to the utilisation area must not exceed the capacity of the area to effectively utilise the effluent/solids.

For the purposes of this condition, 'effectively utilise' includes the use of the effluent/solids for pasture or crop production, as well as the ability of the soil to absorb the nutrient, salt, hydraulic load and organic material.

O4.3 Effluent application to the utilisation area(s) must not occur in a manner that causes surface run-off from the utilisation area(s).

O4.4 The on-site sewage management system and any application area must be inspected and maintained on a regular schedule to ensure proper operation of the system.

O4.5 The licensee must ensure the treatment system is serviced by a suitably qualified service provider that has an appropriate level of experience with the treatment system type. All servicing must be at the frequency recommended by the manufacturer.

O4.6 The licensee must retain a copy of all on-site sewage treatment system servicing reports.

O5 Processes and management

O5.1 The drainage from all areas at the premises which will liberate suspended solids when stormwater runs over these areas must be diverted into adequately sized sedimentation basins.

O5.2 The sedimentation basins must be maintained to ensure that their design capacity is available for the storage of all runoff from cleared areas.

O5.3 All above ground tanks containing material that is likely to cause environmental harm must be bunded or have an alternative spill containment system in place.

O6 Waste management

O6.1 The licensee must ensure that any liquid and/or non liquid waste generated and/or stored at the premises is assessed and classified in accordance with the EPA Waste Classification Guidelines as in force from time to time.

O6.2 The licensee must ensure that waste identified for recycling is stored separately from other waste.

5 Monitoring and Recording Conditions

M1 Monitoring records

M1.1 The results of any monitoring required to be conducted by this licence or a load calculation protocol must be recorded and retained as set out in this condition.

M1.2 All records required to be kept by this licence must be:
a) in a legible form, or in a form that can readily be reduced to a legible form;
b) kept for at least 4 years after the monitoring or event to which they relate took place; and
c) produced in a legible form to any authorised officer of the EPA who asks to see them.

M1.3 The following records must be kept in respect of any samples required to be collected for the purposes of this licence:
a) the date(s) on which the sample was taken;
b) the time(s) at which the sample was collected;
c) the point at which the sample was taken; and
d) the name of the person who collected the sample.

M2 Requirement to monitor concentration of pollutants discharged

M2.1 For each monitoring/discharge point or utilisation area specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1. The licensee must use the sampling method, units of measure, and sample at the frequency, specified opposite in the other columns:

M2.2 Air Monitoring Requirements

POINT 1,2,3

Pollutant	Units of measure	Frequency	Sampling Method
Particulates - Deposited Matter	grams per square metre per month	Monthly	AM-19

M2.3 Water and/ or Land Monitoring Requirements

POINT 4,5,6

Pollutant	Units of measure	Frequency	Sampling Method

Oil and Grease	Visible	Daily during any discharge	Visual Inspection
pH	pH	Daily during any discharge	Grab sample
Total suspended solids	milligrams per litre	Daily during any discharge	Grab sample

M3 Testing methods - concentration limits

M3.1 Monitoring for the concentration of a pollutant emitted to the air required to be conducted by this licence must be done in accordance with:
a) any methodology which is required by or under the Act to be used for the testing of the concentration of the pollutant; or
b) if no such requirement is imposed by or under the Act, any methodology which a condition of this licence requires to be used for that testing; or
c) if no such requirement is imposed by or under the Act or by a condition of this licence, any methodology approved in writing by the EPA for the purposes of that testing prior to the testing taking place.

Note: The *Protection of the Environment Operations (Clean Air) Regulation 2010* requires testing for certain purposes to be conducted in accordance with test methods contained in the publication "Approved Methods for the Sampling and Analysis of Air Pollutants in NSW".

M3.2 Subject to any express provision to the contrary in this licence, monitoring for the concentration of a pollutant discharged to waters or applied to a utilisation area must be done in accordance with the Approved Methods Publication unless another method has been approved by the EPA in writing before any tests are conducted.

M4 Recording of pollution complaints

M4.1 The licensee must keep a legible record of all complaints made to the licensee or any employee or agent of the licensee in relation to pollution arising from any activity to which this licence applies.

M4.2 The record must include details of the following:
a) the date and time of the complaint;
b) the method by which the complaint was made;
c) any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect;
d) the nature of the complaint;
e) the action taken by the licensee in relation to the complaint, including any follow-up contact with the complainant; and
f) if no action was taken by the licensee, the reasons why no action was taken.

M4.3 The record of a complaint must be kept for at least 4 years after the complaint was made.

M4.4 The record must be produced to any authorised officer of the EPA who asks to see them.

M5 Telephone complaints line

M5.1 The licensee must operate during its operating hours a telephone complaints line for the purpose of receiving any complaints from members of the public in relation to activities conducted at the premises or by the vehicle or mobile plant, unless otherwise specified in the licence.

M5.2 The licensee must notify the public of the complaints line telephone number and the fact that it is a complaints line so that the impacted community knows how to make a complaint.

M5.3 The preceding two conditions do not apply until 3 months after: the date of the issue of this licence.

M6 Blasting

M6.1 To determine compliance with conditions L5.2, L5.3, L5.4 and L5.5:
a) Airblast overpressure and ground vibration levels must be measured and electronically recorded for monitoring points 7 and 8 for the parameters specified in Column 1 of the table below; and
b) The licensee must use the units of measure, sampling method, and sample at the frequency specified opposite in the other columns.

Parameters	Units of Measure	Frequency	Sampling Method
Airblast Overpressure	Decibels (Linear Peak)	All Blasts	Australian Standard AS 2187.2-2006
Ground Vibration Peak Particle Velocity	millimetres/second	All Blasts	Australian Standard AS 2187.2-2006

M7 Other monitoring and recording conditions

M7.1 To assess compliance with the noise limits of this licence, attended noise monitoring must be undertaken in accordance with the conditions of this licence and:
a) at the locations R1, R2 and R3 as listed in the limit conditions of this licence;
b) occur annnually in a reporting period, during the times of year when noise propogation from the premises is likely to be at its worst, that is generally winter conditions; and
c) occur during the night period as defined in the NSW Industrial Noise Policy.

M7.2 Noise monitoring must be carried out in accordance with Australian Standard AS 2659.1 - 1998: Guide to the use of sound measuring equipment - Portable sound level metres, and the compliance monitoring guidance provided in the NSW Industrial Noise Policy.

Note: The EPA will consider upon request a review of the noise monitoring results required under this condition after a period of three (3) years (i.e. after August 2014) to assess the suitability and need of the required noise monitoring.

6 Reporting Conditions

R1 Annual return documents

R1.1 The licensee must complete and supply to the EPA an Annual Return in the approved form comprising:
1. a Statement of Compliance,
2. a Monitoring and Complaints Summary,
3. a Statement of Compliance - Licence Conditions,
4. a Statement of Compliance - Load based Fee,
5. a Statement of Compliance - Requirement to Prepare Pollution Incident Response Management Plan,
6. a Statement of Compliance - Requirement to Publish Pollution Monitoring Data; and
7. a Statement of Compliance - Environmental Management Systems and Practices.

At the end of each reporting period, the EPA will provide to the licensee a copy of the form that must be completed and returned to the EPA.

R1.2 An Annual Return must be prepared in respect of each reporting period, except as provided below.

R1.3 Where this licence is transferred from the licensee to a new licensee:
a) the transferring licensee must prepare an Annual Return for the period commencing on the first day of the reporting period and ending on the date the application for the transfer of the licence to the new licensee is granted; and
b) the new licensee must prepare an Annual Return for the period commencing on the date the application for the transfer of the licence is granted and ending on the last day of the reporting period.

R1.4 Where this licence is surrendered by the licensee or revoked by the EPA or Minister, the licensee must prepare an Annual Return in respect of the period commencing on the first day of the reporting period and ending on:
a) in relation to the surrender of a licence - the date when notice in writing of approval of the surrender is given; or
b) in relation to the revocation of the licence - the date from which notice revoking the licence operates.

R1.5 The Annual Return for the reporting period must be supplied to the EPA via eConnect *EPA* or by registered post not later than 60 days after the end of each reporting period or in the case of a transferring licence not later than 60 days after the date the transfer was granted (the 'due date').

R1.6 The licensee must retain a copy of the Annual Return supplied to the EPA for a period of at least 4 years after the Annual Return was due to be supplied to the EPA.

R1.7 Within the Annual Return, the Statements of Compliance must be certified and the Monitoring and Complaints Summary must be signed by:
a) the licence holder; or
b) by a person approved in writing by the EPA to sign on behalf of the licence holder.

R1.8 The licensee must report any exceedence of the licence blasting limits to the regional office of the EPA as soon as practicable after the exceedence becomes known to the licensee or to one of the licensee’s employees or agents.

Note: The term "reporting period" is defined in the dictionary at the end of this licence. Do not complete the

Annual Return until after the end of the reporting period.

Note: An application to transfer a licence must be made in the approved form for this purpose.

R2 Notification of environmental harm

R2.1 Notifications must be made by telephoning the Environment Line service on 131 555.

R2.2 The licensee must provide written details of the notification to the EPA within 7 days of the date on which the incident occurred.

Note: The licensee or its employees must notify all relevant authorities of incidents causing or threatening material harm to the environment immediately after the person becomes aware of the incident in accordance with the requirements of Part 5.7 of the Act.

R3 Written report

R3.1 Where an authorised officer of the EPA suspects on reasonable grounds that:
a) where this licence applies to premises, an event has occurred at the premises; or
b) where this licence applies to vehicles or mobile plant, an event has occurred in connection with the carrying out of the activities authorised by this licence,
and the event has caused, is causing or is likely to cause material harm to the environment (whether the harm occurs on or off premises to which the licence applies), the authorised officer may request a written report of the event.

R3.2 The licensee must make all reasonable inquiries in relation to the event and supply the report to the EPA within such time as may be specified in the request.

R3.3 The request may require a report which includes any or all of the following information:
a) the cause, time and duration of the event;
b) the type, volume and concentration of every pollutant discharged as a result of the event;
c) the name, address and business hours telephone number of employees or agents of the licensee, or a specified class of them, who witnessed the event;
d) the name, address and business hours telephone number of every other person (of whom the licensee is aware) who witnessed the event, unless the licensee has been unable to obtain that information after making reasonable effort;
e) action taken by the licensee in relation to the event, including any follow-up contact with any complainants;
f) details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event; and
g) any other relevant matters.

R3.4 The EPA may make a written request for further details in relation to any of the above matters if it is not satisfied with the report provided by the licensee. The licensee must provide such further details to the EPA within the time specified in the request.

R4 Other reporting conditions

R4.1 **Noise Compliance Assessment Report**

A noise compliance assessment report must be submitted to the EPA within thirty (30) days of the completion of the yearly noise monitoring. The assessment must be prepared by a suitably qualified and experienced acoustical consultant and include:
a) an assessment of compliance with noise limits detailed in the limit conditions of this licence; and
b) an outline of any management actions taken within the monitoring period to address any exceedences of the limits detailed in the limit conditions of this licence.

R4.2 The licensee must report any exceedence of the licence blasting limits to the regional office of the EPA as soon as practicable after the exceedence becomes known to the licensee or to one of the licensee's employees or agents.

R4.3 **Blast Monitoring Report**

The licensee must supply, with each Annual Return, a Blast Monitoring Report which must include the following information relating to each blast carried out within the premises during the reporting period covered by the Annual Return:
a) the date and time of the blast;
b) the location of the blast on the premises;
c) the blast monitoring results at each blast monitoring station; and
d) an explanation for any missing blast monitoring results.

7 General Conditions

G1 Copy of licence kept at the premises or plant

G1.1 A copy of this licence must be kept at the premises to which the licence applies.

G1.2 The licence must be produced to any authorised officer of the EPA who asks to see it.

G1.3 The licence must be available for inspection by any employee or agent of the licensee working at the premises.

8 Special Conditions

E1 Completed Pollution Reduction Programs (PRPs)

E1.1 The licensee has completed the Pollution Reduction Programs (PRPs) as detailed in the table below.

PRP No.	Details	Completed
1	Water Management Investigations	July 2011

2	Operational Noise	March 2011
3	Water Management System Works	September 2012
4	Upgrade Existing Septic System	December 2016

Dictionary

General Dictionary

3DGM [in relation to a concentration limit]	Means the three day geometric mean, which is calculated by multiplying the results of the analysis of three samples collected on consecutive days and then taking the cubed root of that amount. Where one or more of the samples is zero or below the detection limit for the analysis, then 1 or the detection limit respectively should be used in place of those samples
Act	Means the Protection of the Environment Operations Act 1997
activity	Means a scheduled or non-scheduled activity within the meaning of the Protection of the Environment Operations Act 1997
actual load	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
AM	Together with a number, means an ambient air monitoring method of that number prescribed by the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*.
AMG	Australian Map Grid
anniversary date	The anniversary date is the anniversary each year of the date of issue of the licence. In the case of a licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the commencement of the Act.
annual return	Is defined in R1.1
Approved Methods Publication	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
assessable pollutants	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
BOD	Means biochemical oxygen demand
CEM	Together with a number, means a continuous emission monitoring method of that number prescribed by the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*.
COD	Means chemical oxygen demand
composite sample	Unless otherwise specifically approved in writing by the EPA, a sample consisting of 24 individual samples collected at hourly intervals and each having an equivalent volume.
cond.	Means conductivity
environment	Has the same meaning as in the Protection of the Environment Operations Act 1997
environment protection legislation	Has the same meaning as in the Protection of the Environment Administration Act 1991
EPA	Means Environment Protection Authority of New South Wales.
fee-based activity classification	Means the numbered short descriptions in Schedule 1 of the Protection of the Environment Operations (General) Regulation 2009.
general solid waste (non-putrescible)	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997

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flow weighted composite sample	Means a sample whose composites are sized in proportion to the flow at each composites time of collection.
general solid waste (putrescible)	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environmen t Operations Act 1997
grab sample	Means a single sample taken at a point at a single time
hazardous waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
licensee	Means the licence holder describe d at the front of this licence
load calculation protocol	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
local authority	Has the same meaning as in the Protection of the Environment Operations Act 1997
material harm	Has the same meaning as in section 147 Protection of the Environment Operations Act 1997
MBAS	Means methylene blue active substances
Minister	Means the Minister administering the Protection of the Environment Operations Act 1997
mobile plant	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
motor vehicle	Has the same meaning as in the Protection of the Environment Operations Act 1997
O&G	Means oil and grease
percentile [in relation to a concentration limit of a sample]	Means that percentage [eg.50%] of the number of samples taken that must meet the concentration limit specified in the licence for that pollutant over a specified period of time. In this licence, the specified period of time is the Reporting Period unless otherwise stated in this licence.
plant	Includes all plant within the meaning of the Protection of the Environment Operations Act 1997 as well as motor vehicles.
pollution of waters [or water pollution]	Has the same meaning as in the Protection of the Environment Operations Act 1997
premises	Means the premises described in condition A2.1
public authority	Has the same meaning as in the Protection of the Environment Operations Act 1997
regional office	Means the relevant EPA office referred to in the Contacting the EPA document accompanying this licence
reporting period	For the purposes of this licence, the reporting period means the period of 12 months after the issue of the licence, and each subsequent period of 12 mo nths. In the case of a licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the commencement of the Act.
restricted solid waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
scheduled activity	Means an activity listed in Schedule 1 of the Protection of the Environment Operations Act 1997
special waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
TM	Together with a number, means a test method of that number prescribed by the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*.

TSP	Means total suspended particles
TSS	Means total suspended solids
Type 1 substance	Means the elements antimony, arsenic, cadmium, lead or mercury or any compound containing one or more of those elements
Type 2 substance	Means the elements beryllium, chromium, cobalt, manganese, nickel, selenium, tin or vanadium or any compound containing one or more of those elements
utilisation area	Means any area shown as a utilisation area on a map submitted with the application for this licence
waste	Has the same meaning as in the Protection of the Environment Operations Act 1997
waste type	Means liquid, restricted solid waste, general solid waste (putrescible), general solid waste (non - putrescible), special waste or hazardous waste

Mr Nigel Sargent

Environment Protection Authority

(By Delegation)

Date of this edition: 25-July-2000

End Notes

1	Licence transferred through application 140392, approved on 02-May-2001, which came into effect on 08-Jun-2000.
2	Licence varied by notice 1012892, issued on 03-Sep-2002, which came into effect on 28-Sep-2002.
3	Licence transferred through application 142945, approved on 17-Sep-2004, which came into effect on 28-Jul-2004.
4	Licence fee period changed by notice 1074523 approved on 12-Jun-2007.
5	Condition A1.3 Not applicable varied by notice issued on <issue date> which came into effect on <effective date>
6	Licence varied by notice 1119156, issued on 07-Oct-2010, which came into effect on 07-Oct-2010.
7	Licence varied by notice 1500035 issued on 01-Sep-2011
8	Licence varied by notice 1501407 issued on 31-Oct-2011
9	Licence varied by notice 1509251 issued on 29-Apr-2013
10	Licence varied by notice 1527659 issued on 02-Jun-2015
11	Licence varied by notice 1534471 issued on 23-Aug-2016
12	Licence varied by notice 1550028 issued on 25-May-2017

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Appendix 3

Social Impact Assessment Update and Response to Submissions – Key Insights Pty Ltd – December 2017

(Total No. of pages including blank pages = 96)

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State Significant Development
Brandy Hill Quarry Extension

Social Impact Assessment Update and Response to Submissions

Prepared by:

Ellen Davis-Meehan

Key Insights Pty Ltd
September 2018

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List of Abbreviations

BHSA	Brandy Hill and Seaham Action Group
BHQ	Brandy Hill Quarry
CCC	Community Consultative Committee
DGR	Director General Requirements
DPE	Department of Planning and Environment
EIS	Environmental Impact Statement
EP&A	Environmental Protection Authority
LGA	Local Government Area
SIA	Social Impact Assessment
VPA	Voluntary Planning Agreement

Executive Summary

Hanson is seeking to expand the allowable extraction area of the Brandy Hill Quarry and increase the rate of production to 1.5 million tonnes per annum and continue operations for a further 30 years. This is a significant change to the current consent and meets the criteria for assessment as a 'state significant development' (SSD) under section 89C (2) of the Environmental Planning and Assessment Act 1979 (the EP&A Act). Hanson is also seeking consent to install a concrete batching plant, capable of producing 15,000m3 per annum and to receive up to 20,000 tonnes per annum of concrete washout material for recycling. The ability to continue production and sales 24 hours a day, 7 days a week is seeking to be retained.

This social impact assessment update relies on primary research and engagement with local people, a study of community and agency submissions, a review of local planning and policy documents, assessment of the local character of the area through ABS data and visits to the Quarry site and local area, the original EIS and accompanying SIA, the Director General requirements and the response of the Department and Planning and Environment to the social impact issues potentially arising from the expansion proposal. Throughout the research there has been a dialogue with Hanson about possible mitigating responses to the issues raised through the research.

Key social concerns identified by the Department of Planning and Environment's social impact reviewer, and substantiated through this updated social impact research, include:

- loss of rural amenity and 'liveability' caused by expanded hours of operation and additional truck activity;
- loss of sense of place (a quiet, safe, rural environment) caused by expanded hours of operation and additional truck activity;
- general adverse effects on health and wellbeing (e.g. ability to sleep) caused by expanded hours of operation and additional truck activity; and
- property devaluation, especially for residents on and near Brandy Hill Drive, Seaham Road and part of Clarence Town Road.

This research has revealed a mix of attitudes towards the existing baseline impacts associated with the current Brandy Hill Quarry operations ranging from gratitude and acceptance through to positions that oppose any quarry operations at all in the area. This research finds that there have been some communication misunderstandings throughout the preparation of the EIS. Hanson elected to undertake the assessment of the proposed project on its technical merits for the purpose of the EIS preparation. The EIS provides a technical review of the project as it has been proposed with the initial submissions and feedback from the community considered in determining the matters that needed technical assessment (in addition to the Director General Requirements (DGRs) from the Department of Planning and Environment (DPE). Now that the EIS has been prepared and the community has had an opportunity to consider the proposal, Hanson will look more closely at those issues that concern the community from the results of the technical assessment. These matters will be reflected in a final Statement of Commitments.

In addition to the Statement of Commitments, there will be a Voluntary Planning Agreement (VPA). A VPA, as it relates to extractive or mining industries, refers to an agreement with a proponent and a governing authority (normally Council) that specifies contributions to be made under existing plans, policies or guidelines. For the Brandy Hill Quarry, this will refer to the contributions that Hanson will make under Section 94 of the EP&A Act for the maintenance of public services. In 95% of cases this relates to contributions for road maintenance but can refer to other matters as deemed by the consent authority.

This social impact research has provided inputs for both of those instruments (VPA and Statement of Commitments) as well as recommending a mechanism for the community to assist in monitoring their implementation.

This research has also revealed a perception, in some parts of the community, that this expansion, if approved, will result in an immediate and continual 24/7 operation with the maximum amount of truck movements as per the Traffic Study. This will not be the case as the Brandy Hill Quarry business has peaks and troughs according to the contracts they are able to secure. So, while 24/7 operations 365 days per year are highly unlikely to become a reality, the mitigation strategies that accompany any approval need to give some level of comfort that amenity issues will be addressed.

It is also true that Councils, State and Federal Government, business and development agencies and people residing within the LGAs of Maitland and Port Stephens often are seeking outcomes that conflict with each other in some respects. Governments and agencies embrace and promote growth. People want to move to more semi-rural communities; but also, people want infrastructure and services commensurate with a city lifestyle. New developments are approved with the subsequent development of roads and other infrastructure that require aggregate products. Major roads are continuously upgraded as are airports and important civil and environmental protection projects. Such projects all require activity that places more trucks on the road system. Hanson, through its quarries, is meeting market demand. Local people, businesses and governments desire competitively priced aggregate products. As reported in the Newcastle Herald, April 14, 2017:

> *"The ability to continue supplying the Hunter region with products from Brandy Hill Quarry ensures a competitive market in the region. The high cost of transporting materials creates the need for quarries to be in close proximity to large existing markets, such as the Newcastle, Hunter and Central Coast areas." (Hanson)*

The major source of concern to local people is the potential 24/7 operation of the Brandy Hill Quarry and subsequent significant increases in truck movements on the local road system. The potential impacts on amenity and lifestyle are likely to be experienced most acutely by those living near the Quarry, and along Brandy Hill Drive. The potential benefits of the expansion are more wide spread beyond the local community and include a range of economic and social benefits that spread throughout several LGAs.

This research finds that the social impacts identified in the research can be mitigated. It also finds that there has been a willingness on the part of the majority of the local community, even key objectors, to negotiate with Hanson on mitigation strategies. The Hanson approach of waiting for approval to negotiate mitigation strategies has damaged community trust in some sectors of the local community; particularly those involved on the CCC.

The process of this social research has established a pathway for improving community trust, taking specific, immediate actions on community inputs to date where possible, and setting out an agenda for the CCC to consider mitigation strategies as well as providing for a mechanism to monitor the VPA and the Statement of Commitments.

It is desirable to find a balance between Hanson being able to maximise its resource for its own benefit and for the economic flow-ons to the community, and the community being able to continue to live a healthy lifestyle with the amenity they currently appreciate being retained. This is the pivot around which mitigation strategies will revolve.

This updated SIA is in agreement with the conclusions of the original SIA[1] and provides the following risk/benefit summary based on primary and secondary research, and taking into account the current baseline situation:

Potential positive impacts:

- Economic benefits related to securing the supply of constructions materials for critical projects in the Hunter and reaching into the Sydney market. Based on a $22.5 million the economic benefits, for construction and operation, include:
    - 43 direct jobs and flow-on effects of local purchases of goods and services, and spin-off jobs throughout the LGA and beyond.
    - Direct wages and salaries increase approximated to be $3.576 million, and subsequent flow-on impacts including further job generation and salaries estimated at $3.502 million.
    - Support of local growth strategies.
- Employment impacts if a successful "employ locally" program can be implemented.
    - Jobs for local people and contractors – impacts throughout the supply chain.
- Enhancement of community relations through improved contacts with schools, sporting organisations and other bodies and contributions to community aspirations through a documented donations/sponsorship policy.
- Improvements to local safety with expanded bus lay-bys and possible walkways; dependent on ongoing negotiations with the community, Council and other infrastructure providers.
- Continuation of the heritage of the Quarry as a contributor to the local character of the area.

Potential negative impacts:

- Downward pressure on local land values if there are significant and sustained losses to amenity and current lifestyle.
- Amenity and lifestyle impacts if there are substantial increases in truck movements above current baseline.

[1] Original SIA page 40

- Sleep deprivation if continuous 24-hour operations are achieved.
- Cumulative impacts when considered in concert with truck movements from other quarries, particularly Martins Creek and including Council and other truck movements in the area.
- Road safety impacts if mitigations relating to hours of operations, speed limits and enforcement of the Truck Code of Conduct are not enforced.
- Sense of loss of local environment and sense of place if environmental standards are not met.
- Contribution to general traffic throughout the region associated with growth and development.
- Amenity impacts to immediate neighbours associated with increased activity, especially blasting, within the Quarry perimeter.

The risk of not proceeding with the expansion is that the Brandy Hill Quarry will close and there will be a loss of some 20 jobs with flow-on impacts to the economy. As per the 1983 Agreement Council will have a recreation area handed over that it is not likely to want to maintain. The majority of submissions have indicated that they would like to see the Quarry continue its operations; it is generally the scale of those operations that is contested. This updated SIA recommends the following mitigations.

Recommended Mitigation Strategies

1. Formalise the Community Consultative Committee

Formalise the CCC to comply with the Department's Community Consultative Committee Guidelines[2]. Membership of the CCC to comprise:

- An independent chairperson[3]
- Up to seven community representatives[4]
- A council representative from Port Stephens Council
- Up to three representatives from Hanson including the person with direct responsibility for environmental management of the project.

While there is an existing, active CCC; it would be appropriate to follow the guidelines for selection of members at sometime within the 12 months following Project approval.

Agendas and CCC minutes to be available on the website.

A two-way reporting system created and monitored where there is regular discussion of how members of the CCC are disseminating Quarry information and receiving feedback (regular agenda item).

(Note: A formal CCC will be a condition of consent; it is included here in response to community inputs)

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[2] http://www.planning.nsw.gov.au/~/media/Files/DPE/Factsheets-and-faqs/community-consultative- committee-guidelines-state-significant-projects-2016-10.ashx

[3] It is noted that the Brandy Hill Quarry CCC has just appointed an independent chair (Lisa Andrews) from the Department's pool of chairs.

[4] Consider the inclusion of a near neighbour from Giles Street or Clarence Town Road, subject to availability.

2. Design a mechanism for oversight of the 'Statement of Commitments' and Voluntary Planning Agreement (VPA).

The 'Statement of Commitments' has been refined as a result of this research and is a separate document submitted with the EIS. The social impact mitigations contained therein reflect community concerns.

A Voluntary Planning Agreement as it relates to extractive or mining industries refers to an agreement with a proponent and a governing authority (normally Council) that specifies contributions to be made under existing plans, policies or guidelines. For the Brandy Hill Quarry, this will refer to the contributions that Hanson will make under Section 94 of the EP&A Act for the maintenance of public services. In 95% of cases this relates to contributions for road maintenance but can refer to other matters as deemed by the consent authority.

Mitigation strategies contained within the 'Statement of Commitments' and the VPA should be specific and measurable. **Therefore, this key recommendation is to create a mechanism that provides oversight of the Statement of Commitments and the VPA. This mechanism should be a monitoring subcommittee of the CCC that includes community reps, Council and Hanson staff.**

3. Consider additional mitigations in the regular CCC Agenda

Additional strategies recommended that are outside the Statement of Commitments or VPA, but should be a part of the ongoing CCC Agenda[5]:

- Lobby appropriate authority for speed limits to be reduced on Clarence Town Road.
- Make the Code of Conduct for trucks available to the CCC and review and update it as necessary.
- Review number of truck movements during school bus operating times.
- Publish a map of where noise and dust monitors are currently located and make available the data from those monitors. Provide an easily accessed location for this data (e.g. Hanson website).
- Monitor night time quarry operations; consider limitations to prevent sleep deprivation while allowing for some flexibility in peak demand times.
- Bus stop lay-bys: Negotiate, with community and Council, widening of local bus stops to provide safer waiting space for users.
- Discuss options with Council and other infrastructure providers and road users, for ways of increasing local walkability through walkways / cycleways. Needs to be consistent with Council priorities, achievable and able to enhance connectivity for local residents. Explore alternative routes for walkways; for example, along the Hunter Water Pipeline.
- Develop a community donations / sponsorship policy that is fair and consistent across the whole community. Consult beyond the CCC to include local business, school groups and sporting organisations.
- Review Close of Quarry Plans and appropriate post-operations land uses. Call for community submissions on post Quarry land uses.

[5] Some of these strategies have commenced prior to the submission of this report.

4. Improve Quarry accountability through improved communications and engagement.

- Review engagement with the community and adopt a Stakeholder Engagement Plan that includes:
    - Developing a community data base that includes preferred method of engagement (e.g. e-mail, post, website)
    - Link to Quarry information on the Hanson website that is regularly updated
    - Newsletter that is published on-line, or via mail for those who prefer this option.
    - Publish location of all monitoring equipment and provide regular reporting through website and to the CCC.
    - Provide links to key documents online such as the Blast Management Plan, Grievance Procedures and the Code of Conduct for Truck Drivers.
- Review complaints handling processes in the light inputs through this SIA, and make public an amended policy. Create a feedback loop[6].

Final Mitigation Strategies

As a result of ongoing engagement and project refinement the proponent has committed to the following mitigation strategies:

- a 60km/hr imposed speed limit on quarry tucks along Brandy Hill Drive
- changes to operating hours:

Hours of Operation	Construction Works	Monday to Friday 7:00am to 6:00pm Saturday 7:00am to 5:00pm No operation on Sundays
	Blasting	Monday to Friday 9:00am to 5:00pm No blasting on Saturdays or Sundays
	Load and Haul	Monday to Saturday 5:00am to 10:00pm No operation on Sundays
	Primary Crusher	Monday to Saturday 5:00am to 10:00pm No operation on Sundays
	Secondary and Tertiary Crushing and Screening	Monday to Sunday - 24hrs
	Sales and product dispatch	Monday to Sunday - 24hrs
	Maintenance	Monday to Sunday - 24hrs

With proper mitigation strategies, the Brandy Hill Quarry Expansion Project will deliver a net socio-economic benefit to the LGA.

[6] Note that while complaints are rare, and often acted on within a short timeframe, those actions are not always communicated to the complainant.

1. Introduction

Hanson Construction Materials Pty Ltd (Hanson) currently operates a hard rock quarry, Brandy Hill Quarry, in the suburb of Seaham in New South Wales. The property is wholly owned by Hanson (the Company) and the Company have been operating the quarry since 2001. The current development consent was granted by Port Stephens Shire Council in 1983. The continued operation of Brandy Hill Quarry will require expanding the quarry into new areas of the site.

1.1 The Proposal

Hanson is seeking to expand the allowable extraction area and increase the rate of production to 1.5 million tonnes per annum and continue operations for a further 30 years. This is a significant change to the current consent and meets the criteria for assessment as a 'state significant development' (SSD) under section 89C (2) of the Environmental Planning and Assessment Act 1979 (the EP&A Act). Hanson is also seeking consent to install a concrete batching plant, capable of producing 15,000m3 per annum and to receive up to 20,000 tonnes per annum of concrete washout material for recycling. The ability to continue production and sales 24 hours a day, 7 days a week is seeking to be retained.

1.2 About this Social Impact Assessment Update

As an State Significant Development (SSD) the proposal requires a Social Impact Assessment (SIA) as part of the Environmental Impact Statement (EIS). The SIA within the EIS has been strongly criticised in the DPE review for failing to meet the required standards or to address the community issues in depth. The SIA methodology needs to be consistent with the recently released "*Social impact assessment - Draft guidelines for State significant mining, petroleum production and extractive industry development"*.[7]

This social impact assessment update responds to the social impact issues that arise in the submissions to DPE. While it references the original SIA submitted by Hanson, this document stands alone as a piece of social research.

This research has been prepared by a social impact expert as requested in the DPE review. An overview of qualifications and experience of the author Ellen Davis-Meehan is at Appendix 1.

In addition to the DPE criticisms, Key Insights notes that the original SIA did not discuss the baseline situation; it is important to understand the quantum of change between existing operations and the proposed expansion and resultant social impacts.

This methodology for this SIA update has been designed in response to the DPE's Attachment A:

"The Department's Social Impact Assessment (SIA) specialist has reviewed the EIS and had identified significant shortcomings with its SIA (see attached advice). These shortcomings are consistent with feedback from the community that consultation undertaken during the preparation of the EIS did not result in the community's issues and concerns being addressed or resolved. The Department emphasises that meeting relevant assessment criteria does not mean there is no social impact.

[7] http://www.planning.nsw.gov.au/Policy-and-Legislation/~/media/8B6753256417468F80E11708762DA11D.ashx

Some of the key social concerns that were raised at the Department's community meeting and in submissions include the:

- loss of rural amenity and 'liveability' caused by expanded hours of operation and additional truck activity;
- loss of sense of place (a quiet, safe, rural environment) caused by expanded hours of operation and additional truck activity;
- general adverse effects on health and wellbeing (e.g. ability to sleep) caused by expanded hours of operation and additional truck activity; and
- property devaluation, especially for residents on and near Brandy Hill Drive, Seaham Road and part of Clarence Town Road.

The Department requests that Hanson provide a revised SIA which, at a minimum:

a) responds to the potential social impacts of the project, and either proposes adequate mitigation measures or justification as to why no mitigation is warranted. Particular consideration should be given to the various measures put forward by the Brandy Hill & Seaham Action Group (e.g. restricted production and operating hours, construction of shared pathways and road safety measures). Proposed responses should follow the hierarchy of avoid, minimise and mitigate.

b) undertakes a more rigorous assessment of the likely significance of each impact. This assessment of significance should:

i. have regard to the likelihood, extent, duration and severity of each impact;

ii. have regard to the sensitivity of local receivers, their capacity to adapt to change and their level of concern; and

iii. involve affected community members in genuine engagement activities; and

c) identifies proposed mitigation measures and assesses their adequacy**. Hanson should again involve relevant community members (i.e. those living nearby who may be affected by the project).** Community engagement activities should be undertaken by a suitably qualified and experienced practitioner(s). Hanson should identify the name, qualifications, and experience of any practitioner(s)."

2. Methodology

The key methods utilised for this social research update were consultation with local people, (prioritising those living in the neighbourhood of the Quarry), detailed review and consideration of community inputs to date including public meetings and community submissions to the NSW Department of Planning and Environment, and discussion with Hanson representatives about responses to community concerns and mitigation strategies. The methodology consisted of the following components:

Part A: Background Review, Inception Meeting, Issues Summary and Engagement methodology

1. Review available background information regarding the proposed expansion and consultation undertaken to date.
2. Attend an inception meeting (Sydney) and site inspection to assess the geographic area of interest.

3. Summarise critical social impact comments from submissions and prepare an Impact Table to be completed by the end of the SIA update:

Identified Social Impact	Likelihood / Sensitivity	Extent	Duration	Severity
From Community inputs	Is the perception of social impact real or likely? Are particular groups more vulnerable or sensitive to the impact? Is adaption possible over time?	Geographic Extent. Number of people potentially affected.	When the impact will occur and over what period.	The intensity of the potential impact on the social environment. Whether the impact is acute or chronic.

4. Conduct a stakeholder analysis / review consultation to date and prepare a plan for engagement if the project becomes operational. Identify key interviews or meetings that need to occur to complete the SIA Update and Submission Response.

Part B: Assessment of Impacts

5. Undertake additional consultation (via meeting and interview with key targets as identified in 4 above) in order to gather information necessary to determine the likely duration, extent, sensitivity and severity of potential social impacts.

6. Add to the existing SIA by providing deeper analysis of the potential social impacts on the local and regional community, including:
a) The likely duration, extent, sensitivity and severity of potential social impacts.
b) Social impacts associated with predicted environmental impacts.
c) Social impacts relating to the use and availability of public infrastructure and services.
e) The social implications of the economic costs and benefits of the Project.

7. Refine the appropriate measures/mitigation strategies to avoid, minimise or mitigate potential social impacts.

8. Discuss mechanisms that may be used for the management of compliance relating to the proposed mitigation measures and any social impact-related conditions of consent.

9. Provide a Report that updates and references the original SIA and focuses on a deeper analysis of social impact issues raised in the submissions.

The confidentiality of research participants is respected in the documentation of this research update. **Note that all comments and notes on community and agency inputs have been sent to the participants for review and comment before being included in this SIA Update.**

This SIA has taken an "action research" approach where dialogue has been encouraged between Hanson and the community, actions have been recommended by this researcher to Hanson, and outcomes of those actions is being monitored. This is an ongoing process.

Figure 1 Site visit to Brandy Hill Quarry

Figure 2 Quarry Boundary at Giles Street

Figure 3 Property immediately bordering Quarry on Giles Street

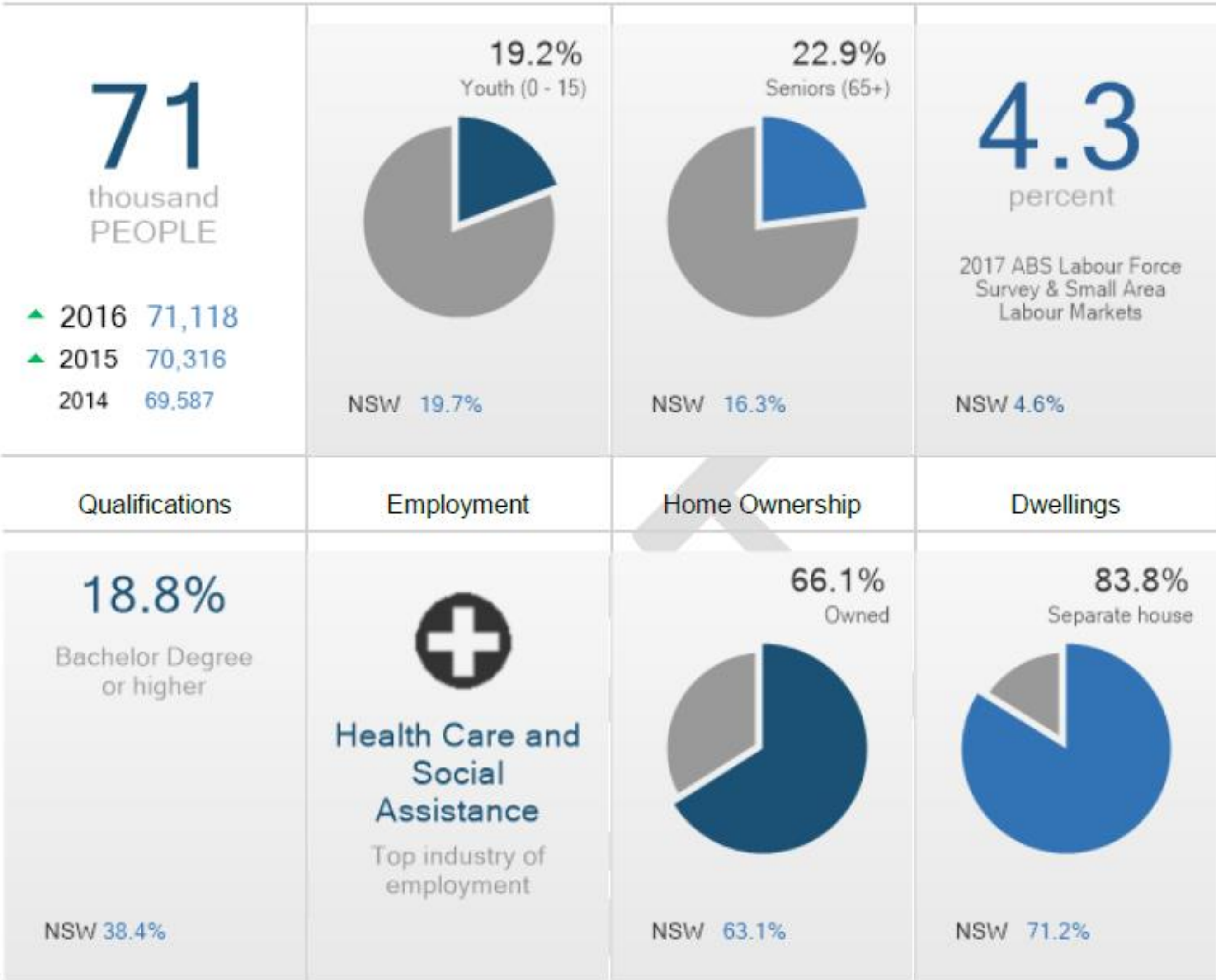
3. Community Profile and Baseline

This SIA Update expands and updates the demographics in Section 7 of Appendix 17 in the EIS[8].

Port Stephens is characterised by a combination of natural features, waterways and rural character; affordable housing; accessibility and its location in a significant Regional labour market, which offers a range of accessible jobs in Port Stephens and the broader region. These factors have ensured that Port Stephens has experienced consistently high population growth over the last 15 years. Other population trends include: an ageing of the population with high growth rates of people aged 65 years and over a small decrease in the 20-34 age group as people leave for higher education and for employment. Areas within the LGA differ in their population characteristics, with the Peninsulas attracting the older age groups (retirees). Port Stephens is a thriving community with great diversity

3.1 Demographics

This section updates the 2015 SIA submitted with the EIS, which relies on 2011 data. The 2016 ABS Census now reveals the following overview of the Port Stephens LGA:



[8] Appendix 17 (Section 17A) Socio-Economic Impact Assessment Page 22-27

3.1.1 Trends – Population and Migration

The total number of people usually resident in Port Stephens in 2016 was 71,118[98]. This represents an increase of 8,986 people (14.46%) from the 2006 total of 62,132 people. Port Stephens LGA has a growing population with a higher percentage of Seniors (65+) than does NSW.

Brandy Hill has a population of 701 people, up from 671 in 2011. 13.4% of the population are Seniors (compared to 22.9% of the LGA) and 15.3% are Youth (1-15 years), compared to 19.2% for the LGA. **In Brandy Hill the age group with strongest representation is 50-59 years (24.96%)** followed by 60-69 years (16.26%). The percentage of 50-59 years is almost double that for Port Stephens, Hunter Region and for NSW. This may be partly explained by pre-retirees making a tree change for a semi-rural lifestyle close to the amenity of large regional centres. It also aligns with qualitative research that suggests professionals are moving into the area.

In nearby Seaham the largest age group by percentage is 40-49years.

In 2016, 89.2% of Brandy Hill residents were at the same address as for the 2011 Census. This suggests a very stable population which compares to 76.02% for the LGA and 76.45% for NSW.

When considering migration over the last 5 years; the small amount of people moving to Brandy Hill came predominantly from the following areas:

- Newcastle: 3.85%
- Maitland: 3.57%

3.1.2 Housing and Family Structure

On Census night 2016 100% of dwellings in Brandy Hill were occupied private dwellings.

45.5% of families in Brandy Hill have two people in the family. This compares to 52.63% for the LGA. 20.57% were in three-person families, 22.01% in four-person families, 7.18% in five-person families and 4.78% were in six-person families. Seaham and Brandy Hill both tend to have larger family groupings than for the entire Port Stephens LGA; however, as the percentage of youth (1-15 years) is lower than for the LGA this suggests that the larger family structures are not always parents with children. The split between "couple family with children" (Brandy Hill: 47.83%) and "couple family without children (Brandy Hill: 46.38%) is about 50/50. Only 5.31% are "one parent families" (compared to 16.3% for the LGA).

3.1.3 Employment

2016 Census data indicate that 35.9% of Brandy Hill residents are employed in full time work. A further 24.71% are employed in part time work. This compares with 27.92% (FT) and 17.54% (PT) for the entire LGA. 28.57% are not in the labour cohort (e.g. retirees or stay-at-home parents) and this is significantly less for the 40.37% out of the labour force across the LGA.

The dominant occupations of Brandy Hill residents are; Professionals (17.53%), followed by Clerical and Administrative Workers (16.95%) and Managers (15.8%). This compares with 14.71%, 12.86% and

[9] ABS 2016 Census Data.

10.83% respectively for the LGA. Labourers, Technicians and Trade Workers and Community and Personal Service Workers make up a significantly smaller percentage of the population than for the LGA. A higher proportion of residents working in typically higher paying sectors aligns with the advantage data for the area revealed in the SEIFA scores below.

A significantly higher proportion of Brady Hill residents drive a car to work (39.37%) compared to the LGA (28.01%) and to NSW (26.11%). This aligns with the higher proportion of residents in full time or part time work and the lack of public transport in the area.

Notably, Machinery Operators and Drivers represent 11.21% of Brandy Hill compared to 8.23% for the LGA. This is an indicator of workers residing close to their employment and is supported by the qualitative research which reports that many of the Brandy Hill Quarry truck drivers live locally.

3.1.4 Measure of Relative Socio-economic Disadvantage (SEIFA)

The Index of Relative Socio-economic Disadvantage (IRSD), is a general socio-economic index that summarises a range of information about the economic and social conditions of people and households within an area.

A SEIFA[10] low score indicates relatively greater disadvantage in general. For example, an area could have a low score if there are (among other things):

1. Many households with low income, many people with no qualifications, or many people in low skill occupations.

A SEIFA high score indicates a relative lack of disadvantage in general. For example, an area may have a high score if there are (among other things):

- Few households with low incomes, few people with no qualifications, and few people in low skilled occupations.

The SEIFA score for Brandy Hill in 2011 was 1,090. The area is relatively more advantaged than the entire LGA with a SEIFA score of 980 and, than Raymond Terrace with a SEIFA score of 904. The SEIFA score for Seaham was 1,083 and for East Seaham, 1,059. In fact, the geographic area of Brandy Hill, Seaham and East Seaham exhibit a relative lack of disadvantage and are the most advantaged areas in the LGA. They compare favourably to many areas in NSW.

3.1.4 Property Values

The median property price in Brandy Hill for the period 1 January 2013-31 December 2013 was $649,000.[11] This was based on 10 house sales. For January – December 2015 the median property price was $835,000 based on 11 house sales during that period. This represents significant growth in value over the 2-year period for the established, stable community; growth of nearly 30%.

From January – December 2016 the median price was $740,000 based on 10 house sales. Currently the median price is $780,000 based on 16 house sales between 1 November 2016 and 13 November 2017.

[10] **Source:** Australian Bureau of Statistics, Socio-Economic Indexes for Areas, Cat. 2033.0.55.001 (2011 data was released on 28 March 2013. 2016 data is expected to be available in 2018).
[11] Data supplied by RP Data Pty Ltd trading as CoreLogic.

In Seaham median prices have seesawed from $680,000 in 2013 (13 house sales), to $464,000 in 2014 (15 house sales), to $680,000 in 2015 (11 house sales) and to $539,500 in 2016 (16 house sales).

With such a small amount of sales care needs to be taken in identifying trends. Qualitative research with local agents reinforces that house prices are fairly stable and do not experience the same strong peaks and troughs as larger city markets.

Brandy Hill is identified as a “high demand market” by realestate.com.au with average visits per month to the website for Brandy Hill sales at 964 per property. This compares to 852 per property for NSW. This data is not statistically significant[12].

3.2 Existing Local and Regional Land Use Character

Section 6.3 Regional Area Assessment of the SIA submitted for the EIS accurately describes the key local and regional land use characteristics. Key points:

- The Brandy Hill Quarry Expansion Project will not result in any change of land use. The land use remains consistent with the local area and the region. There are several quarries in the area with the most relevant, in terms of cumulative impacts, being Daracon’s Martin’s Creek Quarry located 10km to the north west of the Project.
- The local area is central to major transport links; the major route being north/south along the Pacific Highway, normally accessed via Raymond Terrace.
- The location of the Brandy Hill Quarry is within a short distance to sites of high environmental value. While reasonably close, these are outside the area of geographic impact. Sites include the Hunter estuary and wetlands to the south, Stockton sand dunes and beaches to the east, the waterways of Port Stephens in the northeast and the rural hinterland and Williams River to the west. There are also several large areas of natural conservation within a 7km-20km radius; including a number of national parks.
- There are several heritage wooden bridges over which trucks could possibly travel.
- Brandy Hill Quarry’s previous owners sold land along the haul road, Brandy Hill Drive, for Council approved development as large rural-residential lots. The two land uses (quarry and rural-residential) have co-existed for decades.

3.3 Existing Approval

Brandy Hill Quarry operates under consent, issued by Port Stephens Council on 21 December 1983, for Application 1920, for a Hard Rock Quarry and Processing Plant. The Schedule attached to the consent requires the Quarry to undertake all environmental protection measures as outlined the EIS prepared by Resource Planning. At the time the applicant was required to “contribute towards the fund in respect to roads in the immediate vicinity of the area which are likely to be affected by the operation being carried out. The levy per tonne moved is 20c … to be varied annually with movements in the CPI”[13]

[12] Demand is calculated as the average number of visits per listing per month over the last 12 months to realestate.com.au/buy that include at least one property details page view in Brandy Hill, NSW 2324. Supply is calculated as the average number of property listings per month that have been viewed at least once that month on realestate.com.au/buy in Brandy Hill, NSW 2324 over the last 12 months.

[13] Port Stephens Council File: P9/1/12/1920 Schedule 1.

Based on a submission dated 20 May 1991, Council granted an amended consent that allowed: "Condition numbers 15 and 16 of development consent no. 1920 are now hereby deleted."[14] These two conditions referred to "Should claims for compensation in respect of damage or loss of value of property within 2km of the centre of the quarry arise, the applicant shall accept the verdict of an independent board in respect to payment of damage claims …"[15]

The application was subject to Section 94 Contributions "in respect of the upgrading of communication and transport facilities within the area and in this regard widening of Main Road 601 to provide bus lay-bys for the picking up and setting down of school children …"[16]

The applicant at the time had to submit a detailed landscaping plan to Council and enter a legally binding agreement to the effect that the site will be restored in accordance with that landscaping plan[17]: "… all operations upon the site are to cease after quarrying operations have been completed and the site is to be dedicated to Council as public gardens and recreation space at no cost to Council."[18]

There were no conditions placed on the operation that related to hours of operation or to truck movements.

3.4 Current Operations and Baseline Impacts

The Brandy Hill Quarry site covers 561 hectares which includes current operations, the proposed expansion site and surrounding buffer land. The Quarry currently has a 15% market share, which is anticipated to grow up to 30% with the new DA consent.

The Quarry services primarily the Hunter and Central Coast with some sales into the Sydney Metropolitan Region. Projects include:

- Supply of concrete aggregates, asphalt and sealing aggregate for roads – Central Coast, Hunter Valley and Sydney
- Special Projects: Break walls, Riverbank restoration (local area), airports, coal loader, RAAF base.

Quarry staff provided a snapshot of current operations. Between Monday 19/06/2017 and Friday 23/6/2017, the following occurred:

- 307 deliveries:
  - 217 travelled along Brandy Hill Drive and through Raymond Terrace.
  - 90 tuned right at the Quarry driveway and proceeded down Clarence Town Road to Maitland, Rutherford and Cessnock.

Staff note that there are peaks and troughs in Quarry operations depending on market demand and contracts secured. **The bulk of truck traffic proceeds along Brandy Hill Drive.** At present no trucks leave the Quarry site before 5am and incoming trucks cannot arrive before 6.30am. There is a Park in Raymond

[14] Port Stephens Council File No: 1920/83
[15] Port Stephens Council File: P9/1/12/1920 Schedule 1.
[16] Ibid Clause 13.
[17] A comprehensive Quarry Closure and Rehab Plan is normally produced post approval as a requirement of the conditions of consent. This plan is used throughout the quarry's life to ensure rehabilitation objectives are achieved.
[18] Ibid Clause 6.

Terrace where trucks are required to wait if they arrive early. There are 7 trucks based at Brandy Hill Quarry and 6 based at Carrington. Several local people own their own trucks and have contracts with the Quarry. Contractors and Carrington based trucks will arrive in the early morning when demand exists. A Driver Code of Conduct Policy, which is rigorously enforced, appears, in its updated version, at Appendix 2[19].

Trucks are already operating in concert with other trucks from other quarries, garbage trucks, local car traffic and the school bus service. In considering submissions and qualitative inputs for this research, it is clear that many people in the local community are willing to live with current operation levels and resultant impacts. This is true even for many of the objectors, who recognise the long term economic contribution of the Quarry to the area. A proportion of locals are not happy with current baseline impacts.

The Quarry currently delivers 20 jobs and a number of supplier contractors. Around 50% of employees live locally.

In addition to employment, the annual spend with local suppliers is significant. Repair and Maintenance alone is over $3M per annum. It is estimated that over $4M per annum, in total, is spent in the economy through suppliers; and this generates flow-on impacts.

Hanson has records of contribution amounts to Port Stephens Council from the period of December 2005 to March 2018 (12 Years) which indicate that during this 12-year period, $3.47 million has been paid to Port Stephens Council. This amounts to, on average, $283,000 per annum. Based on this annual amount it is estimated that the Quarry would have paid in the order of $9.6 million in contributions since consent was granted in December 1983.

Since April 2013 Hanson has paid $1.44 million towards road infrastructure and maintenance through contributions. Hanson and the CCC have requested that Council provide evidence of how these road contributions have been expended.

The Brandy Hill Quarry also donates to local community organisations including Seaham Preschool, local Netball and Cricket teams as well as supplying free aggregates to the community in times as need; such as post the 2015 floods. There is no structured system of community donations.

Hanson has established an informal Community Consultative Committee to engage with the local community. The community consultation structure appears in the original SIA and social issues scoped up until that 2015 report are detailed there.[20]

The Quarry operates within the limits set by the EPA and other authorities. There are very few complaints about operations to Quarry management. **There have been 4 complaints this year from January – September 2017.**

4. Research Findings

4.1 Summary of Public Submissions

Submissions from the community to the NSW Department of Planning and Environment have been reviewed and analysed. A compressed overview of individual submissions appears at Appendix 3.

[19] The Drivers Code of Conduct has been strengthened as a result of community engagement and the most recent version (September 2018) is attached to this SIA Update

[20] Brandy Hill Quarry Expansion Project Socio-economic Impact Assessment 2015 Pages 33-36

The majority of submissions were from people living in Brandy Hill and the majority of submissions objected to the planned expansion.

In the objections there were two divergent positions presented:

1. Support for the Quarry continuing at the current level of operations with objection focused on the Quarry expansion. Proponents of this position identified current impacts, but recognised that the Quarry had existed for a long time and were prepared to "live with it".
2. No support for the Quarry in any form. Proponents believed that current impacts are unacceptable and not in keeping with the emerging rural / residential communities that surround the Quarry. While the Quarry may have been operating for many years, the community is changing and, according to this group of objectors, the impacts have reached a critically unacceptable level.

Objections overwhelmingly focused on the impacts of increased truck movements. Most submissions assumed that the proposed expansion would mean that the Brandy Hill Quarry would operate at the maximum allowable capacity at all times; namely a 24/7 blasting and transportation operation resulting in the maximum number of allowable trucks on the road at all times.

Not all impacts identified in the submissions are social impacts**. Mostly the social impacts arise from other types of impacts, such as environmental impacts. Therefore, the intensity and duration of the social impacts are dependent on Hanson's ability to manage the environmental impacts.** Such management will require ongoing communication with the community, and this is further detailed in the mitigation strategies.

Where submissions expressed support for the Quarry expansion, reasons of employment and economic outcomes were cited, as well as recognising the Quarry's historical place in the community.

The objections can be grouped in the following key social impact areas:

Loss of Amenity

Residents value the semi-rural lifestyle and relative quiet of the area. Objectors are concerned that 24/7 operations and subsequent truck movements will significantly degrade current amenity.

There are also legacy concerns (about future amenity) related to the future use of the Quarry. Some objectors are concerned about the void that will be left and possible uses; such as an infill waste facility.

Impact on local wildlife, particularly as road kill, is seen as an environmental impact, but also as a social impact in that it degrades local amenity.

Loss of Lifestyle

Many residents are concerned about losing connectivity with each other because they are not able to safely walk along Brandy Hill Drive and other major streets in the area. For the same reason it is anticipated that horse riding and cycling along these roads will no longer be safe on weekends if operations are 24/7. As the area emerges as a rural/residential "lifestyle" community there have been concerns expressed about conflicting land uses and whether a Quarry (industrial) fits with rural/residential zoning.

Safety

The majority of objections to the proposal mention road safety and safety for children waiting at bus stops. The concern is driven by the proposed number of truck movements mentioned in the EIS and the perception that Brandy Hill Drive is no longer suitable for pedestrians. Many objectors mentioned the lack of a dedicated cycle path or pedestrian path in the area and that this impacted negatively on the connectedness of the community.

Some of the safety issues are related to car driver behaviour; for example, overtaking garbage trucks on double lines or general speeding. Some concerns are related to truck driver behaviours; particularly for contracted trucks not owned by Hanson. **It is clear that safety concerns arise from the behaviours of all road users be they Hanson trucks, trucks from other Quarries, Council trucks and local car drivers.**

Some objectors had safety concerns about entering Brandy Hill Drive safely via their own driveways; particularly if they were towing a horse float.

Further, safety concerns extend beyond the immediate vicinity to the intersection at Raymond Terrace and driveway entry to Macdonalds, and to the west to Bolwarra, Paterson and Hinton with rural roads and heritage bridges. Again, concerns identify all road users and trucks from more than one source.

Health and Welfare

Near neighbours and those along the main road roads are concerned about impacts on their health from particulate matter associated with diesel trucks and blasting on site.

Objectors who live locally are also concerned about the duration of noise from truck movements if there is an increase to 24/7 operations and potential sleep deprivation and subsequent health impacts.

Economic Impacts

Many local objectors were concerned about the potential decrease in property values if the increased operating hours were to be approved. Some residents near to the Quarry were concerned about vibration impacts on the structure of their properties and subsequent negative impacts on the value.

There is also concern about the cost to Council for road maintenance associated with truck movements. Not all objectors were aware that Hanson pays a levy to Council for road maintenance. Trucks from a variety of sources, including Martins Creek Quarry, were identified as contributors to road deterioration. It was the view of many objectors that the roads are currently sub-standard and need to be fixed before any increase in truck movements could be considered.

The generation of local employment and flow-through benefits to the economy was seen by some as a positive impact of the expansion with some objectors noting that this positive impact is outweighed by potential negative impacts associated with increased truck movements. Potential negative impacts on tourism in the nearby Barringtons was raised by one objector.

Support and contribution to the regional economy and convenient supply of gravel products to important infrastructure projects and to local people was also identified as a positive economic impact of the expansion.

Heritage

Potential loss of the old heritage bridges in the direction of Maitland was identified as a risk and this impacts on the community’s sense of place and attachment to the area.

The Heritage of the Quarry itself was mentioned and the historical connection it has to the community. This is also seen as valuable and part of the sense of place and character of the area.

Trust

Some objectors raised a lack of trust in Hanson and a disappointment in the EIS, particularly the Traffic Report. Other submissions described the positive contributions that Hanson currently make, such as giving away gravel to locals after a major storm event.

Kate Washington, MP for Port Stephens, reflects the concerns outlined above in her objection to the expansion proposal, while supporting current operations. Ms. Washington's objection summarises potential social impacts associated with increased hours or operation and increased truck movements:

> *"Given the current operations of the Brandy Hill Quarry already impacts negatively on residents' quality of life, the proposed expansion of operation is of great concern. The rural residential areas of Brandy Hill and Seaham are idyllic places of peaceful retreat. The increased operations pose an unacceptable threat to the lifestyle that residents live in the area for. On behalf of those that I represent, there is no objection to the current quarry operations. I share residents' concerns about safety and impacts on quality of life and object to the proposal in its current form."*

4.2 Agency Submissions

Agency submissions on the EIS did not generally address social impacts; and where they did it was in relation to ensuring that environmental impacts are managed so that they do not lead to negative impacts on health and wellbeing.

Agency comments on processes and mitigation were:

Hunter New England Population Health:

> *"HNEPH notes the importance of effective and genuine community consultation with active involvement of adjoining property owners, the community and the local authority … The EIA should ensure that community consultation is continued up to and if approved, during the ongoing operation of the development."*
>
> *(Prof David Durrheim. Director – Health Protection. Hunter New England Population Health.)*

Port Stephens Council:

> *The SIA should include, but not necessarily be limited to, … assessment of the impacts as they relate to the demographics of people who live in the affected suburbs as noted. The SIA should also provide adequate assessment of the cumulative effects that discuss the following:*
>
> - *All quarry related sources of noise, including transport of product and the impacts and cumulative impacts on people*
> - *The impacts of dust associated with all quarry related activities, including road dust as a result of trucks and dust coming of loads in transit, which has not been addressed in the Air Quality Impact Assessment (Appendix 11). The Air Quality Impact Assessment is considered insufficient due to the lack of baseline air quality data and inability to measure and manage quarry related air quality impacts and nil assessment of the impacts of diesel fume emissions.*
> - *On site air quality monitoring equipment to measure baseline air quality (existing air quality and quarry generated air quality impacts) and ongoing measurement and management of quarry related contributions to air quality is recommended if approval is*

granted.

- *The SIA must address S.89 of the Local Government 1993, S.79(b) and S.79(c) Environmental Planning and Assessment Act 1979 and clause 228 of the Environmental Planning and Assessment Regulation 2000.*
- *Identify public infrastructure, such as school bus stops and general public bus stops. Changes to speed limits on Clarence Town Road and Brandy Hill Drive are recommended.*

Economic benefits derived from the development including:

- *Jobs, and a salary increase of $3.576 million. Flow on effects estimated to result in "a further 42 jobs and a further increase in wages and salaries of $3.502 million".*
- *"… it is recognised that the quarry is in a strategic location when considering its proximity to the Sydney market and would assist in the provision of construction materials to enable infrastructure development".*
- *Potential negative economic impacts on business and land values in Seaham.*
- *Economic costs post operations.*

(Samuel Harvey. Development Planner. Port Stephens Council.)

Maitland City Council

"… should there be a demand for quarry material to be transported through towards Maitland, Council is concerned that traffic noise may have a significant impact due the cumulative effect … combined with Martins Creek heavy vehicle traffic."

"In general, there should be consideration to the health and wellbeing of residents that reside along haulage routes associated with the quarry.

- *"Transport Management Plan should link to a Noise Compliance Management Strategy that considers noise monitoring and consultation with Council on outcomes."*

(Scott Henderson. Coordinator Infrastructure Planning Engineering. Maitland City Council.)

4.3 Community Meeting

The NSW Department of Planning and Environment facilitated a Brandy Hill Community Meeting on 22 March 2017. This meeting was advertised and well attended. The meeting notes are relied on in this SIA update as broadly representative of local discussions.[21] The Department's Record of Meeting is attached as Appendix 4.

Several officers from the Department led the Community Meetings with representatives present from the Brandy Hill Seaham Action Group. The Voice of Wallalong and Woodville, and Port Stephens Council, The Member for Port Stephens attended. Andrew Driver (Development Manager) and Chris Dolden (Operations Manager Aggregates) represented Hanson.

An Overview of the Proposal and the Approval Process was given by the Department.

Three presentations were made from representatives of the local residents' action groups. The concerned raised are consistent with those outlined in the Public Submissions summary above (at 3.1).

[21] For this reason, an additional Public Meeting has not been held as part of this research. However, the research has had conversations with local people about their interpretations of inputs from the Community Meeting.

Questions raised at the meeting highlighted concerns about:

- Road safety and adequacy of bus stops
- Noise and pollution impacts associated with increased truck movements
- Cumulative impacts (in relation it trucks particularly)
- Trust in the sincerity of Hanson consultation to date
- Quarry closure at end of operations

4.4 Community Consultation / Research

Specific, targeted consultation, in the form of focus groups, interviews, and locational intercepts, was undertaken as part of this social impact research. The focus was on small meetings with the nearest of neighbours. The starting point was the existing Community Consultative Committee (CCC) with members being asked to invite people to the meetings that they felt should be there. Interviews were also held with some local business people and some intercepts with young workers at a local Seaham shop. Discussion were held with both staff and Ward Councillors of Port Stephens Council. A Quarry visit and meeting with key staff also formed part of the engagement.

4.4.1 Site Meeting at Quarry with Shaun Boland and team (15/07/09)

- **Employment:** Employ 20 people; about 50% of whom live locally (with the area of influence). Our business:
  - Supply of concrete aggregates, asphalt and sealing aggregate for roads – Central Coast, Hunter Valley and Sydney
  - Special Projects: Break walls, Riverbank restoration (local area), airports, coal loader, RAAF base.
- The **concrete batch plant DA** (currently at Raymond Terrace – it is an outdated plant). There are 6 workers there; they may come over, but they are close to retirement age.
- The concrete batch plant will enable us to recycle concrete – excess from building sites etc. It allows us to turn a cost to the business into a profit centre. Councils like the recycled products produced.
- We have superior quality rocks for roads – Council's love it. Our rocks produce a low slip end product. We are preferred by most of the Councils from here to the Central Coast; although Port Stephens Council doesn't use us.
- We are currently providing for a very large contract at the RAAF … upgrade for new fighter jets.
- Providing rocks for river bank reconstruction work – post flooding work, along with Booral Quarry in East Seaham.
- We have provided rock to the upgrade to the Coal Loaders in Newcastle and to the former BHP site.
- **Our annual spend is large with local suppliers.** Just in Repair and Maintenance its over $3M per annum. It would be over $4M in total that flows into the economy through our supplies. Everything from purchasing for our work BBQs and lunches at the local shops in Seaham (butcher and local store) through to bigger maintenance items on the plant; Komatsu Tomago and Westrac Tomago.
- We make a lot of donations: Seaham Preschool, gave away road base to locals, post storm, support for Netball and Cricket teams.
- There is a lot of corporate pride in this Quarry. We do a really good job and we meet all environmental requirements. This is a stand out quarry for Hanson – visitors are always impressed. It's a great place to work.
- We don't employ any apprentices here, but Hanson have a Graduate Trainee Program.
- We help with the Young Driver's Program in schools. We present at the local High School in Raymond Terrace – we show the students a Truckie's perspective on the road; what they can

and can't see.

- We have 7 trucks based out of BHQ and 6 based at Carrington. Dozens of locals own their own truck and are on contract.
- We have a Code of Conduct for all drivers – old and new; our trucks and contractors:
  - Our trucks can leave at 5am.
  - Trucks coming in are on curfew until 6.30am
  - There is a Memo for all drivers on times and on parking – there is a park in Raymond Terrace where we ask them to wait if they are early.
  - If truck drivers break the Code of Conduct they are given one warning and then their contract is terminated. We are really strict on that and we sack any "cowboys".
  - RMS Chain of Reaction (Truck Safety)
  - 70% of our truck movements are along Brandy Hill Drive. The end point for our aggregates determines the route.
- Andrew and Chris put a proposal to the last CCC – about what might be in a VPA. We pay per ton to Port Stephens Council – not convinced it is always well spent by Council.
- There is an issue with the car entrance at Raymond Terrace MacDonald's – it is the worse Maccas to get in and out of.
- **The nature of our business is cyclical; it goes up and down "like a yoyo". This will continue with the expansion** – we want to be able to meet large contracts but there will still be times when we are quiet. Our hours or operation are driven by market needs.
- Blasting complaints: there haven't been any for the last 3 or 4 – even for the 80K shot recently, which was the largest we have ever done.
- **There have been 4 complaints this year from January – September 2017.**
- There is nothing at night atm but that might change. It is demand driven. We are penalised by Hanson for having stock capping (can't have rocks piled up on site).

Corporate Citizens / Possible Mitigation Strategies

- Discussion of truck movements during school bus operating times.
- Gilmours (Darren and Debbie): nearest neighbour on Clarence Town Road – first property on left near Seaham. We have paid for a new fence separating the properties.
- Wild Dog Trapping program twice per year. The contractor Kevin Forward spends a lot of time talking to neighbours – making sure they keep their dogs inside.
- If Brandy Hill Driver were asphalt instead of tar it would be a lot quieter and there would be less potholes.
- Hanson Transport Supervisor – responsible for Compliance and Induction for trucks. Previous personnel have been very good. Everyone's future depends on safe operations.
- Local businesses that benefit from our operation: Cleaning contractors, electrical and mechanical contractors, machine and equipment hire, pest and weed control, environmental services and monitoring, spare parts, consumables, local Seaham shop and butcher, Supermarket and 100 drivers making deliveries.
- The idea of a "Community Trust" for donations that removes Council from the equation could work.

Policies / other comments

- Complaints Register sighted and photographed. Current and in good order. Managed by Nicole.
- Complaints always responded to; however, team were unclear if the responses have been communicated to the complainants. E.g. blasting complaint from Giles Road resulted in monitors

being installed on the Giles Road / BHQ border.

- Team unclear of Complaints policy in terms of length of time to respond, and reporting.
- Noise and Dust is mostly related to truck movements. There is a strict Code of Conduct (not sure where this is published / not sighted) and a clear Chain of Responsibility.
- The local media have not been helpful – on the release of the intended expansion the front-page
- headlines were "1.5M tons and X truck movements". This cemented the maximum operational load in people's mind as a constant for the expansion.
- We used to tell people when we were blasting but we found that it generated complaints, so we don't say anything now. Sometimes there are complaints to the EPA on days that we haven't blasted (e.g. Anzac Day when we were closed).

4.4.2 Meeting with Giles Road Residents

The researcher met in the home of some Giles Road residents. Key points:

- We object to the quarry and its expansion because:
    - It impacts on our investment in the area (moved from Stockton to large rural property 2 years ago). The real estate agent didn't tell us the quarry might expand; he indicated the contrary.
    - Lifestyle and amenity impacts
    - It's our children's future – what about their health and wellbeing?
- Road speeds need to be reduced to 60km/hour; however, people overtake whatever the speed limit is.
- Longer term impacts if zoning in the area changes to residential – already there are more subdivisions of rural property being planned. E.g. 4 Giles Road – rural residential plans that are inappropriate. The more people who move to the area the more conflict there is likely to be with the "industrial use" of BHQ.
- Brandy Hill Drive is full of potholes.
- We chose this area for the social amenity:
    - Local schools and pre-schools are excellent
    - People move here to get into Seaham School
    - There are good bus links to private schools in the region including Hunter Valley Grammar
- We would like to see details now of the Mine Closure and Rehab Plan. What is the end use going to be and what say will we have in it?
- Health, air quality and dust (can see dust plume over quarry from their property high on hill):
    - Very little confidence in Air Quality management – nothing seems transparent. Where are the Monitors located? We would like to see the result of air monitoring available on the website.
    - They say they meet the Standards – but what are they and how do we know?
    - We can hear machinery at 9pm at night.
    - My brother is asthmatic – it has been peaking and troughing – we can't directly attribute it to the quarry; but we suspect it is related to dust levels.
    - Is there dust in our tank water?
    - North easterly is the prevailing in wind in summer and that blows dust right over our

property. Is there dust watering? What can be done to reduce dust? Can they blast on wind free days?
    - How will this not explode into 24/7 operations?
- The gate from BHQ into Giles Road – is there a second entry planned?
- Clearing of 48 hectares – that is a lot of land clearing and environmental damage.
- Out house is moving and cracking. Tiles are falling off our pool. We can't prove why – but we suspect that it is BHQ operations. It is costing us a lot of money.
- We want a clean rural environment.
- We are concerned about the value of our property decreasing with 24/7 operations and increased truck movements. Brandy Hill cops it enough as it is – existing impacts are unacceptable. As residential development has moved out to this area it is time for the quarry to go – industrial and residential are incompatible.
- We know cyclists and motorbike riders who wouldn't come out this way now (they use to) because of safety risk.
- Shift worker drives to work at 4am and comes across trucks on Brandy Hill Drive – they may be from another quarry but from our perspective it is trucks on the road at 4am.
- Emerging characteristic of the area:
    - Brandy Hill has a high level of social amenity: connection and community
    - It is a very progressive community – there are a lot of professionals moving to the area; Doctors, Police etc.
    - It is an emerging artistic community. Next door has held Body Percussion workshops and large community events. We are trying to create a vibrant, artistic community. We have been discussing "slow food" and creating a farm gate experience for visitors.
    - Seaham school is at capacity.
- Maybe the baseload impacts will be OK (not sure, or agreed upon) but we are definitely opposed to an increase in operations.
- We made a report on blasting to the EPA on 6/7/17. It seemed to us that there were three blasts that day. The EPA said "they are not exceeding limits so there is nothing we can do. But please keep ringing up and reporting." This seems to me that the EPA have concerns and want us to report to assist them to deal with the situation. It makes me suspicious of operations that the EPA would be encouraging us to ring up.
- We don't like the idea of a concrete crushing plant – that adds even more pollution.

Summary of suggested mitigations:

- Publicly available air monitoring data
- Dust watering and no blasting on windy days
- No blasting or crushing after 8pm
- Reduce speed limits on the roads
- No trucks during school bus times
- Cycleway / walkway along Brandy Hill Drive

4.4.3 Meeting with CCC Community Members and invited local residents

Chaired by Lisa Andrews, Independent CCC Chair. This was an open focus group in the home of

Margarete and Neil Richie. CCC members had been briefed about the nature of the consultation and asked to invite any local people that they felt would like to have input. No Hanson staff were in attendance. CCC minutes of the meeting Appendix 5.

Prior to meeting commencement Cr Paul Le Mottee asked if the researcher were a "PR Company". The nature of the social impact assessment was explained; namely it was required to be an objective piece of research which must conform with the Department's Social Impact Guidelines.

Peter Rees raised the point that it was inappropriate to ask the community to comment further when they have not seen the amended documents under consideration as part of the EIS. While the point was taken, the Department has asked for the SIA to be revised and this consultation is critical to that process.

Key themes emerged during the discussion and the group agreed on the issues:

- Thee CCC feels like it has been betrayed – we put in a lot of work trying to cooperate with Hanson. Now we see none of our issues addressed in the EIS and we wonder what we have been doing. We feel used; the consultations have just been to "tick a box".
- The previous management has made promises to us – about a cycle/footpath for example, that now no longer seem like they will proceed.
- We need all mitigation works to be done up front. This expansion should not go ahead until current issues are addressed and proper infrastructure is put in place.
- Dollars need to be spent up front.
- Cumulative impacts are a burden to us. This Quarry cannot be considered in isolation from other operations that send trucks down Brandy Hill Drive (and pay no levy to Port Stephens Council).
- We have been told by Hanson (Chris) that "individuals don't count. We are responding to government and external community demands. We are driven by profit and market share." This is offensive. This is our home, our community. We can't drive off at the end of the day. For us it is a life and a relationship.
- Shaun Boland is decent. If he could be honest he would probably say he is embarrassed by Hanson Head Office (Le Mottee)
- We have been bullied by Hanson – we have been asked to remove signs and threatened with legal action if we didn't. The Quarry Facebook page, managed by the Quarry manager (Brad), has accused us of dividing the community. A comment was made on a Facebook page: "Brandy Hill/Seaham action does not stand for me" which referred people to "Brad – quarry manager if you want the true story". Margarete Ritchie rang Brad to alert him that he was being mentioned and in that conversation Brad seemed on the side of that group – he said: "what do you expect?"
- The Quarry needs its social licence to operate – it seems to have lost sight of that.
- We are unsure of the current conditions of consent. There has been no consultation on tonnage increases over time. What can a community do to have a normal life? We seem to be back to square one all the time.
- There are trucks on the road between 6am and 6.30am. Even as early as 5am. We can't always tell if they are from BHQ or from Martin's Creek. Daracon should send their product out by rail – they don't pay levies to anyone.
- There is very little truck movement after 7pm – but we have heard them at 3am sometimes. You

can't get up and check where they are coming from at that time.

- Can we see the current consent under which BHQ operates? That would be a good start – we don't know the current conditions.
- At night, we can hear noise – the thump of the JAW (even towards Duns Creek). **We would lean towards safety and cycleway and put up with operating at night if it came down to that sort of choice. (Not a universally held position – the proposed night operations are the biggest source of objection for most people).**
- The SEPP for Extractive Industries allows for limiting truck movements in residential areas. Should be 6am-6pm. There are noise impacts along Clarence Town Road. **The speed limit should be reduced along Clarence Town Road.**
- The current impacts from quarry operations have not been solved; therefore, local people aren't happy. "the Baseline is not working for us." We believe Hanson have abused their good relationship with the community.
- On a foggy day, it can be like pea soup along Brandy Hill Drive – trucks come out of nowhere. It's very dangerous.
- Council can't maintain the roads now – how will they be able to cope when there are more trucks on the road?
- Asphalt would be a much better road surface, both in terms of noise mitigation and maintenance. However – it's "lala land" to think that would happen. It's too expensive.
- The Cricket Club kids can't ride their bikes on the road – it would be good for them to have a safe cycleway from the fields in Seaham and along Brandy Hill Drive.
- The Seaham Park & Wetland Committee has been told that "donations have finished" e.g. for gravel in Seaham Park. It seems we are being punished for being vocal about this expansion. There appears to be a "divide and conquer" strategy. There is a deliberate attempt to generate contempt across groups in the community. We are blamed for complaining.
- We would like a slower speed limit – especially at intersections.
- It's the "Subbies", not Hanson Trucks that cause most of the problems (CB Transport). They fly past the bus stop – the speed limit past bus stops should be 40 km/hour. Subbies trucks should be fixed – they should be as quiet as Hanson trucks.
- Need flashing lights on school buses to remind people to slow to 40kms/hr.
- 100km/hr. is a concern on Clarence Town Road. 80 km/hour is OK for Brandy Hill Drive.
- Our amenity is being destroyed. At Karama, we can hear blasting and trucks.
- Butterwick Road (5-6km from Quarry) – we can hear and feel blasts. Windows rattle.
- Neika Close (towards flood plains) seems to be in a particular spot that hears the blasts and gets all the dust.
- Would like to see a truck Risk Assessment.
- Is it possible to crush wet? That would make a difference to dust. Worm Drive conveyors?
- The community has got to breaking point with the company.
- Some members have done a trip to the Progress Association in the Southern Highlands and visited 4 quarries.
    - Holcim Lynwood
    - Happy community
    - No trucks through residential areas
    - State of the art equipment

    - We have a lot of work to do – now convinced that all these strategies should be in place up front – including road works and cycleways.
- It is time for this community to "play it tough". If we want something, we should name it and insist on it. The time for waiting for the company to do the right thing has passed.
- Role of the ongoing CCC: it needs to be formalised and meet the Guidelines:
    - Meet twice a year once current issues are resolved.
    - Properly set up.
    - Complaints need to be dealt with immediately as the occur – not at the CCC meetings.
- The time for talking has past. Hanson need to ACT to show some good will. Hanson need to be proactive now.
- When there is a blast complaint – Hanson needs to send people to the houses to hear the blasts – not just rely on a monitor that we never see the data from.
- We are losing contact with friends because we can't walk together any longer – the road is too dangerous.
- Dust – we have heard very little about dust – the Southern Highland Quarries are right on top of this.
- There have been several broken windscreens – from trucks throwing up gravel.
- Concrete crusher – not entirely sure what that will mean for trucks:
    - 20 loaded trucks going up hill
    - Sand trucks
    - Cement trucks
- Not happy with the current 700,000 tonnes – how did that happen? What exactly does the approval say?
- No Quarry – many of us are leaning towards saying this is not an appropriate place for a quarry anymore. Roads are not to AUS Road Standards.
- We must have the road rebuilt and a Footpath / Cycleway from Bandy Hill to Seaham.
- We must check the VPA – build the road first, then maintenance.
- Solastalgia – loss of sense of place.
- Traffic at Raymond Terrace is also an issue. The Macca's there must have the worst entry in Australia.
- We need flashing lights on and 60/km an hour on Clarence Town Road [various opinions on what the speed limit should be but strong agreement that it should be slower than it is now].
- The Asset Manager at Port Stephens Council now understands our issues. He seems to be on board with our concerns. We have felt that Council haven't listened in the past and that we are just a bit "too far out" and forgotten when it comes to infrastructure and road maintenance. More recently they have responded to pot hole complaints made by direct phone calls.
- It is really important that ALL trucks are easily identifiable. ID needs to be on the truck and dog as a condition of consent. And it must be large enough to read.
- The meeting ended with the CCC asking that the research consultant convey these views to Hanson and that a request is made to get some action now, prior to any approval, on some of the current issues.

The CCC was invited to have input on the notes and to make ongoing contributions. **Information about**

Key Insights and this research was posted on the Brandy Hill and Seaham Action Group website[22]. Inputs from the community were fed to the researcher through the CCC. One such input was a concern raised about the impact on wooden heritage bridges in the wider area; including in Maitland City LGA.

Figure 4 Heritage Bridge at Morpeth, looking towards Hinton

4.4.4 *Interview a local early childhood centre*
(Name withheld on request)

Local schools and pre-schools were often mentioned in submissions; therefore, a provider was interviewed to obtain a first-hand perspective. Key points raised were:

- Businesses looking after businesses – we don't want to cause ripples – we all get on with doing business and respect each other.
- Owner grew up in the area – trucks are part of the environment; they always have been. We had to wait for buses and watch the trucks go by when we were kids.
- Increased trucks a concern – we have a turning lane … coming from the opposite direction and it can be can be quite tedious. Our children are contained; they can't get out onto the road … but we want families to be able to turn our property safely.
- 90% of drivers courteous.
- Need to look at entries and exits, intersections, and bus stops. It's not like the city – we can't expect the same type of road infrastructure.
- Wouldn't like to see speed limit slower.
- Level of concern: you can hear the loudest voices … no one has brought it up to the Director of this Centre; but we will ask and encourage anyone who wants to, to contact you. There is more conversation about rural zoning changes than there is about the BHQ expansion.
- In this area we have always needed to be careful of the trucks. I have no problems, personally.
- One preschool and one school in Seaham … no trucks near them.

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22 https://brandyhillaction.org/category/brandy-hill-quarry/

- Driver safety is critical … have seen a fatigued driver recently … nearly ran me off the road. Didn’t complain. (Complaints processes need to be improved – they should flyer drop: “we value safe driving … please let us know).

- Pre-school business is good – we have a waiting list … 2 years in some cases. Business has exploded this year … seeing a lot of people from Raymond Terrace, Wallalong, Paterson and further afield. We don't just service locals.

4.4.5 Discussion with local business owner in Seaham

A casual conversation with a central local business in Seaham was conducted after explaining the purpose of the social research and engagement. Key points raised were:

- We support everyone and don't like to be too public about our own views.
- We benefit from the Quarry – they purchase from us; their workers drop in here.
- A lot of people from around here benefit from the Quarry – a lot of truck drivers live locally. There have always been trucks through Seaham.
- There is a bit of division around town about this development – we try and remain neutral; but really, I don't have a problem with the expansion. The Quarry have done a lot of good things for the community – they gave away a lot of gravel after the recent floods.
- Business is thriving – it is consistently we good. We are flat out at peak times.

4.4.6 Intercept with young workers in Seaham

An informal discussion was held with young workers on a lunch break in Seaham. There were from outside the area but benefitting from work in the area (not associated with the Quarry). As they had to drive in and out of the area every day they were asked about the impact of trucks:

> *"No, it doesn't bother us. We know they are on the road. We just take the back streets when we have to and avoid them. It's not a problem."*

4.4.7 Interview with local Real Estate Agent

The market in the rural area continues on-trend with Sydney and Newcastle; although without the peaks and troughs – it is more stable. Older famers on larger farms and selling up and buying smaller rural holdings. The larger farms are being bought by outsiders; often Doctors and other professionals who are looking for a quite get-away rather than a permanent residence. We are feeling optimistic regardless of what happens at Brandy Hill. (Dungog and Clarence Town based agent).

4.5 Interviews with Council and Councillors

Ward Councillor Paul Le Mottee was at the CCC meeting held on September 15 and provided significant input. A follow-up conversation was held with Ward Councillors who were motivated to support the interests of their constituents while encouraging local business and activity. Negotiations with Council will be critical in developing and monitoring a Voluntary Planning Agreement (VPA) should the expansion be approved.

Members of the CCC requested that there be a discussion with John Maretich, Asset Section Manager at Port Stephens Council. The Brandy Hill Expansion Project was discussed with an emphasis on the history of the project, local infrastructure issues and possible mitigation strategies to alleviate potential negative social impacts. Key points raised:

- Council staff are in communication with members of the CCC and are aware of local issues including those relating to a number of Quarries in the area.

- Council receives a levy per ton from Hanson which is applied annually to the maintenance of local roads in the area. The levy is currently 50c/ton and between $300 and $400K is spent on the local roads per annum. The heavy haulage monies spent to maintain our roads vary from year to year. It is quite common for us to spend in excess of $300K in any one year. Over the last 10 years Council has upgraded Brandy Hill Dr and Seaham Rd utilising the monies from the Brandy Hill Quarry. The Brandy Hill Quarry has been paying a levy to Council since 1983[22]. Martins Creek Quarry, who also send trucks along local roads, pay no maintenance levy to Council.
- Brandy Hill Drive was the original haul road for the Quarry. It is a rural road which services an expanding residential population. The Quarry was part of the local landscape before many of the residents arrived. It is uncommon for rural roads to have footpaths built alongside them. It would be an expensive and difficult task to build a footpath along Brandy Hill Drive because of the terrain. Brandy Hill Drive is on Council's Pathways Plan (reference); but it will never get prioritised for the above reasons.
- We recognise that safety at bus stops is a community concern. We also note that changing demographics in the area mean that the need for bus stops continually changes.
- The two practical mitigation strategies for this proposed expansion would be increasing the size of pull-overs at bus stops and making some concessions around times of trucks movements as they relate to peak periods for school children travelling on the road.

An important possible mitigation strategy for a walkway/cycleway combined with existing infrastructure not along Brandy Hill Drive was discussed.

4.6 Action Research

The researcher has taken an approach to this revised SIA that includes promoting issues to Hanson as they arise and trying to negotiate mitigation strategies that can be implemented immediately.

When at the CCC the issues of trust and concern about lack of action on Hanson's part were raised, a meeting was set up with Andrew Driver, Development Manager, to discuss strategies. A list of concerns and possible actions were presented. Hanson took the step of actioning what it could from those recommendations and writing to the CCC about them. That letter appears at Appendix 6. This is a part of an ongoing action and engagement plan to be implemented by Hanson.

Briefing to Hanson

Field research for the social impact update has revealed that the CCC community members are feeling betrayed and this has damaged trust in the company.

While the Hanson strategy has been to wait for the appropriate time in the approval process to work on mitigation strategies and a VPA; members of the CCC have interpreted this as "no actions intended". Hanson's key messages of "we will commit to a VPA", "we will work with Council and the community" etc. have not gained any traction locally.

As discussed at a meeting between Ellen Davis-Meehan and Andrew Driver last week, it is critical to recognise the disappointment and develop key actions that align with Hanson's intentions.

[22] According to Hanson – Council not sure for how long the levy has been paid.

Key strategies could include:

- Working towards reducing speed limits on Clarence Town Road, in line with Hanson's previous submissions on this matter.
- Immediately make Hanson's Code of Conduct for trucks available to the CCC (Note that all trucks must have ID displayed).
- Internally review the speed that our trucks travel past bus stops during school bus operating times.
- Publish a map of where noise and dust monitors are currently located and develop a plan for making this information accessible.
- Provide Conditions of Consent that determine the limits of our operations.
- Encourage Port Stephens Council to report to the CCC on spending to date of the Hanson levy paid to Council on a per ton basis.
- Review our complaints handling processes in the light of comments from CCC members and others in the community and make public an amended policy.

Consider in the more medium term:

- Reviewing engagement with the community and exploring ways to share accurate information in a timely manner to community members.
- Reviewing inputs from the social impact research as they become available and adding them to Hanson's planning agenda.
- Commencing work on VPA strategies in an open way with Council and the community so that we can demonstrate active commitment to the mitigation of impacts.
- Develop a community donations policy that is fair and consistent across the whole community.

Hanson is awaiting a response from the CCC and will meet to further develop strategies with them early in 2018. Action at the time of writing the SIA includes a scheduled CCC meeting on the contents of a Hanson letter. Conversations with Hanson suggest that there are some small, immediate strategies that can be implemented while the larger issues of 24/7 operation and number of truck movements are to be negotiated.

5. Analysis

Firstly, it is the view of this researcher that there have been some communication misunderstandings throughout the preparation of the EIS whereby Hanson have fully intended to act on community concerns at a time when they were negotiating a VPA. However, some in the community and some Council staff have interpreted this approach as a lack of intention to act at all. This has led to distrust of Hanson, which should be able to be resolved with appropriate action on mitigation strategies.

Secondly, the perception in some parts of the community is that this expansion, if approved, will result in an immediate and continual 24/7 operation with the maximum amount of truck movements as per the Traffic Study. In reality this will not be the case as the Brandy Hill Quarry business has peaks and troughs according to the contracts they are able to secure. The key balance that needs to be found in this expansion project is between Hanson being able to maximise its resource for its own benefit and for the economic flow-ons to the community, and the community being able to continue to live a healthy lifestyle with the amenity they currently appreciate being retained. So, while the perception of 24/7 operations 365 days per year are highly unlikely to become a reality, the mitigation strategies that accompany any approval need to give some level of comfort that amenity issues will be addressed. The key organisations in the community have shown a willingness to negotiate with Hanson to this end.

Thirdly, Councils, State and Federal Government, business and development agencies and people residing within the LGAs of Maitland and Port Stephens often are seeking outcomes that are in conflict with each other in some respects. Governments and agencies embrace and promote growth. People want to move to more semi-rural communities; but also want infrastructure and services commensurate with a city lifestyle. New developments are approved with the subsequent development of roads and other infrastructure that require aggregate products. Major roads are continuously upgraded as are airports and important civil and environmental protection projects. Such projects are often the subject of election promises and all require activity that places more trucks on the road system. Hanson, through its quarries, is meeting market demand. Local people, businesses and governments desire competitively priced aggregate products. As reported in the Newcastle Herald, April 14, 2017:

> *"The ability to continue supplying the Hunter region with products from Brandy Hill Quarry ensures a competitive market in the region. The high cost of transporting materials creates the need for quarries to be in close proximity to large existing markets, such as the Newcastle, Hunter and Central Coast areas." (Hanson)*

The major source of concern to local people is the potential 24/7 operation of the Brandy Hill Quarry and subsequent significant increases in truck movements on the local road system. The potential impacts on amenity and lifestyle are likely to be experienced most acutely by those living near the Quarry, and along Brandy Hill Drive. The potential benefits of the expansion are more wide spread beyond the local community and include a range of economic and social benefits that spread throughout several LGAs.

For near neighbours the potential social impacts associated with a significant increase in activity at the Quarry are: sleep deprivation, impacts on road safety, loss of local amenity and impacts on lifestyle through limiting connectivity via walking along the local roads, and excessive noise and vibration intrusions on a semi-rural existence.

5.1 Social Impact Overview

The analysis of social impacts uses the Department of Planning and Environment's Social Impact Guideline for State Significant Projects. The likelihood, extent, duration and severity of potential social impacts are summarised in the following table. This analysis relies on engagement with the local community and their representatives, key Council personnel, review of submissions to the Department on the Project, the EIS and original SIA, and expert reports prepared as part of the EIS.

Table 1 Social Impact Overview

Identified Social Impact	Likelihood / Sensitivity	Extent	Duration	Severity
Amenity	There is a strong community perception that local amenity will impacted. If truck movements are substantially and consistently increased, and the Quarry operates at times significantly beyond current operating hours; there will be amenity impacts. These will mostly be in the form of acoustic impacts. Some people will adapt to noise impacts over time. Likelihood depends on actual hours of operation and on mitigation strategies.	The geographic extent of amenity impacts will be focused on immediate neighbours and people living along the major haul route; namely Brandy Hill Drive. The major concern is noise impacts at night.	Amenity impacts will occur over the life of the project. Amenity impacts will extend beyond baseline impacts in so far as operation times consistently extend beyond current operation times.	The intensity of the potential impact on the social environment is likely to be **medium, without mitigation.** With proper mitigation of noise and truck movements (which may include some restriction on hours), it is not likely that amenity impacts will be acute or chronic. The history of the area and long-standing operations of Brandy Hill Quarry (with existing baseline) supports this conclusion.
Access	Some community members, particularly those residing along Brandy Hill Drive, are concerned about safe access to and from their properties. This is of particular concern to those towing horse floats. It is likely that residents will, over time, take more care as they leave and enter Brandy Hill Drive.	The geographic extent of amenity impacts will be focused on immediate neighbours and people living along the major haul route; namely Brandy Hill Drive.	Access impacts will occur during Quarry operating hours and throughout the life of the project.	The intensity of the potential impact on the social environment is likely to be **low. This impact will be reduced by mitigations designed to address amenity impacts.** It is not likely that access impacts will be acute or chronic. The history of the area and long-standing operations of Brandy Hill Quarry (with

Identified Social Impact	Likelihood / Sensitivity	Extent	Duration	Severity
				existing baseline) supports this conclusion.
Built Environment	The physical condition of local roads is an ongoing impact of truck movements[23]; not all of which are generated from Brandy Hill Quarry. Low likelihood of increase beyond baseline – subject to cumulative assessment. Public domain, in the form of a walkable and connected road system, may be diminished, however the road infrastructure as is will still be consistent with expectations of a rural road. Low likelihood beyond current baseline.	The geographic extent of amenity impacts will be focused on people using the major haul routes; including Brandy Hill Drive and Clarence Town Road. There may be some cumulative impacts (when considering truck movements from other Quarries and activities) in the local area and along routes in the Maitland City Council LGA.	Impacts on the condition of local roads and on the public domain will occur throughout the life of the project.	The intensity of the impact on the local social environment will depend on the extent of mitigation (in terms of the levy on the Quarry) and the application of the mitigation (in terms of Council's allocation of levy funds). The severity of these impacts is assessed as **medium**, without mitigation. This conclusion is made with reference to general expectations about the walkability of local rural road systems as well as Council's position that a walkway along Brandy Hill Drive is a low priority.
Heritage	Brandy Hill Quarry is a part of the heritage of the local area and was in operation before the local rural residential area was established. The proposal impacts	The geographic extent of the positive heritage benefits is with the Port Stephens LGA;	The impacts, both positive and negative, will occur over the life of the project.	The intensity of these potential impacts, both positive and negative, on the local social environment is **low.**

[23] Note that Council (according to the interview for this research), currently spends in excess of $300,000 per year on maintenance of the local roads. This is funded by a levy on Brandy Hill Quarry.

Identified Social Impact	Likelihood / Sensitivity	Extent	Duration	Severity
	positively on the legacy of that heritage. Somewhat likely. There are some perceptions and concerns that local timber heritage bridges (in Port Stephens and the Maitland LGA) will be damaged by increased truck movements; not all of which will come from Brandy Hill Quarry. Possible (subject to expert assessment).	and more particularly in the local areas of Brandy Hill and Seaham. The impacts on heritage bridges impact on the sense of history for those in the region, and is focused on specific sites.	Impacts on specific bridge sites will depend on the management of cumulative increases in truck movements, over local heritage bridges, from a variety of sources in the region.	
Community	The perception of potential impacts is greatest in the area of community. **<u>Health</u>** Wellbeing impacts arising from air quality (particulates from diesel) and sleep deprivation (noise – trucks and blasting). **Low likelihood of air quality impacts** if Quarry meets all Standards and legal requirements. **Higher likelihood of impacts on sleep** if Quarry operates continuously through the night. **<u>Safety</u>**	The geographic extent of community impacts will be focused on immediate neighbours and people living along, and using, the major haul route; namely Brandy Hill Drive.	These impacts are likely to occur over the life of the project and will require monitoring and managing as per the EIS.	The intensity of the potential community impacts is **medium to high** without mitigation. With mitigation, and a VPA negotiated with the local community, the intensity of these impacts can be reduced to a **low-medium** level. This conclusion is reached with consideration of the current high level of community cohesion and evidence of social capital. Meeting all environmental standards as per the current baseline is critical to the mitigation of these impacts.

Identified Social Impact	Likelihood / Sensitivity	Extent	Duration	Severity
	Risk to pedestrian and cyclist safety, bus stop safety, and general road safety. **Low likelihood of increase beyond current baseline** (with mitigations) **<u>Community Cohesion</u>** Loss of connectivity along Brandy Hill Drive from decreased capacity to walk along the road safely. **Low likelihood of increase beyond current baseline.** Positive community cohesion impacts associated with Brandy Hill Quarry's contribution to community life through its employees and through grants to community organisations. Medium likelihood.			
Economic	Utilisation of a natural resource with flow on effects throughout the region. **High Likelihood.** Contribution to local livelihoods through employment and to economic growth through the supply change. **High Likelihood.**	Local area, LGA, and the region extending south to the Central Coast and at times into the Sydney market. The Hunter Regional Plan 2036, identifies an additional	Throughout the life on the project and beyond, depending on post-quarry usage of the site.	The intensity of the potential economic impacts is **medium.** The Quarry is serving an area of strong construction and development growth, both residential and commercial.

Identified Social Impact	Likelihood / Sensitivity	Extent	Duration	Severity
		70,000 dwellings by 2036 and an additional 60,000 jobs. Building and infrastructure associated with growth predictions in these areas will generate demand for Quarry materials; easily supplied from its strategic location. Infrastructure development will also be enabled in the Sydney market.		Employment impacts and flow-ons are considerable. There is an opportunity cost to not proceeding in this established location. Market demand in a strong growth context will remain.
Environmental	Air quality, biodiversity, and other environmental impacts have a social dimension in that loss of environmental quality impacts on the local character and sense of place. The likelihood of the social dimension to environmental impacts being activated will depend on compliance with relevant environmental	The geographic extent of social impacts arising from potential environmental impacts will be focused on immediate neighbours and people living along the major haul routes. Several councils are likely to	Impacts will occur over the life of the project and beyond, if proper mitigations are not in place and standards are not monitored and met.	Impacts are likely to be **low**; given the current baseline and the Quarry's record in managing environmental impacts to date. Recycling impacts are low to medium; depending on volumes.

Identified Social Impact	Likelihood / Sensitivity	Extent	Duration	Severity
	legislation and on environmental mitigations. Contribution to recycling through concrete batching plant.	benefit from recycling concrete products through the batching plant.		

5.2 Economic Impacts

The original SIA outlines economic impacts including employment impacts[24].[24] In addition this revised SIA has concluded that:

- 20 jobs at the Quarry will be lost if this expansion project does not proceed. This will have impacts for those employees and for the economic contributions they make to their communities. This impact will be spread throughout the region.
- It the expansion does not proceed the Quarry will close and there will be loss of work for contractors and a decrease in income for suppliers.

The SIA notes the estimated cost for the quarry expansion as $15 million, slightly less than the $22.5 million in the EIS. Based on $22.5 million and reinforced by the Port Stephens Council submission, economic risks and benefits include:

- The corresponding creation of direct jobs is estimated at 43 jobs. From this direct expansion in the economy, flow-on industrial effects in terms of local purchases of goods and services are anticipated, and it is estimated that these indirect impacts would result in the gain of a further 42 jobs.
- Direct wages and salaries would increase by $3.576 million. From this direct expansion in the economy, flow-on industrial effects in terms of local purchases of goods and services are anticipated, and it is estimated that these indirect impacts would result in the gain of a further 42 jobs and a further increase in wages and salaries of $3.502 million.
- Securing the supply of construction materials to the Sydney market; delivering local expenditure and employment opportunities
- Contribution to servicing markets in the Hunter, Central Coast and Newcastle. The Hunter Regional Plan 2036, identifies an additional 70,000 dwellings needed by 2036 and an additional 60,000 jobs. Building and infrastructure associated with growth predictions in these areas will generate demand for the Quarry's materials and it is strategically positioned to deliver.
- Contribution to Sydney infrastructure projects.
- Potential negative economic impacts on local land values if there are significant and sustained losses to amenity and current lifestyle. It is difficult to rate these potential impacts as likely given the current baseline data and the fact that property values

[24] Brandy Hill Quarry Expansion Project Socio-economic Impact Assessment 2015 Pages 29-30

steadily increase over time along with NSW trends.
- There are both economic risks and potential benefits for post-operation in terms of land integrity and value. The 1983 Agreement with Council will be reviewed over time.

5.3 Ongoing Community Engagement

"Community involvement" is outlined in the original SIA and refers to the voluntary establishment of the Community Consultative Committee (CCC) and a range of community sponsorships provided by Hanson to the local community[25]. The community concerns identified in the original SIA are accurately scoped and summarised. Community concerns have been assessed in more depth in this report with the benefit of community submissions and further primary research with individuals and groups.

The list of community contributions is not comprehensive in the original SIA. For example; the Quarry's contribution to the Young Driver's Program in schools whereby Hanson employees present at the local High School in Raymond Terrace, showing the students a "truckie's perspective" on the road and relevant driver safety issues. This an important in-kind contribution that provides a public good.

The Quarry's somewhat ad-hoc approach to community support and engagement arises from the fact that is has been established since 1983 and enjoys a long-standing, casual but positive, relationship with the local community. The slow but steady growth in rural residential uses in the local area is leading to a more complex local community with higher expectations of engagement and accountability. While the Quarry meets the external standards of operation required under various approvals, it has not always actively communicated its actions to the local community.

There are a number of improvements that Brandy Hill Quarry can make to its community engagement that will form key mitigation recommendations in this update on the SIA. Some of them are already being acted upon. Key areas identified are:

- Formalisation of the CCC
- Establishment of communication mechanisms through or beyond the CCC, with local businesses and other residents, particularly near neighbours.
- Preparation of a "community sponsorship" policy
- Easily accessible reporting on monitoring data
- Quarry policies accessible on line (e.g. Code of Conduct for Trucks)
- Revision of Grievance Policy with firm commitment to feedback and closing loops
- Implementation of a revised stakeholder engagement plan (ongoing emerging plan)

This SIA update has created a dynamic of engagement and response. That process will continue with the next scheduled meeting between the researcher, Hanson and the CCC scheduled for early in 2018.

5.4 Mitigations

The original SIA detailed a number of mitigation strategies offered by Hanson. This research supports those mitigations, but finds that they need strengthening and extending. The original mitigations are listed here with analysis on their value and with recommendation for amendments. A further set of

[25] SIA Op cit pages 32-36.

mitigation strategies arising from the research and engagement for this SIA is also detailed below.

5.4.1 Original Mitigations[26]

1. Hanson will encourage project employment from the local district.
Hanson will advertise employment positions both on the Company's internal intranet and also using external sources such as Seek of Career One. The advertisement will provide a job description, salary and application details. From here applicants will provide documentation (e.g. resume) and enter into a screening process followed by an interview if required.

Key Insights Comment

This describes general, standard HR practices and needs to be strengthened to promote local employment opportunities.

Amended Mitigation

1.1 Hanson will form partnerships with local employment providers[27], including Indigenous organisations, to source new employees for the Quarry. In addition, Hanson will approach local school career's advisors about presenting to pre-school leavers about employment and apprenticeship with Hanson. Hanson will set a percentage target for employees from within the Port Stephens and Maitland LGAs and report against this target on its website.

2. Hanson will provide training and certification to ensure suitable applications can improve or acquire the necessary skills.
Hanson is committed to generating employment opportunities for the local district, and therefore is able to provide training to expand the knowledge and skill base of applicants. The Company provides training topics inclusive of (but not limited to); heavy vehicle operation, working at height, and risk assessment. The requirement to provide training, and level of training provided, would depend on the job description and also the employee's current skill set.

Key Insights Comment

This is good business practice and a part of Hanson's normal procedures. While generating employment and developing local skills is likely to be an outcome of the Project; this is not a specific mitigation strategy.

3. Manage Heavy Vehicle Traffic
... The Proponent will remain within noise compliance criteria stipulated in the Noise Impact Assessment[28], which stipulates truck movements shall not exceed 602 during the day and 116 during the

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[26] SIA pages 39-49

[27] E.g. Wesley Uniting Employment Raymond Terrace, Joblink Plus Raymond Terrace, Wahroonga Aboriginal Corporation Raymond Terrace: https://www.portstephens.nsw.gov.au/live/community/community-directory/health/wahroonga-aboriginal-corporation

[28] EIS Section 5 Appendix 9

evening … Hanson will endeavour, where reasonable and feasible to transport the majority of bulk construction material from the site during daylight hours (approx. 6am-5pm)

Key Insights Comment

This strategy shows intent, but it does not commit Hanson to any clear mitigation strategy. Negotiation of truck movement times will be a matter for ongoing community engagement and planning with the CCC. This original mitigation is therefore moved to a new mitigation strategy (below) that more broadly addresses the Statement of Commitments, general strategies and the VPA process and monitoring. Further, Hanson will comply with all standards; the company needs to provide information on its website on the location of monitors and noise data (subject of a new mitigation strategy below).

It is difficult to capture the "peaks and troughs" nature of the Quarry business as this mitigation attempts to do. Hanson could define "normal operating hours" and a certain number of days per year when those hours may be varied according to contracts, and with pre-notification to the local community.

4. Maintaining use of existing paths to reduce "spread" of traffic impacts

Hanson will ensure that current heavy vehicle haulage routes are maintained where reasonable and feasible …

Key Insights Comment

This mitigation doesn't commit Hanson to anything and is not included as a final mitigation in this report. The directions of truck movements are limited by location, and dependent on the end destination of haulage materials. Currently about 75% of truck movements are along Brandy Hill Drive. This could be monitored and reported on as a regular CCC agenda item.

5. Continuous Community Involvement

Hanson will maintain consultation and exchange of information with the Brandy Hill and Seaham community over the life of the project where appropriate. This will be achieved through scheduled CCC meetings every three months. Additional important information will be relayed to relevant parities via fact sheets, e-mail correspondence, written correspondence or via face to face exchange when relevant.

Key Insights Comments

This is a critical strategy for monitoring and mitigating impacts throughout the life of the project. Hanson should also make use of its website for the community to easily access information. This mitigation strategy is picked up and expanded in a new strategy (below) on formalisation of the CCC and communication channels.

6. Driver Awareness

Drivers will be informed of any traffic relevant concerns for the local community when relevant and instructed to minimise compression breaking and other activities that generate concern for local residents.

Key Insights Comment

Driver Awareness is a critical mitigation strategy and it related to the adherence to Hanson's Driver Code of Conduct. (Note this has been updated and is at Appendix 2)

Amended Mitigation

6.1 Hanson will implement and promote its Driver Code of Conduct for its employees and contractors. Breach of the Code will result in, after two warnings, dismissal or cancellation of contract. The Code of Conduct will be placed on the website and the CCC will be informed of compliance issues. The Code of Conduct will be reviewed from time to time with the CCC to ensure alignment with community expectations.

5.4.2 New Mitigation Strategies arising from this updated SIA.

1. Formalise the CCC

Formalise the CCC to comply with the Department's Community Consultative Committee Guidelines[29]. Membership of the CCC to comprise:

- An independent chairperson[30]
- Up to seven community representatives[31]
- A council representative from Port Stephens Council
- Up to three representatives from Hanson including the person with direct responsibility for environmental management of the project.

While there is an existing, active CCC; it would be appropriate to follow the guidelines for selection of members at sometime within the 12 months following Project approval.

Agendas and CCC minutes to be available on the website.

A two-way reporting system created and monitored where there is regular discussion of how members of the CCC are disseminating Quarry information and receiving feedback (regular agenda item).
(Note: A formal CCC will be a condition of consent; it is included here in response to community inputs)

2. Design a mechanism for oversight of the 'Statement of Commitments' and Voluntary Planning Agreement (VPA).

The 'Statement of Commitments' has been refined as a result of this research and is a separate document submitted with the EIS. The social impact mitigations contained therein reflect community concerns.

A Voluntary Planning Agreement as it relates to extractive or mining industries refers to an agreement with a proponent and a governing authority (normally Council) that specifies contributions to be made under existing plans, policies or guidelines. For the Brandy Hill Quarry, this will refer to the contributions that Hanson will make under Section 94 of the EP&A Act for the maintenance of public services. In 95% of cases this relates to contributions for road maintenance but can refer to other matters as deemed by the consent authority.
Mitigation strategies contained within the 'Statement of Commitments' and the VPA should be specific

[29] http://www.planning.nsw.gov.au/~/media/Files/DPE/Factsheets-and-faqs/community-consultative- committee-guidelines-state-significant-projects-2016-10.ashx

[30] It is noted that the Brandy Hill Quarry CCC has just appointed an independent chair (Lisa Andrews) from the Department's pool of chairs.

[31] Consider the inclusion of a near neighbour from Giles Street or Clarence Town Road, subject to availability.

and measurable. Therefore, this key recommendation is to create a mechanism that provides oversight of the Statement of Commitments and the VPA. This mechanism should be a monitoring subcommittee of the CCC that includes community reps, Council and Hanson staff.

3. Consider additional mitigations in the regular CCC Agenda
Additional Strategies recommended that are outside the Statement of Commitments or VPA, but should be a part of the ongoing CCC Agenda[32]:

- Lobby appropriate authority for speed limits to be reduced on Clarence Town Road.
- Make the Code of Conduct for trucks available to the CCC and review and update it as necessary.
- Review number of truck movements during school bus operating times.
- Publish a map of where noise and dust monitors are currently located and make available the data from those monitors. Provide an easily accessed location for this data (e.g. Hanson website).
- Monitor night time quarry operations; consider limitations to prevent sleep deprivation while allowing for some flexibility in peak demand times.
- Bus stop lay-bys: Negotiate, with community and Council, widening of local bus stops to provide safer waiting space for users.
- Discuss options with Council and other infrastructure providers and road users, for ways of increasing local walkability through walkways / cycleways. Needs to be consistent with Council priorities, achievable and able to enhance connectivity for local residents. Explore alternative routes for walkways; for example, along the Hunter Water Pipeline.
- Develop a community donations / sponsorship policy that is fair and consistent across the whole community. Consult beyond the CCC to include local business, school groups and sporting organisations.
- Review Close of Quarry Plans and appropriate post-operations land uses. Call for community submissions on post Quarry land uses.

4. Improve Quarry accountability through improved communications and engagement.

- Review engagement with the community and adopt a Stakeholder Engagement Plan that includes:
    - Link to Quarry information on the Hanson website that is regularly updated
    - Newsletter that is published on-line, or via mail for those who prefer this option.
    - Publish location of all monitoring equipment and provide regular reporting through website and to the CCC.
    - Provide inks to key documents online such as the Blast Management Plan, Grievance Procedures and the Code of Conduct for Truck Drivers.
- Review complaints handling processes in the light inputs through this SIA, and make public an

[32] Some of these strategies have commenced prior to the submission of this report.

amended policy. Create a feedback loop[33].

6. Conclusions

Hanson is seeking to expand the allowable extraction area and increase the rate of production to 1.5 million tonnes per annum and continue operations for a further 30 years. This is a significant change to the current consent and meets the criteria for assessment as a 'state significant development' (SSD) under section 89C (2) of the Environmental Planning and Assessment Act 1979 (the EP&A Act). Hanson is also seeking consent to install a concrete batching plant, capable of producing 15,000m3 per annum and to receive up to 20,000 tonnes per annum of concrete washout material for recycling. The ability to continue production and sales 24 hours a day, 7 days a week is seeking to be retained.

This social impact assessment update relies on primary research and engagement with local people, a study of community and agency submissions, a review of local planning and policy documents, assessment of the local character of the area through ABS data and visits to the Quarry site and local area, the original EIS and accompanying SIA, the Director General requirements and the response of the Department and Planning and Environment to the social impact issues potentially arising from the expansion proposal. Throughout the research there has been a dialogue with Hanson about possible mitigating responses to the issues raised through the research.

Key social concerns identified by the Department of Planning and Environment's social impact reviewer, and substantiated through this updated social impact research, include:

- loss of rural amenity and 'liveability' caused by expanded hours of operation and additional truck activity;
- loss of sense of place (a quiet, safe, rural environment) caused by expanded hours of operation and additional truck activity;
- general adverse effects on health and wellbeing (e.g. ability to sleep) caused by expanded hours of operation and additional truck activity; and
- property devaluation, especially for residents on and near Brandy Hill Drive, Seaham Road and part of Clarence Town Road.

The major source of concern to local people is the potential 24/7 operation of the Brandy Hill Quarry and subsequent significant increases in truck movements on the local road system. The potential impacts on amenity and lifestyle are likely to be experienced most acutely by those living near the Quarry, and along Brandy Hill Drive. The potential benefits of the expansion are more wide spread beyond the local community and include a range of economic and social benefits that spread throughout several LGAs.

This research finds that the social impacts identified in the research can be mitigated. It also finds that there has been a willingness on the part of the majority of the local community, even key objectors, to

[33] Note that while complaints are rare, and often acted on within a short timeframe, those actions are not always communicated to the complainant.

negotiate with Hanson on mitigation strategies. The Hanson approach of electing to undertake the assessment of the proposed project on its technical merits for the purpose of the EIS, and then planning to respond to the initial submissions and feedback from the community, has damaged community trust in some sectors of the local community; particularly those involved on the CCC.

The process of this social research has established a pathway for improving community trust, with Hanson taking specific, immediate actions on community inputs to date where possible. In consultation with Hanson mechanisms have been designed for ongoing consideration of social impacts through CCC agenda items, as well as creating a mechanism for oversight of the Statement of Commitments and the VPA.

It is desirable to find a balance between Hanson being able to maximise its resource for its own benefit and for the economic flow-ons to the community, and the community being able to continue to live a healthy lifestyle with the amenity they currently appreciate being retained. This is the pivot around which social impact mitigations will revolve.

This updated SIA is in agreement with the conclusions of the original document[34] and provides the following risk/benefit summary based on the research for this updated SIA and taking into account the current baseline situation:

Potential positive impacts:

- Economic benefits related to securing the supply of constructions materials for critical projects in the Hunter and reaching into the Sydney market. Based on a $22.5 million the economic benefits, for construction and operation, include:
    - 43 direct jobs and flow-on effects of local purchases of goods and services, and spin-off jobs throughout the LGA and beyond.
    - Direct wages and salaries increase approximated to be $3.576 million, and subsequent flow-on impacts including further job generation and salaries estimated at $3.502 million.
    - Support of local growth strategies.
- Employment impacts if a successful “employ locally” program can be implemented.
    - Jobs for local people and contractors – impacts throughout the supply chain.
- Enhancement of community relations through improved contacts with schools, sporting organisations and other bodies and contributions to community aspirations through a document donations/sponsorship policy.
- Improvements to local safety with expanded bus lay-bys and possible walkways; dependent on ongoing negotiations with the community, Council and other infrastructure providers.
- Continuation of the heritage of the Quarry as a contributor to the local character of the area.

Potential negative impacts:

[34] SIA page 40

- Downward pressure on local land values if there are significant and sustained losses to amenity and current lifestyle.

- Amenity and lifestyle impacts if there are substantial increases in truck movements above current baseline.

- Sleep deprivation if continuous 24-hour operations are achieved.

- Cumulative impacts when considered in concert with truck movements from other quarries, particularly Martins Creek and including Council and other truck movements in the area.

- Road safety impacts if mitigations relating to hours of operations, speed limits and enforcement of the Truck Code of Conduct are not enforced.

- Sense of loss of local environment and sense of place if environmental standards are not met.

- Contribution to general traffic throughout the region associated with growth and development.

- Amenity impacts to immediate neighbours associated with increased activity, especially blasting at night, within the Quarry perimeter.

The risk of not proceeding with the expansion is that the Brandy Hill Quarry will close and there will be a loss of some 20 jobs with flow-on impacts to the economy. As per the 1983 Agreement Council will have a recreation area handed over that it is not likely to want to maintain. The majority of submissions have indicated that they would like to see the Quarry continue its operations, it is generally the scale of those operations that is contested. This updated SIA recommends the following mitigations.

6.1 Recommended Mitigation Strategies

1. Formalise the Community Consultative Committee

Formalise the CCC to comply with the Department's Community Consultative Committee Guidelines[35]. Membership of the CCC to comprise:

- An independent chairperson[36]
- Up to seven community representatives[37]
- A council representative from Port Stephens Council
- Up to three representatives from Hanson including the person with direct responsibility for environmental management of the project.

[35] http://www.planning.nsw.gov.au/~/media/Files/DPE/Factsheets-and-faqs/community-consultative- committee-guidelines-state-significant-projects-2016-10.ashx

[36] It is noted that the Brandy Hill Quarry CCC has just appointed an independent chair (Lisa Andrews) from the Department's pool of chairs.

[37] Consider the inclusion of a near neighbour from Giles Street or Clarence Town Road, subject to availability.

While there is an existing, active CCC; it would be appropriate to follow the guidelines for selection of members at sometime within the 12 months following Project approval.

Agendas and CCC minutes to be available on the website.

A two-way reporting system created and monitored where there is regular discussion of how members of the CCC are disseminating Quarry information and receiving feedback (regular agenda item).

(Note: A formal CCC will be a condition of consent; it is included here in response to community inputs)

2. Design a mechanism for oversight of the 'Statement of Commitments' and Voluntary Planning Agreement (VPA).

The 'Statement of Commitments' has been refined as a result of this research and is a separate document submitted with the EIS. The social impact mitigations contained therein reflect community concerns.

A Voluntary Planning Agreement as it relates to extractive or mining industries refers to an agreement with a proponent and a governing authority (normally Council) that specifies contributions to be made under existing plans, policies or guidelines. For the Brandy Hill Quarry, this will refer to the contributions that Hanson will make under Section 94 of the EP&A Act for the maintenance of public services. In 95% of cases this relates to contributions for road maintenance but can refer to other matters as deemed by the consent authority.

Mitigation strategies contained within the 'Statement of Commitments' and the VPA should be specific and measurable. Therefore, this key recommendation is to create a mechanism that provides oversight of the Statement of Commitments and the VPA. This mechanism should be a monitoring subcommittee of the CCC that includes community reps, Council and Hanson staff.

3. Consider additional mitigations in the regular CCC Agenda

Additional strategies recommended that are outside the Statement of Commitments or VPA, but should be a part of the ongoing CCC Agenda[38]:

- Lobby appropriate authority for speed limits to be reduced on Clarence Town Road.
- Make the Code of Conduct for trucks available to the CCC and review and update it as necessary.
- Review number of truck movements during school bus operating times.
- Publish a map of where noise and dust monitors are currently located and make available the data from those monitors. Provide an easily accessed location for this data (e.g. Hanson website).
- Monitor night time quarry operations; consider limitations to prevent sleep deprivation while allowing for some flexibility in peak demand times.
- Bus stop lay-bys: Negotiate, with community and Council, widening of local bus stops to provide safer waiting space for users.

[38] Some of these strategies have commenced prior to the submission of this report.

- Discuss options with Council and other infrastructure providers and road users, for ways of increasing local walkability through walkways / cycleways. Needs to be consistent with Council priorities, achievable and able to enhance connectivity for local residents. Explore alternative routes for walkways; for example, along the Hunter Water Pipeline.

- Develop a community donations / sponsorship policy that is fair and consistent across the whole community. Consult beyond the CCC to include local business, school groups and sporting organisations.

- Review Close of Quarry Plans and appropriate post-operations land uses. Call for community submissions on post Quarry land uses.

4. Improve Quarry accountability through improved communications and engagement.

- Review engagement with the community and adopt a Stakeholder Engagement Plan that includes:
    - Developing a community data base that includes preferred method of engagement (e.g. e-mail, post, website)
    - Link to Quarry information on the Hanson website that is regularly updated
    - Newsletter that is published on-line, or via mail for those who prefer this option.
    - Publish location of all monitoring equipment and provide regular reporting through website and to the CCC.
    - Provide inks to key documents online such as the Blast Management Plan, Grievance Procedures and the Code of Conduct for Truck Drivers.
- Review complaints handling processes in the light inputs through this SIA, and make public an amended policy. Create a feedback loop[39].

[39] Note that while complaints are rare, and often acted on within a short timeframe, those actions are not always communicated to the complainant.

As a result of ongoing engagement and project refinement the proponent has committed to the following mitigation strategies:

- a 60km/hr imposed speed limit on quarry tucks along Brandy Hill Drive
- changes to operating hours:

Hours of Operation	Construction Works	Monday to Friday 7:00am to 6:00pm Saturday 7:00am to 5:00pm No operation on Sundays
	Blasting	Monday to Friday 9:00am to 5:00pm No blasting on Saturdays or Sundays
	Load and Haul	Monday to Saturday 5:00am to 10:00pm No operation on Sundays
	Primary Crusher	Monday to Saturday 5:00am to 10:00pm No operation on Sundays
	Secondary and Tertiary Crushing and Screening	Monday to Sunday - 24hrs
	Sales and product dispatch	Monday to Sunday - 24hrs
	Maintenance	Monday to Sunday - 24hrs

With proper mitigation strategies, the Brandy Hill Quarry Expansion Project will deliver a net socio- economic benefit to the LGA.

Appendix 1 About the Author

Key Insights Pty Ltd

Leading social and applied research and strategic planning

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Ellen Davis-Meehan B.Ed., M.Ed. Stud.

Ellen is the Director and founder of Key Insights Pty Ltd - a social and applied research and strategic planning consultancy. Key Insights has been operating since 1994.

Ellen has extensive consultation, research and project management experience in both the private and public sectors.

Ellen has managed major national and state-wide research projects, organisational reviews, social impact assessments and community consultations, and has facilitated strategic planning processes for small business, large organisations and regional development bodies.

Ellen has consulted in the following areas:

- Social and economic impact assessments
- Primary research in homelessness, crime and crime prevention
- Community and Youth Services, Aged Care, Indigenous services
- Community Management / Strategic Planning
- Place-based Master Plans for local government
- Business Development and Corporate Governance
- International research projects for the UN & private companies
- Socio-economic projects and reporting to the IFC (World Bank)
- Socio-economic development in vulnerable communities

Ellen has conducted numerous community consultations and engagement processes for local government, education providers, developers, mining companies and regional development bodies. She has developed consultation models, service and education programs and complex business plans for a range of activities.

Recent projects:

Study in to the Provision of Catholic Secondary Education in the ACT

Ellen has undertaken extensive primary research into the provision of secondary education across the ACT and reviewed performance data, education trends and the changing ACT demographic characteristics. The report delivered strategies for a sustainable Catholic education system for the next 25 years and beyond. The final report was delivered to the Catholic Education Commission in May 2017.

Ellen competed a similar project for the Diocese of Maitland-Newcastle (http://www.mn.catholic.edu.au/schools/secondary-education-study) and has undertaken several projects for the Diocese in social impact, organisational review and strategic land management planning.

Newcastle Airport Strategic Market Research

Ellen has undertaken extensive primary research into the market potential for Newcastle Airport as it seeks to expand its business. This 2016 project included quantitative and qualitative research as well as facilitated sessions with stakeholders, and the Newcastle Airport Board. Newcastle Airport is a long-term client.

BHPB Hunter River Remediation Project.

Ellen designed and implemented the social impact assessment and the stakeholder engagement for this project which was the largest remediation project in the southern hemisphere at the time. This included community risk assessment, community surveys and public meetings, internal employee research, newsletter and fact sheet production and detailed analysis and reporting.

Hunter Development Corporation Cities Taskforce Engagement Facilitation.

Ellen facilitated the planning focus groups, forums and public meetings for this significant planning process for Newcastle (2013) and again in 2015 where she undertook comprehensive community based research to provide high level advice to the NSW government.

Newcastle Mall Public Domain Business Case

In association with Jenny Roberts of Castlecrest, Ellen panned a detailed business case for improvements to the Newcastle Mall Public Domain for Newcastle City Council with the objective of obtaining grant funding.

Social and Economic Impact Assessment for Gloucester Resources.

Ellen project managed this component of the EIS for a state significant project and implemented a broadly-based methodology in a community with some entrenched opposition to the project.

Research, Audit Mechanism and Sponsorship and Donation Policy Development, Origin Energy

Ellen undertook a research project for Eraring Power Station (Origin) that has set the framework for their future social monitoring and community engagement as well as provided protocols and guidelines for sponsorship and donations.

Social and economic planning including mine closure considerations in the Solomon Islands

Ellen worked with the IFC and World Bank to assist a mining company in Gold Ridge meet international standards and deliver outcomes for the community post-civil unrest. Ellen produced socio-economic documentation, based on consultation and in-country research, to support the company's obligations to their funding bodies.

Social policy research and strategic planning – diverse projects and clients

Ellen has completed many primary research projects for a variety of clients including quantifying homelessness in Newcastle and developing the city's Homelessness Strategy, investigating the experiences of young people from ethnic backgrounds, criminology research for academic Prof Stephen Tomsen including facilitating focus groups with young men and security personnel on violence, research with injecting drug users for Area Health Services, research with remote Indigenous communities for Attorney Generals and federal agencies and international research for the United Nations on legacy issues associated with war crimes in Rwanda.

Projects	For further project work please visit the Key Insights website: www.keyinsights.com.au
Qualifications	▪ Bachelor of Education (University of Sydney) ▪ Master of Educational Studies (University of Newcastle)

Appendix 2 Diver Code of Conduct

Hanson Quarries

Brandy Hill Quarry

Drivers Code of Conduct

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1. General Requirements

Heavy vehicle drivers hauling from Brandy Hill Quarry must:

- Have undertaken a site induction carried out by an approved member of the Quarry staff or suitably qualified person under the direction of the Quarry management;
- Participate in regular toolbox meetings with appropriate supervisor/manager;
- Hold a valid driver's licence for the class of vehicle that is operated;
- Operate the vehicle in a safe manner within and external to the Quarry site; and
- Comply with the direction of authorised site personnel when within the site.

2. Heavy Vehicle Speed

Increased speed means an increase in the risk of a crash and as well as an increase in severity if an accident occurs. A study undertaken for the Australian Transport Safety Bureau found that travelling 10 km/h faster than the average traffic speed can more than double the risk of involvement in a casualty accident (Kloeden, Ponte, & McLean, 2001).

There are two types of speeding:

1. Where a heavy vehicle travels faster than the posted speed limit; and
2. Where a driver travels within the speed limit but because of road conditions (e.g. fog or rain) this speed is inappropriate.

All posted speed limits within the Quarry site are to be strictly adhered to at all times. The speed limits are:

- Quarry Driveway – 60km/hr
- Haul Road – 45km/hr
- within the Quarry (plant/sales yard) – 25km/hr

Vehicle speed on public roads is enforced by the NSW Police Service. There are three types of penalties established under HVNL:

- Infringeable offences – an offence which results in the issue of an infringement notice. It gives the person issued the notice the option of either paying the penalty set out in the notice or electing to have the matter dealt with by a court.
- Court imposed penalties – some offences (general more serious) are not infringeable and must be dealt with by a court. The HVNL sets out the maximum penalty level that the court may apply.
- Demerit points – are managed through each state and territories' road traffic law (NHVR, Penalties and infringements, 2017).

For more information, please the National Heavy Vehicle Regulator website (https://www.nhvr.gov.au/law-policies/penalties-and-infringements).

All heavy vehicle drivers operating out of the Brandy Hill Quarry are to observe the posted speed limits, with speed adjusted appropriately to suit the road environment and prevailing weather conditions, to comply with the NSW Road Rules & Heavy Vehicle National Law. The vehicle speed must be appropriate to ensure the safe movements of the vehicle based on the vehicle configuration.

3. Heavy Vehicle Driver Fatigue

Driver fatigue or drowsy driving is a safety hazard for the road transport industry. The main causes of fatigue are not enough sleep, driving at night (during sleeping hours) and working or being awake for a long time (NHVR, 2017). It is one of the biggest causes of accidents for heavy vehicle drivers. National heavy vehicle driver fatigue laws apply to fatigue-regulated heavy vehicles, which are:

- A vehicle with a Gross Vehicle Mass (GVM) of over 12t
- A combination when the total of the GVM is over 12t
- A truck or a combination including a truck, with a GVM of over 12t with a machine or implement attached.

Under the law, working hour options for fatigue management are:

- Standard hours
- Basic fatigue management
- Advanced fatigue management

All heavy vehicle drivers operating out of the Brandy Hill Quarry are to be aware of their adopted Fatigue Management Scheme and operate within its requirements. By law, all drivers have a duty to not drive a fatigue-regulated heavy vehicle on a road while impaired by fatigue.

4. Heavy Vehicle Compression Braking

Compression braking by heavy vehicles is a source of irritation to the community and can generate numerous complaints from residents, especially at night when residents are sensitive to noise. There are instances compression braking is required for safety reasons, however when passing through or adjacent to residential areas, a reduction in the speed of the vehicle is recommended. This will allow the avoidance of compression breaking at all times.

All heavy vehicle drivers operating out of the Brandy Hill Quarry are to minimise the use of compression brakes, so as not to create excessive noise that could disturb local

residents, where possible. Compression braking within or adjacent to residential areas should only be used if required for safety reasons.

5. Heavy Vehicle Noise

Hanson trucks current hours of transport are 6:30am to 4:30pm, subject to customer demands and operational requirements. Due to truck maintenance, driver training and truck type selection, Hanson trucks are permitted to enter and leave outside of stated hours, as may be required to meet project requirements.

Weighbridge operation for all contractors is 6.30am to 4.30pm, subject to customer demands and operational requirements. No contracted trucks will be ticketed outside these hours. In the unusual circumstance that a contractor requires entry into the Quarry site outside of these hours, Hanson will assess that the contractor truck is designed and maintained to no less standard than trucks within the Hanson fleet and is operated in line with the principles of noise mitigation to local residents.

6. Covering Loads

Loose material on the road surface has the potential to cause road crashes and vehicle damage. Uncovered loads represent the greatest risk to loose material on the road.

All trucks arriving at or departing from the Brandy Hill Quarry, whether loaded with material or not, are required to have an effective cover over their load for the duration of the trip. The load cover may be removed upon arrival at the delivery site.

All care is to be taken to ensure that all loose debris from the vehicle body and wheels are removed prior to leaving the site. Drivers must ensure that following tipping that the tailgate is locked before leaving the site.

Quarry Management is to monitor loose material on the side of the haulage route from Quarry operations and take appropriate action (removal or suppression) regularly.

7. Heavy Vehicle Departure and Arrival

Heavy vehicles travelling in close proximity on dual lane public roads can be of concern to light vehicle drivers as well as increasing noise through or adjacent to residential areas. To alleviate public concern and increase road safety, heavy vehicles leaving the Quarry should try to be separated by a minimum, 1.5 minute interval.

It is difficult to schedule arrivals to the Quarry (except at the commencement of work for the day) due to the different directions of approach from external jobs and the varying job completion times, however, when a driver becomes aware, through visual contact or two-way contact between trucks, that they will arrive at approximately the same time then they are to ensure that there is a suitable gap between vehicles.

To alleviate public concern and increase road safety, heavy vehicles leaving the Brandy Hill Quarry should attempt to be separated by a minimum, 1.5 minute interval.

7.1. Safety initiatives for residential areas and school zones

All drivers are to show respect for our neighbours in the Seaham and Brandy Hill areas. Care is to be taken around school bus stops in the morning (6:45am to 8:30am) and afternoon (2:45pm to 4:30pm) periods. Drivers are to be mindful of children being dropped off and/or picked up in and around Seaham and Brandy Hill areas during these hours. Drivers are to comply with 40km/h speed limit for traffic passing a school bus as well as within school zones.

Brandy Hill Drive is an 80km speed zone. Please give pedestrians using Brandy Hill Drive a wide berth and be aware of the pedestrians' safety, road users' safety and their own safety at all times.

7.2. Primary haulage routes

The primary haulage routes are shown on **Figure 2**, with critical locations highlighted.

Heavy vehicle drivers are to carefully plan their routes so that State and regional roads are given priority for route selection. Local roads should only be used if there is no other option or in an emergency situation. To be considerate of our neighbours, short cuts and deviations should not be used when delivering Quarry products.

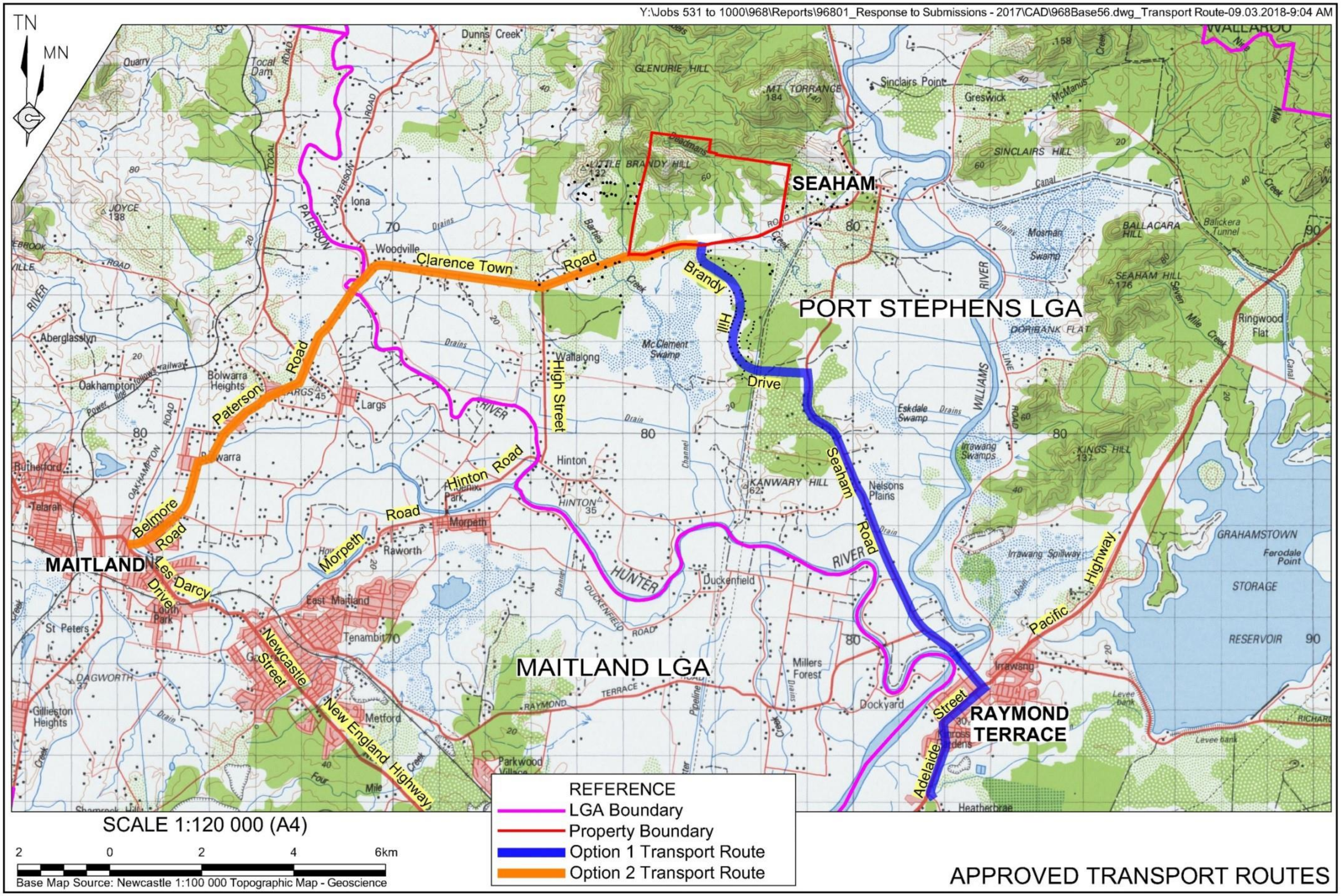

Figure 1: Approved transport routes.

8. Heavy Vehicle Breakdown and Incidents

In the case of a breakdown the vehicle must be towed to the nearest breakdown point as soon as possible. All breakdowns must be reported to the RMS TMC (Transport Management Centre) on 131 700 and the vehicle protected in accordance with the Heavy Vehicle Drivers handbook.

If there is a product spill while loading/unloading or en-route to and from the Quarry, the driver must:

1. Immediately warn persons in the area who may be at risk;
2. Inform their shift supervisor/owner. If the vehicle is owned or contracted by Hanson Construction Materials Pty Ltd, the Brandy Hill Quarry Manager must be immediately informed so that emergency services can be contacted and a clean-up initiated;
3. All spills must be adequately cleaned up and waste disposed of in an acceptable and environmental manner;
4. Put out warning triangles where it is safe to do so;
5. Contact the NSW Police Service.

To ensure that traffic impacts are minimised in the event of an incident, rapid response from the haulage company is required. In order to ensure rapid response to incidents, drivers are encouraged to contact the RMS TMC on 131700, as soon as the stranded vehicle and load is safely secured.

9. Compliance Measures and Monitoring

The document is to be signed by individual drivers and a Hanson Construction Materials Pty Ltd authorised representative at the time when heavy vehicle haulage drivers attend their site induction or shortly thereafter.

To assist in the orderly resolution of complaints, Quarry management will keep a register itemising all reported incidents relating to complaints in regard to heavy vehicle driver conduct external to the Quarry site.

The incident register is to include (where possible):

1. Date of the complaint.
2. Time of the complaint.
3. Name of the complainant (if available).
4. How the complaint was received.
5. Detailed description of the complaint (including location, driver/heavy vehicle details).
6. What / when actions were taken to resolve the issue; and
7. The reply to the person / organisation that made the complaint.

Once the Quarry Manager is satisfied that the complaint is substantiated, an investigation of the location and causes of the complaint will be undertaken. Following investigation of the issue, the

Quarry Manager will provide feedback to the complainant that details the investigations undertaken, the result of the investigation and measures implemented to ensure that operations remain compliant. A description of any follow-up investigations and the response provided to the complainant will also be recorded in the *Complaints Register* upon closure of the issue.

The incident register is to be made available, upon request, to an authorised State Government officer or Council officer.

In addition to the register, any breach of the Code of Conduct will result in the offending driver being placed on a **Driver's Code of Conduct Disciplinary Action Register**.

There are 3 stages to the process:

1st Warning – Driver will be warned for the breach, entered into the register and re-inducted.

2nd Warning – Driver will be warned for the breach, entered into the register, re-inducted and the company of the driver will be notified that a second breach of the site rules has occurred by the offending driver. The result of this second breach will result in the driver being banned from the site for a period to be determined by management, depending on the severity of their actions.

3rd Warning – The driver will be banned and the company of the driver will be notified of the ban period imposed on the driver.

10. Emergency Contact Numbers

- RMS Transport Management Centre – **131 700**
- Port Stephens Council – **(02) 4988 0255**
- Quarry Management – **(02) 4988 6166**
- Complaints Line – **1800 882 478**
- NSW Police Service (Northern Region) – (**02) 4934 0200**
- Transport Shift Manager – **(02) 9660 0441**

11. Code of Conduct Induction

To all Truck Drivers Entering Brandy Hill Quarry

- Weighbridge operating hours for all contractors is 6.30am to 4.30pm, unless otherwise notified by Management. Hanson fleet trucks are permitted at earlier times as required. Non-Hanson trucks to this site are not permitted on Brandy Hill Drive prior to 6:30am, unless otherwise advised.

- All heavy vehicle drivers operating out of the Brandy Hill Quarry are to observe the posted speed limits, with speed adjusted appropriately to suit the road environment and prevailing weather conditions, to comply with the NSW Road Rules & Heavy Vehicle National Law. The vehicle speed must be appropriate to ensure the safe movements of the vehicle based on the vehicle configuration.

- The speed limit along the Haul Road is 45km/hr. The speed limit along the Quarry Driveway is 60km/hr. The speed limit in and around the plant and sales yard is 25 km/hr. When exiting at Clarence Town Road intersection, all trucks must come to a complete stop.

- On entering the Quarry, trucks must communicate via UHF 10 to the Weighbridge Operator or Sales Loader, what products they want. Conversations MUST be kept to a minimum. Change to UHF9 at stop sign when entering Floors 1 & 2. Call up on UHF to let Pit Operators know your movements. Watch out for Heavy Machinery working.

- Drivers are expected to give way to all oncoming vehicles, paying particular attention to Quarry sales loaders and equipment. Trucks must give way to loaders and dump trucks at all times.

- Truck Drivers loading at the stockpiles should remain in their cabins. No children are permitted on site without prior permission from the Operations Manager per Hanson Directive.

- Whilst waiting to be loaded, if drivers exit their cabin they must be cautious of other vehicles moving between and behind stockpiles. Drivers must be wearing adequate PPE such as high visibility clothing, long sleeve shirt and long pants, safety boots and a safety helmet, as per Hanson Directive.

- If undertaking a U-turn or reversing into the appropriate stockpile area, trucks must use all appropriate means of communicating their movements.

- Due to space limitations around loading areas, trucks are expected to slow down to a speed which will ensure they are able to stop quickly if required. Visibility may be reduced around stockpiles, take extra care in these areas.

- To alleviate public concern and increase road safety, heavy vehicles leaving the Brandy Hill Quarry should try to be separated by a minimum, 1.5 minute interval.

- All trucks arriving at or departing from the Brandy Hill Quarry, whether loaded with material or not, are required to have an effective cover over their load for the duration of the trip. The load cover may be removed upon arrival at the delivery site. Tarp in designated area, NOT on weighbridge. Tarping, load and vehicle inspections to be done at work platforms after the weighbridge. No driver is to climb into or onto the back of truck bodies or trailers.

- All care is to be taken to ensure that all loose debris from the vehicle body and wheels are removed prior to leaving the site. Drivers must ensure that following tipping that the tailgate is locked before leaving the site. Never drive with the body in a raised position.

- All drivers are to show respect for our neighbours in the Seaham and Brandy Hill areas. Take care around bus stops in the mornings and afternoons. Brandy Hill Drive is an 80km speed zone. Please give pedestrians using Brandy Hill Drive a wide berth, be aware of their safety and other road users.

- All heavy vehicle drivers operating out of the Brandy Hill Quarry are to minimise the use of compression brakes, so as not to create excessive noise that could disturb local residents, where possible. Compression braking within or adjacent to residential areas should only be used if required for safety reasons.

- Heavy vehicle drivers are to carefully plan their routes so that State and regional roads are given priority for route selection. Local roads should only be used if there is no other option or in an emergency situation. To be considerate of our neighbours, short cuts and deviations should not be used when delivering Quarry products.

- Be conscious of Hanson's seven lifesaving rules:
    1. You must be inducted and competent to operate on our sites.
    2. When working at heights, protect yourself and others below you.
    3. Always use positive isolation, lockout and tag before working on plant and equipment.
    4. Guarding must be in place at all times and replaced immediately following any work on plant and equipment.
    5. Wear your seat belt.
    6. Never text or use a hand held phone whilst driving.
    7. Report all injuries, incidents and hazards to your supervisor/ manager.

- All heavy vehicle drivers operating out of the Brandy Hill Quarry are to be aware of their adopted Fatigue Management Scheme and operate within its requirements. By law, all drivers have a duty to not drive a fatigue-regulated heavy vehicle on a road while impaired by fatigue.

- Failure to comply with the above will result in immediate removal from site.

12. Declaration

DECLARATION

I, the undersigned, hereby agree to abide by Hanson Construction Materials Pty Ltd Driver Code of Conduct for the transportation of Quarry products from the Brandy Hill Quarry, Clarence Town Rd, Seaham NSW to their final destination/s in a safe manner. I have read and understand the requirements outlined in the attached document and will, to the best of my ability, comply and assist with their implementation, requirements and ongoing administration.

The subject document to which this declaration relates is attached as part of the overall document and signing of this declaration confirms that signee has read and understood the entire document:

TRUCK DRIVER

Full Name: ____

Organisation: ____

Signature: ____

Date: ____

HANSON CONSTRUCTION MATERIALS PTY LTD

Company Witness: ____

Date: ____

Complaints Register

Brandy Hill Quarry Complaints Register

DATE to DATE

No.	Date	Time	Name	Nature of Complaint	Complaint Comments	Action / Follow-up Taken

References

Kloeden, C., Ponte, G., & McLean, A. (2001). *Travelling Speed and the Risk of Crash Involvement on Rural Roads.* Adelaide: Department of Transport and Regional Services.

NHVR. (2017). *About fatigue management*. Retrieved November 24, 2017, from National Heavy Vehicle Regulator: https://www.nhvr.gov.au/safety-accreditation-compliance/fatigue-management/about-fatigue-management

NHVR. (2017). *Penalties and infringements*. Retrieved November 23, 2017, from National Heavy Vehicle Regulator: https://www.nhvr.gov.au/law-policies/penalties-and-infringements

Appendix 3 Summary of Public Submissions

All submissions can be viewed on the Department's website. This Table represents a significant selection of public submissions that were reviewed as part of this research.

Location of Submitter	Support / Objects	Key Social Impacts	Other Impacts
Maitland LGA	Objects	Health and welfare impacts associated with: • Truck movements • 27/7 operation Reduction in Property values (socioeconomic impact)	Truck movements causing the following impacts: • Decrease in road safety (particularly the Paterson Rd and Tocal Rd at Bolwarra) • Increased noise • Traffic congestion • Air quality / dust impacts
Brandy Hill local	Objects	Reduction in property value Road safety Amenity impacts caused by 24/7 operations and truck movements.	Truck movements
Mid Coast LGA (Wingham address but has a house in Largs, Maitland LGA)	Objects	Noise impacts on community – operations can be heard as far away as Largs (Maitland LGA). Sleep deprivation from 24/7 operations. Health impacts on workers and the local community from dust pollution. Devaluation of property. Visual impacts associated with land clearing. Cost of truck movements to community and to Council (in terms of road and bridge maintenance.	Conditions of Consent: • Real time open source noise monitoring • Strict operating hours and noise limits. • No trucks leave before 7am. • No trucks lined up on the external road prior to 7am. • No trucks on roads during school bus operating times. • Tonnes per kilometre rate for cost recovery for Council. • Dust suppression equipment be fully operational at all times, including mining/ loading and processing. • Quarry to buy out impacted properties with protection clause for renters. Clearing of 49 hectares and scarring of landscape – rehabilitation needs to be pre-paid and guaranteed.

Location of Submitter	Support / Objects	Key Social Impacts	Other Impacts
			Post consent watering down of conditions.
Seaham local	Objects	Amenity issues related to: • Increased local traffic • Noise • Vibration from drilling and blasting • Dust • 27/7 operations Decrease in property values Road safety	End of quarry use and potential to be a garbage dump Ability of road network an infrastructure to cope with increased truck movements Cumulative impacts Noise, vibrations and dust Impacts on local flora and fauna Impacts on water and waterways
Maitland LGA	Objects	Amenity impacts on local people because of: • Truck movements • Environmental impacts	Noise Vibration Pollution
Brandy Hill local	Objects	Lack of consultation on expansion Local amenity impacts due to 24/7 operation Increased truck movements leading to: • Road safety impacts • Increased damage to local roads Submissions from residents of Brandy Hill and Clarence Town should be given more weight in the analysis	Questions the legal processes associated with approval. Expansion of the quarry, which existed prior to local residents purchasing their land, is unfair.
Maitland LGA	Objects	Amenity impacts on Maitland Shire residents close to truck routes: • 24/7 operations • Road safety • Road congestion (esp. at Paterson Rd and Tocal Rd intersection Bolwarra Heights)	Damage to local roads Noise Air pollution from laden vehicles

Location of Submitter	Support / Objects	Key Social Impacts	Other Impacts
		• Property devaluation due to 24/7 operation and road haulage needs	
Brandy Hill local	Objects	Currently co-exist. Amenity impacts from noise, pollution and road usage.	Given that Council currently struggles to maintain Brandy Hill Road the increase to double the output is not feasible in a residential area.
Sydney	Supports	Local employment Support to regional industry	
Nelsons Plains (Port Stephens)	Objects	Quality of life and health impacts from: • 24/7 operation • Truck movements • Increased dust and diesel levels • Road safety – excessive speed limit at property entrance	Vibration levels impacting on integrity of house and road surface. Truck movements should be limited to business hours, Monday to Friday. Implied suggestion to loser speed limits on the local road.
Brandy Hill local	Objects	Road safety: • Number of driveway entrances • Lack of cycling and walking paths • High number of bus stops where buses cannot completely get off the road. Road congestion at the Brandy Hill Drive / Seaham Road intersection.	Inability of local road system to deal with 24/7 operation and subsequent truck movements. Damage to roads. Council incapable of managing impacts from such a large operation. Per-existing state of local road is bad. Failure of truck drivers to stick to speed limits / compression braking. Impacts on local wildlife.
Maitland LGA (Bolwarra Heights)	Objects	Loss of country lifestyle and community due to excessive noise and truck movements.	
Sydney	Supports	Employment opportunities	Provision of building materials for regional construction projects.
Dungog Shire (Glen Oak)	Supports	Convenient supply of quarry materials. Provision of local employment.	Important local facility for providing materials for concrete, construction and roads.

Location of Submitter	Support / Objects	Key Social Impacts	Other Impacts
		Historical connection community; good corporate citizens. Many of the objectors have moved to the area after the establishment of the quarry and their complaints are unfair.	PSC advises traffic impacts can be mitigated. Growth is essential to maintaining a health business.
Seaham	Objects	Traffic impacts: • Undesirable behaviours of drivers overtaking slow moving trucks • Safety concerns for children dismounting school buses • Delays at the intersection of Adelaide Street and Seaham Road; complicated but the McDonalds on the corner.	Mitigation suggestions: • Additional right turn lane into Adelaide Street; one lane being designated for trucks. • Making Adelaide street two Lanes each way from Port Stephens street to the roundabout at Adelaide street and the Pacific Highway. • Brandy Hill Quarry, Martins Creek Quarry and East Seaham Quarry create a private road from their quarries to the Pacific Highway.
Brandy Hill local	Objects	Safety health and wellbeing impacts from: • Trucks travelling at high speed along Brandy Hill Drive. • Noise and pollution from trucks. • Inadequate local roads for traffic volumes. • Children at risk crossing road.	Accepts Brandy Hill Quarry as part of the community in its current capacity. High amount of roadkill due to trucks. Hanson encouraging employees to support the application, even though they may not live locally.
Brandy Hill local	Objects	Negative impacts on peaceful quiet lifestyle. Brandy Hill Drive particularly dangerous for elderly residents – it is necessary to step onto the verge when trucks pass – this is an uneven surface. Increases in truck movements will make daily walks impossible.	

Location of Submitter	Support / Objects	Key Social Impacts	Other Impacts
		Continuous noise from 24/7 operations will make daily life difficult. Devaluation of our property.	
Brandy Hill local	Objects	Sleep interruption; especially due to trucks driving during "closed hours". Unsafe driving practices and gravel falling from trucks creates personal safety risks. Noise impacts on amenity. Properties devalued.	
Raymond Terrace	Objects	The trucks on the road are dangerous, noisy and fast. Safety impacts for visitors, residents and animals. Ruining a residential area.	
Seaham	Objects	24/7 operations: • Impact adversely on amenity • Roads are inadequate to cope with current loads – safety risks will increase with increased truck movements.	
Brandy Hill (resident and business owner)	Objects	Brandy Hill Road already unsafe for children riding bikes and horses, or getting to the school bus stop. Increased truck movements will lead to increased road safety risks. Driveway entrance to Brandy Hill Road is a particular risk when towing horses or dogs. Health risks associated with increased dust and truck fumes.	Mitigation suggestions: • Immediate and extensive infrastructure to be provided. • A safe cycleway / walking path the full length of Brandy Hill Drive. • Extra turning bays, merging lanes and bus stops on Brandy Hill Drive.
Duns Creek	Objects	Broad geographic area of impact across several LGAs are affected by truck movements:	Comparison made to: 2012 Bulga Milbrodale Progress Association Inc v Minister for Planning and Infrastructure

Location of Submitter	Support / Objects	Key Social Impacts	Other Impacts
		• Seaham/Brandy Hill, Raymond Terrace, Bolwarra, Lorn and Maitland. • Safety risk for residents and in School Zones • Economic burden for Councils. • Amenity impacts on residents of predominantly urban, surrounding high growth areas. • Damage to roads • Health risks from truck noise, diesel fumes and dust and constant machinery noise. Negative impact on sense of place (particularly due to noise impacts) Negative impact on local tourism and property values.	and Warkworth Mining Limited [2013] NSWLEC 48 Positive economic impacts cannot compensate for loss of quality of life and social amenity.
Seaham	Objects	Increasing hours of operation not appropriate in a rural area: • Increased road congestion • Decreased road safety, particularly at night. • Traffic impacts extend into Raymond Terrace. • Loss of amenity due to noise impacts, particularly at night. • Loss of local lifestyle • Negative impact on property values. Negative impacts not offset by employment benefits.	The Quarry should stay at the current tonnage and truck levels. Structural damage to house due to increased blasting; especially with increased Quarry depth. Hanson should buy out residents if it can't prove there will be no damage. Mitigation suggestion: • Increase life of Quarry to 60 years, but decrease hours of operation. • Avoid huge reservoir at end of Quarry life by backfilling extracted area progressively throughout operations. • Keep current consent conditions.
Bandy Hill (immediate neighbours)	Objects	Current base level impacts: • Lifestyle and community connection impacts due	

Location of Submitter	Support / Objects	Key Social Impacts	Other Impacts
		to increased trucks (evident over the last couple of years) • Sleep deprivation from early operation of trucks – from 5am travelling to the Quarry. Also from the crusher which is seems much noisier at night. • Driveway egress doesn't feel safe (trucks speed) • Dust and grime covers everything – we have to keep windows shut which defeats the purpose of living in the country. • Damage to property from blasting. Potential impacts from Quarry extension: • Decreased property value • Diminished privacy as the expansion comes closer to our home • Health concerns associated with pollution from concrete plant. • Rural residential and associated uses now – not consistent with a 24/7 industrial use • Not in the public interest for all of the above reasons.	
Brandy Hill	Concerns	Truck impacts on: • Road conditions and repairs • Ability to exit from driveway safely due to large number of movements • Hold up behind heavy laden vehicles Concerned about infrastructure: • Lack of footpaths, reasonable bus stops and subsequent safety issues;	

Location of Submitter	Support / Objects	Key Social Impacts	Other Impacts
		particularly for school children.	
Nelsons Plains	Objects	Increased truck movements leading to: • Decreased safety on Seaham Road • Decreased ability to safely egress my property • Noise and pollution impacts on amenity; especially with loaded trucks heading south up the incline. • Conflict with Council's residential zoning – 24/7 operations lead to unacceptable traffic, noise and safety issues.	Current shortcomings causing impacts: • 708 Seaham Road – School bus stop and Child Care Centre – not enough space for a bus to pull over safely. • Existing traffic problems for residents along Seaham Road.
Newcastle (Warabrook)	Objects	Increased truck movements will increase safety impacts for concealed driveways and school bus runs.	Former long-time Raymond Terrace resident. Existing noise and dust pollution unacceptable. Newline Road already dangerous.
Brandy Hill	Objects	Increased truck movements leading to: • Safety of children on and off school buses • Decreased safety of walking and riding horses along the road • Safety risks moving horse float on and off property. Diminished air quality leading to health impacts; particularly for asthmatic child.	Diminished air quality.
Brandy Hill	Objects	24/7 operation for 30 years: • Will ruin tranquil ambience • Road safety impacts for local people (pedestrians, cyclists and drivers) and animals • Decrease in property values; particularly along Brandy Hill Drive. • Small increase in jobs does not outweigh	Brandy Hill "was established to be a tranquil, semi-rural, residential suburb" … zoning conflict impacts. Even with recent increases in trucks from Martins Creek, impacts are currently acceptable. However – cites numerous recent dangerous traffic situations involving trucks.

Location of Submitter	Support / Objects	Key Social Impacts	Other Impacts
		negative impacts on local people.	Unacceptable noise and pollution impacts; particularly dust particles and diesel fumes from trucks. Current bus stopping areas inadequate and unsafe. Questions fairness of considering support for the proposal from parties not living in the LGA or near the Quarry. External submissions should not be given the same weight as near neighbours.
Brandy Hill	Objects	Justice issue – the expansion is not fair to local people. 24/7 operations: • Impacts on road safety from constant truck usage – current bus turn-ins inadequate. Convoy of trucks compounds safety issues. • Incompatibility with existing lifestyle which is “a fairly countrified quiet location”. • Public health risk from diesel fumes and particulates.	Impacts on road surface and maintenance. Road not adequate for proposed truck usage. Egress from properties dangerous. Nowhere to pull over, bus stops currently unsafe. Blasting and crushing impacts
Brandy Hill	Objects	Multiple impacts on amenity.	Have noticed increase in traffic over the last couple of years. Clarence Town Rd and Quarry entrance a very scary intersection. Bus stops currently inadequate. Too much dust and noise.
Brandy Hill	Objects	Safety concerns, particularly for children. Decreased property process and cost to quality of life.	Noise due to close proximity of Quarry. Current concerns: activity increasing over the last 10 years, too many trucks on road (especially early

Location of Submitter	Support / Objects	Key Social Impacts	Other Impacts
		Will compensation be offered to families?	morning), safety of children compromised, roads deteriorating. Expansion will lead to: more dust, increased damage to roads, increased dust.
Brandy Hill	Objects	Expansion will create a safety risk for my small children travelling to and from school.	

Appendix 4 Public Meeting

Brandy Hill Community Meeting - 22 March 2017
Record of Meeting

Organisation	Representative
Department of Planning and Environment	Mari Koeck (MK) – Facilitator David Bauche – Senior Communications Officer Colin Phillips (CP) – Team Leader Resource Assessments Gen Seed – A/Senior Planning Officer Resource Assessments Alex Grierson – Planning Officer Resource Assessments Sarah Fabian – Student Planner Resource Assessments
Brandy Hill and Seaham Action group	Neil and Margarete Ritchie (MR) Deb & Les Fisher
Voice of Wallalong and Woodville	Peter Rees
Port Stephens Council	Karen Forsyth
Member for Port Stephens	Kate Washington
Hanson Construction Materials	Andrew Driver – Development Manager Chris Dolden - Operations Manager Aggregates

Meeting start - 6:30pm

- MK commenced the meeting by introducing key attendees and outlining the purpose of the meeting and its agenda.

- CP provided a brief presentation on:
  - Hanson's proposal
  - the Department's assessment process; and
  - how to make a submission.

- Neil Ritchie from the Brandy Hill & Seaham Action Group (BHSA) provided a presentation.
  - Introduction and history of the BHSA.
  - BHSA is not opposed to the operation of the quarry but has concerns about the nature and scale of the proposal as well as some current operational issues.
  - Brandy Hill is a residential area and has co-existed with the quarry throughout the years.
  - There is concern for the future of Brandy Hill Drive in relation to the number of truck movements, particularly from the combined operations of the Martins Creek Quarry expansion and the Brandy Hill expansion proposal.
  - Members of the BHSA are a part of Hanson's Community Consultative Committee (CCC), which has been effective in resolving some community issues with the quarry's operations. Despite the issues raised at the CCC about the proposed expansion, the EIS has not addressed these issues.
  - A key concern is the proposed 24-hour operations and trucking movements and the associated increase in traffic, noise, dust and diesel emissions. These impacts would significantly affect the amenity of the area.
  - There is concern regarding the ability of people to comfortably and safely move on Brandy Hill Drive, particularly in terms of walking, cycling, horse riding, accessing bus stops and the pre-school. The shoulders of the road are inadequate for these

functions.
- o The roads themselves are not in good surface condition and in combination with 24-hour truck movements, the noise impacts would be significant.
- o There is concern about the safety of intersections.
- o As a result of reading the EIS, the BHSA position is as follows:
  - ▪ There is support for the ongoing operation of the quarry, but based on what has been proposed in the EIS, the nature and scale of the operation should remain at a similar level to what is current.
  - ▪ Opposition to 24 hour crushing and truck movements. It is recommended that operating hours stay between 6am to 6pm and are not extended into the evening.
  - ▪ Any future consents should be conditioned to provide footpaths that connect Brandy Hill Drive and Seaham Road (including the bus stops). This should be in addition to Section 94 contributions.

- BHSA presentation – Deb Fisher
  - o The EIS's social impact assessment (Appendix 17) is concerning.
  - o The social impact issues are rated as low for visual, noise, air quality and blasting because they are said to meet the relevant criteria. Additionally, the traffic impact is considered as 'low-medium'.
  - o Residents will be able to see the increased amount of trucks. Blasts and noise are still experienced by residents and there have been complaints in the past about blasting impacts on livestock. The road noise figures in the EIS are questionable.
  - o Truck movements on the roads will double and safety risks will be increased. Brandy Hill Drive has had minimal upgrades over time.
  - o There are ten bus stops on Brandy Hill Drive and no room to pull over, particularly to drop off and pick up children. Many shoulders are ditches making accessibility even more difficult.
  - o There have been several near misses.
  - o A shared cycle/walkway is needed.
  - o There is concern about driveway visibility and the ability of people to safely slow down and turn into their driveways, particularly when turning across the road into driveways.
  - o There is insufficient time for a car to stop when a truck is passing through the Clarence Town Road and Brandy Hill Drive intersection. It takes 20 seconds for a truck to cross the intersection and it takes 6 sections for a car to reach the intersection as it becomes visible. There are safety concerns not only for residents but the truck drivers themselves.
  - o There are significant health benefits of being able to walk locally. However, this is too dangerous and difficult with the existing road and shoulders. Hanson has suggested other areas to walk in, however they are only accessible to those that drive.
  - o Sleep deprivation is likely as a result of increased trucks.
  - o Devaluation of homes.

- Voice of Wallalong and Woodville (VOWW) – Peter Rees
  - o VOWW endorses the remarks of BHSA.
  - o Traffic generation is the key concern to be discussed.
  - o 904 vehicle trips per day have been proposed, an increase of 524 vtpd. The impact on traffic has been based on 2013-14 traffic counts. Traffic counts have increased since this time and the EIS figures unlikely represent current traffic counts. The EIS recorded 1681 vpd for Brandy Hill Drive. The Council for the period 1/12/2016 - 8/12/2016 recorded 2166 vehicles ADT.
  - o For the amount of trucks proposed, protection of pedestrians is needed. Suitable infrastructure should be provided as a result of increased trucks.
  - o The Secretary's requirements require measures to adopt and manage risks for road

safety. This has not been adequately addressed. The TIA emphasised the condition and design of the roads in section 12 “Road Safety”, without regard to pedestrians. Pedestrian safety is dealt with in the “Alternate Transport Modes” in the TIA – look to s94 relief for safety remedy.

- A nexus exists between the impacts of proposal and the unsafe pedestrian environment, and the developer has not provided suitable infrastructure to eliminate danger caused by its proposed expansion.
- There will be cumulative traffic impacts with the proposed Martins Creek Quarry. Updated traffic generation as a result of the Martins Creek Quarry EIS has not been included in the Brandy Hill EIS. There is a difference between the two proposals regarding the amount of trucks on Brandy Hill Drive: MC Quarry believes there will be an additional 84 trucks from its quarry using Brandy Hill Drive; BH Quarry believes there will be only 64. A not insignificant difference.
- There will be a combined daily total of 988 of quarry trucks on Brandy Hill Drive.
- The amount and intensity of trucks would cause an unreasonable and unacceptable impact on the environment. The environment is defined by the EP&A Act as *“**environment** includes all aspects of the surroundings of humans, whether affecting any human as an individual or in his or her social groupings.”* Here the ‘environment’ includes those living adjacent to the roads and those travelling on the roads.
- Sleep deprivation from any number of noisy quarry trucks is a concern.
- Road traffic noise is a major health issue as published in medical journals. The EIS is ambiguous about the impacts of road noise and there is no comfort to residents who expected to see explicit appropriate measures to regulate the times and frequency of truck movements.
- The rural-residential environment is low in background noise and sound travels long distances in the quiet atmosphere, more so at night than in daylight hours.
- A Traffic Management Plan has been proposed to manage traffic impacts. However, it is unclear what that includes. Management measures should be tangible and should be provided now and not later.
- The development application should be refused on traffic grounds alone.

- Questions and comments from the community

  Question 1 – What is the Department’s view of the age and sufficiency of the information presented in the EIS, particularly regarding intersection analysis?

  Answer by CP – we will review the age of the information provided and would appreciate your feedback in a submission. However, at this time it is agreed that the current intersection analysis is not sufficient.

  Question 2 – Is there research out there regarding truck movements and the impacts on human health?

  Answer by CP – The Department has consulted with RMS on the proposal. RMS has guidelines and requirements for road volume capacity. The RMS submission will be made live on the Department’s website.

  Comment by MR – RMS advised that majority of the roads in question are the responsibility on Council.

Comment by CP – It was agreed that the responsibility of the roads is divided between RMS and Council however, the technical specifications of RMS’s policy would more than likely be applied for Council assessments.

Question 3 – Can we upload a video as a submission to demonstrate the noise impacts and where in the EIS does it deal with the loss of social amenity?

Answer by CP – I visited the site today and found that useful in observing noise impacts. In relation to uploading a video, I am uncertain of the specific files types that can be uploaded in a submission and that question will be taken on notice.

The specific details of the EIS will not be investigated tonight, however, if it is felt that there is a deficiency, send a submission so that it is identified.

Videos cannot be uploaded into submissions on the Department's website. However, if you would like to include one in your submission, please email the video to genevieve.seed@planning.nsw.gov.au.

Question 4 – Will the Department look at the cumulative impacts?

Answer by CP – Yes. It is hard to assess things that may not go ahead, such as the Wallalong subdivision area. However, the cumulative impact between the Martins Creek and Brandy Hill proposals will be considered.

Question 5 – The community has identified the need for improved walkability infrastructure. Can the Department apply this as a condition? If not, can you advise us to what can be done?

Answer by CP – To apply this infrastructure as a condition, there would need to be a nexus with the quarry expansion and the need for the infrastructure. It is not just Hanson's trucks that travel down Brandy Hill Drive. These are things that the Department would need to consider, including if the increased trucks from Hanson were the tipping point for requiring the infrastructure. We want to hear your ideas and suggestions as to how this could be addressed.

Question 6 – You visited the site and the surrounding roads today, what is your view about the safety and access to bus stops?

Answer by CP – my personal opinion is that the bus stops are not big enough.

Comment 1 - I am a landowner on the boundary of the quarry. It is clear that there will be a significant impact from the proposal. Housing prices will be affected and the EIS should account for safety impacts as a result on heavy vehicles increasing, not just vehicles in general.

Question 7 – I found some of the background noise levels in the noise impact assessment to be questionable. Do these studies get peer reviewed and does real-time monitoring get used to assess a quarry's noise impact?

Answer by CP – The Department relies on the advice from noise experts at the EPA. The concern about the background noise levels should be expressed in your submission. Real-time monitoring is sometimes used, but is mostly used as a noise management tool for an operational quarry, rather than an assessment tool.

Question 8 – Will air traffic noise be considered as part of the cumulative assessment of impacts?

Answer by CP – No. Noise from aircraft is dealt with under different guidelines (Australian Noise Exposure Forecast – ANEF). Aircraft noise is not part of the quarry proposal.

Comment 2 – Kate Washington State Member for Port Stephens – The community is up against it. Individual submissions are needed. It is disappointing that the community concerns raised during the CCC meetings were not reflected in the EIS. The consultation was not genuine. Participation is the key.

Comment 3 – there are two single lane bridges in the west that have not yet been mentioned. The Wallalong development was held back because of the access difficulties posed by these bridges. The Aboriginal heritage assessment in the EIS is poor.

Question 9 - What time did you visit Brandy Hill Drive today? Was it at 8am during peak hour?

Answer by CP – no it was approximately 11am – 12:45pm and 2-3pm.

Response – Would you like to come at 8am to the bus stop where I drop off my kids?

Answer by CP- I accept the invitation.

Comment 4 – There was a recent fatality in a driveway on Clarence Town Road. The speeds that the trucks will be travelling are a lot faster than what occurred for this fatality. The roads are not made to do what is being proposed.

Question 10 – I am an adjoining landowner. Is there consideration for increasing the buffer zone between quarrying operations and residences?

Answer by CP – I am unable to answer specifically regarding if a buffer would be applied, however, the assessment of noise is made at the residence (where the house is). Will operations be moving closer to the residence? That is a consideration in the assessment of noise impacts.

Comment 5 – Subcontractor trucks are much noisier than the company trucks.

Response by CP – this has been raised with me multiple times and is noted.

Comment 6 – Appendix 18 regarding rehabilitation and closure is a key concern. The void would be 78 metres below sea level and would be filled with water following the completion of mining. There is no discussion as to how long it would take for the void to be filled, or the after use of the void.

Question 11 – How are the objections collated and responded to?

Answer by CP – all submissions are read first. A request for a "Response to Submissions" (RTS) report is prepared by the Department requesting that the Applicant respond to all issues raised. All submissions are made available to the Applicant. The RTS report usually responds to the issues raised, rather than each submission individually. How the RTS is set out is up to the Applicant, however there are examples of these reports on our website if you would like a better understanding.

Comment 7 – consideration needs to be given to the cumulative impacts of diesel fumes, particulates and asbestosis.

Comment 8 - we have been spoken to by Hanson, Council and RMS as if we are just individuals and have no say. The gathering at this meeting shows that when individuals get together we become a community and can stand up for our rights on issues such as safety, health and public amenity.

- Conclusion of meeting – MK thanked all community members who attended the meeting and revisited the way submissions can be made.

Meeting closed – 8:30pm

Appendix 5 CCC Minutes of Consultation Meeting with Key Insights

BRANDY HILL QUARRY CCC & COMMUNITY FORUM MINUTES OF MEETING HELD FRIDAY SEPTEMBER 15, 2017

AT 16 Brandy Hill Drive, Brandy Hill (home of Neil & Margarete Richie)

PRESENT	NAME	ORGANISATION
	Lisa Andrews (LA)	Independent Chairperson
	Ellen Davis-Meehan (EDM)	Key Insights Pty Ltd (Consultant)
	Rob Adams (RA)	Community Representative (Resident)
	Les Fisher (LF)	Community Representative (Resident & member of Brandy Hill/Seaham Action Group)
	Deborah Fisher (DF)	Resident
	Peter Rees (PR)	Community Representative (Resident & Member of Voice of Wallalong & Woodville Inc. [VOWW]) *(left at 6.32pm)*
	Margarete Ritchie (MR)	Community Representative (Resident & member of Brandy Hill/Seaham Action Group, Martins Creek Quarry Action Group and Voice of Wallalong & Woodville [VOWW])
	Neil Ritchie (NR)	Community Representative (Resident & member of Brandy Hill/Seaham Action Group and Voice of Wallalong & Woodville [VOWW])
	Paul Le Mottee (PLe)	Resident *(left at 5.52pm)*
	Darrell Pryer (DR)	Resident
	Jill Cronin (JC)	Resident
	Les Cronin (LC)	Resident
	Christine O'Keefe (CO)	Resident
APOLOGIES	Nil	

WELCOME	The Chair opened the community forum at 4.40pm and welcomed all attendees to the meeting.	
INTRODUCTIONS	The Chair introduced Ellen Davis-Meehan (EDM) from Key Insights (KI) who has been engaged by Hanson to independently review and update its Social Impact Assessment (SIA) for the proposed extension to the Brandy Hill Quarry (BHQ). LA asked EDM to provide background on her qualifications and involvement with the project.	**EDM provided an overview of KI, who is a social research company that will provide an independent and objective review of the social impacts on the proposed extension of BHQ. EDM advised that she would listen and reflect residents' concerns in preparing a final report for consideration in accordance with the Department of Planning & Environment's (DP&E) requirements.**
DECLARATION OF INTEREST	LA advised that she is an approved Independent Chairperson with the Department of Planning and Environment and engaged by Hanson to chair the CCC. Chair asked all present if there were any declarations that they wished to make.	**No declarations from persons present.**
BUSINESS ARISING	Nil	
CORRESPONDENCE	Nil	

COMMUNITY FORUM DISCUSSION	At the outset EDM advised that she had just met with the residents of Giles Road and had met with representatives of the quarry earlier. The purpose of the community forum meeting was for EDM to listen to the concerns of residents on the current operations of the BHQ as well as the potential impact that any extension to the project may bring.	**EDM also stated that she would like to hear suggestions of potential mitigation measures to be imposed, in the event that the application receives approval.**

The following issues were raised and presented by attendees: • Concerns that by EDM's suggesting 'mitigation', that the project will proceed • Final documents not yet available, so representatives present are unable to comment on amendments • Safety concerns are one of the major issues • Decreased ability to walk on side of roads • Pot holes and traffic hazards from truck movements • Residents can't take it anymore. The trucks pass through residential areas; the road structure that carries the trucks is extremely disappointing • Hanson don't care and are waiting to be forced to do something; a sense of betrayal • The local community does not count with Hanson • No compromise from Hanson to address communities' and individual's concerns • Market share and profits before people for Hanson • Providing a product to the greater community (infrastructure) at the expense of local residents who are impacted • Bullying tactics (requesting removal of signs) • Limited community consultation – CCC meetings held, but concerns not taken on board and mitigated	**EDM offered to obtain copy of approval**
• Empty trucks create more noise than full trucks • Contractors/sub-contractors truck drivers not as cautious as Hanson drivers. Often contractors line up on other roads (13 or more) from 4am awaiting for BHQ to allow entry • Regular inspections of trucks to ensure compliance with noise requirements • Effective identification of trucks to allow non-compliance to be identified	**Link to SEPP at end of minutes**
• Cumulative problems because of Martins Creek Quarry (MCQ) {previously owned by State Rail prior to selling it to Daracon} • Current proceedings between MCQ & Dungog Council – awaiting ruling • Discrepancy between the alleged "approved" hours of operation	**PLe encouraged residents to lodge a request with Council when there were potholes, etc.**
• Fewer disruptions after 7.30pm • Possible stockpiling of product to lessen amenity issues • SEPP – Mining, Petroleum Production, Extractive Industries 2007 – is able to prohibit movements in residential areas • Residents have put up with existing operations, despite no amelioration attempts by company, however, residents not willing to allow further impact on their lifestyle from the proposed expansion • 24 hourly operations will be hell for residents	

	• In hot weather bedroom windows need to be open and the noise from the quarry trucks operating at night will be unbearable. • Communities affected want a normal life restored • Need for the control of operating hours (no 4am starts), build safe walking paths, contribute heavily to the safety and maintenance of Brandy Hill Road, Butterwick Road & Clarence Town Road. • Traffic would be quieter if road was asphalt • Community Funds – previously supplied product (free of charge) – now company is not supplying. Feel community/sporting groups are being punished for residents' objections. • EDM suggested reduction of speed limits to perhaps 80kpm • 100kph on Clarence Town Road should be reduced. Current 80kph on Brandy Hill Rd is acceptable. • Suggest road safety signs at the end of each road • Flashing warning lights, advising motorists of heavy vehicles • Noise and vibrations caused from truck movements and operations at quarry are a major problem • No compromise from Hanson in dealing with the issues raised at CCC meetings. Feel it has been a waste of time • No respite from truck movements • Loss of social contact with neighbours and friends because of inability to walk, ride bikes, etc. • Location of quarry is now inappropriate given its proximity to residential areas • Roads needs to be reconstructed to cater for additional loads, not just patched • Not commence extended operations until all approval conditions have been met (i.e. roads upgraded, pathways, etc.) • Deal with complaints immediately, not wait until the next CCC meeting. • Butterwick resident 2km away adversely affected by blasting. • Beautiful amenity of the local area now destroyed by the operations of the quarry	
GENERAL BUSINESS	Details of a tour undertaken by NR & others of the Marulan area, in the southern tablelands of NSW. Holcim Quarry was inspected which demonstrates "world's best practice" and solutions for mitigating noise and dust issues. $30M alone was spent on the upgrading of the highway interchange. No transportation through residential areas. Construction of 10km of rural roads, etc. Operators value their community members. Honest attempt by companies to deal with the potential impacts from the operations.	**Photos taken by NR were shown to the attendees**

Meeting closed at 6.42pm with LA thanking all attendees for their time and contribution. A draft copy of the minutes would be provided to all attendees for comment, prior to finalisation.

ACTION ITEMS

ITEM	ISSUE	RESPONSIBILITY
1	Copy of Consent (approval to operate)	EDM
2	Copy of Code of Conduct	EDM
3	Copy of Amended Traffic Report	EDM
4	Link to SEPP – Mining, Petroleum, Extractive Industries 2007	LA

Item 4 – Link to SEPP

http://www.austlii.edu.au/cgi-bin/viewdb/au/legis/nsw/consol_reg/sepppaei2007924/

Note: The key themes that emerged at the meeting as noted by EDM are attached as the Annexure 'A'.

Appendix 6 Hanson Letter to CCC re Mitigations

24 October 2017

Brandy Hill Quarry - CCC C/- Margarete & Neil Richie 16 Brandy Hill Drive BRANDY HILL, NSW 2324

RE: Hanson Major Project Proposal- SSD5899

Dear Members of the CCC,

Firstly, we would like to thank the members of the CCC for participating in the Brandy Hill Quarry CCC & Community Forum held at your home on 15th September 2017.

As you are aware Ellen Davis-Meehan from Key Insights Pty Ltd attended this forum as part of her instigations into the proposed project's Social Impact Assessment. Following this forum Ellen has passed onto Hanson some of her finding and observations expressed by the community. Following this recommendation were made on key issues that if addressed may demonstration of good faith with the local community the following could improve community engagement outcomes.

Hanson recognising that "wait until approval approach" has led to the assumption that Hanson has not heard the very valuable inputs from the CCC and broader community. This is not the case and we apologise. We are currently working through the initial inputs from the social impact research and there are some things that can action immediately:

- We would like also to see speed limits reduced on Clarence Town Road. We have previously made submissions, but we will immediately make a stronger case and continue to lobby on this issue. We will immediately make our Code of Conduct for trucks available to the CCC and will update it as necessary. Note that all Hanson trucks must have ID displayed. We will immediately internally review the speed that our trucks travel past bus stops during school bus operating times.
- We will publish a map of where noise and dust monitors are currently located, and we will make available the data from those monitors. We will have internal discussions about the best way to deliver on this. It maybe through the website.
- Our current Conditions of Consent that determine the limits of our operations are attached.
- We will continue to press Port Stephens Council to report to the CCC on spending to date of the Hanson levy paid to Council on a per ton basis.
- We will review our complaints handling processes in the light of comments from CCC members and others in the community, and make public an amended policy.

The following we would also like to begin action on; however, as they require some more planning on our part they may be medium term (months as opposed to weeks):

- Reviewing our engagement with the community to ensure that we are not being divisive – exploring ways to share accurate information in a timely manner to community members.
- Reviewing inputs from the social impact research as they become available and adding them to our planning agenda.
- Commencing work on VPA strategies in an open way with Council and the community so that we can determine what is jointly possible and demonstrate our active commitment to the mitigation of impacts. Part of the discussion will include the possibility of a walkway / cycleway along Brandy Hill Road.
- We will develop a community donations policy that is fair and consistent across the whole community.

Finally, thank you for consulting Hanson on this matter. Should you wish to discuss further, please do not hesitate to contact me on 0417 234 774 or 02 9354 2644.

Yours faithfully,

HANSON CONSTRUCTION MATERIALS PTY LTD

ANDREW DRIVER

Development Manager Eastern Region

Appendix 4

Additional Intersection Analysis and Response to Submissions – Intersect Traffic – May 2018

(Total No. of pages including blank pages = 30)

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Ref: 13/024

22nd May 2018

Hanson Construction Materials
Level 5, 75 George Street
PARRAMATTA NSW 2150

Attention: - Andrew Driver

Dear Andrew,

RE: Additional Intersection Analysis and Response to Submissions – Brandy Hill Quarry Expansion.

This letter report provides the results of additional assessment and response to submissions provided by the Department of Planning and Environment and Roads and Maritime Services regarding the proposed extension of the Brandy Hill Quarry.

Intersection Survey and Assessment

Please note that it is considered unreasonable and unnecessary to undertake intersection analysis of all intersections along the haulage routes to the sub-arterial and higher road network as many intersections are observed to be operating with uninterrupted flow conditions and the increase in traffic is not significant enough to alter or impact on intersection efficiency. It is more realistic to assess traffic impacts on the major intersections along the haulage routes that may not be operating with uninterrupted flow conditions and thus likely to be the most sensitive to traffic volume increases. Therefore, the NSW RMS request for further modelling of the three critical intersections along the Raymond Terrace haulage route is considered more practical and targeted based on their superior knowledge of the state road network.

Therefore, additional traffic counts have been undertaken at the following three intersections as requested by NSW RMS and these intersections have been modelled using the Sidra

Intersection 7 intersection analysis model for post development conditions consistent with the existing intersection modelling undertaken in the TIA.

- Raymond Terrace Road / Seaham Road give way controlled rural seagull;
- William Bailey Street / Port Stephens Street / Newline Road roundabout; and
- Adelaide Street / William Bailey Street signalised intersection.

Modelling for these intersections was carried out on the basis that;

1. Intersection layouts remain unchanged;
2. The worst-case scenario such that all additional quarry traffic i.e. 60 vtph during a major order was directed to the Pacific Motorway / Highway at Raymond Terrace.
3. At Adelaide Street 90 % of the development traffic had an origin / destination to the south towards Hexham and 10 % had an origin / destination to the north towards Karuah / Medowie / Port Stephens;
4. The adopted background traffic growth was 1.5 % per annum which is the average background traffic growth rate adopted by NSW RMS in their lower Hunter traffic models;
5. Existing traffic dated used was collected by Northern Transport Planning and Engineering on behalf of Intersect Traffic on 3rd August 2017 and
6. Modelling of the rural seagull at Raymond Terrace Road / Seaham Road did not match the observed behaviour during the traffic counts when the Sidra defaults were used therefore a calibration step was included in this modelling. The calibration was based on the critical gap acceptance criteria for right turning vehicles out of Raymond Terrace Road.

The traffic data collected, and the Sidra Summary results are provided within ***Attachments A and B*** of this response respectively. The modelling undertaken on these intersections showed the following;

- The intersections are all currently operating within the acceptable criteria set by the NSW RMS for LoS, average delays and back of queue lengths during the existing peak AM and PM traffic periods;

- The additional traffic generated by the development does not adversely impact on the current operation of these intersections as post development these intersections initially continue to operate within the acceptable criteria set by the NSW RMS for LoS, average delays and back of queue lengths during the peak AM and PM traffic periods.
- As expected with background traffic growth intersection performance continues to deteriorate over the expected life of the quarry with both the Raymond Terrace Road / Seaham Road rural seagull and the Adelaide Street / William Bailey Street traffic signals operating at capacity by 2024 and 2044 respectively.
- The William Bailey Street / Port Stephens Street / Newline Road roundabout however continues to operate satisfactorily post development through to at least 2044. It is noted however that the proposed Kings Hill residential development has a major impact on this intersection and as a result this intersection is likely to be converted to traffic signals in the future should the residential development proceed. It is understood the upgrading of this intersection is included within the proposed S94 Developer Contributions Plan for the Kings Hill residential development.
- With background traffic growth to 2024 the Raymond Terrace Road / Seaham Road rural seagull would need to be upgraded to a roundabout. This development's contribution to the traffic volumes through the intersection in 2024 is only 3.4 % in the AM peak and 3 % in the PM peak indicating an average contribution of 3.2%. Port Stephens Council has advised NSW RMS already has plans to upgrade this intersection to a roundabout under the blackspot program.
- With background traffic growth through to 2044 (expected life of the quarry) the Adelaide Street / William Bailey Street traffic signals will need to be upgraded to provide additional right turn lanes on both streets. This development's contribution to the traffic volumes through the intersection in 2044 is only 2.4 % in the AM peak and 1.9 % in the PM peak indicating any contribution to the upgrade should only be an average of 2.25 % and arguably should only be applied should the quarry life extend beyond 2044. It is also noted that this intersection is also affected by the proposed Kings Hill residential development and upgrading of the intersection is understood to be included within the proposed S94 Developer Contributions Plan for the Kings Hill residential development.

Overall it can still be concluded that the proposed Quarry Expansion will not adversely impact on the adjoining local and state road network though minor contribution to the future upgrading of the Raymond Terrace Road / Seaham Road rural seagull intersection may be appropriate through a Voluntary Planning Agreement.

Cumulative Traffic Levels

With regards to cumulative traffic levels, the TIA prepared for the Martin's Creek Quarry Expansion by Seca Solution (August 2016) has been reviewed. Table 4.3 of this report identified that the Quarry would generate up to 5 – 6 vtph on their Route 2 which runs through Clarencetown Road, Brandy Hill Drive, Seaham Road and William Bailey Street to Adelaide Street. The Intersect Traffic TIA for the Brandy Hill Quarry made an informed assumption that the Martin's Creek Quarry expansion would increase traffic on the local road network by 5 vtph. It is therefore considered that the TIA prepared for this project has made suitable allowance for the additional traffic generated by the Martins Creek Expansion particularly as the Martins Creek Quarry expansion TIA is based on the full output from the quarry and thus the 5 – 6 vtph would include current traffic volumes.

Drivers Code of Conduct

It is also noted that the Department of Planning and Environment requested that Hanson prepare a Traffic Management Plan and Driver's Code of Conduct and describe measures that may be included in these plans to mitigate potential impacts to amenity.

Generally, a Traffic Management Plan incorporates a Driver Code of Conduct which informs and requires drivers to adhere to road rules, general good practice and specific site related strategies to minimise impacts on adjoining properties and improve road safety. Particular reference in the Driver Code of Conduct include a three strikes enforcement strategy, identification of road safety issues on the main haulage routes from the site and compliance with consent conditions. Examples of strategies contained in existing TMP's in operation on other Hanson Construction Materials Quarries include;

- Limiting truck movements at certain times of the day as per consent conditions;

- Identifying set haulage routes to the sub-arterial road network or higher;
- Use of compression braking and other night time noise issues;
- Load covering;
- Adequately separating deliveries leaving the site;
- Emergency and incident response; and
- Road maintenance measures.

The applicant would expect and accept a condition of consent requiring the preparation of a Traffic Management Plan and Driver Code of Conduct for the quarry with input from Council, NSW RMS and the local community consultative committee.

Consultation with Maitland City Council's Traffic Engineer Mr. Scott Henderson and Port Stephens Council's Traffic Engineer Mr Joe Gleeson has indicated that both Council officers accepted that a condition of consent requiring preparation of a Traffic Management Plan and Driver Code of Conduct for the quarry would alleviate their concerns with the project subject to both Council's having input into the preparation of these documents.

For further information or clarification please do not hesitate to contact me on 02 4936 6200 or 0423 324 188.

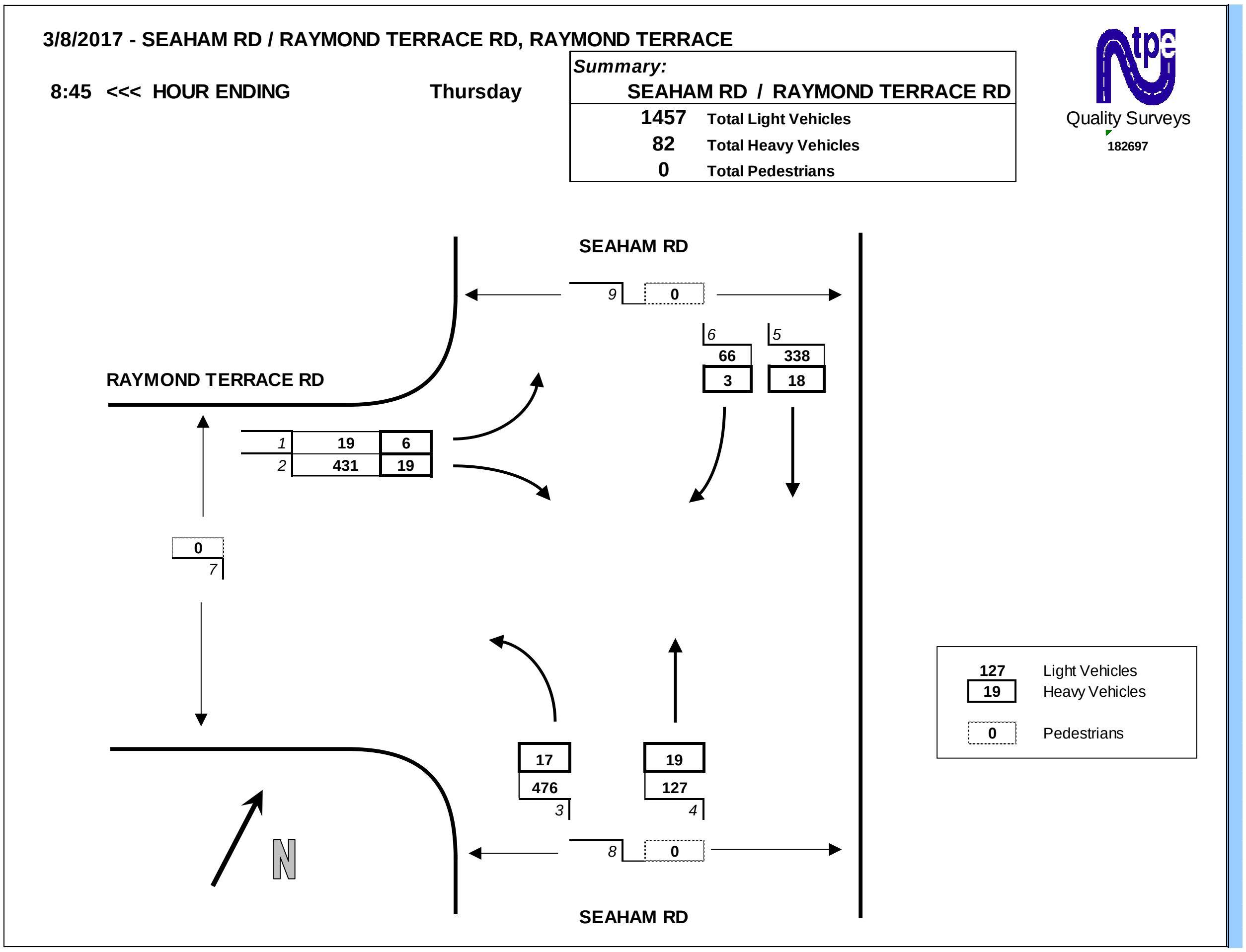
Yours sincerely

Jeff Garry

Director
Intersect Traffic

M: 0423 324 188 **E: jeff@intersecttraffic.com.au** **P: 02 4936 6200**
PO BOX 268 EAST MAITLAND NSW 2323

Attachment A

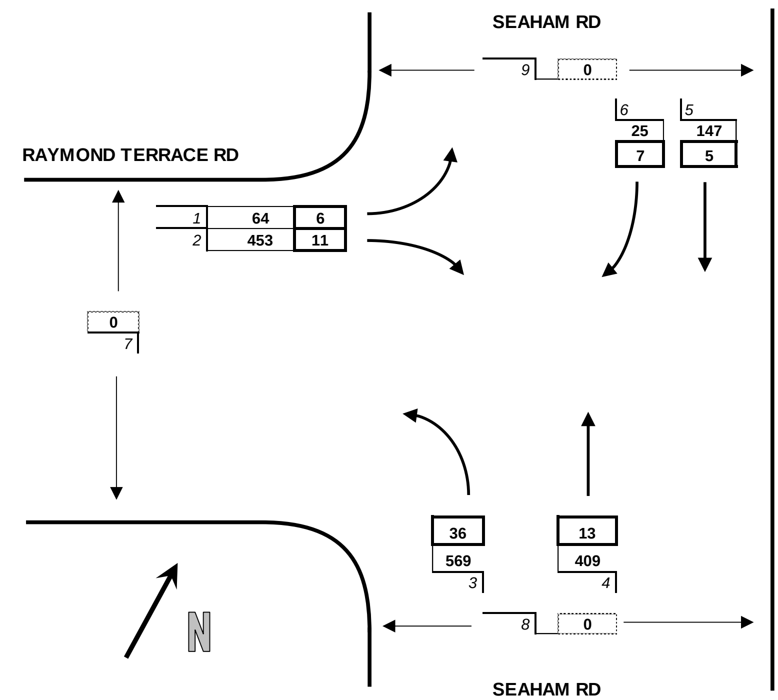


2/8/2017 - SEAHAM RD / RAYMOND TERRACE RD, RAYMOND TERRACE

17:30 <<< HOUR ENDING **Wednesday**

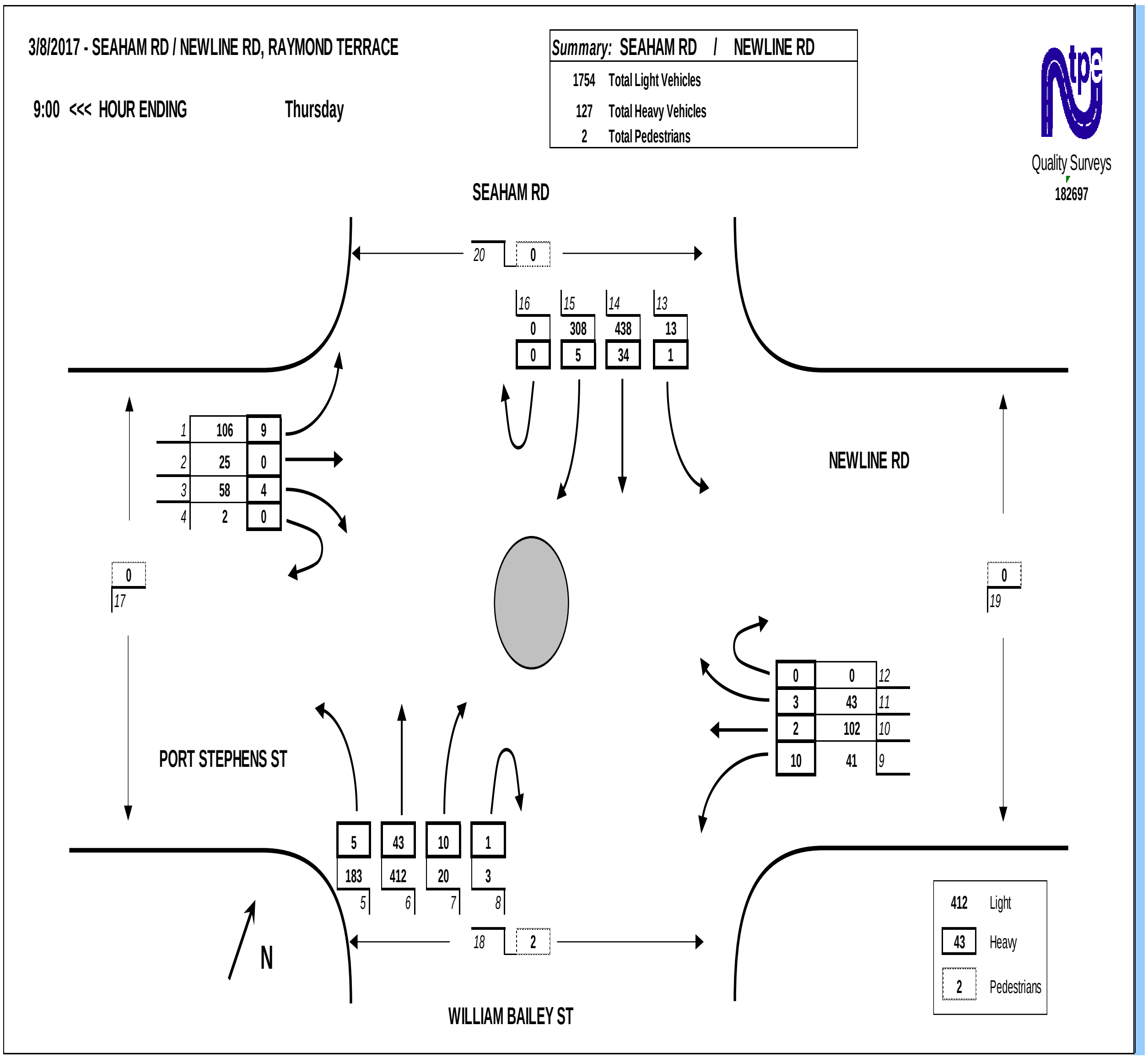
Summary:	
	SEAHAM RD / RAYMOND TERRACE RD
1667	**Total Light Vehicles**
78	**Total Heavy Vehicles**
0	**Total Pedestrians**

Quality Surveys
182697

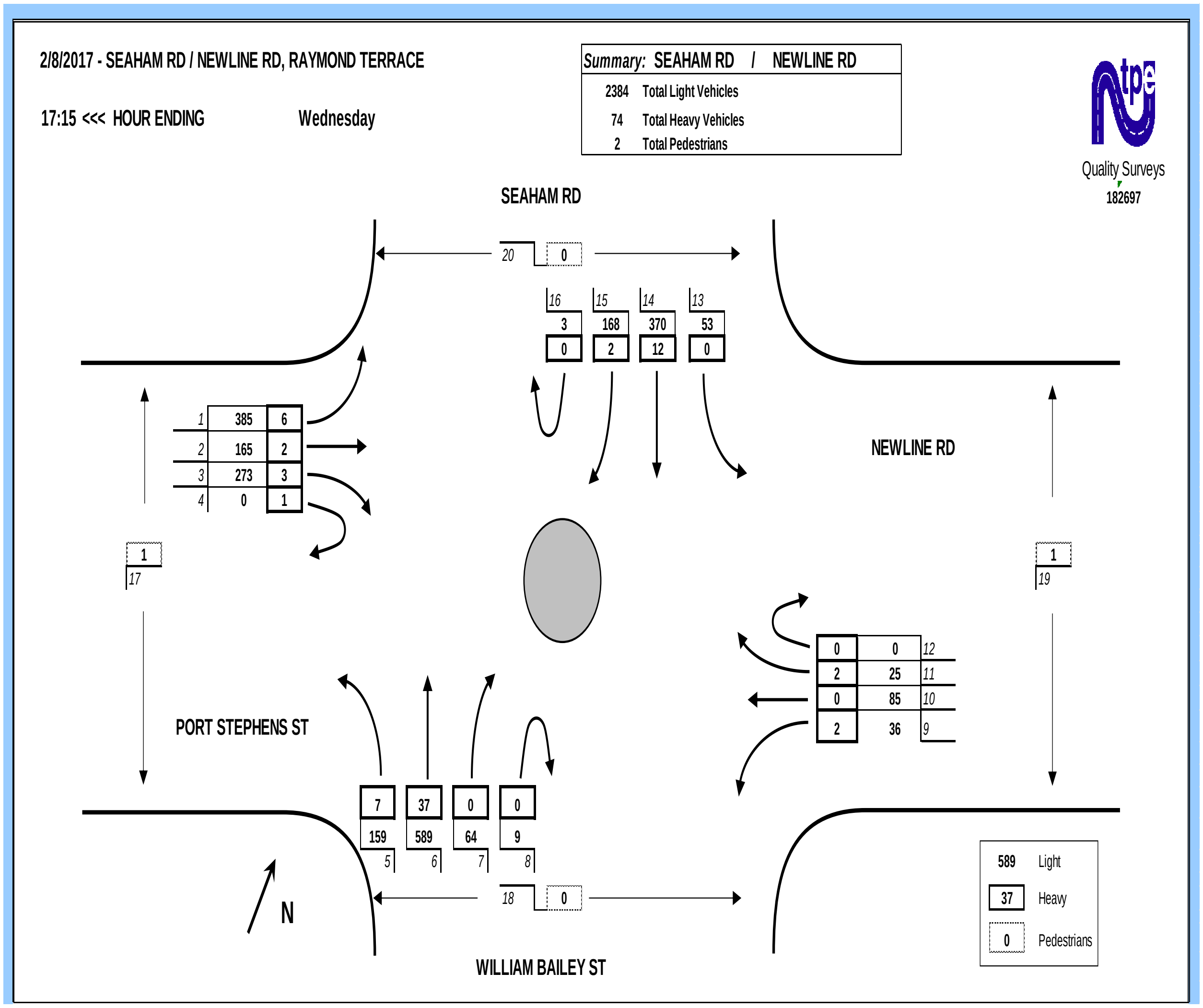


409	Light Vehicles
13	Heavy Vehicles
0	Pedestrians

M: 0423 324 188 E: jeff@intersecttraffic.com.au P: 02 4936 6200
PO BOX 268 EAST MAITLAND NSW 2323



M: 0423 324 188 E: jeff@intersecttraffic.com.au P: 02 4936 6200
PO BOX 268 EAST MAITLAND NSW 2323



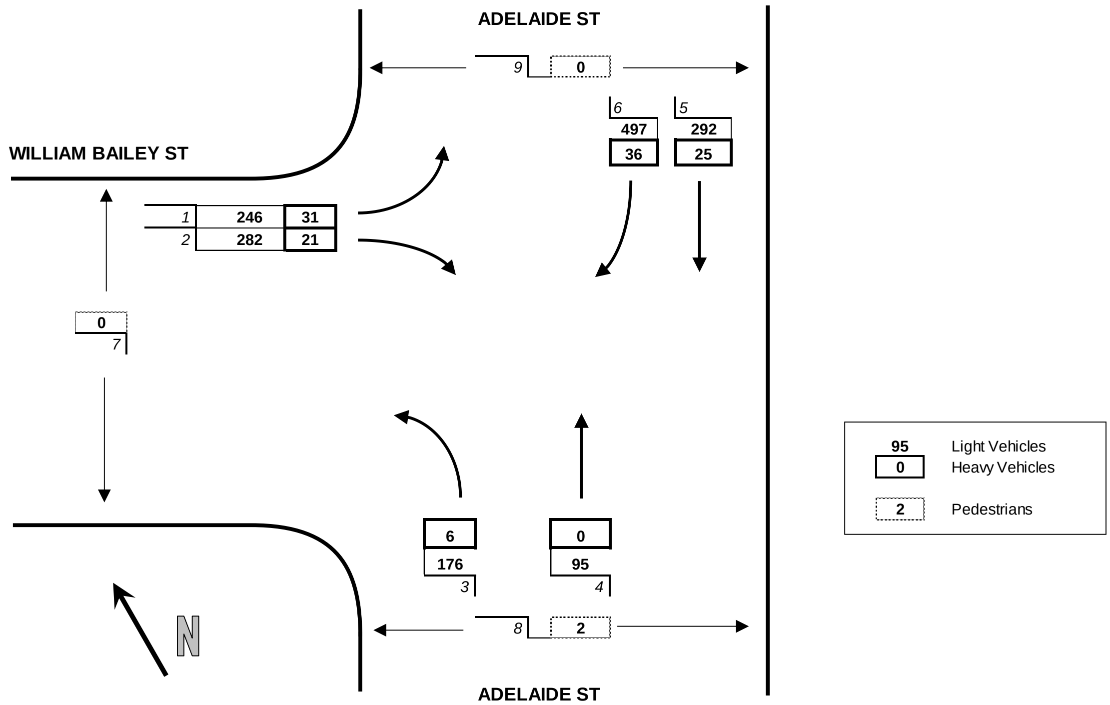
M: 0423 324 188 E: jeff@intersecttraffic.com.au P: 02 4936 6200
PO BOX 268 EAST MAITLAND NSW 2323

3/8/2017 - ADELAIDE ST / WILLIAM BAILEY ST, RAYMOND TERRACE

9:00 <<< HOUR ENDING **Thursday**

Quality Surveys
182697

Summary:	ADELAIDE ST / WILLIAM BAILEY ST
1588	Total Light Vehicles
119	Total Heavy Vehicles
2	Total Pedestrians



M: 0423 324 188 E: jeff@intersecttraffic.com.au P: 02 4936 6200
PO BOX 268 EAST MAITLAND NSW 2323

2/8/2017 - ADELAIDE ST / WILLIAM BAILEY ST, RAYMOND TERRACE

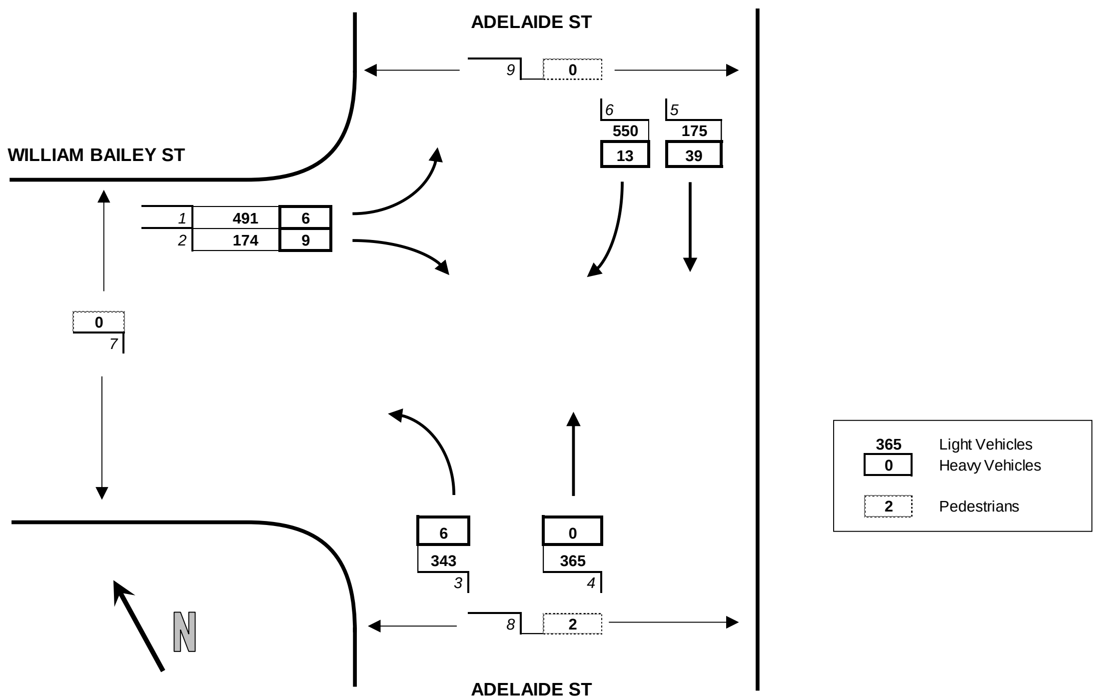
17:00 <<< HOUR ENDING **Wednesday**

Summary:

ADELAIDE ST / WILLIAM BAILEY ST

2098	Total Light Vehicles
73	Total Heavy Vehicles
2	Total Pedestrians

Quality Surveys
182697



M: 0423 324 188 E: jeff@intersecttraffic.com.au P: 02 4936 6200
PO BOX 268 EAST MAITLAND NSW 2323

Attachment B

MOVEMENT SUMMARY

Site: 101 [2017 AM peak]

Raymond Terrace Road / Seaham Road Rural Seagull
Existing traffic
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Raymond Terrace Road											
1	L2	25	24.0	0.496	9.6	LOS A	3.7	27.4	0.60	0.89	54.6
3	R2	450	4.2	0.496	11.0	LOS A	3.7	27.4	0.60	0.89	59.6
Approach		475	5.3	0.496	11.0	LOS A	3.7	27.4	0.60	0.89	59.3
East: Seaham Road											
4	L2	493	3.4	0.325	7.7	LOS A	1.7	12.5	0.20	0.57	63.6
5	T1	146	13.0	0.081	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		639	5.6	0.325	5.9	LOS A	1.7	12.5	0.16	0.44	66.6
West: Seaham Road											
11	T1	356	5.1	0.189	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
12	R2	69	4.3	0.045	7.2	LOS A	0.2	1.5	0.27	0.60	62.7
Approach		425	4.9	0.189	1.2	NA	0.2	1.5	0.04	0.10	76.5
All Vehicles		1539	5.3	0.496	6.2	NA	3.7	27.4	0.26	0.48	66.5

MOVEMENT SUMMARY

Site: 101 [2017 PM peak]

Raymond Terrace Road / Seaham Road Rural Seagull
Existing traffic
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Raymond Terrace Road											
1	L2	70	8.6	0.773	16.7	LOS B	8.3	59.9	0.83	1.27	51.8
3	R2	464	2.4	0.773	19.5	LOS B	8.3	59.9	0.83	1.27	53.0
Approach		534	3.2	0.773	19.1	LOS B	8.3	59.9	0.83	1.27	52.9
East: Seaham Road											
4	L2	605	6.0	0.392	7.6	LOS A	2.3	17.1	0.15	0.57	63.1
5	T1	422	3.1	0.221	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
Approach		1027	4.8	0.392	4.5	LOS A	2.3	17.1	0.09	0.34	69.0
West: Seaham Road											
11	T1	152	3.3	0.080	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
12	R2	32	21.9	0.032	9.0	LOS A	0.1	1.1	0.48	0.67	56.5
Approach		184	6.5	0.080	1.6	NA	0.1	1.1	0.08	0.12	74.6
All Vehicles		1745	4.5	0.773	8.6	NA	8.3	59.9	0.31	0.60	63.6

MOVEMENT SUMMARY

Site: 101 [2017 AM peak + development]

Raymond Terrace Road / Seaham Road Rural Seagull

Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Raymond Terrace Road											
1	L2	25	24.0	0.520	10.2	LOS A	4.0	29.4	0.64	0.94	54.1
3	R2	450	4.2	0.520	11.7	LOS A	4.0	29.4	0.64	0.94	59.0
Approach		475	5.3	0.520	11.6	LOS A	4.0	29.4	0.64	0.94	58.7
East: Seaham Road											
4	L2	493	3.4	0.325	7.7	LOS A	1.7	12.5	0.20	0.57	63.6
5	T1	176	27.8	0.107	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		669	9.9	0.325	5.7	LOS A	1.7	12.5	0.15	0.42	67.1
West: Seaham Road											
11	T1	386	12.4	0.214	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
12	R2	69	4.3	0.047	7.3	LOS A	0.2	1.5	0.31	0.61	62.5
Approach		455	11.2	0.214	1.1	NA	0.2	1.5	0.05	0.09	76.7
All Vehicles		1599	8.9	0.520	6.1	NA	4.0	29.4	0.27	0.48	66.7

MOVEMENT SUMMARY

Site: 101 [2017 PM peak + development]

Raymond Terrace Road / Seaham Road Rural Seagull

Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Raymond Terrace Road											
1	L2	70	8.6	0.822	19.8	LOS B	9.9	70.9	0.87	1.39	49.5
3	R2	464	2.4	0.822	22.7	LOS B	9.9	70.9	0.87	1.39	50.6
Approach		534	3.2	0.822	22.3	LOS B	9.9	70.9	0.87	1.39	50.5
East: Seaham Road											
4	L2	605	6.0	0.392	7.6	LOS A	2.3	17.1	0.15	0.57	63.1
5	T1	452	9.5	0.246	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
Approach		1057	7.5	0.392	4.3	LOS A	2.3	17.1	0.09	0.33	69.2
West: Seaham Road											
11	T1	192	18.2	0.110	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
12	R2	32	21.9	0.034	9.3	LOS A	0.1	1.1	0.51	0.69	56.2
Approach		224	18.8	0.110	1.3	NA	0.1	1.1	0.07	0.10	75.4
All Vehicles		1815	7.6	0.822	9.3	NA	9.9	70.9	0.32	0.61	63.0

MOVEMENT SUMMARY

Site: 101 [2024 AM peak]

Raymond Terrace Road / Seaham Road Rural Seagull

Giveway / Yield (Two-Way)
Design Life Analysis (Final Year): Results for 7 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Raymond Terrace Road											
1	L2	28	24.0	0.610	11.4	LOS A	5.4	39.7	0.70	1.03	52.9
3	R2	497	4.2	0.610	13.3	LOS A	5.4	39.7	0.70	1.03	57.5
Approach		525	5.3	0.610	13.2	LOS A	5.4	39.7	0.70	1.03	57.3
East: Seaham Road											
4	L2	545	3.4	0.362	7.7	LOS A	2.0	14.5	0.22	0.58	63.4
5	T1	194	27.8	0.118	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		739	9.9	0.362	5.7	LOS A	2.0	14.5	0.17	0.42	67.1
West: Seaham Road											
11	T1	427	12.4	0.236	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
12	R2	76	4.3	0.053	7.4	LOS A	0.2	1.7	0.33	0.61	62.4
Approach		503	11.2	0.236	1.1	NA	0.2	1.7	0.05	0.09	76.6
All Vehicles		1767	8.9	0.610	6.6	NA	5.4	39.7	0.29	0.51	66.1

MOVEMENT SUMMARY

Site: 101 [2024 PM peak]

Raymond Terrace Road / Seaham Road Rural Seagull

Giveway / Yield (Two-Way)
Design Life Analysis (Final Year): Results for 7 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Raymond Terrace Road											
1	L2	77	8.6	1.015	88.5	LOS F [11]	41.9	301.4	1.00	3.12	25.5
3	R2	513	2.4	1.015	92.3	LOS F [11]	41.9	301.4	1.00	3.12	25.8
Approach		590	3.2	1.015	91.8	LOS F [11]	41.9	301.4	1.00	3.12	25.7
East: Seaham Road											
4	L2	669	6.0	0.435	7.6	LOS A	2.7	20.0	0.17	0.57	63.0
5	T1	499	9.5	0.272	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
Approach		1168	7.5	0.435	4.4	LOS A	2.7	20.0	0.10	0.32	69.2
West: Seaham Road											
11	T1	212	18.2	0.122	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
12	R2	35	21.9	0.040	9.6	LOS A	0.2	1.3	0.53	0.72	55.9
Approach		248	18.8	0.122	1.4	NA	0.2	1.3	0.08	0.10	75.3
All Vehicles		2006	7.6	1.015	29.7	NA	41.9	301.4	0.36	1.12	46.5

MOVEMENT SUMMARY

Site: 101 [2044 AM peak]

Raymond Terrace Road / Seaham Road Rural Seag
Giveway / Yield (Two-Way)
Design Life Analysis (Final Year): Results for 27 years

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Raymond Terrace Road											
1	L2	35	24.0	0.928	29.3	LOS C	21.4	156.4	0.92	1.92	41.1
3	R2	632	4.2	0.928	33.0	LOS C	21.4	156.4	0.92	1.92	43.9
Approach		667	5.3	0.928	32.8	LOS C	21.4	156.4	0.92	1.92	43.8
East: Seaham Road											
4	L2	693	3.4	0.468	7.9	LOS A	2.9	21.2	0.29	0.58	63.1
5	T1	247	27.8	0.150	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
Approach		940	9.9	0.468	5.8	LOS A	2.9	21.2	0.22	0.43	66.8
West: Seaham Road											
11	T1	542	12.4	0.301	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
12	R2	97	4.3	0.072	7.7	LOS A	0.3	2.3	0.38	0.64	62.2
Approach		639	11.2	0.301	1.2	NA	0.3	2.3	0.06	0.10	76.6
All Vehicles		2247	8.9	0.928	12.5	NA	21.4	156.4	0.38	0.78	59.6

MOVEMENT SUMMARY

Site: 101 [2044 PM peak]

Raymond Terrace Road / Seaham Road Rural Seagull

Giveway / Yield (Two-Way)
Design Life Analysis (Final Year): Results for 27 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Raymond Terrace Road											
1	L2	98	8.6	1.827	1503.8	LOS F[11]	432.8	3112.3	1.00	14.31	2.3
3	R2	652	2.4	1.827	1506.8	LOS F[11]	432.8	3112.3	1.00	14.31	2.3
Approach		750	3.2	1.827	1506.4	LOS F[11]	432.8	3112.3	1.00	14.31	2.3
East: Seaham Road											
4	L2	850	6.0	0.558	7.7	LOS A	4.2	30.9	0.23	0.56	62.7
5	T1	635	9.5	0.346	0.0	LOS A	0.0	0.0	0.00	0.00	79.8
Approach		1485	7.5	0.558	4.4	LOS A	4.2	30.9	0.13	0.32	69.0
West: Seaham Road											
11	T1	270	18.2	0.155	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
12	R2	45	21.9	0.063	11.0	LOS A	0.2	2.1	0.60	0.80	54.8
Approach		315	18.8	0.155	1.6	NA	0.2	2.1	0.09	0.11	75.0
All Vehicles		2550	7.6	1.827	446.0	NA	432.8	3112.3	0.38	4.41	7.4

MOVEMENT SUMMARY

Site: 101v [2044 PM peak no development - Conversion]

Raymond Terrace Road / Seaham Road Rural Seagull

Roundabout
Design Life Analysis (Final Year): Results for 27 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Raymond Terrace Road											
1	L2	98	8.6	0.175	10.9	LOS A	0.9	6.7	0.67	0.79	60.5
3	R2	652	2.4	0.674	19.3	LOS B	7.7	55.2	0.88	0.99	56.5
Approach		750	3.2	0.674	18.2	LOS B	7.7	55.2	0.85	0.97	56.9
East: Seaham Road											
4	L2	850	6.0	0.543	5.6	LOS A	5.5	40.6	0.31	0.49	65.9
5	T1	593	3.1	0.379	6.2	LOS A	3.1	22.0	0.25	0.45	68.0
Approach		1443	4.8	0.543	5.9	LOS A	5.5	40.6	0.28	0.47	66.7
West: Seaham Road											
11	T1	212	3.3	0.267	9.5	LOS A	1.9	14.0	0.81	0.76	63.7
12	R2	45	21.9	0.107	18.3	LOS B	0.6	4.8	0.75	0.85	53.4
Approach		257	6.6	0.267	11.1	LOS A	1.9	14.0	0.80	0.77	61.6
All Vehicles		2450	4.5	0.674	10.2	LOS A	7.7	55.2	0.51	0.65	62.8

MOVEMENT SUMMARY

Site: 101 [2017 AM]

William Bailey Street / Port Stephens Street / Newline Road roundabout.

Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Port Stephens Street											
1	L2	115	7.8	0.130	6.6	LOS A	0.7	5.4	0.61	0.67	53.0
2	T1	25	0.0	0.113	6.7	LOS A	0.6	4.3	0.61	0.73	52.0
3	R2	62	6.5	0.113	11.5	LOS A	0.6	4.3	0.61	0.73	51.8
3u	U	2	0.0	0.113	13.4	LOS A	0.6	4.3	0.61	0.73	52.9
Approach		204	6.4	0.130	8.2	LOS A	0.7	5.4	0.61	0.70	52.5
East: William Bailey Street											
4	L2	188	2.7	0.231	7.4	LOS A	1.3	9.3	0.62	0.71	52.5
5	T1	455	9.5	0.458	7.0	LOS A	3.3	25.2	0.70	0.70	53.2
6	R2	30	33.3	0.458	12.5	LOS A	3.3	25.2	0.70	0.70	52.0
6u	U	4	25.0	0.458	14.3	LOS A	3.3	25.2	0.70	0.70	53.3
Approach		677	8.7	0.458	7.4	LOS A	3.3	25.2	0.68	0.71	52.9
North: Newline Road											
7	L2	51	19.6	0.302	8.7	LOS A	1.5	10.8	0.68	0.84	51.1
8	T1	104	1.9	0.302	8.1	LOS A	1.5	10.8	0.68	0.84	52.7
9	R2	46	6.5	0.302	13.0	LOS A	1.5	10.8	0.68	0.84	52.5
9u	U	1	0.0	0.302	14.8	LOS B	1.5	10.8	0.68	0.84	53.6
Approach		202	7.4	0.302	9.4	LOS A	1.5	10.8	0.68	0.84	52.2
West: William Bailey Street											
10	L2	14	7.1	0.167	5.3	LOS A	0.9	6.8	0.37	0.48	53.3
11	T1	472	7.2	0.442	5.0	LOS A	3.4	24.9	0.39	0.53	53.9
12	R2	313	1.6	0.442	9.4	LOS A	3.4	24.9	0.40	0.56	53.4
12u	U	1	0.0	0.442	11.5	LOS A	3.4	24.9	0.40	0.56	54.5
Approach		800	5.0	0.442	6.7	LOS A	3.4	24.9	0.40	0.54	53.7
All Vehicles		1883	6.7	0.458	7.4	LOS A	3.4	25.2	0.55	0.65	53.1

MOVEMENT SUMMARY

Site: 101 [2017 PM]

William Bailey Street / Port Stephens Street / Newline Road roundabout.

Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Port Stephens Street											
1	L2	391	1.5	0.571	11.3	LOS A	4.8	33.9	0.88	1.02	50.0
2	T1	167	1.2	0.564	10.3	LOS A	5.0	35.1	0.88	0.99	50.1
3	R2	276	1.1	0.564	14.9	LOS B	5.0	35.1	0.88	0.99	50.1
3u	U	1	0.0	0.564	16.9	LOS B	5.0	35.1	0.88	0.99	50.9
Approach		835	1.3	0.571	12.3	LOS A	5.0	35.1	0.88	1.00	50.0
East: William Bailey Street											
4	L2	166	4.2	0.211	6.5	LOS A	1.2	8.5	0.54	0.64	53.1
5	T1	626	5.9	0.558	6.0	LOS A	4.7	34.9	0.66	0.61	53.4
6	R2	64	0.0	0.558	10.5	LOS A	4.7	34.9	0.66	0.61	53.4
6u	U	9	100.0	0.558	15.0	LOS B	4.7	34.9	0.66	0.61	52.5
Approach		865	6.1	0.558	6.6	LOS A	4.7	34.9	0.63	0.62	53.3
North: Newline Road											
7	L2	38	5.3	0.233	8.2	LOS A	1.2	8.5	0.71	0.83	51.7
8	T1	85	0.0	0.233	8.2	LOS A	1.2	8.5	0.71	0.83	52.9
9	R2	27	7.4	0.233	13.1	LOS A	1.2	8.5	0.71	0.83	52.7
9u	U	1	0.0	0.233	14.9	LOS B	1.2	8.5	0.71	0.83	53.8
Approach		151	2.6	0.233	9.1	LOS A	1.2	8.5	0.71	0.83	52.6
West: William Bailey Street											
10	L2	53	0.0	0.184	8.0	LOS A	1.1	7.6	0.69	0.74	52.1
11	T1	382	3.1	0.487	7.5	LOS A	4.1	29.1	0.79	0.76	52.4
12	R2	170	1.2	0.487	11.9	LOS A	4.1	29.1	0.81	0.77	52.1
12u	U	3	0.0	0.487	14.0	LOS A	4.1	29.1	0.81	0.77	53.2
Approach		608	2.3	0.487	8.8	LOS A	4.1	29.1	0.79	0.76	52.3
All Vehicles		2459	3.3	0.571	9.2	LOS A	5.0	35.1	0.76	0.80	51.9

MOVEMENT SUMMARY

Site: 101 [2017 AM + development]

William Bailey Street / Port Stephens Street / Newline Road roundabout.

Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Port Stephens Street											
1	L2	115	7.8	0.136	6.9	LOS A	0.8	5.8	0.65	0.70	52.9
2	T1	25	0.0	0.119	7.0	LOS A	0.6	4.7	0.65	0.75	51.8
3	R2	62	6.5	0.119	11.8	LOS A	0.6	4.7	0.65	0.75	51.6
3u	U	2	0.0	0.119	13.7	LOS A	0.6	4.7	0.65	0.75	52.7
Approach		204	6.4	0.136	8.5	LOS A	0.8	5.8	0.65	0.72	52.4
East: William Bailey Street											
4	L2	188	2.7	0.235	7.4	LOS A	1.3	9.5	0.62	0.71	52.5
5	T1	485	15.1	0.503	7.6	LOS A	3.9	30.9	0.73	0.75	52.9
6	R2	30	33.3	0.503	12.9	LOS A	3.9	30.9	0.73	0.75	51.9
6u	U	4	25.0	0.503	14.7	LOS B	3.9	30.9	0.73	0.75	53.2
Approach		707	12.6	0.503	7.8	LOS A	3.9	30.9	0.70	0.74	52.7
North: Newline Road											
7	L2	51	19.6	0.312	9.0	LOS A	1.5	11.3	0.70	0.85	50.9
8	T1	104	1.9	0.312	8.4	LOS A	1.5	11.3	0.70	0.85	52.5
9	R2	46	6.5	0.312	13.3	LOS A	1.5	11.3	0.70	0.85	52.3
9u	U	1	0.0	0.312	15.0	LOS B	1.5	11.3	0.70	0.85	53.4
Approach		202	7.4	0.312	9.7	LOS A	1.5	11.3	0.70	0.85	52.0
West: William Bailey Street											
10	L2	14	7.1	0.177	5.3	LOS A	1.0	7.5	0.37	0.48	53.3
11	T1	502	12.7	0.467	5.1	LOS A	3.8	28.0	0.41	0.53	53.7
12	R2	313	1.6	0.467	9.4	LOS A	3.8	28.0	0.42	0.56	53.4
12u	U	1	0.0	0.467	11.5	LOS A	3.8	28.0	0.42	0.56	54.5
Approach		830	8.4	0.467	6.7	LOS A	3.8	28.0	0.41	0.54	53.6
All Vehicles		1943	9.6	0.503	7.6	LOS A	3.9	30.9	0.57	0.66	53.0

MOVEMENT SUMMARY

Site: 101 [2017 PM + development]

William Bailey Street / Port Stephens Street / Newline Road roundabout.

Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Port Stephens Street											
1	L2	391	1.5	0.587	11.7	LOS A	4.9	34.9	0.88	1.03	49.7
2	T1	167	1.2	0.577	10.5	LOS A	5.1	35.8	0.89	1.02	49.9
3	R2	276	1.1	0.577	15.2	LOS B	5.1	35.8	0.89	1.02	49.9
3u	U	1	0.0	0.577	17.2	LOS B	5.1	35.8	0.89	1.02	50.7
Approach		835	1.3	0.587	12.6	LOS A	5.1	35.8	0.89	1.02	49.8
East: William Bailey Street											
4	L2	166	4.2	0.222	6.5	LOS A	1.2	9.1	0.54	0.64	53.1
5	T1	656	10.2	0.588	6.2	LOS A	5.1	39.1	0.68	0.62	53.2
6	R2	64	0.0	0.588	10.5	LOS A	5.1	39.1	0.68	0.62	53.3
6u	U	9	100.0	0.588	15.2	LOS B	5.1	39.1	0.68	0.62	52.3
Approach		895	9.3	0.588	6.7	LOS A	5.1	39.1	0.66	0.63	53.1
North: Newline Road											
7	L2	38	5.3	0.243	8.4	LOS A	1.3	9.0	0.73	0.85	51.5
8	T1	85	0.0	0.243	8.4	LOS A	1.3	9.0	0.73	0.85	52.7
9	R2	27	7.4	0.243	13.4	LOS A	1.3	9.0	0.73	0.85	52.5
9u	U	1	0.0	0.243	15.1	LOS B	1.3	9.0	0.73	0.85	53.6
Approach		151	2.6	0.243	9.4	LOS A	1.3	9.0	0.73	0.85	52.4
West: William Bailey Street											
10	L2	53	0.0	0.200	8.1	LOS A	1.2	8.5	0.70	0.75	52.0
11	T1	412	10.2	0.527	8.2	LOS A	4.7	35.2	0.81	0.82	52.0
12	R2	170	1.2	0.527	12.4	LOS A	4.7	35.2	0.83	0.83	51.9
12u	U	3	0.0	0.527	14.5	LOS A	4.7	35.2	0.83	0.83	52.9
Approach		638	6.9	0.527	9.3	LOS A	4.7	35.2	0.81	0.81	52.0
All Vehicles		2519	5.6	0.588	9.5	LOS A	5.1	39.1	0.77	0.82	51.7

MOVEMENT SUMMARY

Site: 101 [2024 AM]

William Bailey Street / Port Stephens Street / Newline Road roundabout.

Roundabout
Design Life Analysis (Final Year): Results for 7 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Port Stephens Street											
1	L2	127	7.8	0.163	7.4	LOS A	1.0	7.4	0.71	0.74	52.6
2	T1	28	0.0	0.143	7.5	LOS A	0.8	6.0	0.70	0.78	51.5
3	R2	69	6.5	0.143	12.4	LOS A	0.8	6.0	0.70	0.78	51.3
3u	U	2	0.0	0.143	14.2	LOS A	0.8	6.0	0.70	0.78	52.4
Approach		225	6.4	0.163	9.0	LOS A	1.0	7.4	0.71	0.76	52.1
East: William Bailey Street											
4	L2	208	2.7	0.271	7.9	LOS A	1.6	11.4	0.67	0.75	52.1
5	T1	536	15.1	0.579	9.1	LOS A	5.4	43.0	0.80	0.85	52.4
6	R2	33	33.3	0.579	14.5	LOS A	5.4	43.0	0.80	0.85	51.4
6u	U	4	25.0	0.579	16.3	LOS B	5.4	43.0	0.80	0.85	52.7
Approach		781	12.6	0.579	9.1	LOS A	5.4	43.0	0.77	0.82	52.3
North: Newline Road											
7	L2	56	19.6	0.373	10.2	LOS A	2.0	14.9	0.75	0.90	50.1
8	T1	115	1.9	0.373	9.6	LOS A	2.0	14.9	0.75	0.90	51.6
9	R2	51	6.5	0.373	14.5	LOS A	2.0	14.9	0.75	0.90	51.4
9u	U	1	0.0	0.373	16.2	LOS B	2.0	14.9	0.75	0.90	52.5
Approach		223	7.4	0.373	10.9	LOS A	2.0	14.9	0.75	0.90	51.2
West: William Bailey Street											
10	L2	15	7.1	0.198	5.5	LOS A	1.1	8.6	0.40	0.50	53.2
11	T1	555	12.7	0.523	5.3	LOS A	4.5	33.7	0.46	0.55	53.5
12	R2	346	1.6	0.523	9.6	LOS A	4.5	33.7	0.48	0.57	53.2
12u	U	1	0.0	0.523	11.7	LOS A	4.5	33.7	0.48	0.57	54.3
Approach		917	8.4	0.523	6.9	LOS A	4.5	33.7	0.46	0.55	53.4
All Vehicles		2147	9.6	0.579	8.3	LOS A	5.4	43.0	0.63	0.71	52.6

MOVEMENT SUMMARY

Site: 101 [2024 PM]

William Bailey Street / Port Stephens Street / Newline Road roundabout.

Roundabout
Design Life Analysis (Final Year): Results for 7 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Port Stephens Street											
1	L2	432	1.5	0.740	17.5	LOS B	7.9	56.2	0.99	1.19	46.1
2	T1	185	1.2	0.719	15.3	LOS B	8.0	56.8	1.00	1.17	47.0
3	R2	305	1.1	0.719	19.9	LOS B	8.0	56.8	1.00	1.17	47.0
3u	U	1	0.0	0.719	21.9	LOS B	8.0	56.8	1.00	1.17	47.7
Approach		923	1.3	0.740	17.9	LOS B	8.0	56.8	0.99	1.18	46.5
East: William Bailey Street											
4	L2	183	4.2	0.253	6.8	LOS A	1.5	10.6	0.58	0.67	52.8
5	T1	725	10.2	0.668	7.5	LOS A	7.4	56.2	0.78	0.74	52.7
6	R2	71	0.0	0.668	11.8	LOS A	7.4	56.2	0.78	0.74	52.8
6u	U	10	100.0	0.668	16.9	LOS B	7.4	56.2	0.78	0.74	51.9
Approach		989	9.3	0.668	7.9	LOS A	7.4	56.2	0.74	0.73	52.7
North: Newline Road											
7	L2	42	5.3	0.297	9.3	LOS A	1.6	11.6	0.78	0.89	50.9
8	T1	94	0.0	0.297	9.2	LOS A	1.6	11.6	0.78	0.89	52.1
9	R2	30	7.4	0.297	14.2	LOS A	1.6	11.6	0.78	0.89	51.9
9u	U	1	0.0	0.297	15.9	LOS B	1.6	11.6	0.78	0.89	53.0
Approach		167	2.6	0.297	10.2	LOS A	1.6	11.6	0.78	0.89	51.8
West: William Bailey Street											
10	L2	59	0.0	0.237	8.6	LOS A	1.4	10.6	0.75	0.79	51.6
11	T1	455	10.2	0.626	10.0	LOS A	6.9	51.2	0.90	0.92	51.1
12	R2	188	1.2	0.626	14.5	LOS B	6.9	51.2	0.93	0.95	50.9
12u	U	3	0.0	0.626	16.6	LOS B	6.9	51.2	0.93	0.95	51.9
Approach		705	6.9	0.626	11.2	LOS A	6.9	51.2	0.90	0.92	51.1
All Vehicles		2783	5.6	0.740	12.1	LOS A	8.0	56.8	0.87	0.94	50.1

MOVEMENT SUMMARY

Site: 101 [2044 AM]

William Bailey Street / Port Stephens Street / Newline Road roundabout.

Roundabout
Design Life Analysis (Final Year): Results for 27 years

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Port Stephens Street											
1	L2	162	7.8	0.278	9.2	LOS A	2.0	14.8	0.89	0.88	51.3
2	T1	35	0.0	0.250	9.5	LOS A	1.6	11.9	0.86	0.90	50.3
3	R2	87	6.5	0.250	14.4	LOS A	1.6	11.9	0.86	0.90	50.1
3u	U	3	0.0	0.250	16.2	LOS B	1.6	11.9	0.86	0.90	51.1
Approach		287	6.4	0.278	10.9	LOS A	2.0	14.8	0.88	0.89	50.8
East: William Bailey Street											
4	L2	264	2.7	0.400	9.8	LOS A	2.7	19.2	0.80	0.87	50.8
5	T1	681	15.1	0.850	21.9	LOS B	16.4	130.8	1.00	1.37	44.4
6	R2	42	33.3	0.850	27.5	LOS B	16.4	130.8	1.00	1.37	43.7
6u	U	6	25.0	0.850	29.2	LOS C	16.4	130.8	1.00	1.37	44.6
Approach		993	12.6	0.850	19.0	LOS B	16.4	130.8	0.95	1.24	45.9
North: Newline Road											
7	L2	72	19.6	0.631	18.4	LOS B	4.7	34.9	0.91	1.10	45.2
8	T1	146	1.9	0.631	17.5	LOS B	4.7	34.9	0.91	1.10	46.4
9	R2	65	6.5	0.631	22.4	LOS B	4.7	34.9	0.91	1.10	46.3
9u	U	1	0.0	0.631	24.1	LOS B	4.7	34.9	0.91	1.10	47.2
Approach		284	7.4	0.631	18.9	LOS B	4.7	34.9	0.91	1.10	46.1
West: William Bailey Street											
10	L2	20	7.1	0.262	5.9	LOS A	1.6	12.1	0.48	0.55	52.8
11	T1	705	12.7	0.691	5.9	LOS A	7.6	56.7	0.62	0.59	52.9
12	R2	440	1.6	0.691	10.2	LOS A	7.6	56.7	0.68	0.61	52.5
12u	U	1	0.0	0.691	12.2	LOS A	7.6	56.7	0.68	0.61	53.6
Approach		1166	8.4	0.691	7.5	LOS A	7.6	56.7	0.64	0.60	52.8
All Vehicles		2730	9.6	0.850	13.2	LOS A	16.4	130.8	0.81	0.91	49.2

MOVEMENT SUMMARY

Site: 101 [2044 PM]

William Bailey Street / Port Stephens Street / Newline Road roundabout.

Roundabout
Design Life Analysis (Final Year): Results for 27 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Port Stephens Street											
1	L2	549	1.5	1.356	668.2	LOS F[11]	194.3	1378.2	1.00	8.08	5.0
2	T1	235	1.2	1.276	525.5	LOS F[11]	184.8	1306.0	1.00	7.68	6.4
3	R2	388	1.1	1.276	530.2	LOS F[11]	184.8	1306.0	1.00	7.68	6.4
3u	U	1	0.0	1.276	532.2	LOS F[11]	184.8	1306.0	1.00	7.68	6.4
Approach		1173	1.3	1.356	593.9	LOS F[11]	194.3	1378.2	1.00	7.87	5.6
East: William Bailey Street											
4	L2	233	4.2	0.362	7.7	LOS A	2.3	16.6	0.68	0.75	52.2
5	T1	922	10.2	0.957	28.9	LOS C	33.0	251.9	0.99	1.54	41.0
6	R2	90	0.0	0.957	33.7	LOS C	33.0	251.9	1.00	1.57	40.7
6u	U	13	100.0	0.957	40.3	LOS C	33.0	251.9	1.00	1.57	40.2
Approach		1257	9.3	0.957	25.5	LOS B	33.0	251.9	0.93	1.40	42.6
North: Newline Road											
7	L2	53	5.3	0.466	13.4	LOS A	3.1	22.1	0.89	1.00	48.2
8	T1	119	0.0	0.466	13.3	LOS A	3.1	22.1	0.89	1.00	49.3
9	R2	38	7.4	0.466	18.4	LOS B	3.1	22.1	0.89	1.00	49.1
9u	U	1	0.0	0.466	20.0	LOS B	3.1	22.1	0.89	1.00	50.1
Approach		212	2.6	0.466	14.3	LOS A	3.1	22.1	0.89	1.00	49.0
West: William Bailey Street											
10	L2	74	0.0	0.306	9.0	LOS A	1.9	14.1	0.78	0.83	51.3
11	T1	579	10.2	0.810	15.4	LOS B	13.6	100.9	0.96	1.12	47.7
12	R2	239	1.2	0.810	20.8	LOS B	13.6	100.9	1.00	1.18	46.9
12u	U	4	0.0	0.810	22.9	LOS B	13.6	100.9	1.00	1.18	47.7
Approach		896	6.9	0.810	16.3	LOS B	13.6	100.9	0.96	1.11	47.7
All Vehicles		3539	5.6	1.356	210.9	LOS F[11]	194.3	1378.2	0.96	3.45	13.6

MOVEMENT SUMMARY

Site: 101 [2017 AM]

Adelaide Street / William Bailey Street
Signals - Fixed Time Isolated Cycle Time = 51 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Adelaide Street											
5	T1	317	7.9	0.726	27.1	LOS B	4.3	32.4	1.00	0.89	41.5
6	R2	533	6.8	0.902	37.5	LOS C	18.1	134.2	1.00	1.11	36.4
Approach		850	7.2	0.902	33.6	LOS C	18.1	134.2	1.00	1.03	38.1
North: William Bailey Street											
7	L2	277	11.2	0.210	6.8	LOS A	1.2	9.2	0.32	0.63	52.7
9	R2	303	6.9	0.873	36.5	LOS C	9.4	69.7	1.00	1.08	36.8
Approach		580	9.0	0.873	22.3	LOS B	9.4	69.7	0.67	0.87	43.1
West: Adelaide Street											
10	L2	182	3.3	0.192	11.1	LOS A	2.1	15.2	0.58	0.69	50.0
11	T1	95	0.0	0.269	23.5	LOS B	1.5	10.5	0.94	0.70	43.3
Approach		277	2.2	0.269	15.4	LOS B	2.1	15.2	0.70	0.69	47.5
All Vehicles		1707	7.0	0.902	26.8	LOS B	18.1	134.2	0.84	0.92	41.1

MOVEMENT SUMMARY

Site: 101 [2017 PM]

Adelaide Street / William Bailey Street
Signals - Fixed Time Isolated Cycle Time = 47 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Adelaide Street											
5	T1	214	18.2	0.412	21.1	LOS B	2.4	19.5	0.95	0.74	44.5
6	R2	563	2.3	0.905	35.9	LOS C	18.0	128.6	1.00	1.12	37.1
Approach		777	6.7	0.905	31.8	LOS C	18.0	128.6	0.99	1.02	38.9
North: William Bailey Street											
7	L2	497	1.2	0.397	8.0	LOS A	3.5	25.0	0.47	0.68	52.2
9	R2	183	4.9	0.799	32.2	LOS C	4.8	35.4	1.00	0.97	38.5
Approach		680	2.2	0.799	14.5	LOS B	4.8	35.4	0.61	0.76	47.7
West: Adelaide Street											
10	L2	349	1.7	0.380	11.5	LOS A	4.2	29.7	0.65	0.73	49.8
11	T1	365	0.0	0.816	24.4	LOS B	6.3	44.0	0.98	0.90	42.8
Approach		714	0.8	0.816	18.1	LOS B	6.3	44.0	0.82	0.82	46.0
All Vehicles		2171	3.4	0.905	21.9	LOS B	18.0	128.6	0.82	0.87	43.6

MOVEMENT SUMMARY

Site: 101 [2017 AM + development]

Adelaide Street / William Bailey Street
Signals - Fixed Time Isolated Cycle Time = 55 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Adelaide Street											
5	T1	317	7.9	0.783	30.6	LOS C	4.8	35.9	1.00	0.94	39.9
6	R2	538	7.6	0.884	35.8	LOS C	18.4	136.9	1.00	1.06	37.0
Approach		855	7.7	0.884	33.9	LOS C	18.4	136.9	1.00	1.01	38.0
North: William Bailey Street											
7	L2	282	12.8	0.211	6.8	LOS A	1.2	9.6	0.29	0.63	52.8
9	R2	328	14.0	0.890	40.3	LOS C	11.4	89.1	1.00	1.10	35.4
Approach		610	13.4	0.890	24.8	LOS B	11.4	89.1	0.67	0.88	41.7
West: Adelaide Street											
10	L2	207	15.0	0.233	11.5	LOS A	2.6	20.7	0.57	0.69	49.4
11	T1	95	0.0	0.290	25.9	LOS B	1.6	11.5	0.95	0.70	42.1
Approach		302	10.3	0.290	16.0	LOS B	2.6	20.7	0.69	0.70	46.9
All Vehicles		1767	10.1	0.890	27.7	LOS B	18.4	136.9	0.83	0.91	40.6

MOVEMENT SUMMARY

Site: 101 [2017 PM + development]

Adelaide Street / William Bailey Street
Signals - Fixed Time Isolated Cycle Time = 49 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Adelaide Street											
5	T1	214	18.2	0.430	22.3	LOS B	2.5	20.5	0.95	0.74	43.9
6	R2	568	3.2	0.901	36.0	LOS C	18.6	133.6	1.00	1.11	37.0
Approach		782	7.3	0.901	32.2	LOS C	18.6	133.6	0.99	1.01	38.7
North: William Bailey Street											
7	L2	502	2.2	0.398	8.0	LOS A	3.6	25.8	0.46	0.68	52.2
9	R2	208	16.3	0.875	37.2	LOS C	6.3	50.0	1.00	1.11	36.4
Approach		710	6.3	0.875	16.5	LOS B	6.3	50.0	0.62	0.80	46.3
West: Adelaide Street											
10	L2	374	8.3	0.423	12.1	LOS A	4.7	35.5	0.66	0.74	49.2
11	T1	365	0.0	0.851	26.6	LOS B	6.8	47.4	0.99	0.94	41.7
Approach		739	4.2	0.851	19.3	LOS B	6.8	47.4	0.82	0.84	45.2
All Vehicles		2231	6.0	0.901	22.9	LOS B	18.6	133.6	0.81	0.89	43.0

MOVEMENT SUMMARY

Site: 101 [2024 AM]

Adelaide Street / William Bailey Street
Signals - Fixed Time Isolated   Cycle Time = 65 seconds (Practical Cycle Time)
Design Life Analysis (Final Year): Results for 7 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Adelaide Street											
5	T1	350	7.9	0.877	40.3	LOS C	6.7	50.0	1.00	1.06	36.1
6	R2	594	7.6	0.914	44.8	LOS D [11]	25.7	191.4	1.00	1.09	33.9
Approach		945	7.7	0.914	43.1	LOS D [11]	25.7	191.4	1.00	1.08	34.7
North: William Bailey Street											
7	L2	312	12.8	0.227	6.8	LOS A	1.6	12.1	0.27	0.62	52.8
9	R2	362	14.0	0.872	41.7	LOS C	13.9	109.2	1.00	1.03	34.9
Approach		674	13.4	0.872	25.6	LOS B	13.9	109.2	0.66	0.84	41.4
West: Adelaide Street											
10	L2	229	15.0	0.260	13.1	LOS A	3.6	28.8	0.58	0.70	48.4
11	T1	105	0.0	0.325	30.5	LOS C	2.1	14.9	0.96	0.71	40.0
Approach		334	10.3	0.325	18.6	LOS B	3.6	28.8	0.70	0.70	45.4
All Vehicles		1953	10.1	0.914	32.9	LOS C	25.7	191.4	0.83	0.93	38.4

MOVEMENT SUMMARY

Site: 101 [2024 PM]

Adelaide Street / William Bailey Street
Signals - Fixed Time Isolated   Cycle Time = 58 seconds (Practical Cycle Time)
Design Life Analysis (Final Year): Results for 7 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Adelaide Street											
5	T1	236	18.2	0.437	25.5	LOS B	3.2	26.1	0.95	0.75	42.3
6	R2	628	3.2	0.911	40.8	LOS C	24.4	175.3	1.00	1.10	35.3
Approach		864	7.3	0.911	36.6	LOS C	24.4	175.3	0.99	1.00	37.0
North: William Bailey Street											
7	L2	555	2.2	0.429	8.5	LOS A	4.7	33.2	0.45	0.69	51.9
9	R2	230	16.3	0.891	43.3	LOS D [11]	8.3	65.9	1.00	1.12	34.3
Approach		785	6.3	0.891	18.7	LOS B	8.3	65.9	0.61	0.82	45.1
West: Adelaide Street											
10	L2	413	8.3	0.472	14.8	LOS B	6.4	47.6	0.69	0.79	47.6
11	T1	403	0.0	0.866	31.1	LOS C	8.9	62.1	0.98	0.95	39.7
Approach		817	4.2	0.866	22.8	LOS B	8.9	62.1	0.84	0.87	43.4
All Vehicles		2465	6.0	0.911	26.3	LOS B	24.4	175.3	0.82	0.90	41.4

MOVEMENT SUMMARY

Site: 101 [2044 AM]

Adelaide Street / William Bailey Street
Signals - Fixed Time Isolated   Cycle Time = 150 seconds (Practical Cycle Time)
Design Life Analysis (Final Year): Results for 27 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Adelaide Street											
5	T1	445	7.9	0.948	98.2	LOS F[11]	20.3	151.7	1.00	1.17	22.9
6	R2	756	7.6	0.965	88.4	LOS F[11]	72.9	544.0	1.00	1.06	24.1
Approach		1201	7.7	0.965	92.0	LOS F[11]	72.9	544.0	1.00	1.10	23.7
North: William Bailey Street											
7	L2	396	12.8	0.266	6.6	LOS A	3.3	25.4	0.17	0.60	53.0
9	R2	461	14.0	0.952	97.4	LOS F[11]	44.0	344.9	1.00	1.05	22.8
Approach		857	13.4	0.952	55.5	LOS D[11]	44.0	344.9	0.62	0.84	31.0
West: Adelaide Street											
10	L2	291	15.0	0.345	29.7	LOS C	11.9	94.0	0.64	0.84	39.8
11	T1	133	0.0	0.351	64.7	LOS E[11]	5.9	41.2	0.95	0.73	29.1
Approach		424	10.3	0.351	40.7	LOS C	11.9	94.0	0.74	0.80	35.7
All Vehicles		2483	10.1	0.965	70.6	LOS F[11]	72.9	544.0	0.82	0.96	27.5

MOVEMENT SUMMARY

Site: 101 [2044 PM]

Adelaide Street / William Bailey Street
Signals - Fixed Time Isolated   Cycle Time = 150 seconds (Practical Cycle Time)
Design Life Analysis (Final Year): Results for 27 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Adelaide Street											
5	T1	301	18.2	0.462	58.9	LOS E[11]	9.9	79.9	0.94	0.77	30.5
6	R2	798	3.2	0.919	57.9	LOS E[11]	62.0	445.7	0.97	0.97	30.3
Approach		1099	7.3	0.919	58.2	LOS E[11]	62.0	445.7	0.96	0.91	30.3
North: William Bailey Street											
7	L2	705	2.2	0.504	12.9	LOS A	15.0	107.1	0.41	0.74	49.0
9	R2	292	16.3	0.909	88.1	LOS F[11]	24.9	198.7	1.00	0.99	24.2
Approach		998	6.3	0.909	34.9	LOS C	24.9	198.7	0.58	0.82	37.7
West: Adelaide Street											
10	L2	525	8.3	0.623	36.6	LOS C	22.7	170.5	0.80	0.98	37.2
11	T1	513	0.0	0.915	74.0	LOS F[11]	28.2	197.4	0.98	0.98	27.1
Approach		1038	4.2	0.915	55.1	LOS D[11]	28.2	197.4	0.89	0.98	31.4
All Vehicles		3135	6.0	0.919	49.7	LOS D[11]	62.0	445.7	0.82	0.90	32.7

Appendix 5

Updated Noise & Vibration Impact Assessment – Vipac Engineers & Scientists Ltd – September 2018

(Total No. of pages including blank pages = 138)

* A colour version of this Appendix is available on the digital version of this document

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Vipac Engineers & Scientists

Hanson Construction Materials

Brandy Hill Quarry Expansion

Updated Noise Impact Assessment

29N-14-0060-TRP-822352-13

26 September 2018

Report Title: Updated Noise Impact Assessment
Job Title: Brandy Hill Quarry Expansion

DOCUMENT NO: 29N-14-0060-TRP -822352-13	**REPORT CODE:** TRP
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10, 11	17/27 Jul 2018	Revised Draft Issues
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13	26 Sep 2018	Revised Final Issue

DISTRIBUTION

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EXECUTIVE SUMMARY

Vipac Engineers and Scientists Ltd (Vipac) was commissioned by Hanson Construction Materials to conduct a Noise Impact Assessment for the proposed expansion of the existing Brandy Hill Quarry, at 979 Clarence Town Road, NSW.

This report presents the revision and findings of the Noise Impact Assessment that has been prepared to assess the potential impacts associated with the proposed expansion of the Quarry. This updated assessment includes the reestablishment of the relevant noise criteria, the reassessment of the noise prediction model and additional noise control measures required for the project.

A noise impact assessment has been undertaken to determine the potential noise impact associated with the proposed expansion of the existing Brandy Hill Quarry, on noise sensitive receptors in the surrounding area.

Noise prediction modelling has been undertaken for each of the proposed five operational stages associated with the proposed expansion of the quarry, taking into consideration both the neutral and worst-case weather conditions during the day, evening and night periods. Construction noise predictions of the establishment of the quarry expansion (Stage 1 and 4) are also taken into consideration.

Operational noise during each stage of the proposed expansion is predicted to be generally compliant with the Project Specific Noise Levels. Non-compliance with the Project Specific Noise Levels has been predicted at some residences along Clarence Town Road during worst case operating and climate conditions. However this is predicted to be in the range of 1dB(A) to 2dB(A) above the criteria level and is considered a negligible impact. Regardless, Hanson has committed to a range of noise mitigation and management measures including a quarterly noise monitoring program that would confirm that noise levels are at or below predicted levels. The assessment of operational noise during the night time period indicates that night time operations would not result in sleep disturbance.

Trucks are a feature of the local setting, with Clarence Town Road and Seaham Road important arterial connections to regional areas. Existing road traffic noise levels already exceed the road noise criteria during the day time period, which has been confirmed from consultation with the local community. Hanson is proposing to limit hourly product despatch levels to 30 laden loads per hour, consistent with current operations. In addition, Hanson would introduce a speed limit of 60km/hr for all product despatch activities on Brandy Hill Drive. The road traffic noise assessment has concluded that the proposed traffic limits would limit the change in noise level for the daytime period to a level less than 1.1dB(A). A change in noise level of 2dB(A) is considered barely perceptible to the average human ear and therefore it is concluded that the change to day time road traffic noise levels would be negligible. The proposed limit to transport levels during the night time period would limit the change in noise level to less than 2dB(A) and remain within the relevant criteria specified in the Road Noise Policy. Hanson's commitment to introduce a speed limit of 60km/hr for all product despatch activities on Brandy Hill Drive would result in reduced noise generated by product despatch activities that use Brandy Hill Drive. This would effectively reduce the maximum noise levels likely to cause sleep disturbance.

All feasible and reasonable noise control measures have been considered, including consideration of further noise control for any receiver likely to be affected by excessive noise. The proposed noise controls include design controls such as enclosures and multiple barriers/earthbunds and standard noise mitigation measures such as limiting the use of exhaust brakes. In addition to this, a regular noise monitoring program (including quarterly surveys at nominated residential sites, traffic noise surveys and an annual survey of quarry plant and equipment) is recommended to ensure noise amenity and compliance is monitored, reviewed and reported as an ongoing measure.

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1 INTRODUCTION

Vipac Engineers and Scientists Ltd (Vipac) was commissioned by Hanson Construction Materials to conduct a Noise Impact Assessment for the proposed expansion of the existing Brandy Hill Quarry, at 979 Clarence Town Road, NSW and approximately 2.1km to the west of the village of Seaham.

A Noise Assessment Report for the Brandy Hill Quarry Expansion Project was prepared by Vipac in August 2016 to accompany the Environmental Impact Statement for the proposed expansion. The Environmental Impact Statement and accompanying documents were exhibited by the Department of Planning and Environment from 10 March 2017 to 9 April 2017. This document is an update of the 2016 Noise Impact Assessment and addresses submissions received during the public exhibition period and will be incorporated into a Response to Submissions document.

Revision of the noise prediction models and the re-establishment of the noise criteria have been made. A summary of the revision and all other findings are outlined in this report.

2 GLOSSARY OF TERMS

A list of commonly used acoustical terms (and their definition) used in this report is provided below in ***Table 1***, as an aid to readers of the report.

Table 1: Definition of Acoustical Terms

Term	Definition
$L_{eq,1hr}$	Equivalent Continuous Noise Level - which, lasting for as long as a given noise event, has the same amount of acoustic energy as the given event for the period of one hour.
$L_{A10,1\ hr}$	The noise level, which is equalled or exceeded for 10% of the measurement period of one hour.
$L_{A90,T}$	The noise level, which is equalled or exceeded for 90% of a given measurement period, T. $L_{A90,T}$ is used in Australia as the descriptor for background noise.
$L_{Aeq,T}$	The equivalent continuous A-weighted sound pressure level that has the same mean square pressure level as a sound that varies over time, for a given time period. It can be considered as the average sound pressure level over the measurement period and is commonly used as a descriptor for ambient noise.
L_n	The Sound Pressure levels that is equalled or exceeded for n% of the interval time period. Commonly used noise intervals are L_1, L_{10}, L_{90} and L_{99}%.
$L_{Aeq,15hrs}$	The L_{Aeq} noise level for the 15-hour daytime period extending from 7am to 10pm.
$L_{Aeq,9hrs}$	The L_{Aeq} noise level for the 9-hour night-time period extending from 10am to 7am.

3 PROJECT DESCRIPTION

3.1 SITE LOCATION

The Brandy Hill Quarry is located at 979 Clarence Town Road, Seaham, which is a suburb within the Port Stephens local government area in the Hunter Region of New South Wales. The quarry site is located approximately 12km north-west of Raymond Terrace, 3.5km west of Seaham and approximately 175km north of Sydney.

3.2 EXISTING QUARRY OPERATION

The Quarry is located on a property that is approximately 554 hectares in area of which 18.6ha is occupied by the extraction area, 11.1ha by the processing area and 5.3ha occupied by the stockpiling. The surrounding area is predominately zoned as rural landscape with minimal primary production (see AQIA). The quarry produces approximately 620,000 tonnes of material per year, which equates to approximately 150 truck movements each day. The peak period for truck movements is between 6am to 12pm with on average 80% of daily activities occurring between those periods. Road access to the quarry site is off Clarence Town Road at the intersection with Brandy Hill Drive

It is Vipac's understanding that the existing quarry is permitted to operate on a 24-hour basis, but that this does not occur at present.

Table 2: Proposed Operating Hours

Activity	Day	Time
Construction Works	Monday – Friday	7:00am-6:00pm
	Saturday	7:00am-5:00pm
	Sunday and Public Holidays	None
Blasting	Monday – Friday	9:00am-5:00pm
	Saturday, Sunday and Public Holidays	None
Load and Haul	Monday – Saturday	5:00am-10:00pm
	Sunday and Public Holidays	None
Primary Crusher	Monday – Saturday	5:00am-10:00pm
	Sunday and Public Holidays	None
Secondary and Tertiary Crushing and Screening	Any day	24 Hours
Sales and Despatch	Any day	24 Hours
Maintenance	Any day	24 Hours

3.3 PROPOSED QUARRY EXPANSION

The proposed operating hours of the quarry are outlined in ***Table 2***. The proposed quarry expansion will involve extending the life of the quarry to allow for extraction of additional resources at a rate of up to 1.5 million tonnes per annum. The proposed extraction area extension includes resources beneath part of the existing quarry infrastructure area. In order to accommodate the proposed extraction area, it is proposed to relocate the existing plant infrastructure approximately 500m south of the current location, as shown in ***Figure 3-1***.

It is also proposed to receive concrete washout material from Hanson and Hymix concrete batch plants in order to produce blended recycled aggregates and road base. Concrete recycling would commence from Stage 1 of operations. Approximately 20,000 tonnes of washout material will be received by the concrete batch plants, through mainly the use of tipper trucks and directly using concrete agitator trucks. The material will be processed with the existing site material to process into recycled road base and other fill and drainage materials and the material will be processed within the quarrying operations area.

The proposed quarry has been divided into 5 Stages. The following summarise each stage

STAGE 1

The initial stage will comprise of expanding the western end of the quarry towards the south, creating four broad benches running from the southwest to northeast and will create a large quarry pit floor at RL 22-metres. Overburden will be used to create an amenity barrier at the southern end of the proposed fixed plant location.

STAGE 2

Stage 2 will further expand the existing western end of the quarry towards the southwest of the proposed expansion boundary. Seven broad benches will be created, and the quarry pit floor will be at RL -8metres. Topsoil will also be used to rehabilitate the upper benches above RL 20m (AHD) as these benches will remain exposed upon completion of the quarry rehabilitation. Rehabilitation will be continual from stage two onwards and all final form areas will be planted with self-sustaining native vegetation communities and derived native grasslands.

STAGE 3

Stage 3 will expand the quarry along the southern extraction boundary towards the existing plant infrastructure. The western dam will be removed, and ten broad benches will be created with the pit floor at RL -38metres. Overburden will be used for rehabilitation of the benches that have reached their final form.

STAGE 4

Stage 4 will entail widening the benches towards the eastern extraction boundary. This stage will involve relocating processing activities to the south of the existing processing areas. The weighbridge, amenities and maintenance building will be relocated to suit the pit form. At this stage, there will be twelve broad benches and the quarry pit floor will be at RL-58metres. This stage is the last stage where previously undisturbed land will be stripped to allow access to the resource material and to make space for the fixed plant and stockpile area. There will also be a 15metres high noise bund along the boundary of the new fixed processing plant.

STAGE 5

The final stage of the planned pit realises the final form of the quarry. This stage will expand the quarry to the proposed extraction boundary at the eastern and southern end. The final pit will consist of fourteen broad benches and the quarry pit floor at RL-78metres. At completion of this stage, rehabilitation would begin with the quarry void progressively filling with water through groundwater seepage and rain events up to RL30metres, where an equilibrium level would be reached.

3.4 NOISE SENSITIVE RECEIVERS

A list of the nearest potentially affected noise sensitive receivers to the quarry is provided below in ***Table 3***.

Table 3: Noise Sensitive Receivers

ID	Description	UTM Location (m)		Distance from Quarry approx. (km)	Direction from Quarry (˚)
		X	Y		
R1	122B Dunns Creek Road	374075	6388164	3.2	310
R2	16 Uffington Road	375376	6390226	4.3	341
R3	60 Green Wattle Creek Road	374057	6387248	2.8	295
R4	34 Timber Top Road	378601	6388683	3.0	31
R5	35 Timber Top Road	378489	6388803	3.1	29
R6	36 Timber Top Road	378524	6388708	3.0	32
R7	13 Mooghin Road	378852	6385492	1.4	90
R8	14 Mooghin Road	378874	6385763	1.4	87
R9	13 Giles Road	375391	6386160	1.2	273
R10	13B Giles Road	375515	6385619	1.1	257
R11	866 Clarence Town Road	375653	6384015	2.0	231
R13.1	994 Clarence Town Road	377028	6384170	1.1	188
R13.2	104 Brandy Hill Drive	376908	6384090	1.2	185

R14	1034 Clarence Town Road	377412	6384283	1.0	176
R15	1060 Clarence Town Road	377624	6384207	1.0	173
R16	1094 Clarence Town Road	377933	6384401	0.8	153
R17	1189 Clarence Town Road	378709	6385138	1.2	96
R18	1203 Clarence Town Road	379027	6385084	1.5	97
R19	25 Brandy Hill Drive	378318	6381515	3.9	150

The location of the existing plant infrastructure is illustrated in the aerial photograph shown in ***Figure 3-1***. It should be noted that as part of the proposed quarry expansion plans, the existing plant infrastructure will be decommissioned and the processing activities relocated. The distances represented in the Blast Impact Assessment therefore differ from the distances presented above in Table 3 of the Noise Impact Assessment as the distances presented in the Noise and Vibration Impact Assessment report refer to the separation distance from the residential properties to the overall site boundary of the quarry, and take account of the proposed expansion area of the quarry and the relocation of the processing plant to the south of the current positions of the processing plant. The Blast Impact Assessment reports separation distances from the residential dwelling to the proposed future quarry extraction area boundary, as opposed to the overall quarry site boundary, which includes the processing areas, weighbridge and workshop/maintenance areas, etc.

The locations of the noise sensitive receptors located in the surrounding area are shown in ***Figure 3-2*** and ***Figure 3-3.*** The noise sensitive receivers taken into consideration in this assessment are representative of the nearest existing noise sensitive receptors to both the existing operational Brandy Hill Quarry and the proposed expansion area of the Quarry. The extent of the property boundary with regard to the surrounding area of land under the ownership of the Quarry owners and operators (i.e. Hanson Construction Materials) is also shown in ***Figure 3-1.*** The noise monitoring locations from 2014, 2015 and 2018 (indicated by the blue mark) are outlined in the site map below.

There is no vacant land that is closer to the Brandy Hill Quarry than the noise sensitive prediction locations assessed in this report.

All property owned by Hanson Construction Materials in the vicinity of the Quarry is considered "project related" and is not considered in this assessment.

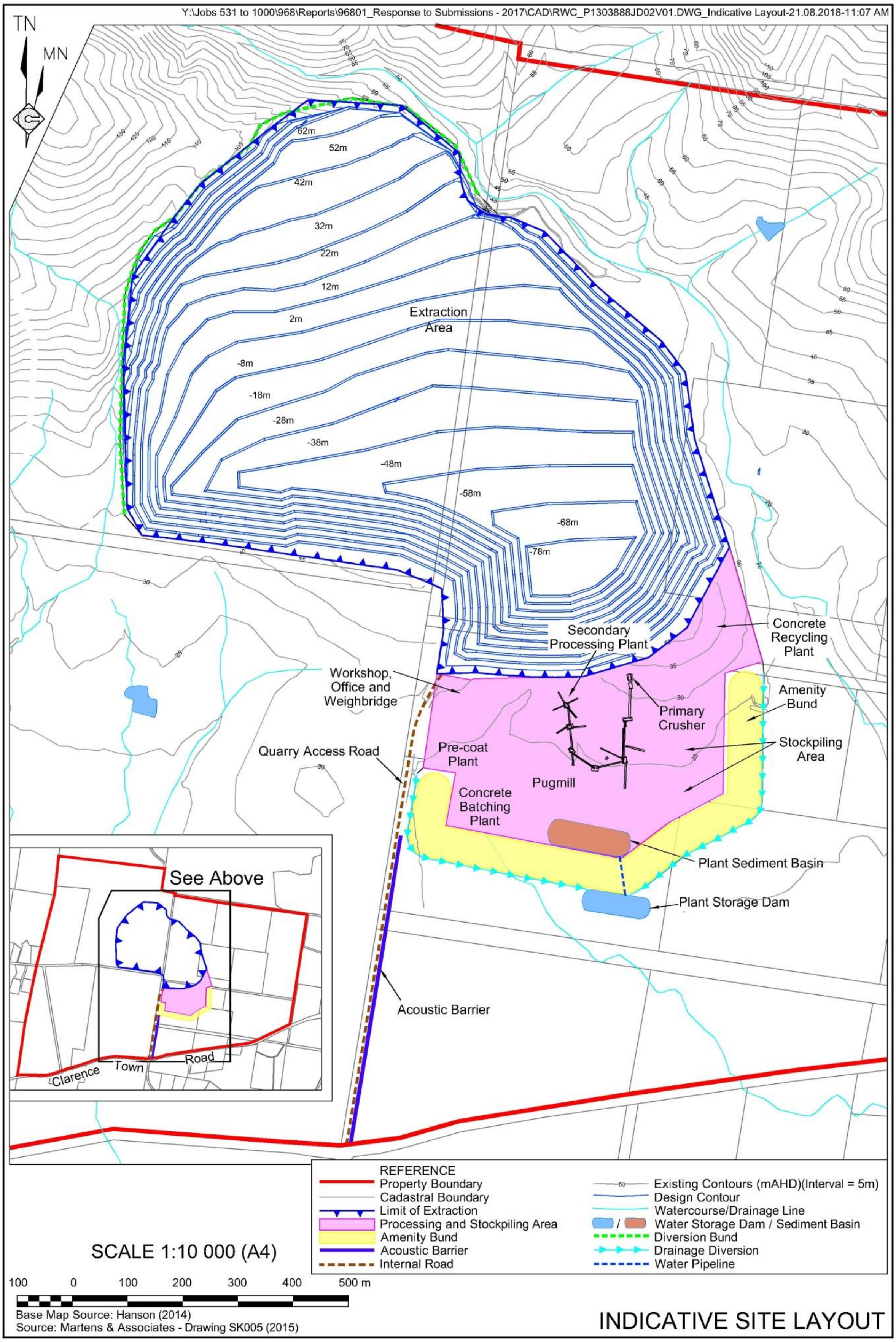


Figure 3-1: Brandy Hill Property Boundary, Location of Current Infrastructure & Proposed Plant Infrastructure

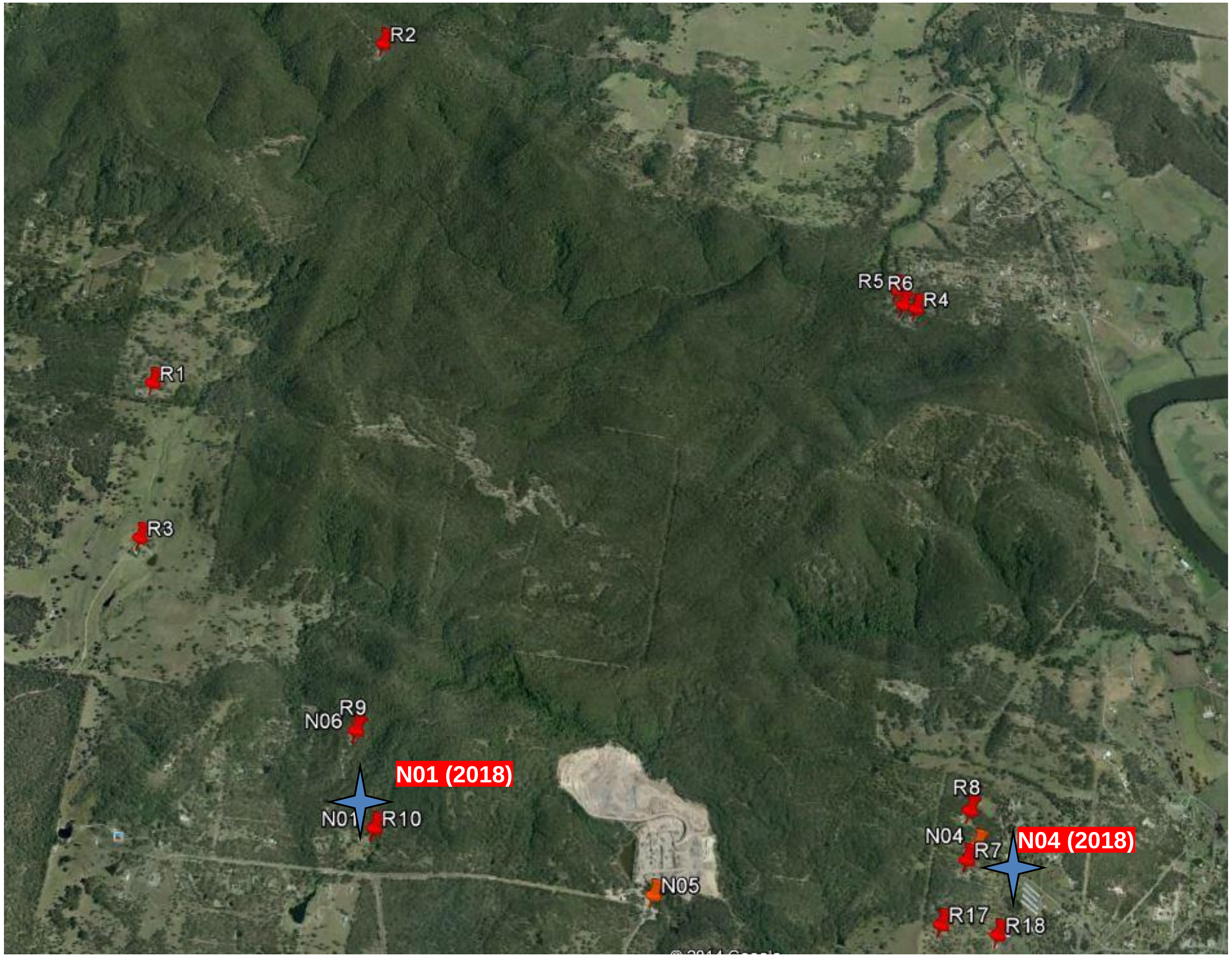


Figure 3-2: Noise Monitoring Locations (N01, N04, N05 & N06) and Noise Sensitive receivers (R1 to R10 and R17 to R18)

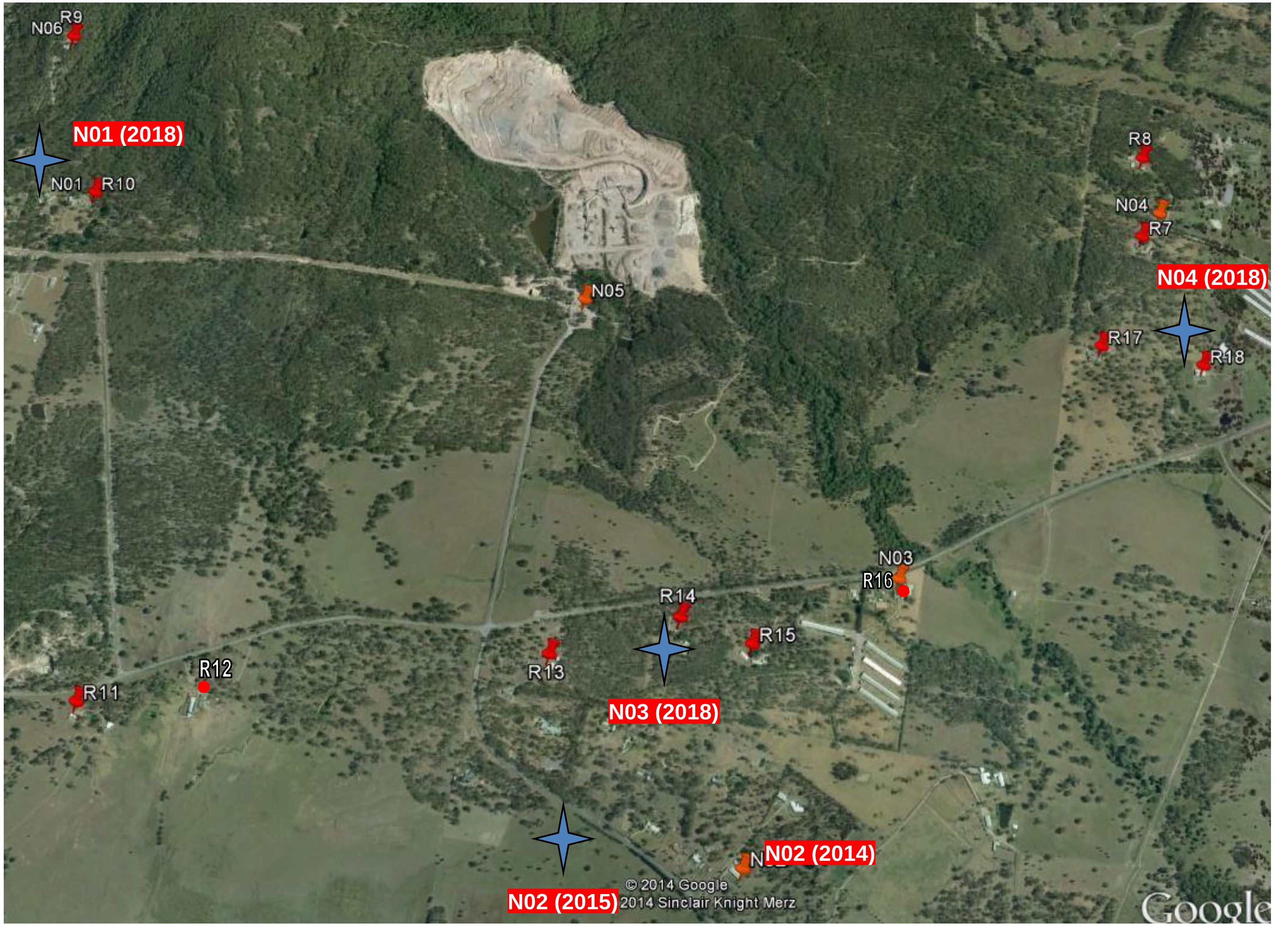


Figure 3-3: Noise Monitoring Locations (N01 to N06) and Noise Sensitive Receivers (R7 to R18)

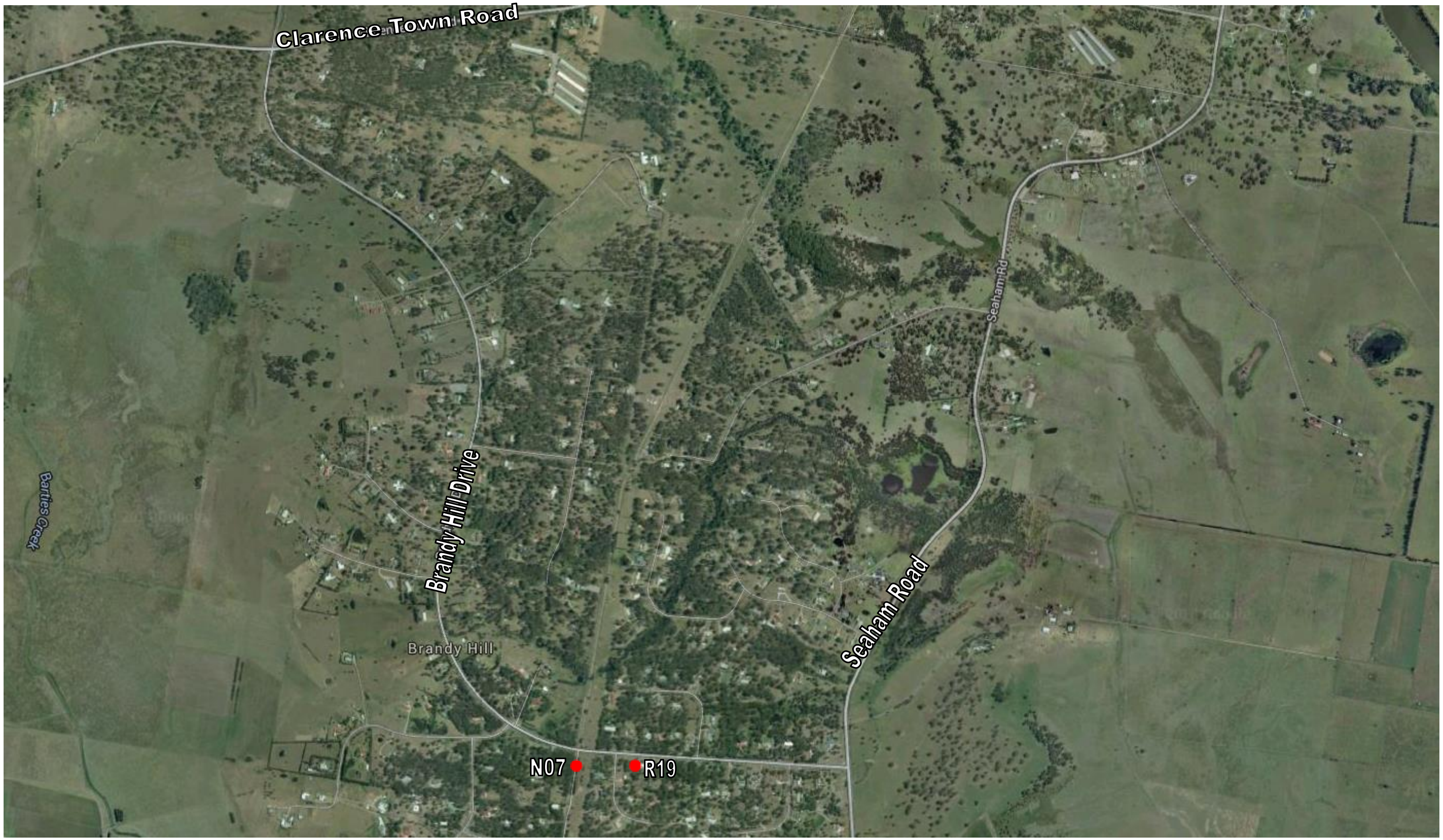


Figure 3-4: Noise Monitoring Location (N07) and Location of nearest receiver to Brandy Hill Drive (R19)

4 EXISTING NOISE ENVIRONMENT

4.1 NOISE MONITORING LOCATIONS AND METHODS

Vipac installed noise logging equipment at seven locations to measure baseline environmental noise levels at representative noise sensitive receptor locations in the vicinity of the existing (and proposed quarry expansion) site. In addition to the noise sensitive receptors, noise monitoring was also undertaken on-site near the weighbridge at the quarry (N05). The location of the monitoring points are listed in ***Table 4*** and illustrated in ***Figure 3-1, Figure 3-2*** and ***Figure 3-3.*** It should be noted, the new N01 noise measurement has replaced the previous N01 noise measurement and the N06 noise measurement.

It should be noted, re-monitoring of location N01, N03 and N04 was undertaken in March 2018. The purpose of this was to obtain more reliable background noise data for the surrounding receivers by ensuring more reliable monitoring locations at the sites (taking into consideration extraneous noise (e.g. chicken farm and shielding from the Brandy Hill Quarry) and by filtering out any seasonal insect/cricket noise influence from the measurements.

A road traffic noise measurement was conducted at 90 Brandy Hill Drive (N02) in September 2014. Another road traffic noise measurement was undertaken in March 2015 at 115 Brandy Hill Drive (revised N02) and 33 Brandy Hill Drive (N07). Details of the traffic volumes assumed for the noise predictions are outlined in Section 6.5. The existing traffic volumes on Brandy Hill Drive, Clarence Town Road and the Brandy Hill Quarry Access Road were determined by Intersect Traffic using auto-tube traffic counters. This determined the volumes of all traffic travelling on the road network in the vicinity of the quarry in addition to a separate determination of the volume of Brandy Hill Quarry generated traffic movements on the road network in the area. The associated existing traffic noise levels in the area were determined during the baseline noise logging surveys (March 2015). As the noise loggers were in place during the same time period that the road traffic auto-tube counters were in place. It should be noted however, that the auto-tube counters were positioned at sections of the roads that were not in the immediate vicinity of the noise loggers, in order to eliminate the potential influence of the tyre and tube-count cable interaction on noise levels, which would not be representative of typical conditions.

Table 4: Monitoring Locations

Loc.	Noise Survey Dates	Location / Address	Description	Instrument	Serial No.
N01	07/03/2018 – 13/03/2018	13A Giles Road, Seaham	Residential	SVAN-957	14566
N02	09/3/2015 – 16/03/2015	115 Brandy Hill Drive, Brandy Hill	Residential	LD 870	1465
N03	07/03/2018 – 13/03/2018	1060 Clarence Town Road, Seaham	Residential	SVAN-957	27552
N04	07/03/2018 – 13/03/2018	10 Mooghin Road, Seaham	Residential	SVAN-957	23294
N05	09/09/2014 – 15/09/2014	Brandy Hill Quarry- reference	Quarry site	Duo dB01	10304
N06	17/09/2014 – 23/09/2014	13 Giles Road, Seaham	Residential	LD 870	1465
N07	09/3/2015 – 16/03/2015	33 Brandy Hill Drive, Brandy Hill	Residential	LD 870	1466

The noise logging equipment were programmed to accumulate noise data continuously over sampling periods of 15-minutes for the entire monitoring period. Internal software then calculates and stores the Ln percentile noise levels for each sampling period, which can later be retrieved for detailed analysis. Meteorological data during the noise logging survey period was obtained from the Bureau of Meteorology (BoM) Weather Station at Williamtown NSW (061078). Where adverse meteorological conditions such as wind exceeding 5m/s and/or rain were observed in any 15-minutes period, these data were excluded.

The instruments were calibrated using a Rion NC-73 calibrator immediately before and after monitoring and showed a maximum error of 0.5 dB, which is within acceptable tolerances. ***Table 5*** outlines the purpose of the noise monitoring for each location.

4.2 LONG TERM NOISE MEASUREMENT

Measurement results obtained from the noise loggers have been analysed in accordance with the procedures set out in the NSW Industrial Noise Policy (INP) to determine the existing background noise levels of the surrounding area. These background noise levels will form the fundamental basis for the establishment of associated operational and construction noise criteria.

Noise monitoring undertaken within the Quarry Site in September 2014 is presented in **Table 6**. A summary of the ambient noise level for location N05 (quarry noise reference) is provided in **Table 7**.

Table 5: Purpose of Noise Monitoring

Loc.	Location / Address	Purpose of Monitoring
N01	13A Giles Road, Seaham	Conducted in March 2018 to establish the noise criteria for receivers R1, R2, R3, R6, R9, and R10
N02	115 Brandy Hill Drive, Brandy Hill	To measure road traffic noise along Brandy Hill and calibrate measurement with the road noise prediction model
N03	1060 Clarence Town Road, Seaham	To establish the noise criteria for receivers R11 – R16
N04	10 Mooghin Road, Seaham	To establish the noise criteria for receivers R4, R5, R7, R8, R17 and R18
N05	Brandy Hill Quarry- reference	To measure the quarry operational noise and calibrate measurement with the operational noise prediction model
N06	13 Giles Road, Seaham	Conducted in September 2014 to establish the noise criteria for receivers R1, R2, R3, R6, R9, and R10
N07	33 Brandy Hill Drive, Brandy Hill	To measure road traffic noise along Brandy Hill and calibrate measurement with the road noise prediction model

Table 6: Background & Ambient Noise Monitoring Results, (N05), dB(A)

Date	ABL (L_{A90})			L_{Aeq}		
	Day	Evening	Night	Day	Evening	Night
Tuesday, 9 September 2014	n/a	28	23	n/a	32	37
Wednesday, 10 September 2014	36	28	23	44	42	38
Thursday, 11 September 2014	31	30	21	43	40	38
Friday, 12 September 2014	32	26	n/a	48	39	n/a
Saturday, 13 September 2014	30	n/a	n/a	44	n/a	n/a
Sunday, 14 September 2014	33	31	23	44	63	37
Tuesday, 16 September 2014	32	n/a	n/a	44	n/a	n/a
Median (RBL)	**32**	**29**	**27**	/	/	/
Logarithmic Average	/	/	/	**45**	**56**	**37**

*** –** The level has been adjusted to 30 dB(A) for day, evening and night time period, following the instructions in INP Section 3.1. The Standards states: *'Where the rating background level is found to be less than 30 dB(A), then it is set to 30dB(A).*

Table 7: Summary of current ambient noise levels for N05 (dB(A))

Loc.	Period	L_{Aeq}	L_{A90}	RBL[1]
N05	Day	57	49	48
	Evening	47	44	44
	Night	56	38	33

It is noted that insect/cricket noise has been identified as an extraneous noise that, while a feature of the local setting, is only present during warmer seasons. Vipac developed a methodology for filtering out insect/cricket noise (further described in the discussion of noise monitoring reports in Section 4.3) based on frequency ranges. The filtering of cricket noise was undertaken at locations N01, N03 and N04 for background noise monitoring for the purpose of assessing operational noise levels at these locations. With filtering of cricket noise, a noticeable difference in background noise level was identified, particularly at monitoring locations N03 and N04 during the night-time period. **Table 8**, **Table 9** and **Table 10** present the filtered long term measurement results at N01, N03 and N04, which excluded the cricket noise intrusion. These measurements were used to re-establish the noise criteria for the surrounding receivers.

Noise monitoring for locations N01, N03 and N04 also include the average wind and rain conditions identified during monitoring. The new N01 noise results replace both the previous N01 and N06 noise measurement. A summary of the current ambient noise levels at the monitoring locations as determined for the baseline noise logging surveys is presented in **Table 11**. The results of the noise logging surveys are presented graphically in ***Appendix A***.

Table 8: Background & Ambient Noise Monitoring Results, (N01), dB(A) – with filtering

Date	ABL (L_{A90})			L_{Aeq}			Weather Condition	
	Day	**Evening**	**Night**	**Day**	**Evening**	**Night**	**Rain (mm)**	**Wind (km/h)**
Wednesday – 07/03/2018	-	27	26	45	40	40	4.4	Calm
Thursday - 08/03/2018	31	28	27	50	44	37	0.2	6
Friday - 09/03/2018	30	28	27	62	43	35	2.8	9
Saturday - 10/03/2018	29	27	26	50	42	32	0.6	2
Sunday - 11/03/2018	29	29	26	46	46	38	0	7
Monday - 12/03/2018	31	32	31	48	40	36	0	7
Tuesday - 13/03/2018	33	32	31	54	45	45	0	7
Median (RBL)	**30**	**28**	**27**	/	/	/	-	-
Logarithmic Average	/	/	/	**55**	**43**	**40**	**-**	**-**

Table 9: Background & Ambient Noise Monitoring Results (N03), dB(A) - with filtering

Date	ABL (L_{A90})			L_{Aeq}			Weather Condition	
	Day	Evening	Night	Day	Evening	Night	Rain (mm)	Wind (km/h)
Wednesday – 07/03/2018	-	29	27	44	45	45	4.4	Calm
Thursday - 08/03/2018	34	30	28	46	44	41	0.2	6
Friday - 09/03/2018	34	31	28	52	45	39	2.8	9
Saturday - 10/03/2018	33	29	27	46	43	38	0.6	2
Sunday - 11/03/2018	31	29	27	45	44	40	0	7
Monday - 12/03/2018	32	28	27	54	45	40	0	7
Tuesday - 13/03/2018	31	29	27	56	53	43	0	7
Median (RBL)	**32**	**29**	**27**	/	/	/	-	-
Logarithmic Average	/	/	/	**51**	**47**	**42**	**-**	**-**

Table 10: Background & Ambient Noise Monitoring Results (N04), dB(A) - with filtering

Date	ABL (L_{A90})			L_{Aeq}			Weather Condition	
	Day	Evening	Night	Day	Evening	Night	Rain (mm)	Wind (km/h)
Wednesday – 07/03/2018	36	30	29	54	53	41	4.4	Calm
Thursday - 08/03/2018	35	30	30	56	53	43	0.2	6
Friday - 09/03/2018	34	32	30	49	44	41	2.8	9
Saturday - 10/03/2018	35	32	30	47	59	42	0.6	2
Sunday - 11/03/2018	34	31	30	45	57	44	0	7
Monday - 12/03/2018	34	32	31	47	54	42	0	7
Tuesday - 13/03/2018	36	33	32	60	53	38	0	7
Median (RBL)	**35**	**32**	**30**	**/**	**/**	**/**	-	-
Logarithmic Average	**/**	**/**	**/**	**54**	**55**	**42**	**-**	**-**

Table 11: Summary of current ambient noise levels (dB(A))

Loc.	Period	L_{Aeq}	L_{A90}	RBL[1]
N01	Day	55	30	30
	Evening	43	28	30*
	Night	40	27	30*
N03	Day	51	32	32
	Evening	47	29	30*
	Night	42	27	30*
N04	Day	54	35	35
	Evening	55	32	32
	Night	42	30	30

Note:
Day is defined as 0700 to 1800.
Evening is defined as 1800 to 2200
Night is defined as 2200 to 0700
n/a – Not available: Noise monitoring throughout the specific time period was incomplete.
*** –** The level has been adjusted to 30 dB(A) for day, evening and night time period, following the instructions in INP Section 3.1. The Standards states: *'Where the rating background level is found to be less than 30 dB(A), then it is set to 30dB(A).*

Noise monitoring results at locations N02 and N07 for the purpose of recording existing road traffic noise levels is presented in **Table 12** and **Table 13**.

Table 12: Background & Ambient Noise Monitoring Results, (N02), dB(A)

Date	ABL (L_{A90})			L_{Aeq}		
	Day	Evening	Night	Day	Evening	Night
Monday, 9 March 2015	n/a	40	39	n/a	53	56
Tuesday, 10 March 2015	39	39	36	58	53	55
Wednesday, 11 March 2015	38	n/a	38	58	54	56
Thursday, 12 March 2015	37	38	44	58	53	58
Friday, 13 March 2015	n/a	n/a	n/a	n/a	n/a	n/a
Saturday, 14 March 2015	35	43	36	55	54	51
Median (RBL)	**38**	**39**	**36**	/	/	/
Logarithmic Average	/	/	/	**57**	**53**	**51**

[1]RBL is the median of the overall assessment background noise level calculated using EPA Industrial Noise Policy methodology as defined in the glossary of acoustic terms

Table 13: Background & Ambient Noise Monitoring Results, (N07), dB(A)

Date	ABL (L_{A90})			L_{Aeq}		
	Day	Evening	Night	Day	Evening	Night
Tuesday, 10 March 2015	56	55	51	60	59	57
Wednesday, 11 March 2015	58	59	55	61	61	58
Thursday, 12 March 2015	56	56	54	60	59	58
Friday, 13 March 2015	n/a	n/a	n/a	n/a	n/a	n/a
Saturday, 14 March 2015	40	50	51	52	55	57
Median (RBL)	**55**	**56**	**52**	/	/	/
Logarithmic Average	/	/	/	**59**	**59**	**57**

Noise measurements at N02 and N07 have been analysed in accordance with the procedures set out in the NSW Road Noise Policy (RNP) and noise levels are presented for the RNP noise criteria metrics (previous tables showed noise levels relative to the NSW INP metrics). The noise results for these locations are presented in **Table 14** and **Table 15**, and a summary of the traffic noise results are presented in **Table 16**.

Table 14: Summary of current ambient noise levels for N02 (dB(A))

Date	Day $L_{Aeq-15hr}$	Night $L_{Aeq-9hr}$
Tuesday, 9 September 2014	n/a	50.8
Wednesday, 10 September 2014	57.4	50.9
Thursday, 11 September 2014	56.8	50.9
Friday, 12 September 2014	57.2	53.8
Saturday, 13 September 2014	n/a	n/a
Sunday, 14 September 2014	n/a	48.6
Logarithmic Average	**56.7**	**51.3**

Note:
Day is defined as 0700 to 2200.
Night is defined as 2200 to 0700

Table 15: Summary of current ambient noise levels for N07 (dB(A))

Date	Day $L_{Aeq-15hr}$	Night $L_{Aeq-9hr}$
Monday, 9 March 2015	n/a	55.6
Tuesday, 9 September 2014	59.8	57.0
Wednesday, 10 September 2014	61.4	58.3
Thursday, 11 September 2014	59.8	58.0
Friday, 12 September 2014	n/a	n/a
Saturday, 13 September 2014	n/a	57.1
Logarithmic Average	**60.4**	**57.3**

Table 16: Summary of current ambient noise levels (dB(A))

Loc.	Period	L_{Aeq}
N02	Day $L_{Aeq-15hr}$	56.7
	Night $L_{Aeq-9hr}$	51.3
N07	Day $L_{Aeq-15hr}$	60.4
	Night $L_{Aeq-9hr}$	57.3

4.3 DISCUSSION OF NOISE LOGGING SURVEY RESULTS

The baseline noise logging surveys were undertaken at monitoring locations representative of noise sensitive receptors located in the vicinity of the quarry site, with the exception of the monitoring point N05, which was undertaken at Brandy Hill Quarry as a reference point location. All of the other baseline noise survey monitoring points (N01 – N04 and N06 – N07) were undertaken at monitoring points representative of residential properties located in the surrounding area. With regard to the summary noise levels and rated background levels (RBLs) in the vicinity of the Quarry site, it is noted that there are some unusual patterns where the ambient, background and RBL is raised during the evening and night-time periods, in comparison with the levels recorded during the day period. This is considered to be a result of local patterns of land use, for example, vehicle noise from people returning home from work.

The variations in the noise logging results for each noise descriptor at each of the monitoring locations are presented graphically in ***Appendix A*** of this report. The variations in the noise levels need to be considered in the context of the monitoring locations and the noise sources apparent at each monitoring location.

In this regard, whereas the setting of each monitoring location was in close proximity to residential properties, it should be noted that while these properties can be described as rural residential properties, three of the monitoring points (i.e. monitoring points N01, N04 and N06) were relatively removed from Clarence Town Road and Brandy Hill Drive, which are the main roads in the area and were less influenced by traffic noise as a contributor of the overall ambient noise sources noted, while one of the monitoring points was situated in relatively close proximity to Clarence Town Road (i.e. monitoring point N03), and the other two monitoring points were situated in relatively close proximity to Brandy Hill Drive (i.e. monitoring points N02 and N07) and these locations were influenced to a greater extent by intermittent traffic noise during the daytime. Of these properties, the most pronounced elevated levels during the evening and night periods were apparent at the monitoring points N01 and N04.

A range of contributory noise sources were noted at all of the baseline noise monitoring locations during the attended daytime noise measurements conducted at each monitoring location as outlined below in ***Section 4.4***. The patterns and the range between the different statistical noise metrics/descriptors (i.e. the L_{A10}, L_{Aeq} and L_{A90} trends) presented in ***Appendix A*** for the noise logging data are notable in that there is a very close correlation between the variations in the L_{A10}, L_{Aeq} and L_{A90} trends for the monitoring locations N01 and N04.

An analysis of the attended and unattended noise measurements of locations N01, N03 and N04 in March 2018 was undertaken and Vipac has noted the following details:

- Cricket/cicada noise was predominantly present during the night time attended measurement. Intermittent cricket noise was present during the day but was not the dominant noise.
- Cricket noise peak in frequency bands of 3.15kHz and 4kHz The noise levels in these frequency bands range from 7-20dB higher than the adjacent frequency bands.
- Between 18:30 and 9:00 cricket noise was present during the unattended noise measurements.

Based on the details outlined above, it was possible to filter out the cricket noise in the long-term noise monitoring data. The third octave bands adjacent to the cricket noise frequencies (i.e. 2.5kHz and 5kHz) between the time frame of 18:30 and 9:00 have been used to replace the cricket noise frequencies (i.e. 3.15kHz and 4kHz). This method of filtering was conducted on the L_{eq} and L_{90} long term measurement results to assist in providing a more representative characterisation of the background noise levels without undue influence from dominant insect/cricket noise (however, it is noted that insect noise would be a natural part of the background noise environment at these sites during warmer periods from October to March).

4.4 ATTENDED NOISE MEASUREMENTS

4.4.1 SHORT TERM BACKGROUND NOISE MEASUREMENT

In addition to the unattended noise logging surveys, Vipac also conducted short period 15-minute attended noise measurements at the baseline monitoring locations (N01 to N06) to quantify the dominant and contributory noise sources associated with the overall ambient noise levels in the area. The results of the attended noise surveys at each monitoring location are presented in ***Table 17***. It should be noted, the noise measurements for N01, N03 and N04 presented below are not filtered.

Table 17: Attended Noise Survey results

Loc.	Date & Time	L_{Aeq}	L_{A90}	Description
N01	22/03/2018 10:24	43	40	**Intermittent:** Birds chirping and insect (crickets) noise. Leaves rustling. Faint truck noise from a far distance. No machinery noise from the quarry was audible.
N02	09/09/2014 12:21	50.5	36.8	The overall noise environment was dominated by traffic noise on Brandy Hill Drive. Domestic activities such as lawn mowing at a distant property, music playing at a neighbouring property were influential at times during the survey. Additional source was noise from the birds in the area.
N03	07/03/2018 16:50	60	41	Local traffic along Clarence Town road
N04	09/09/2014 15:55	56	37	**Intermittent:** Birds chirping and insect (crickets) noise. Distant traffic noise along Clarence Town Road
N05	09/09/2014 16:47	53.9	52.4	Monitoring within the quarry site identified that the dominant noise source in this area initially was a quarry truck on the weighbridge. Subsequently the noise environment was dominated by quarry operations in the stockpiling area. Birds chirping nearby were audible but not significant.
N06	23/09/2014 12:09	45.0	30.4	Dominant noise source generally was a combination of breeze in trees and birds chirping in the area. Occasionally, dog barking was audible at this monitoring location. In addition, road traffic noise was also faintly audible.
N07	16/03/2015 15:17	55.6	39.9	The overall noise environment was dominated by traffic noise on Brandy Hill Drive. Occasionally, domestic activities were audible at the monitoring location. Noise from birds was also audible throughout the survey

4.4.2 NOISE MEASUREMENT OF TRUCKS PASSING BY

A noise measurement of trucks passing by was conducted at two locations on the 22nd and 23rd March 2018. The first monitoring location was adjacent to the residential property at 27 Brandy Hill Drive, Brandy Hill, on Merindah Close. The measurement was taken approximately 35 metres from Brandy Hill Drive. The second monitoring location was conducted near the residential property located at the corner of Seaham Road and Hinton Road. This measurement was taken approximately 16 metres from Seaham Road.

The purpose of this assessment is to determine the existing L_{Amax} truck noise at the nearest residential property nearest to the roads in question and to identify the potential impact on sleep disturbance for future reference.

Table 18: Truck Movement Measurement

Location of Measurement	Truck	L_{Amax} Noise Measurement
35 metres from Brandy Hill Drive	Hanson Truck & Dog	74
	Hanson Truck & Dog	75
	Hanson Truck & Dog	79
	Truck & Dog	74
	Hanson Truck & Dog	76
	Truck & Dog	76
	Haulage Truck	72
	Truck & Dog	74
	Hanson Truck & Dog	74
	Small Delivery Truck	71
16 metres from Seaham Road	Small Delivery Truck	72
	Haulage Truck	83
	Medium Delivery Truck	78
	Garbage Truck	82
	Hanson Concrete Mixer	79
	Tanker Truck	75
	Truck & Dog	81
	Hanson Truck & Dog	80
	Medium Truck	73
	Hanson Concrete Mixer	82
	Haulage Truck	75
	Truck & Dog	83
	Truck & Dog	79
	Truck & Dog	77
	Hanson Concrete Mixer	77

Noise measurements of trucks passing-by were recorded between 71-79 L_{AMax} at approximately 35 metres away from Brandy Hill Drive. Noise measurements of truck passing-by were recorded between 72-83 L_{AMax} at approximately 16 metres away from Seaham Road.

It should also be noted, road traffic noise measurement was undertaken by Vipac between 9th and 14th March 2015 at location N07 (approximately 30 metres from Brandy Hill Drive). The L_{AMax} was recorded between 61-85dB during the night period.

5 CRITERIA

5.1 NSW EPA INDUSTRIAL NOISE POLICY

The NSW Environmental Protection Authority (NSW EPA) Industrial Noise Policy (INP) sets limits on the noise that may be generated by facilities ranging from industrial premises/sites to processing plants and includes quarries such as the Brandy Hill Quarry. These limits are dependent upon the existing noise levels at the site and noise sensitive receptors located in the surrounding area and are implemented to ensure changes to the existing noise environment are minimised and deal with the intrusiveness of the noise and the amenity of the environment. The most stringent of the limits is taken as the limiting criterion for the noise source. The Project Specific Noise Level is the most stringent of the amenity criteria or the intrusiveness criteria for the location.

The amenity criteria are recommended acceptable L_{Aeq} noise levels for residences in Rural and Suburban areas and are provided in Table 2.1 of the INP. Amenity criteria are formulated to protect against cumulative impacts.

The intrusiveness noise criterion requires that the $L_{Aeq,15minutes}$ for the noise source, measured at the most sensitive receiver under worst-case conditions, should not exceed the Rated Background Level (RBL) by more than 5dB, represented as follows:

- $L_{Aeq,15minutes} < RBL + 5dB$

Noise levels associated with the proposed Quarry expansion plan and potential impacts on nearby noise sensitive receptors (located in the surrounding area) will be required to comply with the Project Specific Noise Levels detailed in ***Table 19***, which have been determined on the basis of the results of the baseline noise surveys.

Table 19: Project Specific Noise Levels at Noise Sensitive Receptors dB(A)- Residential

Location	Period	L_{Aeq}	RBL	Recommended Acceptable L_{Aeq}[1]	Intrusiveness Criteria Level	Project Specific Noise Level
N01 (rural residential)	Day	55	30	50	53	35
	Evening	43	28*	45	57	35
	Night	40	27*	40	52	35
N03 (suburban residential)	Day	51	32	55	42	37
	Evening	47	29*	45	41	35
	Night	42	27*	40	38	35
N04 (rural residential)	Day	54	35	50	61	40
	Evening	55	32	45	58	37
	Night	42	30	40	61	35

[1] Recommended Acceptable L_{Aeq} noise level (amenity criteria) for a residence in Rural and Suburban area from Table 2.1 in EPA Industrial Noise Policy (INP).

* It should be noted that the NSW INP (Section 3.1.2) sets a minimum Rating Background Level (RBL) for assessment purposes and states the following:

'Where the rating background level is found to be less than 30 dB(A), then it is set to 30 dB(A)'.

5.1.1 NOISE ASSESSMENT CRITERIA – LOW FREQUENCY NOISE

The Low Frequency Noise (LFN) assessment comprises of identifying LFN impact that may be of concern and comparing the LFN against a spectral noise limit. The screening tool to identify LFN is the "C-A" methodology which consists of predicting the noise impact in both 'C' and 'A' weighted values and comparing the difference to determine whether there is a 15dB difference. If a 15dB difference is identified then further analysis is undertaken.

The LFN is then assessed against the spectral LFN limit, outlined in Section C2 of the Noise Policy for Industry 2017 (NPI). This spectral noise limit is presented in ***Table 20***.

Table 20: Low Frequency Noise Spectral Limit

Hz/dB(Z)	One-third octave L_{Zeq}, 15min threshold level												
Frequency (Hz)	**10**	**12.5**	**16**	**20**	**25**	**31.5**	**40**	**50**	**63**	**80**	**100**	**125**	**160**
dB(Z)	92	89	86	77	69	61	54	50	50	48	48	46	44

5.2 CONSTRUCTION NOISE LIMIT

The Interim Construction Noise Guideline states:

'noise from industrial sources (for example, factories, quarrying, mining, and including construction associated with quarrying and mining) – this is assessed under the NSW Industrial Noise Policy (EPA 2000).'

However, the NSW Industrial Noise Policy (INP) also states that:

Examples of noise sources that are NOT dealt with by the policy are:

- *Transportation corridors (roadways, railways and air corridors)*
- *Motor sport facilities*
- ***Construction activities***
- *Noise sources covered by regulations*
- *(domestic/neighbourhood noise).*

'Construction activities' within the INP is defined as *'activities that are related to the establishment phase of a development and that will occur on a site for only a limited time period.'* Construction noise by its nature is temporary and should not be treated as long-term/permanent noise source. However, the construction noise should be kept to a minimum and the noise limit established in accordance with the INP should serve as a guideline only. The aim of the INP is to protect the majority of residences and other sensitive land uses from noise pollution most of the time.

For the purpose of this assessment, the construction noise is assessed against the Project Specific Noise Levels established in ***Table 19***. If construction noise levels exceed the INP limit, noise management control should be implemented during the construction works.

5.3 VOLUNTARY LAND ACQUISTION AND MITIGATION POLICY

The Voluntary Land Acquisition and Mitigation Policy (NSW Government, 2014) applies to all State Significant extractive industry developments and sets out the rights of a landowner with respect to requests for voluntary mitigation and land acquisition as a result of excessive noise and air quality (particulate matter) impacts. It should be noted that this policy also applies to vacant land, which is considered as being impacted should the predicted noise levels exceed the impact assessment criteria over an area greater than 25% of the land holding, irrespective of a residence being situated on that property.

5.4 NSW EPA ROAD NOISE POLICY

5.4.1 NOISE ASSESSMENT CRITERIA – RESIDENTIAL LAND USES

The requirements of the NSW Road Noise Policy (RNP) are also applicable to this assessment. ***Table 21*** summarises the road category to establish the noise assessment criteria based on the type of road and the land use developments.

Potential Brandy Hill Quarry related traffic noise impacts have been assessed on Brandy Hill Drive only, as the vast majority of Hanson Construction Materials (Brandy Hill) truck movements associated both with the existing quarry operations and proposed expansion of the quarry utilise Brandy Hill Drive.

Brandy Hill Drive provides connection between arterial roads (Clarence Town Road/Seaham Road) and local roads and is classified as a sub-arterial road. ***Table 21*** (refer to Table 3 of the RNP) below presents the road noise criteria for a sub-arterial road.

Table 21: Road Traffic Noise Assessment Criteria for Residential Land Uses

Road Category	Type of project / land use	Assessment Criteria/ Target Noise Level, dB(A)	
		Day (7am-10pm) 15-hr	Night (10pm-7am) 9-hr
Sub-arterial road	3. Existing residences affected by additional traffic on existing sub-arterial roads generated by land use developments.	L_{Aeq}, (15-hour) 60 (external)	L_{Aeq}, (9-hour) 55 (external)

Note: These criteria are for assessment against façade- corrected noise levels when measured in front of a building façade. Hence, a correction factor of 2.5 dB is added to the predicted noise levels

5.4.2 RELATIVE INCREASE CRITERIA

As outlined in Section 2.4 of the Road Noise Policy, in addition to the assessment criteria outlined in ***Table 21***, any increase in the total traffic noise level at a location due to a proposed project or traffic-generating development must be considered. Residences experiencing increases in total traffic noise level above the relative increase criteria in ***Table 22*** should be considered for mitigation (refer to Table 6 of the RNP).

Table 22: Relative increase criteria for residential land uses

Road Category	Type of project/development	Total traffic noise level increase dB(A)	
		Day (7am to 10pm) 15-hr	Night (10pm to 7am) 9-hr
Sub-arterial roads	Land use development with the potential to generate additional traffic on existing road	Existing traffic LAeq,15hour + 12dB (external)	Existing traffic LAeq,9hour + 12dB (external)

As stated in Section 3.4 of the RNP, where existing traffic noise levels are already above the noise assessment criteria, the primary objective is to reduce these through feasible and reasonable management and mitigation. A secondary objective is to protect against reduced amenity as a result of a project by applying the relative increase criteria.

In assessing feasible and reasonable mitigation measures, an increase of up to 2dB represents a minor impact that is considered barely perceptible to the average person.

5.4.3 PRACTICE NOTE 3 (SLEEP DISTURBANCE IMPACT)

In the previous noise impact assessment, Vipac had referenced the most recent sleep disturbance guidance set out in the RNP. The RNP refers to the RTA Practice Note 3 protocol as the method for assessing and reporting on maximum noise levels that may cause sleep disturbance. The guidelines indicate that:

- Maximum internal noise levels below 50-55 dB(A) are unlikely to cause awakening reactions, and
- One or two noise events per night with maximum internal noise levels of 65-70 dB(A) are not likely to significantly affect health and well-being.

It is noted that the existing road traffic noise along Brandy Hill Road already exceeds the road traffic noise guideline outlined above, as shown in Section 4.4.2. Therefore as a result, feasible and reasonable noise control strategies to avoid any further rise of the L_{Amax} should be implemented, as outlined in Section 8.1.1.

6 MODELLING

A revision of the noise model has been undertaken to address the issues raised in submissions concerning noise predictions and impacts.

Noise prediction modelling was undertaken using the SoundPLAN computational noise prediction software package. The use of the SoundPLAN noise prediction modelling software and referenced modelling methodology is accepted for use in the state of NSW by the Environmental Protection Authority (EPA) for environmental noise modelling purposes. SoundPLAN is a proprietary noise prediction modelling package that has been used for numerous quarrying, mining and industrial noise impact assessments conducted both by Vipac and other consultancy practices.

6.1 GEOGRAPHICAL DATA

Table 23 below lists the drawings/information received and used in the noise model.

Table 23: List of Drawings

Description	Date	Provided by
Brandy Hill PDP_May 2014_Stage 1	16.10.2014	Hanson Construction Materials
Brandy Hill PDP_May 2014_Stage 2	16.10.2014	Hanson Construction Materials
Brandy Hill PDP_May 2014_Stage 3	16.10.2014	Hanson Construction Materials
Brandy Hill PDP_May 2014_Stage 4	16.10.2014	Hanson Construction Materials
Brandy Hill PDP_May 2014_Stage 5	16.10.2014	Hanson Construction Materials
Ground elevation of the study area	15.09.2014	Land & Property Information, NSW

6.2 NOISE SOURCES

A noise emissions survey of the Quarry Infrastructure (mechanical plant & equipment) was conducted during typical operations on 17th & 23rd September 2014 at the existing Brandy Hill Quarry. Subsequently, the sound pressure measurements taken of all major infrastructure components were analysed and calculated sound power levels derived for the machinery (noise source contributor) associated with the current quarry operations. It is proposed that the same or similar models of plant equipment currently used at the quarry would also be used for the proposed expansion area of the quarry. The sound power levels of all noise sources that were not obtained on site were collected from the Vipac data library.

Table 24 details the sound power levels of the current mechanical plant and equipment associated with the existing operations and activities at the Quarry site.

Table 24: Quarry Operations – Sound Power Levels (L_w)-dB

Plant & Equipment	L_{WA}	Frequency- Linear									
		31.5	63	125	250	500	1k	2k	4k	8k	16k
Primary Crusher (enclosed)	**88**	116	108	101	88	71	62	61	51	40	40
Primary Crusher (opening)	**103**	110	108	103	104	101	97	95	89	82	82
Screen 1 – Stage 1-3	**109**	105	104	101	98	99	101	104	102	95	75
Secondary Crusher & Screen (enclosed)	**87**	114	105	101	89	73	67	68	59	45	52
Secondary Crusher & Screen (opening)	**108**	108	105	103	105	103	102	102	97	87	93

Plant & Equipment	L_{WA}	Frequency- Linear									
		31.5	63	125	250	500	1k	2k	4k	8k	16k
Crusher 3, 4 + 5 (enclosed)	**76**	106	92	89	77	64	56	56	46	38	38
Crusher 3, 4 +5 (opening)	**97**	97	97	61	67	75	83	91	91	91	86
Screen 1, 2, 3 and 4 (enclosed) – Stages 4 & 5	**82**	107	111	111	110	113	117	117	113	102	89
Screen 1, 2, 3 and 4 (opening) – Stages 4 & 5	**108**	100	99	99	100	103	103	98	87	87	103
Screen 5	**97**	98	98	93	94	92	90	90	89	86	79
Dump Truck CAT 773B Tipping into Crusher	**113**	108	118	112	109	109	107	107	100	92	83
Dump Truck CAT 773B	**112**	102	107	109	104	104	104	109	95	84	76
Dump Truck CAT 773E	**112**	102	107	109	104	104	104	109	95	84	76
Excavator – PC600	**99**	94	104	107	99	98	93	87	84	78	69
Excavator – PC450	**96**	99	100	96	93	91	87	82	73	65	91
Loader WA 500	**101**	96	111	106	101	100	95	91	84	79	72
Watercart	**103**	89	106	97	98	101	99	96	89	82	75
Pugmill	**111**	106	110	102	108	109	107	103	99	91	85
Volvo L250G	**101**	91	99	106	96	97	97	94	84	76	66
Truck being loaded	**107**	91	104	101	101	103	100	101	97	91	82
Truck & Dog	**108**	100	111	102	94	97	98	106	88	83	83
Concrete Agitator	**108**	111	111	102	94	97	98	106	88	83	83
Pre-coat Plant	**99**	100	111	110	98	97	92	86	77	72	72
Conveyor Belt	**87**	90	91	89	88	86	81	79	74	66	55
Conveyor Driver	**80**	102	89	91	85	76	67	65	54	44	34
Road Lorry- Full 39t	**108**	118	109	101	100	104	99	98	91	91	123
Mobile Crusher	**107**	100	107	110	106	104	103	98	93	88	92
Truck revving	**105**	95	95	95	99	102	99	98	94	88	79
Drilling Rig	**114**	93	98	104	114	115	113	107	104	101	95
Grader	**113**	97	100	109	104	108	109	106	103	103	103
Excavator with mounted Hammer	**118**	117	112	114	111	110	115	110	110	101	101
Crane	**104**	71	84	89	99	101	94	95	85	77	77

6.3 WEATHER CONDITIONS

Two noise prediction modelling scenarios were run using the SoundPLAN program using CONCAWE algorithms in order to approximate the expected neutral and worst-case weather scenarios. It should be noted that sound will propagate further through the atmosphere under certain weather conditions. The 'worst-case' weather conditions chosen are those that are highly conducive to sound propagation.

The weather parameters used in the CONCAWE calculations to approximate expected neutral and worst-case weather situations at the quarry site are outlined in ***Table 25*** below. As operations occur during daytime hours, this situation has been considered in the noise predictions. The weather parameters used in the noise predictions have been determined based on the annual data from the Bureau of Meteorology (BoM) Weather Station at Williamtown NSW (061250).

Table 25: Sound Plan Weather Parameters

Parameter	Day		Evening/Night	
	Neutral	Worst-Case	Neutral	Worst-Case
Pasquill Stability Category	B	D	D	F
Wind Speed (m/s)	0	3	0	3
Humidity (%)	53	53	73	73
Temperature (deg Celsius)	18	18	6	6
Met Category	3	5	4	6

For the purpose of establishing a conservative noise prediction result, all worst-case scenario noise models consider a 3-m/s wind direction from source to all surrounding receivers.

6.4 NOISE MODELLING SCENARIOS

The proposed quarry extension has been divided into 5 stages. ***Table 26***, ***Table 27*** and ***Table 28*** set out the activities associated with the noise sources during day and evening/night periods for stages 1 to 5. The difference between each stage in terms of noise emissions will primarily be associated with varying heights associated with the plant items operating in the quarry pit for each stage and the changing location for fixed plant between Stages 1-3 and Stages 4-5.

It should be noted that construction stage 1 occurs during Stage 1 of the quarry operation and construction stage 2 occurs during Stage 3 of the quarry operation. Stage 1 construction is establishing the amenity bund at the expanded quarry site. Stage 2 construction is construction of the fixed processing plant within the relocated Processing Area for operational Stages 4 and 5.

Table 26: Quarry activities (Stages 1, 2 & 3) during the day, evening and night period

Day/Evening Period		Night Period	
Noise Sources	**Height above terrain**	**Noise Sources**	**Height above terrain**
Primary Crusher	10 metres	Screen 1	8 metres
Screen 1	8 metres	Secondary Crusher & Screen (Enclosed)	10 metres
Secondary Crusher & Screen (Enclosed)	10 metres	Crushers 3, 4+5 (enclosed)	10 metres
Crushers 3, 4+5 (enclosed)	10 metres	Screens 3 and 4 (enclosed)	10 metres
Screens 3 and 4 (enclosed)	10 metres	Screen 5	10 metres
Screen 5	10 metres	Conveyor Belts	5 metres
Conveyor Belts	5 metres	Conveyor Drivers	5 metres
Conveyor Drivers	5 metres	Pre-Coat Plant (PP)	2 metres
Pre-Coat Plant (PP)	2 metres	Pugmill operating (Pm)	4 metres
Pugmill operating (Pm)	4 metres	Mobile Crusher (MC)	3 metres
Mobile Crusher	3 metres	2x Front End Loaders – WA500 (Crushing Plant Area)	2 metres
2x Front End Loaders – WA500 (Crushing Plant Area)	2 metres	30x Road Lorry – Full 39t entering/leaving the site	2 metres
Front End Loaders – Volvo L250G (east of Crushing Plant Area)	2 metres	30x Truck & Dog – Full 39t entering/leaving the site	2 metres
Dump Truck CAT 773B	2 metres		
Dump Truck CAT 773E	2 metres		
Watercart	2 metres		
Drilling Rig (DR)	2 metres		
Grader	2 metres		
Excavator with Hammer (RH)	2 metres		
Excavator PC450 (Ex)	2 metres		
Excavator PC600 (Ex)	2 metres		
30x Road Lorry – Full 39t entering/leaving the site	2 metres		
30x Truck & Dog – Full 39t entering/leaving the site	2 metres		

Table 27: Quarry activities (Stages 4 & 5) during the day, evening and night period

Day/Evening Period		Night Period	
Noise Sources	**Height above terrain**	**Noise Sources**	**Height above terrain**
Primary Crusher	10 metres	Screen 1	8 metres
Secondary Crusher & Screen (Enclosed)	10 metres	Secondary Crusher & Screen (Enclosed)	10 metres
Crushers 3, 4+5 (enclosed)	10 metres	Crushers 3, 4+5 (enclosed)	10 metres
Screens 1, 3 and 4 (enclosed)	10 metres	Screens 1, 3 and 4 (enclosed)	10 metres
Screen 5	10 metres	Screen 5	10 metres
Conveyor Belts	5 metres	Conveyor Belts	5 metres
Conveyor Drivers	5 metres	Conveyor Drivers	5 metres
Pre-Coat Plant (PP)	2 metres	Pre-Coat Plant (PP)	2 metres
Pugmill operating (Pm)	4 metres	Pugmill operating (Pm)	4 metres
Concrete Agitator	3 metres	Mobile Crusher (MC)	3 metres
Mobile Crusher (MC)	3 metres	2x Front End Loaders – WA500 (Crushing Plant Area)	2 metres
2x Front End Loaders – WA500 (Crushing Plant Area)	2 metres	2x Front End Loaders – Volvo L250G (east of Crushing Plant Area)	2 metres
2x Front End Loaders – Volvo L250G (east of Crushing Plant Area)	2 metres	30x Road Lorry – Full 39t entering/leaving the site	2 metres
Dump Truck CAT 773B	2 metres	30x Truck & Dog – Full 39t entering/leaving the site	2 metres
Dump Truck CAT 773E	2 metres		
Watercart	2 metres		
Drilling Rig (DR)	2 metres		
Grader	2 metres		
Excavator with Hammer (RH)	2 metres		
Excavator PC450 (Ex)	2 metres		
Excavator PC600 (Ex)	2 metres		
30x Road Lorry – Full 39t entering/leaving the site	2 metres		
30x Truck & Dog – Full 39t entering/leaving the site	2 metres		

Table 28: Construction Stage 1 during Quarry operation (Stage 1)

Day Period	
Noise Sources	**Height above terrain**
Primary Crusher	10 metres
Screen 1	8 metres
Secondary Crusher & Screen (Enclosed)	10 metres
Crushers 3, 4+5 (enclosed)	10 metres
Screens 3 and 4 (enclosed)	10 metres
Screen 5	10 metres
Conveyor Belts	5 metres
Conveyor Drivers	5 metres
Pre-Coat Plant (PP)	2 metres
Pugmill operating (Pm)	4 metres
Mobile Crusher (MC)	3 metres
2x Front End Loaders – WA500 (Crushing Plant Area)	2 metres
Front End Loaders – Volvo L250G (east of Crushing Plant Area)	2 metres
Front End Loaders – WA500 (Expanded Area)	2 metres
Road Lorry – Construction Area	2 metres
Dump Truck CAT 773B	2 metres
Dump Truck CAT 773E	2 metres
Watercart	2 metres
Drilling Rig (DR)	2 metres
Grader	2 metres
Excavator with Hammer (RH)	2 metres
Excavator PC450 (Ex)	2 metres
Excavator PC600 (Ex)	2 metres
30x Road Lorry – Full 39t entering/leaving the site	2 metres
30x Truck & Dog – Full 39t entering/leaving the site	2 metres

Table 29: Construction Stage 2 during Quarry operation (Stage 3)

Day Period

Noise Sources	Height above terrain
Primary Crusher	10 metres
Screen 1	8 metres
Secondary Crusher & Screen (Enclosed)	10 metres
Crushers 3, 4+5 (enclosed)	10 metres
Screens 3 and 4 (enclosed)	10 metres
Screen 5	10 metres
Conveyor Belts	5 metres
Conveyor Drivers	5 metres
Pre-Coat Plant (PP)	2 metres
Pugmill operating (Pm)	4 metres
Mobile Crusher (MC)	3 metres
2x Front End Loaders – WA500 (Crushing Plant Area)	2 metres
Front End Loaders – Volvo L250G (east of Crushing Plant Area)	2 metres
Front End Loaders – WA500 (Expanded Area)	2 metres
Road Lorry – Construction Area	2 metres
Dump Truck CAT 773B	2 metres
Dump Truck CAT 773E	2 metres
Watercart	2 metres
Drilling Rig (DR)	2 metres
Grader	2 metres
Excavator with Hammer (RH)	2 metres
Excavator PC450 (Ex)	2 metres
Excavator PC600 (Ex)	2 metres
30x Road Lorry – Full 39t entering/leaving the site	2 metres
30x Truck & Dog – Full 39t entering/leaving the site	2 metres
Concrete Agitator (extended area)	2 metres
Excavator (extended area)	2 metres
Road Truck (extended area)	2 metres
Crane (extended area)	15 metres

6.5 NOISE CONTROL ASSUMPTIONS

The following noise control recommendations have been implemented in the Noise Prediction Model.

6.5.1 ENCLOSURE FOR CRUSHING MACHINES & SCREENS

Enclosures are to be installed on all crushing machines and screens, excluding Screen 1 and Screen 5 (for stages 1-3). The enclosure should comprise the following specifications (which have been assumed in the noise model in order to meet the criteria):

- A 9m^2 opening has been allowed for on the enclosure.
- Standard enclosure construction methods which ensure that all joints between enclosure screen panels are sealed airtight.
- The enclosure should consist of 0.6mm steel sheets both sides of a 92mm steel stud with 100mm fibreglass insulation within the cavity. An alternative enclosure material can also be used, provided it achieves an equal or greater noise reduction property as outlined in Table 30 below.

Table 30: Enclosure Noise Reduction Properties

Noise Reduction Properties									
Enclosure	**31.5Hz**	**63Hz**	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**
Crushing & Screening Plant Enclosure	5	11	13	26	41	46	45	49	52

6.5.2 NOISE BARRIERS/EARTHBUND

Noise barrier/earthbunds for Stages 1-5 should be constructed for various machinery items at the Brandy Hill Quarry. The barriers/earthbunds will require the following minimum properties:

- All joints between noise screen panels should be sealed airtight and should not have an air gap between the screens. If a gap is required underneath the barrier, we recommend that the gap be kept to a minimum so that it is installed close to the ground as much as possible.
- The construction of the proposed noise barrier may be formed of precast/aerated concrete, fibreglass reinforced plasterboard with dense infill material, 12mm thick compressed fibre cement panel etc. or similar material with a density of greater than 20kg/m^2. Earth mounds can also be used.
- A layout of the barrier is shown in Figure 6-1 to Figure 6-3 shown in green.
- The height of each barrier is outlined below:
  - Four earthbunds within the existing Crushing Plant Site: **4 metres high.**
  - Barrier/earthbunds within and near the expanded Crushing Plant Area should be constructed to the specifications described in ***Table 31***:

Table 31: Barrier/Earthbund Specifications

Barrier/Earthbund No.	Distance from fixed source (m)	Length (m)	Height (m)
1	5m from Mobile Crusher	15m	4m
2	200m from Primary Crusher	600m	18m
3	Approximately 180m south from Crushing Plant	700m (total)	18m
		120m (mid)	20m
4	25m east from the Concrete Agitator	60m	4m
5	Adjacent to Haul Truck Road	500m	3m

6.6 NOISE MODEL LAYOUT

Layouts of each construction and operational stage of the Brandy Hill Quarry used for the noise prediction models are presented from Figure 6-4 to Figure 6-9. It should be noted that construction stage 1 occurs during Stage 1 of the quarry operation and construction stage 2 occurs during Stage 3 of the quarry operation. Stage 1 construction is establishing the amenity barrier at the expanded quarry site. Stage 2 construction is the constructing the fixed crushing plant within the extended Brandy Hill Quarry area for next operational stages (Stages 4 & 5).

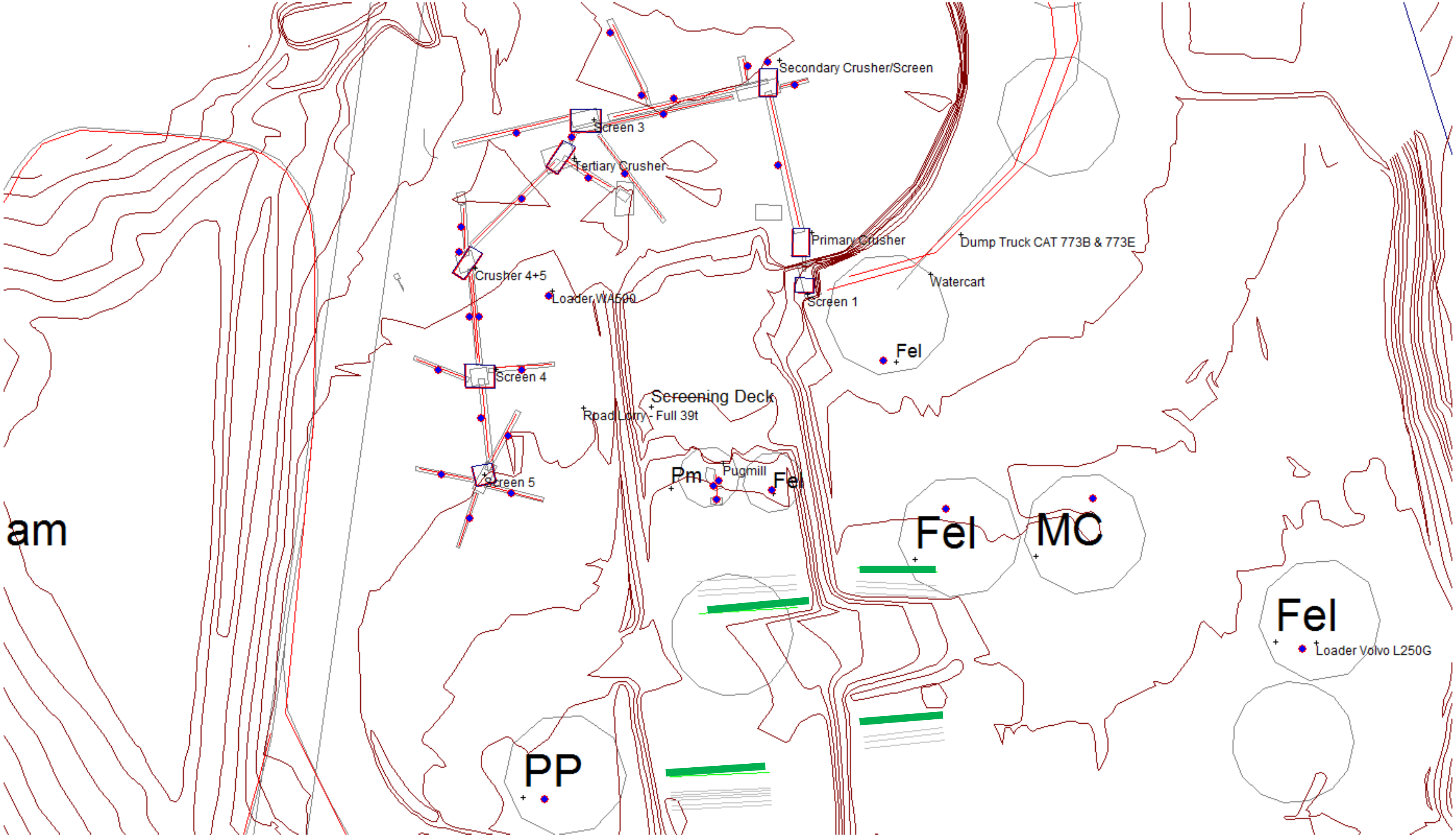


Figure 6-1 Crushing Plant Area Layout Stages 1-3, with noise barrier locations

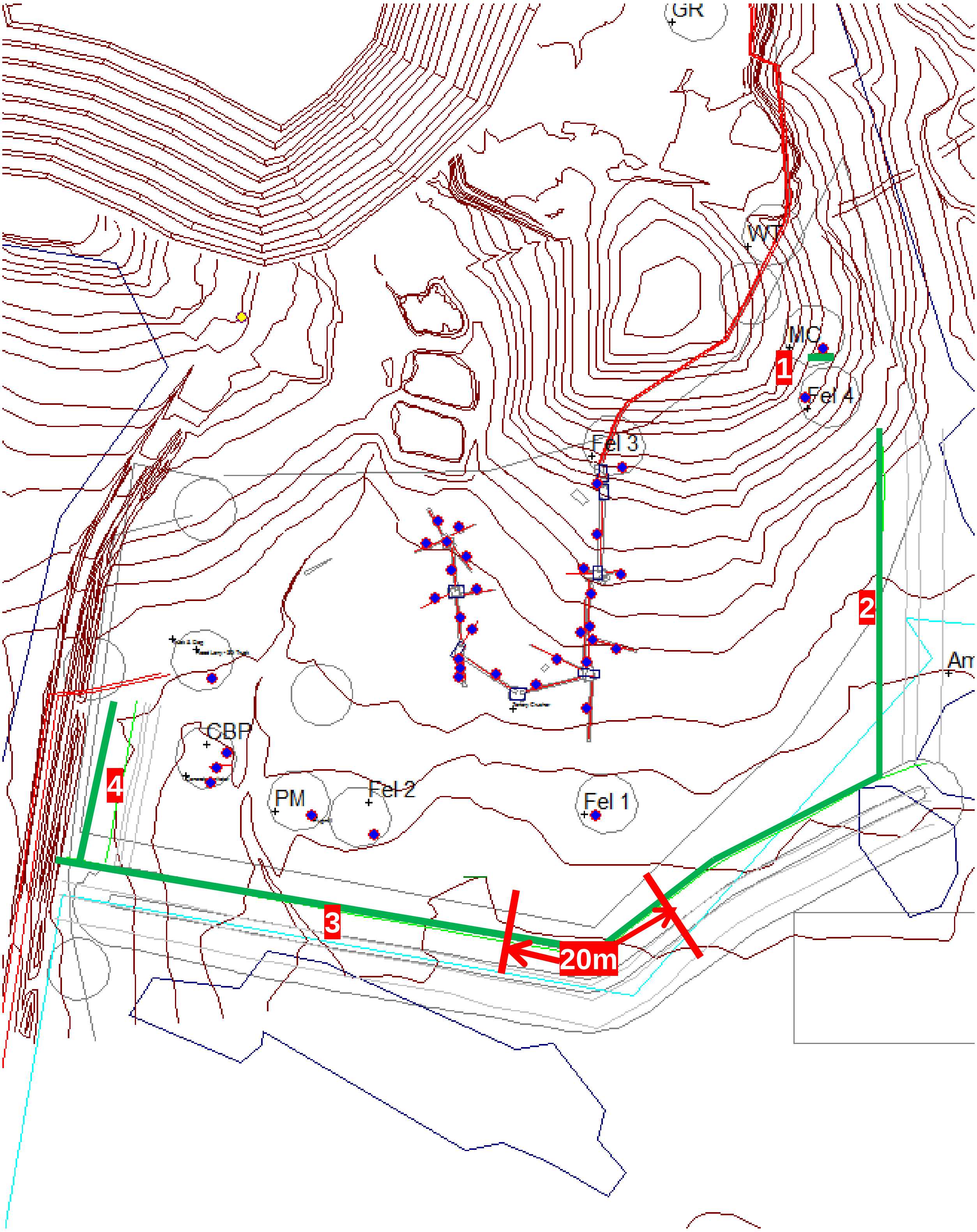


Figure 6-2 Layout of earthbund/barrier within expanded Brandy Hill Quarry site

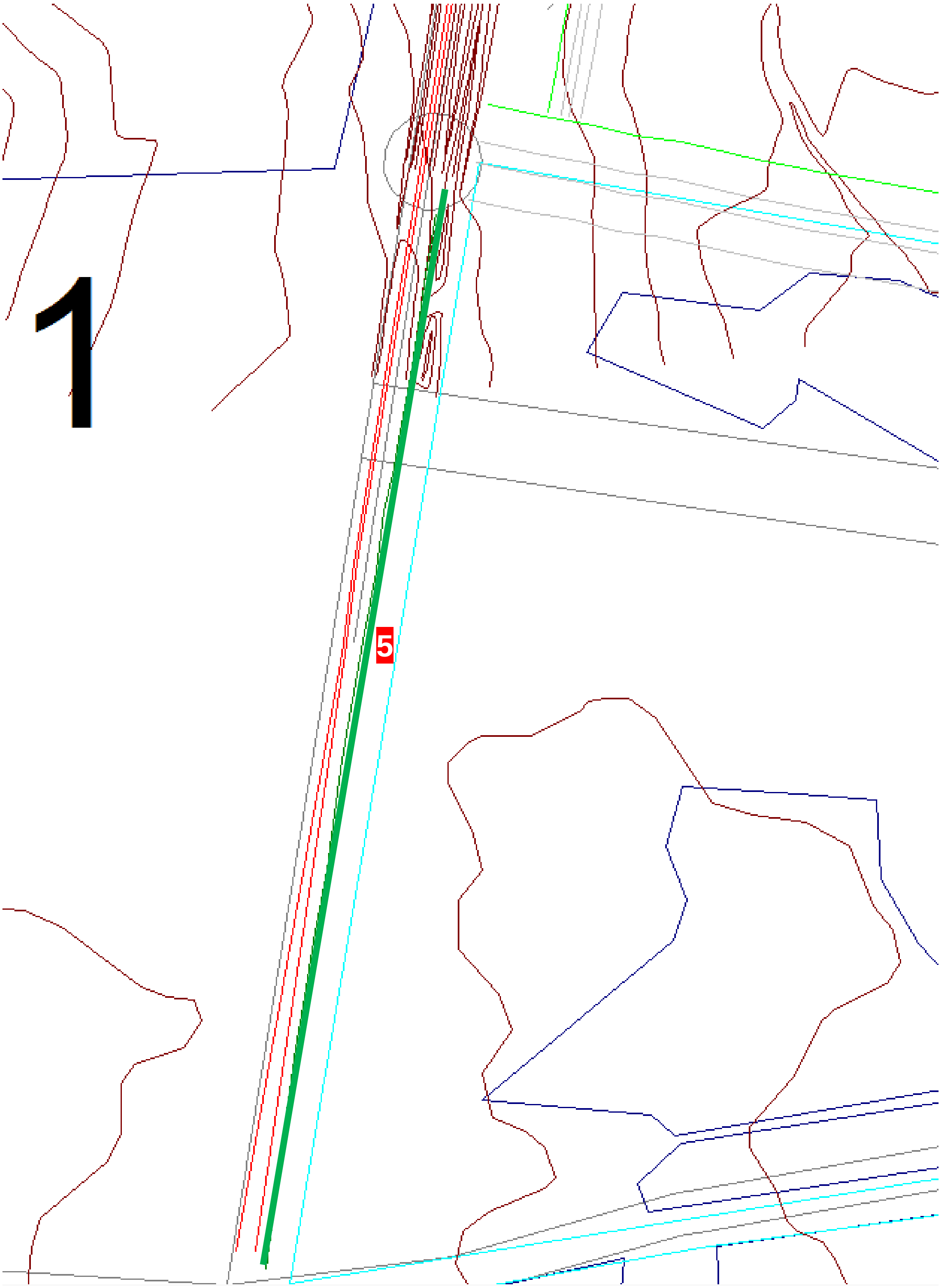


Figure 6-3 Layout of Barrier 5 - Adjacent to Haul Truck Road

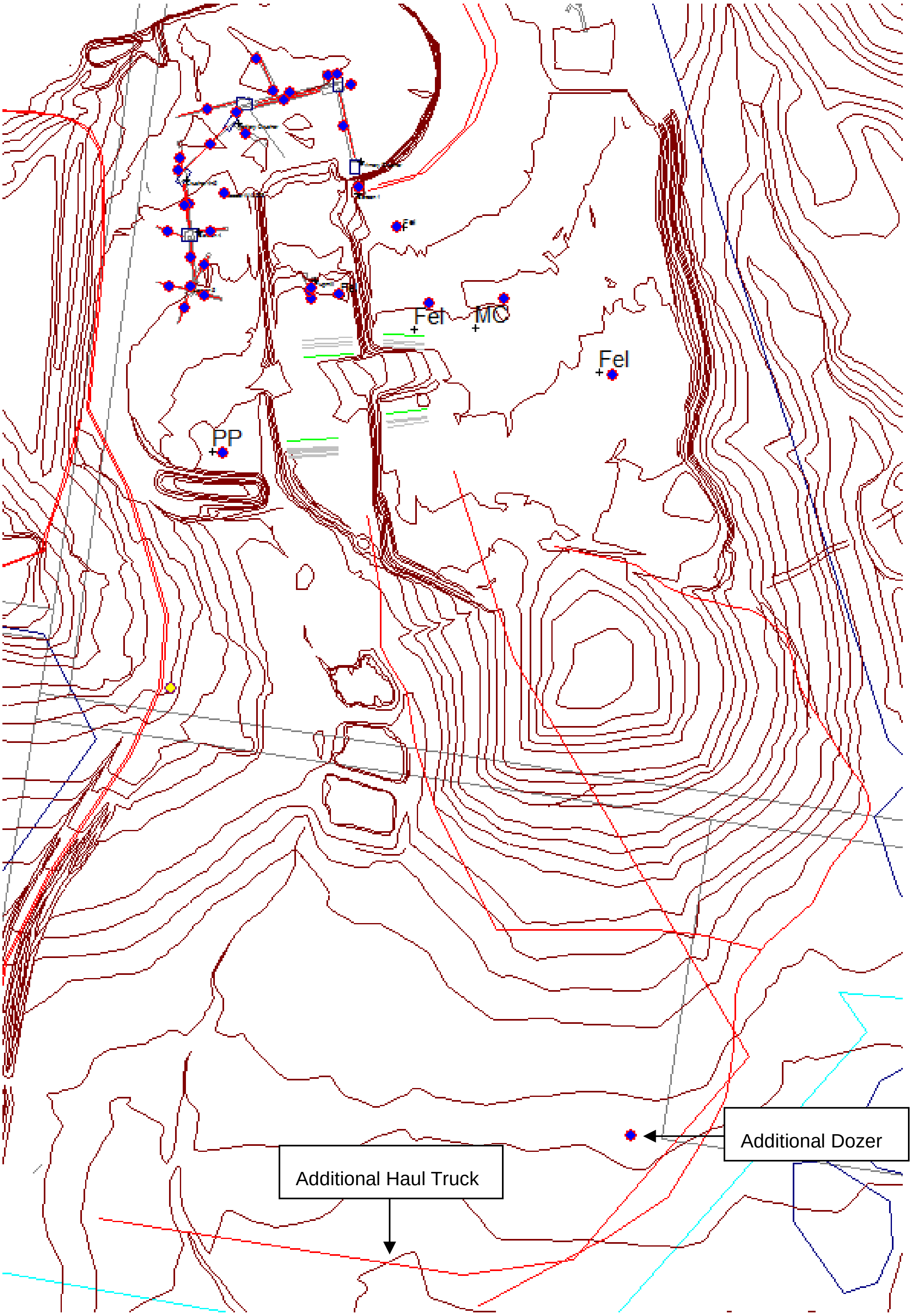


Figure 6-4 Construction Work Layout (including Stage 1 Operations)

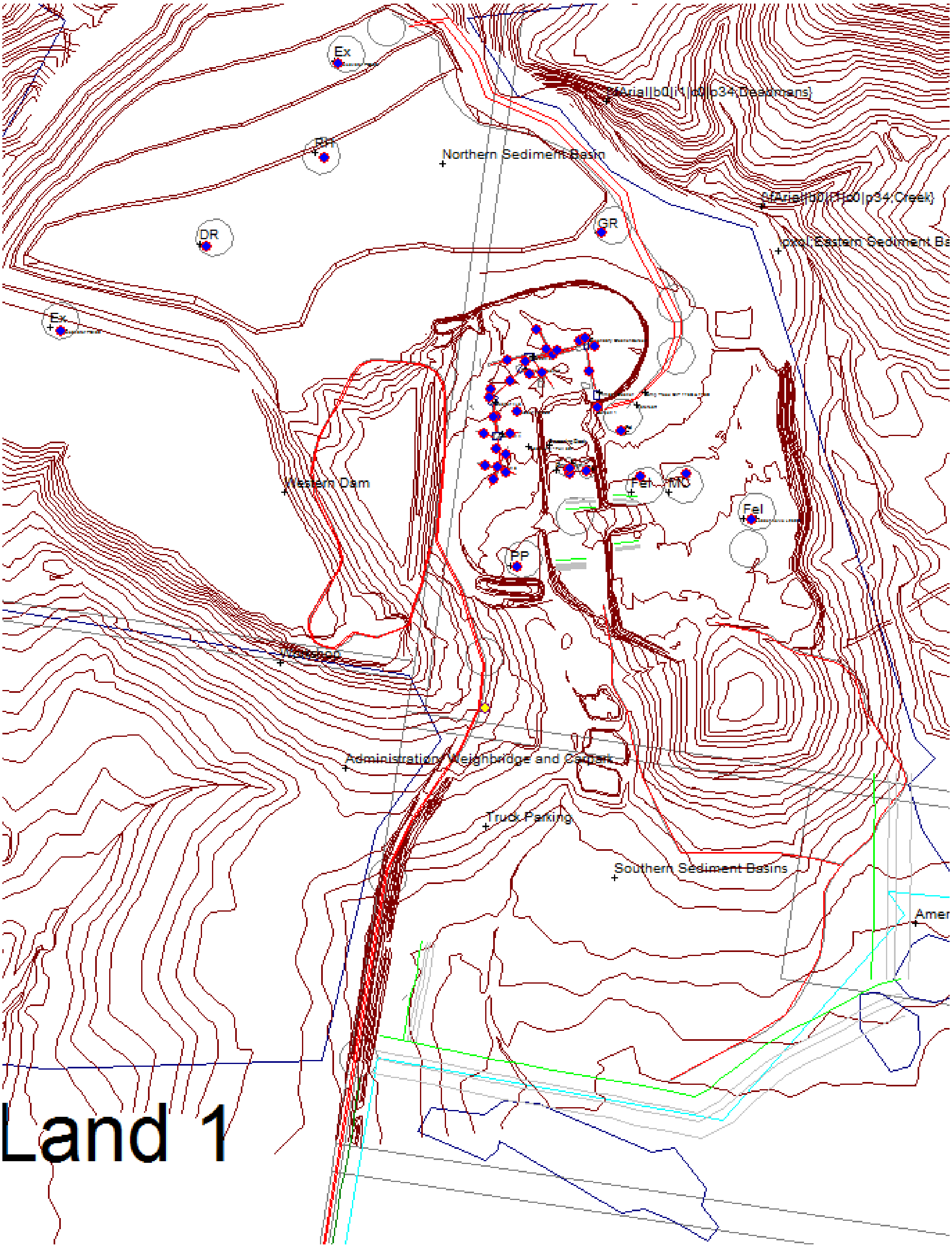


Figure 6-5 Stage 1 Site Layout

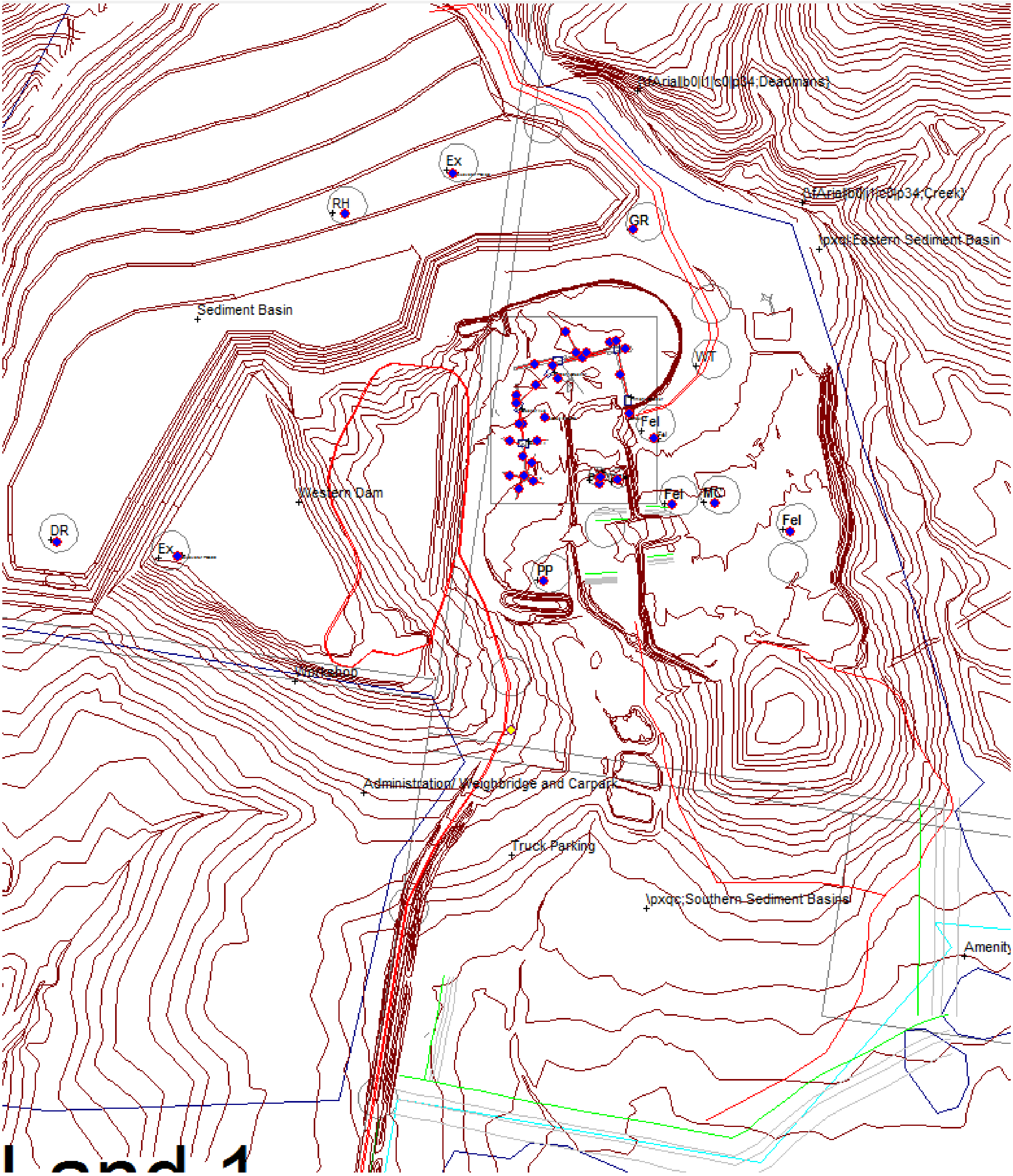


Figure 6-6 Stage 2 Site Layout

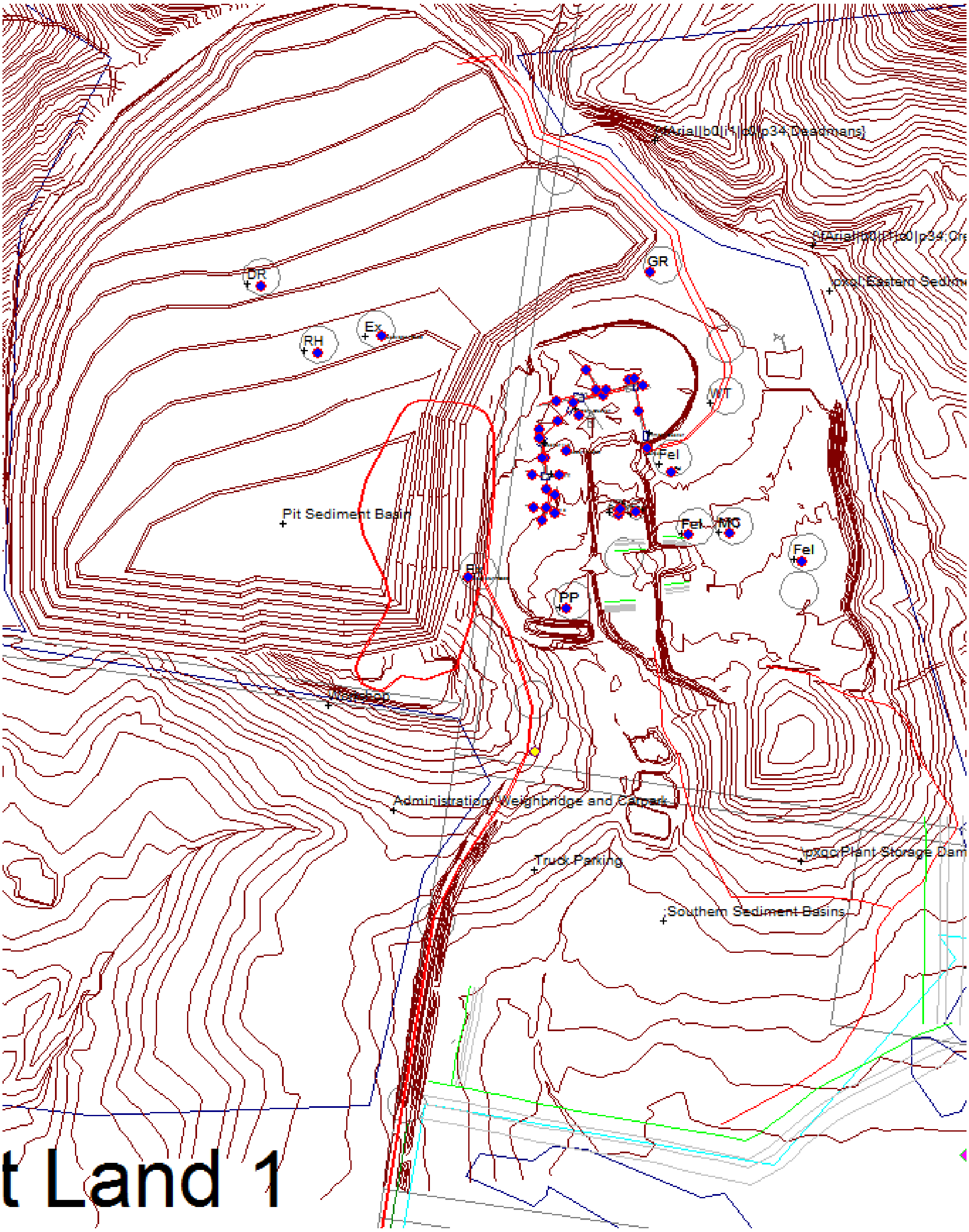


Figure 6-7 Stage 3 Site Layout

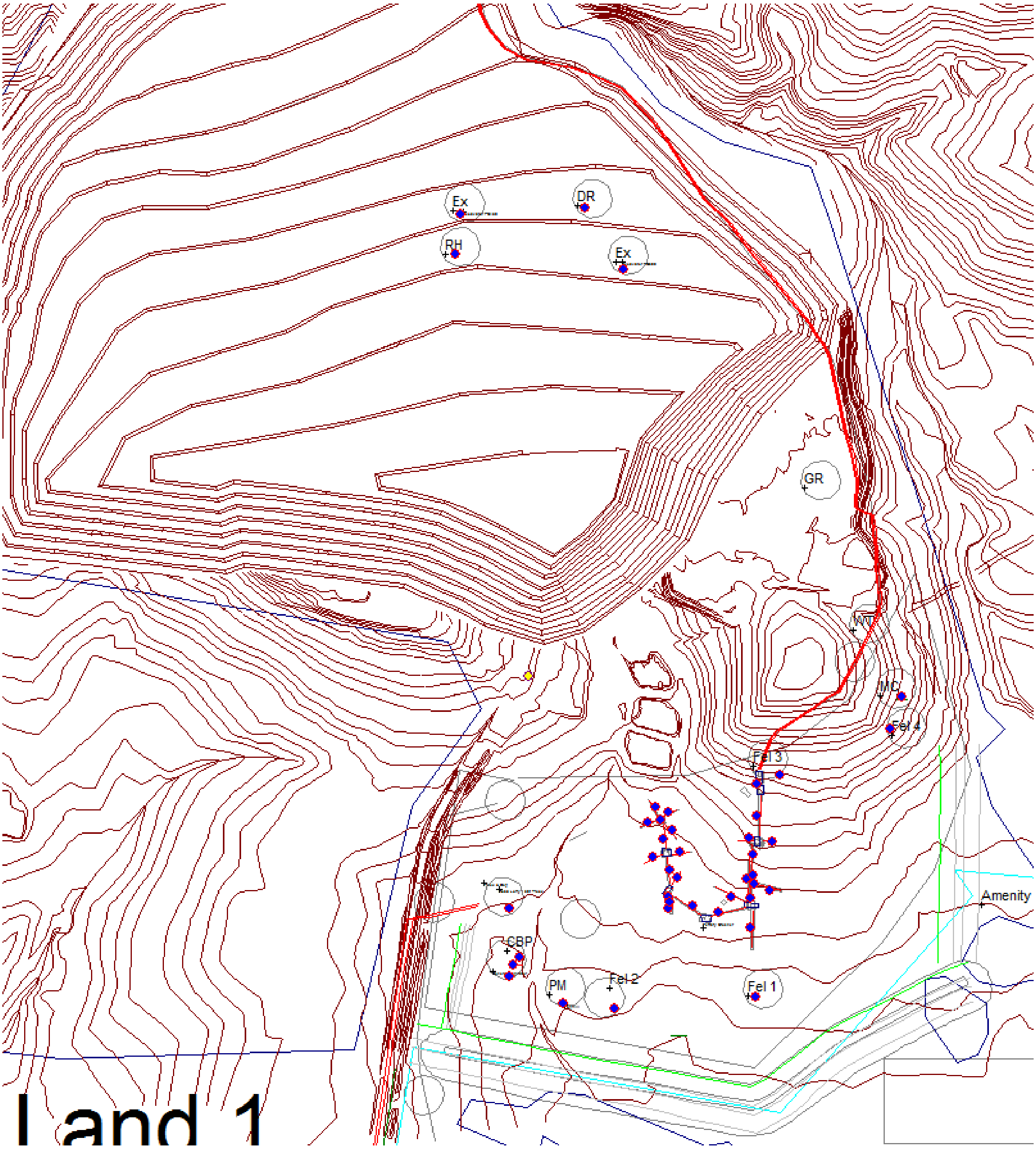


Figure 6-8 Stage 4 Site Layout

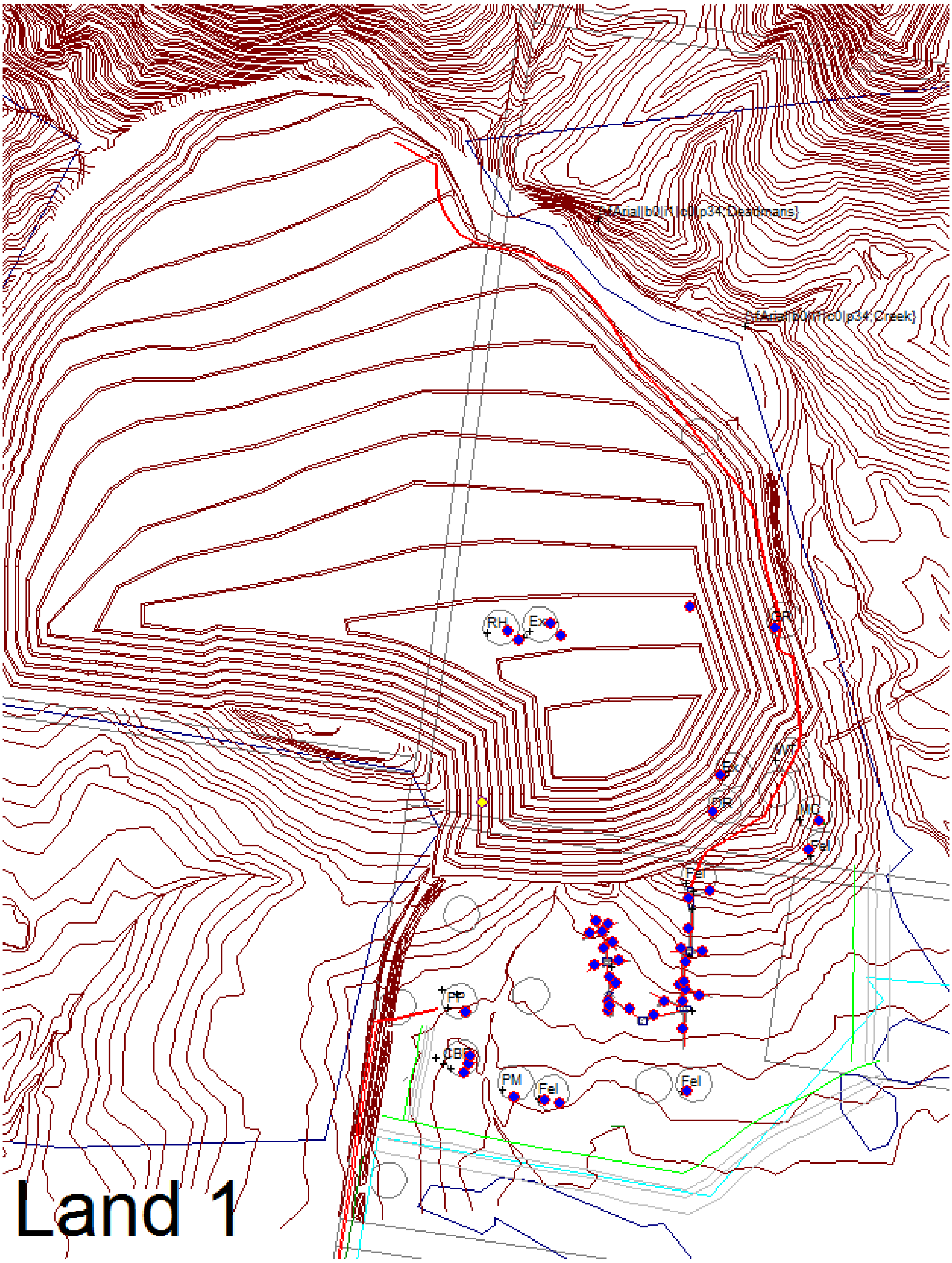


Figure 6-9 Stage 5 Site Layout

6.7 NOISE IMPACT FROM GENERATED TRAFFIC

The Calculation of Road Traffic Noise (CoRTN) method of traffic noise prediction was used, which is a method approved by the EPA. The traffic data presented in the report entitled Traffic Impact Assessment "Quarry Expansion Project, 979 Clarence Town Road, Seaham" (by Intersect Traffic dated October 2014) was used to calculate the traffic generation.

Vipac has been advised by Hanson Construction Materials that the majority of quarry-related truck movements will utilise Brandy Hill Drive and the residents along this road are concerned about road impacts. Therefore, this assessment is focussed on Brandy Hill Drive for potential road traffic noise impacts associated with the quarry.

Table 32 presents the existing traffic volumes obtained during the auto-count traffic surveys undertaken in March 2015 (by Intersect Traffic), which was used to predict the generated traffic noise impact on sensitive receivers. The traffic data presented in ***Table 31*** was recorded over a period of one week in March 2015 and include weighbridge counts to determine the project's current noise traffic contribution. It is noteworthy that the two week traffic counts for the Traffic Impact Assessment were undertaken in September 2014 over a two week period. There will be variation in the different data sets.

Vipac understands that the Traffic Impact Assessment has estimated that the road capacity at Brandy Hill Drive would accommodate 904 vehicles per day. However, based on previous assessments, it is likely that the road traffic noise will be a more limiting factor. With this in mind, Vipac has assessed the potential quarry traffic noise impact for the proposed Brandy Hill Quarry expansion by determining the allowable maximum number of truck movements that can be accommodated on Brandy Hill Drive before the overall road traffic noise levels exceed the applicable noise criteria at the noise sensitive receivers located along Brandy Hill Drive.

Table 32: Traffic Volumes - Brandy Hill Drive

Traffic Details	Base Traffic	Existing Hanson truck movements
Average Daily Traffic -Weekdays	1845	240
Average of Daily Heavy Vehicles -Weekdays	458	
15-hour traffic flows	1630	214
Number of heavy vehicles – 15 hours	400	
9 hour traffic flows	215	27
Number of heavy vehicles – 9 hours	59	
Speed Limit (km/h)	88*	88*

* According to the Traffic Impact Assessment for the Martins Creek Quarry prepared by Seca Solution (reference: P0254), the 85th percentile speed along Brandy Hill Drive was recorded at 88km/h. Therefore this speed will be used in the noise prediction model as a conservative assumption.

Table 33 presents the prediction assumptions used to assess the existing and future (2028) road traffic noise along Brandy Hill Drive. The assumptions for the future predictions also include the number of the various heavy vehicles. The increase of the estimated Average Annual Daily traffic volume is based the 1% traffic volume increase per annum along Brandy Hill Drive, as outlined in the Traffic Impact Assessment report prepared by Intersect Traffic (reference: 13/024).

Table 33: Road Traffic Noise Prediction Assumptions

Parameters	Assumptions		
	Existing Road Traffic (2015)	**Future Road Traffic (2028)**	
Estimated Average Annual Daily Traffic (AADT)	1845	2100	
Traffic volume Day and Night	Day: 1630 Night: 215	Day: 1855 Night: 245	
Heavy Vehicle Amount	Hanson Trucks: 240 Other Trucks: 218	**Day** Martin Creek Quarry:180 Hanson Trucks:603 Other Trucks:219	**Night** Martin Creek Quarry:24 Hanson Trucks:117 Other Trucks:25
Number of lanes each way	Northbound: 1 lane Southbound: 1 lane	Northbound: 1 lane Southbound: 1 lane	
Road Speed	88km/h	60km/h	

Hanson has proposed to reduce the speed limit along Brandy Hill Drive from 80km/h to 60km/h to attenuate road traffic noise emissions. The lower 60 km/h speed limit has been applied in the model to all trucks along Brandy Hill Drive.

7 RESULTS

7.1 OPERATIONAL PHASE OF PROPOSED QUARRY EXTENSION

7.1.1 MODELLED QUARRY NOISE – EXISTING OPERATIONAL PHASE

Table 34 provides the predicted noise impact at the calibration point (N05) during typical quarry operations. The operations of the quarry at the time of the measurements included the excavators, loaders, haul trucks, primary crusher, secondary crushers and screens. The noise prediction was also based on the meteorological conditions at the time of the attended measurements.

Table 34: Existing Quarry Operations - Predicted Noise Impact

Location	Quarry Contribution L_{Aeq}(dB)	
	Predicted Noise Levels	Measured Noise Levels
N05	52	54

The results of the noise prediction model show general agreement between the predicted levels and measured noise levels. Calibration of the operational quarry noise prediction model was undertaken by comparing the predicted noise levels with the measured noise levels at the monitoring point N05 based on the proximity of the monitoring point N05 to Hanson Construction Materials' quarry pit. It is acknowledged that the noise monitoring point N05 was representative of a reference position on-site at Brandy Hill Quarry and noise monitoring was also conducted at additional monitoring points, representative of noise sensitive receptors surrounding Brandy Hill Quarry. However, the additional monitoring locations (N01, N02, N03, N04 and N06) were situated further from Brandy Hill Quarry and were influenced by other extraneous noise sources such as traffic noise, insects, birds, agricultural and domestic activities near the properties, and were not dominated by noise emissions from Brandy Hill Quarry. The influence of the other extraneous noise sources at the noise sensitive monitoring locations was noted during the attended noise surveys. Noise impact from Brandy Hill Quarry operations was not apparent at these monitoring locations (N01, N02, N03, N04 and N06). Therefore, only monitoring point N05 was used to calibrate the noise model for the quarry operational phase noise predictions.

7.1.2 MODELLED QUARRY NOISE – PROPOSED EXPANSION OPERATIONAL PHASE

Noise prediction re-modelling has been carried out to identify the potential impact associated with the proposed quarry expansion on the existing noise environment at the nearest noise sensitive receptors located in proximity to the site. The predicted noise levels representative of the operational phase of the expanded quarry for both neutral weather conditions and worst-case weather conditions for each stage during the day and evening/night period are presented from ***Table 35*** to ***Table 44***.

Table 35: Operational Phase - Predicted Noise Impact (Day & Evening Period) –Stage 1

Receiver ID	Neutral – Day		Worst Case – Day		Noise Criteria Day/ Evening dB(A)	15dB difference between C & A Weighting	Comply with LFN Spectrum Limit
	dB(A)	dB(C)	dB(A)	dB(C)			
R001-122B Duns Creek Road	0	21	7	27	35 / 35	TRUE	COMPLY
R002-16 Uffington Road	3	25	5	28	35 / 35	TRUE	COMPLY
R003-60 Green Wattle Creek Road	2	23	12	29	35 / 35	TRUE	COMPLY
R004-34 Timber Top Road	0	18	6	24	40 / 35	TRUE	COMPLY
R005-35 Timber Top Road	0	17	5	23	40 / 35	TRUE	COMPLY
R006-36 Timber Top Road	0	18	6	24	35 / 35	TRUE	COMPLY
R007-13 Mooghin Road	16	41	23	45	40 / 35	TRUE	COMPLY
R008-14 Mooghin Road	15	39	24	44	40 / 35	TRUE	COMPLY
R009-13 Giles Road	8	30	16	35	35 / 35	TRUE	COMPLY
R010-13B Giles Road	15	38	24	42	35 / 35	TRUE	COMPLY
R011-866 Clarence Town Road	23	44	33	48	37 / 35	TRUE	COMPLY
R013.1 -994 Clarence Town Road	28	48	36	52	37 / 35	TRUE	COMPLY
R013.2 -104 Brandy Hill Drive	28	46	36	50	37 / 35	FALSE	COMPLY
R014-1034 Clarence Town Road	28	48	37	52	37 / 35	TRUE	COMPLY
R015-1060 Clarence Town Road	25	45	34	49	37 / 35	TRUE	COMPLY
R016-1094 Clarence Town Road	28	49	37	53	37 / 35	TRUE	COMPLY
R017-1189 Clarence Town Road	26	46	35	50	40 / 35	TRUE	COMPLY
R018-1203 Clarence Town Road	21	41	30	46	40 / 35	TRUE	COMPLY

Table 36: Operational Phase - Predicted Noise Impact (Night Period) –Stage 1

Receiver ID	Neutral – Night		Worst Case – Night		Noise Criteria Night dB(A)	15dB difference between C & A Weighting	Comply with LFN Spectrum Limit
	dB(A)	dB(C)	dB(A)	dB(C)			
R001-122B Duns Creek Road	1	23	6	25	35	TRUE	COMPLY
R002-16 Uffington Road	4	23	7	26	35	TRUE	COMPLY
R003-60 Green Wattle Creek Road	7	26	12	29	35	TRUE	COMPLY
R004-34 Timber Top Road	0	19	4	22	35	TRUE	COMPLY
R005-35 Timber Top Road	0	18	3	21	35	TRUE	COMPLY
R006-36 Timber Top Road	0	19	4	22	35	TRUE	COMPLY
R007-13 Mooghin Road	17	41	21	43	35	TRUE	COMPLY
R008-14 Mooghin Road	14	40	19	42	35	TRUE	COMPLY
R009-13 Giles Road	12	32	17	34	35	TRUE	COMPLY
R010-13B Giles Road	19	39	24	41	35	TRUE	COMPLY
R011-866 Clarence Town Road	28	45	33	47	35	FALSE	COMPLY
R013.1 -994 Clarence Town Road	31	48	35	51	35	TRUE	COMPLY
R013.2 -104 Brandy Hill Drive	30	46	35	49	35	FALSE	COMPLY
R014-1034 Clarence Town Road	30	49	36	51	35	TRUE	COMPLY
R015-1060 Clarence Town Road	27	46	33	48	35	TRUE	COMPLY
R016-1094 Clarence Town Road	31	49	36	52	35	TRUE	COMPLY
R017-1189 Clarence Town Road	27	46	33	48	35	TRUE	COMPLY
R018-1203 Clarence Town Road	23	42	29	44	35	TRUE	COMPLY

Table 37: Operational Phase - Predicted Noise Impact (Day & Evening Period) –Stage 2

Receiver ID	Neutral – Day		Worst Case – Day		Noise Criteria Day/ Evening dB(A)	15dB difference between C & A Weighting	Comply with LFN Spectrum Limit
	dB(A)	dB(C)	dB(A)	dB(C)			
R001-122B Duns Creek Road	0	21	7	27	35 / 35	TRUE	COMPLY
R002-16 Uffington Road	0	21	5	27	35 / 35	TRUE	COMPLY
R003-60 Green Wattle Creek Road	2	23	12	29	35 / 35	TRUE	COMPLY
R004-34 Timber Top Road	0	18	6	23	40 / 35	TRUE	COMPLY
R005-35 Timber Top Road	0	17	5	23	40 / 35	TRUE	COMPLY
R006-36 Timber Top Road	0	18	6	24	35 / 35	TRUE	COMPLY
R007-13 Mooghin Road	15	41	23	45	40 / 35	TRUE	COMPLY
R008-14 Mooghin Road	14	39	22	43	40 / 35	TRUE	COMPLY
R009-13 Giles Road	8	30	16	35	35 / 35	TRUE	COMPLY
R010-13B Giles Road	15	38	24	42	35 / 35	TRUE	COMPLY
R011-866 Clarence Town Road	24	44	33	48	37 / 35	TRUE	COMPLY
R013.1 -994 Clarence Town Road	28	48	36	52	37 / 35	TRUE	COMPLY
R013.2 -104 Brandy Hill Drive	28	46	36	50	37 / 35	FALSE	COMPLY
R014-1034 Clarence Town Road	28	48	37	52	37 / 35	TRUE	COMPLY
R015-1060 Clarence Town Road	25	45	34	49	37 / 35	TRUE	COMPLY
R016-1094 Clarence Town Road	28	49	37	53	37 / 35	TRUE	COMPLY
R017-1189 Clarence Town Road	26	46	35	50	40 / 35	TRUE	COMPLY
R018-1203 Clarence Town Road	20	41	30	45	40 / 35	TRUE	COMPLY

Table 38: Operational Phase - Predicted Noise Impact (Night Period) –Stage 2

Receiver ID	Neutral – Night		Worst Case – Night		Noise Criteria Night dB(A)	15dB difference between C & A Weighting	Comply with LFN Spectrum Limit
	dB(A)	dB(C)	dB(A)	dB(C)			
R001-122B Duns Creek Road	1	23	6	25	35	TRUE	COMPLY
R002-16 Uffington Road	1	23	7	26	35	TRUE	COMPLY
R003-60 Green Wattle Creek Road	7	26	12	29	35	TRUE	COMPLY
R004-34 Timber Top Road	0	19	4	22	35	TRUE	COMPLY
R005-35 Timber Top Road	0	18	3	21	35	TRUE	COMPLY
R006-36 Timber Top Road	0	19	4	22	35	TRUE	COMPLY
R007-13 Mooghin Road	17	41	21	43	35	TRUE	COMPLY
R008-14 Mooghin Road	15	40	19	42	35	TRUE	COMPLY
R009-13 Giles Road	12	32	17	34	35	TRUE	COMPLY
R010-13B Giles Road	19	39	24	41	35	TRUE	COMPLY
R011-866 Clarence Town Road	28	45	33	47	35	FALSE	COMPLY
R013.1 -994 Clarence Town Road	31	48	35	51	35	TRUE	COMPLY
R013.2 -104 Brandy Hill Drive	30	46	35	49	35	FALSE	COMPLY
R014-1034 Clarence Town Road	31	49	36	51	35	TRUE	COMPLY
R015-1060 Clarence Town Road	28	46	33	48	35	TRUE	COMPLY
R016-1094 Clarence Town Road	31	49	36	52	35	TRUE	COMPLY
R017-1189 Clarence Town Road	28	46	33	48	35	TRUE	COMPLY
R018-1203 Clarence Town Road	24	42	29	44	35	TRUE	COMPLY

Table 39: Operational Phase - Predicted Noise Impact (Day & Evening Period) –Stage 3

Receiver ID	Neutral – Day		Worst Case – Day		Noise Criteria Day/ Evening dB(A)	15dB difference between C & A Weighting	Comply with LFN Spectrum Limit
	dB(A)	dB(C)	dB(A)	dB(C)			
R001-122B Duns Creek Road	0	13	7	27	35 / 35	TRUE	COMPLY
R002-16 Uffington Road	4	20	13	31	35 / 35	TRUE	COMPLY
R003-60 Green Wattle Creek Road	3	18	12	29	35 / 35	TRUE	COMPLY
R004-34 Timber Top Road	0	10	6	24	40 / 35	TRUE	COMPLY
R005-35 Timber Top Road	0	9	5	23	40 / 35	TRUE	COMPLY
R006-36 Timber Top Road	0	10	6	24	35 / 35	TRUE	COMPLY
R007-13 Mooghin Road	16	32	23	45	40 / 35	TRUE	COMPLY
R008-14 Mooghin Road	15	31	22	44	40 / 35	TRUE	COMPLY
R009-13 Giles Road	8	26	16	35	35 / 35	TRUE	COMPLY
R010-13B Giles Road	16	33	24	43	35 / 35	TRUE	COMPLY
R011-866 Clarence Town Road	26	37	34	49	37 / 35	TRUE	COMPLY
R013.1 -994 Clarence Town Road	29	51	36	52	37 / 35	TRUE	COMPLY
R013.2 -104 Brandy Hill Drive	29	50	36	50	37 / 35	FALSE	COMPLY
R014-1034 Clarence Town Road	30	46	37	53	37 / 35	TRUE	COMPLY
R015-1060 Clarence Town Road	27	44	34	50	37 / 35	TRUE	COMPLY
R016-1094 Clarence Town Road	30	43	37	53	37 / 35	TRUE	COMPLY
R017-1189 Clarence Town Road	27	38	35	50	40 / 35	TRUE	COMPLY
R018-1203 Clarence Town Road	22	34	30	46	40 / 35	TRUE	COMPLY

Table 40: Operational Phase - Predicted Noise Impact (Night Period) –Stage 3

Receiver ID	Neutral – Night		Worst Case – Night		Noise Criteria Night dB(A)	15dB difference between C & A Weighting	Comply with LFN Spectrum Limit
	dB(A)	dB(C)	dB(A)	dB(C)			
R001-122B Duns Creek Road	1	23	6	26	35	TRUE	COMPLY
R002-16 Uffington Road	8	27	14	30	35	TRUE	COMPLY
R003-60 Green Wattle Creek Road	7	26	12	29	35	TRUE	COMPLY
R004-34 Timber Top Road	0	20	5	22	35	TRUE	COMPLY
R005-35 Timber Top Road	0	19	3	22	35	TRUE	COMPLY
R006-36 Timber Top Road	0	20	5	22	35	TRUE	COMPLY
R007-13 Mooghin Road	18	42	21	44	35	TRUE	COMPLY
R008-14 Mooghin Road	16	40	19	42	35	TRUE	COMPLY
R009-13 Giles Road	12	32	17	34	35	TRUE	COMPLY
R010-13B Giles Road	20	40	24	42	35	TRUE	COMPLY
R011-866 Clarence Town Road	29	46	33	48	35	FALSE	COMPLY
R013.1 -994 Clarence Town Road	31	49	35	51	35	TRUE	COMPLY
R013.2 -104 Brandy Hill Drive	31	47	34	49	35	FALSE	COMPLY
R014-1034 Clarence Town Road	32	50	35	52	35	TRUE	COMPLY
R015-1060 Clarence Town Road	29	47	33	48	35	TRUE	COMPLY
R016-1094 Clarence Town Road	32	50	36	52	35	TRUE	COMPLY
R017-1189 Clarence Town Road	28	47	33	49	35	TRUE	COMPLY
R018-1203 Clarence Town Road	24	42	29	44	35	TRUE	COMPLY

Table 41: Operational Phase - Predicted Noise Impact (Day & Evening Period) –Stage 4

Receiver ID	Neutral – Day		Worst Case – Day		Noise Criteria Day/ Evening dB(A)	15dB difference between C & A Weighting	Comply with LFN Spectrum Limit
	dB(A)	dB(C)	dB(A)	dB(C)			
R001-122B Duns Creek Road	0	18	5	24	35 / 35	TRUE	COMPLY
R002-16 Uffington Road	4	25	14	31	35 / 35	TRUE	COMPLY
R003-60 Green Wattle Creek Road	2	23	11	29	35 / 35	TRUE	COMPLY
R004-34 Timber Top Road	0	15	3	21	40 / 35	TRUE	COMPLY
R005-35 Timber Top Road	0	15	3	20	40 / 35	TRUE	COMPLY
R006-36 Timber Top Road	0	15	3	21	35 / 35	TRUE	COMPLY
R007-13 Mooghin Road	17	41	26	46	40 / 35	TRUE	COMPLY
R008-14 Mooghin Road	11	37	19	42	40 / 35	TRUE	COMPLY
R009-13 Giles Road	9	32	18	37	35 / 35	TRUE	COMPLY
R010-13B Giles Road	17	38	26	43	35 / 35	TRUE	COMPLY
R011-866 Clarence Town Road	22	43	32	48	37 / 35	TRUE	COMPLY
R013.1 -994 Clarence Town Road	27	48	35	51	37 / 35	TRUE	COMPLY
R013.2 -104 Brandy Hill Drive	26	44	32	48	37 / 35	TRUE	COMPLY
R014-1034 Clarence Town Road	27	50	35	54	37 / 35	TRUE	COMPLY
R015-1060 Clarence Town Road	24	47	32	50	37 / 35	TRUE	COMPLY
R016-1094 Clarence Town Road	28	52	36	56	37 / 35	TRUE	COMPLY
R017-1189 Clarence Town Road	28	46	37	51	40 / 35	FALSE	COMPLY
R018-1203 Clarence Town Road	24	42	33	47	40 / 35	FALSE	COMPLY

Table 42: Operational Phase - Predicted Noise Impact (Night Period) –Stage 4

Receiver ID	Neutral – Night		Worst Case – Night		Noise Criteria Night dB(A)	15dB difference between C & A Weighting	Comply with LFN Spectrum Limit
	dB(A)	dB(C)	dB(A)	dB(C)			
R001-122B Duns Creek Road	0	18	5	25	35	TRUE	COMPLY
R002-16 Uffington Road	10	25	16	32	35	TRUE	COMPLY
R003-60 Green Wattle Creek Road	7	23	12	30	35	TRUE	COMPLY
R004-34 Timber Top Road	0	15	3	22	35	TRUE	COMPLY
R005-35 Timber Top Road	0	15	3	22	35	TRUE	COMPLY
R006-36 Timber Top Road	0	15	3	22	35	TRUE	COMPLY
R007-13 Mooghin Road	22	41	27	47	35	TRUE	COMPLY
R008-14 Mooghin Road	15	37	20	43	35	TRUE	COMPLY
R009-13 Giles Road	14	32	19	38	35	TRUE	COMPLY
R010-13B Giles Road	22	38	27	44	35	TRUE	COMPLY
R011-866 Clarence Town Road	27	43	32	49	35	TRUE	COMPLY
R013.1 -994 Clarence Town Road	32	48	36	52	35	TRUE	COMPLY
R013.2 -104 Brandy Hill Drive	31	44	34	49	35	TRUE	COMPLY
R014-1034 Clarence Town Road	30	50	34	54	35	TRUE	COMPLY
R015-1060 Clarence Town Road	28	47	32	51	35	TRUE	COMPLY
R016-1094 Clarence Town Road	31	52	36	56	35	TRUE	COMPLY
R017-1189 Clarence Town Road	32	46	37	52	35	TRUE	COMPLY
R018-1203 Clarence Town Road	28	42	33	48	35	TRUE	COMPLY

Table 43: Operational Phase - Predicted Noise Impact (Day & Evening Period) –Stage 5

Receiver ID	Neutral – Day		Worst Case – Day		Noise Criteria Day/ Evening dB(A)	15dB difference between C & A Weighting	Comply with LFN Spectrum Limit
	dB(A)	dB(C)	dB(A)	dB(C)			
R001-122B Duns Creek Road	0	24	5	24	35 / 35	TRUE	COMPLY
R002-16 Uffington Road	7	32	16	32	35 / 35	TRUE	COMPLY
R003-60 Green Wattle Creek Road	2	29	11	29	35 / 35	TRUE	COMPLY
R004-34 Timber Top Road	0	21	5	21	40 / 35	TRUE	COMPLY
R005-35 Timber Top Road	0	21	4	21	40 / 35	TRUE	COMPLY
R006-36 Timber Top Road	0	21	4	21	35 / 35	TRUE	COMPLY
R007-13 Mooghin Road	20	46	21	46	40 / 35	TRUE	COMPLY
R008-14 Mooghin Road	15	42	20	42	40 / 35	TRUE	COMPLY
R009-13 Giles Road	9	37	18	37	35 / 35	TRUE	COMPLY
R010-13B Giles Road	18	43	27	43	35 / 35	TRUE	COMPLY
R011-866 Clarence Town Road	25	48	34	48	37 / 35	FALSE	COMPLY
R013.1 -994 Clarence Town Road	29	51	36	51	37 / 35	TRUE	COMPLY
R013.2 -104 Brandy Hill Drive	29	48	34	48	37 / 35	FALSE	COMPLY
R014-1034 Clarence Town Road	31	54	36	54	37 / 35	TRUE	COMPLY
R015-1060 Clarence Town Road	29	51	33	51	37 / 35	TRUE	COMPLY
R016-1094 Clarence Town Road	33	56	37	56	37 / 35	TRUE	COMPLY
R017-1189 Clarence Town Road	31	52	37	52	40 / 35	FALSE	COMPLY
R018-1203 Clarence Town Road	26	47	33	47	40 / 35	TRUE	COMPLY

Table 44: Operational Phase - Predicted Noise Impact (Night Period) –Stage 5

Receiver ID	Neutral – Night		Worst Case – Night		Noise Criteria Night dB(A)	15dB difference between C & A Weighting	Comply with LFN Spectrum Limit
	dB(A)	dB(C)	dB(A)	dB(C)			
R001-122B Duns Creek Road	0	22	5	25	35	TRUE	COMPLY
R002-16 Uffington Road	10	28	16	32	35	TRUE	COMPLY
R003-60 Green Wattle Creek Road	7	27	12	30	35	TRUE	COMPLY
R004-34 Timber Top Road	0	20	4	22	35	TRUE	COMPLY
R005-35 Timber Top Road	0	20	3	22	35	TRUE	COMPLY
R006-36 Timber Top Road	0	20	4	22	35	TRUE	COMPLY
R007-13 Mooghin Road	22	45	27	47	35	TRUE	COMPLY
R008-14 Mooghin Road	15	41	20	43	35	TRUE	COMPLY
R009-13 Giles Road	14	36	19	38	35	TRUE	COMPLY
R010-13B Giles Road	22	42	27	44	35	TRUE	COMPLY
R011-866 Clarence Town Road	28	47	33	49	35	TRUE	COMPLY
R013.1 -994 Clarence Town Road	32	50	36	52	35	TRUE	COMPLY
R013.2 -104 Brandy Hill Drive	31	47	34	49	35	TRUE	COMPLY
R014-1034 Clarence Town Road	30	52	34	54	35	TRUE	COMPLY
R015-1060 Clarence Town Road	28	49	32	51	35	TRUE	COMPLY
R016-1094 Clarence Town Road	31	54	36	56	35	TRUE	COMPLY
R017-1189 Clarence Town Road	32	50	37	52	35	TRUE	COMPLY
R018-1203 Clarence Town Road	28	45	33	48	35	TRUE	COMPLY

Operational noise from the Brandy Hill quarry proposed expansion is predicted to be generally compliant with the Project Specific Noise Levels. Predicted operational noise marginally exceeds the evening and night-time criteria at Receivers R13, R14, R16 and R17 by between 1 to 2 dB for some stage scenarios (during worst case operating and climate conditions) and is considered a negligible impact. All noise impact predictions were found to be within the low frequency noise limits (including noise spectra), as specified in Section 5.1.1.

It is noted that the main low frequency noise contribution would be from trucks entering and leaving the quarry along the internal quarry access road (which is contained in the noise model). However, it is noted that even though low frequency noise from public roads is not assessed, it is likely that all trucks passing along Clarence Town Road would contribute low frequency noise at the nearest receivers.

7.1.3 VOLUNTARY LAND ACQUISTION AND MITIGATION POLICY

There is no vacant land that is closer to the Brandy Hill Quarry than the noise sensitive prediction locations assessed in this report. All property owned by Hanson Construction Materials in the vicinity of the Quarry is considered “project related” and is not considered in this assessment.

The predicted noise impact of between 1dB and 2dB exceedance relative to the criteria (at a small number of receivers for some stage scenarios) is considered negligible and as a result would not trigger mitigation or acquisition at any properties.

7.1.4 OPERATIONAL SLEEP DISTURBANCE

It should be noted, the INP provides no definitive criteria for assessment of sleep disturbance. A sleep disturbance criterion of 15dBA above the prevailing $L_{A90(15minute)}$ level has been used and is referenced in the INP Application Notes but is acknowledged in the INP Application Notes as not being ‘ideal’.

In October 2017, the EPA released the Noise Policy for Industry (NPI) superseding the INP. Under the transitional arrangements for this policy, the provisions of the INP remain relevant to the assessment of operational noise for the Proposal as this was the guideline relevant at the time that the Director-General’s Assessment Requirements were issued. However, given the lack of definitive guidance in the INP for the assessment of sleep disturbance, it is considered more appropriate to use the criteria established in the NPI. Section 2.5 of the NPI provides the following guidance relating to noise disrupting sleep.

Where the subject development/premises night-time noise levels at a residential location exceed:

- $L_{Aeq,15min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or
- L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater,

a detailed maximum noise level event assessment should be undertaken.

These NPI criteria also align with the World Health Organisation (WHO) Guidelines 1999 criteria.

In all instances, the project-specific noise levels for the evening and night time periods are more stringent than the higher sleep disturbance noise level triggers, and therefore the assessment of evening and night time operational noise levels is considered to provide an indication of potential sleep disturbance.

The operational noise assessment at residences adjacent to Clarence Town Road would exceed the project-specific assessment criteria by between 1 and 2 dB(A) during worst case operating scenarios (noise levels between 36dB(A) and 37dB(A) have been predicted) but would meet the NPI sleep disturbance criteria by at least 3 dB. Therefore the assessment of operational noise during the night time period indicates that night time operations would not result in sleep disturbance.

With regard to the maximum noise level event assessment, the maximum noise levels from a subset of the quarry noise sources could be up to 10 to 15 dB higher than the assumed sound power levels used in the modelling. Therefore, the likely L_{Amax} noise impact from all sources combined (even in the unlikely worst case scenario of all sources operating at maximum levels simultaneously) is predicted to be less than the 52 dB(A) L_{Amax} criterion at the nearest receivers for maximum noise level events and would not result in sleep disturbance. In addition, it is noted that road traffic noise events along Clarence Town Road already exceed this level currently at the nearest receivers.

7.2 TRAFFIC NOISE IMPACT

A reassessment of the road traffic noise prediction model was undertaken to verify the previous noise traffic model and to also include any additional information which may assist in determining a suitable road traffic noise recommendation.

7.2.1 TRAFFIC NOISE MODEL CALIBRATION

The model was calibrated with the noise data from the baseline noise monitoring surveys. The predicted $L_{10, (15hrs)}$ and $L_{10, (9hrs)}$ was compared with the $L_{10, (15hrs)}$ and $L_{10, (9hrs)}$ calculated from logging data, and a calibration constant was determined. **Table 45** provides the results of the measured and predicted $L_{10, (15hrs)}$ and $L_{10, (9hrs)}$ values used to calculate the calibration constants.

Table 45: Model Calibration – dB(A)

Period	Noise Parameter	N02	N07
Day Time	Predicted $L_{A10\ (15hr)}$	52.8	60.7
	Logging (measured) $L_{A10\ (15hr)}$	60.4	61.2
	Difference	+7.6	+0.5
Night Time	Predicted $L_{A10\ (9hr)}$	43.8	51.9
	Logging (measured) $L_{A10\ (9hr)}$	54.4	59.4
	Difference	+10.6	+7.5

The model calibration during the day time is generally acceptable and is representative of the dominance of traffic noise on Brandy Hill Drive, in the area during the daytime. However there was a significant difference between the predicted and the logging measurement levels during the night-time, which is most likely representative of the dominance of other noise sources in the area during the night-time (e.g. noise from insects) and the comparatively lower traffic noise levels from Brandy Hill Drive during the night-time. This is also evident in the results of the road traffic auto-counts for Brandy Hill Drive, with an approximate average of 215 vehicles on the road during the night. With lower volumes of traffic on Brandy Hill Drive during the night the ambient noise levels are most likely influenced by other noise sources such as insects, which contributed to elevated noise levels during the night-time as logged during the baseline surveys.

Calibration of the road traffic noise prediction model was undertaken by comparing the predicted noise levels with the measured noise levels at the monitoring point N07 based on the proximity of the monitoring point N07 to Brandy Hill Drive and the proximity of the monitoring point to the sensitive receptor R19, which is the nearest sensitive receiver to Brandy Hill Drive.

It is acknowledged that the noise monitoring location N02 was situated at a noise sensitive receptor located off Brandy Hill Drive. However, the receptor at N02 is situated further from the road (approximately125m) than the property R19 (approximately 30m) represented by the monitoring location N07. It should be noted the noise measurement at N02 was likely affected by extraneous noise (i.e. insect and wildlife noise), hence the relatively large difference between the predicted and measured road traffic noise.

Calibration of the noise model was also based on the measured noise levels at N07, given the fact that, of the noise monitoring locations taken into consideration for the purpose of this assessment, the noise levels recorded at N07 were not affected by operational quarry noise emissions from the quarry site or road traffic noise emissions on Clarence Town Road. It was therefore considered that calibration of the model with the measured noise levels recorded at the monitoring location N07 was the most accurate approach.

7.2.2 NOISE PARAMETER CONVERSION

To determine the other required noise parameters, logging data was used to calculate differences between the noise parameters. Correction factors are presented in ***Table 46.***

Table 46: Parameters Calibration – dB(A)

Location ID	Noise Parameter	Measured (L_{Aeq})	Measured (L_{A10})	Difference in Noise Parameters (L_{Aeq} – L_{A10})	Predicted (L_{A10})	Difference in Predicted & Measured Results
N02	$L_{Aeq\ (15hr)}$ $L_{Aeq\ (9hr}$	56.7 51.3	60.4 54.4	-3.7 -3.1	52.8 43.8	+7.6 +10.6
N07	$L_{Aeq\ (15hr)}$ $L_{Aeq\ (9hr)}$	60.4 57.3	61.2 59.4	-0.8 -2.1	60.7 51.9	+0.5 +7.5

The total noise source adjustment in the model to predict noise parameters, which include the model calibration and the noise parameter conversion, are shown in ***Table 47*** below. The model calibration value for the night-time period is not added to the overall model adjustment, as the measured noise levels during the night-time were influenced by extraneous noise sources (other than traffic noise, such as insects) and therefore it is assumed that the model calibration during the night-time period is calibrated.

As outlined above, the night-time noise levels were influenced to a greater extent by noise sources such as birds and insects throughout the night, as opposed to traffic noise, which was the dominant noise source in the vicinity of the monitoring locations N02 and N07 during the daytime. It is not possible to model the noise emissions from the natural noise sources such as birdsong and insect noise, due to the variability and randomness of these natural noise sources. The model adjustment/correction factors presented in ***Table 47*** below are calibrated based on the variations recorded during the noise logging surveys in combination with the variations in the predicted road traffic noise levels, in order to more accurately refine the noise prediction results.

Table 47: Summary of Model Adjustments – dB(A)

Location ID	Noise Parameter	Model Cal	Parameter Cal	Total
N02	$L_{Aeq\ (15hr)}$ $L_{Aeq\ (9hr)}$	+7.6 +7.6[1]	-3.7 -3.1	+3.9 -4.5
N07	$L_{Aeq\ (15hr)}$ $L_{Aeq\ (9hr)}$	+0.5 +0.5[1]	-0.8 -2.1	-0.3 -1.6

7.2.3 TRAFFIC NOISE IMPACT ASSESSMENT

7.2.3.1 DAY & NIGHT TRAFFIC NOISE ASSESSMENT

Only one noise sensitive reception point has been modelled to assess the road traffic noise impact from Brandy Hill Quarry traffic travelling on Brandy Hill Drive. This receiver is considered the nearest receiver to the road, and is situated at a set-back distance of approximately 30 metres from Brandy Hill Drive (R19, 25 Brandy Hill Drive), as shown in ***Figure 4***.

The result of the noise predictions associated with the existing traffic volumes and the future traffic generated by the proposed quarry are presented in ***Table 48***. The noise levels presented in ***Table 48*** include the façade correction factor of 2.5dB.

The results indicate that the modelled existing traffic noise levels at the receivers located off Brandy Hill Drive are within the criteria during the night-time period but are above the noise criteria during the day period. As stated in Section 3.4 of the Road Noise Policy and outlined in ***Section 5.3*** above, where the existing traffic noise levels have already exceeded the noise criteria, the objectives are to reduce noise levels through the implementation of reasonable and feasible mitigation and protect against excessive impacts to amenity. In this context, change in noise level of up to 2dB represents a minor impact that is considered barely perceptible to the average person.

[1] Day period model calibration is used for the night time model calibration as the measured noise levels were influenced by other sources.

It is noted that the day period noise assessment has been assessed based on the criterion whereby the difference between the existing traffic noise level and future traffic noise level should not exceed 2dB. For the night-time period noise assessment, the existing noise level is within the noise criteria and therefore the night-time assessment has been assessed based on the applicable noise criterion of $L_{Aeq,9hour}$ 55dB, during the night-time period.

Table 48: Existing and Future Traffic Noise Levels dB(A) at R19 – 25 Brandy Hill Drive

Daytime / Night-time	Existing Noise Levels (Base Traffic Flow)	Traffic Generated		Applicable Noise Criteria	Difference
		Allowable Truck Movements	Future Noise Levels dB(A)		
Day period (7am to 10pm)	62.2	603	63.3	64.2	+1.1
Night Period (10pm to 7am)	52.1	117	54.1	55	+2

Vipac recommends that transport operations for the Brandy Hill Quarry be limited to a total of 603 Hanson truck movements during the daytime period. This recommendation is based on limiting the change in noise level to 2dB or less and assumed background traffic growth of 1% per annum along Brandy Hill Drive. During the night-time period, operations should be limited to 117 trucks movements inclusive of the existing 28 Hanson truck movements.

It is noted that the total allowable truck movements presented in Table 48 has increased from the initial assessment in August 2016. This is due to modified transport operations with the principal change being inclusion of a reduced speed limit of 60km/hr for all Hanson product despatch activities on Brandy Hill Drive. The August 2016 assessment assumed a speed of 88km/hr for all Hanson vehicles. The reduced speed limits result in a lower noise generation and therefore the permissible traffic volume within the relevant noise criteria is higher.

Overall, the predicted noise generated by Brandy Hill Quarry Operations and Quarry Traffic on Brandy Hill Drive would comply with the daytime and night-time noise criteria provided that the total number of truck movements on Brandy Hill Drive is kept within the acceptable limit of 603 truck movements during the daytime and 117 truck movements during the night-time periods respectively.

7.2.3.2 HOURLY ROAD TRAFFIC NOISE ASSESSMENT (MORNING SHOULDER)

The client has advised the operation of the Brandy Hill Quarry will also consist of a morning shoulder despatch period between 5:00am-7:00am. An hourly road traffic noise assessment was also undertaken to determine the limit of truck movements along Brandy Hill Drive between the hours of 5:00am and 7:00am. The hourly road traffic noise assessment is based on the hourly traffic volume count on Brandy Hill Drive determined by Intersect Traffic in March 2015 and the measured road traffic noise level.

The Calculation of Road Traffic Noise (CoRTN) method of traffic noise prediction was used, which is a method approved by the EPA.

Table 49 presents the road traffic noise prediction assumptions used to assess the existing and future (2028) road traffic noise along Brandy Hill Drive and the predicted road traffic noise level. The assumptions for the future predictions also include the number of the various heavy vehicles. The future truck movement limit is based on the 2dB relative increase of the existing hourly road traffic noise

Table 49: Hourly Road Traffic Noise Assessment (Assumptions & Results)

Parameters	Existing Road Traffic Noise (2015)		Future Road Traffic Noise (2028)	
	5:00am to 6:00am	6:00am to 7:00am	5:00am to 6:00am	6:00am to 7:00am
Hourly Traffic Volume	42	75	47	85
Hourly Heavy Vehicle %	25	25	76	69
Heavy Vehicle Amount	Heavy Vehicles: 10	Heavy Vehicles: 19	Martin Creek Quarry: 6* Hanson Trucks: **18** Other Trucks:12 Total: 36	Martin Creek Quarry: 12 Hanson Trucks: **25** Other Trucks:21 Total: 58
Road Speed (km/h)	88	88	60	60
Noise Impact at R19 L_{Aeq} (1 hour)	59.7	62.2	61.7	64.2

* It was advised that the Martin Creek Quarry commence operations at 5:30am, hence only 6 truck movements is assumed.

It is recommended 18 truck movements associated with Brandy Hill Quarry between 5:00am and 6:00am is permitted. Between 6:00am and 7:00am it is recommended 25 truck movements associated with Brandy Hill Quarry would be permissible without exceeding the 2dB relative noise criterion.

The remaining 74 Hanson trucks movements, which is equivalent to an average of 11 truck movements per hour [or more precisely 10.6], is allowed between 10pm and 5am without exceeding the applicable night-time noise criterion.

7.2.4 SLEEP DISTURBANCE

Unattended road traffic noise measurement was undertaken by Vipac between 9th and 14th March 2015 at location N07 and the L_{AMax} was recorded between 61-85dB during the night period. In addition to this, Vipac undertook attended noise measurements near the N07 monitoring location, approximately 30 metres from Brandy Hill Drive, on the 21st and 22nd March 2018. Measurements of trucks passing by were recorded between 71-79dB L_{Amax}. Therefore, the existing trucks passing by already exceeds any noise disturbance L_{Amax} noise guideline outlined within the NSW RNP.

It should be noted the NSW RNP states the following in Section 1.2:

Although it is not mandatory to achieve the noise assessment criteria in this RNP, proponents will need to provide justification if it not considered feasible or reasonable to achieve them. The policy must be used during the environmental assessment of road proposals to develop feasible and reasonable noise mitigation measures.

If the existing trucks passing along Brandy Hill Road already exceed any noise disturbance L_{Amax} noise guideline, then the primary focus for this assessment should be to prevent the higher L_{Amax} noise level of Hanson trucks passing by through reasonable and feasible mitigation.

Hanson Construction Materials have proposed to implement reasonable and feasible preventative measures to minimise truck noise emissions along Brandy Hill Drive. Hanson Construction Materials has committed to reducing truck noise levels (compared to existing noise generated) by reducing the speed limit along Brandy Hill Drive from 80km/h to 60km/h for all Hanson product despatch activities.

It is recommended that truck drivers associated with the Brandy Hill Quarry be instructed to enter and exit the quarry in a courteous manner and without undue traffic noise. Also, truck drivers are advised to avoid the use of engine brakes, particularly within residential areas, to avoid higher noise emissions from trucks. These measures should be included in the existing Driver's Code of Conduct.

The proposed noise management control to be undertaken by truck drivers associated with the Brandy Hill Quarry are more likely to minimise noise emissions along Brandy Hill Drive than any other trucks (and represents a likely reduction in noise from the Hanson trucks relative to other truck users on the road).

7.3 INITIAL DEVELOPMENT (CONSTRUCTION) OF THE PROPOSED EXPANSION AREA OF THE QUARRY

The activities associated with the initial development of the expanded area of the quarry will comprise of excavators removing overburden material and loading the overburden into dump trucks for transportation. The truck movements are associated with establishing the expanded area and the 18/20 metre high amenity barrier. The expanded area also comprises of a dozer, moving the material.

The construction noise assessment has been revised and the following amendments have been made:

- The construction noise predictions are assessed in accordance with the NSW Industrial Noise Policy.
- The amount of construction phases have been reduced from 5 to 2 stages. It was found the previous construction noise layout phases were fairly similar with exception to the truck haul route. The revised construction assessment consists of the following:
    - Construction Stage 1: Operation of Quarry (Stage 1) and establishing the amenity barrier along the boundary of the extended Brandy Hill Quarry.
    - Construction Stage 2: Operation of Quarry (Stage 3) and construction of the fixed crushing plant in the extended Brandy Hill Quarry for the next operational stages (4 and 5).

Noise modelling has been undertaken to assess the potential noise impacts associated with the initial development phase of the proposed expanded area of the quarry for all stages. The results of the noise predictions associated with each stage are presented in ***Table 50*** to ***Table 51.***

It should be noted, any noise impact prediction that is 2dB above the assigned noise criteria at each receiver location is considered non-compliant.

Table 50: Construction Stage 1 during Stage 1 Quarry Operation Noise Impact Prediction – Day time

Receiver ID	Neutral – Day		Worst Case – Day		Noise Criteria Day dB(A)	15dB difference between C & A Weighting	Comply with LFN Spectrum Limit
	dB(A)	dB(C)	dB(A)	dB(C)			
R001-122B Duns Creek Road	0	21	6	26	35	TRUE	COMPLY
R002-16 Uffington Road	0	21	5	27	35	TRUE	COMPLY
R003-60 Green Wattle Creek Road	2	23	12	28	35	TRUE	COMPLY
R004-34 Timber Top Road	0	18	6	23	40	TRUE	COMPLY
R005-35 Timber Top Road	0	17	5	23	40	TRUE	COMPLY
R006-36 Timber Top Road	0	18	6	23	35	TRUE	COMPLY
R007-13 Mooghin Road	17	41	24	45	40	TRUE	COMPLY
R008-14 Mooghin Road	15	39	24	43	40	TRUE	COMPLY
R009-13 Giles Road	8	30	16	33	35	TRUE	COMPLY
R010-13B Giles Road	16	38	24	42	35	TRUE	COMPLY
R011-866 Clarence Town Road	24	44	33	48	37	TRUE	COMPLY
R013.1 -994 Clarence Town Road	29	48	36	51	37	TRUE	COMPLY
R013.2 -104 Brandy Hill Drive	28	46	35	49	37	FALSE	COMPLY
R014-1034 Clarence Town Road	31	50	38	53	37	TRUE	COMPLY
R015-1060 Clarence Town Road	28	46	35	50	37	FALSE	COMPLY
R016-1094 Clarence Town Road	32	51	35	52	37	TRUE	COMPLY
R017-1189 Clarence Town Road	27	46	36	50	40	FALSE	COMPLY
R018-1203 Clarence Town Road	22	41	31	45	40	TRUE	COMPLY

Construction noise (Stage 1) from the Brandy Hill Quarry marginally exceeds the day noise criterion at Receiver R14. Only one marginal exceedance of approximately 1dB is found.

It is recommended that during construction of the amenity barrier that the southern edge of the amenity barrier is formed first during main construction to provide a screen between construction equipment and nearest receivers located along Clarence Town Road.

Table 51: Construction Stage 2 during Stage 3 Quarry Operation Noise Impact Prediction – Day time

Receiver ID	Neutral – Day		Worst Case – Day		Noise Criteria Day dB(A)	15dB difference between C & A Weighting	Comply with LFN Spectrum Limit
	dB(A)	dB(C)	dB(A)	dB(C)			
R001-122B Duns Creek Road	0	21	7	26	35	TRUE	COMPLY
R002-16 Uffington Road	0	22	5	28	35	TRUE	COMPLY
R003-60 Green Wattle Creek Road	2	23	12	28	35	TRUE	COMPLY
R004-34 Timber Top Road	0	18	6	24	40	TRUE	COMPLY
R005-35 Timber Top Road	0	18	5	23	40	TRUE	COMPLY
R006-36 Timber Top Road	0	19	6	24	35	TRUE	COMPLY
R007-13 Mooghin Road	17	41	25	45	40	TRUE	COMPLY
R008-14 Mooghin Road	15	39	22	43	40	TRUE	COMPLY
R009-13 Giles Road	7	28	16	33	35	TRUE	COMPLY
R010-13B Giles Road	16	38	25	42	35	TRUE	COMPLY
R011-866 Clarence Town Road	26	44	34	48	37	FALSE	COMPLY
R013.1 -994 Clarence Town Road	28	47	35	51	37	TRUE	COMPLY
R013.2 -104 Brandy Hill Drive	27	45	35	49	37	FALSE	COMPLY
R014-1034 Clarence Town Road	30	48	37	52	37	TRUE	COMPLY
R015-1060 Clarence Town Road	27	45	34	49	37	TRUE	COMPLY
R016-1094 Clarence Town Road	28	47	36	51	37	TRUE	COMPLY
R017-1189 Clarence Town Road	28	46	37	50	40	FALSE	COMPLY
R018-1203 Clarence Town Road	23	41	32	46	40	FALSE	COMPLY

Construction noise (Stage 2) from the Brandy Hill Quarry meets the day noise criterion at all receivers. All noise impact predictions for construction stages were found to be within the low frequency noise spectrum limits, as specified in Section 5.1.1.

It is noted that the construction noise limit (established in accordance with the INP) should serve as a guideline only, and note that the construction of the amenity barrier is only temporary and is not treated as long-term/permanent noise source.

It is recommended that a Noise Compliance Management Strategy be implemented for Brandy Hill Quarry to ensure minimal impact on surrounding receivers. This should comprise of a noise monitoring programme whereby Brandy Hill Quarry operational phase noise emissions are assessed at the nearest noise sensitive receptors by way of an attended environmental noise monitoring survey at a frequency to be determined in consultation with NSW EPA.

8 ADDITIONAL NOISE CONTROL MEASURES

8.1 OPERATIONAL NOISE

The following noise control recommendations should be considered for operation of the Brandy Hill Quarry.

8.1.1 NOISE MANAGEMENT FOR TRUCK DRIVERS

All truck drivers associated with the Brandy Hill Quarry should be adhere to the following noise management control

1. Strict adherence to the approved hours of operation for transport activities will be enforced by management.
2. All project employees and contractors are to be instructed to enter and exit the quarry in a courteous manner and without undue traffic noise. And to also be advised to keep within the speed limits and engine brakes are avoided, particularly within residential areas, to avoid higher noise emissions from trucks.
3. All access roads would be signposted and speed limited to minimise transport noise.

8.1.2 TONAL NOISE

A review of the 1/3 octave band Sound Power Levels of the machines listed below have been undertaken to identify any tonal noise output:

- Crusher 3 + 4
- Primary Crusher
- Secondary Crusher
- Screen 5
- Screen 1, 2, 3 and 4 (these screens are considered to have the same Sound Power Level)
- Dump Truck Cat 77B tipping into Crusher
- Dump Truck CAT 773B
- Excavator PC600
- Loader WA 500
- Watercart
- Excavator
- Pugmill
- Volvo L250G
- Truck Idling
- Truck being loaded
- Truck revving
- Conveyor driver (enclosed)
- Conveyer belt
- Mobile Impact Crusher (Concrete Recycling Plant)

It was noted the Dump Truck CAT 773B has a tonal noise emission at 2kHz and it is recommended an acoustic assessment be undertaken to determine the cause. Potential control measures to reduce the tonal noise may include installing a muffler.

The Sound Power Level survey is to be undertaken annually and a review of the 1/3 octave band Sound Power Levels should also be undertaken to identify tonal noise output. Further details of the annual noise assessment are outlined in Section 8.1.3.

It is also recommended that all mobile equipment be provided with a broadband quacker alarm to avoid any tonal noise emissions.

8.1.3 NOISE MONITORING PLAN

The following noise program has been developed to ensure the noise compliance at the nearest noise sensitive receivers. The proposed quarterly noise surveys and assessments will cover noise survey locations, analysis of monitored data and reporting to check and confirm noise compliance.

The monitoring program will be conducted in general accordance with the NSW Industrial Noise Policy and Australian Standard 1055: 1997: Acoustics – Description and Measurement of Environmental Noise. Monitoring will consist of attended noise monitoring at the nearest affected residences outlined in ***Table 52***. Additionally, a noise reference site will be established at an intermediate location to monitor the actual noise levels from quarry operations.

Table 52: Table of Nominated Monitoring Locations (Quarterly Surveys)

Rec ID	Address	Monitoring Time and Frequency		
		Day	Evening	Night
R07	13 Mooghin Road	1	1	1
R10	13B Giles Road	1	1	1
R13	994 Clarence Town Road	1	1	1
R16	1094 Clarence Town Road	1	1	1
R17	1189 Clarence Town Road	1	1	1

Quarterly Noise Surveys – Operational

The quarterly noise monitoring program should consist of the following:

- Conduct attended noise monitoring surveys on a quarterly basis at nominated sites, as provided in ***Table 52***.
- Noise from the premises are to be measured at the most affected point or within the residential boundary or at the most affected point within 30 meters of the dwelling where the dwelling is more than 30 meters from boundary to determine the $L_{Aeq,15min}$ noise limit given in ***Table 19***. The modification factors presented in Section 4 of the NSW Industrial Policy shall also be applied to the measured noise level where applicable.
- At each nominated monitoring location, the attended measurements shall be conducted using Type 1 integrating sound level meter over a 15 minute period on at least one occasion during daytime (7am to 6pm), evening (6pm to 10pm) and night time (10pm to 7am). During the survey, the operator will identify the character and duration of acoustically significant noise sources.
- On-site meteorological data is to be collected from the quarry weather station and also during operator attended surveys using a hand held meter. Atmospheric conditions including wind speed, wind direction and air temperature will be measured prior to each attended noise monitoring session.
- Reporting of noise results from each monitoring period will include the following:
    - Summary of appropriate noise descriptors;
    - Evaluation of results, including analysis and correlation of data from attended monitoring and weather stations and comparison with noise limits;
    - Reports will include a statement of compliance.

Instrumentation and Measurement Parameters

All acoustic instrumentation for the monitoring plan shall meet the requirements of AS IEC 61672 Sound Level Meters and carry current NATA or manufacturer calibration certificates. Monitoring instrumentation shall be programmed to continuously record statistical noise level indices in 15 minute intervals (which would include metrics, L_{Amax}, L_{A1}, L_{A10}, L_{A90} L_{Aeq}, and may include L_{A5}, L_{A50} and L_{Amin}). Instrument calibration shall be conducted before and after each survey, with variation in calibrated levels not to exceed ± 0.5 dB.

All noise measurements should be accompanied by both qualitative description (including cloud cover) and quantitative measurements of prevailing local weather condition throughout the survey period.

Plant Noise Surveys

An acoustic survey of plant and equipment shall be conducted annually or at the request of the regulators.

The purpose of the survey is to ascertain sound power levels for individual items of plant and equipment in order to subsequently determine the acceptability. Sound power levels would then be correlated with any non-compliance to assist in identifying specific areas for further investigation. Such evaluation will take into account engineering, safety, economic, regulatory and other considerations.

Additionally, a review of the 1/3 octave band Sound Power Levels should also be conducted to identify tonal noise output.

Traffic Noise Monitoring

Traffic noise monitoring shall include the following items:

- Conduct unattended noise monitoring surveys for the duration of one week on a quarterly basis at the nearest receiver located on the proposed truck route (i.e. Brandy Hill Drive, Clarence Town Road, etc.)
- Noise from the premises is to be measured at the most affected point, which is 1 meter from the dwelling façade.
- On site meteorological data is to be collected from the quarry weather station. Atmospheric conditions including rain, wind speed, wind direction and air temperature shall be recorded during the measurement period.
- Reporting of noise results from each monitoring period will include the following:
    - Raw data from noise logger;
    - Evaluation of results, including analysis and correlation of data from unattended monitoring and weather stations and comparison with noise limits;
    - Reports will include statement of compliance.

8.2 CONSTRUCTION NOISE MANAGEMENT

Work practices at any time of day.

- Use toolbox talks to discuss ways to minimise noise;
- Ensure site managers periodically check the site and nearby residences and other sensitive land uses for noise problems so that solutions can be quickly applied;
- Include in tenders, employment contracts, subcontractor agreements and work method statements clauses that require minimisation of noise and compliance with directions from management to minimise noise;
- Avoid the use of radios or stereos outdoors where neighbours can be affected;
- Avoid shouting, and minimise talking loudly and slamming vehicle doors;
- Keep truck drivers informed of designated vehicle routes, parking locations, acceptable delivery hours or other relevant practices (for example, minimising the use of engine brakes, and no extended periods of engine idling).
- Develop simple signage and display in clearly visible locations around the site that relate to relevant work practices and noise control.

It is also important to interact with the community to ensure a good working relationship between the proponent and the community, receive feedback on the project's environmental performance and work cooperatively towards the outcomes of benefit to the project.

Table 53 gives a guideline approach to community consultation, notification and complaint handling. This guide is adopted from the Interim Construction Noise guideline and is suitable for this project and provides measure such as letter box drops, project specific respite offer, phone calls and specific notification.

Table 53: Construction and notification guideline adopted from the Interim Construction Noise Guideline

Consultation and Notification
Notification before and during construction
• Provide, reasonably ahead of time, information such as total building time, what works are expected to be noisy, their duration, what is being done to minimise noise and when respite periods will occur. For works outside standard hours, inform affected residents and other sensitive land use occupants between five and 14 days before commencement. • Provide information to neighbours before and during construction through media such as letterbox drops, meetings or individual contact. In some areas, the proponent will need to provide notification in languages other than English. A website could also be established for the project to provide information. • Use a site information board at the front of the site with the name of the organisation responsible for the site and their contact details, hours of operation and regular information updates. This signage should be clearly visible from the outside and include afterhours emergency contact details. • Maintain good communication between the community and project staff. • Appoint a community liaison officer where required. • For larger projects consider a regular newsletter with site news, significant project events and timing of different activities. • Provide a toll free contact phone number for enquiries during the works. • Facilitate contact with people to ensure that everyone can see that the Site Manager understands potential issues, that a planned approach is in place and that there is an ongoing commitment to minimise noise.
Complaints handling
• Provide a readily accessible contact point, for example through 24 hour toll free information and complaint's line. • Give complaints a fair hearing. • Have a documented complaints process, including an escalation procedure so that if a complainant is not satisfied there is a clear path to follow. • Call back as soon as possible to keep people informed of action to be taken to address noise problems. Call back at night time only if requested by the complainant to avoid further disturbance. • Provide a quick response to complaints, with complaints handling staff having both a good knowledge of the project and ready access to information. • Keep a register of any complaints, including details such as date, time, person receiving complaint, complainant's phone number, person referred to, description of the complaint, work area (for larger projects), time of verbal response and timeframe for written response where appropriate

9 CONCLUSION

A noise impact assessment has been undertaken to determine the potential noise impact associated with the proposed expansion of the existing Brandy Hill Quarry, on noise sensitive receptors in the surrounding area.

The noise assessment comprised of determining the operational and construction noise emissions from the Brandy Hill Quarry and assessing the existing and future road traffic noise generated along Brandy Hill Drive. The noise prediction model assumptions, including the noise control plan/strategies, are outlined in Section 6 of this report. The noise controls include enclosures and multiple barriers/earthbunds to be implemented.

Noise prediction modelling has been undertaken for five operational stages and two construction stages associated with the proposed expansion of the quarry, taking into consideration both the neutral and worst-case conditions during the day, evening and night periods. Operational noise during each stage of the proposed expansion is predicted to be generally compliant with the Project Specific Noise Levels. Non-compliance with the Project Specific Noise Levels has been predicted at some residences along Clarence Town Road during worst case operating and climate conditions. However this is predicted to be in the range of 1dB(A) to 2dB(A) above the criteria level and is considered a negligible impact. Regardless, Hanson has committed to a range of noise mitigation and management measures including a quarterly noise monitoring program that would confirm that noise levels are at or below predicted levels. The assessment of operational noise during the night time period indicates that night time operations would not result in sleep disturbance. Construction noise is predicted to comply at surrounding receiver locations. However, noise management control should be implemented to ensure construction noise is kept to a minimum.

The predicted heavy vehicle traffic noise generated by the quarry is predicted to comply with the relevant criteria, provided the total number of truck movements along Brandy Hill Drive does not exceed the prescribed allowable trucks. Trucks are a feature of the local setting, with Clarence Town Road and Seaham Road important arterial connections to regional areas. Existing road traffic noise levels already exceed the road noise criteria during the day time period, which has been confirmed from consultation with the local community. Hanson is proposing to limit hourly product despatch levels to 30 laden loads per hour, consistent with current operations. In addition, Hanson would introduce a speed limit of 60km/hr for all product despatch activities on Brandy Hill Drive. The road traffic noise assessment has concluded that the proposed traffic limits would limit the change in noise level for the daytime period to a level less than 1.1dB(A). A change in noise level of 2dB(A) is considered barely perceptible to the average human ear and therefore it is concluded that the change to day time road traffic noise levels would be negligible. The proposed limit to transport levels during the night time period would limit the change in noise level to less than 2dB(A) and remain within the relevant criteria specified in the Road Noise Policy. Hanson's commitment to introduce a speed limit of 60km/hr for all product despatch activities on Brandy Hill Drive would result in reduced noise generated by product despatch activities that use Brandy Hill Drive. This would effectively reduce the maximum noise levels likely to cause sleep disturbance.

Additional noise control recommendations and management steps are outlined in Section 8. All feasible and reasonable noise control measures have been considered, including consideration of further noise control for any receiver likely to be affected by excessive noise. In addition to this, a regular noise monitoring program (including quarterly surveys at nominated residential sites, traffic noise surveys and an annual survey of quarry plant and equipment) is recommended to ensure noise amenity and compliance is monitored, checked and reported as an ongoing measure.

Appendix A NOISE LOGGING RESULTS

Figure 9-1: Monitoring Location N01

Figure 9-2: Monitoring Location N02

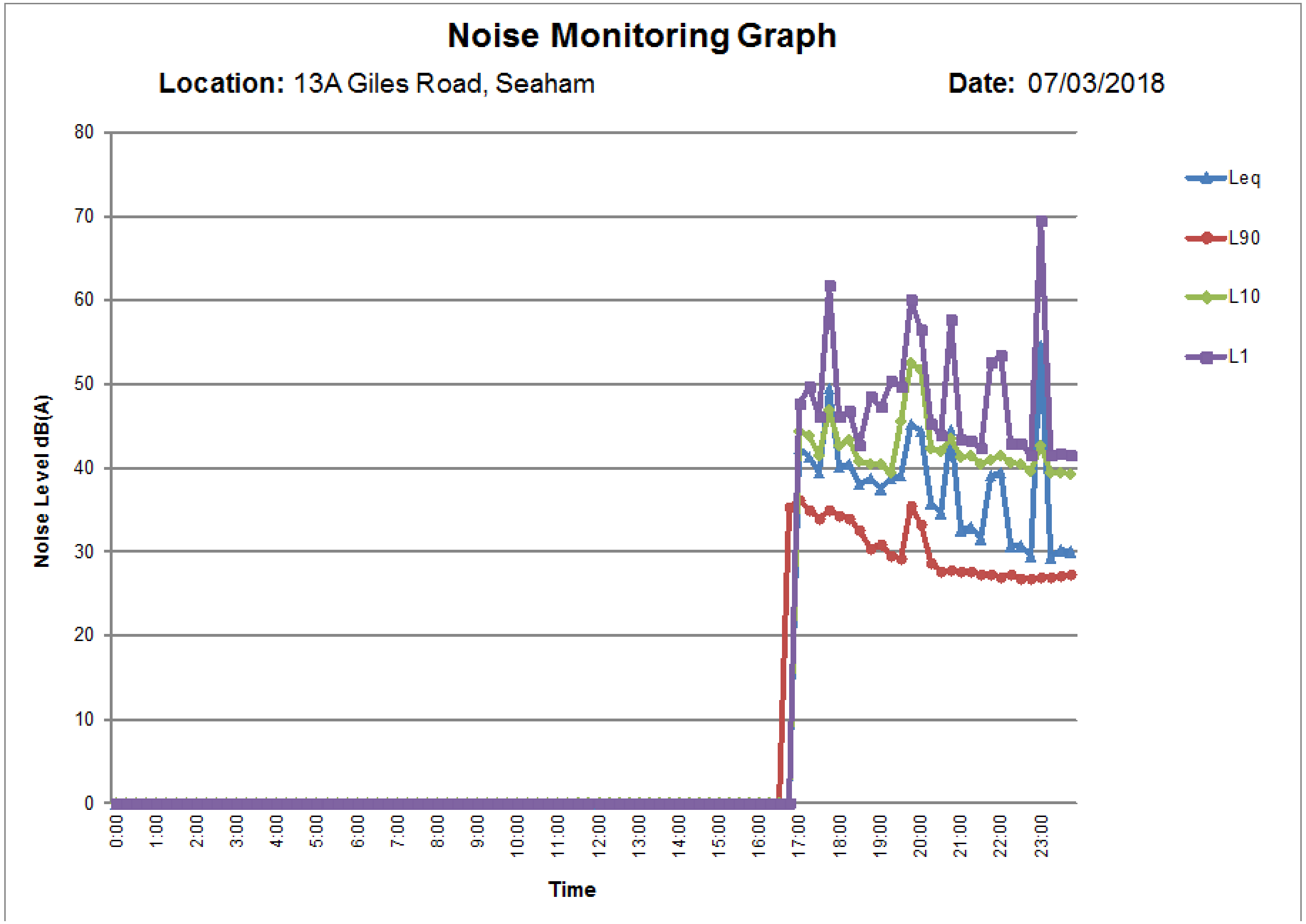
Figure 9-3: Monitoring Location N03

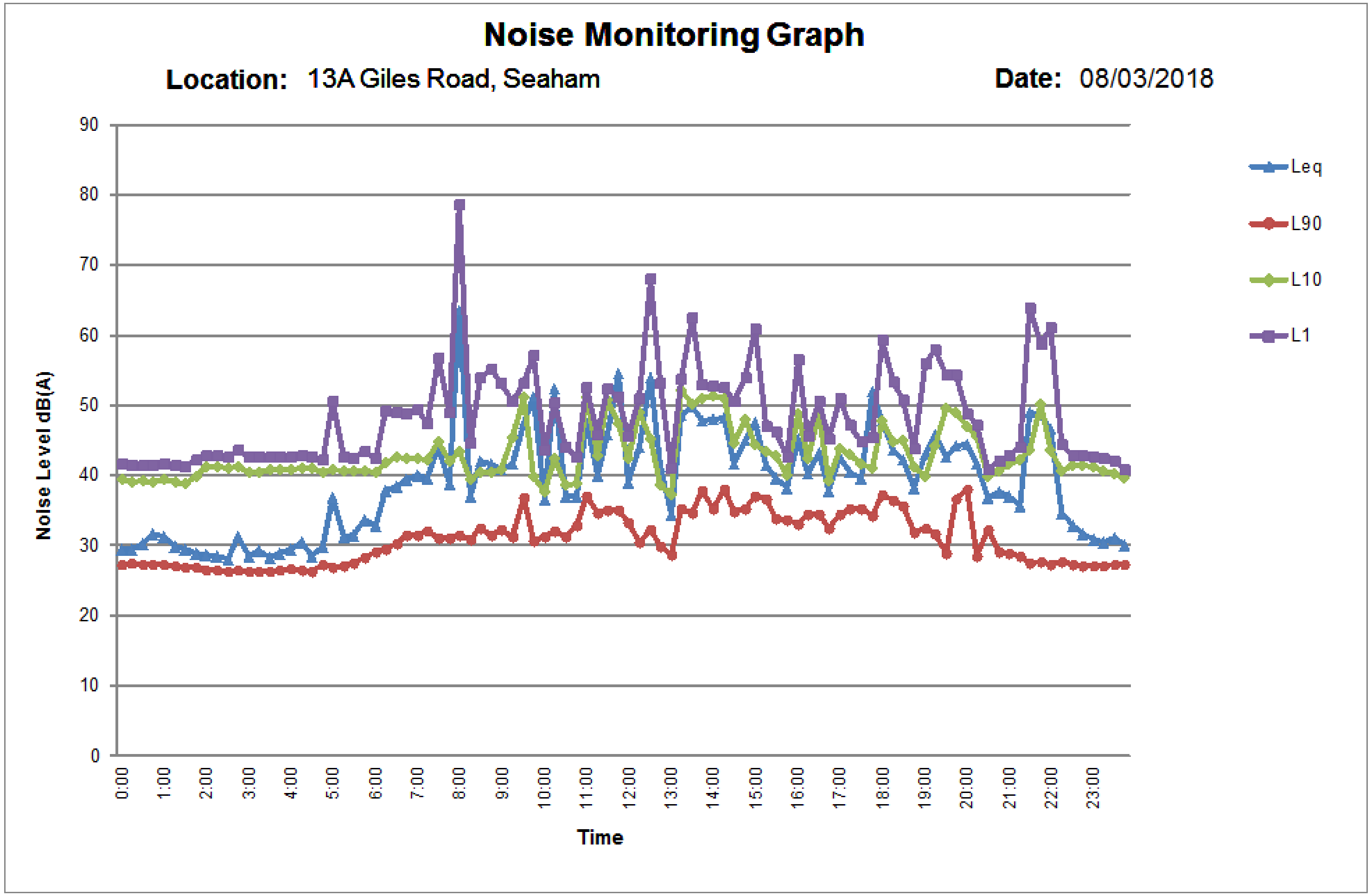
Figure 9-4: Monitoring Location N04

Figure 9-5: Monitoring Location N05

Figure 9-6: Monitoring Location N07

Appendix B NOISE GRAPHS




Noise Monitoring Graph
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Date: 08/03/2018
Noise Level dB(A)
90
80
70
60
50
40
30
20
10
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
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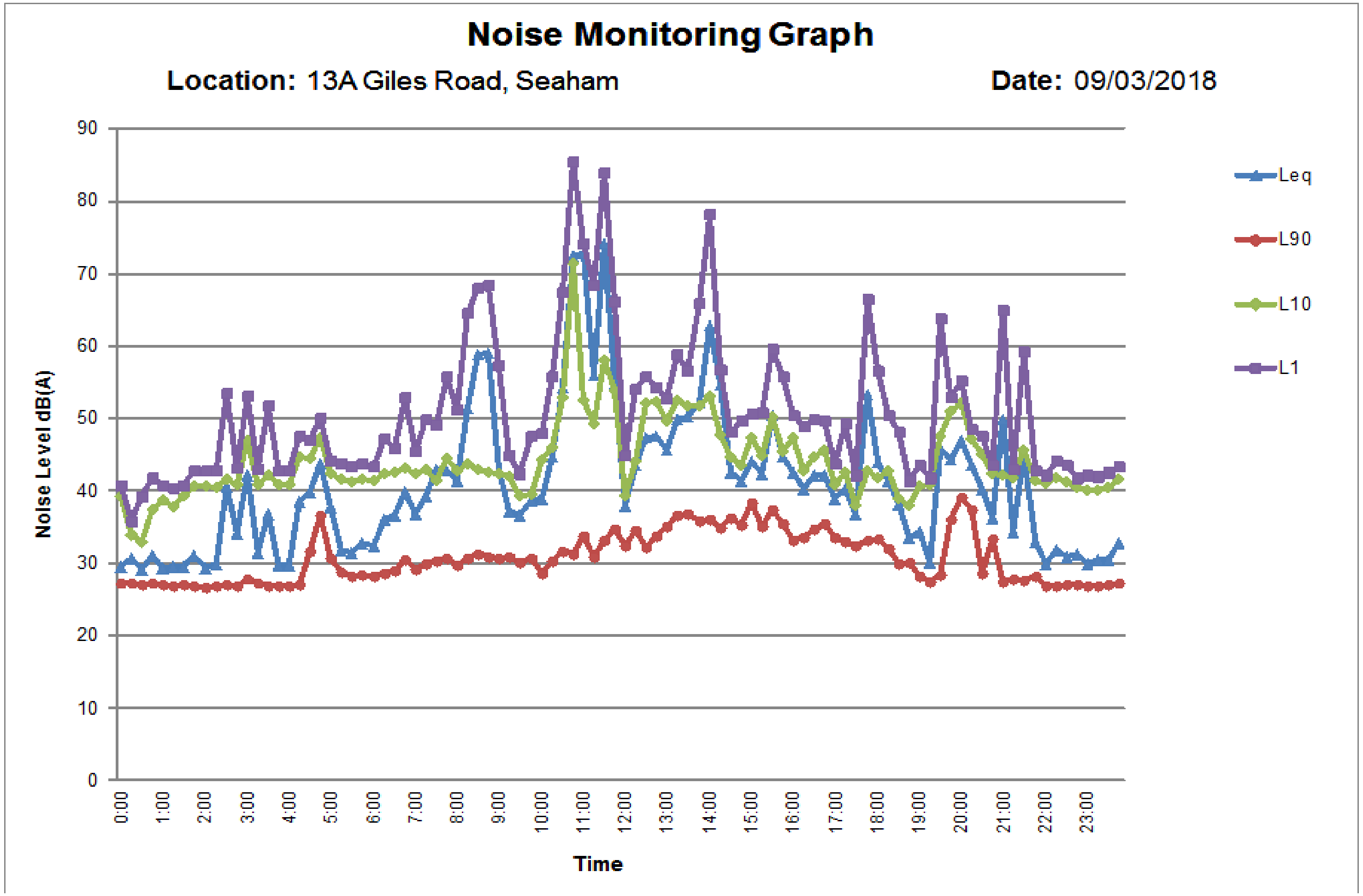
23:00
Time
Leq
L90
L10
L1


Noise Monitoring Graph
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Date: 09/03/2018
Noise Level dB(A)
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50
40
30
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4:00
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6:00
7:00
8:00
9:00
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11:00
12:00
13:00
14:00
15:00
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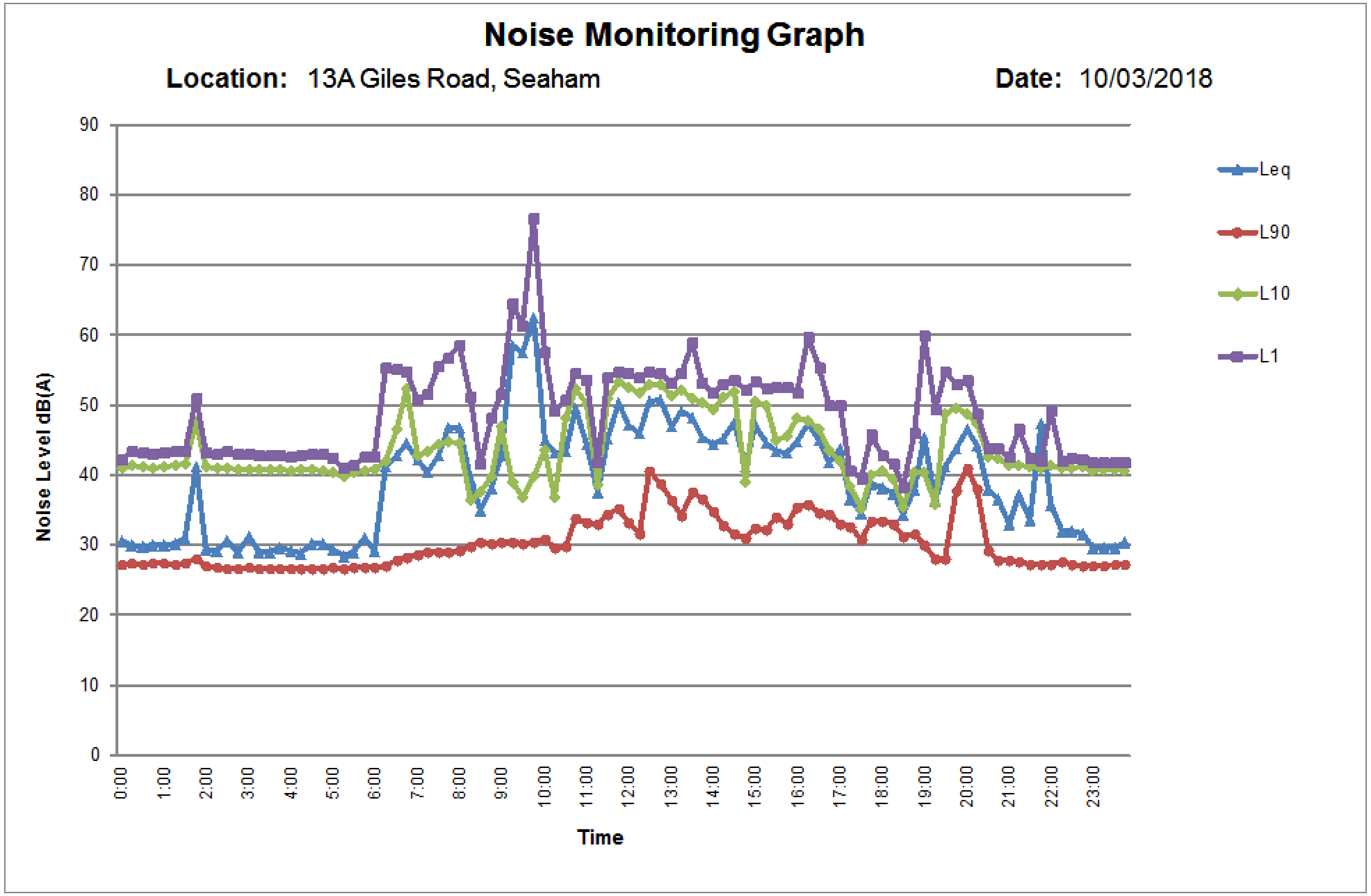
Leq
L90
L10
L1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2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
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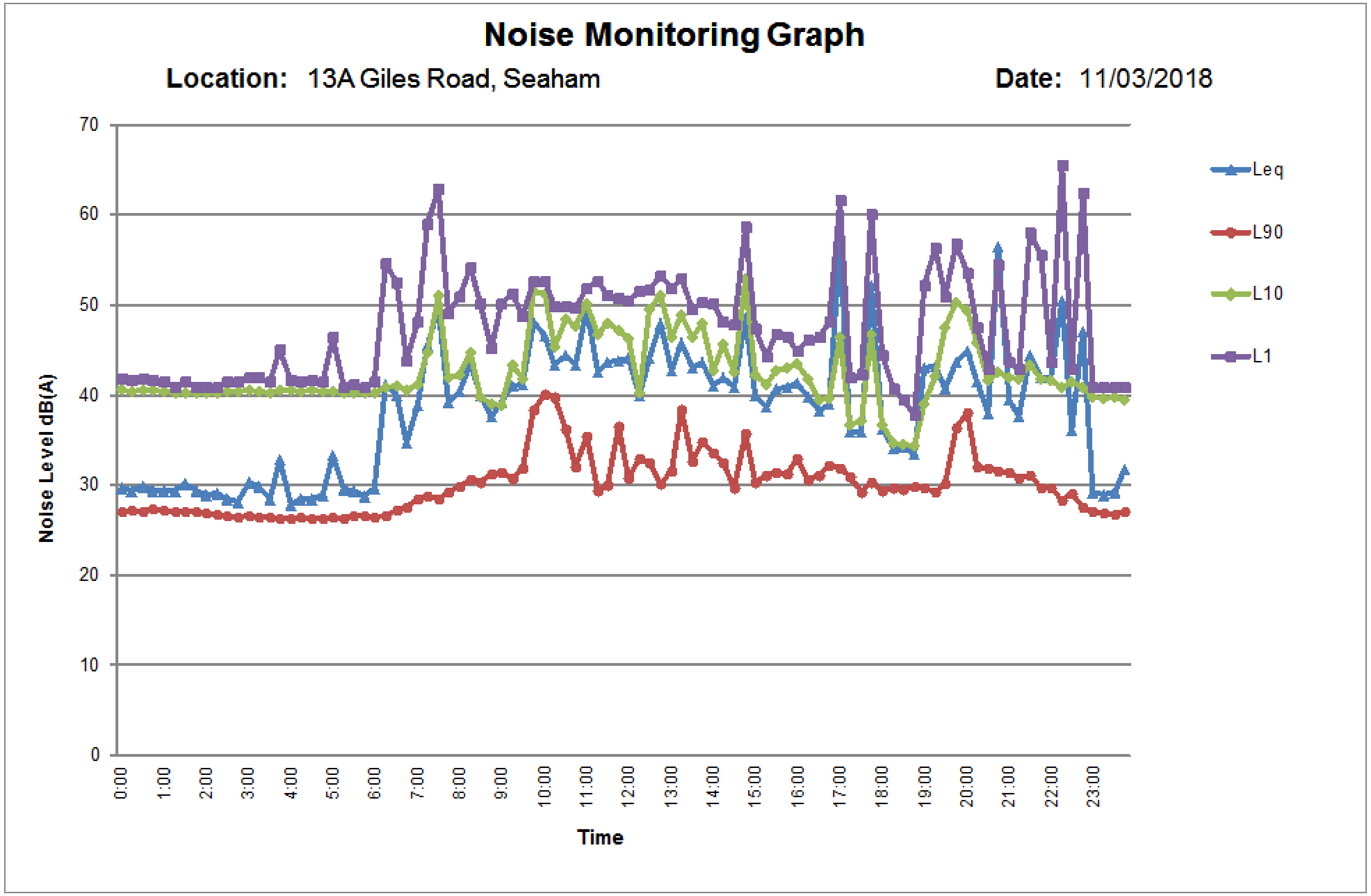
Leq
L90
L10
L1


Noise Monitoring Graph
Location: 13A Giles Road, Seaham
Date: 11/03/2018
Noise Level dB(A)
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40
30
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0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
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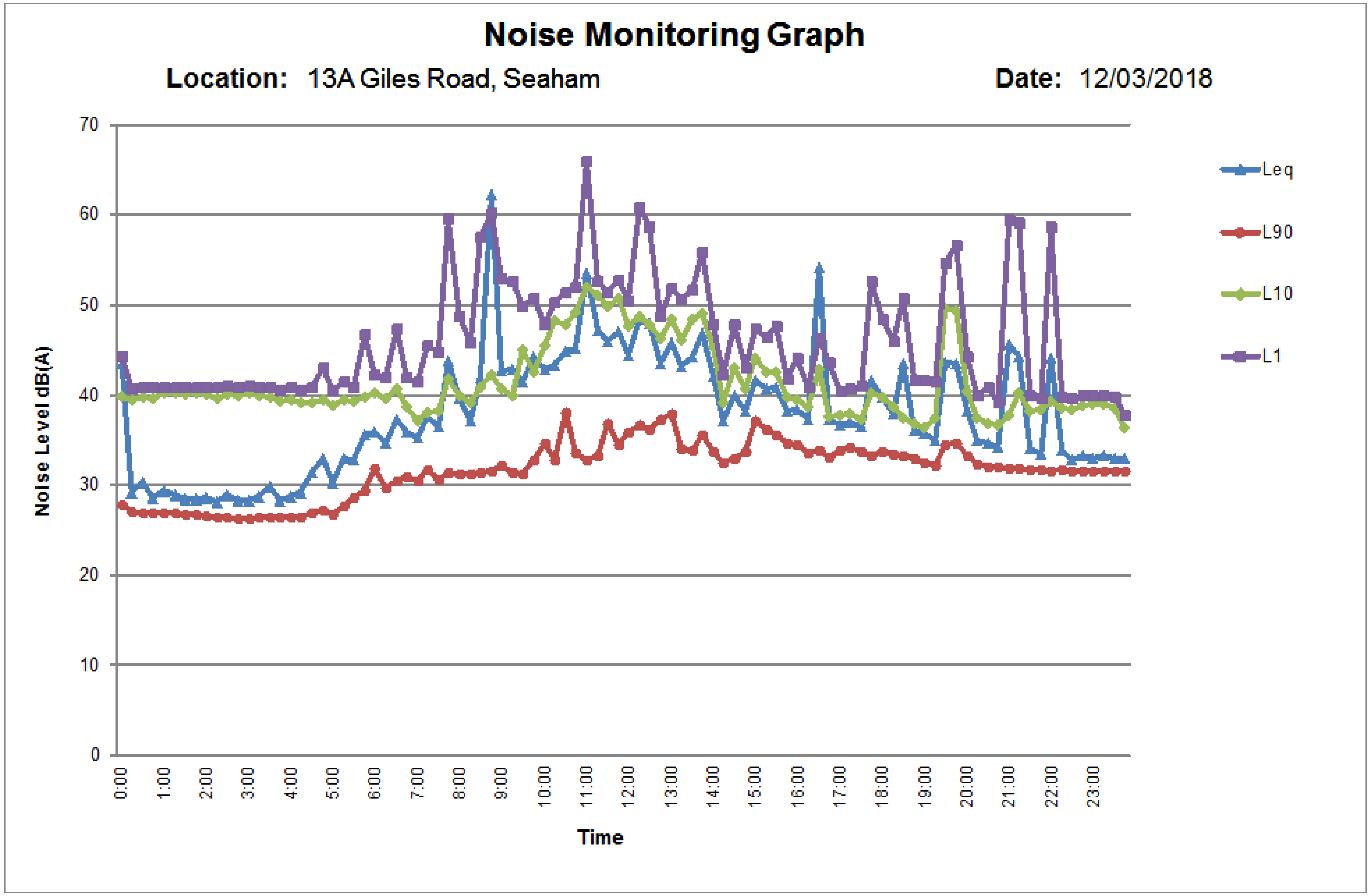
Noise Monitoring Graph
Location: 13A Giles Road, Seaham
Date: 12/03/2018
Noise Level dB(A)
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40
30
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1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
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11:00
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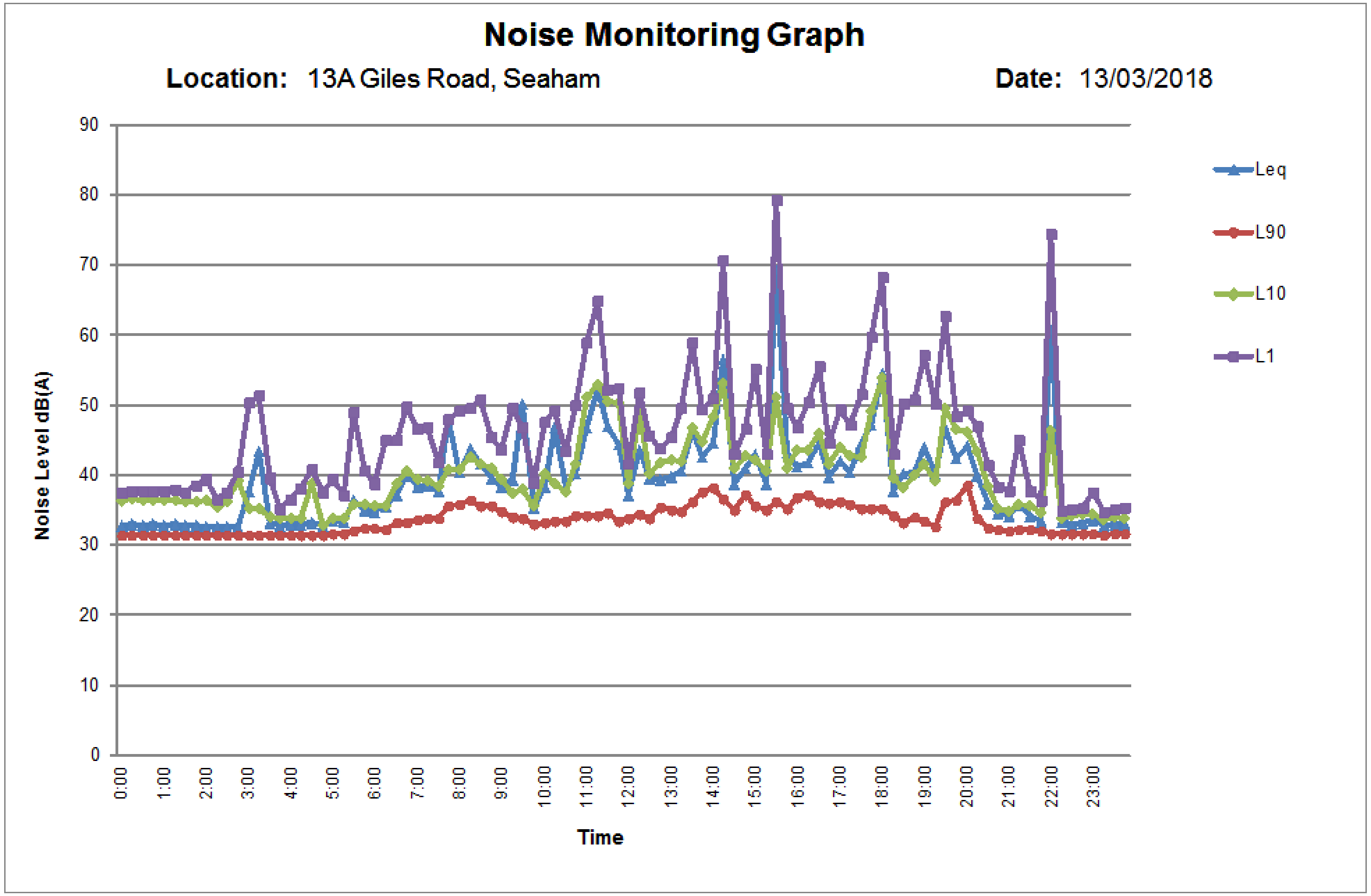
L10
L1


Noise Monitoring Graph
Location: 13A Giles Road, Seaham
Date: 13/03/2018
Noise Level dB(A)
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30
40
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11:00
12:00
13:00
14:00
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19:00
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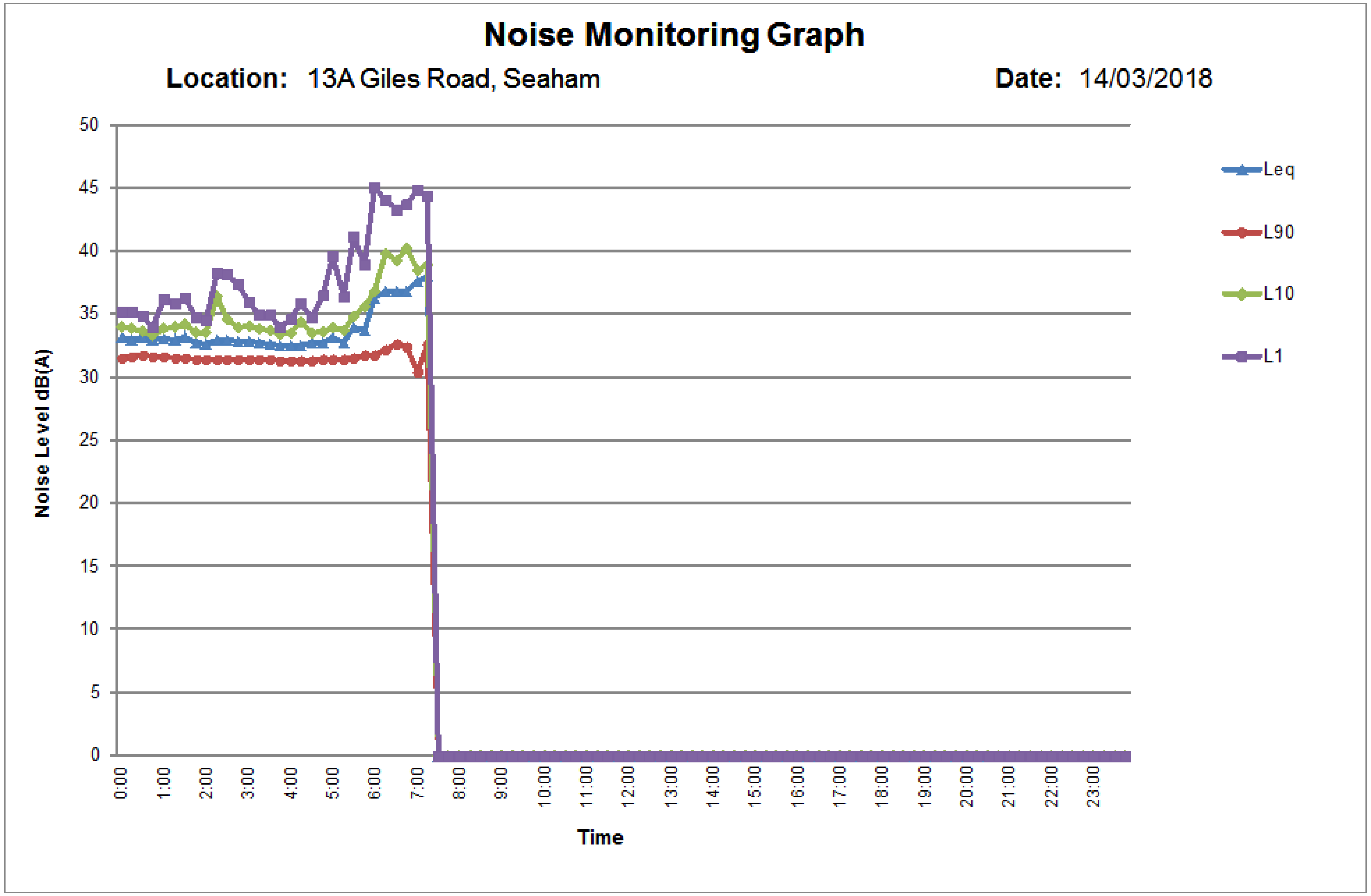
22:00
23:00
Leq
L90
L10
L1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Date: 14/03/2018
Noise Level dB(A)
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35
30
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20
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10
5
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
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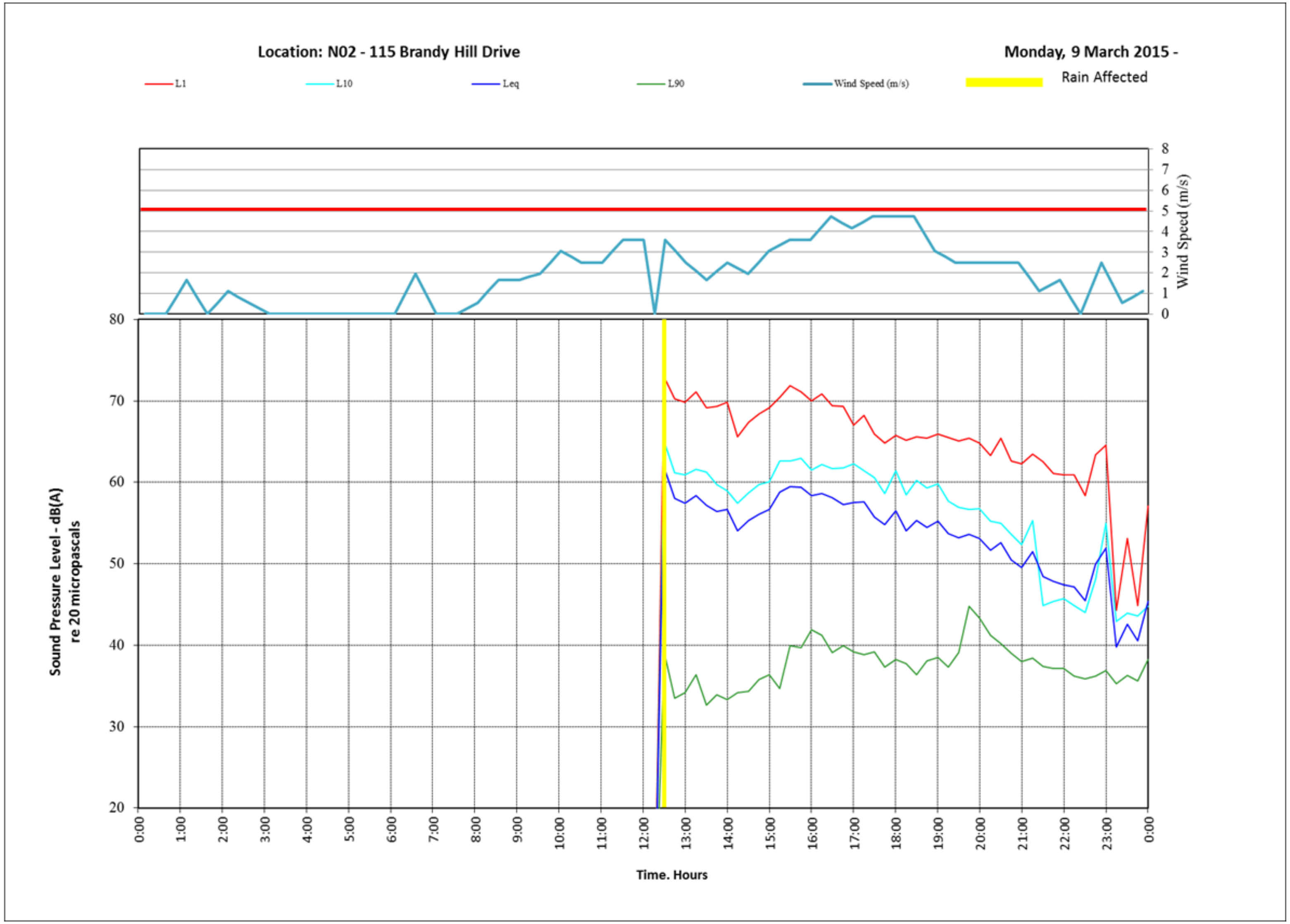
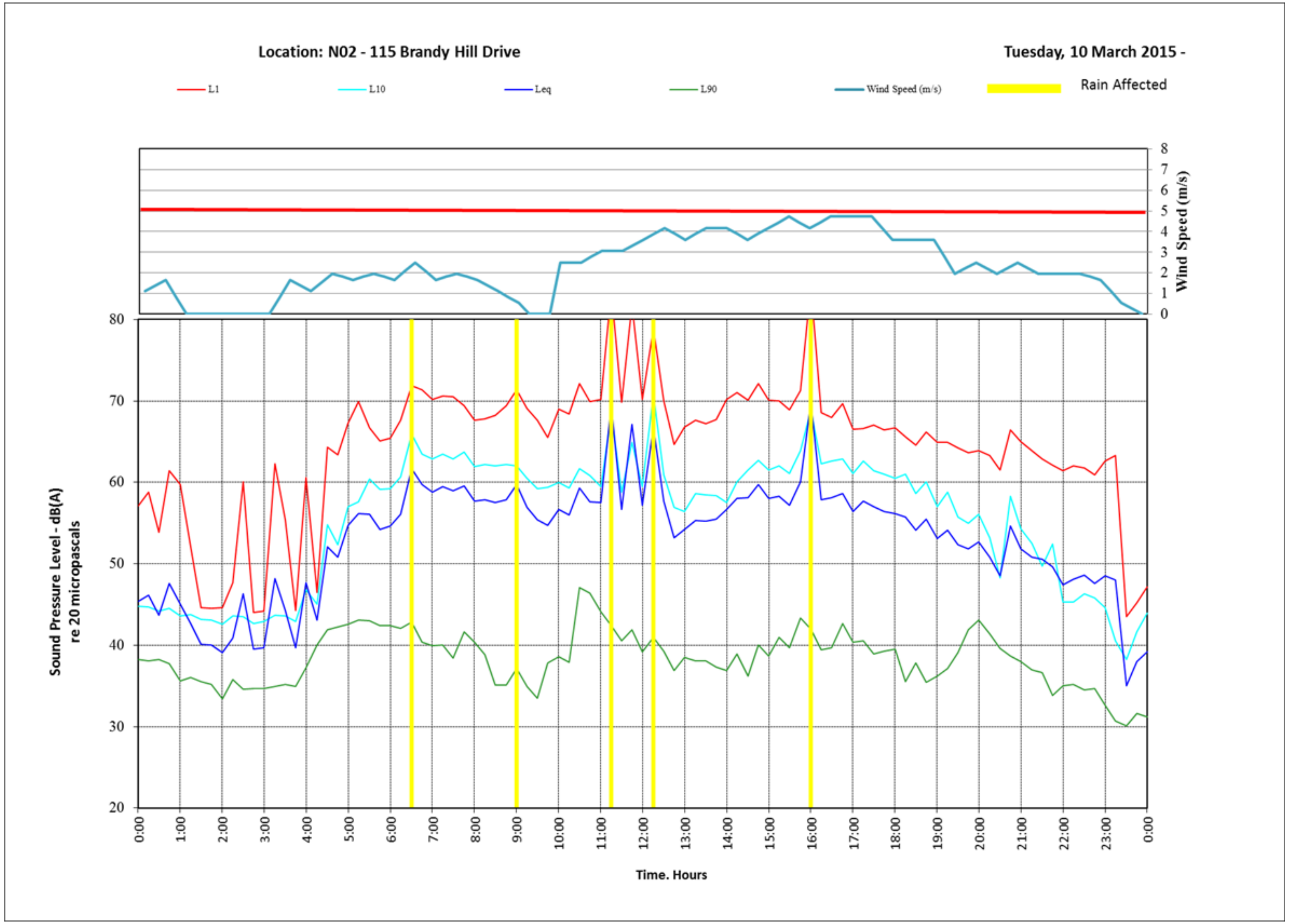
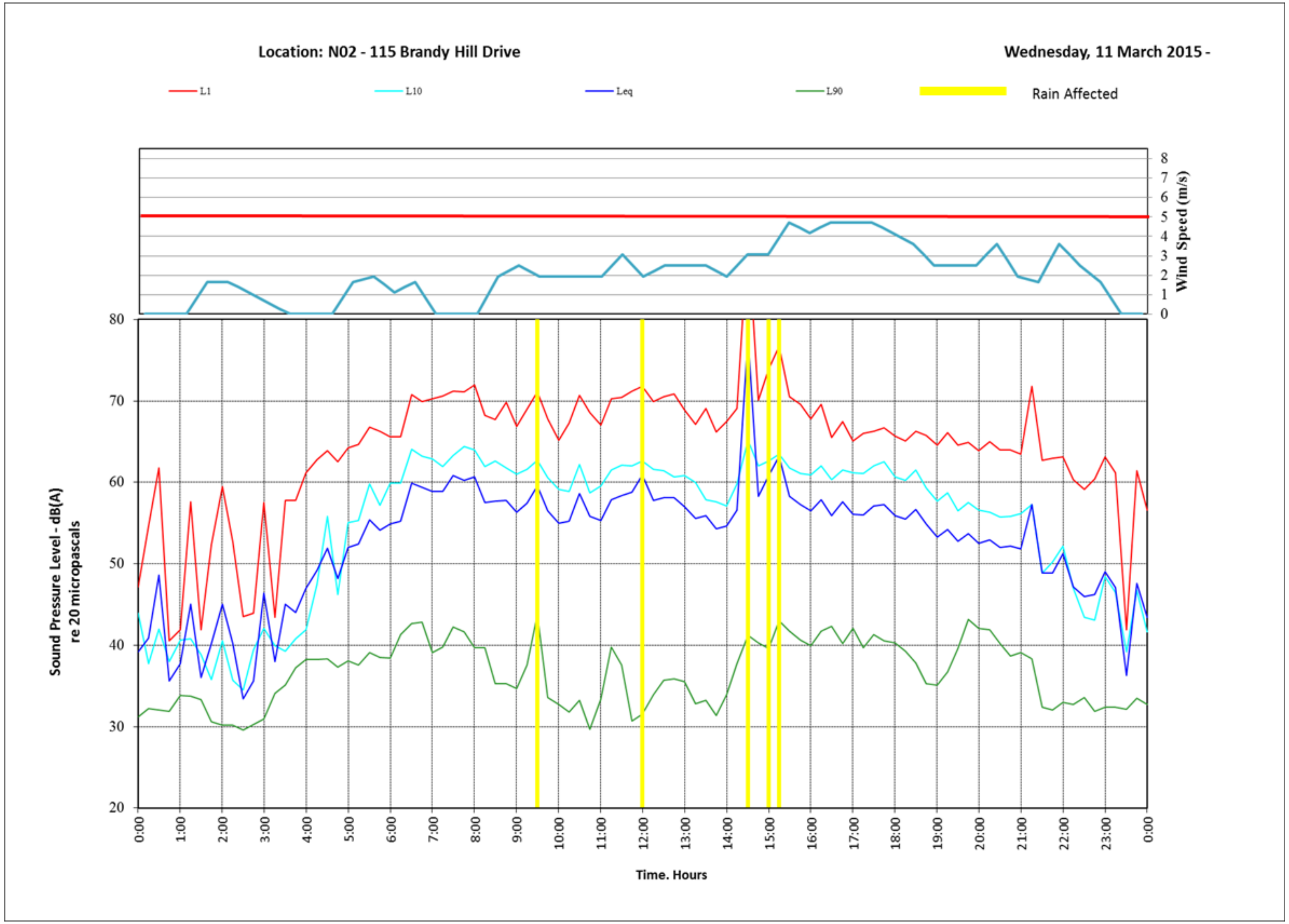
Leq
L90
L10
L1


Location: N02 - 115 Brandy Hill Drive
Monday, 9 March 2015 -
L1
L10
Leq
L90
Wind Speed (m/s)
Rain Affected
Wind Speed (m/s)
Sound Pressure Level - dB(A) re 20 micropascals
Time. Hours


Location: N02 - 115 Brandy Hill Drive
Tuesday, 10 March 2015 -
L1
L10
Leq
L90
Wind Speed (m/s)
Rain Affected
Wind Speed (m/s)
Sound Pressure Level - dB(A) re 20 micropascals
Time. Hours


Location: N02 - 115 Brandy Hill Drive
Wednesday, 11 March 2015 -
L1
L10
Leq
L90
Rain Affected
Wind Speed (m/s)
Sound Pressure Level - dB(A) re 20 micropascals
Time. Hours
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
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18:00
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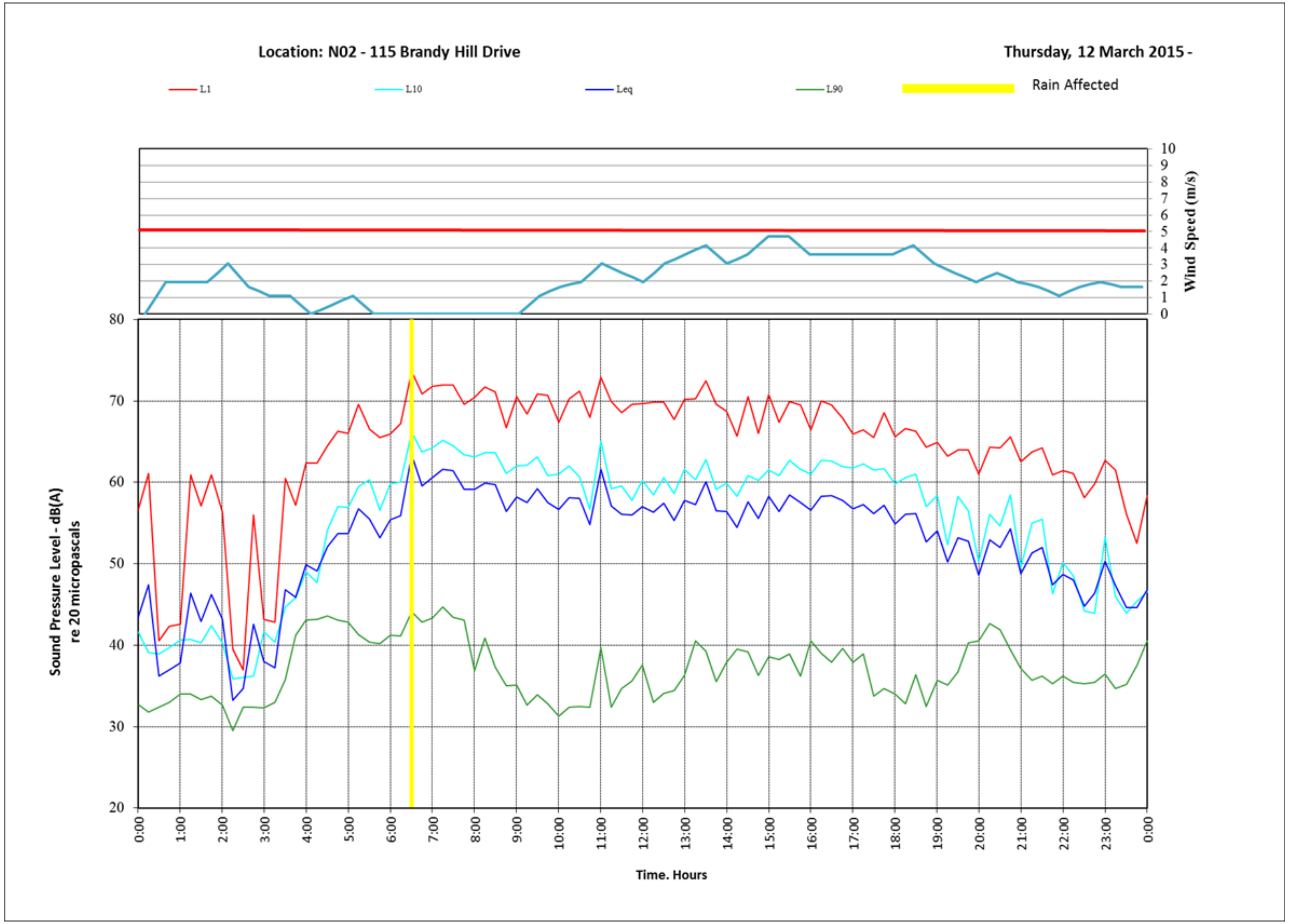
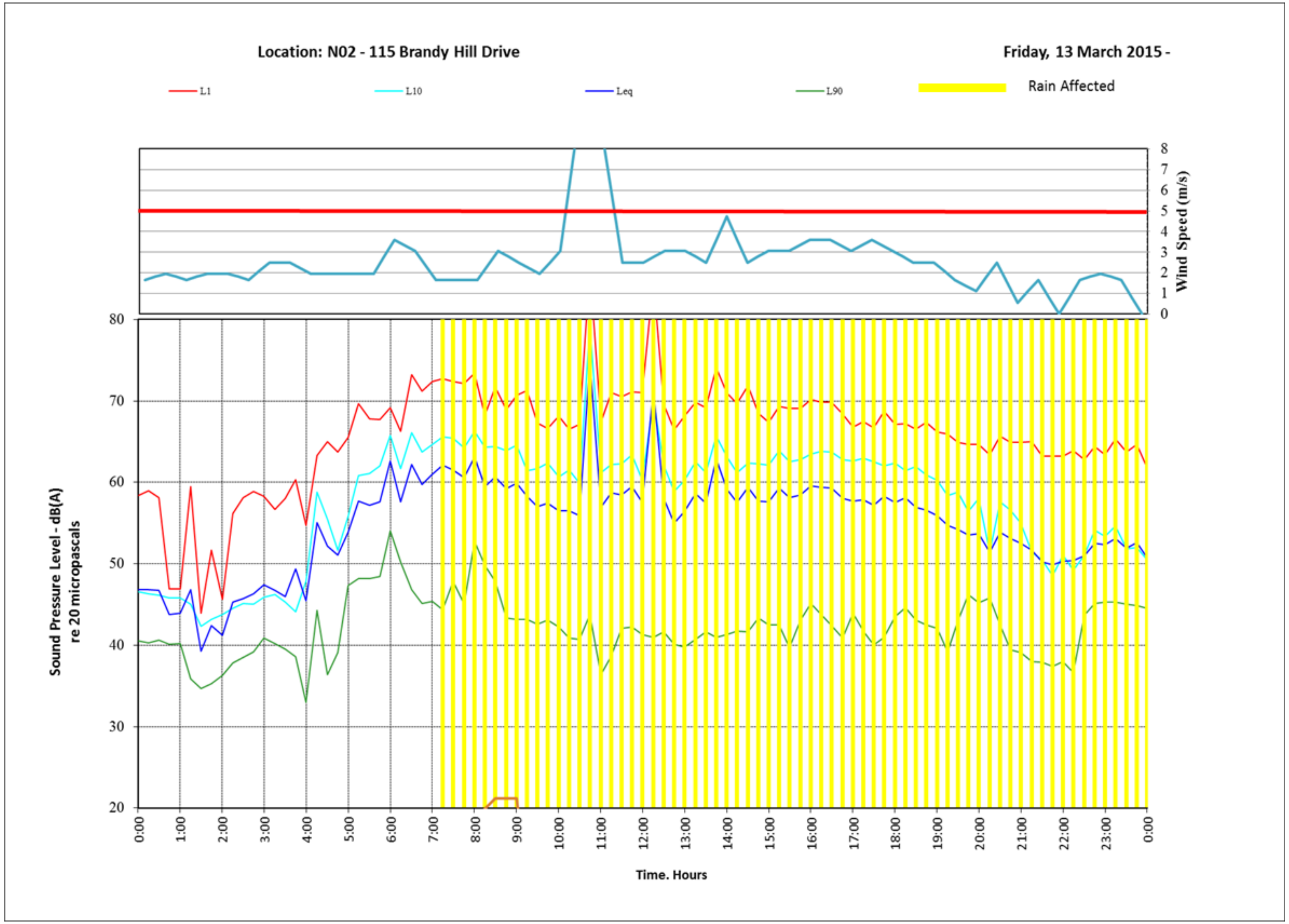
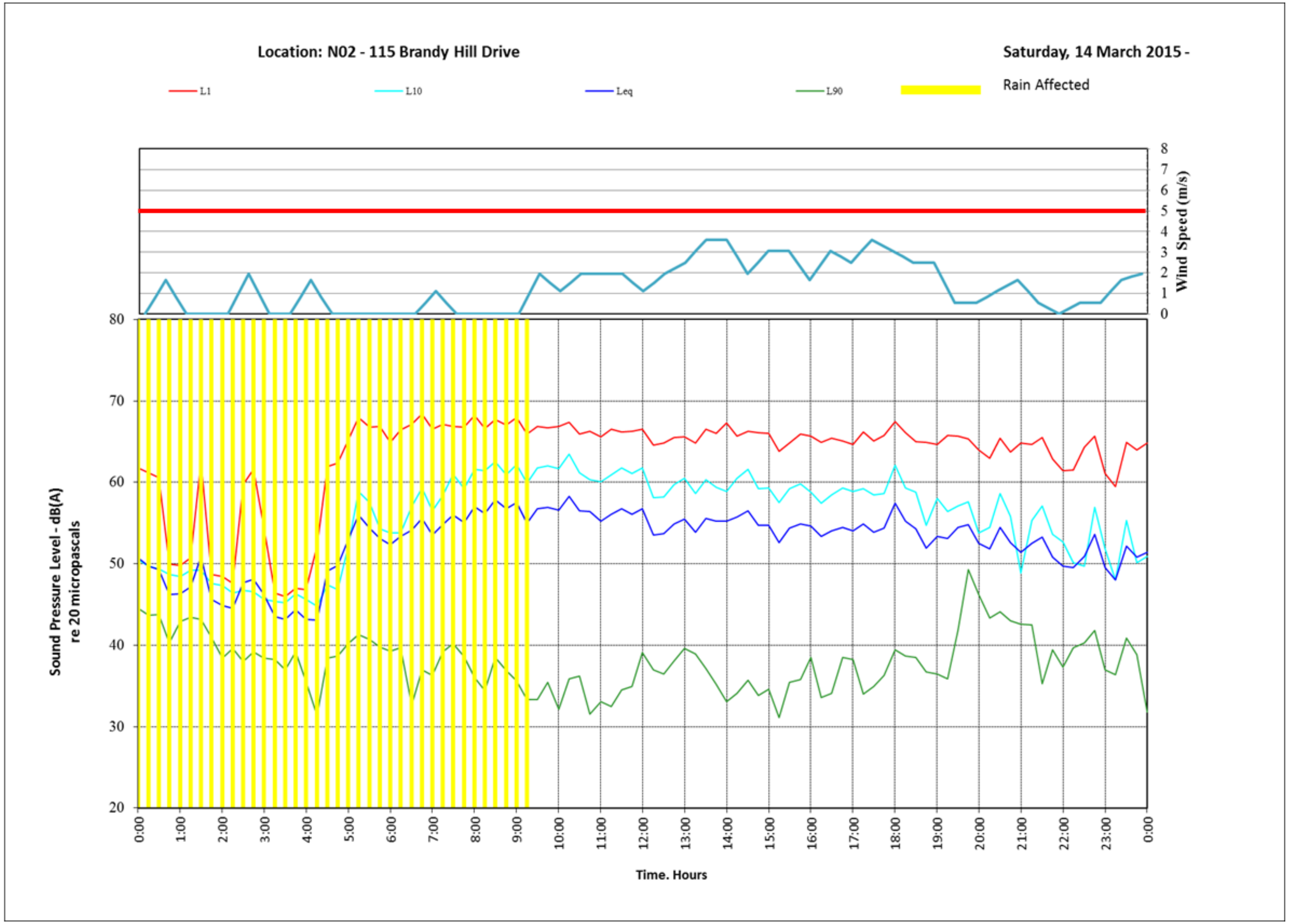
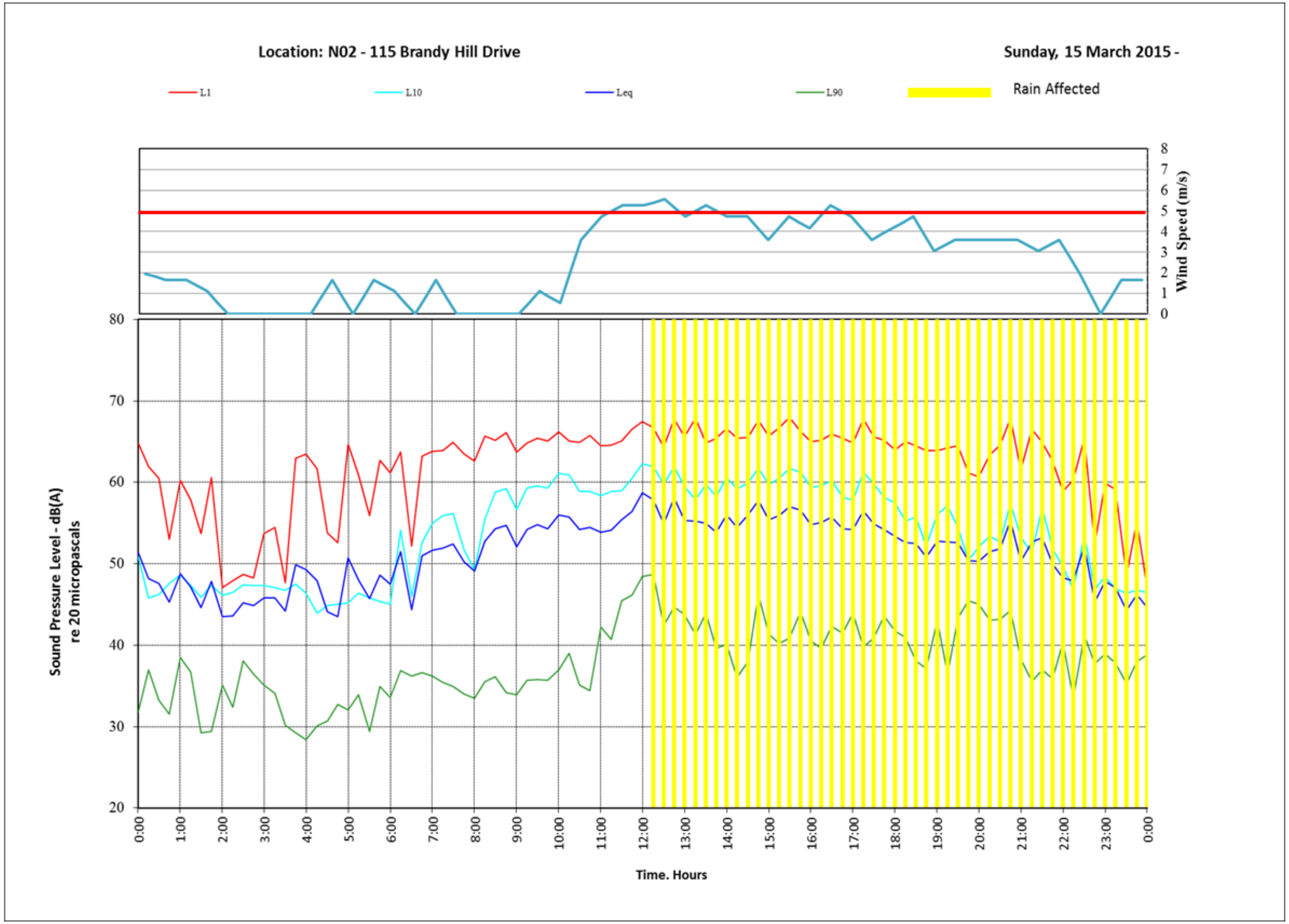
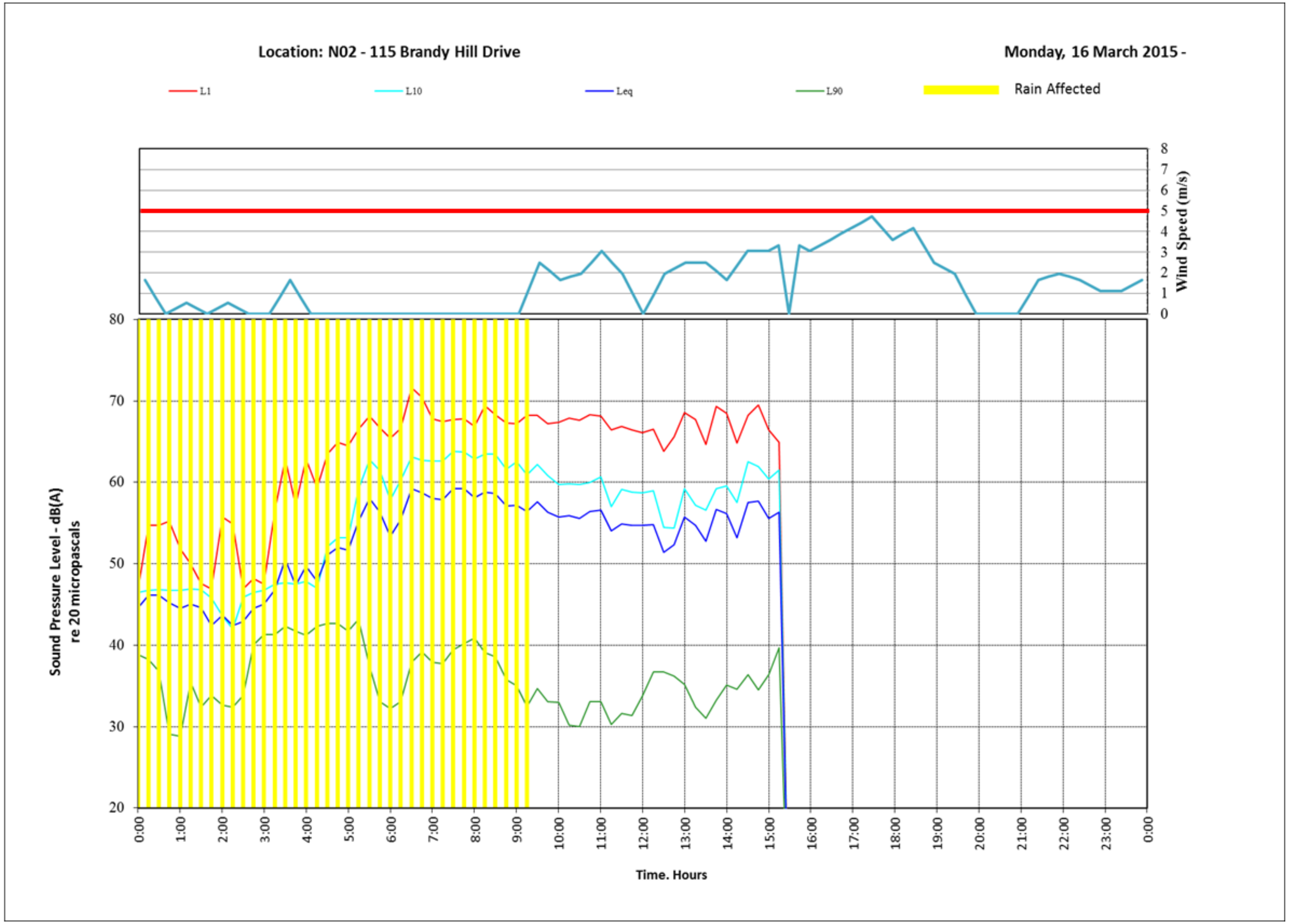
20:00
21:00
22:00
23:00
0:00


Location: N02 - 115 Brandy Hill Drive
Thursday, 12 March 2015 -
L1
L10
Leq
L90
Rain Affected
Wind Speed (m/s)
Sound Pressure Level - dB(A) re 20 micropascals
Time. Hours


Location: N02 - 115 Brandy Hill Drive
Friday, 13 March 2015 -
L1
L10
Leq
L90
Rain Affected
Wind Speed (m/s)
Sound Pressure Level - dB(A) re 20 micropascals
Time. Hours


Location: N02 - 115 Brandy Hill Drive
Saturday, 14 March 2015 -
L1
L10
Leq
L90
Rain Affected
Wind Speed (m/s)
Sound Pressure Level - dB(A) re 20 micropascals
Time. Hours


Location: N02 - 115 Brandy Hill Drive
Sunday, 15 March 2015 -
L1
L10
Leq
L90
Rain Affected
Wind Speed (m/s)
Sound Pressure Level - dB(A) re 20 micropascals
Time. Hours


Location: N02 - 115 Brandy Hill Drive
Monday, 16 March 2015 -
L1
L10
Leq
L90
Rain Affected
Wind Speed (m/s)
Sound Pressure Level - dB(A) re 20 micropascals
Time. Hours
0
1
2
3
4
5
6
7
8
20
30
40
50
60
70
80
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
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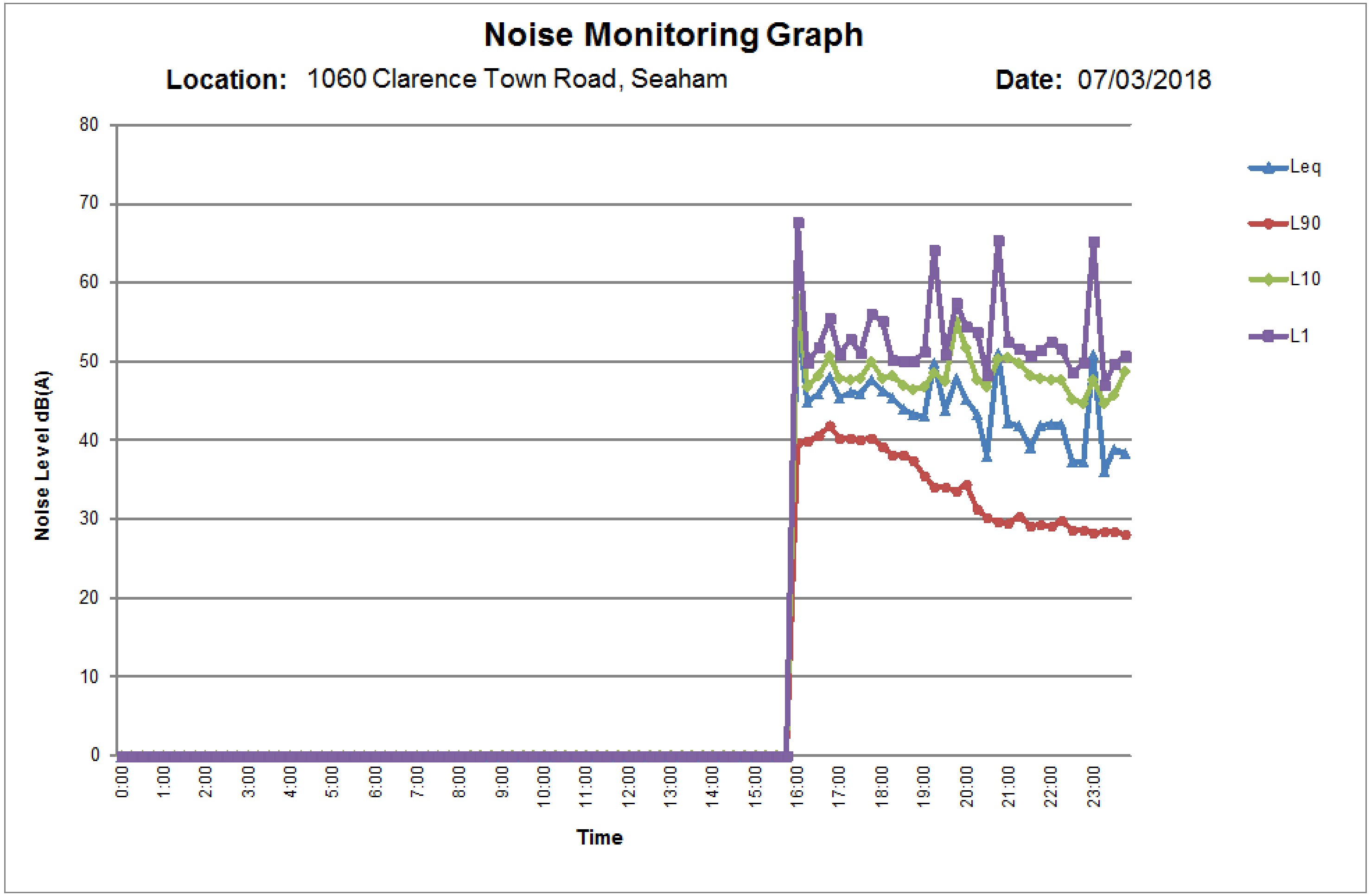
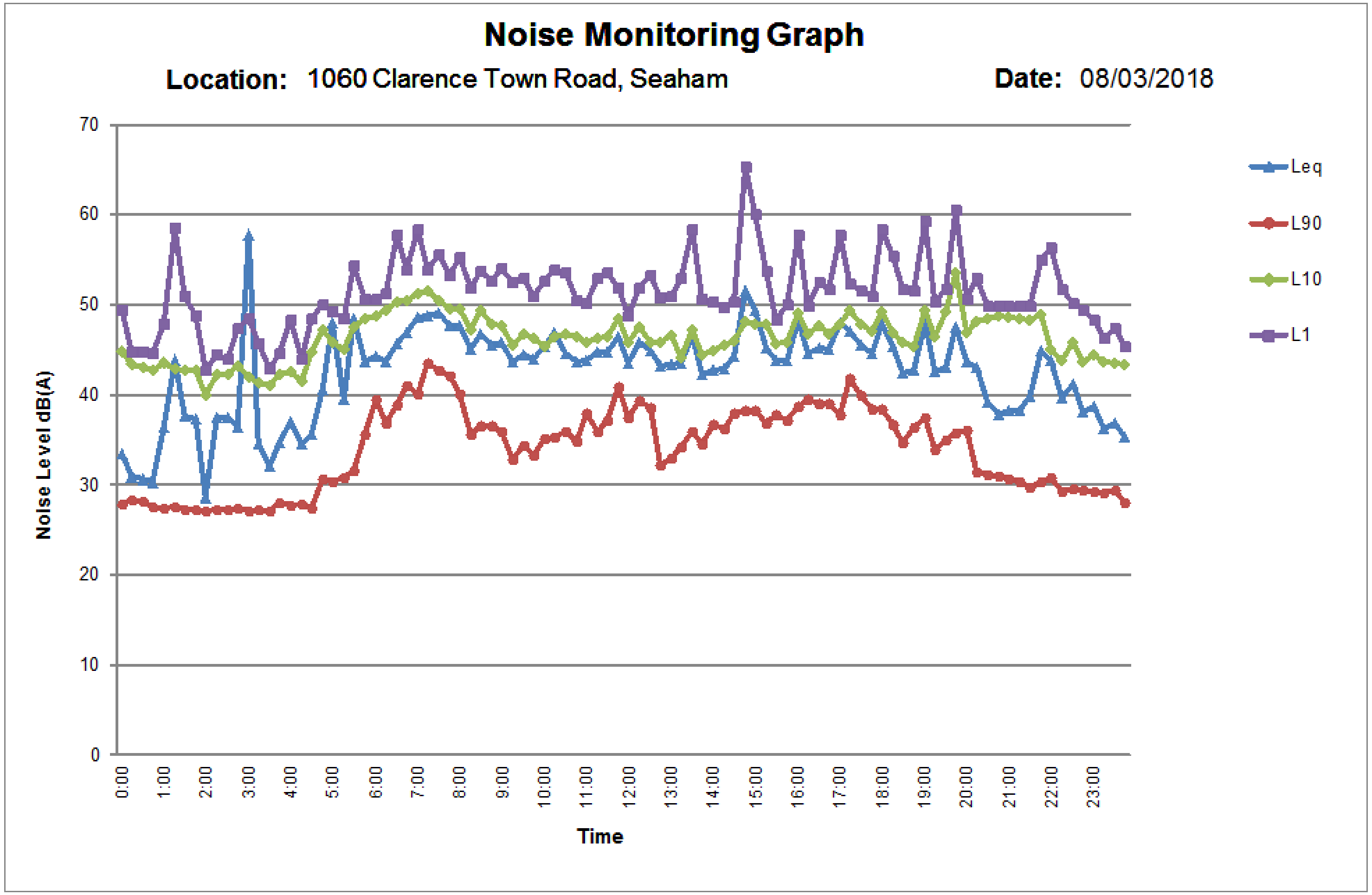
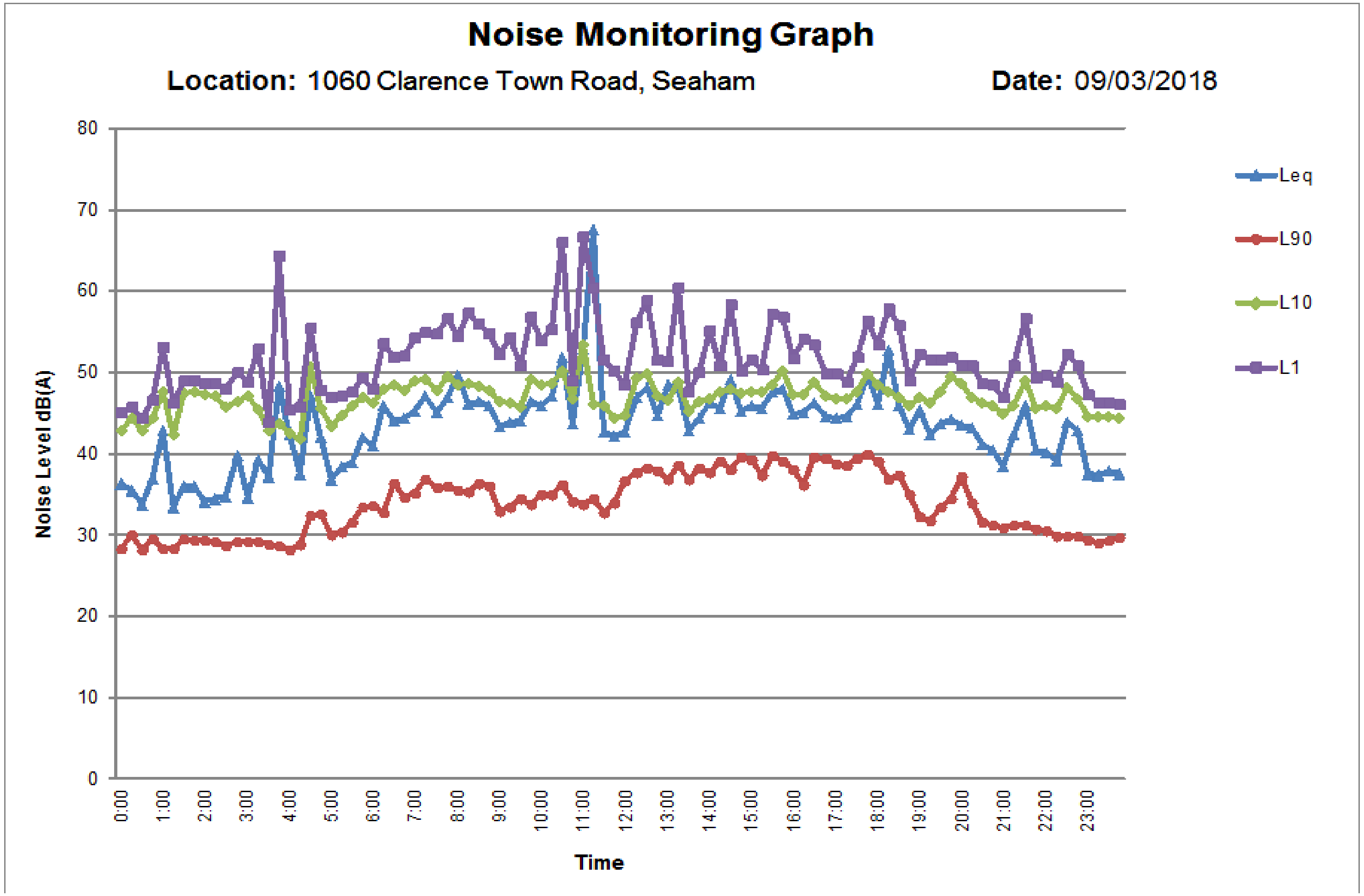
22:00
23:00
0:00


Noise Monitoring Graph
Location: 1060 Clarence Town Road, Seaham
Date: 07/03/2018
Noise Level dB(A)
80
70
60
50
40
30
20
10
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Time
Leq
L90
L10
L1


Noise Monitoring Graph
Location: 1060 Clarence Town Road, Seaham
Date: 08/03/2018
Noise Level dB(A)
70
60
50
40
30
20
10
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Time
Leq
L90
L10
L1


Noise Monitoring Graph
Location: 1060 Clarence Town Road, Seaham
Date: 09/03/2018
Noise Level dB(A)
80
70
60
50
40
30
20
10
0
0:00
1:00
2:00
3:00
4:00
5:00
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7:00
8:00
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12:00
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15:00
16:00
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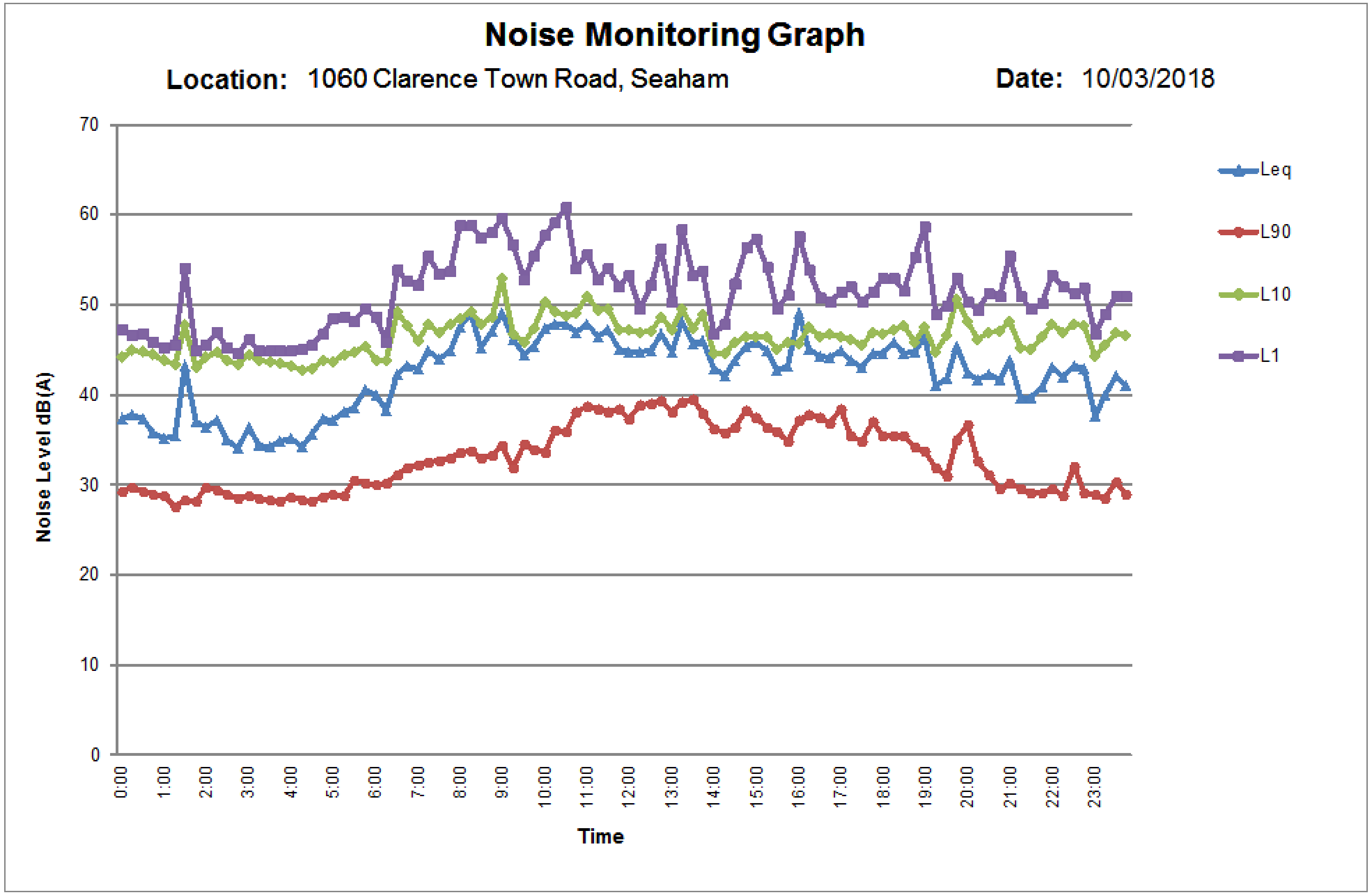
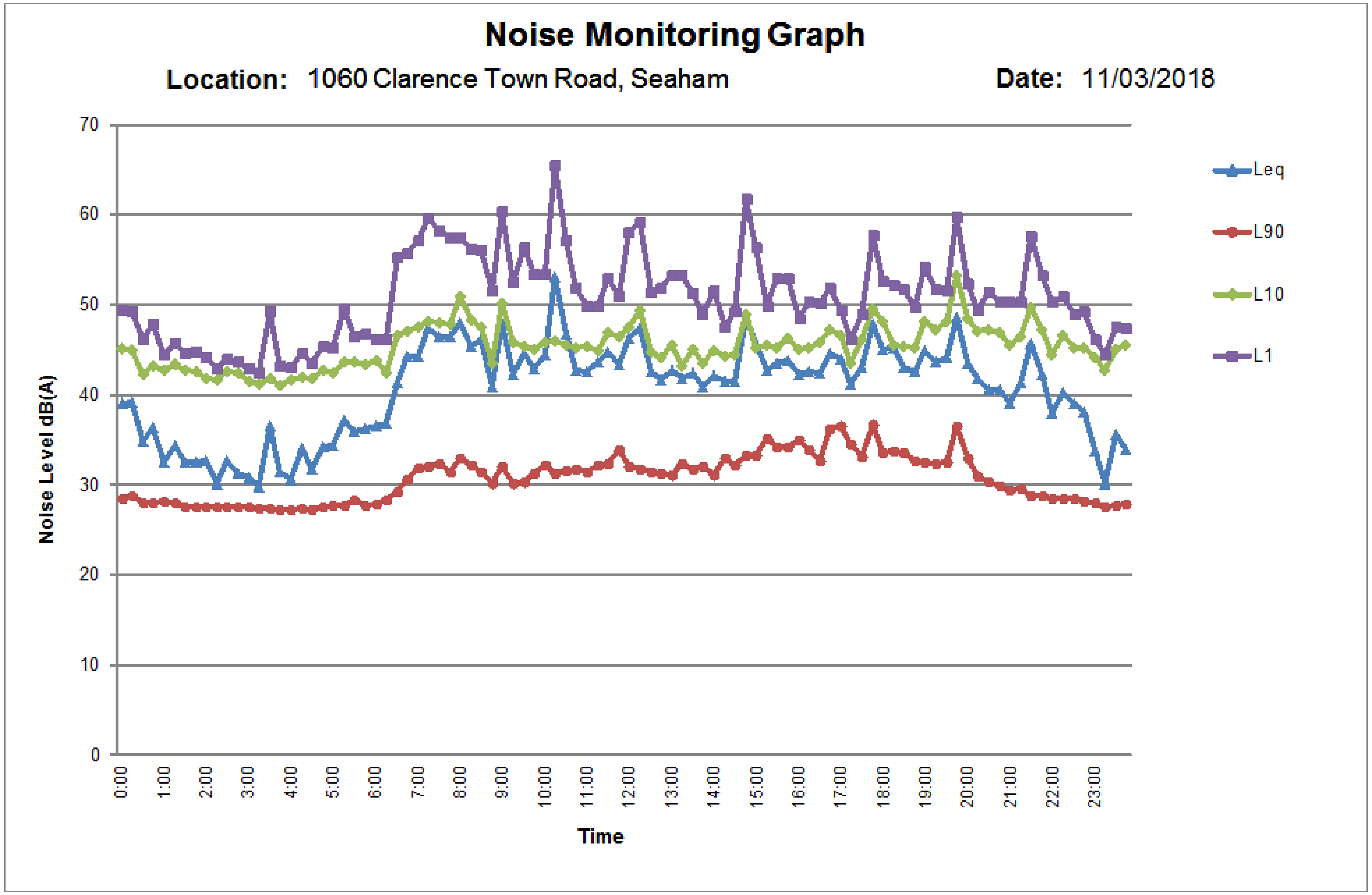
19:00
20:00
21:00
22:00
23:00
Time
Leq
L90
L10
L1


Noise Monitoring Graph
Location: 1060 Clarence Town Road, Seaham
Date: 10/03/2018
Noise Level dB(A)
70
60
50
40
30
20
10
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Time
Leq
L90
L10
L1


Noise Monitoring Graph
Location: 1060 Clarence Town Road, Seaham
Date: 11/03/2018
Noise Level dB(A)
70
60
50
40
30
20
10
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
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12:00
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14:00
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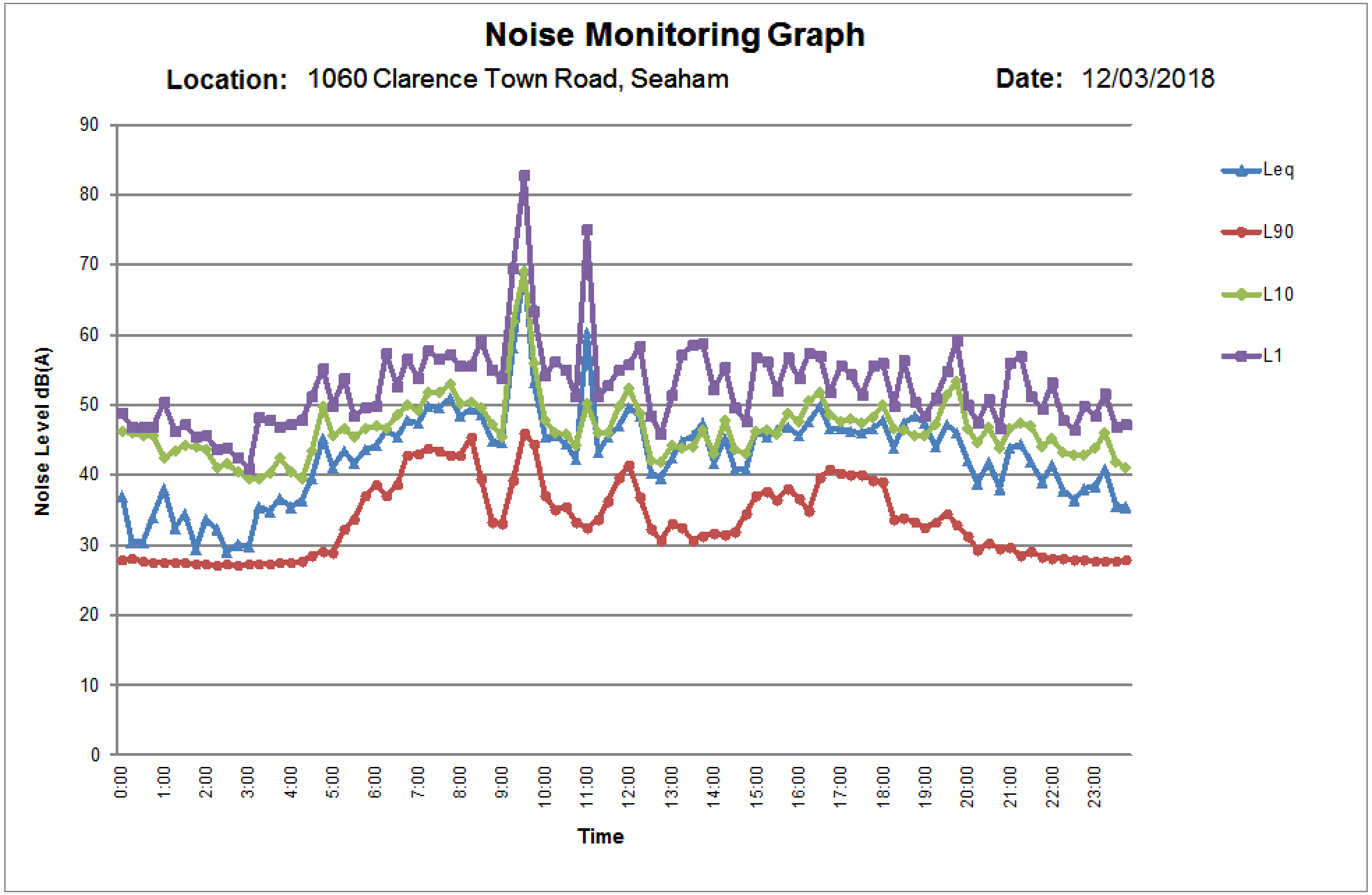
21:00
22:00
23:00
Time
Leq
L90
L10
L1


Noise Monitoring Graph
Location: 1060 Clarence Town Road, Seaham
Date: 12/03/2018
Noise Level dB(A)
90
80
70
60
50
40
30
20
10
0
0:00
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4:00
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18:00
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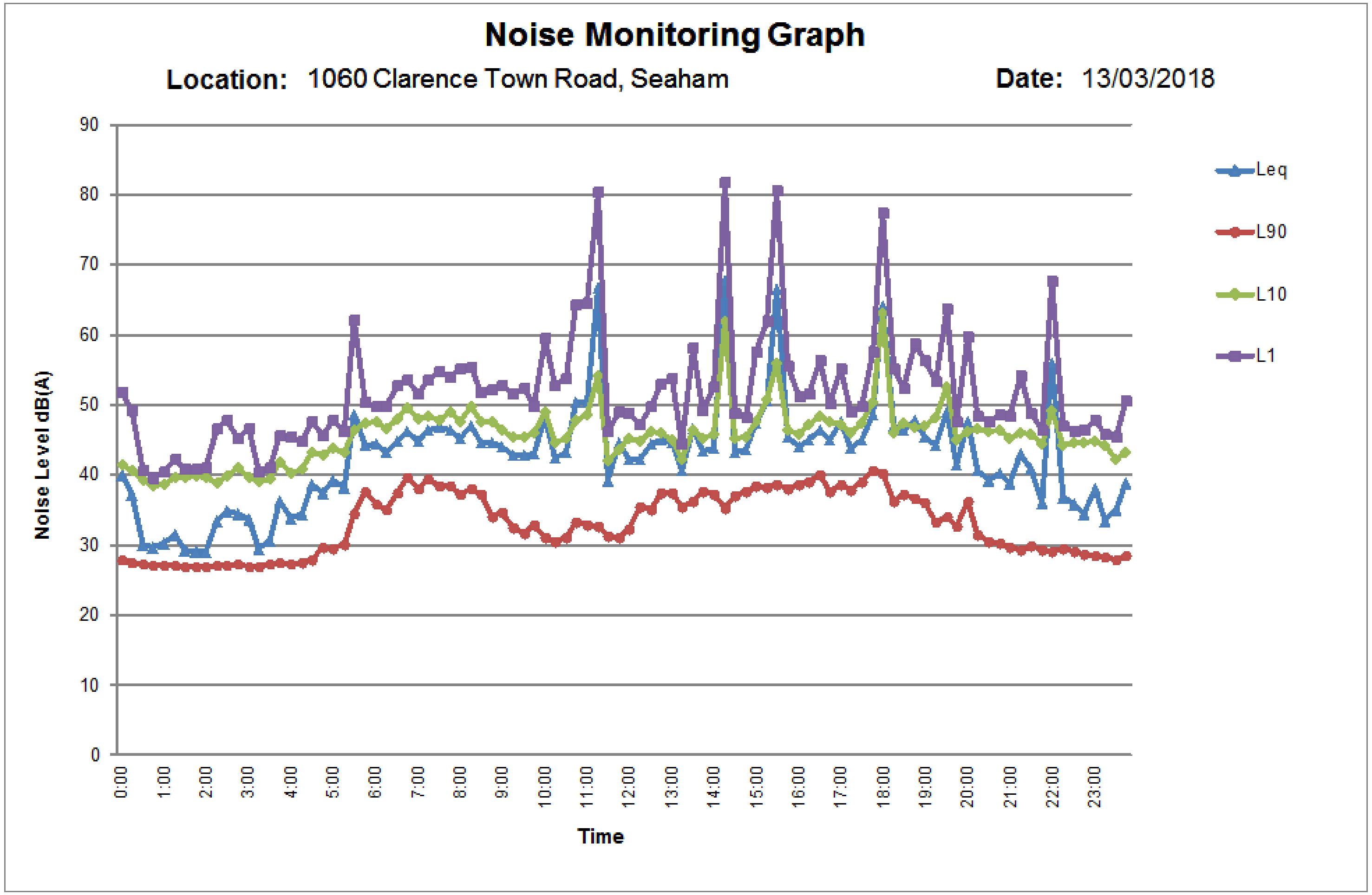
20:00
21:00
22:00
23:00
Time
Leq
L90
L10
L1


Noise Monitoring Graph
Location: 1060 Clarence Town Road, Seaham
Date: 13/03/2018
Noise Level dB(A)
0
10
20
30
40
50
60
70
80
90
0:00
1:00
2:00
3:00
4:00
5:00
6:00
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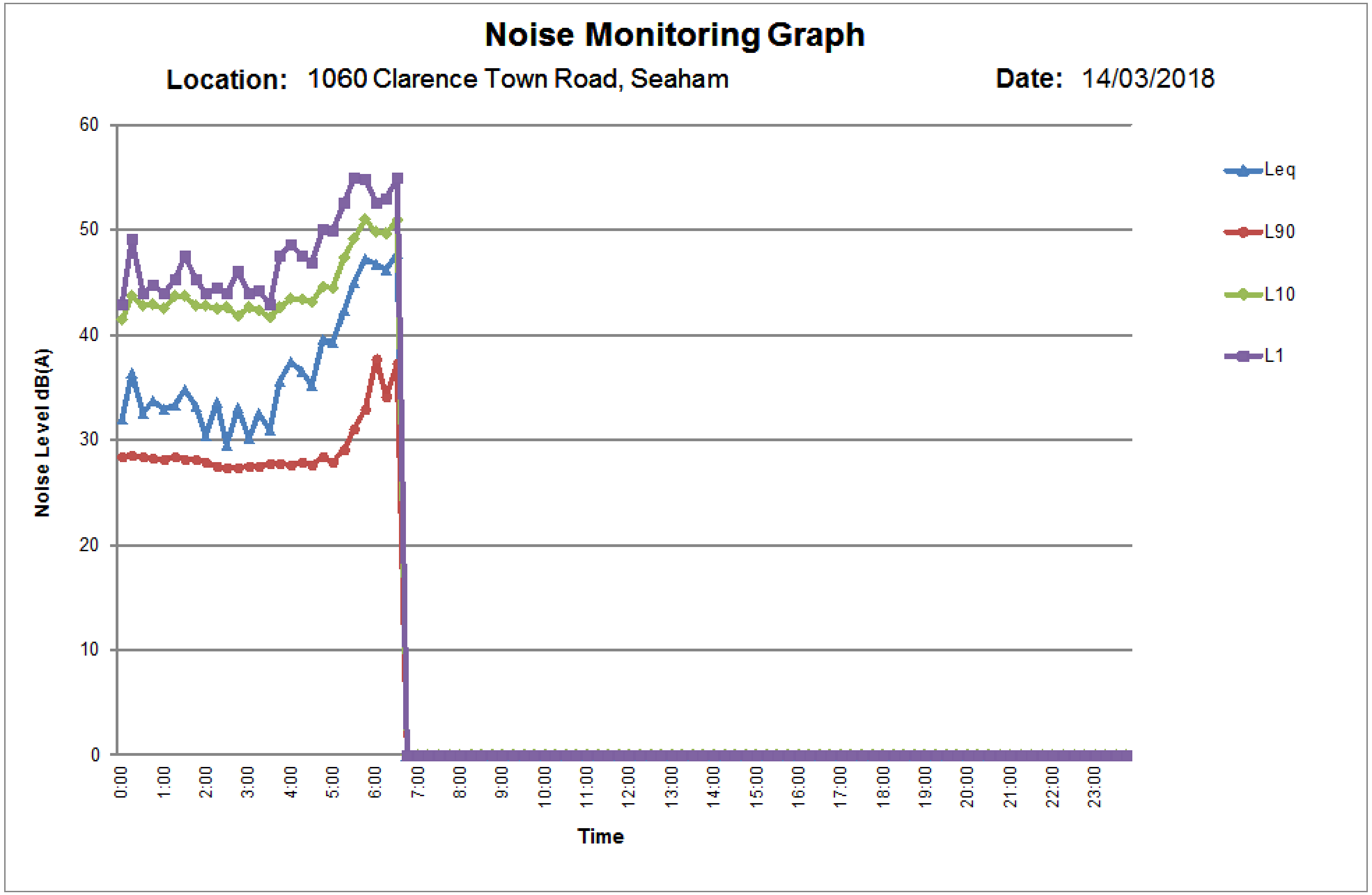
19:00
20:00
21:00
22:00
23:00
Time
Leq
L90
L10
L1


Noise Monitoring Graph
Location: 1060 Clarence Town Road, Seaham
Date: 14/03/2018
Noise Level dB(A)
60
50
40
30
20
10
0
0:00
1:00
2:00
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21:00
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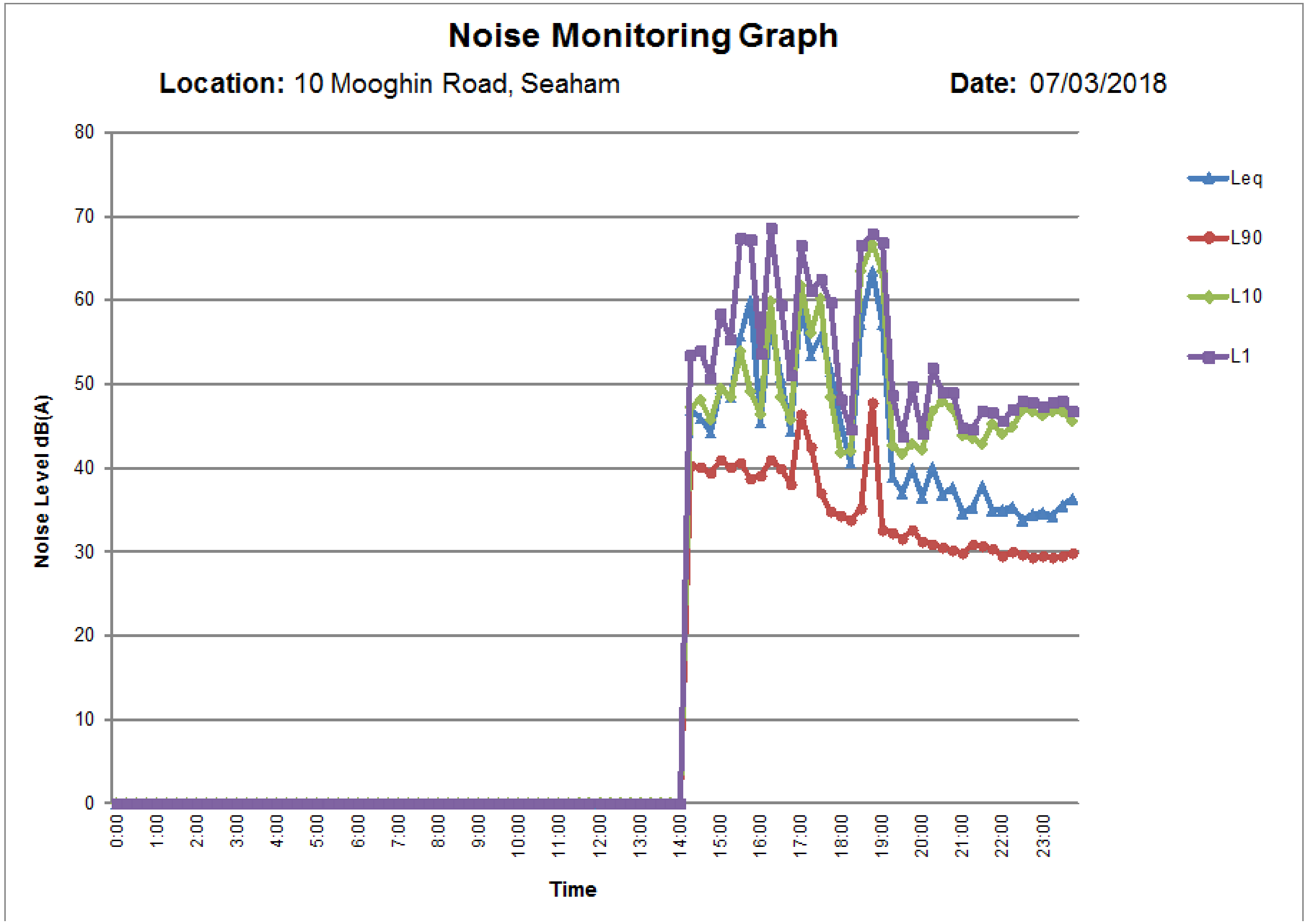
23:00
Time
Leq
L90
L10
L1


Noise Monitoring Graph
Location: 10 Mooghin Road, Seaham
Date: 07/03/2018
Noise Level dB(A)
80
70
60
50
40
30
20
10
0
0:00
1:00
2:00
3:00
4:00
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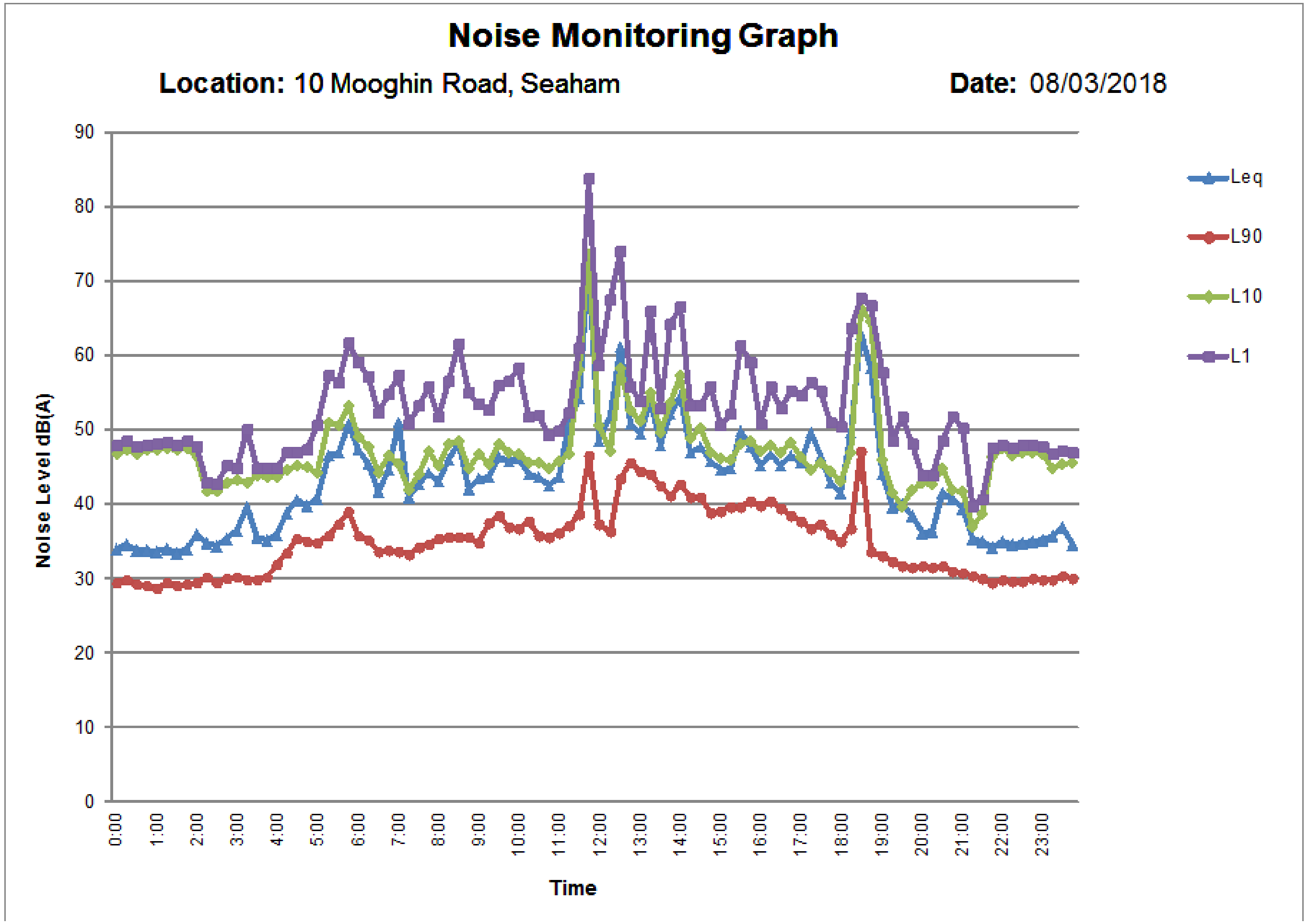
23:00
Time
Leq
L90
L10
L1


Noise Monitoring Graph
Location: 10 Mooghin Road, Seaham
Date: 08/03/2018
Noise Level dB(A)
90
80
70
60
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40
30
20
10
0
0:00
1:00
2:00
3:00
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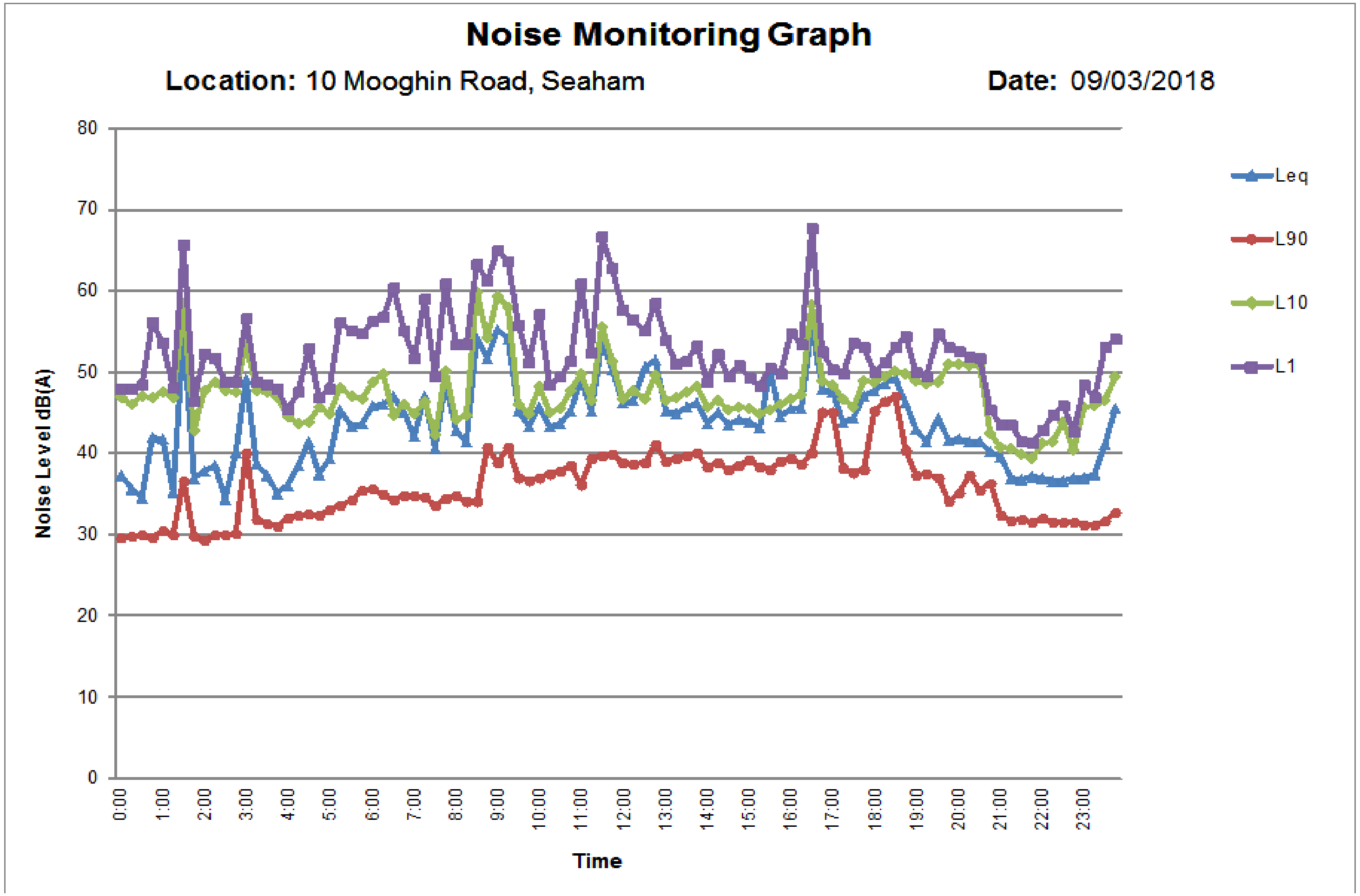
23:00
Time
Leq
L90
L10
L1


Noise Monitoring Graph
Location: 10 Mooghin Road, Seaham
Date: 09/03/2018
Noise Level dB(A)
0
10
20
30
40
50
60
70
80
0:00
1:00
2:00
3:00
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5:00
6:00
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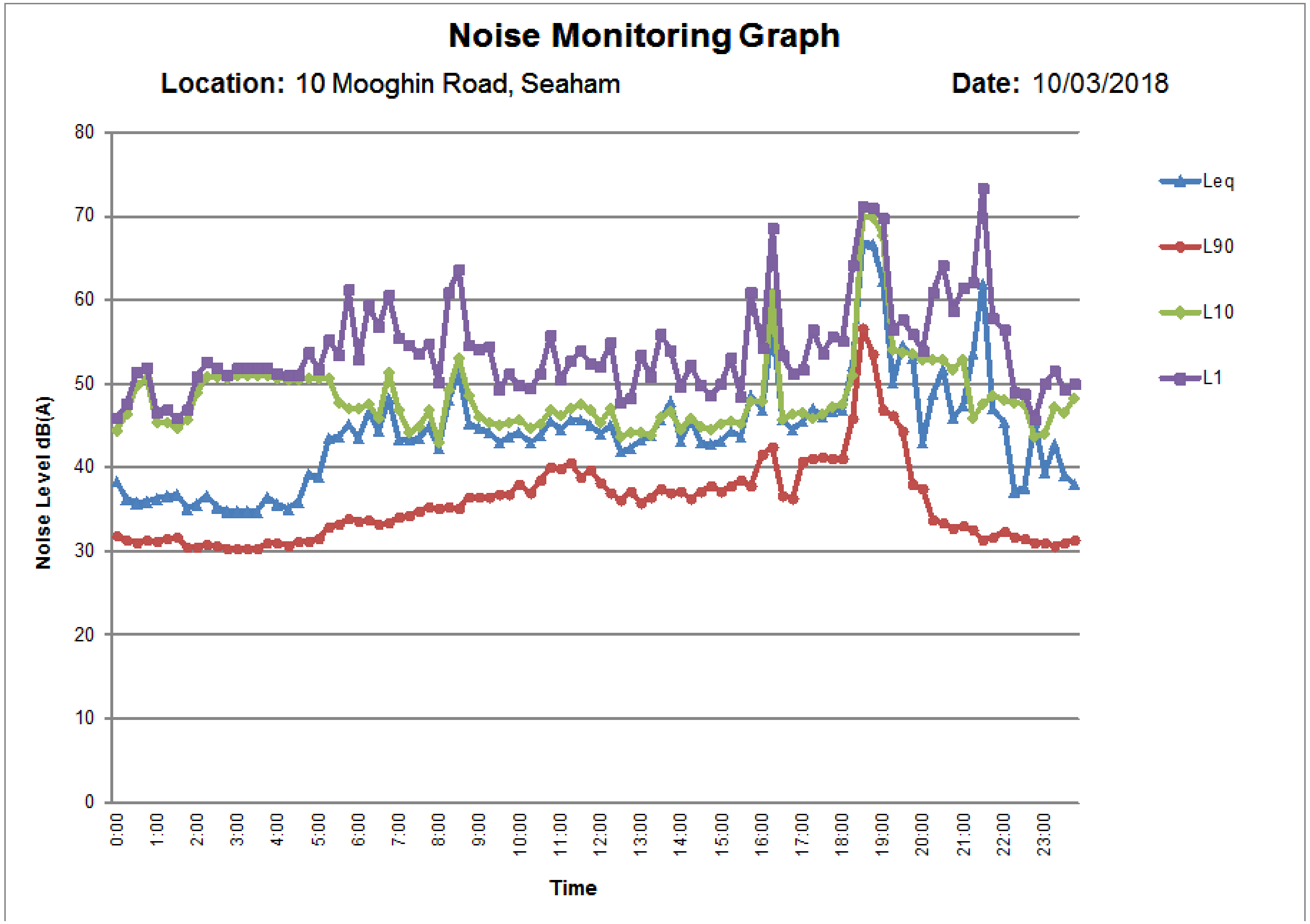
Time
Leq
L90
L10
L1


Noise Monitoring Graph
Location: 10 Mooghin Road, Seaham
Date: 10/03/2018
Noise Level dB(A)
80
70
60
50
40
30
20
10
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0:00
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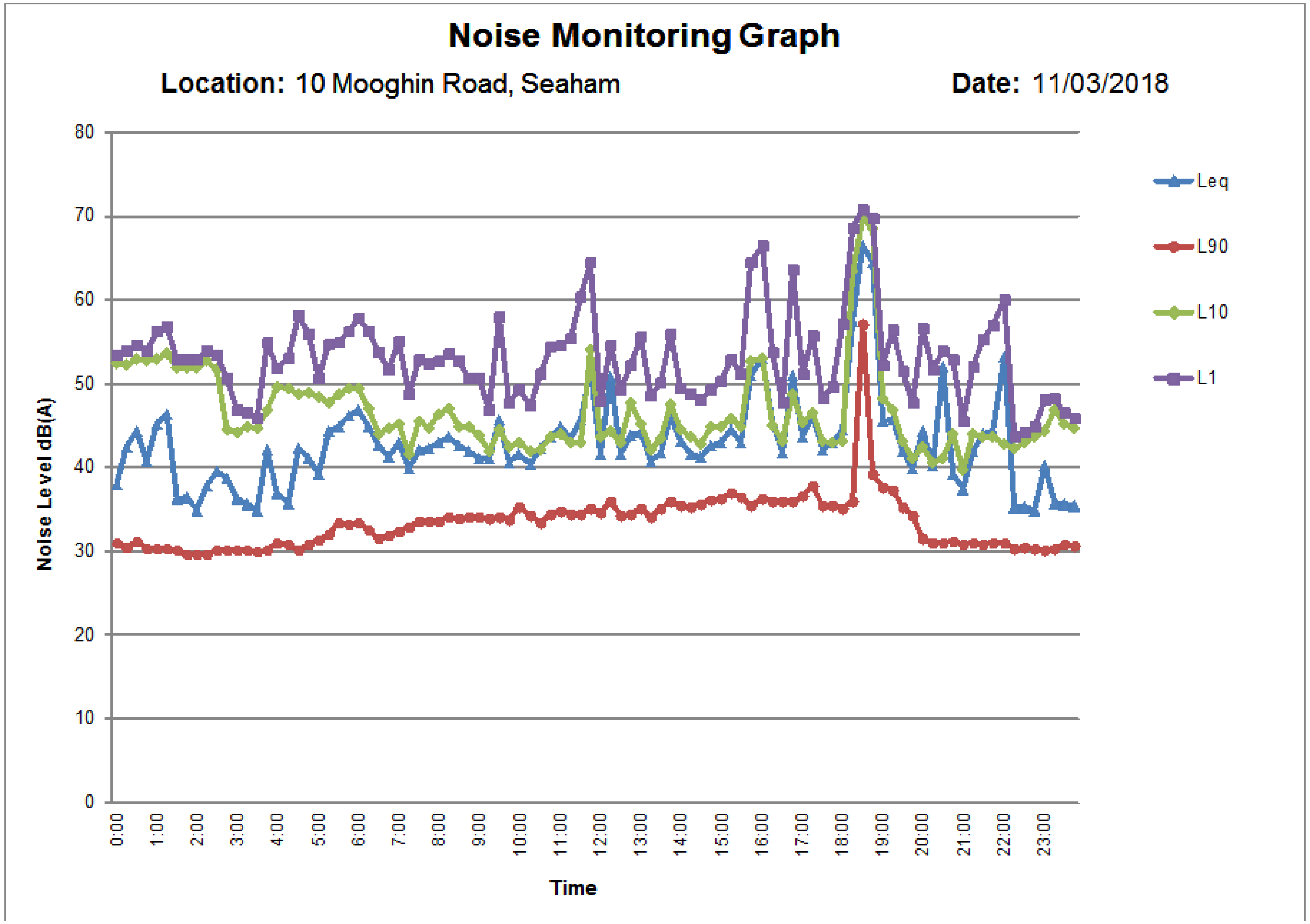
23:00
Time
Leq
L90
L10
L1


Noise Monitoring Graph
Location: 10 Mooghin Road, Seaham
Date: 11/03/2018
Noise Level dB(A)
80
70
60
50
40
30
20
10
0
0:00
1:00
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14:00
15:00
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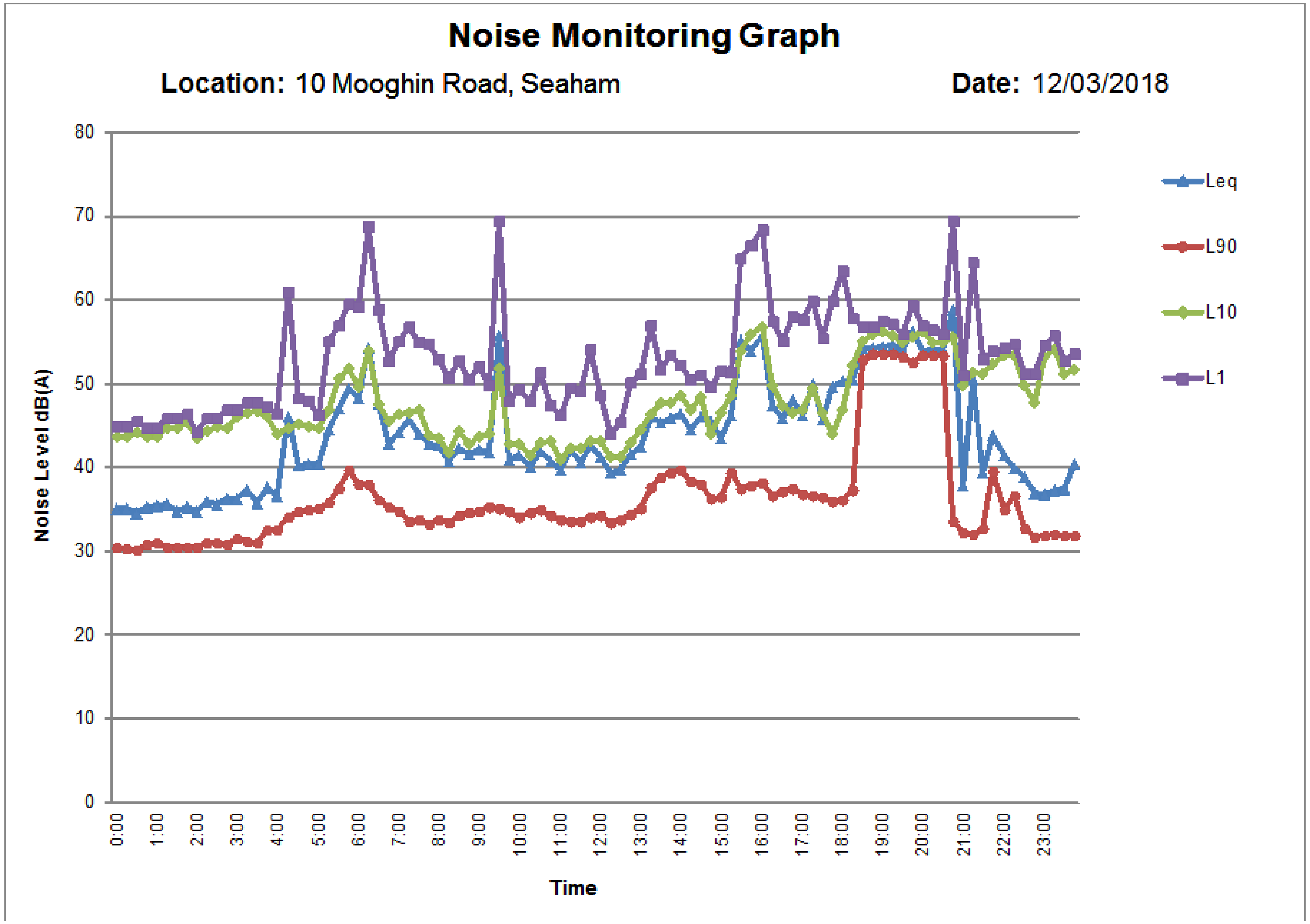
21:00
22:00
23:00
Time
Leq
L90
L10
L1


Noise Monitoring Graph
Location: 10 Mooghin Road, Seaham
Date: 12/03/2018
Noise Level dB(A)
80
70
60
50
40
30
20
10
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00
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12:00
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15:00
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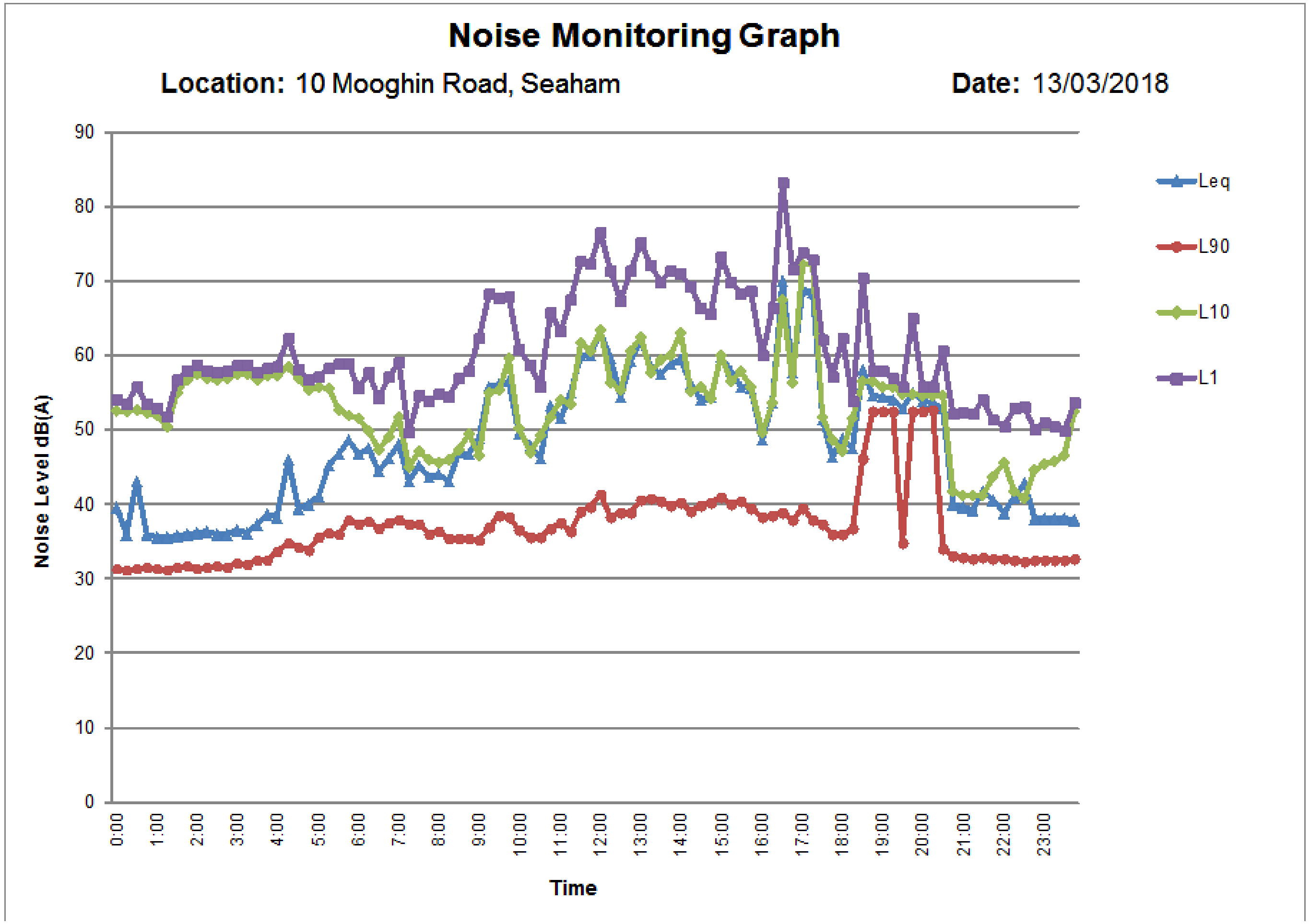
18:00
19:00
20:00
21:00
22:00
23:00
Time
Leq
L90
L10
L1


Noise Monitoring Graph
Location: 10 Mooghin Road, Seaham
Date: 13/03/2018
Noise Level dB(A)
90
80
70
60
50
40
30
20
10
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
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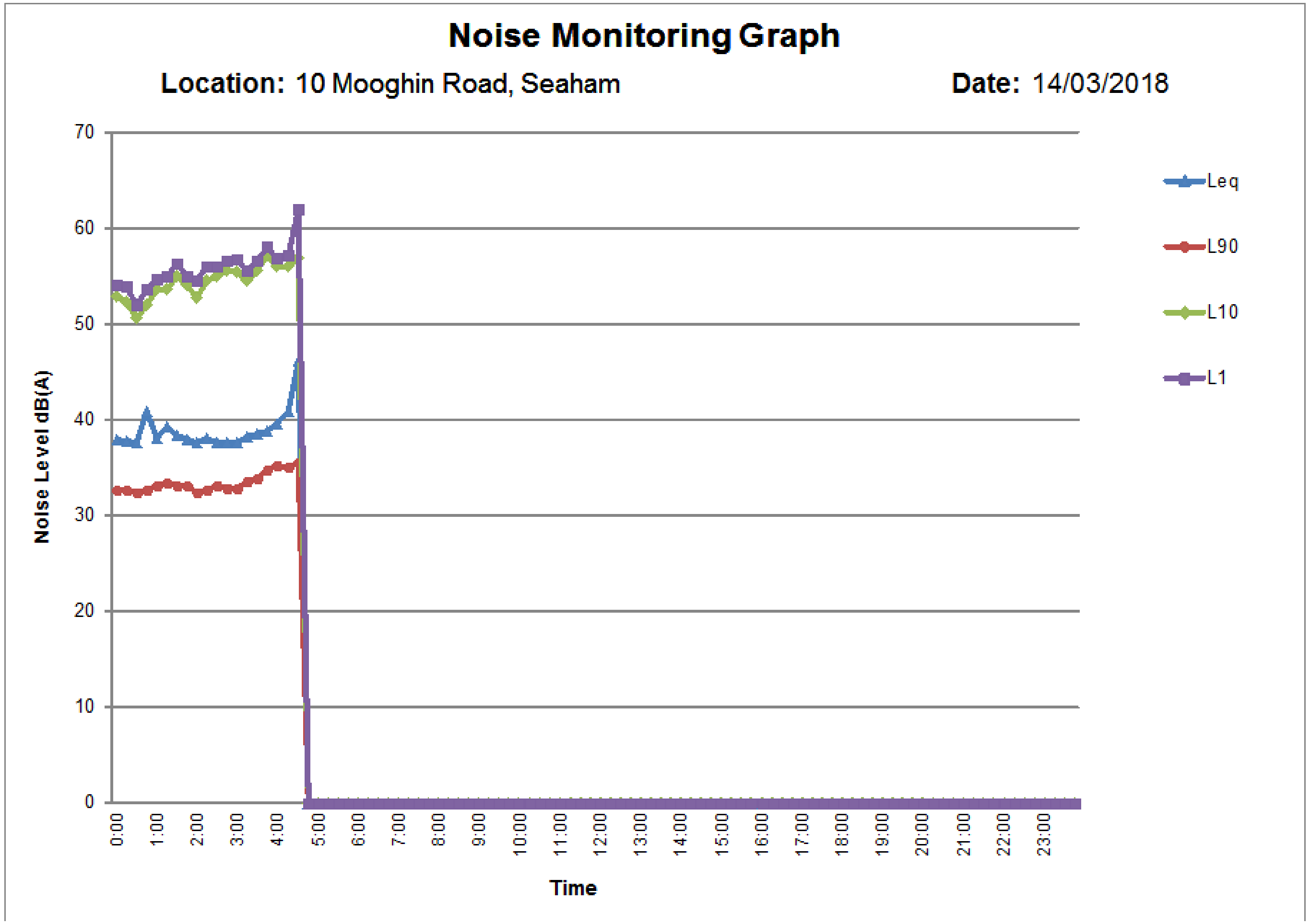
19:00
20:00
21:00
22:00
23:00
Time
Leq
L90
L10
L1


Noise Monitoring Graph
Location: 10 Mooghin Road, Seaham
Date: 14/03/2018
Noise Level dB(A)
70
60
50
40
30
20
10
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
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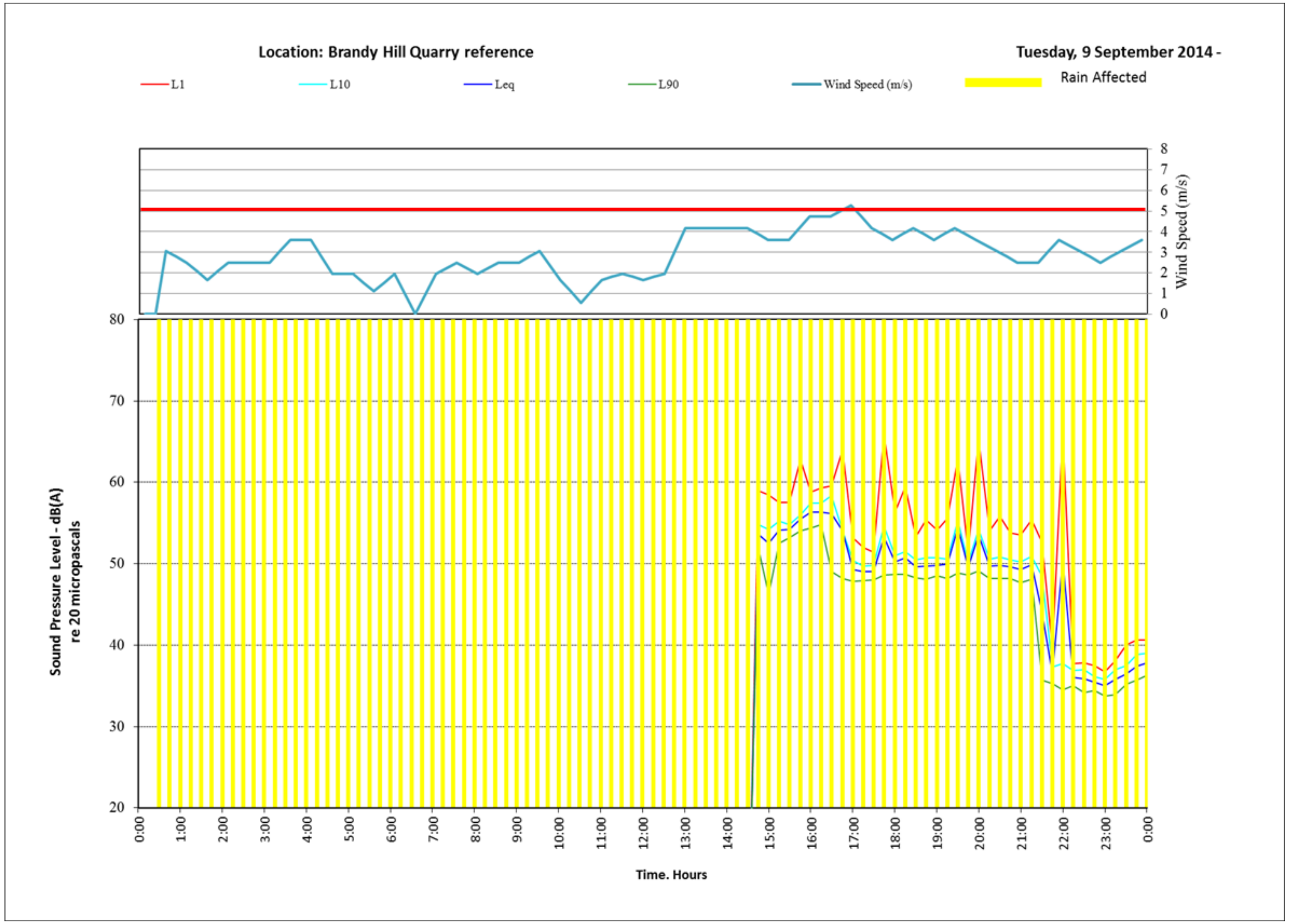
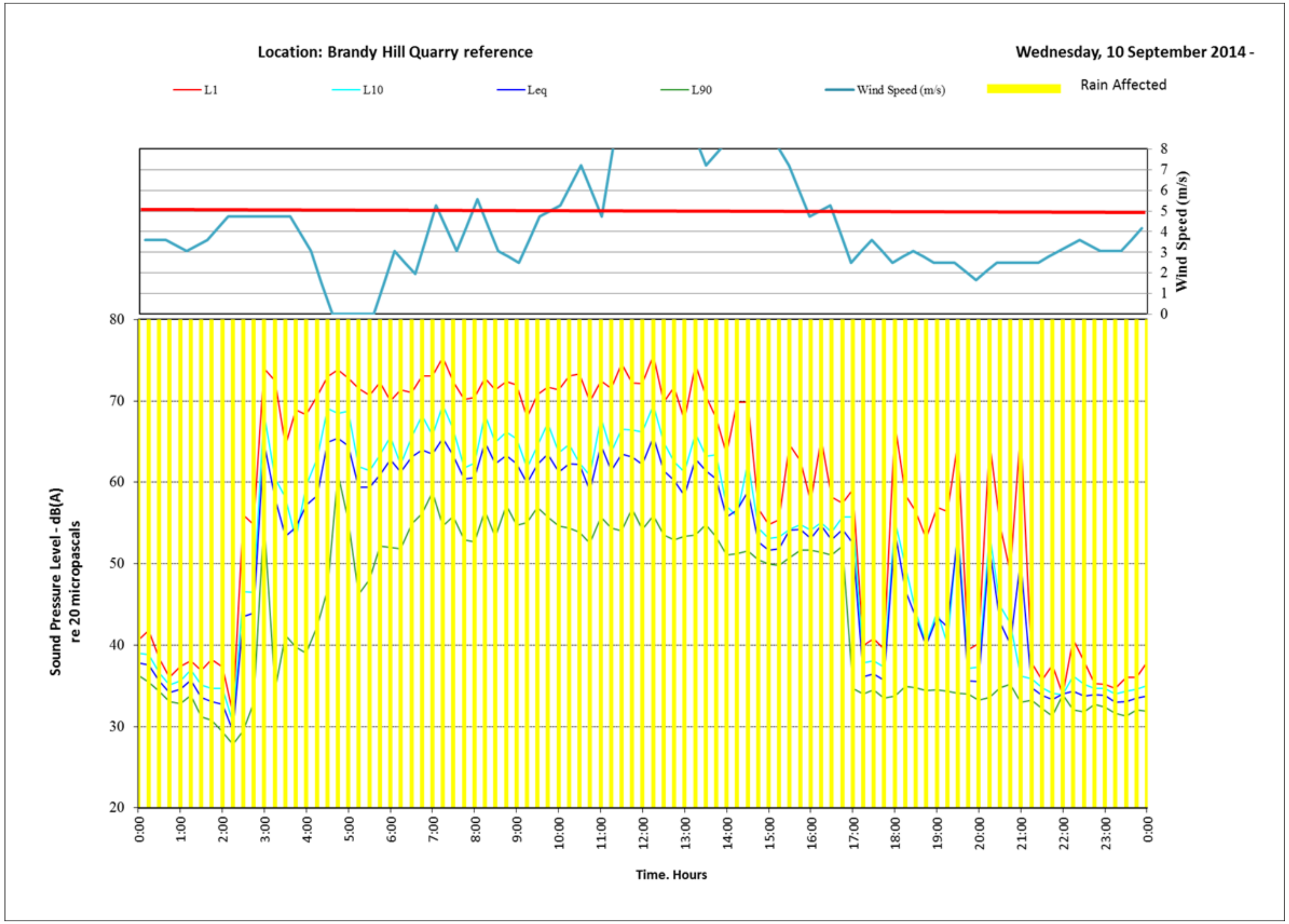
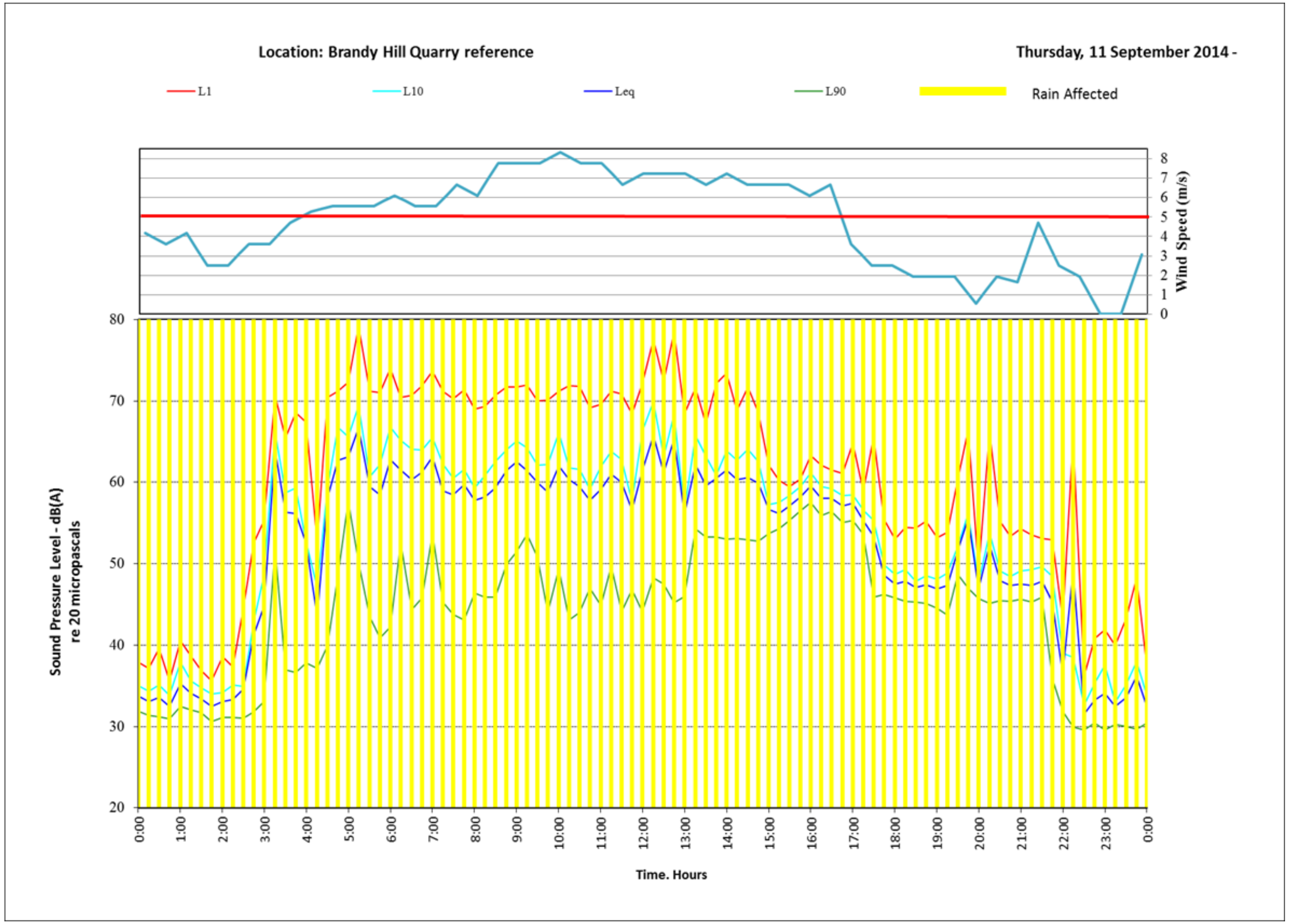
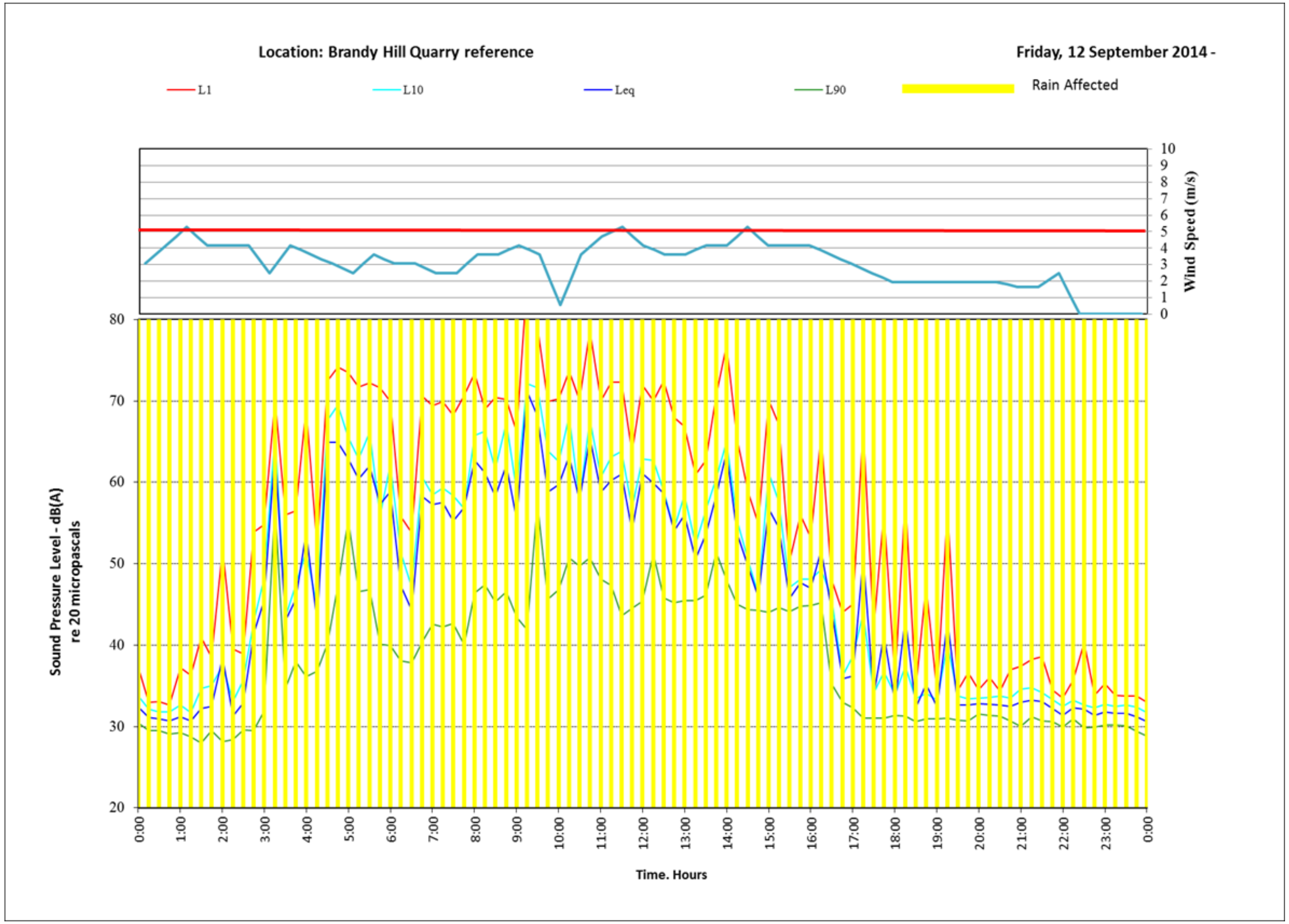
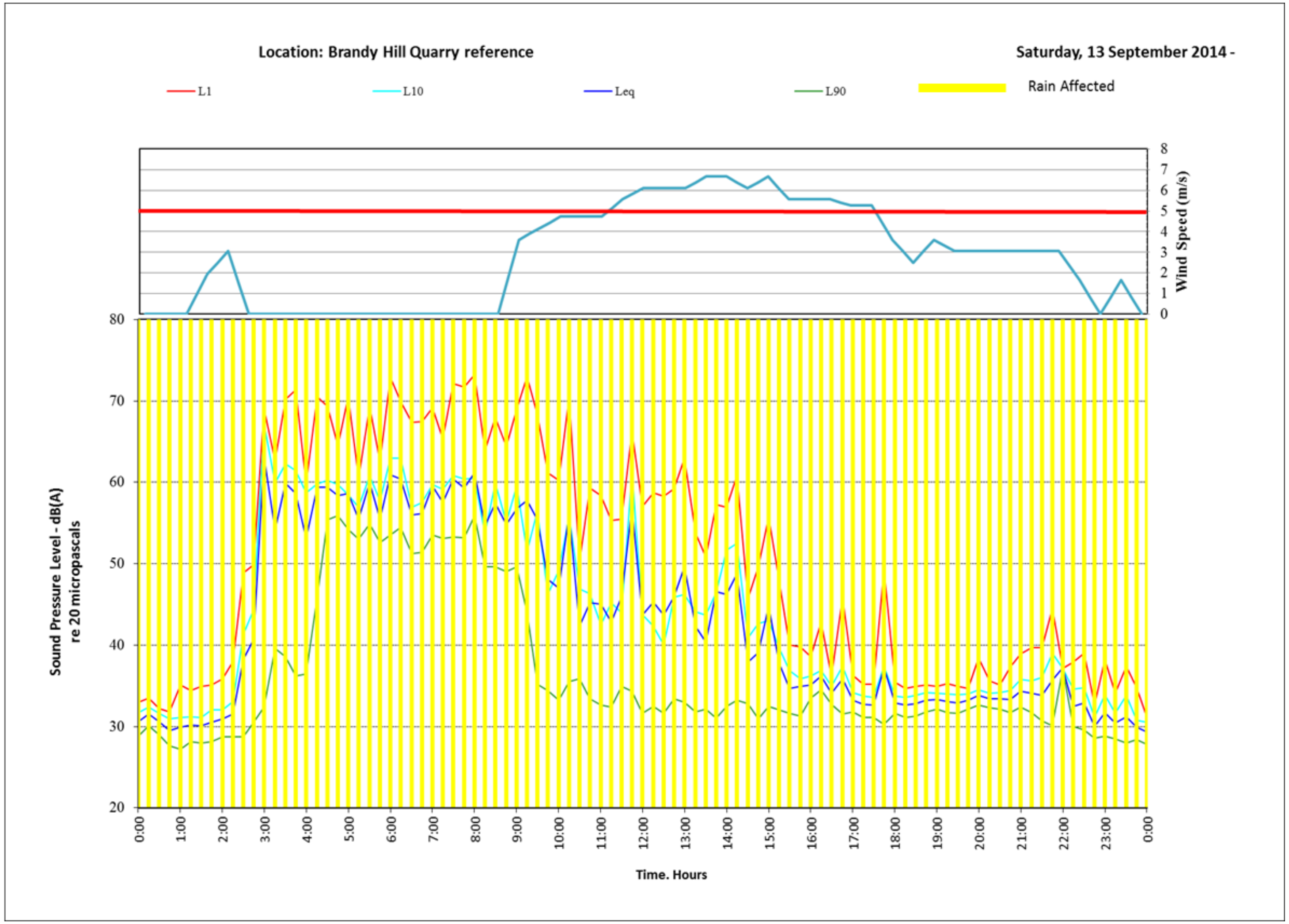
19:00
20:00
21:00
22:00
23:00
Time
Leq
L90
L10
L1

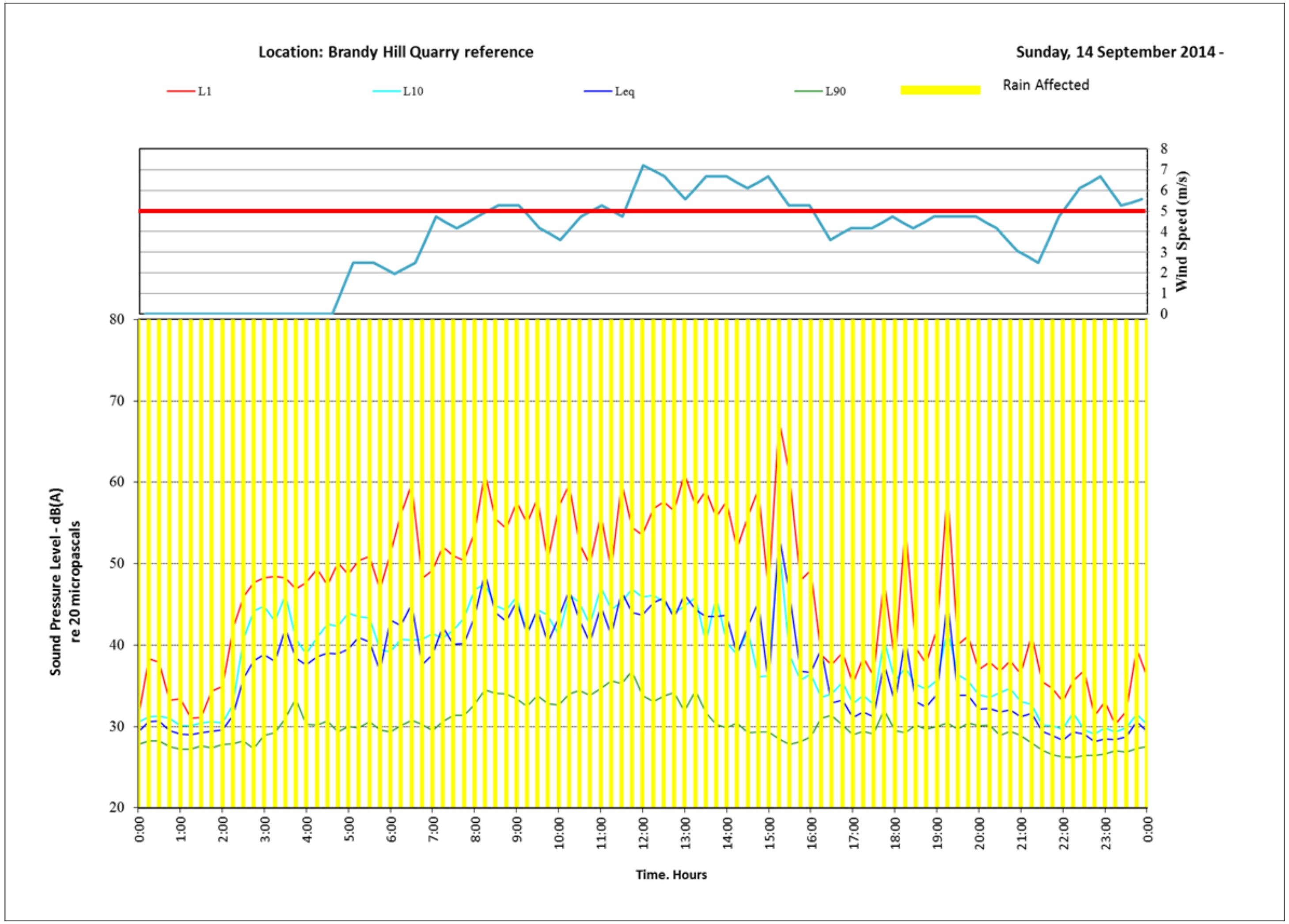

Location: Brandy Hill Quarry reference
Tuesday, 9 September 2014 -
L1
L10
Leq
L90
Wind Speed (m/s)
Rain Affected
Wind Speed (m/s)
Sound Pressure Level - dB(A) re 20 micropascals
Time. Hours

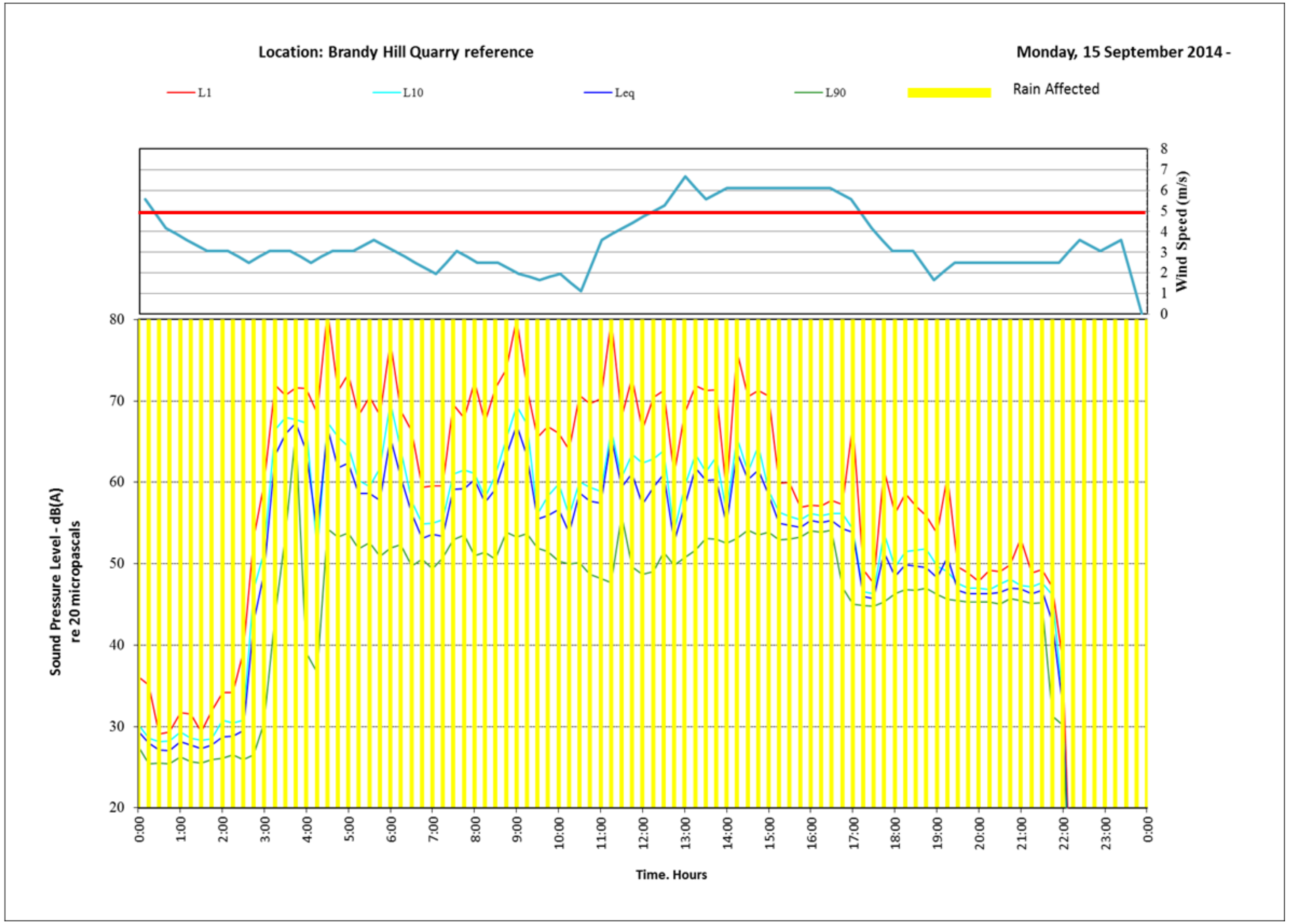

Location: Brandy Hill Quarry reference
Wednesday, 10 September 2014 -
L1
L10
Leq
L90
Wind Speed (m/s)
Rain Affected
Wind Speed (m/s)
Sound Pressure Level - dB(A) re 20 micropascals
Time. Hours

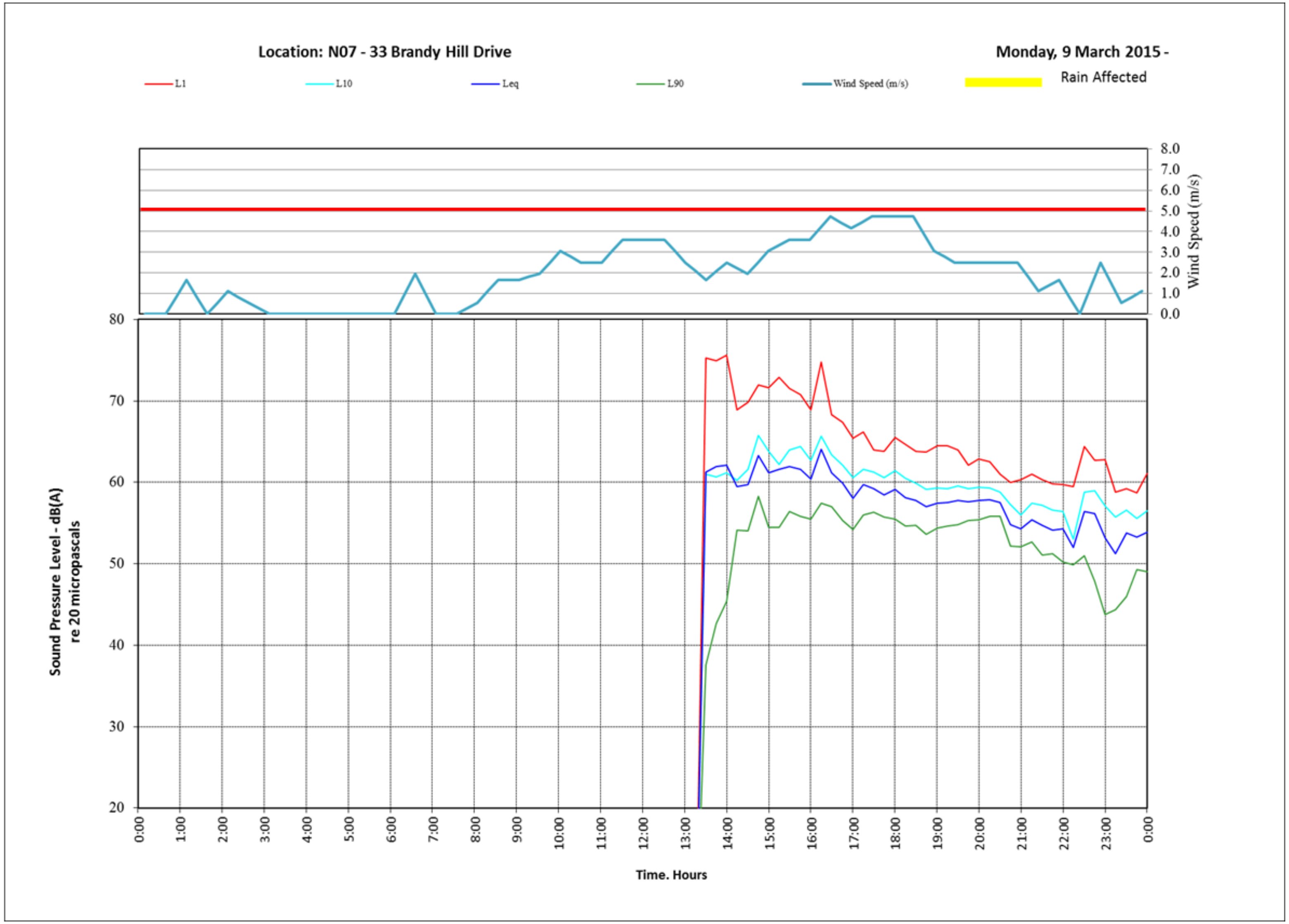

Location: Brandy Hill Quarry reference
Thursday, 11 September 2014 -
L1
L10
Leq
L90
Rain Affected
Wind Speed (m/s)
Sound Pressure Level - dB(A) re 20 micropascals
Time. Hours


Location: Brandy Hill Quarry reference
Friday, 12 September 2014 -
L1
L10
Leq
L90
Rain Affected
Wind Speed (m/s)
Sound Pressure Level - dB(A) re 20 micropascals
Time. Hours


Location: Brandy Hill Quarry reference
Saturday, 13 September 2014 -
L1
L10
Leq
L90
Rain Affected
Wind Speed (m/s)
Sound Pressure Level - dB(A) re 20 micropascals
Time. Hours


Location: Brandy Hill Quarry reference
Sunday, 14 September 2014 -
L1
L10
Leq
L90
Rain Affected
Wind Speed (m/s)
Sound Pressure Level - dB(A) re 20 micropascals
Time. Hours


Location: Brandy Hill Quarry reference
Monday, 15 September 2014 -
L1
L10
Leq
L90
Rain Affected
Wind Speed (m/s)
Sound Pressure Level - dB(A) re 20 micropascals
Time. Hours


Location: N07 - 33 Brandy Hill Drive
Monday, 9 March 2015 -
L1
L10
Leq
L90
Wind Speed (m/s)
Rain Affected
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Wind Speed (m/s)
80
70
60
50
40
30
20
Sound Pressure Level - dB(A) re 20 micropascals
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
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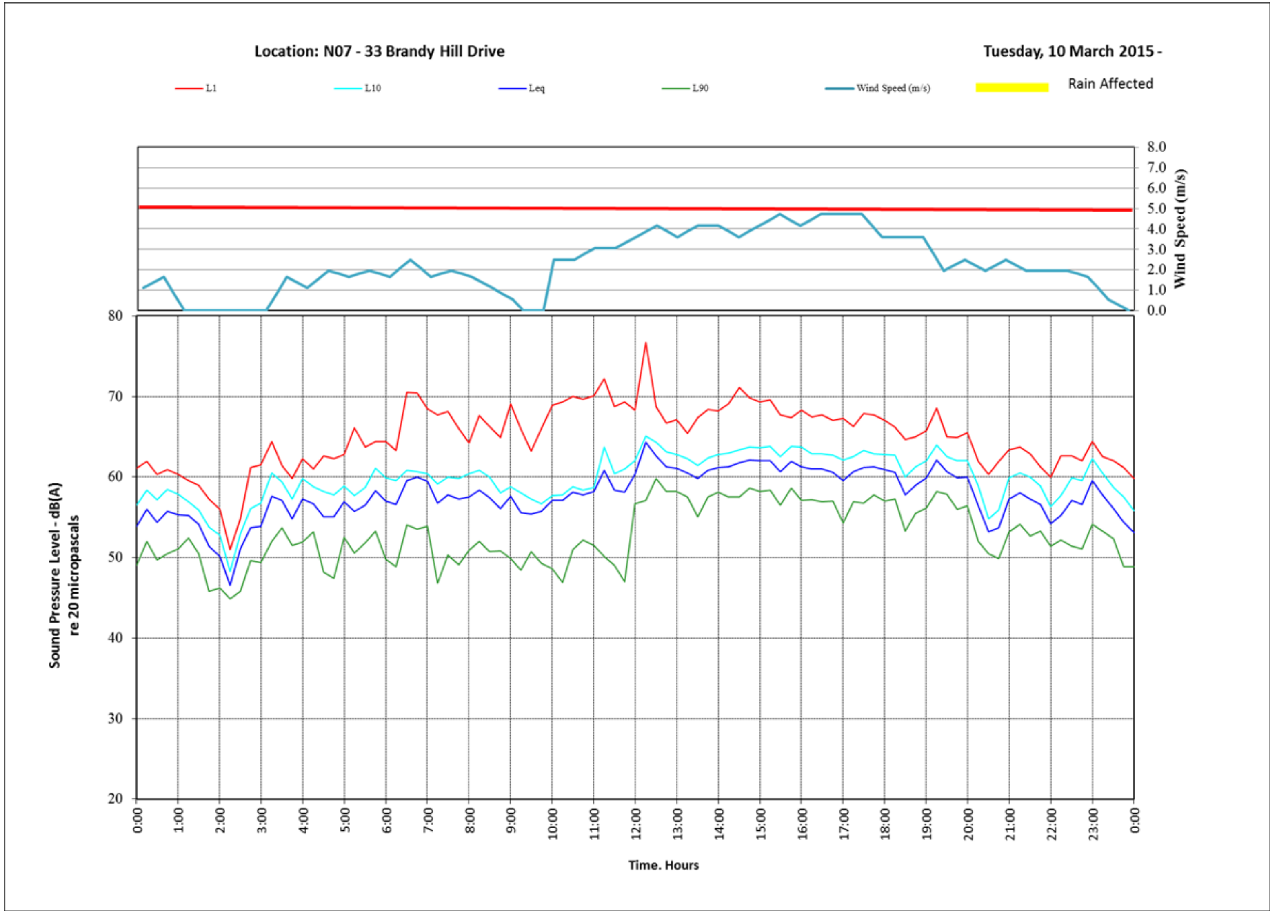
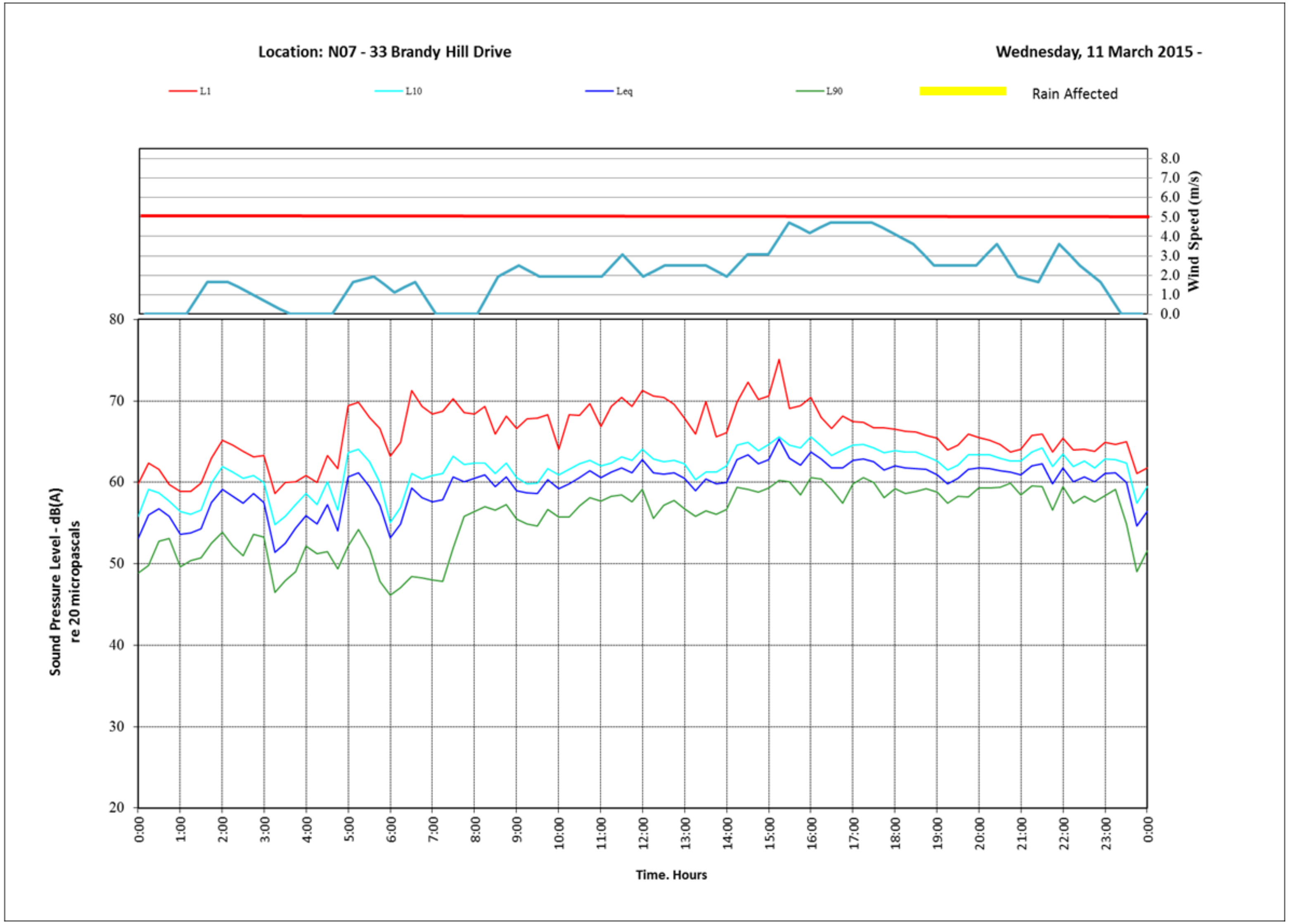
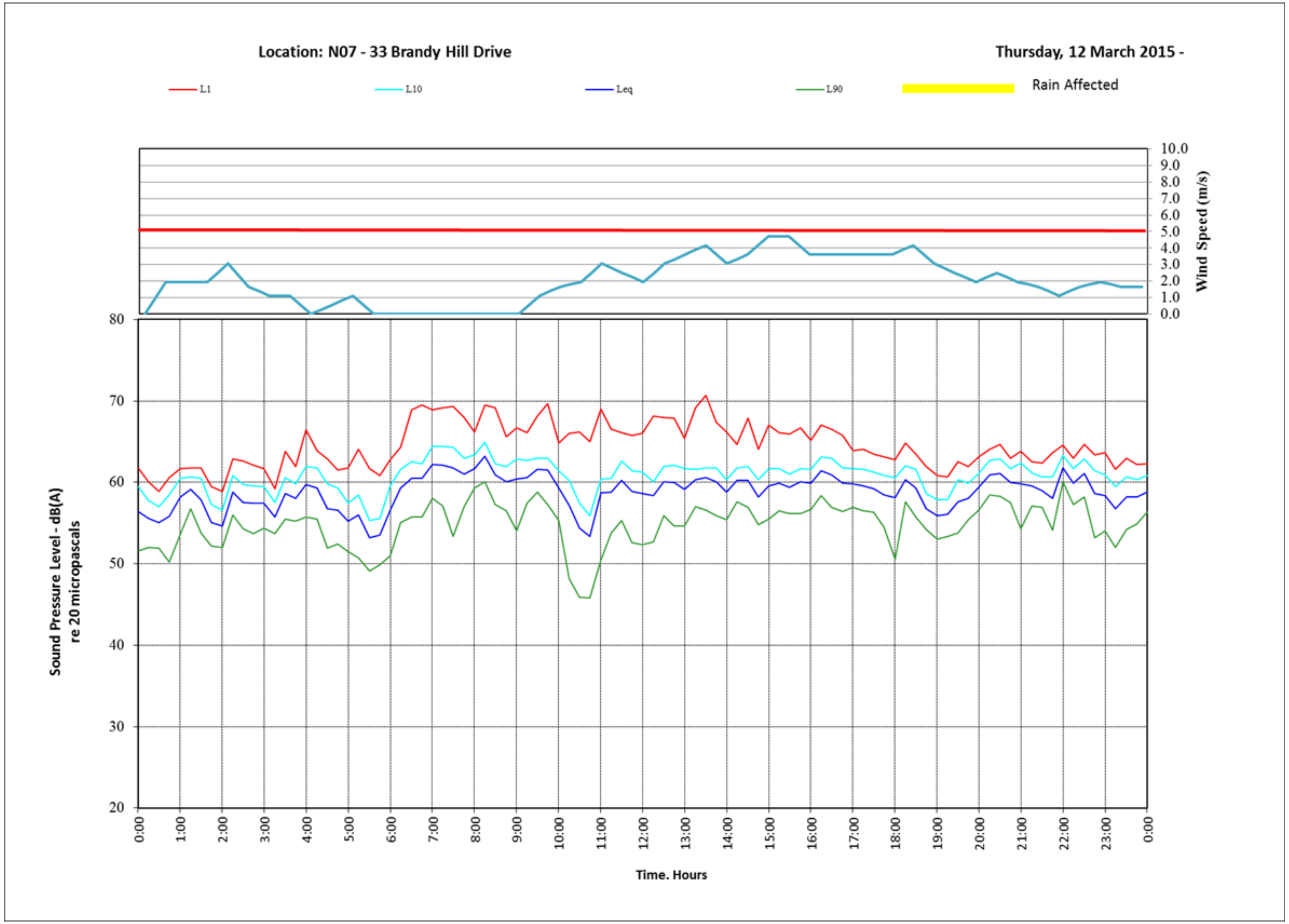
22:00
23:00
0:00
Time. Hours


Location: N07 - 33 Brandy Hill Drive
Tuesday, 10 March 2015 -
L1
L10
Leq
L90
Wind Speed (m/s)
Rain Affected
Wind Speed (m/s)
Sound Pressure Level - dB(A) re 20 micropascals
Time. Hours


Location: N07 - 33 Brandy Hill Drive
Wednesday, 11 March 2015 -
L1
L10
Leq
L90
Rain Affected
Wind Speed (m/s)
Sound Pressure Level - dB(A) re 20 micropascals
Time. Hours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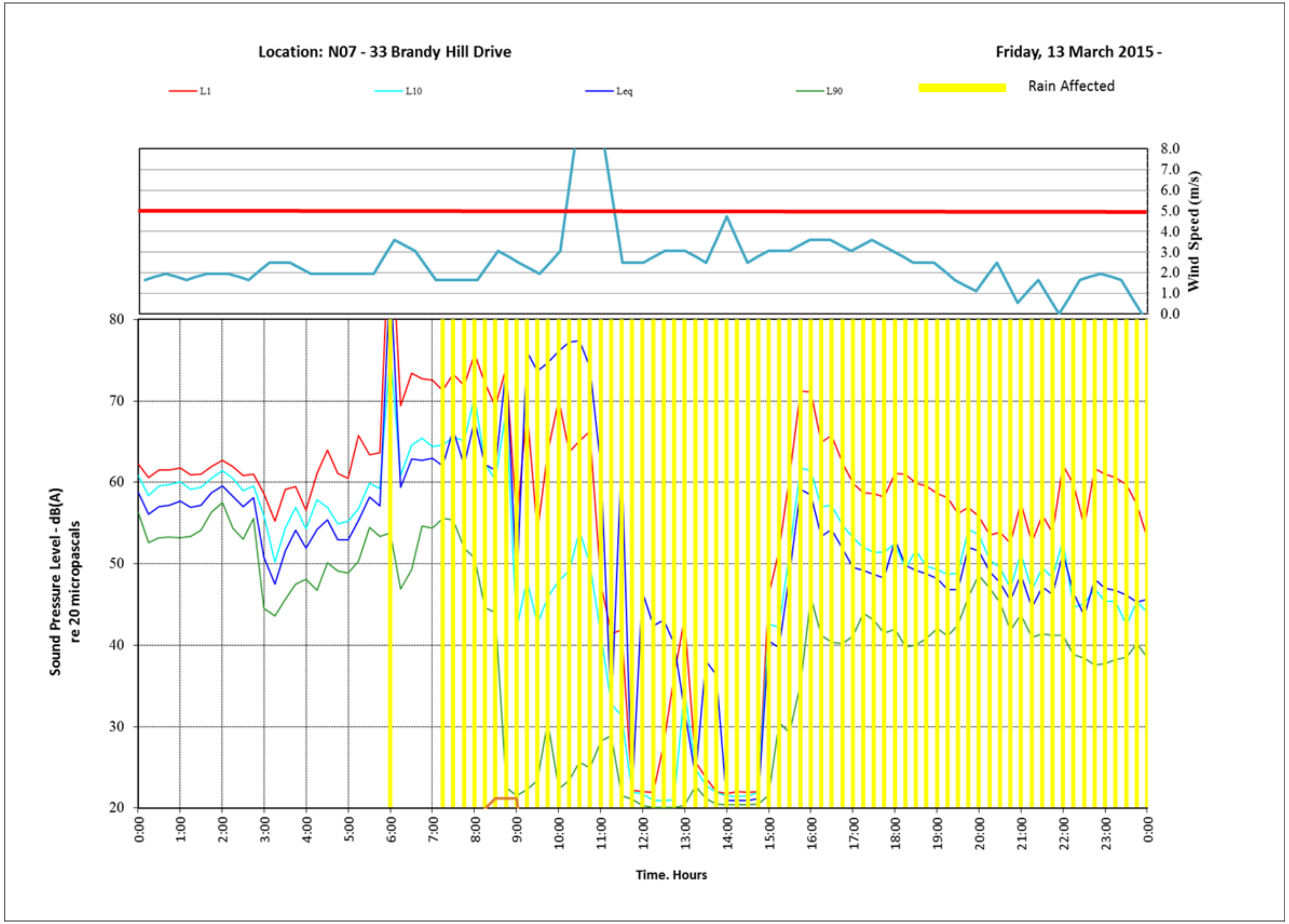
L10
Leq
L90
Rain Affected
Wind Speed (m/s)
Sound Pressure Level - dB(A) re 20 micropascals
Time. Hours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3.0
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0.0
Sound Pressure Level - dB(A) re 20 micropascals
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70
60
50
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30
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0:00
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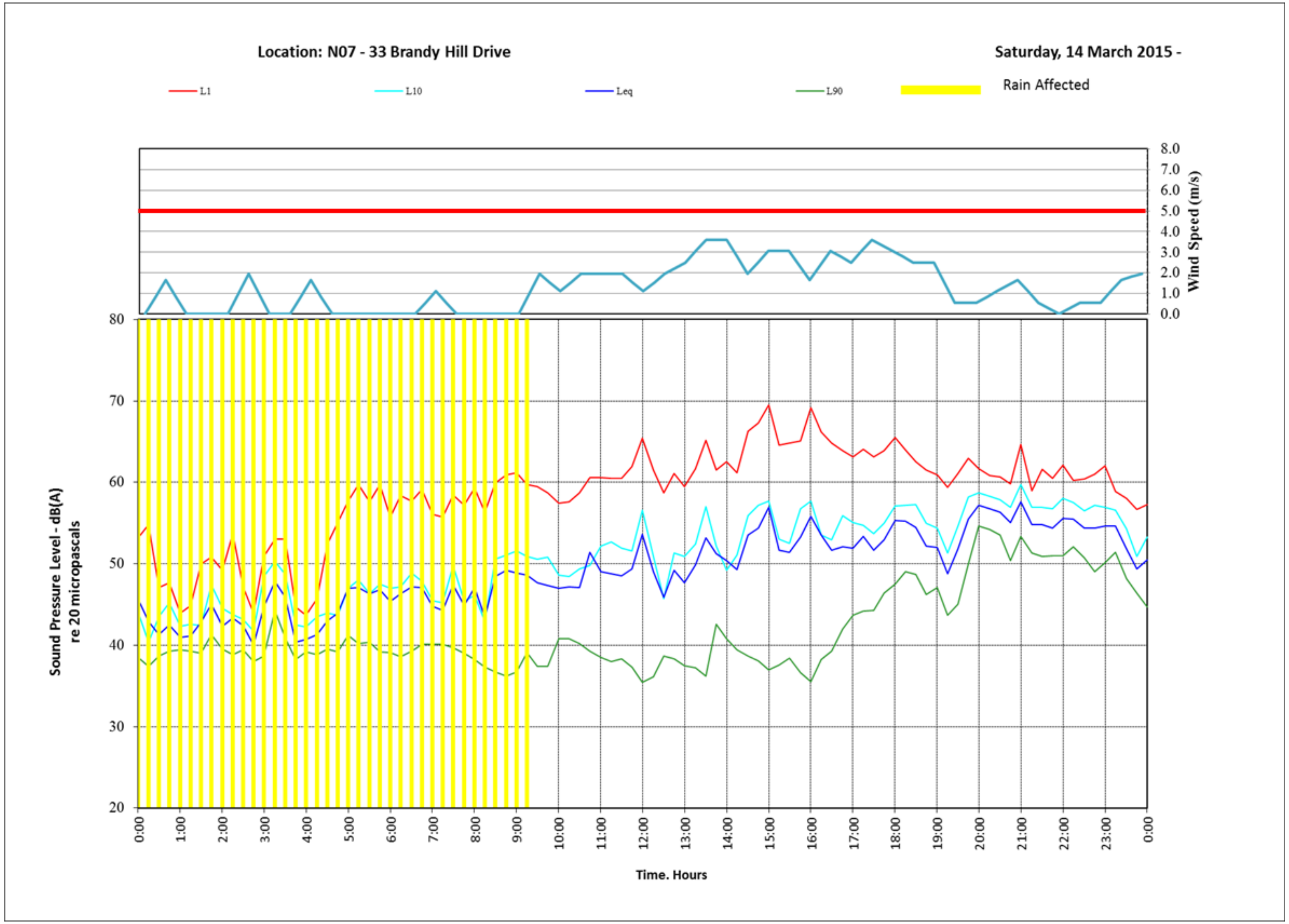
Time. Hours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Leq
L90
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4.0
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0.0
Sound Pressure Level - dB(A) re 20 micropascals
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70
60
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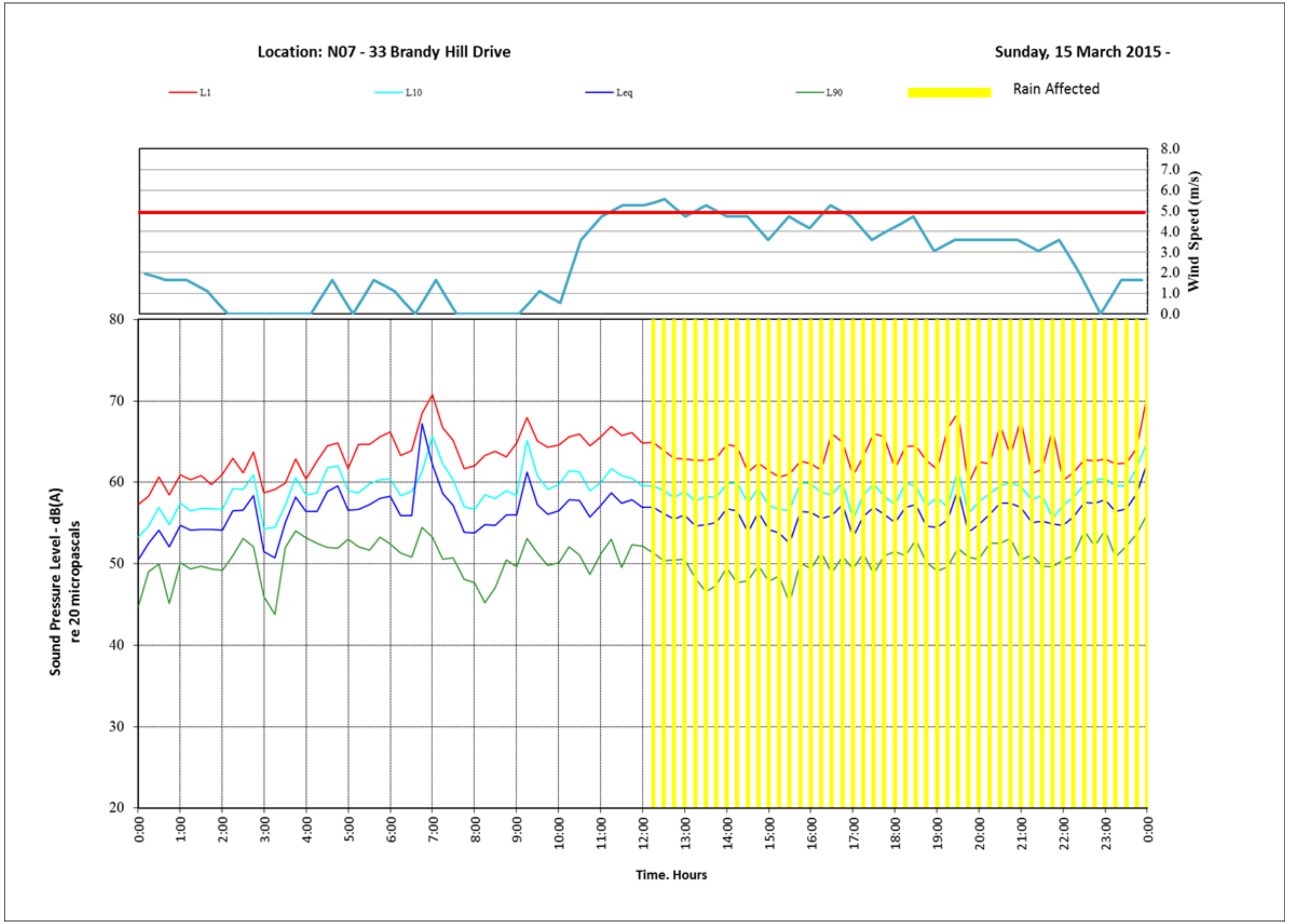
Time. Hours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Leq
L90
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Sound Pressure Level - dB(A) re 20 micropascals
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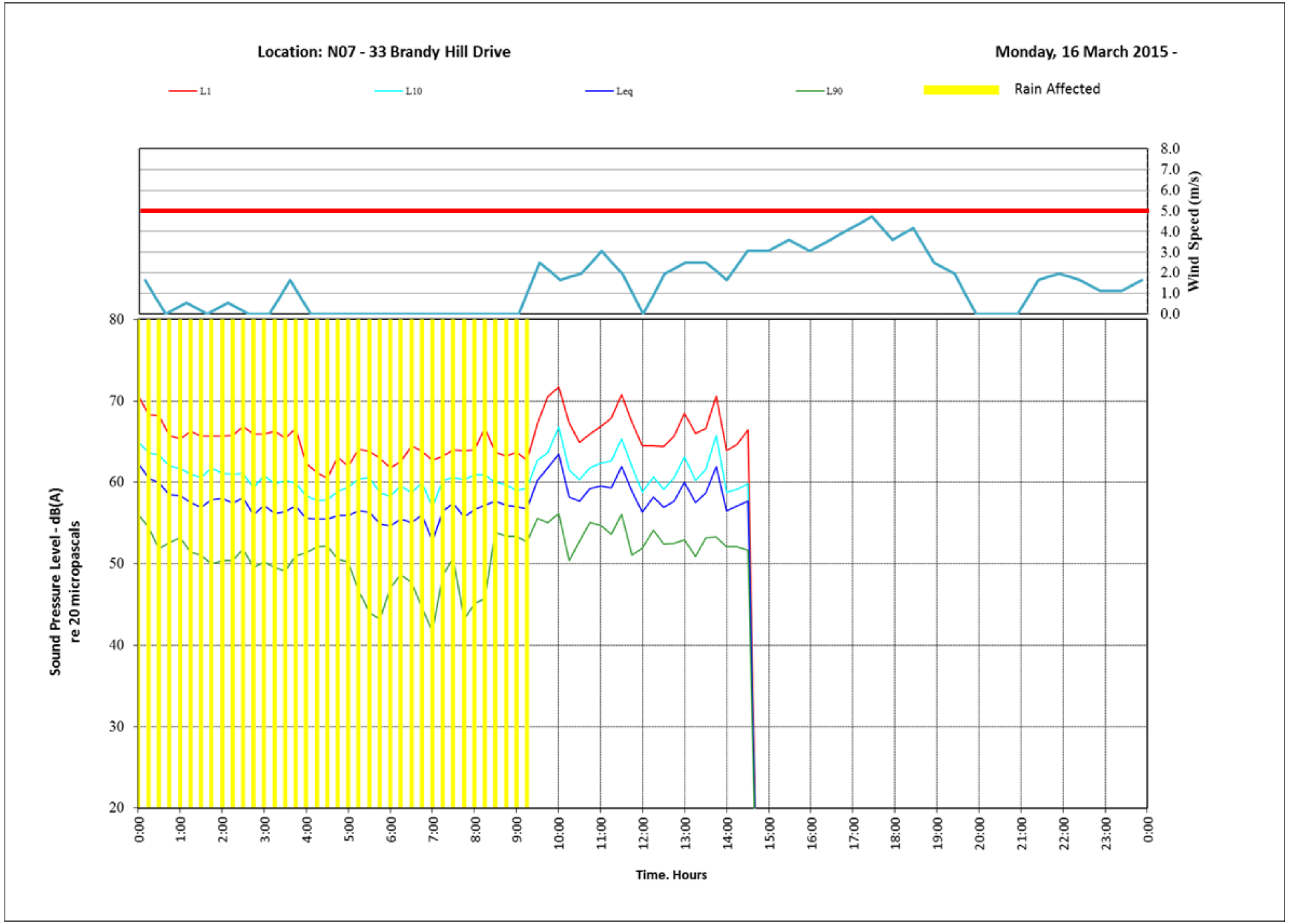
Time. Hours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Leq
L90
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5.0
4.0
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Sound Pressure Level - dB(A) re 20 micropascals
80
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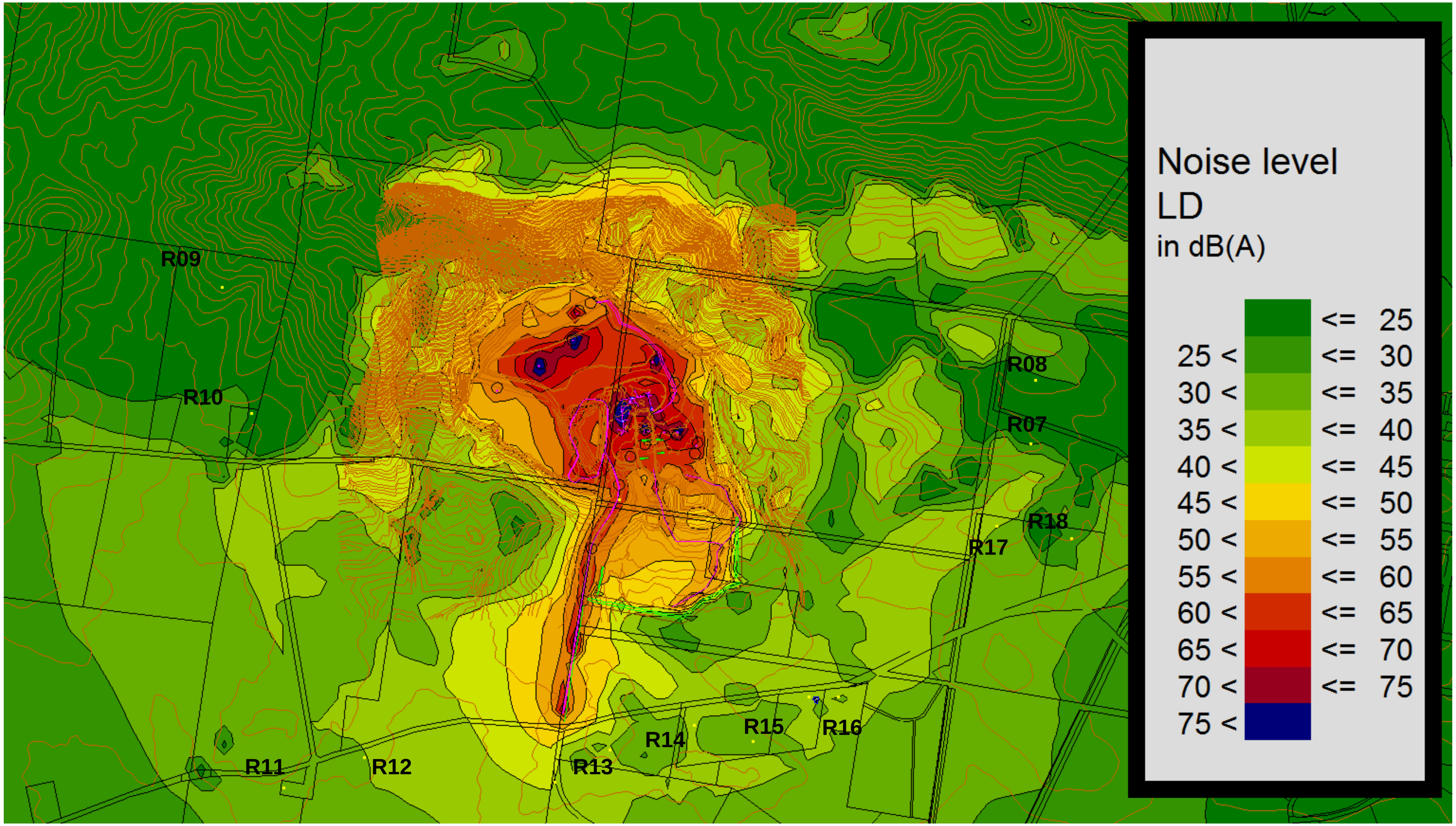
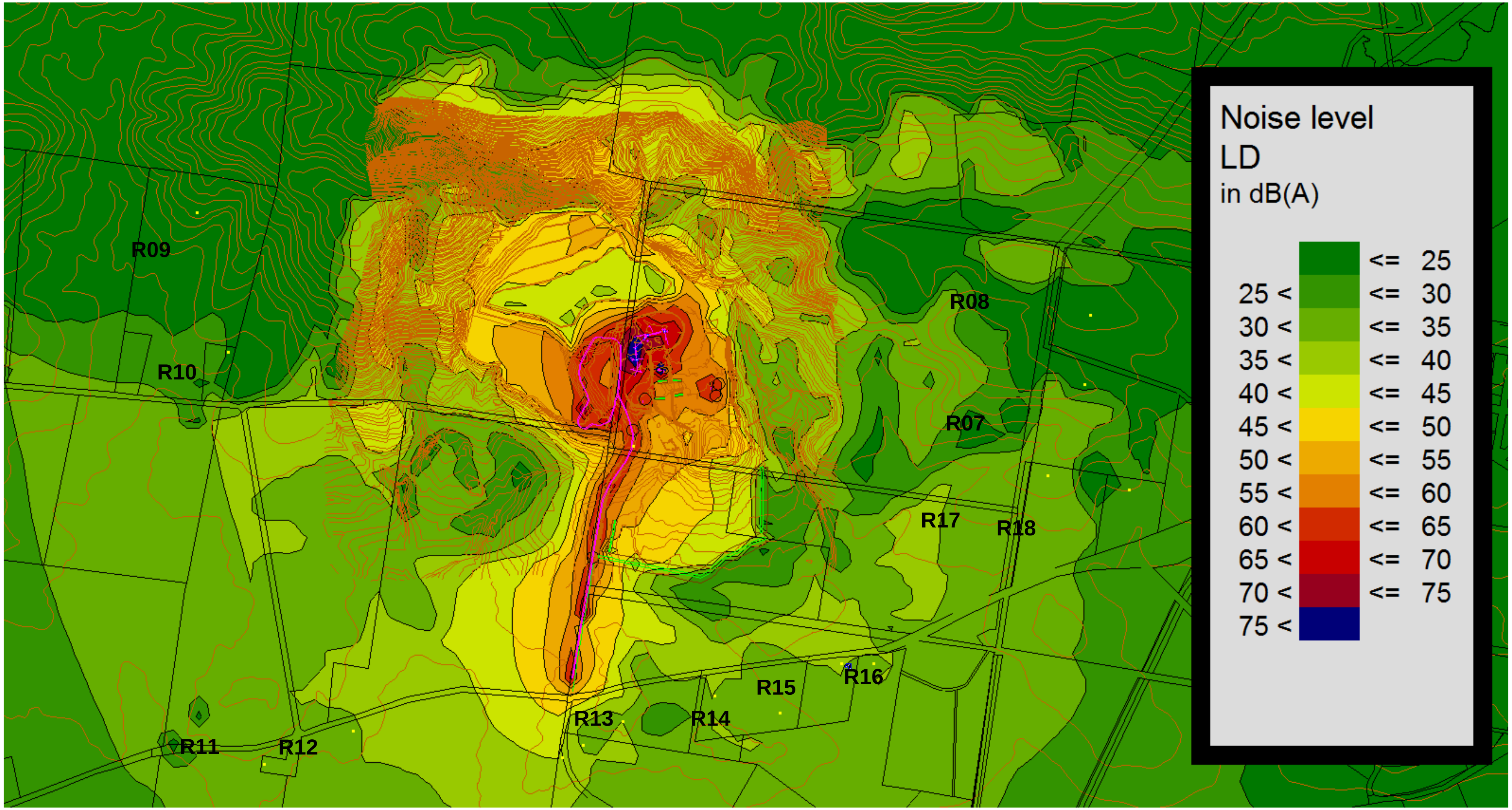
Time. Hours

Appendix C NOISE CONTOURS



Stage 1 (Day) Worst Case Scenario



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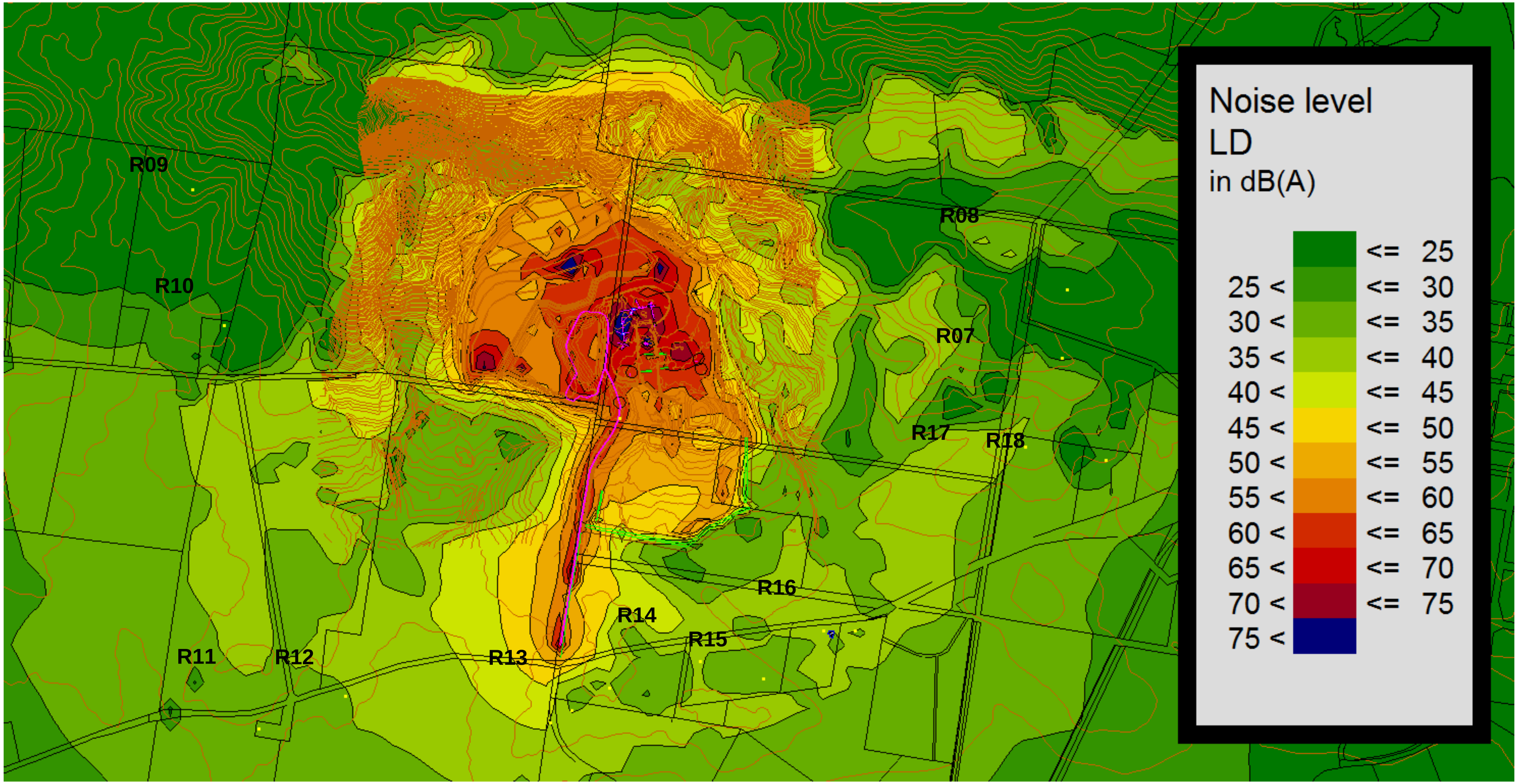

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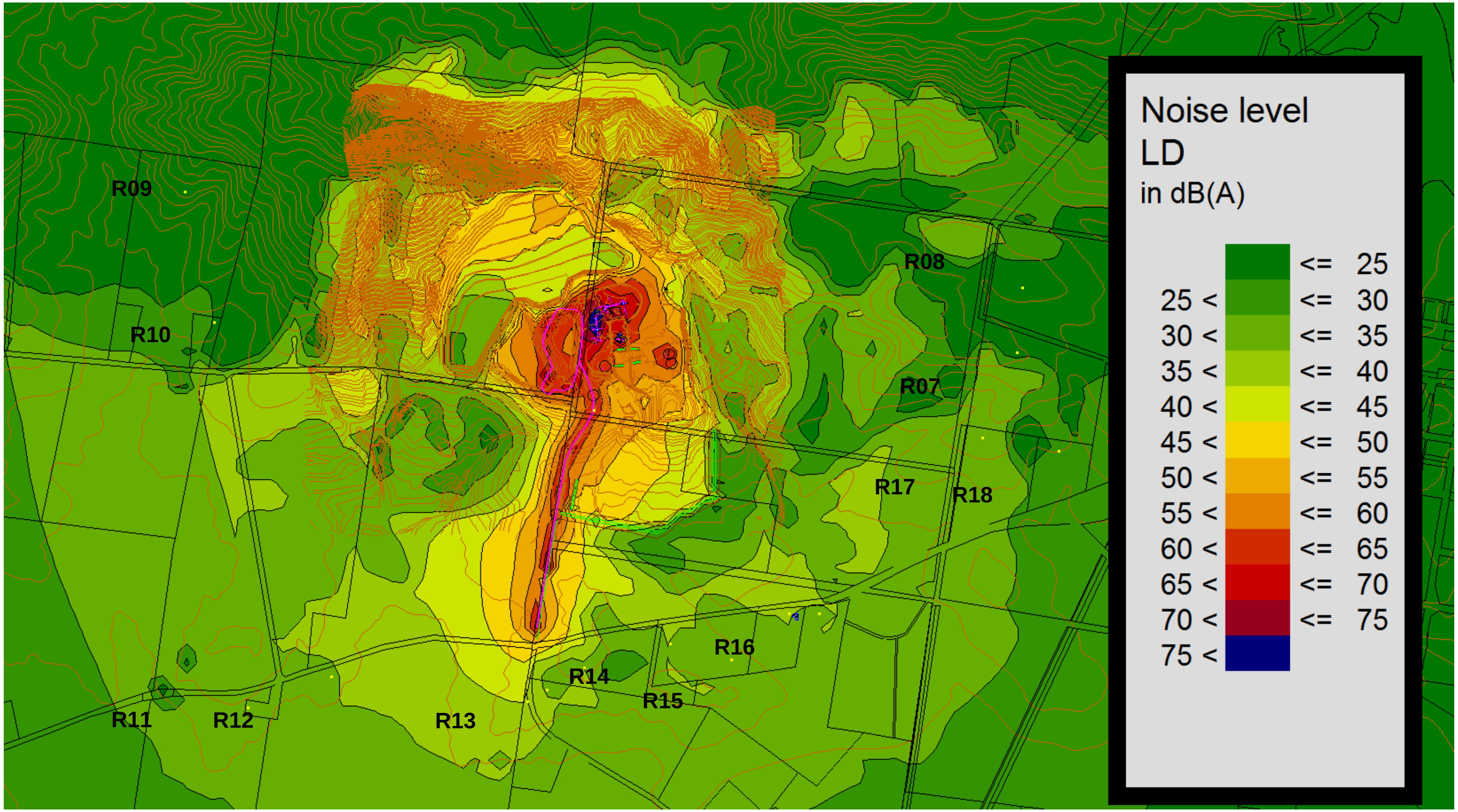

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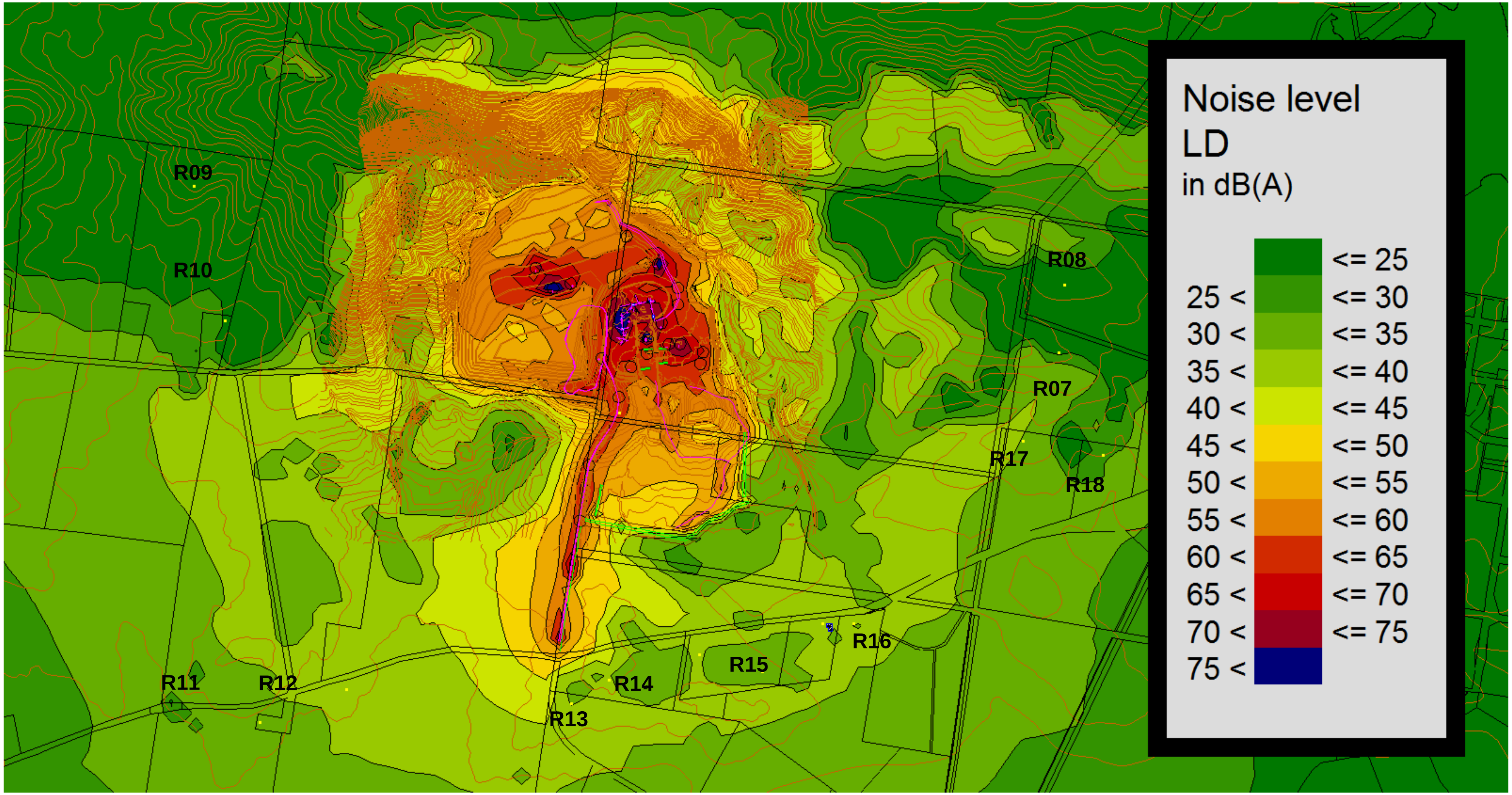
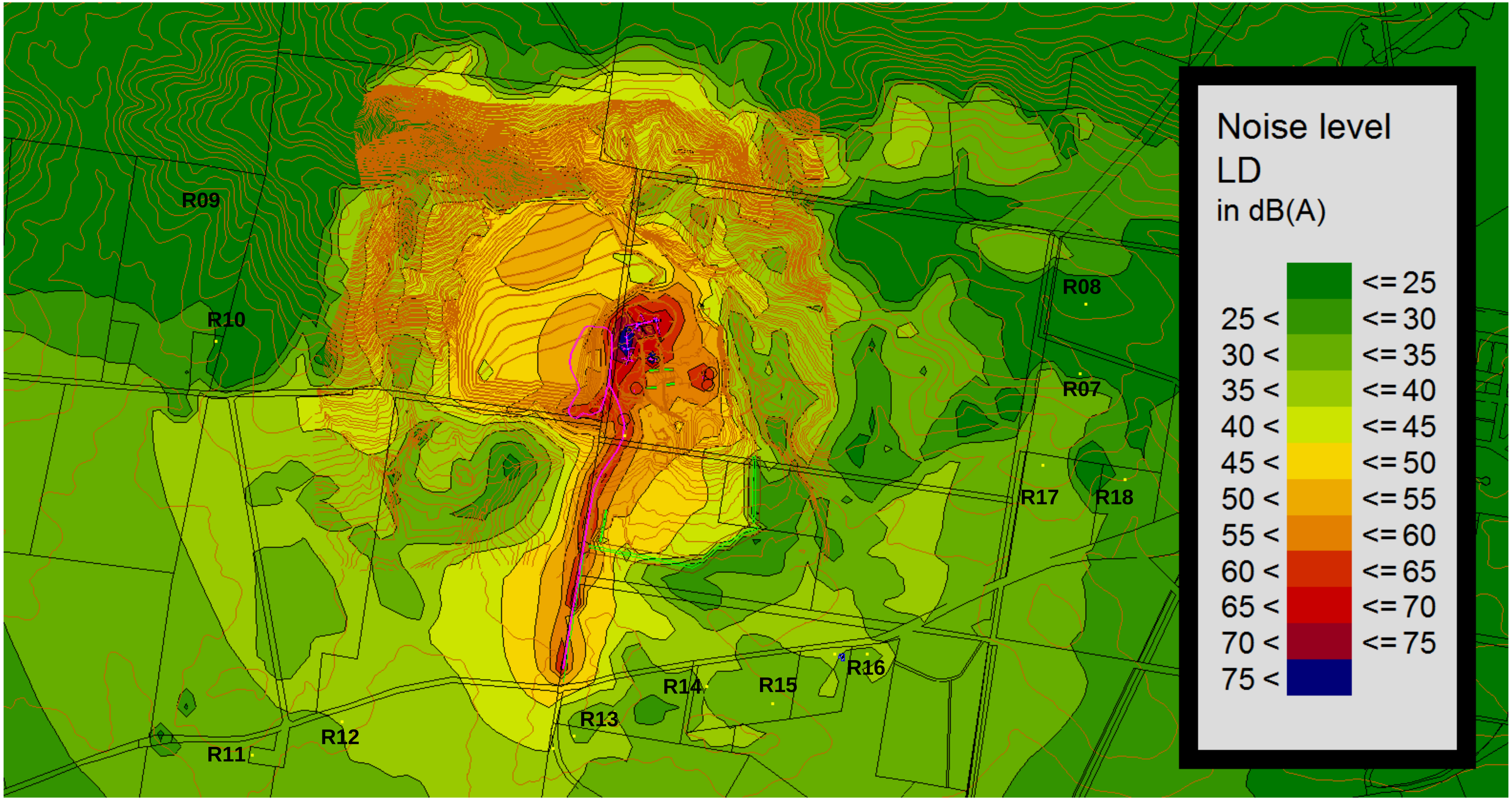
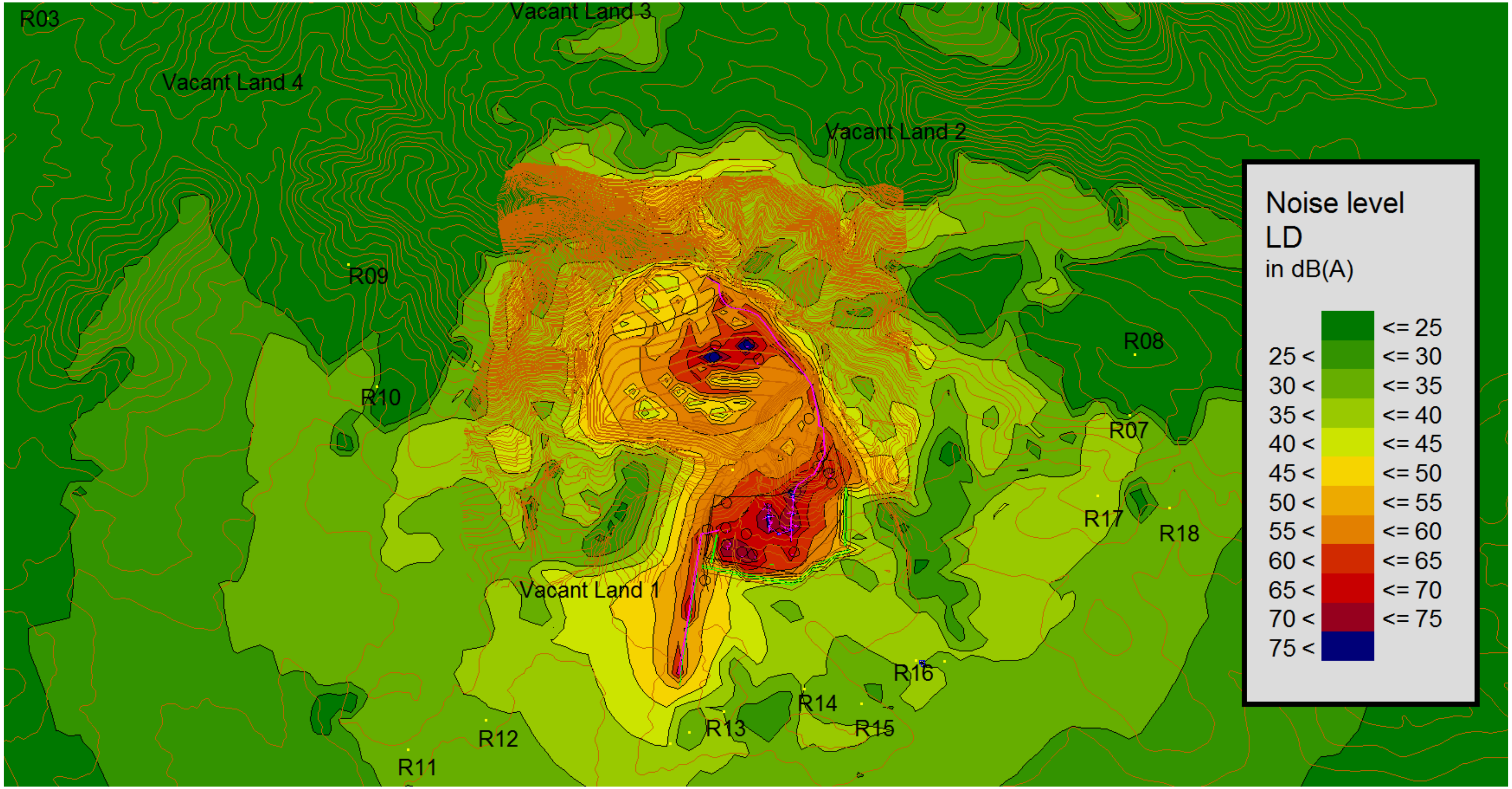


Stage 3 (Day) Worst Case Scenario



Stage 3 (Night) Worst Case Scenario



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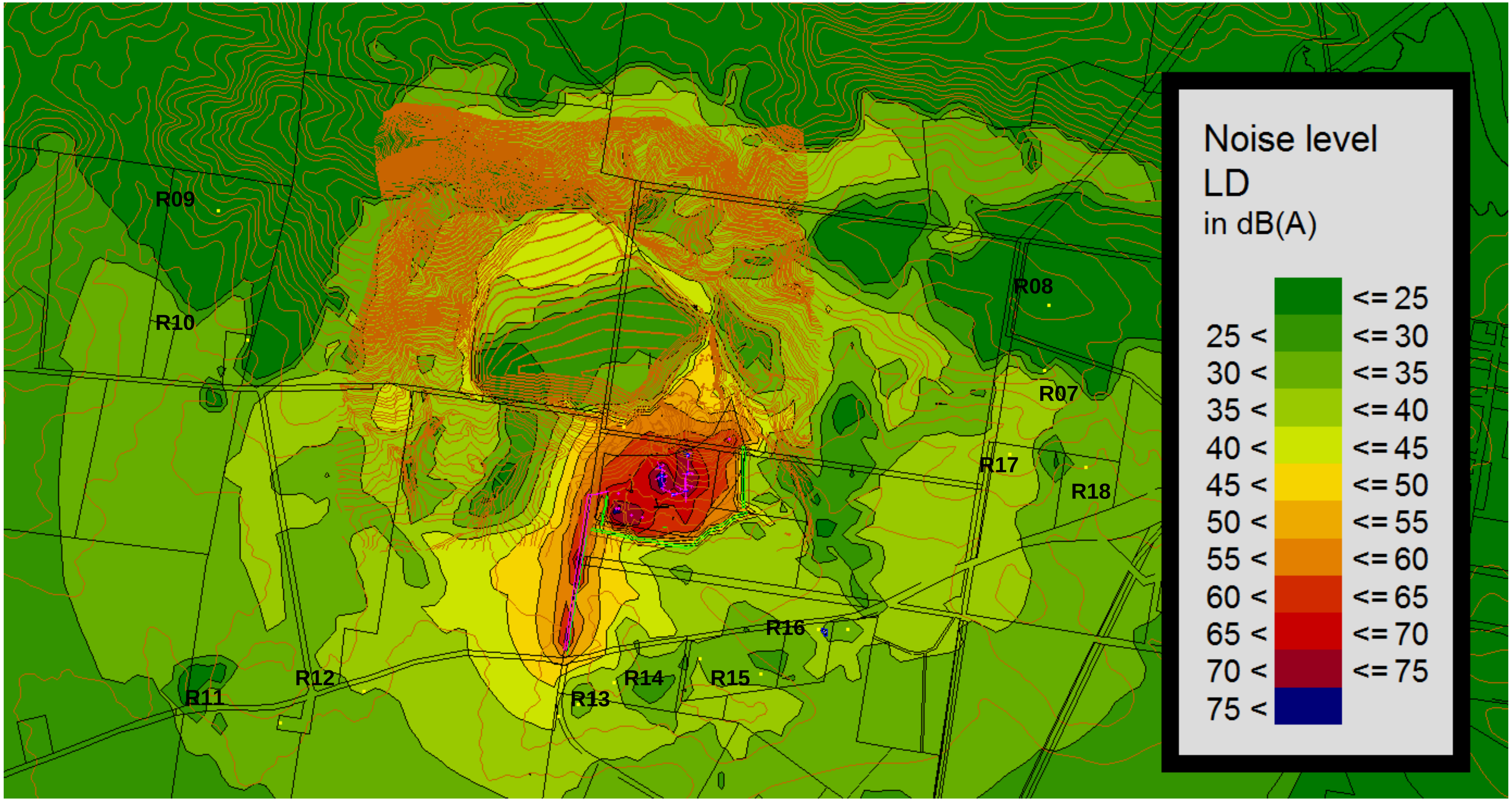
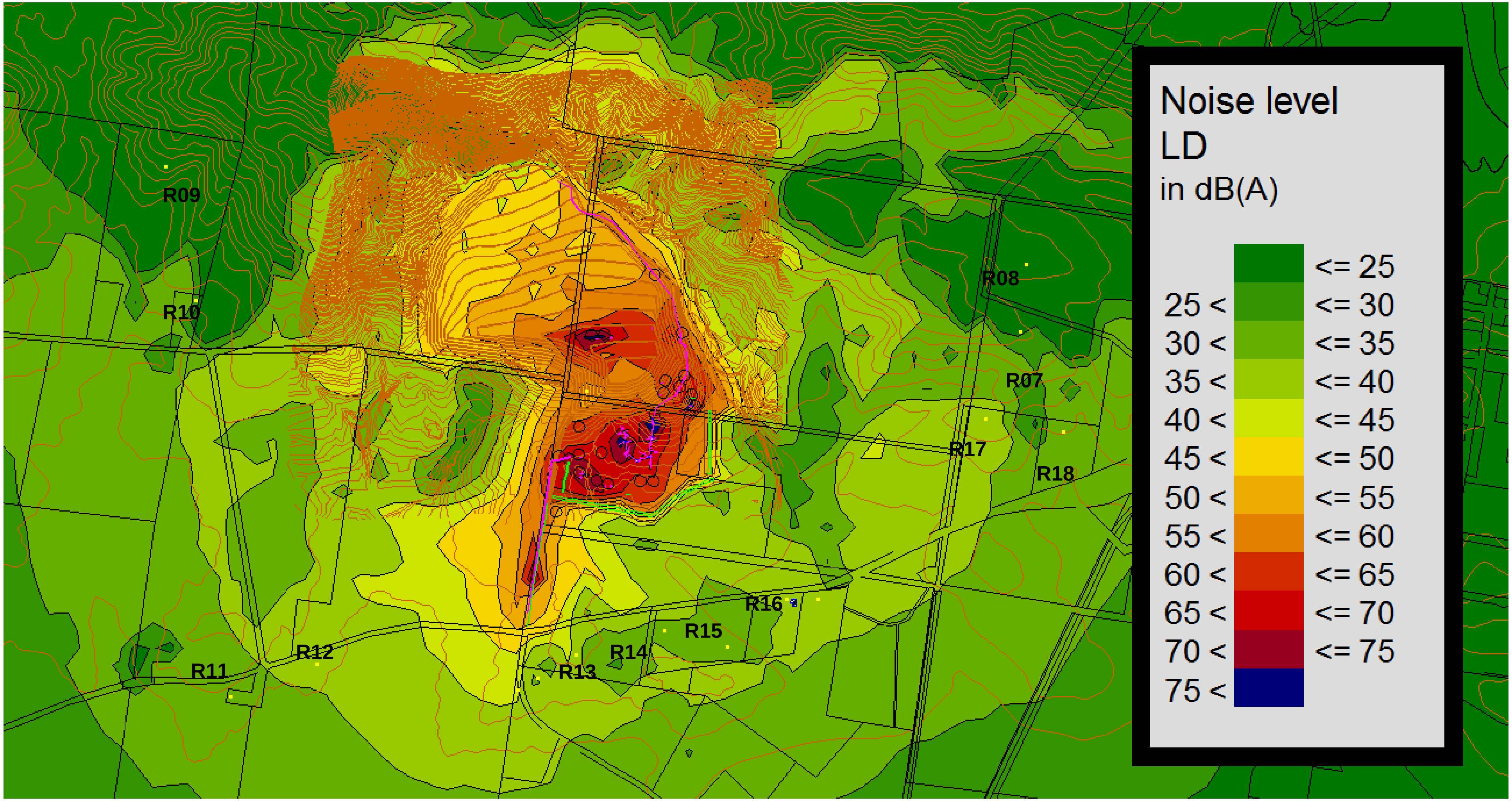
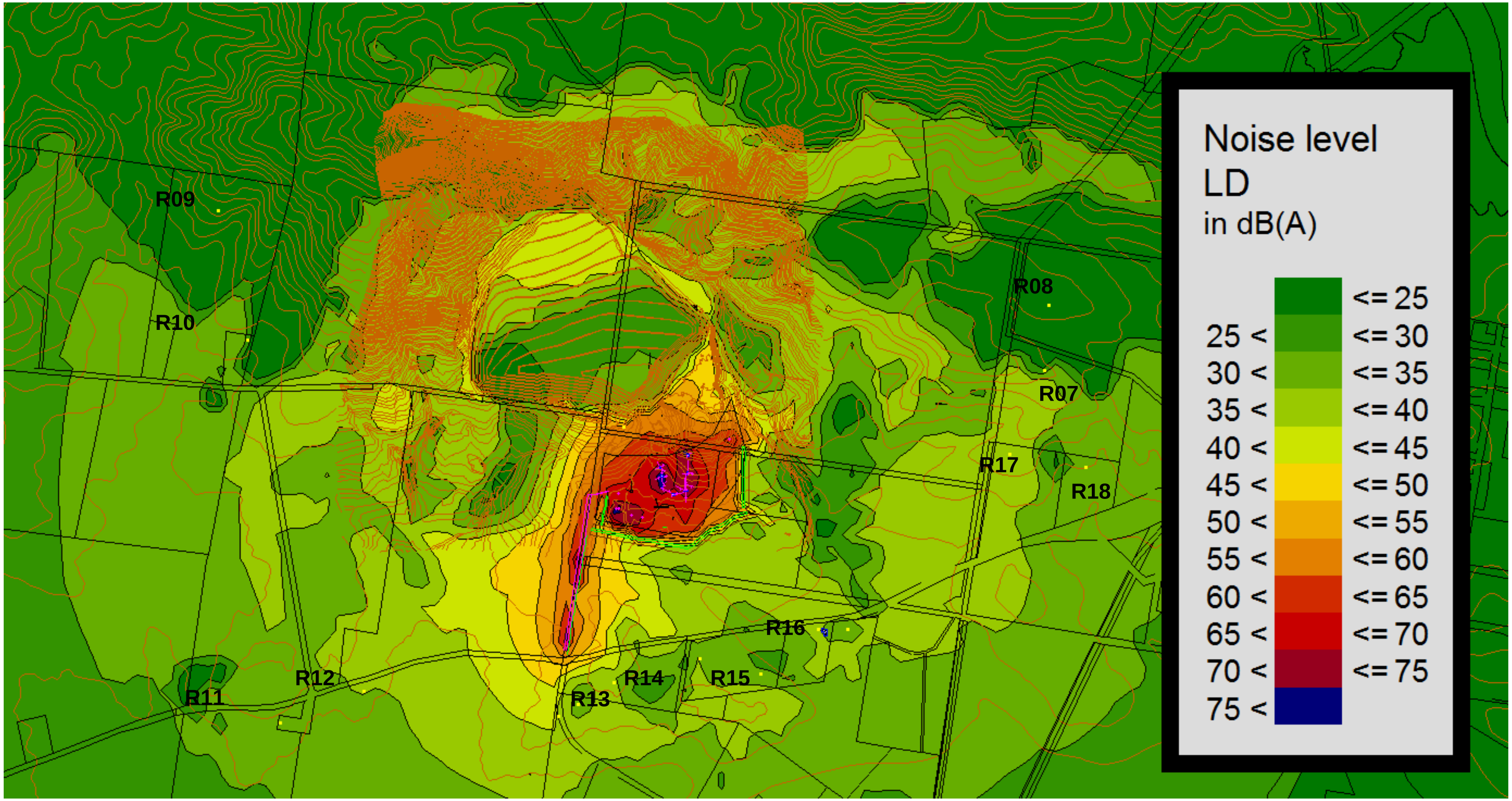


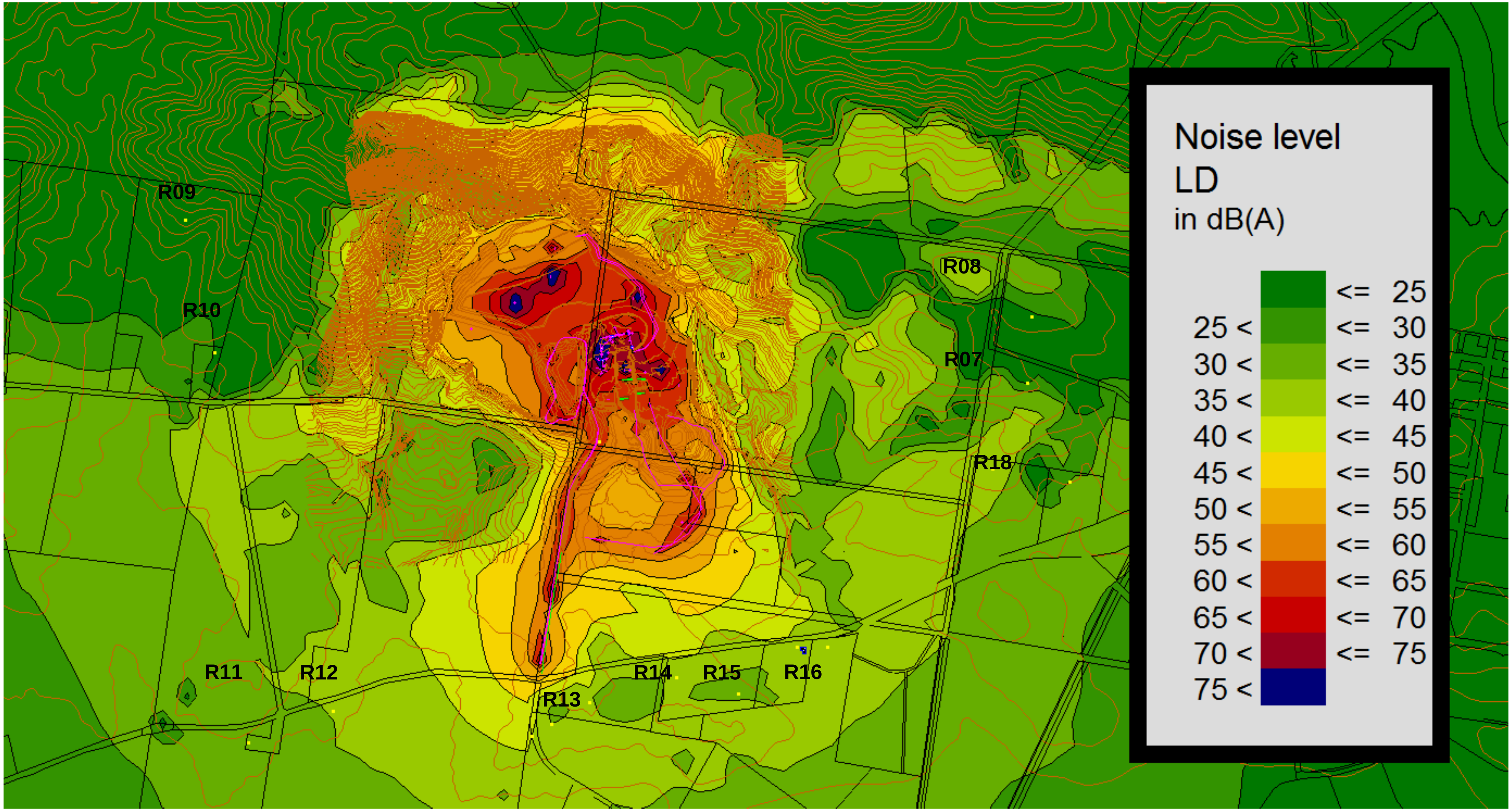
Stage 4 (Night) Worst Case Scenario



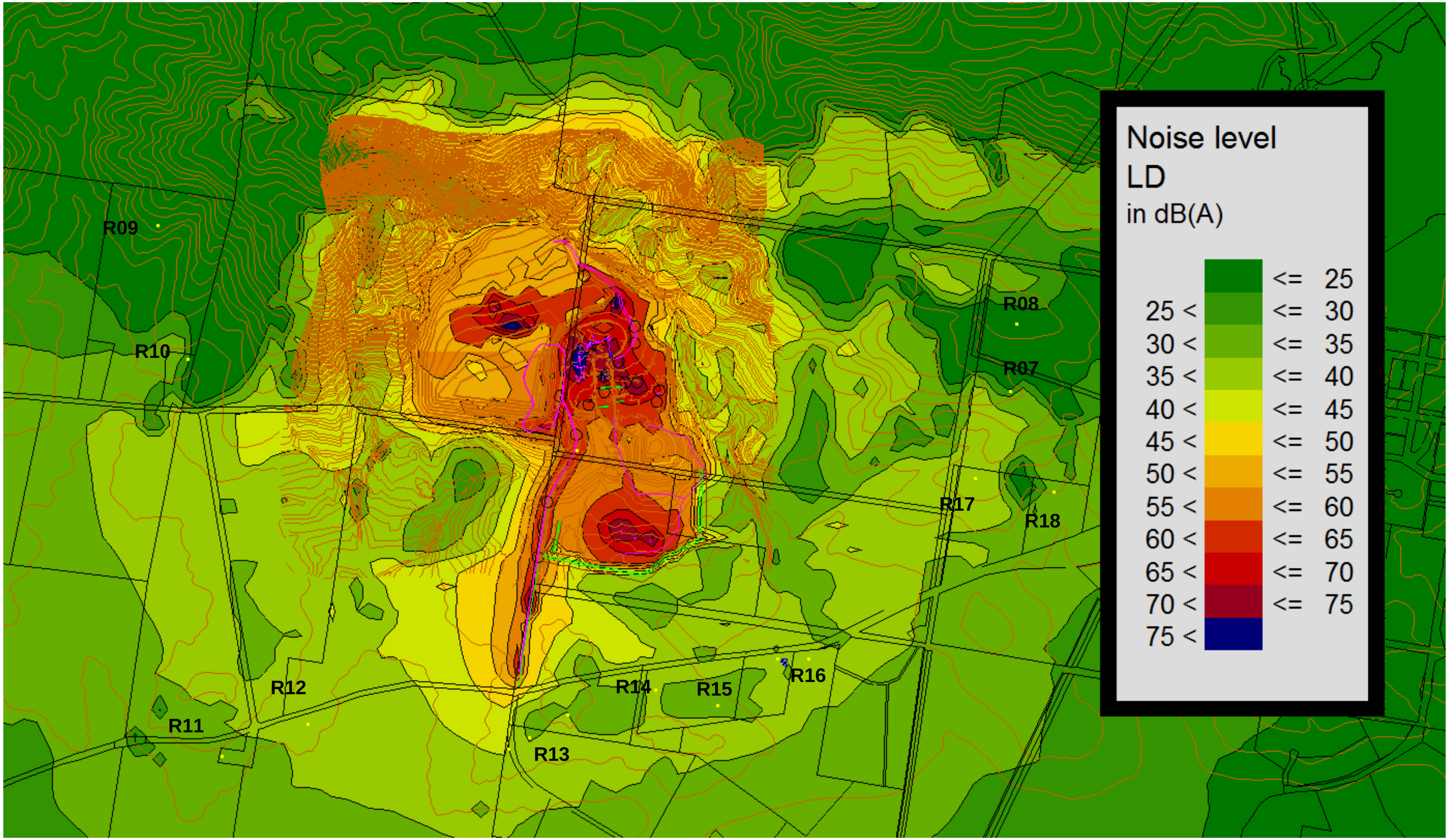
Stage 5 (Day) Worst Case Scenario



Stage 5 (Night) Worst Case Scenario



Construction Stage 1 (Day) Worst Case Scenario



Construction Stage 2 (Day) Worst Case Scenario

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Appendix 6

Updated Amended Air Quality Assessment – Vipac Engineers & Scientists Ltd – September 2018

(Total No. of pages including blank pages = 102)

* A colour version of this Appendix is available on the digital version of this document

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Vipac Engineers & Scientists

Hanson Construction Materials

Brandy Hill Quarry Expansion

Updated Air Quality Assessment

29N-14-0060-TRP-517221-10

27 September 2018

Brandy Hill Quarry Expansion Updated Air Quality Assessment	
DOCUMENT NO: 29N-14-0060-TRP-517221-10	**REPORT CODE:** TRP
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AUTHORISED BY:		
	Dr. Steve Thomas **Principal Air Quality Consultant**	Date: 27 Sept 2018
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5	25 Jan 2016	Comment
6	19 May 2016	Final
7	20 May 2016	Final
8	23 July 2018	Revised Final
9	31 July 2018	Final
10	27 Sept 2018	Final
DISTRIBUTION		
Copy No 2	**Location**	
1	Project	
2	Client (PDF Format)	Uncontrolled Copy

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EXECUTIVE SUMMARY

Vipac Engineers and Scientists Ltd (Vipac) was commissioned by Hanson Construction Materials (Hanson) to prepare an air quality impact assessment for the proposed expansion of the Brandy Hill Quarry (BHQ), located near the town of Seaham, New South Wales.

This Level 2 assessment predicts particulate matter and air pollutant emissions and dispersion concentrations in accordance with the relevant NSW guidelines and is based on computational modelling. Recommendations for design and management controls are provided, where needed. The modelling is based on staged operational scenarios provided by Hanson. The emission rates for individual extractive activities were calculated in accordance with the National Pollutant Inventory (NPI) - *Emissions Estimation Technique (EET) Manual for Mining.*

The main air emissions from BHQ operations are caused by crushing and screening, wind-borne dust, vehicle usage, materials handling and transfers. A major source of dust will be from the construction of an amenity barrier at the southern boundary of the quarry, but this will be a temporary activity. Once completed, the amenity barrier would provide long-term attenuation benefits by limiting the dispersal of the ground-borne particulate emissions, such as PM_{10} from the BHQ.

In order to assess the impact of a quarry expansion on the receiving environment, the incremental impact is quantified and added to existing background pollutant concentrations. Vipac has used dust deposition monitoring results from BHQ as well as daily particulate monitoring data from NSW EPA site at Beresfield in the predictions.

The results of the modelling have shown that during all stages, the Total Suspended Particles (TSP), dust deposition and Respirable Crystalline Silica (RCS) predictions comply with the relevant criteria.

Predicted exceedances of annual $PM_{2.5}$ concentrations are driven by a high background concentration assumed for the assessment which already exceeds the criterion of 8 $\mu g/m^3$. The results have shown that the proposed efficiency controls for the processing plant, as modelled, significantly reduce the particulate emissions and impact on sensitive receptors.

The construction of an amenity barrier at the southern boundary of the future processing area will assist in limiting the dispersal of the ground-borne particulate emissions, such as PM_{10}. The height of the conveyors and other plant will not protrude above the barrier and therefore the emissions are expected to be significantly reduced at sensitive receptors along Clarence Town Road.

Recommendations for the installation of a continuous particulate matter monitor such as a Tapered Element Oscillating Microbalance (TEOM) or Beta Attenuation Monitor (BAM) capable of sampling particle sizes down to 10µm on a continual basis, or similar equipment (the capabilities of which should be discussed and minimum requirements agreed with NSW EPA in advance) and weather station at the fence-line of the quarry have been made. This would demonstrate the successful implementation of proactive dust controls measures, allow adaptive air quality management and reduce the likelihood of exceedances and complaints.

A greenhouse gas assessment has been undertaken for the extension proposal. This assessment determined the carbon dioxide equivalent (CO_2-e) emissions from the project according to international and Federal guidelines. Calculating the GHG emissions for the life of the BHQ, based on an extraction rate of 1.5 Mtpa for 30 years the following GHG emissions are expected:

- Scope 1 emissions: 296,072.5 tonnes CO_2-equivalent;
- Scope 2 emissions: 85,426.5 tonnes CO_2-equivalent; and
- Scope 3 emissions: 41,242.5 tonnes CO_2-equivalent.

The estimated maximum annual operational phase emissions represent less than 0.005% of Australia's latest greenhouse gas inventory estimates.

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1 INTRODUCTION

Vipac Engineers and Scientists Ltd (Vipac) was commissioned by Hanson Construction Materials (Hanson) to prepare an air quality impact assessment for the proposed expansion of the Brandy Hill Quarry (BHQ), located approximately 21 km to the west of the village of Seaham, New South Wales.

The purpose of this assessment is to predict particulate matter generation and dispersion to evaluate the potential impacts of air pollutants generated from the construction and operational stages of the BHQ expansion and to provide recommendations to mitigate any potential impacts on nearby sensitive receptors.

A technical report (the Brandy Hill Quarry Expansion – Air Quality Assessment Report (Vipac Report Ref No. 29N-14-0060-TRP-517221-7)) outlining the methodology and results of the air quality assessment was prepared by Vipac in May 2016 to accompany the Environmental Impact Statement for the proposed expansion. The EIS and accompanying documents were exhibited by the Department of Planning and Environment from 10 March 2017 to 9 April 2017. This document addresses submissions received during the public exhibition period and will be incorporated into a Response to Submissions document.

Modified operational and construction scenarios (see Section 8.2) have been developed by Hanson since the issue of the Air Quality Assessment Report in May 2016. This document therefore outlines the methodology and results of the modelling assessment of the modified scenarios while addressing the submissions. The assessment also accounts for additional mitigation consistent with that proposed for the noise and vibration impact assessment of the proposed quarry expansion (29N-14-0060-TRP-822352-13).

2 PROJECT DESCRIPTION

2.1 Site Location

The quarry is located in Seaham, which is a village within the Port Stephens local government area in the Hunter Region of New South Wales. The quarry is located on land owned by Hanson that is approximately 554 hectares in area. The surrounding area is predominately zoned as rural landscape with minimal primary production.

The suburb of Brandy Hill lies to the south and is zoned as a large lot residential area. Seaham lies to the east and is zoned as a low density residential area. To the west and northwest of the BHQ extraction area, within the property boundary, the land is zoned as an environmental management area. To the north is a property zoned as an environmental conservation area. Road access to BHQ is at Clarence Town Road at the intersection with Brandy Hill Drive.

2.2 Proposed Expansion

The proposed expansion will involve extending the life of the quarry to allow for extraction of additional resources at a rate of up to 1.5 million tonnes per annum (Mtpa). The proposed extraction area extension includes extraction resources beneath part of the existing quarry infrastructure area. In order to accommodate the proposed extraction area, it is proposed to relocate the existing plant infrastructure approximately 550 m south of the current location, as shown in ***Figure 2-1***.

It is also proposed to receive concrete washout material from concrete batch plants in order to produce blended recycled aggregates and road base. Approximately 20,000 tonnes of washout material will be received and the material will be crushed and blended with the aggregate material to produce recycled road base and other fill and drainage materials. A mobile crushing unit or similar small crushing system would be used for this process.

2.2.1 Extraction boundaries

The proposed disturbance area associated with the quarry is approximately 54 hectares. The total resource available within the proposed extraction boundary is 78 million tonnes of hard rock.

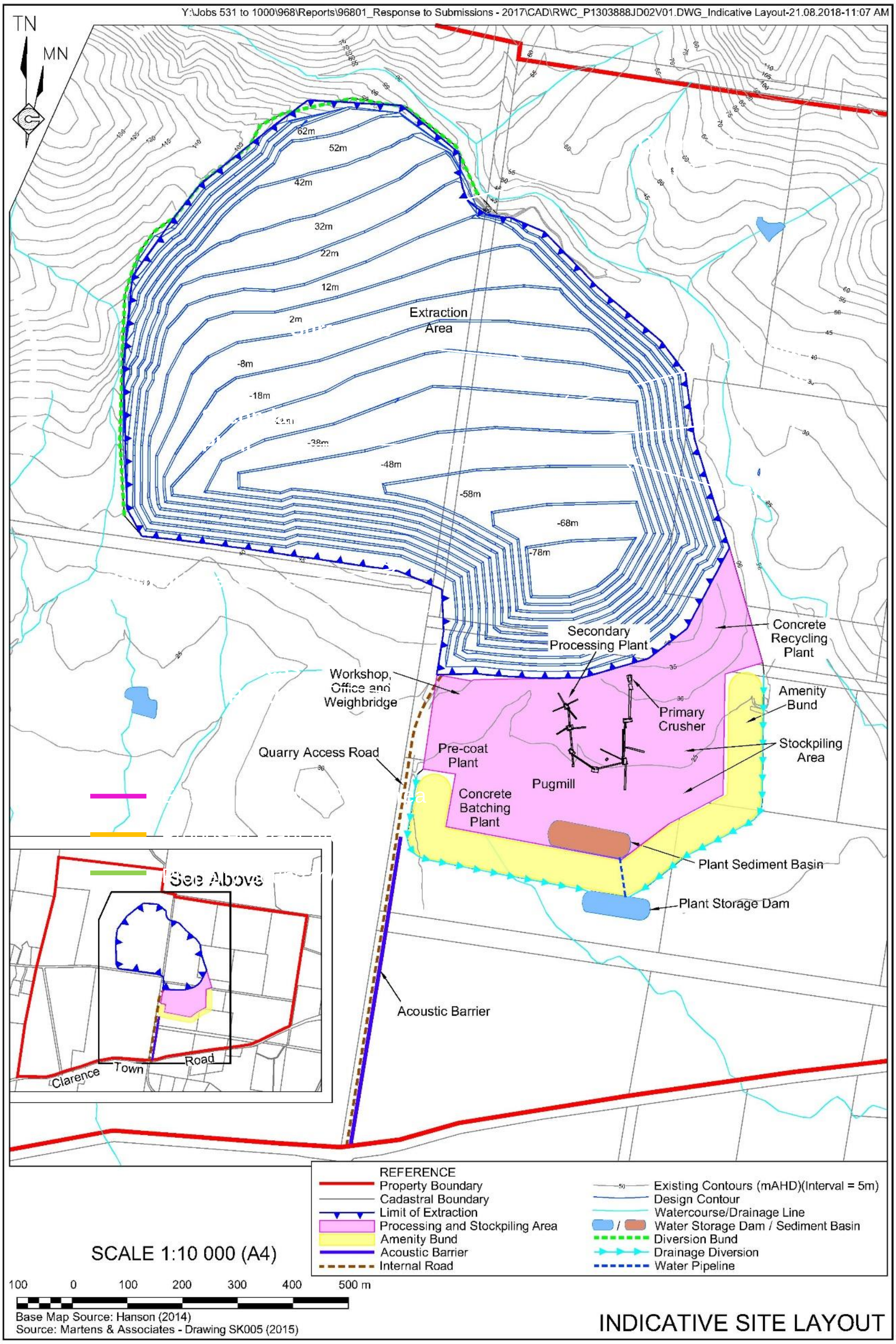


Figure 2-1: Current Infrastructure Area with Proposed Plant Infrastructure Area

The location of the existing plant infrastructure is illustrated in the aerial photograph shown in ***Figure 2-1***. It should be noted that as part of the proposed quarry expansion plans, the existing plant infrastructure will be relocated to the area outlined above in orange (i.e. the Proposed Plant Area).

2.2.2 Proposed Operating Hours

The proposed operating hours of the quarry are outlined in ***Table 2-1***.

Table 2-1: Proposed Operating Hours

Activity	Day	Time
Construction Works	Monday – Friday	7:00am-6:00pm
	Saturday	7:00am-5:00pm
	Sunday and Public Holidays	None
Blasting	Monday – Friday	9:00am-5:00pm*
	Saturday, Sunday and Public Holidays	None
Load and Haul	Monday – Saturday	5:00am-10:00pm
	Sunday and Public Holidays	None
Primary Crusher	Monday – Saturday	5:00am-10:00pm
	Sunday and Public Holidays	None
Secondary and Tertiary Crushing and Screening	Any day	24 Hours
Sales and Despatch	Any day	24 Hours
Maintenance	Any day	24 Hours
Source: Modified after Hanson (2017) - Table 1.3.2 * Blasting hours in the EIS were 8:00am to 5:00pm and have been adjusted on the advice of the EPA.		

2.2.3 Expansion Stages

The planned development of BHQ would occur in five stages:

<u>STAGE 1</u>

The initial stage will comprise of expanding the western end of the quarry towards the south, creating four broad benches running from the southwest to northeast and will create a large quarry pit floor at RL 22-metres. Overburden will be used to create an amenity barrier at the southern end of the proposed fixed plant location.

<u>STAGE 2</u>

Stage 2 will further expand the existing western end of the quarry towards the southwest of the proposed expansion boundary. Seven broad benches will be created and the quarry pit floor will be at RL -8metres. Topsoil will also be used to rehabilitate the upper benches above RL 20m (AHD) as these benches will remain exposed upon completion of the quarry rehabilitation. Rehabilitation will be continual from stage two onwards and all final form areas will be planted with self-sustaining native vegetation communities and derived native grasslands.

STAGE 3

Stage 3 will expand the quarry along the southern extraction boundary towards the existing plant infrastructure. The western dam will be removed and ten broad benches will be created with the pit floor at RL -38metres. Overburden will be used for rehabilitation of the benches that have reached their final form.

STAGE 4

Stage 4 will entail widening the benches towards the eastern extraction boundary. This stage will involve relocating processing activities to the south of the existing processing areas. The weighbridge, amenities and maintenance building will be relocated to suit the pit form. At this stage, there will be twelve broad benches and the quarry pit floor will be at RL-58metres. This stage is the last stage where previously undisturbed land will be stripped to allow access to the resource material and to make space for the fixed plant and stockpile area. There will also be a 15metres high noise bund along the boundary of the new fixed processing plant.

STAGE 5

The final stage of the planned pit realises the final form of the quarry. This stage will expand the quarry to the proposed extraction boundary at the eastern and southern end. The final pit will consist of fourteen broad benches and the quarry pit floor at RL-78metres. At completion of this stage, rehabilitation would begin with the quarry void progressively filling with water through groundwater seepage and rain events up to RL30metres, where an equilibrium level would be reached.

As noted in Section 1, this assessment also accounts for additional mitigation scenarios consistent with those proposed for the noise and vibration impact assessment of the proposed quarry expansion. These additional scenarios include:

- Enclosures are to be installed on all crushing machines and screens, excluding Screen 1 (for Stages 1-3) and Screen 5, for future stages at the Brandy Hill Quarry; and
- Conveyor height can vary and conveyors are enclosed for Stage 4.

Further details of the modelled mitigation scenarios are discussed in Section 8.

2.2.4 Infrastructure

Ancillary plant such as a pre-coat plant for asphalts is used for existing operations and would also form part of the proposed expansion to assist in meeting industry demands for these products. The existing office block, quarry crib room, amenities block and transport crib room block have been on site for 20 years and are proposed to be relocated at Stage 4.

The proposal would incorporate a concrete batch plant within the quarry site. The concrete plant will supply concrete within the local markets. The plant will produce approximately 15,000 m^3 of concrete each year and will have a fleet of approximately two twin steer trucks with average load-size of approximately 5.5 m^3. The batch plant will produce approximately 2,700 additional trips per annum.

The plant infrastructure will be constructed on a concrete hard stand area and water runoff will be managed on site. The plant would consist of an upright silo, incline conveyor belt, load bin, admixture bunded area, and batchroom amenities. The profile of the batch plant will be kept under the existing quarry infrastructure to minimise any visual impact.

Hanson is also seeking consent to receive concrete washout material to be recycled on site. The concrete material will be stockpiled on site until a suitable quantity is available, this will then be crushed and blended with aggregate material to make a road base product. This can have additional cementitious material added as a binder to make different road base products to suit demand.

2.2.5 Current Equipment

Current quarry operations utilise the following mobile equipment:

- 2 x Komatsu WA500-6 front end loader;
- Volvo L250g front end loader;
- Caterpillar 773B dump truck and Caterpillar 773E dump truck;
- Komatsu PC600 excavator and Komatsu PC450 excavator; and
- Water cart

Current quarry operations utilise the following fixed plant:

- Jaques 48” x 42” double toggle jaw crusher and Jaques 4’ gyratory crusher;
- Allis Chalmers 60” gyratory crusher;
- Kawasaki 1200 cone crusher;
- Rotorpactor MKII (barmac) crusher;
- Jaques 4’ x 10’ two deck, Jaques 6’ x 16’ two deck vibrating screen, Jaques 8’ x 20’ three deck vibrating screen;
- 2 x Malco 8’ x 20’ three deck vibrating screens;
- 28 conveyor belts;
- Pug mill and associated conveyors and cementitious material silos; and
- Pre coat and associated conveyors and oil storage.

2.3 Sensitive Receptors

A review of the area has identified several sensitive receptors within the locality of the BHQ. The approximate geographic coordinates of the closest sensitive receptors are presented in ***Table 2-2*** and ***Figure 2-2***.

Figure 2-2: Sensitive Receptor Locations with the Quarry Boundary and Proposed Plant Area

Table 2-2: Sensitive Receptor Details

ID	Description	Universal Transverse Mercator Location (m)		Distance from Quarry (km)	Direction from Quarry (˚)
		X	Y		
R1	122B Dunns Creek Road	374075	6388164	3.2	310
R2	16 Uffington Road	375376	6390226	4.3	341
R3	60 Green Wattle Creek Road	374057	6387248	2.8	295
R4	34 Timber Top Road	378601	6388683	3.0	31
R5	35 Timber Top Road	378489	6388803	3.1	29
R6	36 Timber Top Road	378524	6388708	3.0	32
R7	13 Mooghin Road	378852	6385492	1.4	90
R8	14 Mooghin Road	378874	6385763	1.4	87
R9	13 Giles Road	375391	6386160	1.2	273
R10	13B Giles Road	375515	6385619	1.1	257
R11	866 Clarence Town Road	375653	6384015	2.0	231
R12	994 Clarence Town Road	377028	6384170	1.1	188
R13	1034 Clarence Town Road	377412	6384283	1.0	176
R14	1060 Clarence Town Road	377624	6384207	1.0	173
R15	1094 Clarence Town Road	377933	6384401	0.8	153
R16	1189 Clarence Town Road	378709	6385138	1.2	96
R17	1203 Clarence Town Road	379027	6385084	1.5	97

2.4 Vacant Land Receptors

In addition to the sensitive receptors outlined in Section 2.3, there are 4 vacant lands in the vicinity of the Brandy Hill Quarry. The addresses associated with the 4 vacant lands is detailed in ***Table 2-3***.

Table 2-3: Address of Vacant Land

Land	Lot			Address
	Lot	Section	Plan	
Vacant Land 1	25	Null	DP 1101305	888 Clarence Town Road, Seaham
Vacant Land 2	1	Null	DP 158373	150 Clarence Town Road, Seaham
Vacant Land 3	52	Null	DP 752 487	Green Wattle Creek Road, Seaham
Vacant Land 4	11	Null	DP 1160191	21 Green Wattle Creek Road, Butterwick

2.5 Local Topography

The BHQ is situated is approximately 26 km from the coast and sits at the base of a mountain range. The local topography as modelled is presented in ***Figure 2-3***. The red dot shows the approximate location of BHQ.

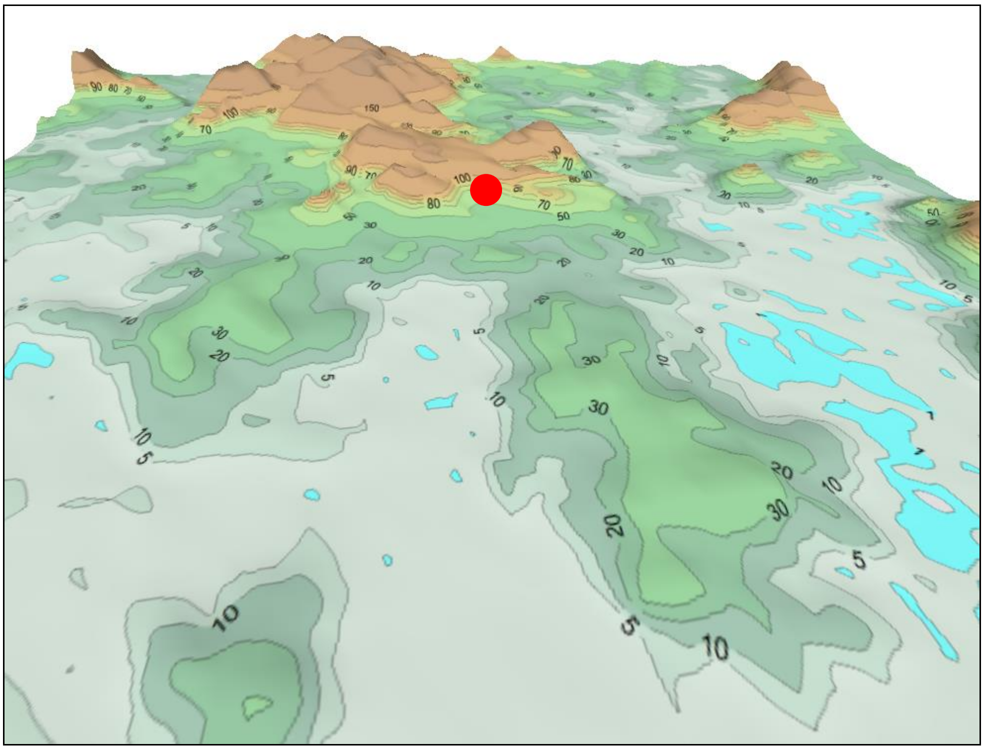


Figure 2-3: Local Topography Surrounding BHQ

3 POLLUTANTS OF CONCERN

The main emissions to air from quarrying operations are caused by crushing and screening, wind-borne dust, vehicle usage, materials handling and transfers. Fugitive air emissions can be estimated using emission factors combined with site-specific information such as the silt and moisture content of material being handled.

Dust is a generic term used to describe fine particles that are suspended in the atmosphere. The dust emissions considered in this report are particulate matter in various sizes:

- Total Suspended Particles (TSP) - Particulate matter with a diameter up to 50 microns;
- PM_{10} - Particulate matter less than 10 microns in size;
- $PM_{2.5}$ - Particulate matter less than 2.5 microns in size;
- Respirable Crystalline Silica (RCS); and
- Dust Deposition – deposited matter that falls out of the atmosphere.

Crystalline silica is a basic component of sand (soil, granite and many other minerals). Quartz is the most common form of crystalline silica. Cristobalite and tridymite are two other forms of crystalline silica. Only the respirable particles (<7 µm in aerodynamic diameter those which are capable of reaching the gas exchange region of the lungs) are considered when determining health effects of crystalline silica. Silicosis is generally considered a workplace risk.

Repeated and prolonged exposure to relatively high concentrations of crystalline silica can cause the disease known as silicosis. This respiratory disease is characterised by scarring and hardening of the lung tissue and it reduces the ability of the lungs to extract oxygen from the air.

4 REGULATORY FRAMEWORK

4.1 National Legislation

4.1.1 National Environment Protection Measure for Ambient Air Quality

Australia's first national ambient air quality standards were outlined in 1998 as part of the National Environment Protection Measure for Ambient Air Quality (National Environment Protection Council , 1998).

The Ambient Air Measure (referred to as Air NEPM) sets national standards for the key air pollutants; carbon monoxide, ozone, sulfur dioxide, nitrogen dioxide, lead and particles (PM_{10} and $PM_{2.5}$). The Air NEPM requires the State's governments to monitor air quality and to identify potential air quality problems.

4.2 State Legislation and Guidelines

4.2.1 Environment Protection Authority (NSW) Approved Methods

The *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (2016) detail both the assessment methodology and criteria for air quality assessments. Due to the type of industry and proximity to sensitive receptors, the requirements for a Level 2 assessment have been followed.

While the most recent update of the Approved Methods (2016) was published in January 2017 after the original air quality impact assessment was issued, the criteria within the updated Approved Methods have been used for this amended assessment.

4.2.2 Protection of the Environment Operations (Clean Air) Regulation 2010

The *Protection of the Environment Operations (Clean Air) Regulation 2010 (Clean Air Regulation)* (NSW Government) provides regulatory measures to control emissions from wood heaters, open burning, motor vehicles and fuels and industry. The operation of BHQ does not trigger any regulatory emissions relating to industry; however the emission requirements for goods vehicles must be adhered to.

4.2.3 Action for Air

Action for Air (Environmental Protection Authority, 1998) seeks to provide long-term ongoing emission reductions, however it does not target acute and extreme exceedances from events such as bushfires. The aim of Action for Air includes:

- Meeting the national air quality standards for six pollutants as identified in the Ambient Air-NEPM; and
- Reducing the population's exposure to air pollution and the associated health costs.

The six pollutants in the Ambient Air-NEPM are CO, NO_2, SO_2, lead, ozone and PM_{10}. The pollutant from the BHQ expansion that is relevant to the Action for Air is PM_{10}. Action for Air aims to reduce air emissions to enable compliance with the Ambient Air-NEPM targets to achieve the aims described above, with a focus on motor vehicle emissions. The BHQ expansion would address the aims of the Action for Air Plan by implementing reasonable and feasible mitigation measures to reduce dust (e.g. PM_{10}) emissions and continue to implement an air quality monitoring plan to assess BHQ expansion against the Ambient Air-NEPM goals.

4.2.4 Respirable Crystalline Silica Guidelines

The NSW Office of Environment and Heritage (OEH) have not detailed an impact assessment criterion for Respirable Crystalline Silica (RCS). The Victorian EPA has adopted an annual average (as $PM_{2.5}$) ambient assessment criterion for mining and extractive industries of 3 µg/m^3 (EPA Victoria, 2007). This criterion has been adopted for this assessment.

4.2.5 Voluntary Land Acquisition and Mitigation

In the Voluntary Land Acquisition and Mitigation Policy dated 15th December 2014, it states that:

Voluntary Mitigation Rights

A consent authority should only apply voluntary mitigation rights where, even with the implementation of best practice management, the development contributes to exceedences of the mitigation criteria set out in **Table 4-1**:

- At any residence or privately owned land; or
- At any workplace on privately owned land where the consequences of those exceedances in the opinion of the consent authority are unreasonably deleterious to worker health or the carrying out of business at that workplace, including consideration of the following factors:
  - The nature of the workplace;
  - The potential for exposure of workers to elevated levels of particulate matter;
  - The likely period of exposure; and
  - The health and safety measures already employed in the workplace.

Table 4-1: Particulate Matter Mitigation Criteria

Pollutant	Averaging Period	Mitigation Criterion		Impact Type
PM_{10}	Annual	30 µg/m^3 *		Human health
PM_{10}	24 hour	50 µg/m^3 **		Human health
TSP	Annual	90 µg/m^3 *		Amenity
Dust Deposition	Annual	2 g/m^2/month**	4 g/m^2/month*	Amenity

* Cumulative impact (i.e. increase in concentrations due to the development plus background concentrations due to all other sources).
** Incremental impact (i.e. increase in concentrations due to the development alone), with zero allowable exceedances of the criteria over the life of the development.

Voluntary Land Acquisition Rights

A consent authority should only apply voluntary land acquisition rights where, even with the implementation of best practice management, the development is predicted to contribute to exceedances of the acquisition criteria in **Table 4-2**. At any residence or privately owned land; or

- At any workplace on privately owned land where the consequences of those exceedances in the opinion of the consent authority are unreasonably deleterious to worker health or the carrying out of business at that workplace, including consideration of the following factors:
  - The nature of the workplace;
  - The potential for exposure of workers to elevated levels of particulate matter;
  - The likely period of exposure; and
  - The health and safety measures already employed in the workplace.
- On more than 25% of any privately owned land where there is an existing dwelling or where a dwelling could be built under existing planning controls.

Table 4-2: Particulate Matter Acquisition Criteria

Pollutant	Averaging Period	Acquisition Criterion		Impact Type
PM_{10}	Annual	30 µg/m³ *		Human health
PM_{10}	24 hour	50 µg/m³ **		Human health
TSP	Annual	90 µg/m³ *		Amenity
Dust Deposition	Annual	2 g/m²/month **	4 g/m²/month *	Amenity

* Cumulative impact (i.e. increase in concentrations due to the development plus background concentrations due to all other sources).
** Incremental impact (i.e. increase in concentrations due to the development alone), with five allowable exceedances of the criteria over the life of the development.

4.3 Project Criteria

From all of the regulations the strictest applicable criteria have been selected for this assessment and are presented in ***Table 4-3***.

Table 4-3: Project Air Quality Goals

Pollutant	Basis	Criteria	Averaging Time	Source
TSP	Amenity	90 µg/m³	Annual	Approved Methods
PM_{10}	Human Health	50 µg/m³	24-hour	Approved Methods
	Human Health	25 µg/m³	Annual	Approved Methods
$PM_{2.5}$	Human Health	25 µg/m³	24-hour	Approved Methods
	Human Health	8 µg/m³	Annual	Approved Methods
Dust deposition	Amenity	Maximum incremental increase of 2 g/m²/month	Annual	Approved Methods
	Amenity	Maximum total of 4 g/m²/month	Annual	Approved Methods
Silica	Human Health	3 µg/m³	Annual	VIC EPA

5 METHODOLOGY

Computational modelling of air dispersion is used to predict the maximum levels of air pollutants based on the local topography, weather conditions and emission rates for the various sources of pollutants. The maximum levels are compared with criteria provided in ***Table 4-3***. Air quality controls are applied to reduce emission rates when non-compliance is predicted.

5.1 Emission Estimation

The emission rates for individual activities were obtained from the National Pollutant Inventory (NPI) - *Emissions Estimation Technique (EET) Manual for Mining.* (Department of Sustainability, Environment, Water, Population and Communities, 2012). The NPI emission factors are derived from the USEPA AP-42 (see ***Appendix B***).

Emission factors can be used to estimate emissions of TSP and PM_{10} to the air from various sources. Emission factors relate to the quantity of a substance emitted from a source to some measure of activity associated with the source. Common measures of activity include distance travelled, quantity of material handled, or the duration of the activity (Department of Sustainability, Environment, Water, Population and Communities, 2012).

Emission factors are used to estimate an operation's emissions by the general equation:

$$E_{i\,(kg/yr)} = \left[A_{(t/h)} \times OP_{(h/yr)} \right] \times EF_{i\,I(kg/t)} \times \left[1 - \frac{CE_i}{100} \right]$$

Where:

$E_{i\,(kg/yr)}$ = Emission rate of pollutant

$A_{(t/h)}$ = Activity rate

$OP_{(h/yr)}$ = operating hours

$EF_{i\,I(kg/t)}$ = uncontrolled emission factor of pollutant

CE_i = overall control efficiency for pollutant

The equations, activity rates and data relevant to the estimation of the emissions are presented in ***Appendix B***.

5.2 Air Dispersion Modelling

5.2.1 Overview

The meteorological data used in the dispersion modelling was processed in two steps. Synoptic scale meteorological data were first processed in The Air Pollution Model (TAPM) and then further processed in CALMET to produce the wind field and weather data suitable for dispersion modelling with CALPUFF.

This method is known as the 'No Observation' approach as detailed in the Generic Guidance and Optimum Model Settings for the CALPUFF modelling system in the 'Approved methods for the Modeling and Assessment of Air Pollutants in NSW' (NSW OEH, 2011). The no observation approach is considered appropriate for regulatory screening modelling.

5.2.2 TAPM

TAPM (version 4), is a three dimensional meteorological and air pollution model developed by the CSIRO Division of Atmospheric Research. The detailed description of the TAPM model is provided in the TAPM user manual (Hurley P, 2008a). The Technical Paper on TAPM (Hurley P, 2008b) describes technical details of the model equations, parameterisations, and numerical methods. A summary of some verification studies using TAPM is also available (Hurley P, 2008c).

TAPM solves the fundamental fluid dynamics and scalar transport equations to predict meteorology and (optionally) pollutant concentrations. It consists of coupled prognostic meteorological and air pollution concentration components. The model predicts airflow important to local scale air pollution, such as sea breezes and terrain induced flows, against a background of larger scale meteorology provided by synoptic analyses. TAPM was run in the data assimilation mode with hourly average data incorporated for the measurement data collected at the Tocal Bureau of Meteorology Station for the modelling period (1/01/13 to 31/12/13). The model setup for TAPM is presented in **Table 5-1**.

Table 5-1 TAPM Setup Parameters

Parameter	**Value**
Number of grids and spacing	4 (30km, 10km, 3km, 1km)
Number of grid points	30 x 30 x 25
Duration of analysis	January 1 2013 – December 31 2013
Centre of TAPM model	32° 42.0 S, 151° 41.5 E
Data assimilation with observations	
Assimilation stations (nudging)	Tocal Bureau of Meteorology Station

5.2.3 CALMET

CALMET is the meteorological pre-processor to CALPUFF and includes a wind field generator containing objective analysis and parameterised treatments of slope flows, terrain effects, and terrain blocking effects. The pre-processor uses the meteorological inputs in combination with land use and geophysical information for the modelling domain to predict a gridded three dimensional meteorological field (containing data on wind components, air temperature, relative humidity, mixing height, and other micro meteorological variables) for the domain used in the CALPUFF dispersion model.

CALMET uses the meteorological data input in combination with land use and geophysical information to predict a gridded meteorological field for the modelling domain.

As noted above, Vipac used the no observation approach for this site which uses prognostic data generated using TAPM for the assessment. The CALMET domain used in the assessment with the modelling setup is presented in ***Table 5-2***.

Table 5-2: CALMET Setup Parameters

Parameter	**Value**
Meteorological grid domain	55km x 55km (110 x 110 x 9 grid dimensions)
Meteorological grid resolution	0.5km
Surface meteorological stations	None
Upper air meteorological station	None
3D Windfield	3D windfields from TAPM (1km resolution) input as an initial guess to CALMET

5.2.4 CALPUFF

CALPUFF (Scire, et al., 2000) is a multi layer, multi species, non-steady state puff dispersion model that can simulate the effects of time and space varying meteorological conditions on emissions transport, transformation and removal. The model contains algorithms for near source effects such as building downwash, partial plume penetration, sub-grid scale interactions as well as longer range effects such as substance removal, chemical transformation, vertical wind shear and coastal interaction effects. The model employs dispersion equations based on a Gaussian distribution of emissions across released puffs and takes into account the complex arrangement of emissions from point, area, volume and line sources.

CALPUFF is a US EPA regulatory model and is the recommended mode for complex terrain and odour studies, as it can assess katabatic drift. A detailed description of CALPUFF is provided in the user manual (TRC, 2006).

The emissions from the quarry have been modelled using CALPUFF (v6.4.2) with the following key inputs:

- meteorological dataset for 01/2013 to 12/2013 generated in CALMET
- grid origin 367.32 km Easting; 6374.92 km Northing
- 80 x 80 grid with a grid spacing 250 m
- terrain data from NASA Shuttle Research Topography Mission
- partial plume adjustment for terrain influences
- radius of terrain set to 3km and minimum radius of influence to 0.1km.

6 EXISTING CONDITIONS

6.1 Existing Sources of Air Pollutants

Aside from the existing quarry activities and rural residences, the surrounding land is forest with some commercial chicken farms located at Mooghin Road and south of Clarence Town Road.

6.2 Background Dust Deposition

Dust deposition monitoring is conducted at three locations as detailed in the Environment Protection Licence (number 1879 dated 29th April 2013). These locations are shown in ***Figure 6-1*** and the monthly results for insoluble solids are presented in ***Figure 6-2***.

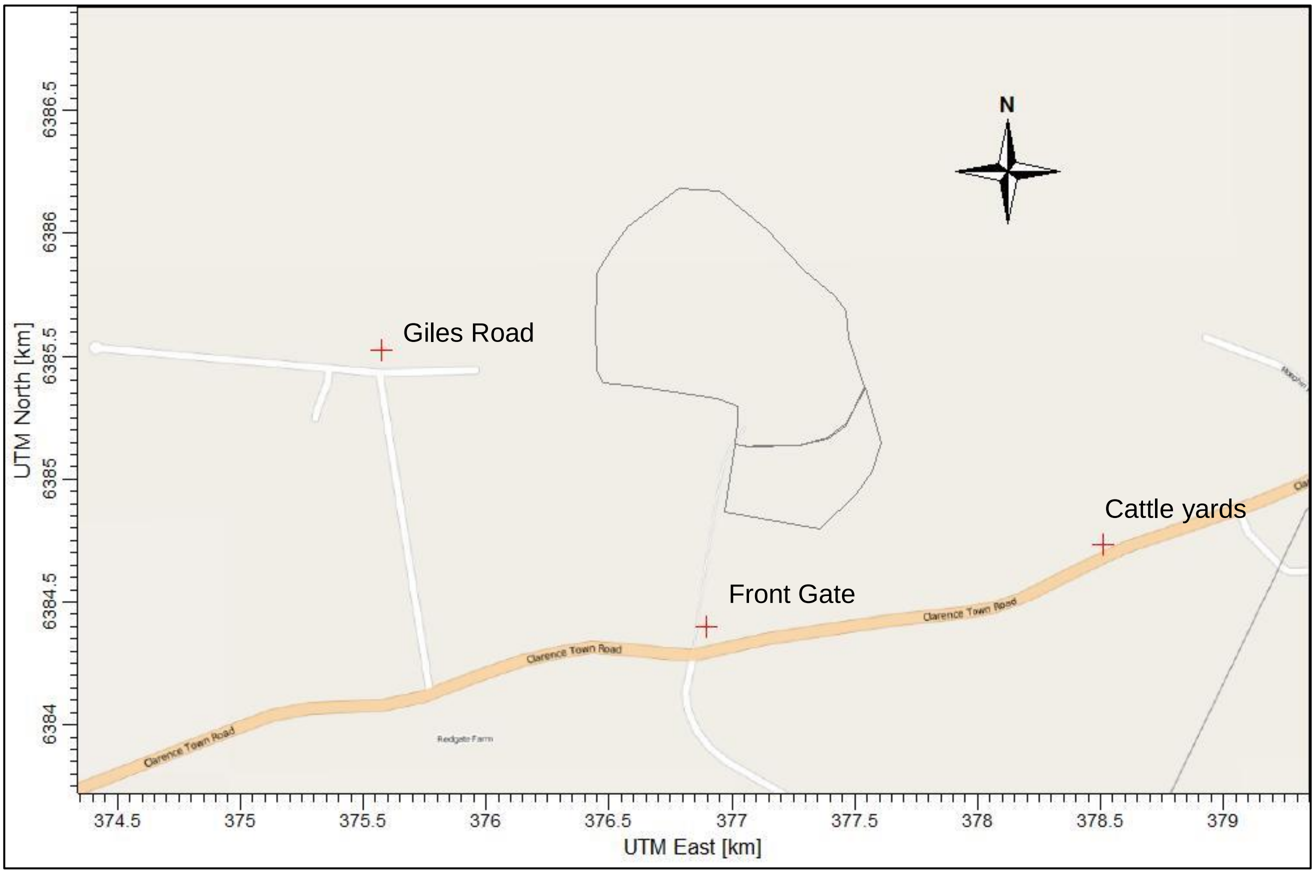


Figure 6-1: Approximate Dust Deposition Monitoring Locations [Hanson, 2014]

The dust deposition levels for the monitoring period Sept 2013 to August 2014 can be summarised as follows:

- Giles Road – the average deposition was 0.5 g/m^2/month with the highest monthly rate of 0.9 g/m^2/month, which occurred in January 2014 with a recorded rainfall of 42 mm;
- Front Gate – the average deposition was 2.1 g/m^2/month with the highest monthly rate of 6.3 g/m^2/month, which occurred in December 2013 with a recorded rainfall of 6 mm; and
- Cattle Yards – the average deposition was 0.5 g/m^2/month with the highest monthly rate of 6.0 g/m^2/month, which occurred in November 2013 with a recorded rainfall of 52 mm.

The dust deposition criterion is 4 g/m^2/month.

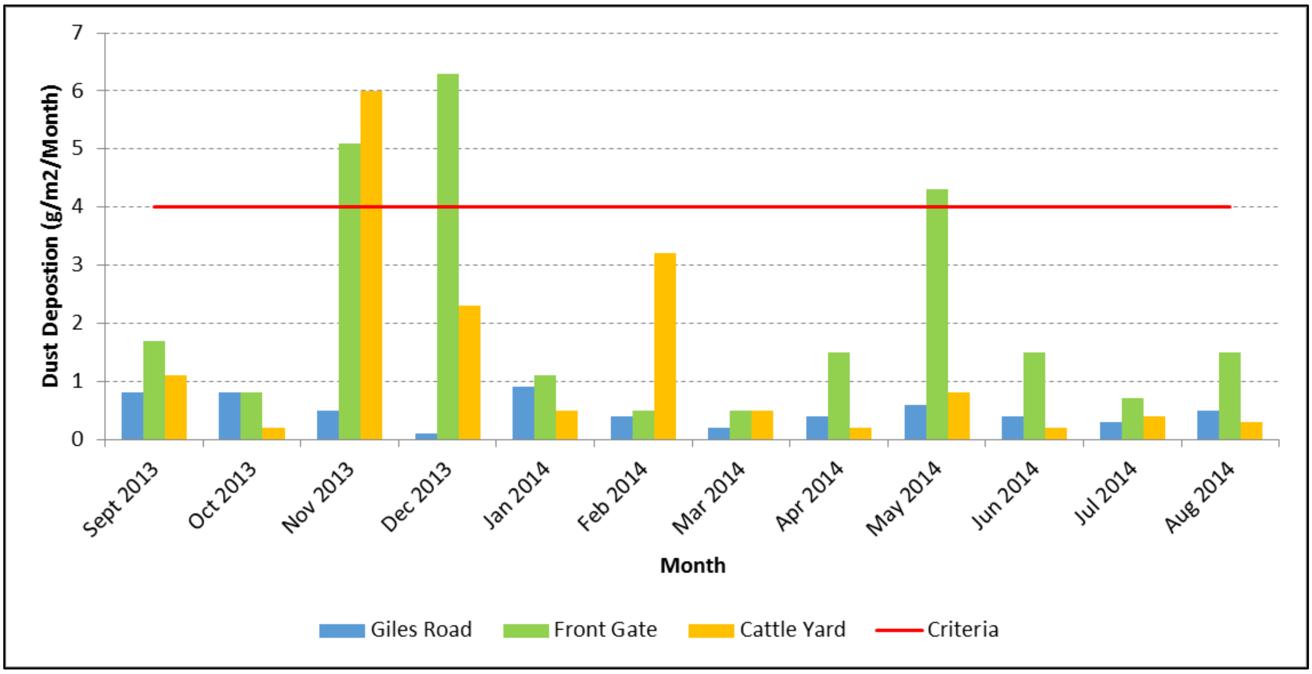


Figure 6-2: Dust Deposition (Insoluble Solids) Results [Hanson, 2014]

The dust deposition data presented in ***Figure 6-2*** is collected and managed by an external consultant. The dust values are usually accompanied with basic comments regarding the condition of the gauge if exceedances are detected. The commentary attributed to exceedances suggests that samples were affected by bird droppings or the gauge was compromised. There is no commentary relating to weather conditions or operational activities; therefore in the circumstances where no commentary is given, it is difficult to identify the corresponding operational or climatic drivers which may cause an exceedance of the criterion due to the month long exposure period.

It should also be noted that, at the time that records were taken, the local council was using the adjacent vacant land for stockpiling road construction material near the front of the Quarry, which may also have elevated the levels on occasion.

The bottle located at the front gate is adjacent to the sealed entrance road (which is watered) which means there is limited wheel generated dust. The background concentrations of particulate matter discussed in Section 6.3 do not provide any information as dust deposition is a local issue. As such no conclusions can be drawn as to the origin or the spatial extent of these exceedances of the criterion; however it is noted that these exceedances appear to be infrequent in nature and over the annual averaging period, deposited dust readings are compliant.

6.3 Ambient Particulate Monitoring

6.3.1 PM_{10}

PM_{10} is not currently monitored for compliance in the vicinity of the BHQ site. As a substitute, data is available from the closest Office of Environment and Heritage's (OEH) Beresfield monitoring station. This air quality monitoring site is located at Francis Greenway High School, Beresfield, approximately 14.2 km SSW of the BHQ. Whilst this monitoring location is not wholly representative of the conditions of the local area surround BHQ, it is considered to be more representative than the other OEH monitoring stations. ***Figure 6-3*** illustrates the locations of the current Newcastle Air Monitors operated by OEH and it can clearly be seen that the Beresfield location is not only closer but also more representative of rural locations than the other stations.

In order to obtain an indication of likely PM_{10} concentrations in the region of the BHQ, the daily-varying (24-hour average) PM_{10} concentrations recorded at this station in 2013 has been analysed;

- The highest 24-hour concentration was 55.3 µg/m^3 on 17th and 18th October 2013, with five exceedances of the criteria during the year. The sixth highest value was 48.8 µg/m^3;
- The annual average excluding the exceedances was 20.9 µg/m^3; and
- The 90th percentile was 33.8 µg/m^3 and the 70th percentile was 23.8 µg/m^3.

Level 2 air quality assessments require ambient monitoring data for at least one year of continuous measurements be used in the dispersion modelling process (Department of Environment & Conservation, 2005). The 24-hour average PM_{10} concentrations recorded at the Beresfield monitoring station for the period 1st January 2013 to 31st December 2013 are presented in ***Figure 6-4***.

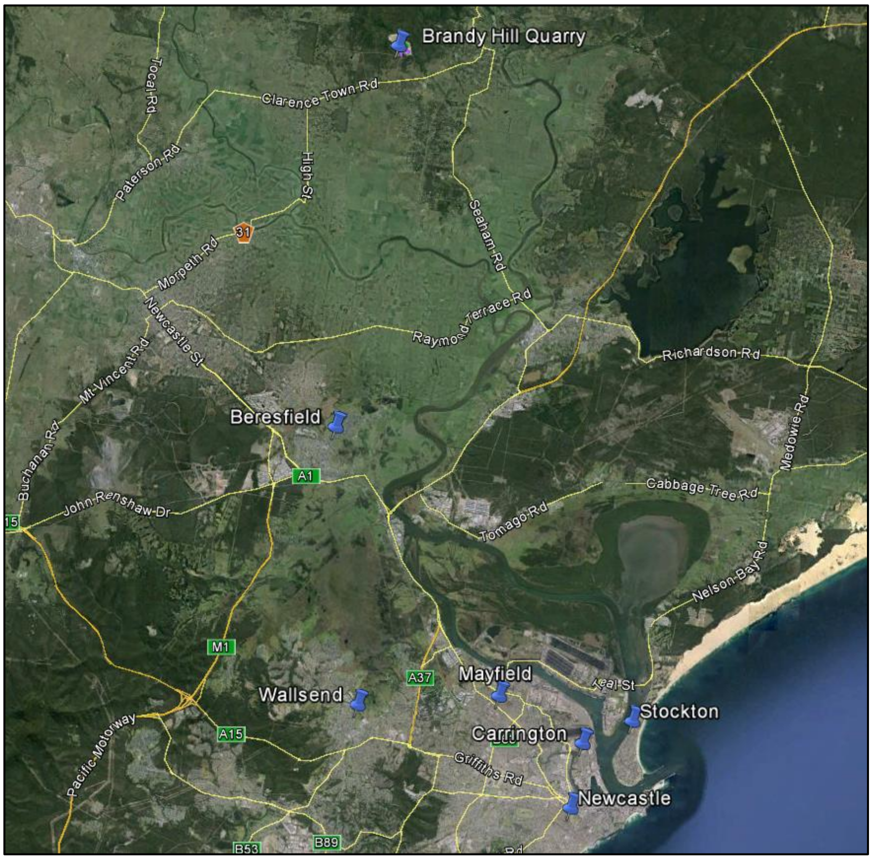


Figure 6-3: OEH Operated Air Monitoring Station Locations

6.3.2 $PM_{2.5}$

As with PM_{10}, $PM_{2.5}$ is not monitored in the vicinity of the BHQ site. As a substitute, data from the Beresfield monitoring station was used. In order to obtain an indication of likely $PM_{2.5}$ concentrations in the region of the BHQ, the daily-varying (24-hour average) PM_{10} concentrations recorded at this station in 2013 has been analysed;

- The highest 24-hour concentration was 38.4 µg/m^3 on the 18th October 2013, with one exceedance of the criteria during the year. The second highest 24-hour concentration was 23.6 µg/m^3;

- The annual average excluding the one exceedance was 8.1 µg/m^3, which exceeds the annual criterion of 8 µg/m^3; and
- The 90th percentile was 13.2 µg/m^3 and the 70th percentile was 9.5 µg/m^3.

The 24-hour average $PM_{2.5}$ concentrations recorded at the Beresfield monitoring station for the period 1st January 2013 to 31st December 2013 are presented in ***Figure 6-5***.

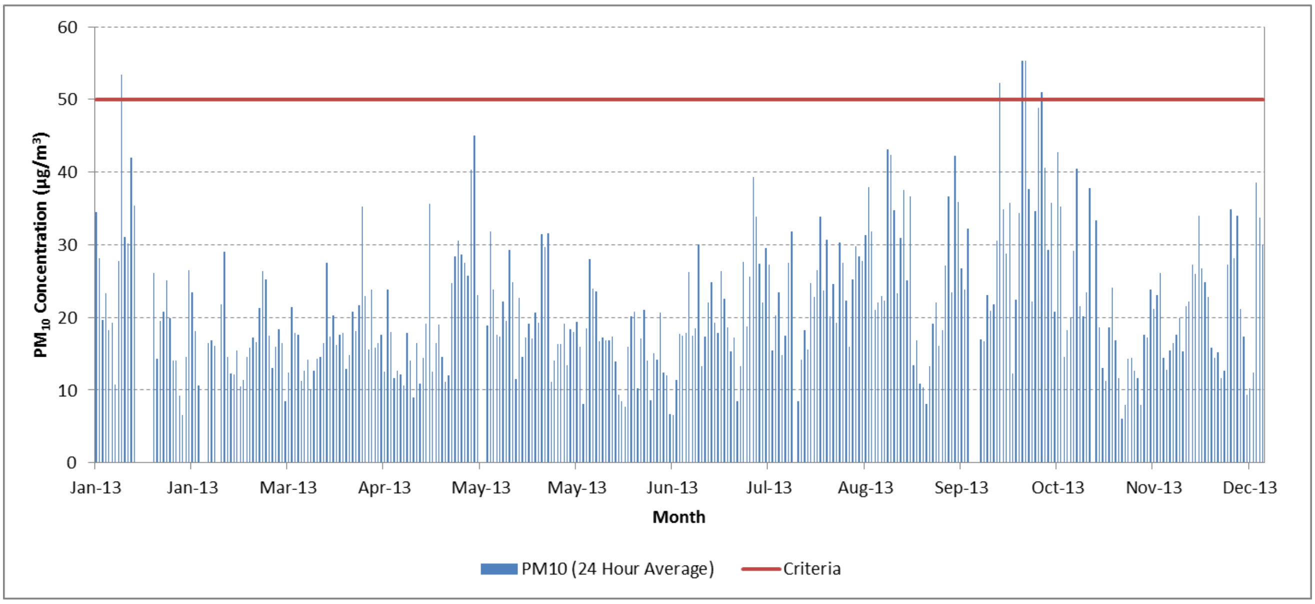


Figure 6-4: PM_{10} Concentrations at Beresfield [DECCW, 2014]

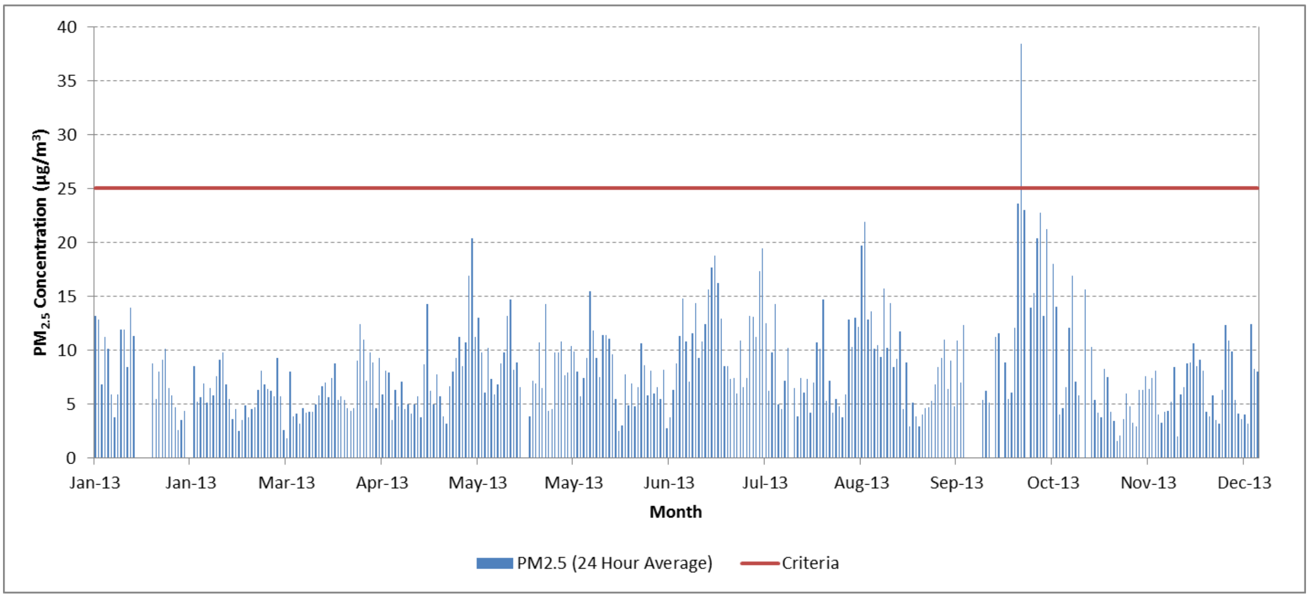


Figure 6-5: $PM_{2.5}$ Concentrations at Beresfield [DECCW, 2014]

Figure 6-6 shows the distribution of the 24 hour PM_{10} and $PM_{2.5}$ concentration monitoring data. It can be seen that 27% of PM_{10} 24-hour concentrations are in the range 20-25 µg/m^3 whilst 46% of the $PM_{2.5}$ 24-hour concentrations are in the range 5-10 µg/m^3.

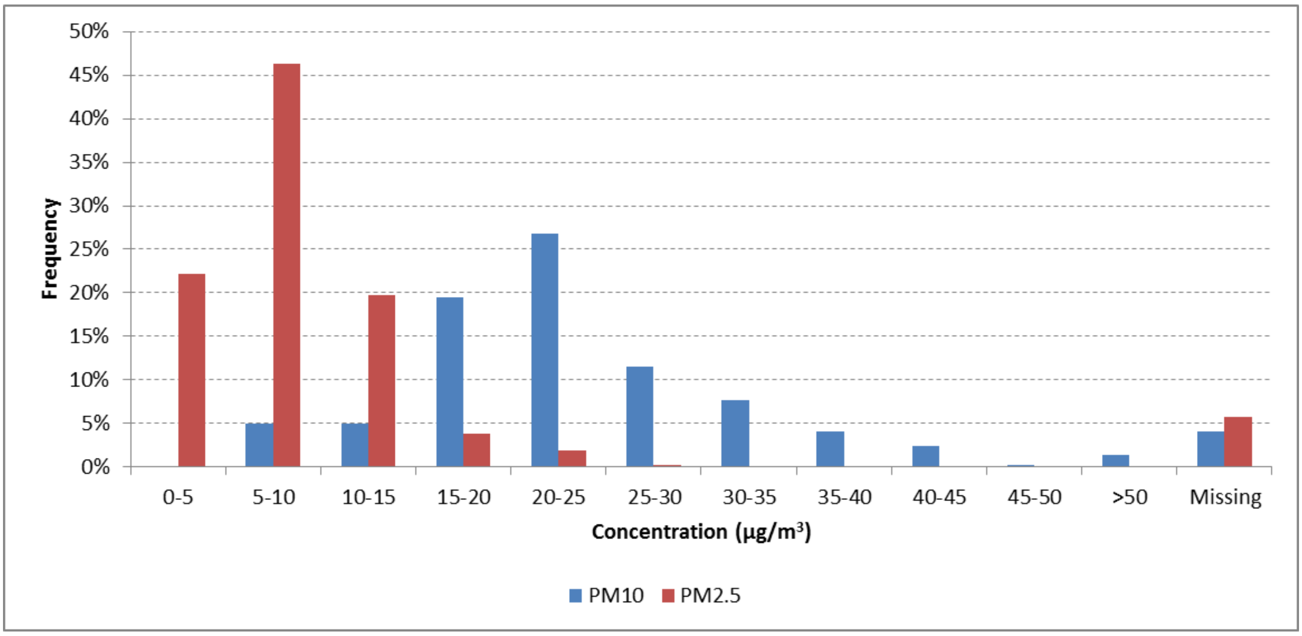


Figure 6-6: 24-Hour Average Particulate Concentration Distribution at Beresfield [DECCW, 2014]

6.3.3 TSP

TSP is not currently monitored in the vicinity of the BHQ. In this instance, TSP concentrations have been assumed to be twice those of the measured PM_{10} concentrations at Beresfield. It is noted that the PM_{10} sub-set is typically 50% of TSP mass in regions where road traffic is not the dominant particulate source (NSW Minerals Council, 2000).

6.4 Respirable Crystalline Silica

In lieu of any data of the silica content of the rock at Brandy Hill, Hanson has provided a report for another Hanson Project (Somersby in NSW) (SLR, 2012). The SLR report referenced a report by Toxikos (2005), which stated that data collected in Victoria estimated the respirable crystalline silica (RCS) annual average background concentration to be 0.7 µg/m^3. In the absence of any local data and in respect that this approach has been used previously in NSW, it has been assumed that the annual average background concentration of 0.7 µg/m^3 for RCS for the quarry is both reasonable and representative.

6.5 Project Assigned Background Concentrations

A summary of the assigned background concentrations used in this study are presented in ***Table 6-1***. These background concentrations will be used to add to the predicted incremental impact from BHQ operation to derive total concentrations:

- Individual 24-hour average predicted PM_{10} and $PM_{2.5}$ concentration will be paired in time with the corresponding 24-hour concentration within the adopted 2013 monitoring dataset to obtain total impact at each receptor;
- The frequency distribution of predicted 24-hour average concentrations of PM_{10} and $PM_{2.5}$ will be compared with the corresponding frequency distribution of the monitoring dataset to provide an indication of the likelihood of elevated cumulative impacts occurring. It is considered that this method will be of significant use in determining the likely impact of expanded operations at the BHQ; and
- Annual average PM_{10}, $PM_{2.5}$, TSP and monthly dust deposition will be assessed through the addition of the dataset average concentrations.

Table 6-1: Assigned Project Background Concentrations

Parameter	Air Quality Objective	Period	Applied Background	Comments
TSP	90 µg/m^3	Annual	41.8 µg/m^3	Double annual average PM_{10}
PM_{10}	50 µg/m^3	24 Hour	Varies	Daily Beresfield Data for 2013
	30 µg/m^3	Annual	20.9 µg/m^3	Annual Average Beresfield Data
$PM_{2.5}$	25 µg/m^3	24 Hour	Varies	Daily Beresfield Data for 2013
	8 µg/m^3	Annual	8.1 µg/m^3	Annual Average Beresfield Data
Dust Deposition	4 g/m^2/month	24 Hour	2.1 g/m^2/month	BHQ data
Silica	3 µg/m^3	Annual	0.7 µg/m^3	No local data – VIC data used

It should be noted that the $PM_{2.5}$ annual average already exceeds the 8 µg/m^3 criterion and the highest 24-hour PM_{10} concentration is 48.8 µg/m^3, which is just below the PM_{10} criterion of 50 µg/m^3.

7 METEOROLOGY

At the time this assessment was undertaken, there was no site specific meteorological data available for consideration.

Long term weather data has been obtained from the Bureau of Meteorology weather station Patterson (Tocal) Automatic Weather Station [AWS] Street (Site number 061250). The mean temperature range is between 6.2º and 29.8º with the coldest month being July and the hottest being January. Rainfall in the region is variable, with most rainfall in the warmer months. On average, most of the annual rainfall is received between January and March. Rainfall is lowest between July and September, with a mean annual rainfall of 927.9 mm.

Table 7-1: Mean Long-term Weather Data for Patterson [BOM 1967-2014]

Month	Temperature		Rainfall (mm)	9 am Conditions			3 pm Conditions		
	Max (°C)	Min (°C)		Temp (°C)	RH (%)	Wind Speed (km/h)	Temp (°C)	Mean RH (%)	Wind Speed (km/h)
Jan	29.8	17.6	102.5	22.7	74	7.0	28.3	52	14.6
Feb	28.8	17.6	121.5	22.0	79	5.5	27.4	56	12.3
Mar	27.0	15.7	115.8	20.6	80	5.8	25.7	58	11.6
Apr	24.2	12.5	80.0	18.0	77	7.0	23.0	56	11.3
May	20.7	9.6	72.6	14.6	80	8.4	19.7	58	11.4
Jun	17.8	7.5	76.8	11.9	78	11.0	16.8	59	13.8
Jul	17.4	6.2	40.7	11.0	76	11.5	16.4	55	15.0
Aug	19.4	6.6	37.2	12.6	69	13.3	18.3	46	17.9
Sep	22.5	8.9	48.1	16.2	64	13.1	20.9	46	17.8
Oct	25.0	11.4	66.3	19.1	64	11.1	23.3	48	16.5
Nov	26.7	14.0	86.6	20.1	69	9.5	25.1	49	16.5
Dec	29.0	16.2	78.0	22.2	69	8.5	27.5	49	16.1
Annual	**24.0**	**12.0**	**927.9**	**17.6**	**73**	**9.3**	**22.7**	**53**	**14.6**

7.1 TAPM Meteorological Data

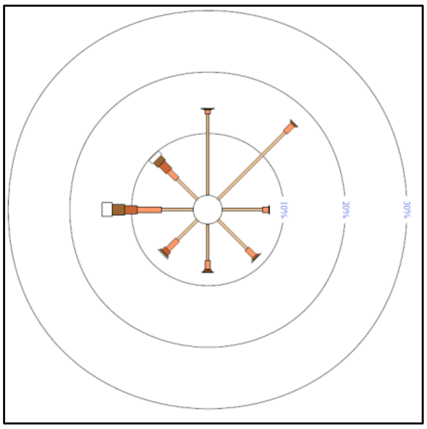
Meteorological data for the site was generated using meteorological data using The Air Pollution Model (TAPM) at the site for 2013. The TAPM configuration is presented in ***Section 5.2.2***

A comparison of the AWS wind roses and the TAPM generated wind roses for 09:00 and 15:00 hours are presented in ***Figure 7-1***. The Patterson AWS is located approximately 10 km west and 4 km north of the quarry and is influenced by mountains immediately to the west and north-west. The TAPM wind roses were extracted from the 1 km grid, therefore the overall location does not align with the AWS location. The wind rose could not be extracted from CALMET as the grid did not extend wide enough.

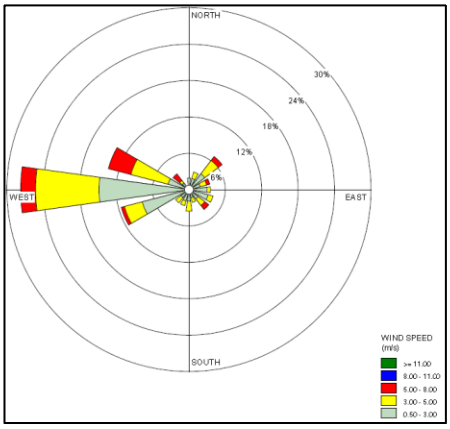
It can be seen from ***Figure 7-1*** that the 09:00 hour wind rose has more dominant winds from the west, and the 15:00 hour wind roses are very similar. The terrain between the AWS and the quarry is generally flat; however the quarry sits in a ‘bowl’ with the mountains on the west, north and east. Any differences in the wind fields will be addressed in the CALMET model.

A windfield plot is therefore provided to further demonstrate that the developed meteorological dataset accurately captures local terrain effects. As shown in ***Figure 7-2***, the windflow paths follow the terrain contours close to the quarry site.

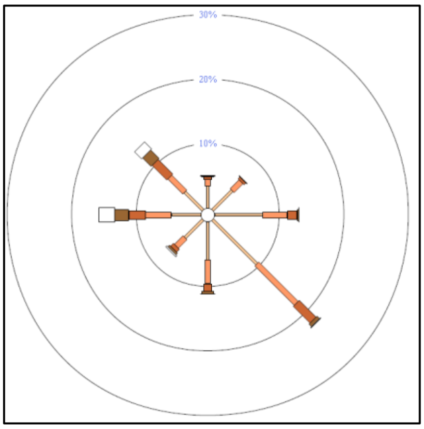
We therefore conclude that the meteorological dataset generated for the dispersion modelling is representative of local conditions.



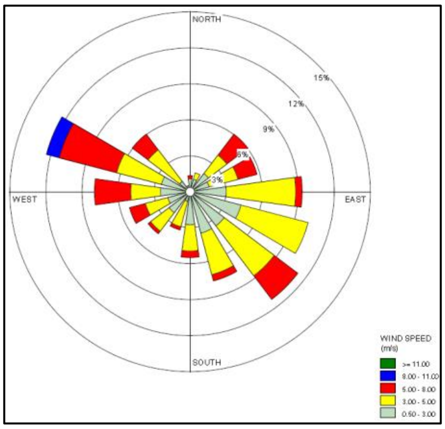
BOM Wind rose for Patterson 09:00 hours



TAPM extracted wind rose 09:00 hours



BOM Wind rose for Patterson 15:00 hours



TAPM extracted wind rose 15:00 hours

Figure 7-1: Comparison of Patterson AWS Wind roses and TAPM Wind roses

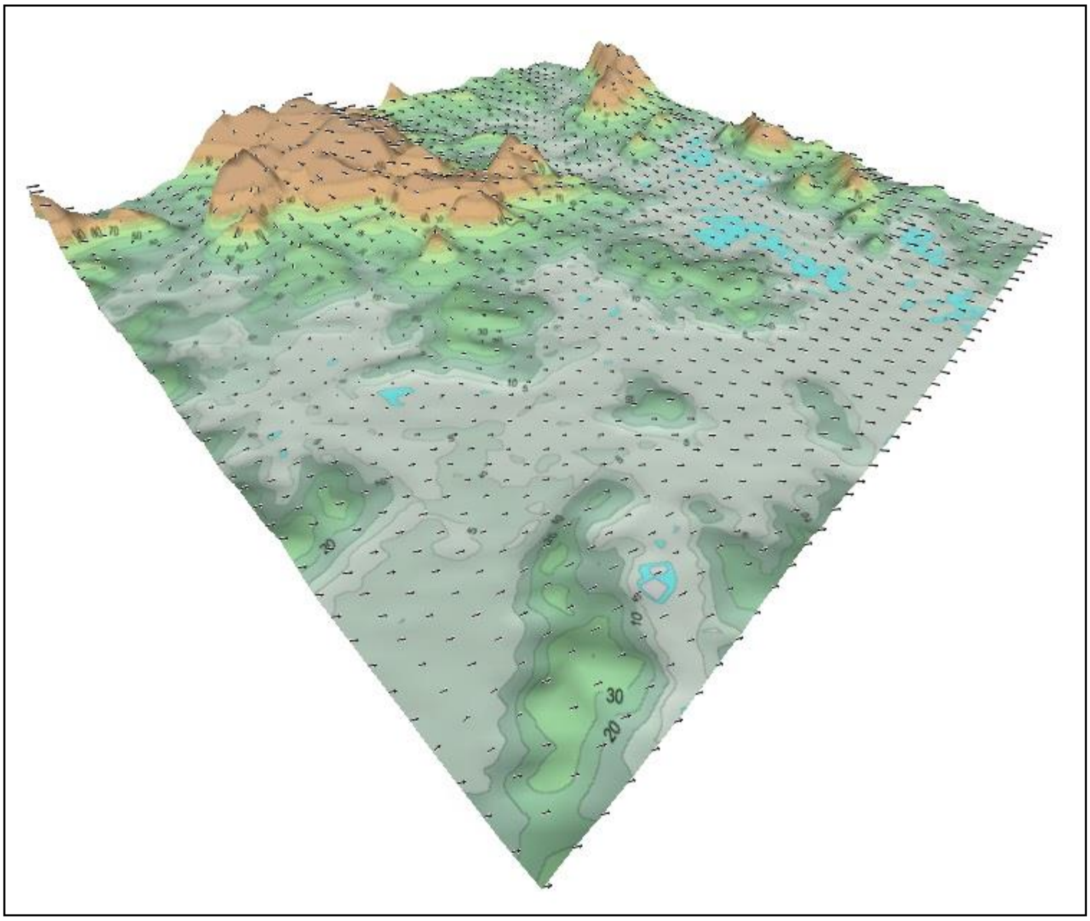
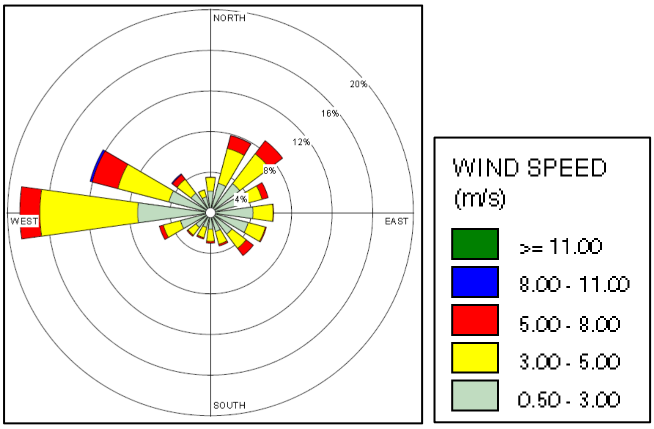
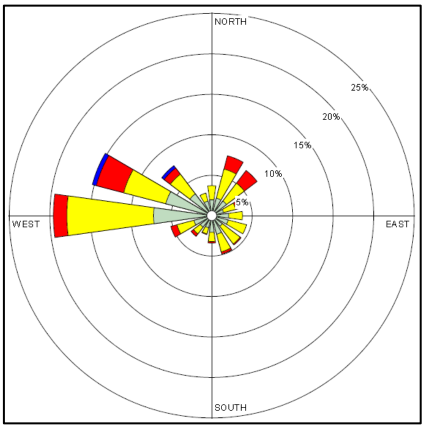


Figure 7-2: Windflow plot in the vicinity of the quarry site

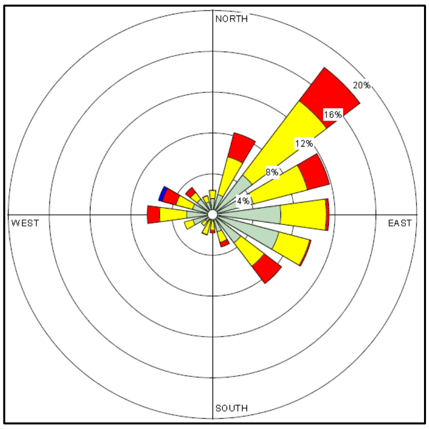
The seasonal wind roses are presented in ***Figure 7-3*** and show that winds blowing from the west are dominant during Spring, Autumn and Winter. These winds will carry the pollutants towards sensitive receptors R7, R8, R16 and R17. During the summer months, the receptors R11 to R15 are likely to be affected due to north easterly winds.



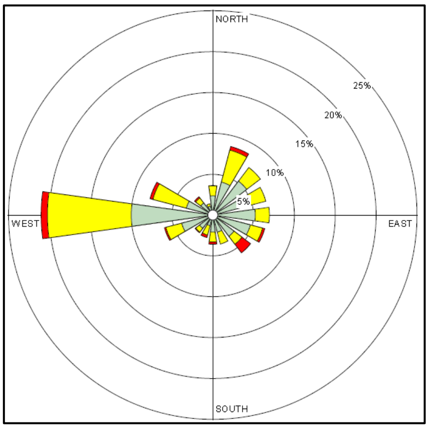
Annual (Calm – 1.37%)



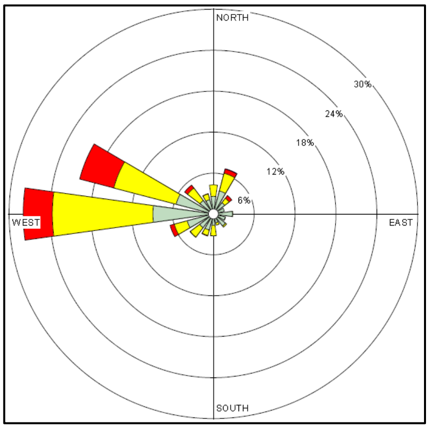
Spring (Calm – 1.01%)



Summer (Calm – 1.06%)



Autumn (Calm – 2.36%)



Winter (Calm – 1.04%)

Figure 7-3: Site-Specific Wind Roses by Season for 2013 [TAPM]

7.1.1 Atmospheric Stability

Atmospheric stability refers to the tendency of the atmosphere to resist or enhance vertical motion. The Pasquill-Turner assignment scheme identifies six Stability Classes (Stability Classes A to F), to categorise the degree of atmospheric stability. These classes indicate the characteristics of the prevailing meteorological conditions and are used as input into various air dispersion models. The frequency of occurrence for each stability class and the associated average wind speed at the quarry for 2013 is detailed in ***Table* 7-2**. The data identifies that Stability Class D is most common; this stability class is indicative of neutral conditions neither enhancing nor impeding pollutant dispersion.

Table 7-2: Annual Stability Class Distribution Predicted [TAPM, 2013]

Stability Class	Description	Frequency of Occurrence (%)	Average Wind Speed (m/s)
A	Very unstable low wind, clear skies, hot daytime conditions	1.95%	1.8
B	Unstable clear skies, daytime conditions	9.25%	2.6
C	Moderately unstable moderate wind, slightly overcast daytime conditions	14.83%	3.4
D	Neutral high winds or cloudy days and nights	38.15%	3.2
E	Stable moderate wind, slightly overcast night-time conditions	18.58%	3.3
F	Very stable low winds, clear skies, cold night-time conditions	17.24%	2.9

7.1.2 Mixing Height

Mixing height is defined as the height of the layer adjacent to the ground over which an emitted or entrained inert non-buoyant tracer will be mixed (by turbulence) within a time scale of about one hour or less.

Diurnal variations in mixing depths are illustrated in ***Figure 7-4***. As would be expected, an increase in the mixing depth during the morning is apparent, arising due to the onset of vertical mixing following sunrise. Maximum mixing heights occur in the mid to late afternoon, due to the dissipation of ground-based temperature inversions and the growth of convective mixing layer.

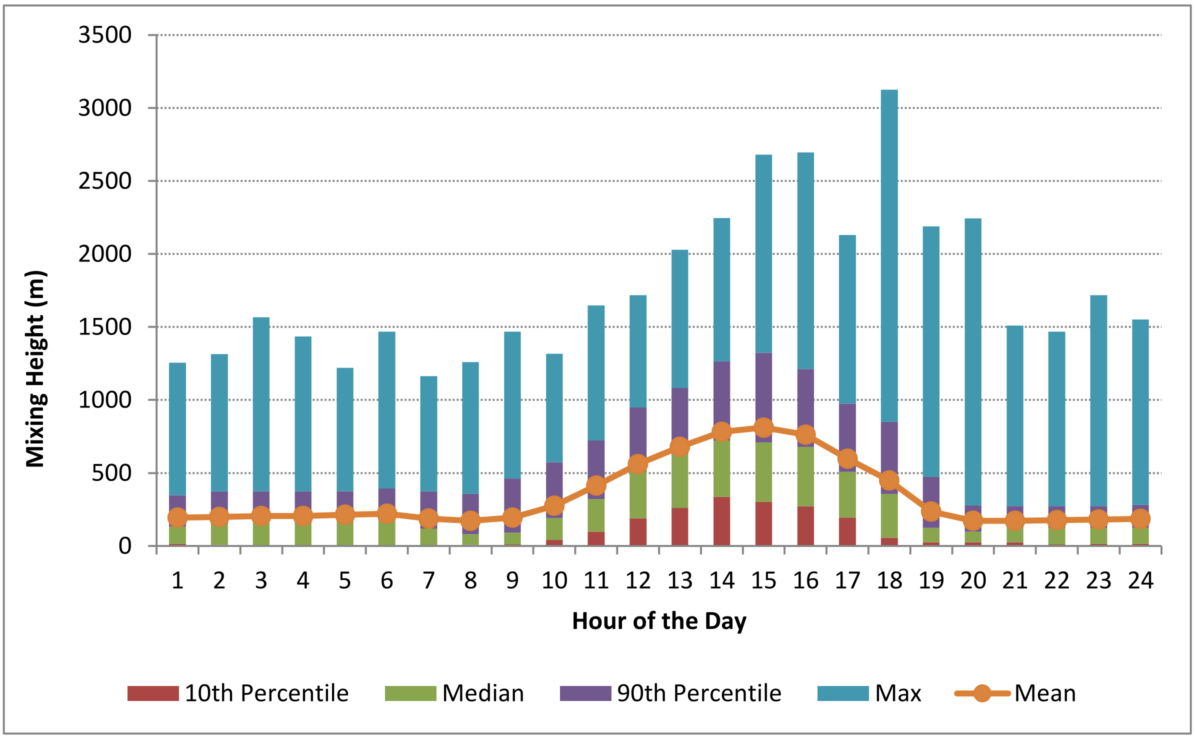


Figure 7-4: Mixing Height [TAPM, 2013]

8 SOURCES AND EMISSION ESTIMATION

Dust generation will be the main air quality issue associated with the proposed expansion. The emission sources include vehicles entering or leaving the site, mobile equipment exhaust emissions or blast fume. In general, the location of the mobile plant and blasting will be at a sufficient distance from the sensitive receptors, such that the pollutants, including blast fume will be dispersed fully and will not cause an impact. Additionally, the emissions from vehicles entering and leaving the site will potentially be double when compared to the existing situation; the vehicles will be using heavily trafficked roads and the increase in exhaust emissions associated with these vehicles will be negligible when compared to the existing traffic flows on these roads. This section provides information upon which the emission rates were derived using the equations and parameters detailed in ***Appendix B***.

8.1 Modelling Scenarios

Stages 1 to 4 were considered to generate the worst case emissions because these stages are the only stages where previously undisturbed land will be stripped to allow access to the resource material to make room for the fixed plant and stockpile area. Furthermore, Stage 4 involves maximum extraction of material.

For the purposes of accurate modelling predictions, therefore, the modelling simulates different phases of the project as described below:

- Current - Current site operations with an annual production rate of 0.7 Mtpa;
- Stage 1 - Proposed site operations with an annual production rate of 1.5 Mtpa including the construction of the amenity barrier;
- Stage 2 - Proposed site operations with an annual production rate of 1.5 Mtpa; and
- Stage 4 - Proposed site operations with an annual production rate of 1.5 Mtpa including the concrete batching plant and relocation of the fixed plant. This stage is the last stage where previously undisturbed land will be stripped to allow access to the resource material. By Stage 2, the amenity barrier to the southern boundary will be complete and stand between 18 m and 20 m high, however this barrier has not been modelled in CALPUFF due to limitations of the software. As such, Stage 4 is representative of the relocation of the processing plant and incorporates the proposed mitigation measures for the relocated processing area.

The Stages that will be assessed are representative of each production phase. ***Table 8-1*** compares the current and proposed operations at BHQ.

Table 8-1: Comparison of Currently Approved Brandy Hill Quarry and the Proposed Project [Hanson, 2014]

Components	Current Operations	Proposed Operations
Quarry Life	No limit prescribed in existing consent. EIS states in excess of 30 years.	Approval is sought for 30 years.
Limits on Production	No Limit set by PSSC. Currently 0.7 Mtpa.	1.5 Mtpa
Quarry Footprint	Refer to ***Figure 2-1***	Extension of quarry pit and relocation of quarry infrastructure. Refer to ***Figure 8-1*** to ***Figure 8-4***
Operational Hours	No Limit	Sales, Production & Maintenance: 24 hours Mon. – Sun., Blasting: 9am - 5pm Mon - Fri.
Concrete Production	Not currently operating	15,000 m^3 per year
Concrete Recycling	Not currently operating	20,000 tonnes per year

Each modelling scenario incorporates the following activities:

- Open pit operations (drilling, blasting, mobile plant and haul truck movements);
- Processing operations (vehicle movements, material unloading, crushers, screening, material transfers, stockpiling of materials);

- Wind generated emissions from stockpiles;
- Concrete recycling emissions have been included from Stage 1; and
- Concrete batching plant emissions have been included for the Stage 4 scenario.

The following assumptions have been made:

- Continuous 24-hour plant operation, 365 days per year. In reality this situation would not occur (see Section 2.2.2 for proposed operating hours);
- A site visit determined that all crushers are enclosed and the existing screens (for the current operations assessment) are open;
- Watering of haul roads is Level 1 (i.e. to 2 $L/m^2/h$);
- Throughputs for each crusher, screen, conveyor and stockpile were provided by Hanson for the current scenario. These have been adjusted for the future scenarios;
- Enclosures are to be installed on all crushing machines and screens, excluding Screen 1 (for stages 1-3) and Screen 5, for future stages at the Brandy Hill Quarry; and
- Conveyor height can vary and conveyors are enclosed for Stage 4.

Additional assumptions and equations are presented in ***Appendix B***.

8.2 Location of Sources

Figure 2-1 presents the current quarry operations including the location of pit, stockpiles, processing area infrastructure. The location of each activity was based on this information for the current scenario. The processing area for Stages 1 and 2 would not change from the current configuration. For the Stage 4 assessment scenario the processing plant is relocated 550 m south of the current position. ***Figure 8-1*** to ***Figure 8-4*** displays the layout for the future scenarios for all sources. It should be noted that the concrete batching plant (CBP) is only in Stage 4, whilst the amenity barrier construction occurs in Stage 1. The in-pit haul roads change location based on pit layout during each stage.

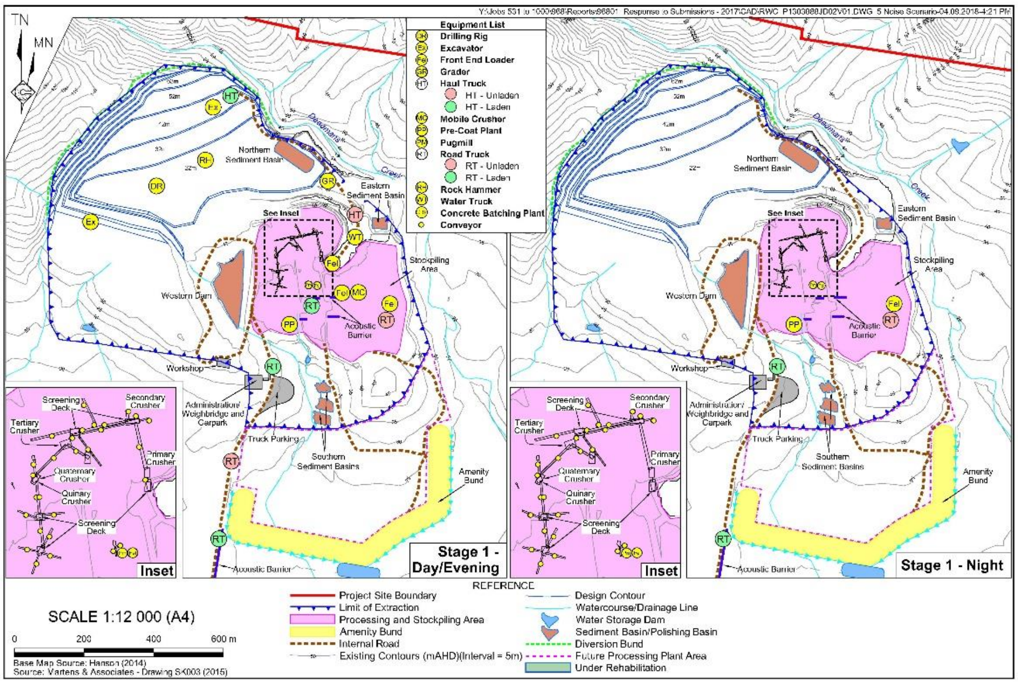


Figure 8-1: Location of Future Sources, Stage 1

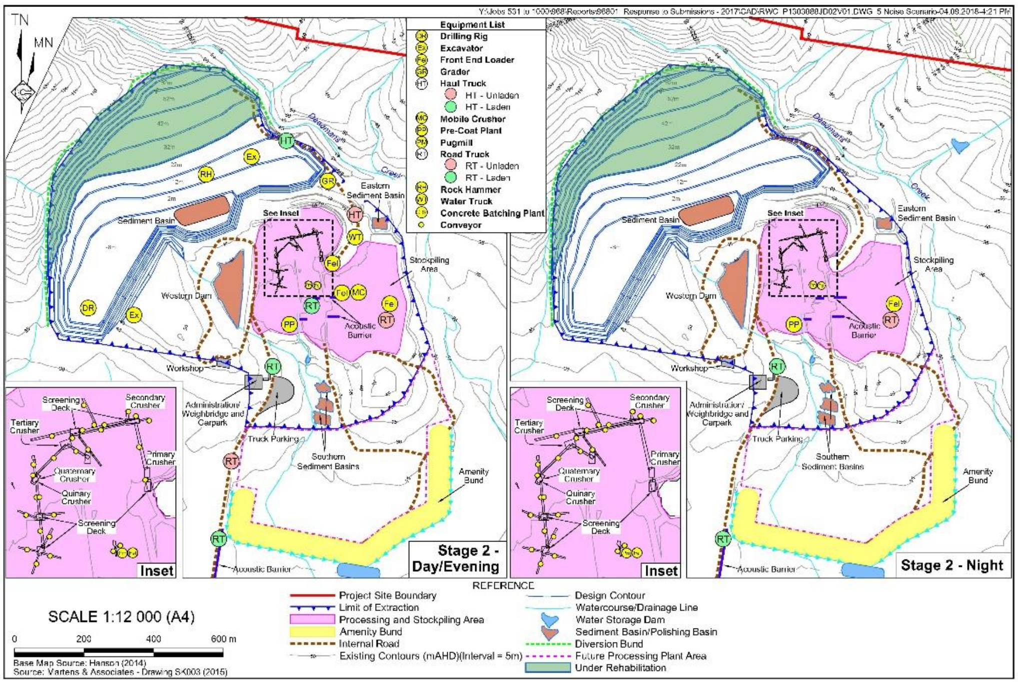


Figure 8-2: Location of Future Sources, Stage 2

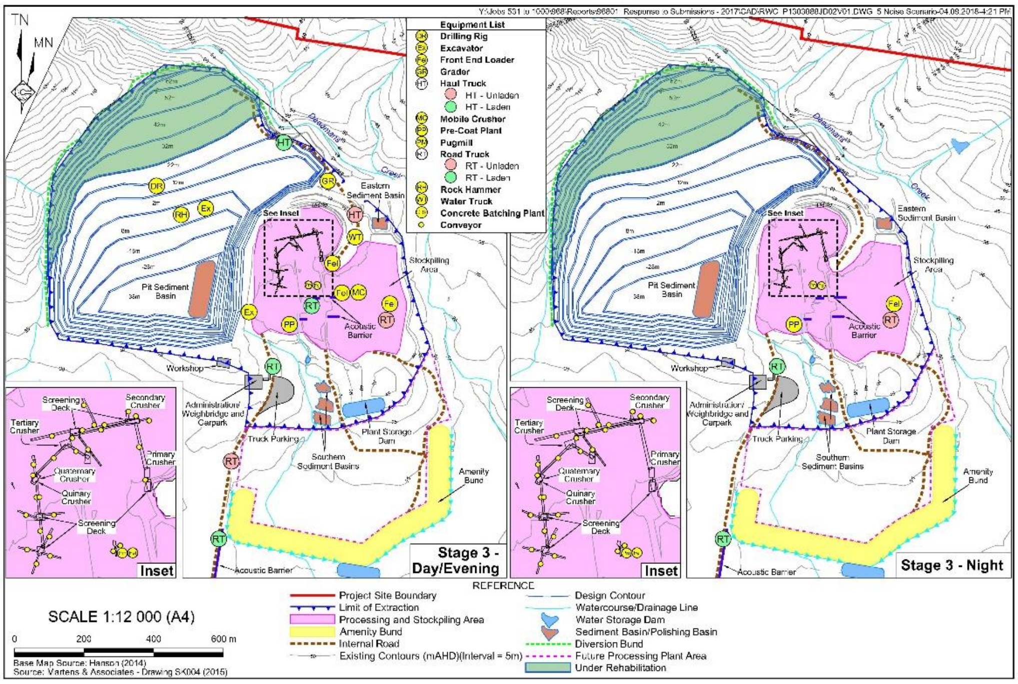


Figure 8-3: Location of Future Sources, Stage 3

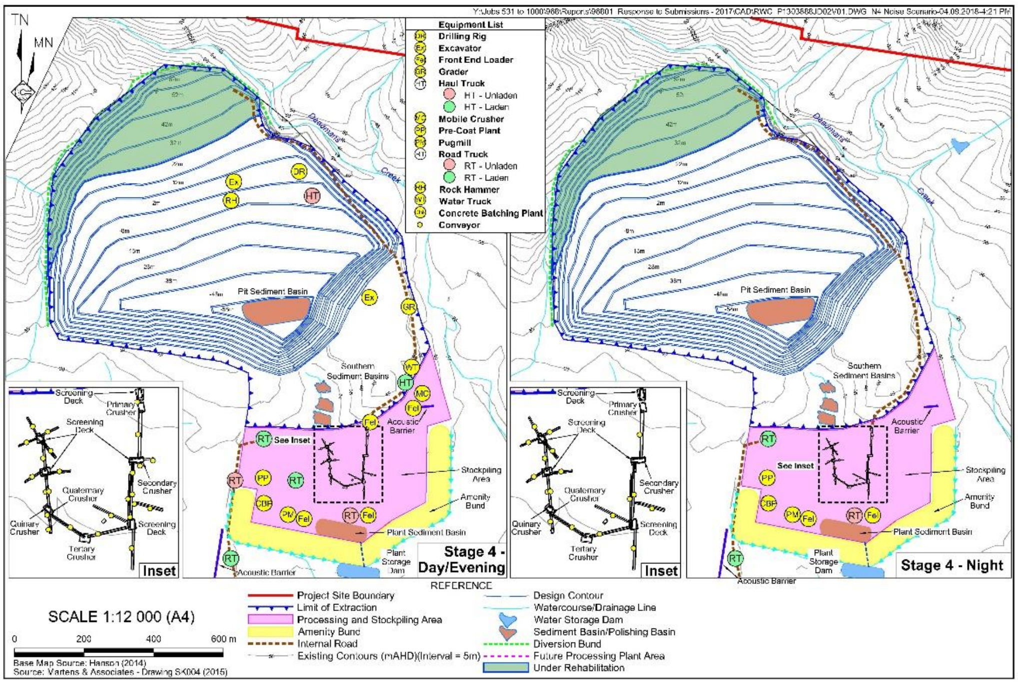


Figure 8-4: Location of Future Sources, Stage 4

8.3 Emissions by Source

As discussed in ***Section 5.1***, the emission estimation for individual activities has been derived from NPI Emission Estimation Technique manuals and US EPA AP42 documentation. Where calculation methods require site-specific parameters, these have been provided by Hanson, as detailed in ***Appendix B***. Emission rates for $PM_{2.5}$ are limited; so in order to derive the ratio of PM_{10} to $PM_{2.5}$, US EPA AP42 documentation and the Western Regional Air Partnership study (WRAP, 2006) has been used.

The annual calculated emissions for TSP, PM_{10} and $PM_{2.5}$ are presented in ***Table 8-2*** to ***Table 8-4*** for each source type and assessment stage. It should be noted that all sources are classed as fugitive and there are no point sources associated with this project.

Table 8-2: Calculated Annual TSP Emissions by Source for Each Assessment Stage (t/year)

Fugitive Source	Current	Stage 1	Stage 2	Stage 4
Drilling and Blasting	1.8	1.8	1.8	1.8
Mobile Plant	35.0	75.0	75.0	75.0
Haul Truck Movements	38.6	76.9	76.9	82.4
Raw Material Unloading	0.1	0.2	0.2	0.2
Stockpile Loading	0.1	0.2	0.2	0.2
Wind erosion	2.6	2.6	2.6	2.6
Crushers & Screens	37.5	44.5	27.0	8.2
Conveyors	23.7	50.7	50.7	0.5
Product Truck Movements	16.8	36.0	36.0	18.3
Amenity Barrier Construction/Wind Erosion	-	0.9	<0.1	<0.1
Concrete Plant	-	-	-	7.2

Table 8-3: Calculated Annual PM_{10} Emissions by Source for Each Assessment Stage (t/year)

Fugitive Source	Current	Stage 1	Stage 2	Stage 4
Drilling and Blasting	0.9	0.9	0.9	0.9
Mobile Plant	16.8	36.0	36.0	36.0
Haul Truck Movements	6.8	15.4	15.4	17.2
Raw Material Unloading	<0.1	0.1	0.1	0.1
Stockpile Loading	0.1	0.1	0.1	0.1
Wind erosion	0.8	0.8	0.8	0.8
Crushers & Screens	12.9	15.3	9.3	2.8
Conveyors	11.2	24.0	24.0	0.2
Product Truck Movements	3.0	6.3	6.3	3.2
Amenity Barrier Construction/Wind Erosion	-	0.3	<0.1	<0.1
Concrete Plant	-	-	-	3.6

Table 8-4: Calculated Annual $PM_{2.5}$ Emissions by Source for Each Assessment Stage (t/year)

Fugitive Source	Current	Stage 1	Stage 2	Stage 4
Drilling and Blasting	0.1	0.1	0.1	0.1
Mobile Plant	3.7	7.9	7.9	7.9
Haul Truck Movements	0.3	0.7	0.7	1.2
Raw Material Unloading	<0.1	<0.1	<0.1	<0.1
Stockpile Loading	0.0	0.0	0.0	<0.1
Wind erosion	0.1	0.1	0.1	0.1
Crushers & Screens	1.9	2.3	1.4	0.4
Conveyors	1.7	3.6	3.6	<0.1
Product Truck Movements	0.1	0.4	0.3	0.2
Amenity Barrier Construction/Wind Erosion	-	0.1	0.0	0.0
Concrete Plant	-	-	-	0.5
Diesel[1]	0.02	0.04	0.05	0.16

1. Diesel combustion emissions of TSP and PM_{10} are accounted for in their source EF, only $PM_{2.5}$ emissions are therefore presented separately here.

The emissions of TSP, PM_{10} and $PM_{2.5}$ reflect the increase in production between the current operations and the proposed operations. During the construction of the amenity barrier (Stage 1), one item of mobile plant has been reallocated to the amenity barrier construction source rather than mobile plant source. It can be seen from ***Table 8-2*** to ***Table 8-4*** that the highest emissions of the total operations are mobile plant, crushers and screens, haul truck movements on unpaved roads and conveyors. During Stage 4, the processing plant will be new and will include best practice mitigation such as enclosed conveyors.

Emission rates for RCS were derived using the soil sizing and analysis report conducted by Amdel Limited (Toxikos, 2005) as reported in SLR (2012). The samples were from Somersby Quarry which is also operated by Hanson. The particle size distribution for the collected samples is listed in ***Table 8-5***.

Table 8-5: Calculated Size Distribution for Somersby Quarry [as reported by SLR, 2012]

Sample	Moisture Content (%)	Size Distribution (wt%)			Estimated Quartz Content of -4 µm Fraction (wt%)
		+63 µm "sand and gravel"	-63 µm + 4 µm "silt"	- 4 µm "clay"	
Stockpile	8.9	84	8	8	3.0
Haul Road	5.6	85	7	8	3.2

The estimated quartz content was based on the 4 µm fraction. For the purposes of this assessment, the 4 µm fraction is considered appropriate for estimating the quartz content as $PM_{2.5}$. The emission factors for PM_{10} have been used to estimate RCS. It is been assumed that all PM_{10} emissions contained 3.2% RCS.

It should be noted that the particle size distribution outlined in ***Table 8-5*** has only be used to derive a RCS value relative to the calculated PM_{10} emissions. In lieu of any site-specific particle size data, the standard particle parameters and emission ratios contained in the CALPUFF model and the NPI emission factors calculations have been used.

9 IMPACT ASSESSMENT

This section presents the results of the air quality impact assessment for predicted ground level concentrations of TSP, PM_{10}, $PM_{2.5}$, RCS and dust deposition for the proposed operations at varying stages.

The results of the dispersion modelling include individual sensitive receptor and contour plots that are indicative of ground-level concentrations. This impact assessment provides the results in terms of the cumulative impact (incremental plus background) for the 100th percentile (i.e. maximum value) in units as per the criterion and time periods. For 24-hour average PM_{10} and $PM_{2.5}$ predictions, the contemporaneous concentrations are the predicted pollutant concentrations added to the daily monitoring results from Beresfield as discussed in ***Section 6.3***.

9.1 Total Suspended Particulates

The predicted cumulative annual average TSP is presented in ***Table 9-1*** for each assessment stage. It can be seen from ***Table 9-1*** that, when the annual average background concentration of 41.8 µg/m^3 is applied to the model predictions, the cumulative annual average TSP is predicted to be less than 59 µg/m^3, which is below the criterion of 90 µg/m^3. The highest incremental increases will occur at 1189 Clarence Town Road during Stage 2.

As such the TSP emissions from BHQ are not predicted to adversely impact upon the sensitive receptors. A contour plot is presented in ***Appendix C***.

Table 9-1: Predicted Annual Average Cumulative TSP Concentrations (µg/m^3) [Criteria - 90 µg/m^3]

Receptor	Background (µg/m^3)	Predicted Annual Average Cumulative TSP Concentrations (µg/m^3)			
		Current	Stage 1	Stage 2	Stage 4
122B Duns Creek Road	41.8	42.2	42.1	42.1	41.9
16 Uffington Road	41.8	41.9	41.9	41.9	41.9
60 Green Wattle Creek Road	41.8	42.4	42.3	42.2	42.1
34 Timber Top Road	41.8	42.1	42.0	42.0	41.9
35 Timber Top Road	41.8	42.1	42.0	42.0	41.9
36 Timber Top Road	41.8	42.1	42.0	42.0	41.9
13 Mooghin Rd	41.8	46.6	45.5	45.1	44.0
14 Mooghin Rd	41.8	45.2	44.5	44.2	43.2
13 Giles Road	41.8	45.4	44.8	44.5	43.1
13B Giles Road	41.8	46.0	45.2	45.4	43.7
866 Clarence Town Road	41.8	45.9	45.0	44.9	44.6
994 Clarence Town Road	41.8	46.4	45.2	44.9	47.8
1034 Clarence Town Road	41.8	46.7	45.5	45.3	47.5
1060 Clarence Town Road	41.8	46.3	45.2	45.1	46.5
1094 Clarence Town Road	41.8	45.7	44.8	44.7	46.4
1189 Clarence Town Road	41.8	58.9	54.8	54.6	48.5
1203 Clarence Town Road	41.8	56.0	52.6	52.5	47.9

9.2 PM_{10}

9.2.1 24-Hour Average

Table 9-2 provides the maximum cumulative concentrations at each receptor including contemporaneous background concentrations and associated number of exceedances of the criteria for the modelled year.

The results can be summarized as follows:

- No exceedances of the cumulative PM_{10} criteria are predicted to occur at any of the receptors modelled for the current operations.
- Exceedances of the 24 hour average criteria are predicted at two receptors (1189 and 1203 Clarence Town Road) predicted for Stage 1.
- Exceedances of the 24 hour average criteria are predicted at two receptors (13 Giles Road and 1189 Clarence Town Road) predicted for Stage 2.
- Exceedances of the 24 hour average criteria are predicted at two receptors (994 and 1034 Clarence Town Road) predicted for Stage 4.

Further discussion of the exceedances and incremental increases in PM_{10} concentrations is provided in Section 9.2.1.1.

Table 9-2: Maximum Cumulative 24-Hour Average PM_{10} Concentrations and Daily Exceedances ($\mu g/m^3$) [Criteria - 50 $\mu g/m^3$]

Receptor	Predicted Max 24-Hour PM_{10} Concentrations ($\mu g/m^3$) with Daily Exceedances							
	Current Scenario		Stage 1 Scenario		Stage 2 Scenario		Stage 4 Scenario	
	Total	No. of Exceedances	Total	No. of Exceedances	Total	No. of Exceedances	Total	No. of Exceedances
122B Duns Creek Road	46.5	0	46.5	0	46.5	0	46.5	0
16 Uffington Road	46.5	0	46.5	0	46.5	0	46.5	0
60 Green Wattle Creek Road	46.5	0	46.5	0	46.5	0	46.5	0
34 Timber Top Road	46.5	0	46.5	0	46.5	0	46.5	0
35 Timber Top Road	46.5	0	46.5	0	46.5	0	46.5	0
36 Timber Top Road	46.5	0	46.5	0	46.5	0	46.5	0
13 Mooghin Rd	46.7	0	46.8	0	46.7	0	46.6	0
14 Mooghin Rd	46.6	0	46.6	0	46.6	0	46.6	0
13 Giles Road	46.5	0	49.7	0	49.8	0	46.5	0
13B Giles Road	46.5	0	48.0	0	48.2	0	46.5	0
866 Clarence Town Road	46.5	0	46.5	0	46.5	0	46.5	0
994 Clarence Town Road	48.1	0	49.1	0	49.0	0	**50.9**	1
1034 Clarence Town Road	47.2	0	47.8	0	47.6	0	**50.4**	1
1060 Clarence Town Road	46.9	0	47.3	0	47.2	0	47.6	0
1094 Clarence Town Road	47.2	0	48.5	0	48.4	0	49.3	0
1189 Clarence Town Road	47.1	0	**59.5**	4	**60.2**	5	47.1	0
1203 Clarence Town Road	47.0	0	**55.7**	3	**55.7**	3	46.8	0

9.2.1.1 Maximum Incremental Contemporaneous Results

The maximum predicted contemporaneous 24-hour average PM_{10} is presented in ***Table 9-2*** for each assessment stage. The contemporaneous concentrations are the predicted pollutant concentrations added to the daily monitoring results from Beresfield as discussed in ***Section 6.3***. For each receptor location, the highest predicted concentration occurs at different times, therefore the background concentrations vary. The incremental increase for each sensitive receptor is presented in ***Table 9-3***.

For each individual day the maximum concentrations at each sensitive receptor depend on the following:

- Daily varying background concentrations as presented in ***Section 6***; and
- Quarry emissions averaged over 24-hour periods based on wind speed, direction and other meteorological parameters.

In addition, the differences between each scenario (i.e. addition/location of sources, different production rates etc.) may affect the day upon which the maximum concentration from the quarry operations are predicted at each receptor due to the weather conditions.

The highest 24-hour average incremental increase is 33.9 µg/m^3 at 1189 Clarence Town Road during Stage 2. The primary emission source contribution to the predicted incremental increase are the dust generated by haul truck movements. These emissions can be effectively managed by watering of the haul roads (as modelled) and regulating vehicle speeds to less than 40 km/h (as recommended).

High concentrations at receptors along Clarence Town Road during Stage 1 are driven by the emissions from the temporary construction of the amenity barrier, which when complete will protect the sensitive receptors from dust emissions. It should also be noted that working on the amenity barrier will not occur every day, therefore these activities can be managed to occur when wind is not blowing towards the receptors of concern. As the impacts will be temporary in nature and dust suppression and management techniques will be applied, the high PM_{10} levels are considered a worst-case concentration.

Whereas during Stage 4, predicted decreases in PM_{10} impacts at the sensitive receptors are a result of the relocation of the processing plant with adopted mitigation measures. The PM_{10} impacts during Stage 4 are predicted to be similar or lower than the current Stage impacts.

Time-series graphs of the predicted source contributions (incremental concentrations) and cumulative concentrations for the sensitive receptors for which exceedances are predicted as follows:

- ***Figure 9-1*** to ***Figure 9-2*** displays time-graphs for sensitive receptors 16 and 17 during Stage 1;
- ***Figure 9-3*** to ***Figure 9-4*** displays time-graphs for sensitive receptors 16 and 17 during Stage 2; and
- ***Figure 9-5*** to **Figure 9-6** displays time-graphs for sensitive receptors 12 and 13 during Stage 4.

As shown in the three figures, the contribution from the quarry sources to the predicted concentration levels (shown in blue) are much lower than the criteria (red). However, when the background is added, the cumulative concentrations (brown) marginally exceed the criteria.

It is also noted that the exceedances predicted for Stage 4 are only marginally above the criteria which include a contribution from the BHQ dust sources of approximately 10 µg/m^3 and an adopted background contribution of approximately 40 µg/m^3.

Table 9-3: Predicted Max 24-Hour Incremental PM_{10} Concentrations (µg/m³)

Receptor	Predicted 24-Hour Average Incremental PM_{10} Concentrations (µg/m³)			
	Current	Stage 1	Stage 2	Stage 4
122B Duns Creek Road	1.9	3.4	3.2	1.4
16 Uffington Road	1.1	2.1	2.0	1.1
60 Green Wattle Creek Road	2.6	4.7	4.7	3.0
34 Timber Top Road	1.8	3.4	3.3	1.6
35 Timber Top Road	1.6	3.0	2.9	1.3
36 Timber Top Road	1.7	3.2	3.1	1.3
13 Mooghin Rd	8.7	12.7	13.2	5.0
14 Mooghin Rd	11.8	20.0	21.5	5.1
13 Giles Road	16.0	28.5	29.0	9.2
13B Giles Road	9.3	18.1	18.0	10.5
866 Clarence Town Road	11.0	19.1	18.8	8.3
994 Clarence Town Road	10.1	17.7	17.1	11.4
1034 Clarence Town Road	8.3	15.1	14.6	12.2
1060 Clarence Town Road	11.6	21.0	19.8	16.1
1094 Clarence Town Road	4.4	7.6	7.4	9.6
1189 Clarence Town Road	19.4	33.3	33.9	18.5
1203 Clarence Town Road	17.9	30.9	31.7	17.5

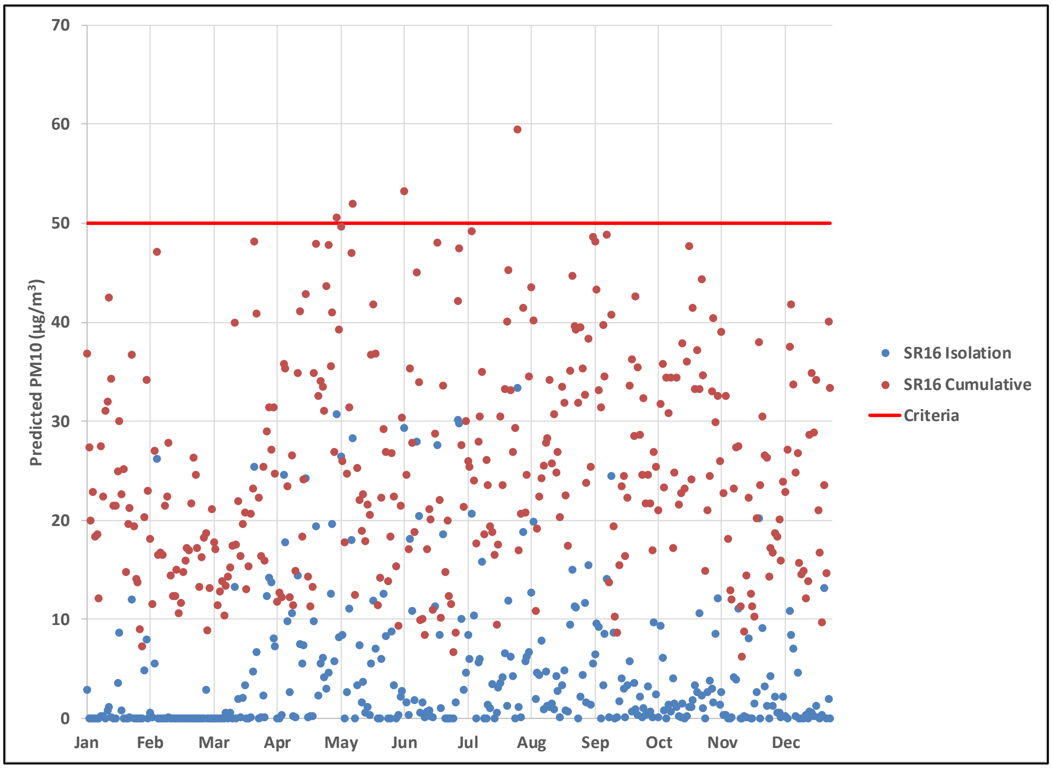


Figure 9-1: Time-series of Predicted 24 Hour Average PM_{10} at Sensitive Receptor 16, Stage 1

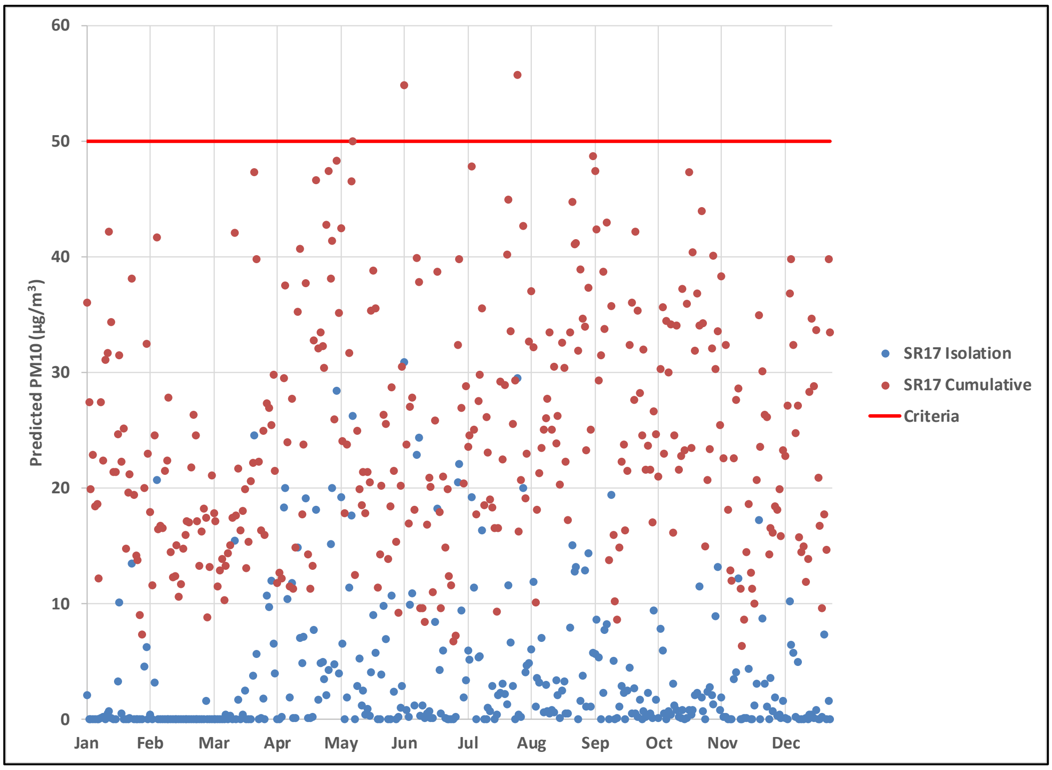


Figure 9-2: Time-series of Predicted 24 Hour Average PM10 at Sensitive Receptor 17, Stage 1

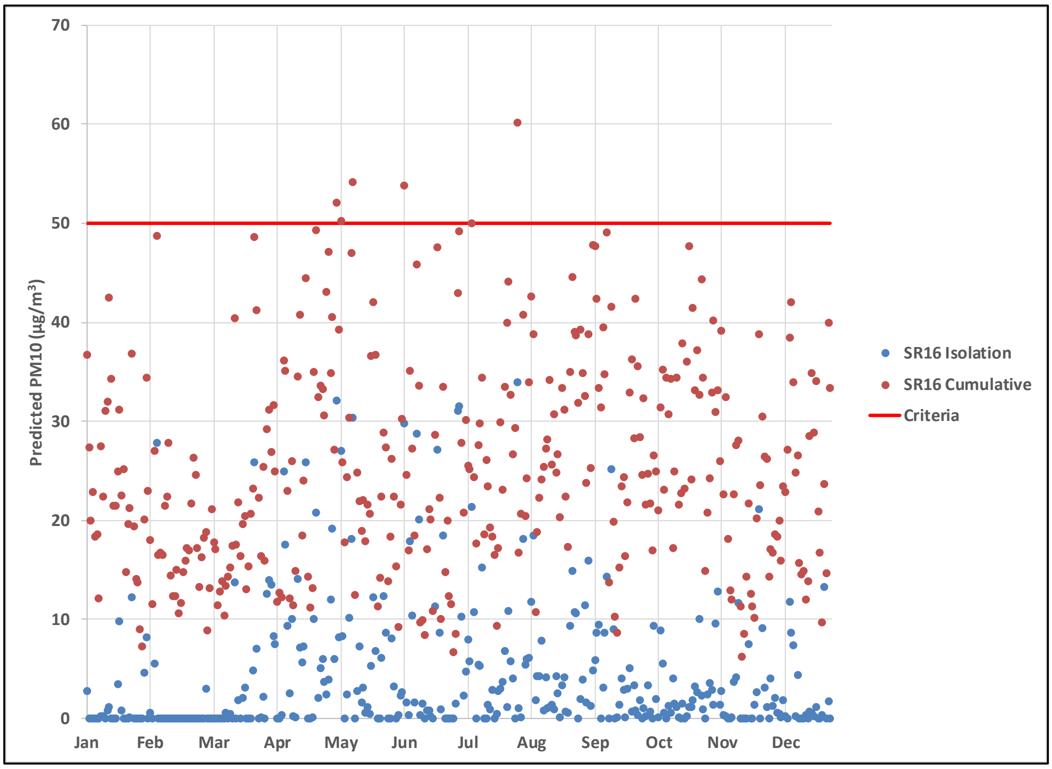


Figure 9-3: Time-series of Predicted 24 Hour Average PM10 at Sensitive Receptor 16, Stage 2

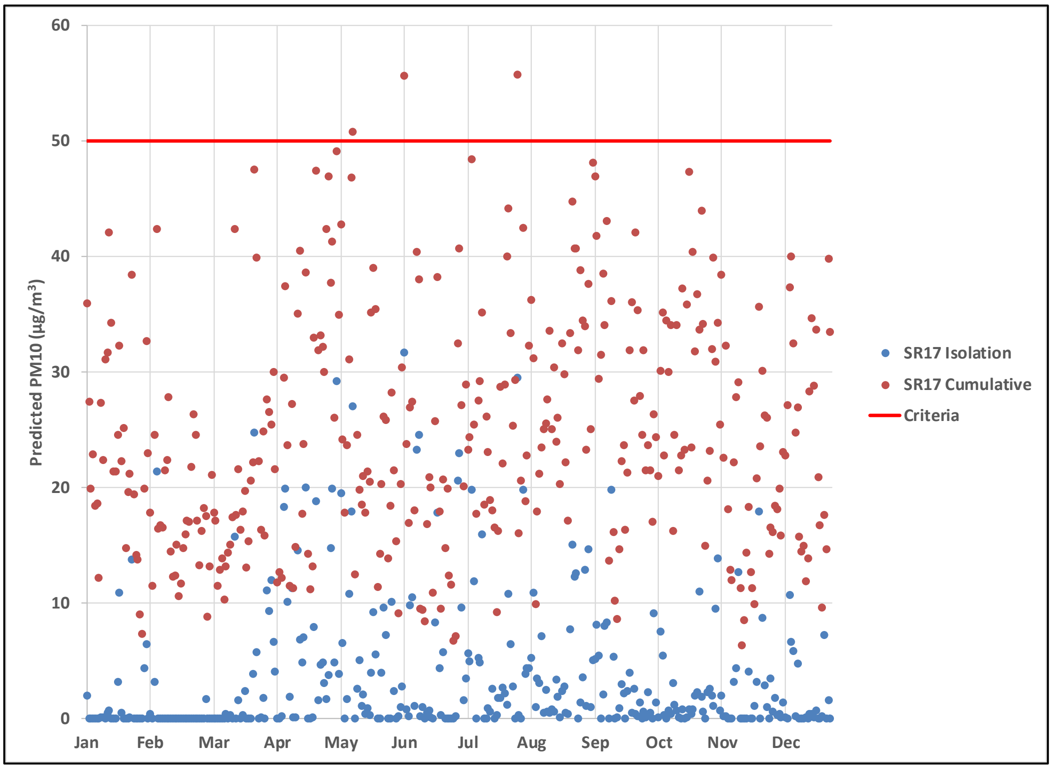


Figure 9-4: Time-series of Predicted 24 Hour Average PM10 at Sensitive Receptor 17, Stage 2

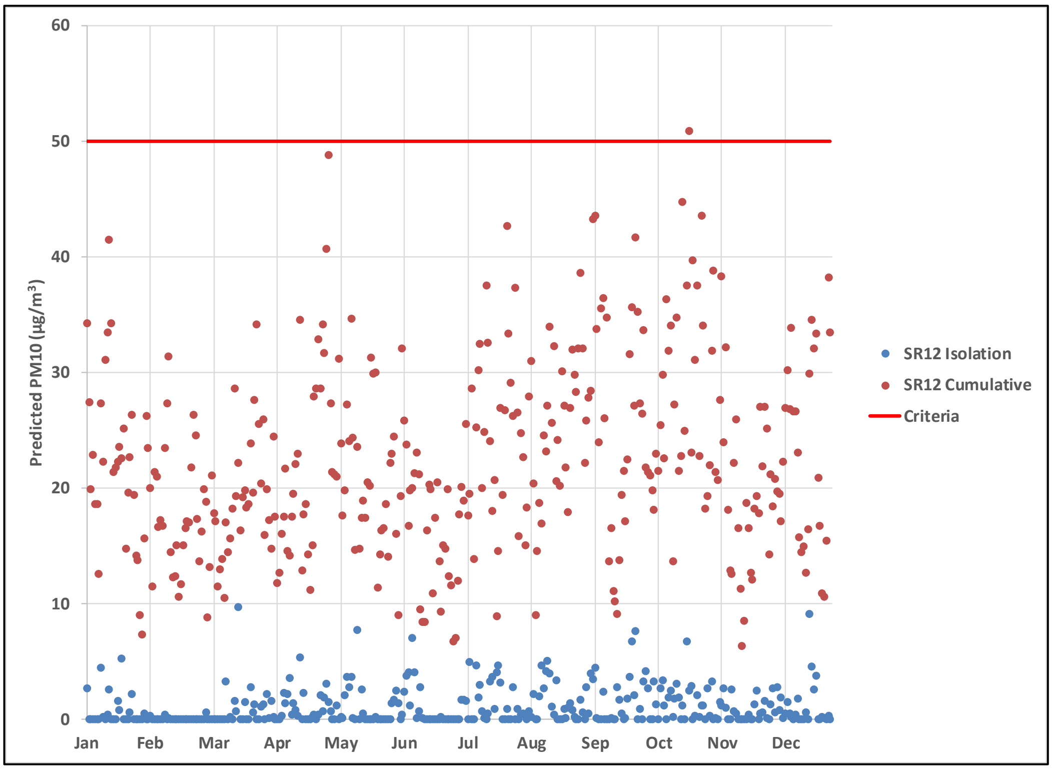


Figure 9-5: Time-series of Predicted 24 Hour Average PM10 at Sensitive Receptor 12, Stage 4

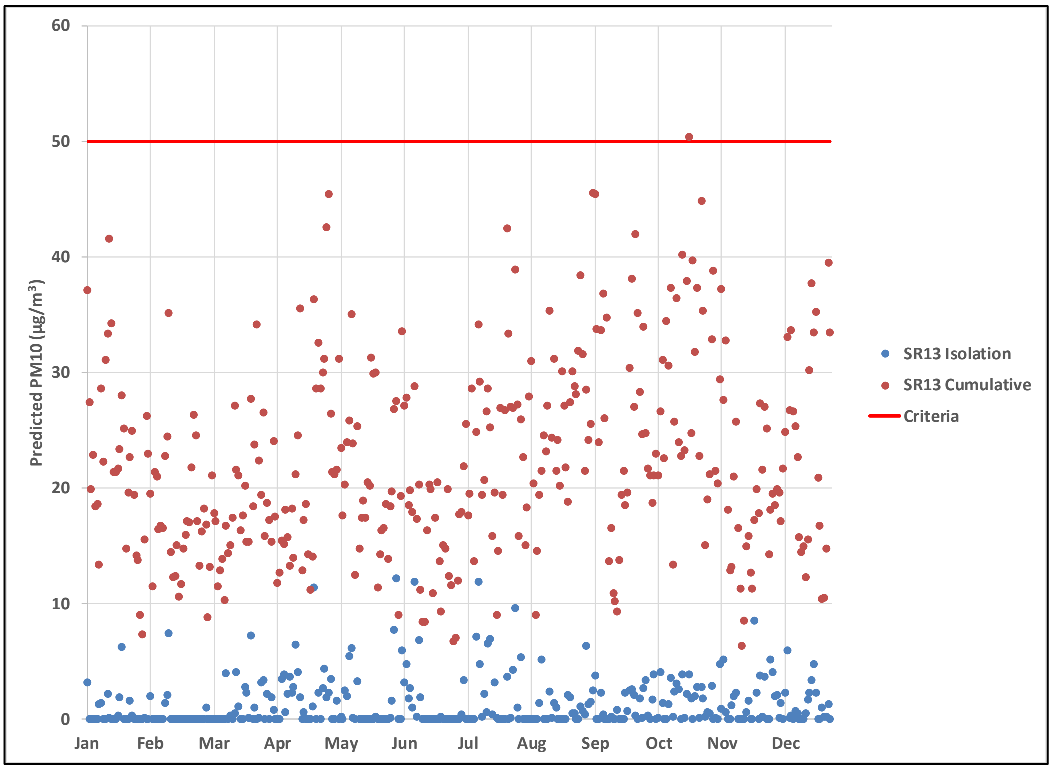


Figure 9-6: Time-series of Predicted 24 Hour Average PM10 at Sensitive Receptor 13, Stage 4

9.2.2 Annual Average

The PM_{10} annual average criterion of 25 µg/m³ has been adopted for this assessment. ***Table 9-4*** presents the predicted total PM_{10} concentrations at sensitive receptors for each assessment stage. Background PM_{10} concentration of 20.9 µg/m³ are included in the predictions.

It can be seen from Table 9-6 that the total PM_{10} concentration will be less than the 25 µg/m³ criterion at all sensitive receptor locations for the future Stage 4. The highest annual average PM_{10} concentration during the proposed future stage development is 25.5 µg/m³ which will occur at 1189 Clarence Town Road during Stage 2. This concentration is slightly above the criteria of 25 µg/m³ and is dominated by the adopted background of 20.9 µg/m³. As discussed in Section 9.2.1.1, high concentrations at receptors along Clarence Town Road during Stage 1 are driven by the emissions from the temporary construction of the amenity barrier and Stage 2 by haul truck movements. **As such the annual PM_{10} emissions from BHQ are not predicted to adversely impact upon the sensitive receptors.** A contour plot is presented in ***Appendix C***.

Table 9-4: Predicted Total Annual Average PM_{10} Concentrations (µg/m^3) [Criteria - 25 µg/m^3]

Receptor	Background (µg/m^3)	Predicted Total Annual Average PM_{10} Concentrations with Background Concentrations (µg/m^3)			
		Current	Stage 1	Stage 2	Stage 4
122B Duns Creek Road	20.9	21.0	21.0	21.0	21.0
16 Uffington Road	20.9	21.0	20.9	20.9	20.9
60 Green Wattle Creek Road	20.9	21.1	21.1	21.1	21.0
34 Timber Top Road	20.9	21.0	21.0	21.0	20.9
35 Timber Top Road	20.9	21.0	21.0	21.0	20.9
36 Timber Top Road	20.9	21.0	21.0	21.0	20.9
13 Mooghin Rd	20.9	22.6	22.1	22.2	21.6
14 Mooghin Rd	20.9	22.2	21.8	21.9	21.4
13 Giles Road	20.9	22.1	21.8	22.0	21.4
13B Giles Road	20.9	22.3	22.1	22.2	21.5
866 Clarence Town Road	20.9	22.2	22.0	22.0	21.6
994 Clarence Town Road	20.9	22.3	21.9	22.0	22.2
1034 Clarence Town Road	20.9	22.4	22.0	22.1	22.2
1060 Clarence Town Road	20.9	22.3	22.0	22.0	22.0
1094 Clarence Town Road	20.9	22.1	21.8	21.8	21.9
1189 Clarence Town Road	20.9	**26.5**	**25.2**	**25.5**	22.8
1203 Clarence Town Road	20.9	25.6	24.5	24.7	22.5

9.3 $PM_{2.5}$

9.3.1 24-Hour Average

Table 9-5 provides the maximum cumulative total $PM_{2.5}$ concentrations at each receptor including contemporaneous background concentrations and associated number of exceedances of the criteria. Analysis of the daily predictions has identified that the maximum 24-hour concentration at each receptor and the number of daily exceedances of the criteria.

The results can be summarized as follows:

- There are no exceedances of the relevant 24 hour average $PM_{2.5}$ criteria of 25 µg/m^3 at any of the receptors modelled.
- The maximum predicted concentration is 24.8 µg/m^3 at 1034 Clarence Town Road during Stage 4 operations.
- At 1060 Clarence Town Road, the $PM_{2.5}$ predictions are higher for the current scenario than the Stage 1 results.

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Table 9-5: Maximum 24-Hour Average $PM_{2.5}$ Concentrations and Daily Exceedances (µg/m^3) [Criteria - 25 µg/m^3]

Receptor	Predicted Max 24-Hour $PM_{2.5}$ Concentrations (µg/m^3) with Daily Exceedances							
	Current Scenario		Stage 1 Scenario		Stage 2 Scenario		Stage 4 Scenario	
	Total	No. of Exceedances	Total	No. of Exceedances	Total	No. of Exceedances	Total	No. of Exceedances
122B Duns Creek Road	22.3	0	22.3	0	22.3	0	22.3	0
16 Uffington Road	22.3	0	22.3	0	22.3	0	22.3	0
60 Green Wattle Creek Road	22.3	0	22.3	0	22.3	0	22.3	0
34 Timber Top Road	22.3	0	22.3	0	22.3	0	22.3	0
35 Timber Top Road	22.3	0	22.3	0	22.3	0	22.3	0
36 Timber Top Road	22.3	0	22.3	0	22.3	0	22.3	0
13 Mooghin Rd	22.9	0	23.3	0	23.4	0	22.7	0
14 Mooghin Rd	22.9	0	23.0	0	23.0	0	22.6	0
13 Giles Road	22.3	0	22.3	0	22.3	0	22.3	0
13B Giles Road	22.3	0	22.3	0	22.3	0	22.3	0
866 Clarence Town Road	23.0	0	22.8	0	22.9	0	22.4	0
994 Clarence Town Road	23.2	0	22.9	0	22.8	0	24.4	0
1034 Clarence Town Road	22.8	0	22.6	0	22.6	0	24.8	0
1060 Clarence Town Road	23.4	0	23.0	0	22.9	0	24.5	0
1094 Clarence Town Road	23.0	0	23.0	0	23.0	0	22.9	0
1189 Clarence Town Road	23.8	0	22.5	0	22.5	0	23.4	0
1203 Clarence Town Road	23.7	0	22.5	0	22.5	0	23.3	0

9.3.2 Annual Average

The $PM_{2.5}$ annual average criterion of 8 µg/m^3 has been adopted for this assessment. ***Table 9-6*** presents the predicted cumulative $PM_{2.5}$ concentrations at sensitive receptors for each assessment stage. A background $PM_{2.5}$ concentration of 8.1 µg/m^3 is included in the predictions.

Table 9-6: Predicted Total Annual Average $PM_{2.5}$ Concentrations (µg/m^3) [Criteria - 8 µg/m^3]

Receptor	Background (µg/m^3)	Predicted Total Annual Average $PM_{2.5}$ Concentrations with Background Concentrations (µg/m^3)			
		Current	Stage 1	Stage 2	Stage 4
122B Duns Creek Road	8.1	8.12	8.13	8.12	8.12
16 Uffington Road	8.1	8.11	8.11	8.11	8.11
60 Green Wattle Creek Road	8.1	8.14	8.14	8.14	8.14
34 Timber Top Road	8.1	8.12	8.12	8.12	8.12
35 Timber Top Road	8.1	8.12	8.12	8.12	8.12
36 Timber Top Road	8.1	8.12	8.12	8.12	8.12
13 Mooghin Rd	8.1	8.44	8.47	8.46	8.37
14 Mooghin Rd	8.1	8.34	8.37	8.36	8.28
13 Giles Road	8.1	8.25	8.30	8.29	8.25
13B Giles Road	8.1	8.30	8.34	8.33	8.30
866 Clarence Town Road	8.1	8.34	8.32	8.31	8.37
994 Clarence Town Road	8.1	8.35	8.30	8.30	8.65
1034 Clarence Town Road	8.1	8.35	8.29	8.29	8.56
1060 Clarence Town Road	8.1	8.33	8.28	8.27	8.47
1094 Clarence Town Road	8.1	8.31	8.26	8.25	8.51
1189 Clarence Town Road	8.1	8.99	8.99	8.97	8.67
1203 Clarence Town Road	8.1	8.86	8.83	8.81	8.56

It can be seen from ***Table 9-6*** that the predicted incremental changes in $PM_{2.5}$ concentration are less than or slightly higher than existing levels. This result is caused by the additional mitigation implemented under the proposed expansion. **As such the annual $PM_{2.5}$ emissions from BHQ are not predicted to adversely impact upon the sensitive receptors**. A contour plot is presented in ***Appendix C***.

9.4 Respirable Crystalline Silica

The RCS annual average criterion of 3 µg/m^3 has been adopted for this assessment. ***Table 9-7*** presents the predicted total RCS concentrations at sensitive receptors for each assessment stage. A background RCS of 0.7 µg/m^3 is included in the predictions.

Table 9-7: Predicted Total Annual Average RCS Concentrations (µg/m³) [Criteria – 3 µg/m³]

Receptor	Background (µg/m³)	Predicted Total Annual Average RCS Concentrations (µg/m³)			
		Current	Stage 1	Stage 2	Stage 4
122B Duns Creek Road	0.7	0.70	0.70	0.70	0.70
16 Uffington Road	0.7	0.70	0.70	0.70	0.70
60 Green Wattle Creek Road	0.7	0.70	0.70	0.70	0.70
34 Timber Top Road	0.7	0.70	0.70	0.70	0.70
35 Timber Top Road	0.7	0.70	0.70	0.70	0.70
36 Timber Top Road	0.7	0.70	0.70	0.70	0.70
13 Mooghin Rd	0.7	0.71	0.71	0.71	0.71
14 Mooghin Rd	0.7	0.71	0.71	0.71	0.71
13 Giles Road	0.7	0.70	0.71	0.71	0.70
13B Giles Road	0.7	0.71	0.71	0.71	0.71
866 Clarence Town Road	0.7	0.71	0.71	0.71	0.71
994 Clarence Town Road	0.7	0.71	0.71	0.71	0.72
1034 Clarence Town Road	0.7	0.71	0.71	0.71	0.71
1060 Clarence Town Road	0.7	0.71	0.71	0.71	0.71
1094 Clarence Town Road	0.7	0.71	0.71	0.70	0.71
1189 Clarence Town Road	0.7	0.73	0.73	0.73	0.72
1203 Clarence Town Road	0.7	0.72	0.72	0.72	0.71

It can be seen from ***Table 9-7*** that the highest predicted RCS concentration is 0.73 µg/m³, which will occur during Stage 2 at 1189 Clarence Town Road.

Overall, the RCS concentration is below the criterion and is not expected to impact on the nearby sensitive receptors. A contour plot is presented in ***Appendix C***.

9.5 Dust Deposition

The predicted incremental increase in monthly average dust deposition is presented in ***Table 9-8*** for each assessment stage. The assessment criterion for dust deposition is a maximum incremental increase of 2 g/m^2/month. It can be seen from ***Table 9-8*** that the highest incremental increase in dust deposition is 0.30 g/m^2/month, which will occur at 13 Mooghin Road during Stage 1.

When the background dust deposition level of 2.1 g/m^2/month is applied to the predictions detailed in ***Table 9-8***, the highest dust deposition monthly average is 2.4 g/m^2/month, which complies with the total dust deposition criterion of 4 g/m^2/month.

Overall, the predicted levels comply with the incremental increase and the total dust deposition criteria and therefore dust is not expected to be a nuisance for sensitive receptors.

Table 9-8: Predicted Monthly Average Incremental Dust Deposition (g/m^2/month) [Criteria – 2 g/m^2/month]

Receptor	Background (g/m^2/month)	Predicted Annual Average Incremental Dust Deposition (g/m^2/month)			
		Current	Stage 1	Stage 2	Stage 4
122B Duns Creek Road	2.1	0.03	0.01	0.01	0.00
16 Uffington Road	2.1	0.02	0.01	0.01	0.00
60 Green Wattle Creek Road	2.1	0.03	0.01	0.01	0.01
34 Timber Top Road	2.1	0.04	0.02	0.01	0.01
35 Timber Top Road	2.1	0.04	0.01	0.01	0.01
36 Timber Top Road	2.1	0.04	0.02	0.01	0.01
13 Mooghin Rd	2.1	0.77	0.30	0.19	0.09
14 Mooghin Rd	2.1	0.60	0.23	0.16	0.06
13 Giles Road	2.1	0.16	0.06	0.05	0.02
13B Giles Road	2.1	0.06	0.02	0.02	0.01
866 Clarence Town Road	2.1	0.07	0.03	0.02	0.02
994 Clarence Town Road	2.1	0.07	0.03	0.02	0.04
1034 Clarence Town Road	2.1	0.07	0.03	0.02	0.03
1060 Clarence Town Road	2.1	0.06	0.02	0.02	0.02
1094 Clarence Town Road	2.1	0.04	0.02	0.01	0.03
1189 Clarence Town Road	2.1	0.12	0.28	0.19	0.10
1203 Clarence Town Road	2.1	0.02	0.12	0.09	0.06

9.6 Summary of Results

The results of the modelling have shown that during all Stages, the TSP, dust deposition and RCS predictions comply with the relevant criteria and averaging periods.

For most sensitive receptors the maximum daily PM_{10} concentrations are driven by the background concentrations obtained from Beresfield monitoring station. In addition, the exceedances of annual $PM_{2.5}$ concentrations are driven by the high background concentration which already exceeds the criterion of 8 µg/m^3.

As discussed in ***Section 10***, the modelling of Stages 2 and 4 does not take into consideration the 18-20 m high amenity barrier which will protect these receptors. The summary of results for all Stages is presented in ***Table 9-9*** and shows that compliance with the criteria is achieved for TSP, dust deposition (both total and incremental), RCS and the annual concentration of PM_{10}.

Table 9-9: Summary of Results for All Stages

Pollutant	Time Basis	Criteria	Maximum Predicted Concentrations at Any Receptor				Compliant
			Current	Stage 1	Stage 2	Stage 4	
TSP	Annual	90 µg/m^3	58.9	54.8	54.6	48.5	✓
PM_{10}	24 Hour	50 µg/m^3	47.3	59.5	60.2	50.9	×
	Annual	25 µg/m^3	26.5	25.3	25.5	22.8	×
$PM_{2.5}$	24 Hour	25 µg/m^3	23.8	23.0	23.0	24.8	✓
	Annual	8 µg/m^3	8.99	8.99	8.97	8.67	×
Dust Deposition	Monthly Total	4 g/m^2/month	2.8	2.4	2.3	2.2	✓
	Monthly Increase	2 g/m^2/month	0.7	0.3	0.2	0.1	✓
RCS	Annual	3 µg/m^3	0.72	0.73	0.73	0.72	✓

9.7 Impacts on Vacant Land

The air quality impact on the vacant lands for the modelled pollutants is provided in ***Table 9-10*** to ***Table 9-13***. As shown in the tables, the predicted impacts from the incremental increases in particulate matter are all well below the relevant criteria specified in the Voluntary Land Acquisition and Mitigation Policy. The cumulative model predictions for TSP and PM_{10} are below criteria for the PM_{10}, TSP and dust deposition results at the modelled vacant land receptors.

Table 9-10: Model Predictions at Vacant Land -Current Stage

Land	PM10 (µg/m³)		TSP (µg/m³)	Dust Deposition (g/m²/month)**
	24 hour**	Annual*	Annual*	
Vacant Land 1	16.7	22.0	45.1	0.06
Vacant Land 2	9.0	21.7	44.4	0.03
Vacant Land 3	4.7	21.1	42.3	0.01
Vacant Land 4	6.6	21.1	42.4	0.01
Criteria	**50**	**30**	**90**	**4**

** cumulative*
*** incremental*

Table 9-11: Model Predictions at Vacant Land – Stage 1

Land	PM10 (µg/m³)		TSP (µg/m³)	Dust Deposition (g/m²/month)**
	24 hour**	Annual*	Annual*	
Vacant Land 1	16.7	21.8	44.4	0.02
Vacant Land 2	9.3	21.5	43.8	0.01
Vacant Land 3	4.7	21.0	42.2	0.01
Vacant Land 4	6.6	21.1	42.3	0.01
Criteria	**50**	**30**	**90**	**4**

** cumulative*
*** incremental*

Table 9-12: Model Predictions at Vacant Land – Stage 2

Land	PM10 (µg/m³)		TSP (µg/m³)	Dust Deposition (g/m²/month)**
	24 hour**	Annual*	Annual*	
Vacant Land 1	16.7	21.8	44.5	0.02
Vacant Land 2	9.2	21.5	43.9	0.01
Vacant Land 3	4.7	21.0	42.2	0.01
Vacant Land 4	6.6	21.1	42.3	0.01
Criteria	**50**	**30**	**90**	**4**

** cumulative*
*** incremental*

Table 9-13: Model Predictions at Vacant Land – Stage 4

Land	**PM10 (µg/m³)**		**TSP (µg/m³)**	**Dust Deposition (g/m²/month)****
	24 hour**	**Annual***	**Annual***	
Vacant Land 1	2.4	21.9	45.6	0.01
Vacant Land 2	11.8	22.3	47.9	0.01
Vacant Land 3	2.4	21.0	42.1	0.01
Vacant Land 4	1.6	21.0	42.1	0.01
Criteria	**50**	**30**	**90**	**4**

** cumulative*
*** incremental*

10 BLAST FUME IMPACTS

The dust impacts from blasting have been assessed in ***Section 9***; however blasting activities have the potential to generate gases such as NO_2 and CO as well as dust. Blast fume emissions can vary greatly depending on a number of factors but largely depend on the tendency of a particular blast (or holes within the shot) to generate significant NO_2 emissions.

Existing blasting operations at Brandy Hill are undertaken by Maxam Australia which use RIOFLEX MX 10000 as the explosive. The bulk load of explosive for Brandy Hill in the period of March 2015 to February 2016 is shown in ***Table 10-1***. The average blast is 12,035 kg per blast.

Table 10-1: Blasting History at Brandy Hill [Maxam Australia, 2016]

Date	Average of Quantity (kg)	Count of Count	Sum of Quantity (kg)
31/03/2015	6050	2	12100
30/04/2015	5739	1	5739
31/05/2015	6470	2	12940
30/06/2015	5067	2	10134
31/07/2015	3667	3	11000
31/08/2015	5460	1	5460
30/09/2015	6725	2	13450
31/10/2015	7764	3	23293
30/11/2015	5810	2	11620
31/12/2015	11080	1	11080
31/01/2016	8775	2	17549
29/02/2016	10058	1	10058
Average	6889	1.8	12035
Total	**82665**	**22**	**144423**

The NPI Emission Estimation Technique Manual for Explosives Detonation and Firing Ranges (Department of Sustainability, Environment, Water, Population and Communities, 2012) provides the following emission factors:

- NO_X – 0.2 kg/tonne of explosive; and
- CO – 17 kg/tonne of explosive.

It is assumed that the blasting requirements remain similar to the current situation; using the average quantity of explosives per blast (12,035kg) the resultant emissions are:

- NO_X – 2,407 kg/blast or 28.9 tonnes/annum; and
- CO – 204,600 kg/blast or 2,455.2 tonnes/annum.

The blasting emissions for the current stage are assumed to remain consistent with the existing operations Model predictions for Stage 4 and the current stage are provided for the blasting fumes at the sensitive receptors for NO_X and CO in ***Table 10-2*** and compared with ambient air quality criteria specified in the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (2016).

As shown in ***Table 10-2***, all predictions are well below the air quality criteria.

Table 10-2: Model Predictions for Blast Fume Emissions, Current Stage and Stage 4

	Current Stage Predictions (µg/m^3)					Stage 4 Predictions (µg/m^3)				
Rec	CO			NOx		CO			NOx	
	15 min	1 hour	8 hour	1 hour	1 year	15 min	1 hour	8 hour	1 hour	1 year
1	1243	942	257	11	0.07	682	517	254	6	0.04
2	1164	882	286	11	0.03	733	555	159	7	0.02
3	1123	851	399	10	0.11	671	509	222	6	0.07
4	1283	972	537	12	0.05	852	646	228	8	0.03
5	978	741	409	9	0.05	520	394	177	5	0.03
6	1143	866	485	11	0.05	619	469	179	6	0.03
7	5012	3798	939	46	0.83	2910	2205	673	28	0.65
8	3773	2859	968	35	0.64	2272	1722	716	22	0.45
9	4839	3667	2066	45	0.65	3182	2411	1760	30	0.39
10	3898	2954	1503	35	0.69	2314	1754	1235	22	0.47
11	2277	1726	825	20	0.35	1223	927	463	12	0.29
12	2000	1516	499	18	0.22	1473	1116	419	14	0.19
13	2507	1900	629	23	0.22	1964	1489	525	18	0.18
14	2301	1744	580	21	0.22	1898	1439	550	18	0.18
15	2453	1859	426	22	0.24	2066	1566	483	19	0.20
16	6873	5209	2479	62	1.45	3599	2727	1210	34	0.95
17	4912	3723	2178	45	1.06	3026	2293	1086	28	0.72
Criteria	**100,000**	**30,000**	**10,000**	**246**	**62**	**100,000**	**30,000**	**10,000**	**246**	**62**

11 MITIGATION & MONITORING

11.1 Overview

Table 11-1 provides an overview of the mitigation measures considered as part of this proposed expansion. All operational mitigation and the proposed amenity barrier are additional mitigation measures to limit the dust impacts. Hanson has committed to both the operational and future mitigation.

Table 11-1: Overview of Mitigation Measures

Mitigation Measures Considered	Modelled/proposed
Watering of haul roads	Modelled (see Appendix B3 for more information)
Enclosed Screens	Modelled (see Appendix B3 for more information)
Enclosed Crushers	Modelled (see Appendix B3 for more information)
Loading Stockpiles	Modelled (see Appendix B3 for more information)
Enclosed conveyors	Modelled (see Appendix B3 for more information)
Amenity Barrier	Proposed

11.2 Dust Mitigation

Appendix B presents the proposed emission controls under the proposed expansion. These controls include continual watering of the haul roads, variable stacking height and enclosed crushing equipment. The future mitigation measures also include: Enclosures are to be installed on all crushing machines and screens, excluding Screen 1 (for Stages 1-3) and Screen 5, for future stages at the Brandy Hill Quarry, conveyor height can vary and conveyors are enclosed (for Stage 4) and revegetation of the amenity barrier (from Stage 2). The mitigation measures are modelled as reflected in ***Table 11-2***.

From ***Table 11-2*** it can be seen that crushers and screens and the conveyors were generating the significant emissions during the current, Stage 1 and Stage 2 phases. These sources are virtually eliminated through engineering controls specifically designed to control dust. As a result of controlling these dust sources, the contributions from vehicle movements (mobile plant, haul truck and product truck movements) become more significant. These emissions will be controlled through water suppression; with more frequent suppression occurring during dry weather conditions and when dust is visible.

Hanson is committed to limiting the dust emissions through water suppression and management.

Table 11-2: TSP Emissions Contributions by Source

Activity	Percentage of emissions			
	Current	Stage 1	Stage 2	Stage 4
Drilling and Blasting	1%	1%	1%	1%
Mobile Plant	22%	26%	28%	38%
Haul Truck Movements	25%	27%	28%	42%
Raw Material Unloading	0%	0%	0%	0%
Stockpile Loading	0%	0%	0%	0%
Wind erosion	2%	1%	1%	1%
Crushers & Screens	24%	15%	10%	4%
Conveyors	15%	18%	19%	0%
Product Truck Movements	11%	12%	13%	9%
Bund Construction	-	0%	0%	0%
Concrete Plant	-	-	-	4%
Diesel	1%	1%	1%	1%
Total	**100%**	**100%**	**100%**	**100%**

The construction of an 18 m to 20 m amenity barrier at the southern boundary of the future processing area will assist in limiting the dispersal of the ground-borne particulate emissions, as shown in ***Figure 2-1***. The height of the conveyors and the relocated quarry plant/equipment will not protrude above the barrier and therefore the emissions are expected to be significantly reduced at sensitive receptors along Clarence Town Road. Due to the limitations of the CALPUFF software, the barrier could not be modelled as a mitigation measure and the mitigation is therefore not included in the impact assessment.

General dust control measures are currently implemented by Hanson and these measures will continue. In addition, it is recommended that the following measures are undertaken to reduce dust emissions:

- Minimise the potential for dust emissions from the construction of the amenity barrier by watering;
- Minimise the potential for dust emissions from wind erosion of the amenity barrier by revegetation as soon as practical after construction is completed;
- Minimise the potential for dust emissions from unpaved haul roads and exposed ground by watering a minimum of 2L/m^2/h during dry conditions or more frequently when required;
- Minimise the potential for dust emissions from stockpile wind erosion by watering where applicable;
- Maintain a wheel wash at the exit of BHQ to remove dust from vehicle wheels. This will reduce the likelihood of dust visibly accumulating on the road.

11.3 Diesel Emissions

All vehicles and mobile plant are required to comply with the Protection of the Environment Operations (POEO) Act 1997 and the Clean Air Regulations (NSW EPA, 2013). This will be achieved through regular maintenance of vehicles, which when coupled with the distances between BHQ and the sensitive receptors, the overall impact will be negligible.

11.4 Air Monitoring Network

The current environment licence (licence number 1879 dated 29th April 2013) stipulates three dust deposition monitoring locations are sufficient.

In the Director General Requirements (DGR's) for this Project, the EPA state that they are moving away from dust deposition monitoring due to a more proactive real-time data collection methods for PM_{10}. The EPA has requested that the cost benefit analysis of Hi Volume Sampling and Tapered Element Oscillating Microbalance (TEOM) or a Beta Attenuation Monitor (BAM) is undertaken, as shown in ***Table 11-3***. Additionally, dust deposition monitoring has also been included to outline the differences in measurement techniques.

Table 11-3: PM_{10} Measurement Technique Cost Benefit Analysis

Measurement Technique	Benefits	Disadvantages	Australian Standard
Hi Volume Sampler	The particulate concentration is calculated at a laboratory based on the total mass of the sample divided by the volume of air drawn through the filter paper. The filter can be analysed for further analysis such as RCS.	Time resolution is limited to 24 hour and the results are only available several days after the measurement. Estimated precision - ±2 µg/m^3	AS/NZS 3580.9.6:2003
TEOM/BAM	Provide real-time data with short resolution (<1 hour) that can be used for proactive particulate control. Estimated precision - ±0.5 µg/m^3	High capital costs.	AS/NZS 3580.9.8-2001
Dust Deposition Gauges	Low capital costs	30 day average deposition to determine nuisance	AS/NZS 3580.10.1-2003

Based on this assessment, consideration should be given to the installation of continuous particulate matter monitoring equipment as recommended in the NSW Approved Methods for the Sampling and Analysis of Air Pollution or as otherwise agreed by the DPE at the fence-line of the quarry (as close to Clarence Town Road as possible). Additionally, the installation of a meteorological station at BHQ would be beneficial to provide more accurate wind conditions at the quarry rather than using the Tocal AWS.

The installation of particulate matter monitoring equipment and weather station will demonstrate the successful implementation of proactive dust management techniques to allow adaptive air quality management and reduce the likelihood of complaints and exceedances. Any equipment must be installed, maintained and sited in accordance with the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (Department of Environment & Conservation, 2007).

12 GREENHOUSE GAS

A greenhouse gas assessment has been undertaken for this proposed expansion. This assessment determines the carbon dioxide equivalent (CO_2-e) emissions from the project according to international and Federal guidelines.

Greenhouse gases include water vapour, carbon dioxide (CO_2), methane, nitrous oxide and some artificial chemicals such as chlorofluorocarbons (CFCs). Water vapour is the most abundant greenhouse gas. These gases vary in effect and longevity in the atmosphere, but scientists have developed a system called Global Warming Potential to allow them to be described in equivalent terms to CO_2 (the most prevalent greenhouse gas) called equivalent carbon dioxide emissions (CO_2-e). A unit of one tonne of CO_2-e (t CO_2-e) is the basic unit used in carbon accounting. An emissions inventory, or 'carbon footprint', is calculated as the sum of the emission rate of each greenhouse gas multiplied by the global warming potential.

The Department of the Environment and Energy (DOEE) monitors and compiles databases on anthropogenic activities that produce greenhouse gases in Australia. The DOEE has published greenhouse gas emission factors for a range of anthropogenic activities. The DOEE methodology for calculating greenhouse gas emissions is published in the National Greenhouse Accounts (NGA) Factors workbook (Department of Environment, 2014). This workbook is updated regularly to reflect current compositions in fuel mixes and evolving information on emission sources.

The scope that emissions are reported, as defined by the NGA Factors Workbook is determined by whether the activity is within the organisation's boundary (Scope 1 – Direct Emissions) or outside the organisation's boundary (Scopes 2 and 3 – Indirect Emissions). Emission factors used in this assessment have been derived from either the Department of Environment, site-specific information or from operational details obtained from similar emission sources.

The purpose of this report is to evaluate the GHG emissions from the operation of BHQ. Calculating the GHG emissions for the life of the BHQ, based on an extraction rate of 1.5 Mtpa for 30 years the following GHG emissions are expected:

- Scope 1 emissions: 296,072.5 tonnes CO_2-equivalent;
- Scope 2 emissions: 85,426.5 tonnes CO_2-equivalent; and
- Scope 3 emissions: 41,242.5 tonnes CO_2-equivalent.

The estimated maximum annual operational phase emissions represent less than 0.005% of Australia's latest greenhouse gas inventory estimates.

The full greenhouse gas assessment is presented in ***Appendix D***.

13 CONCLUSION

Hanson propose to expand the extent of the extraction area at BHQ and increase the annual production rate to 1.5 million tonnes. The purpose of this air quality assessment is to evaluate the potential impacts to air quality from the proposed stages of the expansion and to provide recommendations to mitigate and minimise any potential impacts that might have an effect on nearby sensitive receptors.

The main air emissions from BHQ operations are caused by wind-borne dust, crushing and screening, vehicle usage, materials handling and transfers. A major source of dust during Stage 1 of the proposed expansion will be from the construction of an 18 m to 20 m high amenity barrier at the southern boundary of the quarry, but this will be a temporary activity. Once completed, the bund will provide long-term attenuation benefits by limiting the dispersal of the ground-borne particulate emissions, such as PM_{10} from the quarry.

In addition, the primary emission source contribution during Stage 2 is dust generated by haul truck movements. These emissions can be effectively managed by watering of the haul roads (as modelled) and regulating vehicle speeds to less than 40 km/h (as recommended).

In order to assess the impact of a quarry expansion on the receiving environment, the incremental impact is quantified and added to existing background pollutant concentrations. Vipac has used dust deposition monitoring results from BHQ as well as daily particulate monitoring data from NSW EPA site at Beresfield in the predictions. For the purposes of accurate predictions, the modelling simulated different Stages of the project:

- Current - Current site operations with an annual production rate of 0.7 Mtpa;
- Stage 1 - Proposed site operations with an annual production rate of 1.5 Mtpa including the construction of the amenity barrier;
- Stage 2 - Proposed site operations with an annual production rate of 1.5 Mtpa; and
- Stage 4 - Proposed site operations with an annual production rate of 1.5 Mtpa including the concrete batching plant and relocation of the fixed plant. This stage is the last stage where previously undisturbed land will be stripped to allow access to the resource material. By Stage 2, the amenity barrier to the southern boundary will be complete and stand between 18 m and 20 m high, however this barrier has not been modelled in CALPUFF due to limitations of the software. As such, Stage 4 is representative of the relocation of the processing plant and incorporates the proposed mitigation measures for the relocated processing area.

The results of the modelling have shown that during all Stages, the TSP, dust deposition and RSC predictions comply with the relevant criteria. For most sensitive receptors the maximum daily and annual PM_{10} and $PM_{2.5}$ concentrations are driven by the background concentrations obtained from Beresfield monitoring station.

The exceedances of annual $PM_{2.5}$ concentrations are driven by the high background concentration which already exceeds the criterion of 8 µg/m^3. The results have shown that the proposed efficiency controls for the processing plant as modelled significantly reduce the particulate emissions and impact on sensitive receptors. The modelling of Stage 4 does not take into consideration the 18 m to 20 m high amenity barrier which will protect these receptors.

The construction of an 18 m to 20 m high amenity barrier at the southern boundary of the future processing area will assist in limiting the dispersal of the ground-borne particulate emissions. The height of the conveyors and other plant will not protrude above the amenity barrier and therefore the emissions are expected to be significantly reduced at sensitive receptors along Clarence Town Road.

Recommendations for the installation of continuous particulate matter monitoring equipment as detailed in the NSW Approved Methods or as otherwise agreed by the DPE and weather station have been made. The installation of particulate matter monitoring equipment and weather station will demonstrate the successful implementation of proactive dust management techniques to allow adaptive air quality management and reduce the likelihood of complaints and exceedances.

A greenhouse gas assessment has been undertaken for this project. This assessment determines the carbon dioxide equivalent (CO_2-e) emissions from the project according to international and Federal guidelines. Calculating the GHG emissions for the life of the BHQ, based on an extraction rate of 1.5 Mtpa for 30 years the following GHG emissions are expected:

- Scope 1 emissions: 296,027.5 tonnes CO_2-equivalent;
- Scope 2 emissions: 85,426.5 tonnes CO_2-equivalent; and
- Scope 3 emissions: 41,242.5 tonnes CO_2-equivalent.

The estimated maximum annual operational phase emissions represent less than 0.005% of Australia's latest greenhouse gas inventory estimates.

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Appendix A: GLOSSARY

Ambient Monitoring	Ambient monitoring is the assessment of pollutant levels by measuring the quantity and types of certain pollutants in the surrounding, outdoor air.
AWS	Automatic Weather Station
BHQ	Brandy Hill Quarry (project site)
BOM	Bureau of Meteorology
Carbon Dioxide Equivalent	A metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential (expressed as CO_2-e).
Conveyor	Mechanical handling equipment (which may include a belt, chain or shaker) used to move materials from one location to another.
Deforestation	Conversion of forested lands for non-forest uses.
Deposited Matter	Any particulate matter that falls from suspension in the atmosphere
Dust	Generic term used to describe fine particles that are suspended in the atmosphere. The term is nonspecific with respect to the size, shape and chemical composition of the particles.
Embodied energy	Energy consumed by all of the processes associated with the production of a building, from the mining and processing of natural resources to manufacturing, transport and product delivery.
Emissions	Release of a substance (usually a gas) into the atmosphere.
Emissions Factor	Unique value for scaling emissions to activity data in terms of a standard rate of emissions per unit of activity (e.g., grams emitted per litre of fossil fuel consumed).
EPA	Environmental Protection Authority (NSW)
Fluorinated Gases	Powerful synthetic greenhouse gases such that are emitted from a variety of industrial processes.
Fluorocarbons	Carbon-fluorine compounds that often contain other elements such as hydrogen, chlorine, or bromine. Common fluorocarbons include chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs).
Fugitive Dust	Dust derived from a mixture of not easily defined sources. Dust is commonly derived from such non-point sources such as vehicular traffic on unpaved roads, materials transport and handling
Global Warming Potential	Measure of the total energy that a gas absorbs over a particular period of time (usually 100 years), compared to carbon dioxide.
Greenhouse Gas (GHG)	Any gas that absorbs infrared radiation in the atmosphere. Greenhouse gases include, carbon dioxide, methane, nitrous oxide, ozone, chlorofluorocarbons, hydrochlorofluorocarbons, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride.
Haul Roads	Roads used to transport extracted materials by truck around a mine/quarry site

Hydrocarbons	Substances containing only hydrogen and carbon. Fossil fuels are made up of hydrocarbons.
Hydrochlorofluorocarbons	Compounds containing hydrogen, fluorine, chlorine, and carbon atoms. Although ozone depleting substances, they are less potent at destroying stratospheric ozone than chlorofluorocarbons.
Hydrofluorocarbons (HFCs)	Compounds containing only hydrogen, fluorine, and carbon atoms. HFCs are emitted as by-products of industrial processes and are also used in manufacturing.
Methane (CH_4)	A hydrocarbon that is a greenhouse gas with a global warming potential most recently estimated at 25 times that of carbon dioxide (CO_2).
mg	Milligram ($g \times 10^{-3}$)
Micron	Unit of measure µm ($metre \times 10^{-6}$)
Nuisance Dust	Dust which reduces environmental amenity without necessarily resulting in material environmental harm. Nuisance dust generally comprises particles greater than 10 micrograms.
OEH	Office of Environment & Heritage (NSW)
Overburden	Material of any nature that overlies a deposit of useful materials
PM_{10}	Particulate matter less than 10 microns in size
$PM_{2.5}$	Particulate matter less than 2.5 microns in size
TSP	Total Suspended Particles is particulate matter with a diameter up to 50 microns
$\mu g/m^3$	Micrograms per cubic metre

Appendix B: EMISSION ESTIMATION

B.1 EMISSION ESTIMATION EQUATIONS

The major air emissions from extraction activities is fugitive dust. Emission factors can be used to estimate emissions of TSP, PM_{10} and $PM_{2.5}$ to the air from various sources. Emission factors relate to the quantity of a substance emitted from a source to some measure of activity associated with the source. Common measures of activity include distance travelled, quantity of material handled, or the duration of the activity.

The National Pollutant Inventory Emission Estimation Technique Manual for Mining (January 2012) provide the equations and emission factors to determine the emissions of TSP and PM_{10} from mining and quarrying activities. These emission factors incorporate emission factors published by the USEPA in their AP-42 documentation.

Excavation of Overburden

The default emission rates in the NPI EET for Mining have been used for this emission factor.

Material Unloading

Emission rate for dust from stockpile has been calculated using the following emission rates from AP42 11.19.2:

TSP = PM_{10} multiplied by 2

PM_{10} = default of 0.00005

$PM_{2.5}$ = 15% of PM_{10} is $PM_{2.5}$

Crushing and Screening

The default emission rates in the NPI EET for Mining and AP42 11.19.2 have been used.

Drilling

The default emission rates in the NPI EET for Mining and have been used for these emission factors. 10% PM_{10} is $PM_{2.5}$. Six holes per day is the estimated rate.

Blasting

The TSP emission rate for blasting has been calculated using the following equation:

$$Emissions_{\text{TSP}} = 0.00022\ x\ Area\ blasted\ (m^2)^{1.5} \text{ kg /blast}$$

PM_{10} is TSP multiplied by 0.52 and 10% of PM_{10} is $PM_{2.5}$. Area blasted is 1225 m^2 with 25 blasts per year.

In-Pit Retention

The default reductions as detailed in the NPI EET for Mining were applied to one pit in Stage 4 only as the pit is more than RL -50 m:

TSP = 50% reduction

PM_{10} and $PM_{2.5}$ = 5% reduction

Haul Roads

The dust emission rate from haul roads has been calculated using the following equation:

$$Emissions = \left(\frac{0.4536}{1.6093}\right) x\ k\ x \left(\frac{s_{(\%)}}{12}\right)^{\alpha} x \left(\frac{W_{(t)}}{3}\right)^{0.45} \text{ kg /VKT}$$

Where:

k = 4.9 for TSP, 1.5 for PM_{10} and 0.15 for $PM_{2.5}$.

$s_{(\%)}$ = surface material silt content (provided by Hanson for different particulate sizes)

W = mean vehicle weight (tons converted to tonnes)

a = 0.7 for TSP, 0.9 for PM_{10} and $PM_{2.5}$

Conveyors

The dust emission rate from conveyor transfer points has been calculated using the following equation:

$$Emissions = k\ x\ 0.0016 \frac{\left({U}/{2.2}\right)^{1.3}}{\left({M}/{2}\right)^{1.4}} \text{ kg /transfer point}$$

Where:

k = 0.74 for TSP, 0.35 for PM_{10}. 15% of PM_{10} is $PM_{2.5}$

U = mean wind speed (m/s)

M = material moisture content (1%)

Stockpile Loading

Emission rates for dust from stockpile loading have been calculated using the following emission rates from AP42 11.19.2:

TSP = PM_{10} multiplied by 2

PM_{10} = 0.00005

$PM_{2.5}$ = 15% of PM_{10} is $PM_{2.5}$

Wind Erosion

The emission rate for dust from stockpile has been calculated using the following equation for TSP:

$$Emissions = 1.9\ x \left(\frac{s_{(\%)}}{1.5}\right) x\ 365\ x \left(\frac{365-p}{235}\right) x \left(\frac{f_{(\%)}}{15}\right) \text{ kg /ha /yr}$$

Where:

$s_{(\%)}$ = silt content (provided by Hanson for different particulate sizes).

P = number of days per year when rainfall is greater than 0.25 mm. A review of the TAPM metrological data has determined there are 216 days where rainfall is greater than 0.25 mm.

$f_{(\%)}$ = percentage of time that wind speed is greater than 5.4 m/s at the mean height of the stockpile. The frequency of wind speed >5.4 m/s has been determined to be 7.8%.

The fraction of PM_{10} in TSP is 50% and $PM_{2.5}$ is 15% of PM_{10}

Meteorological parameters for emission estimation as determined by TAPM:

- Mean wind speed is 3.11 m/s;
- Percentage of time when wind speed >5.4 m/s is 7.8%; and
- Number of days with rainfall >0.25 mm is 216.

B.2 ACTIVITY OVERVIEW

Operating Hours

Extraction and processing of material has been modelled as 24 hours per day whilst the construction of the bund has been modelled as 12 hours per day.

Extraction Rates

The current extraction rate is 0.7 Mtpa and this expansion proposes a future extraction rate of 1.5 Mtpa for Stages 1, 2 and 4.

Table B-2-14-1: Extraction Rates Modelled

Activity	Modelling Scenario			
	Current	Stage 1	Stage 2	Stage 4
Annual Extraction Rate (Mtpa)	0.7	1.5	1.5	1.5
Daily Extraction Rate (tonnes)	1,918	4,110	4,110	4,110

Barrier Construction

The construction of amenity barrier will occur in Stage 1. This equates to 24,198 m^3 of overburden per annum moved to create the bund. One excavator will be active on the barrier during construction.

Haul Roads

Haul road locations for each scenario were provided by Hanson and incorporated into the model.

Table B-2-14-2: Haul Road Lengths Modelled

Total Haul Road Length	Modelling Scenario			
	Current	Stage 1	Stage 2	Stage 4
Extraction Pit (km)	1.4	0.7	0.7	0.7
Processing Area (km)	1.8	1.8	1.8	0.9

Silt Content

Silt content data for the quarry was provided by Hanson for particulates > 75 and < 2 um. Using the data the following silt content percentages were derived 7.5% for TSP, 4.5% for PM_{10} and 2% $PM_{2.5}$.

Table 14-3 and Table 14-4 outline the emission factors and key parameters applied in the emissions estimation.

Table 14-3: Source type Emission Factors applied

Source type	TSP Emission factor	Derived TSP Emission factor	PM10/TSP ratio	PM2.5/TSP ratio	Units	Controls applied
Pit Activities						
Excavator on Overburden	0.025	-	0.48	0.105	kg/t	No control
Dozer on overburden	0.025	-	0.48	0.105	kg/t	No control
Grader	0.19	-	0.31	0.02	kg/VKT	Water sprays, 50%
Blasting/drilling:						
Drilling	0.59	-	0.52	0.052	kg/hole	No control
Blasting	$0.00022 \times A^{1.5}$	9.43	0.52	0.052	kg/blast	No control
Wind erosion:						
stockpiles/pits/haul roads	0.4	-	0.5	0.02	kg/ha/h	Water sprays, 50%
Processing & Handling:						
Conveying/Transfers	-	0.005	0.4	0.07	kg/t	Enclosed Stage 4, 70%
Crushing	0	-	-	-		Enclosed, 100%
Screening	0.0125	-	0.34	0.05	kg/t	Enclosed Stage 4, 100%
Loading stockpiles	0.0001	-	0.5	0.075	kg/t	No control
Unloading stockpiles	0.03	-	0.42	0.07	kg/t	Water sprays, 50%
Trucks dumping overburden	0.012	-	0.35	0.02	kg/t	Water sprays, 70%
Loading to trucks	0.0001	-	0.5	0.075	kg/t	No control
Wheel generated dust:						
Unpaved roads	$1.38 \times (s/12)^{0.7} \times (W/3)^{0.45}$	4.86	0.175	0.008	kg/VKT	50% for level 1 watering

Table 14-4: Parameters applied in emissions estimation

Parameter ID	Value	Units	Description	Data source
U	3.1	m/s	mean wind speed	TAPM-CALMET derived meteorological data set
W	172	t	Truck capacity	client supplied
p	216	days	rainfall > 0.25mm	BoM data
f	7.8	%	% time winds > 5.4m/s	TAPM-CALMET derived meteorological data set
Holes	6	Holes/day	Holes drilled per day	Client supplied
A	1225	m^2/blast	Area blasted	Client supplied
B	1	Blast/week	Blasts per week	Client supplied
s	6	%	Silt content	Client supplied
Wind erosion area:				
Stage 1	1.5×10^5	m^2	area	Derived from plans
Stage 2	2.2×10^5	m^2	area	Derived from plans
Stage 4	3.4×10^5	m^2	area	Derived from plans
Haul road activity:				
Stockpile to weighbridge	8	VKT/day	Vehicle kilometres travelled per day	Client supplied
Stockpiles	13	VKT/day	Vehicle kilometres travelled per day	Client supplied
Plant to weighbridge	5	VKT/day	Vehicle kilometres travelled per day	Client supplied
Main haul road	54	VKT/day	Vehicle kilometres travelled per day	Client supplied

B.3 EMISSION CONTROLS APPLIED

The following control efficiencies were applied to each modelling scenario.

Table B-3-14-5: Control Efficiencies Applied to Emission Estimation

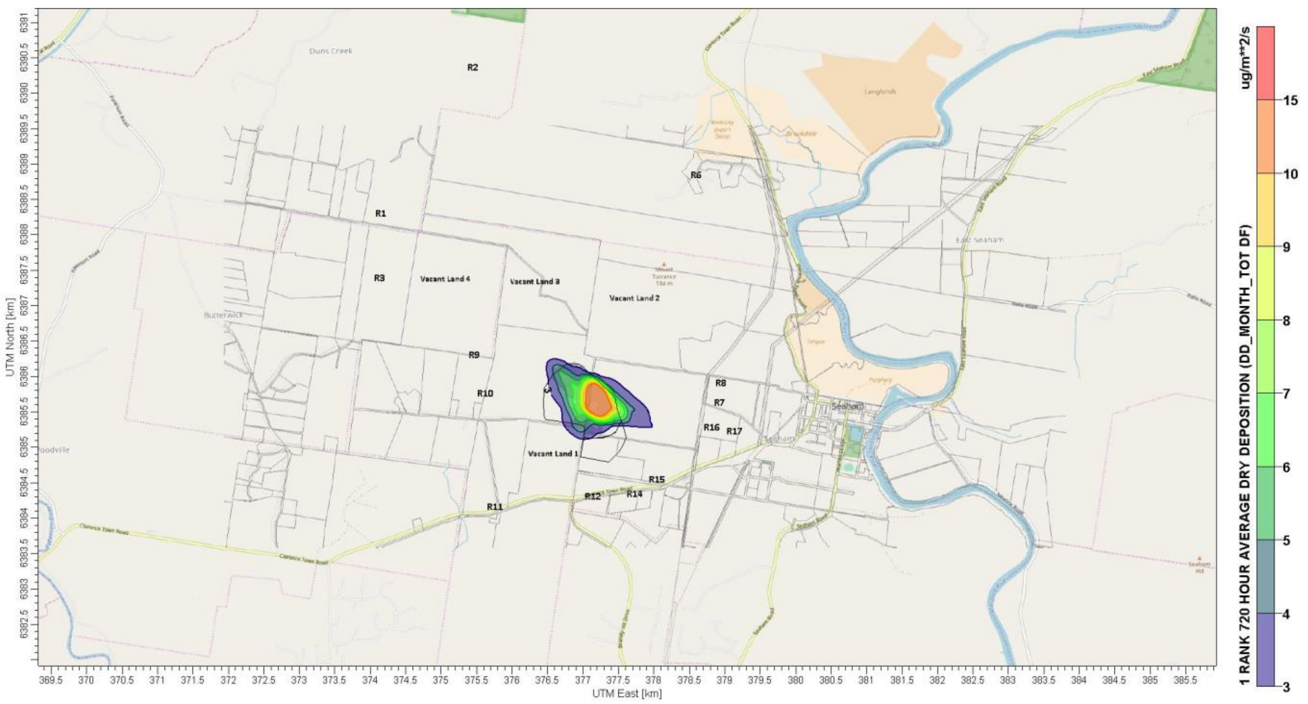
Activity	Modelling Scenario			
	Current	Stage 1	Stage 2	Stage 4
Haul Roads	Watering Level 1 (50%)	Watering Level 1 (50%)	Watering Level 1 (50%)	Watering Level 1 (50%)
Crushing	-	Enclosed (100%)	Enclosed (100%)	Enclosed (100%)
Screening (Screens 2, 3 and 4 and all Stage 4)	Enclosed (100%)	Enclosed (100%)	Enclosed (100%)	Enclosed (100%)
Loading Stockpiles	Variable Height Stacker (25%)	Variable Height Stacker (25%)	Variable Height Stacker (25%)	Variable Height Stacker (25%)
In-Pit Retention	-	-	-	NPI reductions
Conveyors	-	-	-	Enclosure (70%)
Construction Barrier Wind Erosion	-	-	Revegetation (99%)	Revegetation (99%)

Appendix C: **CONTOUR PLOTS**

The contour plots are created from the predicted ground-level concentrations at the network of gridded receptors within the modelling domain at frequent intervals. These gridded values are converted into contours using triangulation interpolation in the CALPOST post-processing software within the CALPUFF View software (Version 7.2 - June 2014).

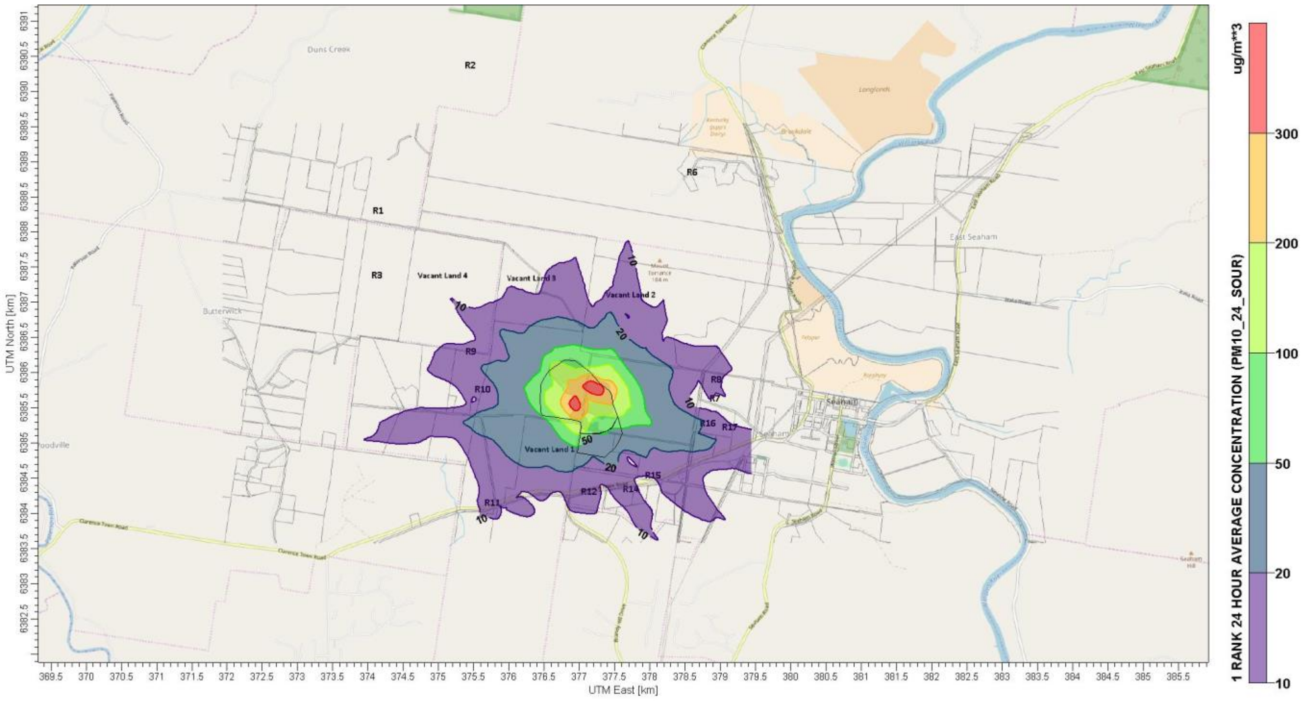
Contour plots illustrate the spatial distribution of ground-level concentrations across the modelling domain for each time period of concern. However, this process of interpolation causes a smoothing of the base data that can lead to minor differences between the contours and discrete model predictions.

C.1 CURRENT OPERATIONS



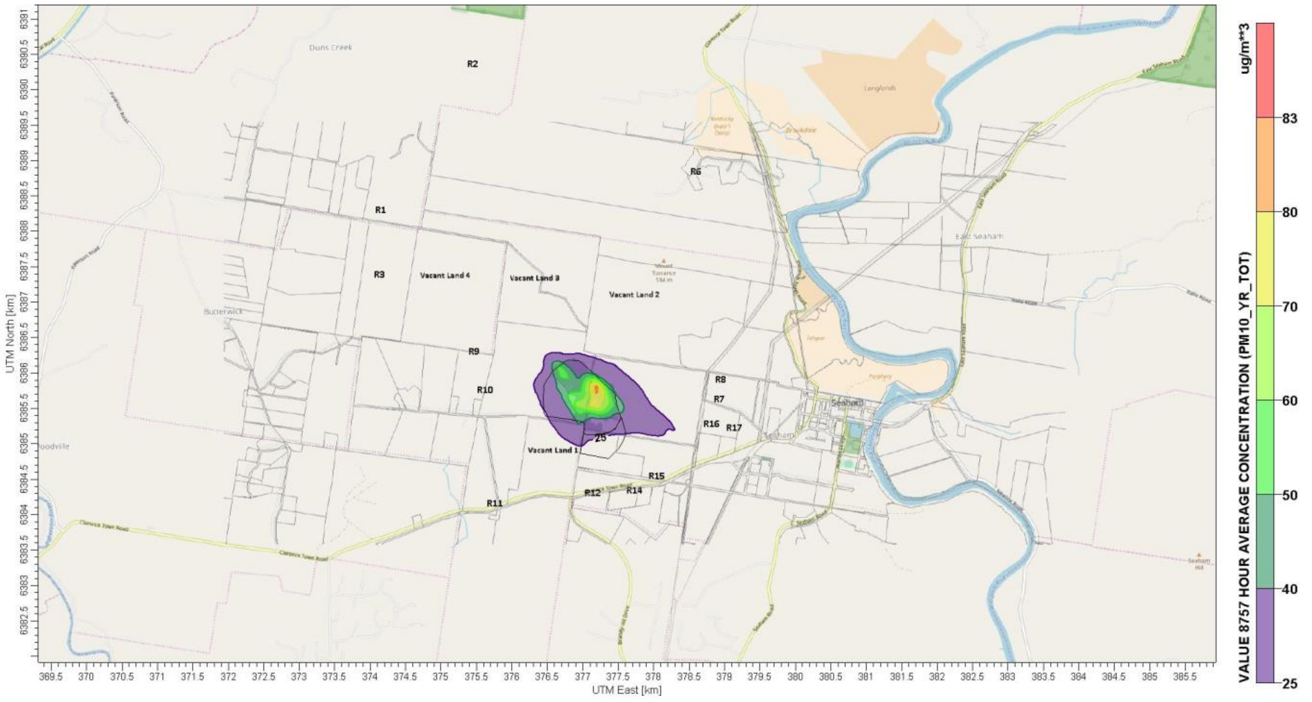
Pollutant:	Averaging Period:	Percentile:	Criteria:
Dust Deposition	Month	100th	4 g/m^2/month

Comment:
Current operations in relation to the future quarry boundary and processing area. Includes background of 2.1 g/m^2/month



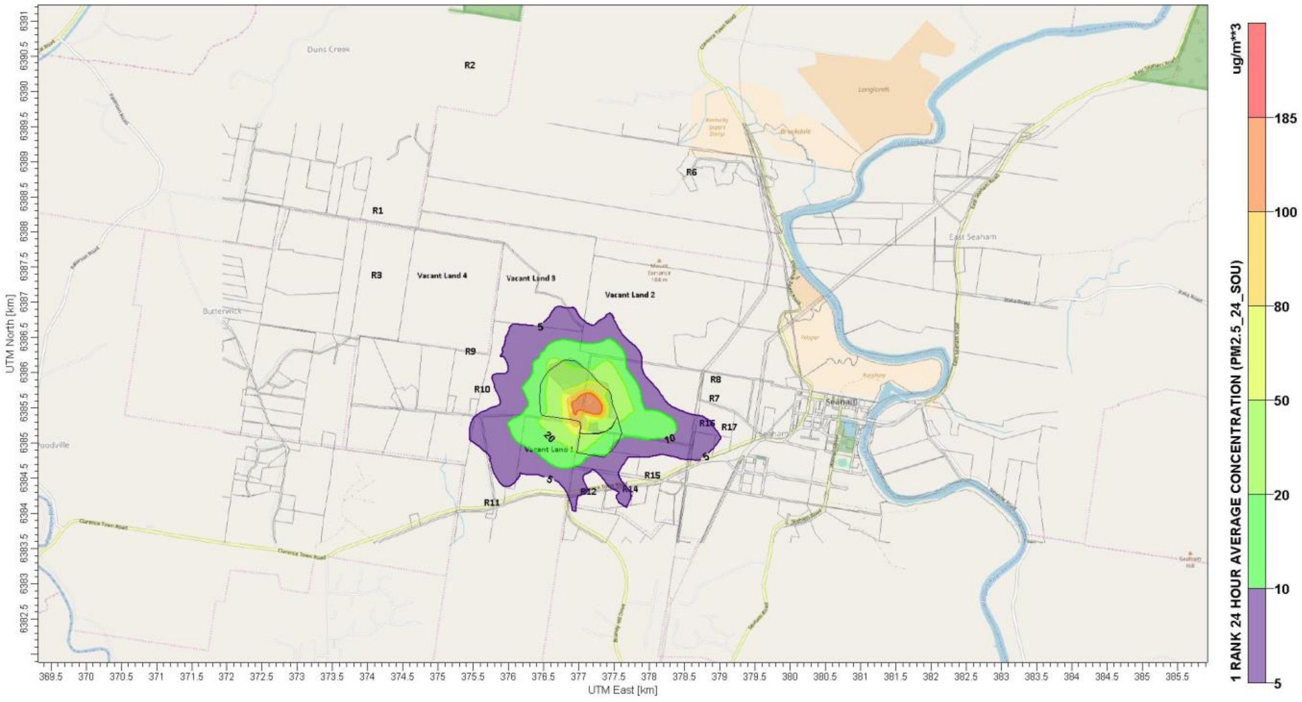
Pollutant: PM10 (Incremental)	Averaging Period: 24 hour	Percentile: 100th	Criteria: 50 µg/m3

Comment:
Current operations in relation to the future quarry boundary and processing area



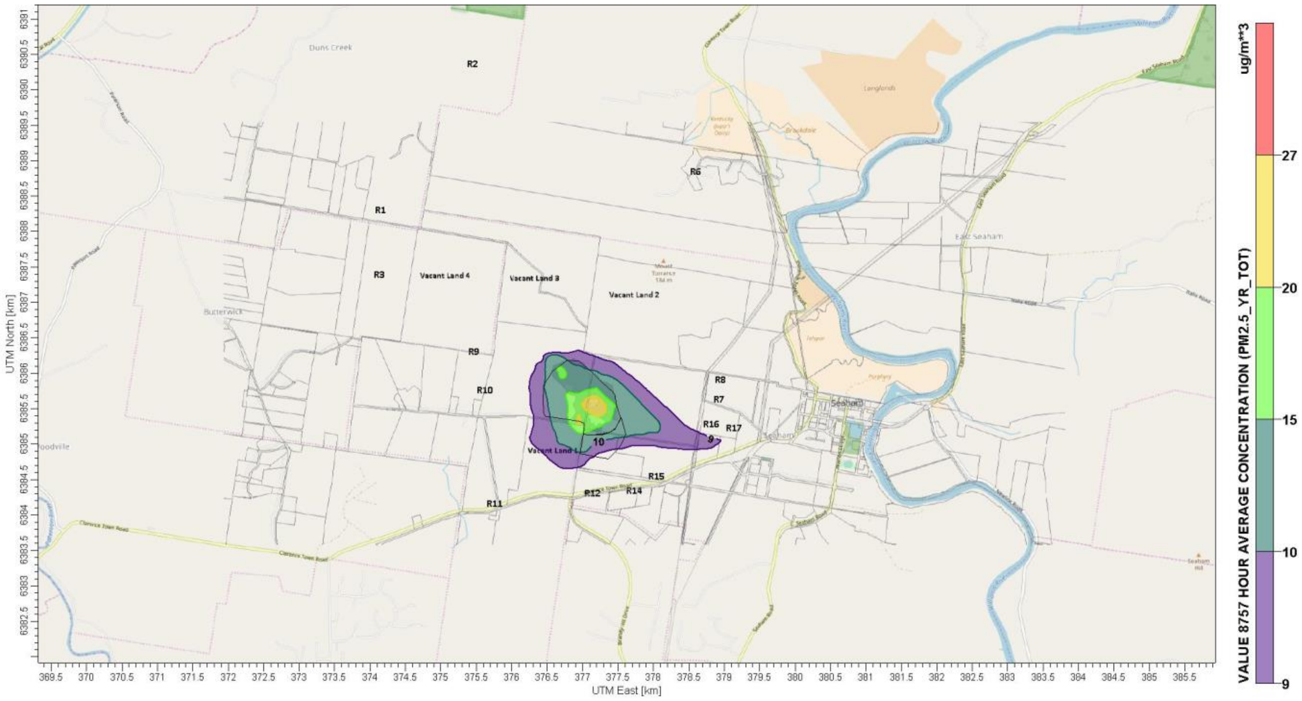
Pollutant:	Averaging Period:	Percentile:	Criteria:
PM_{10} (Total)	Annual	100th	30 µg/m^3

Comment:
Current operations in relation to the future quarry boundary and processing area. Includes background of 20.9 µg/m^3



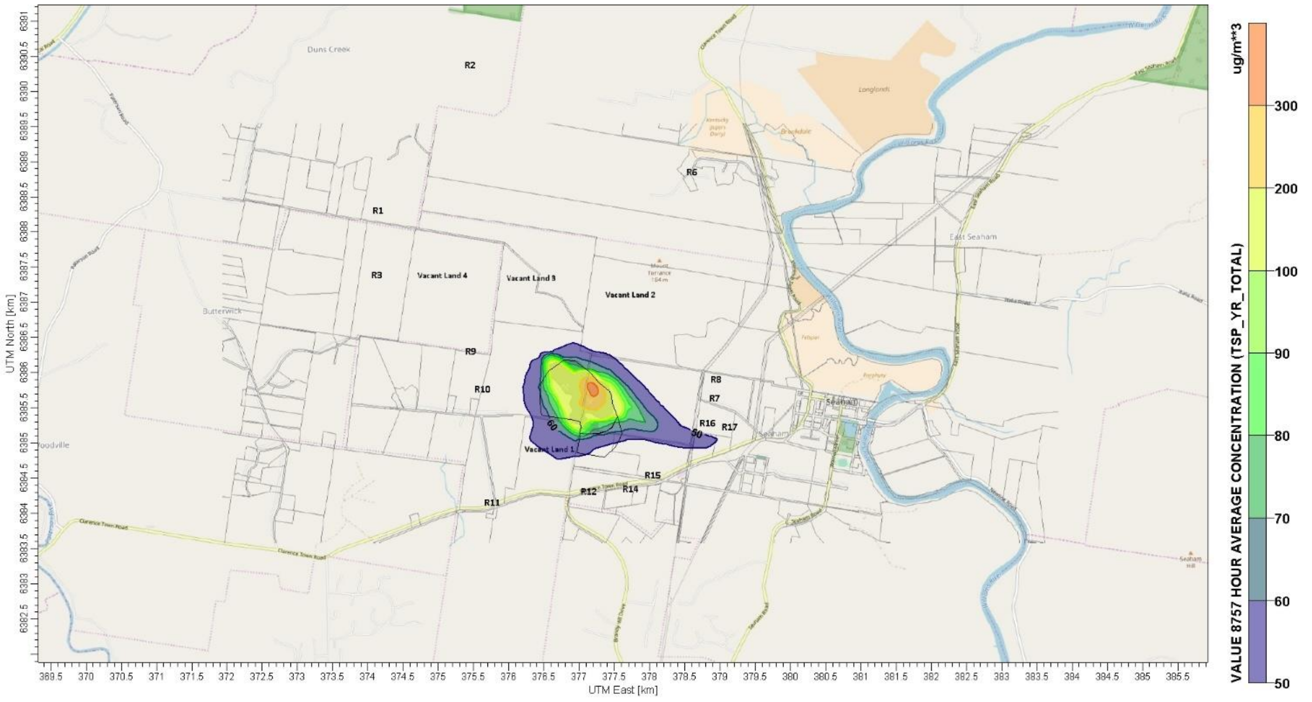
Pollutant: PM$_{2.5}$ (Incremental)	**Averaging Period:** 24 hour	**Percentile:** 100th	**Criteria:** 25 µg/m^3

Comment:
Current operations in relation to the future quarry boundary and processing area



Pollutant:	Averaging Period:	Percentile:	Criteria:
$PM_{2.5}$ (Total)	Annual	100^{th}	8 µg/m^3

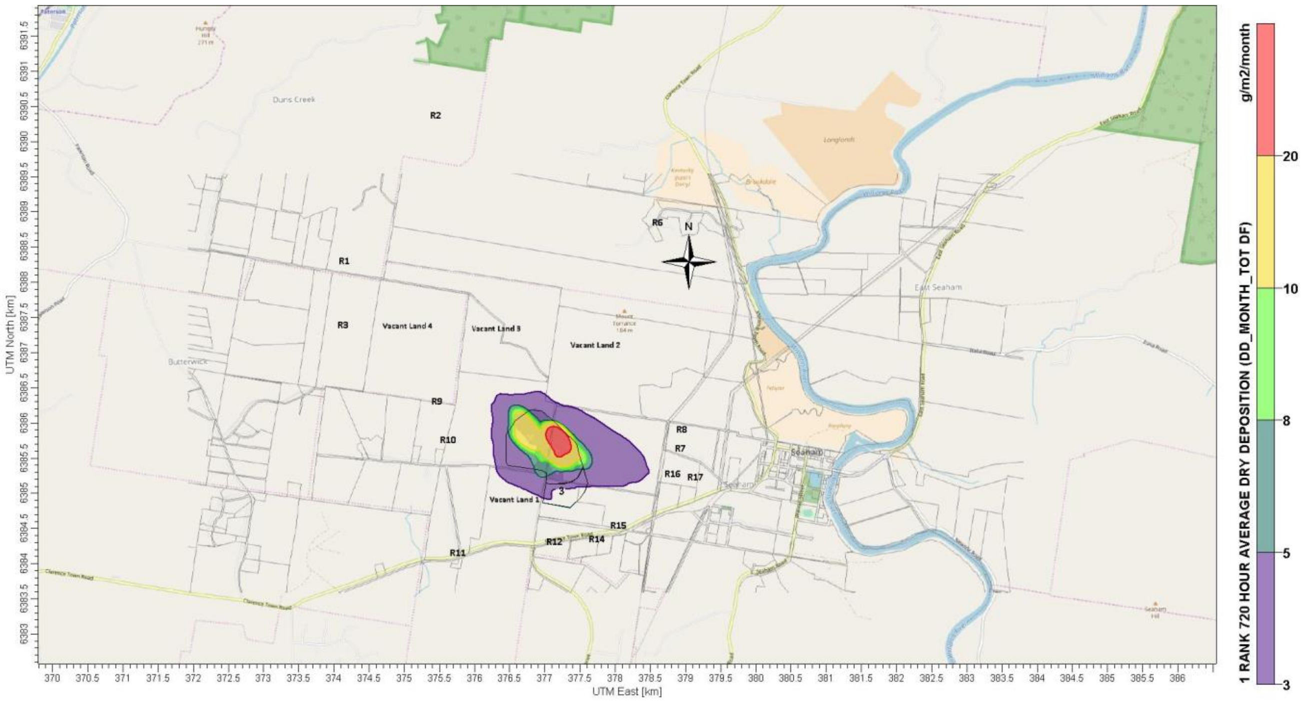
Comment:
Current operations in relation to the future quarry boundary and processing area.
Includes background concentration of 8.1 µg/m^3



Pollutant:	Averaging Period:	Percentile:	Criteria:
TSP (Total)	Annual	100th	90 µg/m³

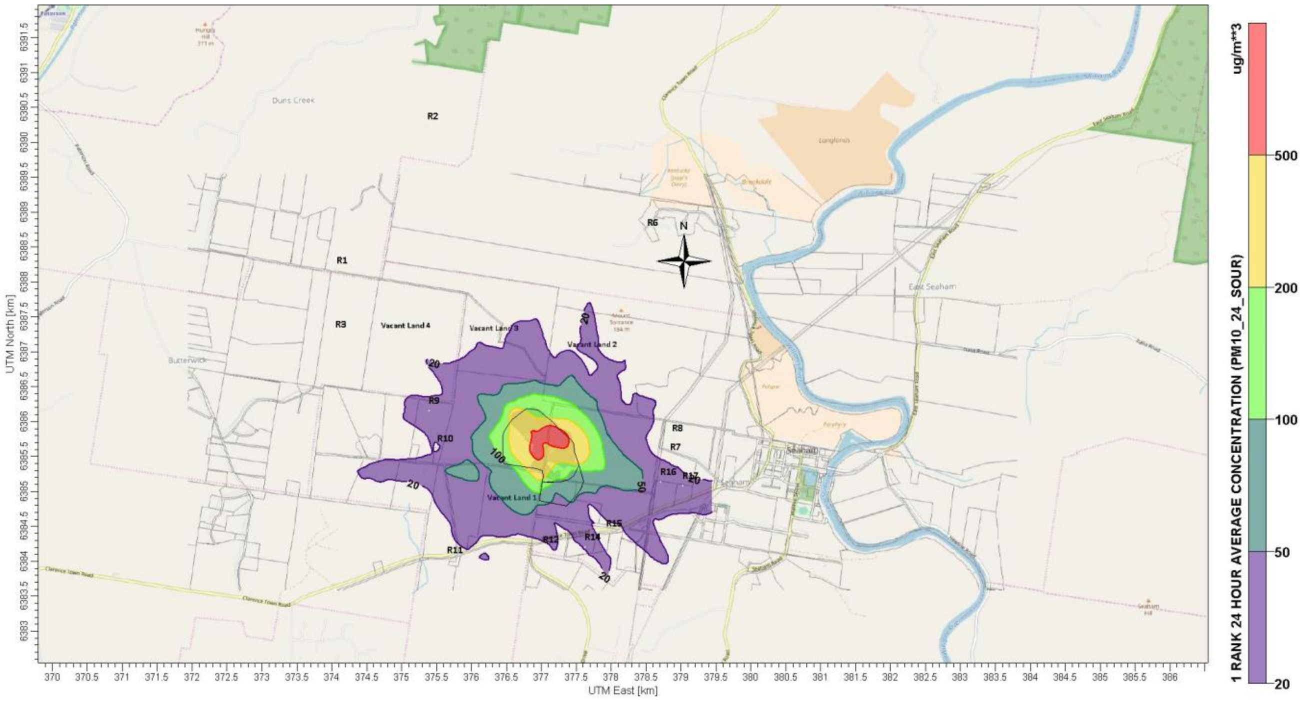
Comment:
Current operations in relation to the future quarry boundary and processing area.
Includes background concentration of 41.8 µg/m³

C.2 STAGE 1



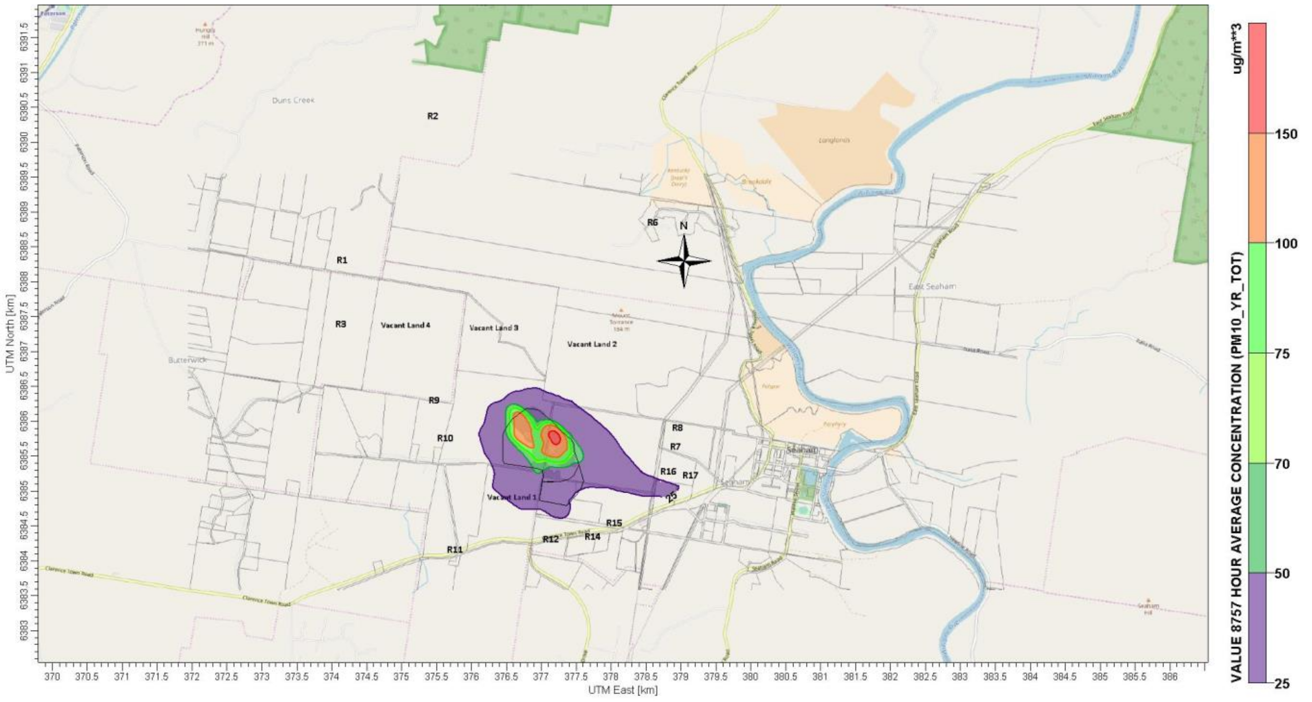
Pollutant: Dust Deposition	Averaging Period: Month	Percentile: 100th	Criteria: 4 g/m^2/month

Comment:
Stage 1 operations in relation to the future quarry boundary and processing area.
Includes background of 2.1 g/m^2/month



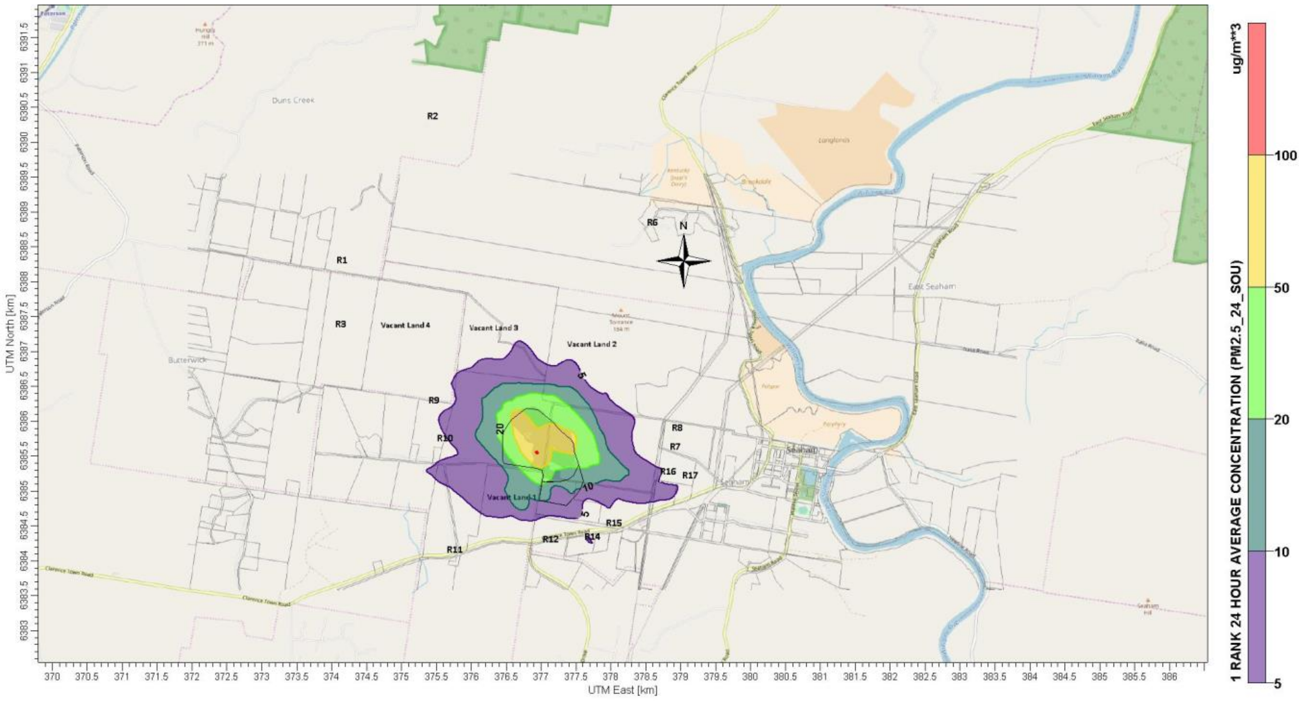
Pollutant: PM$_{10}$ (Incremental)	Averaging Period: 24 hour	Percentile: 100th	Criteria: 50 µg/m^3

Comment:
Stage 1 operations in relation to the future quarry boundary and processing area



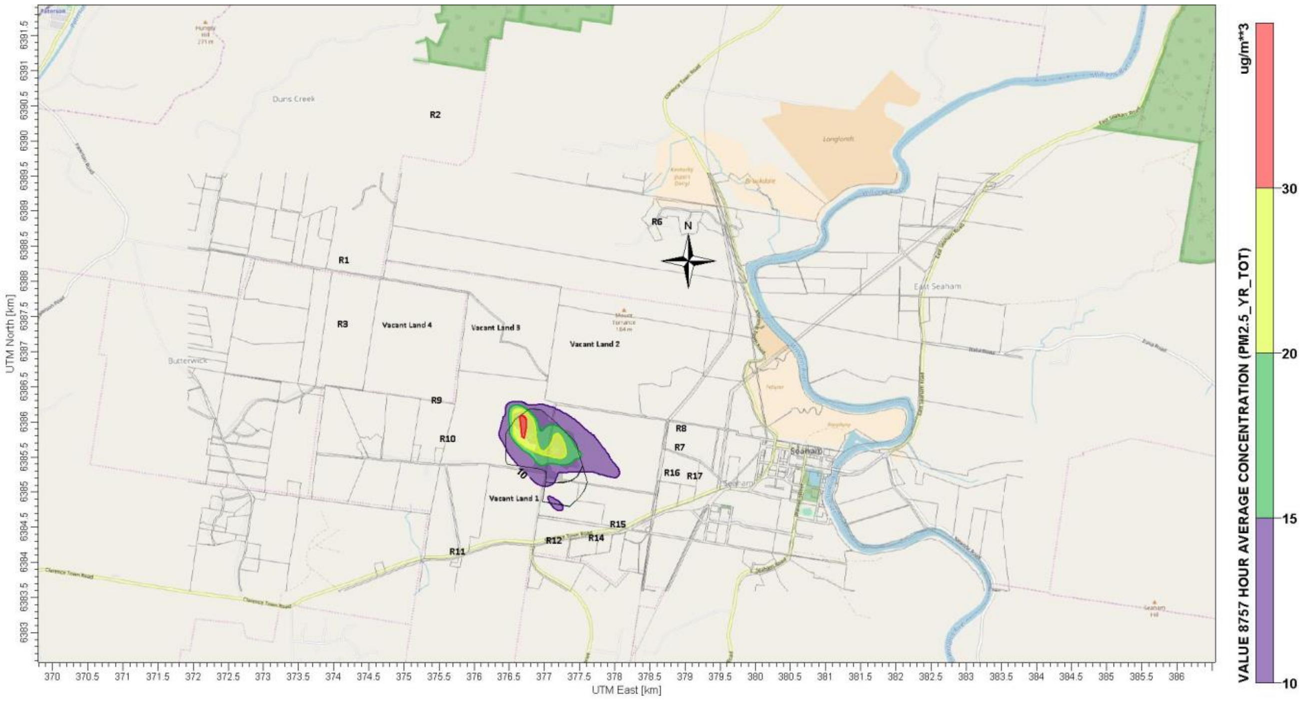
Pollutant: PM10 (Total)	Averaging Period: Annual	Percentile: 100th	Criteria: 30 µg/m^3

Comment:
Stage 1 operations in relation to the future quarry boundary and processing area.
Includes background concentration of 20.9 µg/m^3



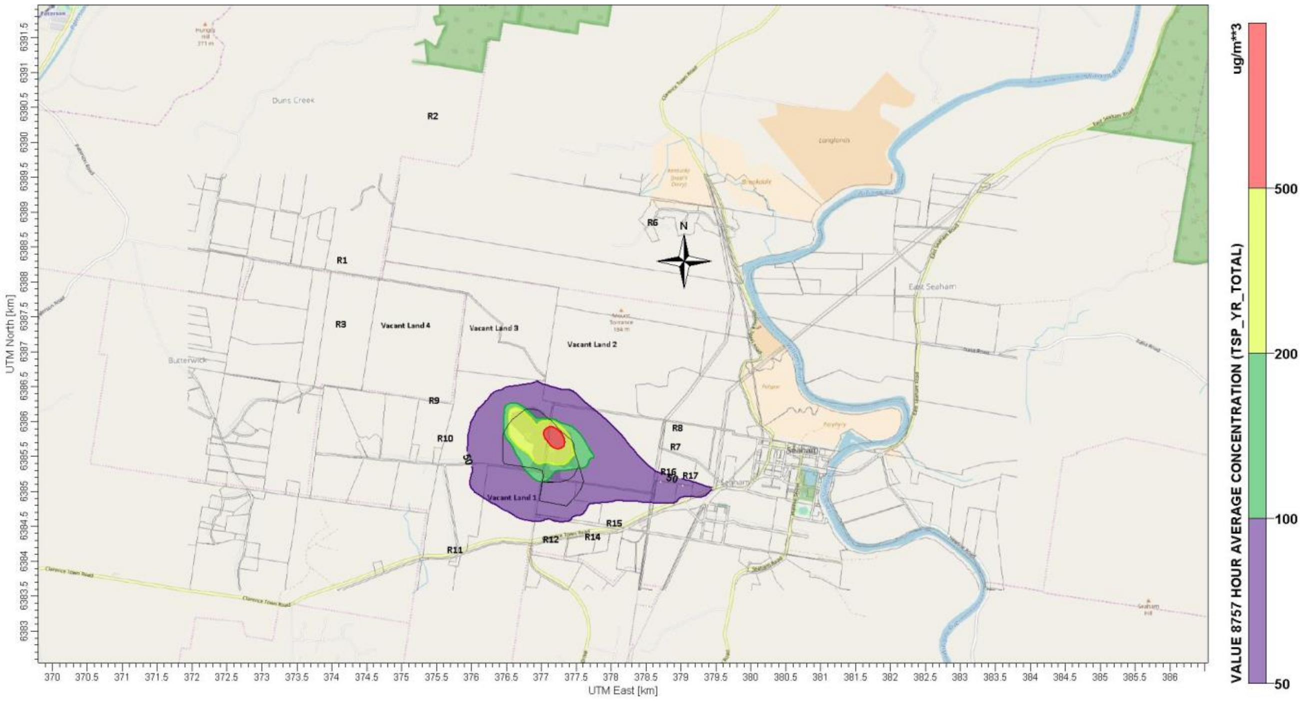
Pollutant:	Averaging Period:	Percentile:	Criteria:
$PM_{2.5}$ (Incremental)	24 hour	100th	25 µg/m^3

Comment:
Stage 1 operations in relation to the future quarry boundary and processing area



Pollutant:	Averaging Period:	Percentile:	Criteria:
$PM_{2.5}$ (Total)	Annual	100th	8 µg/m³

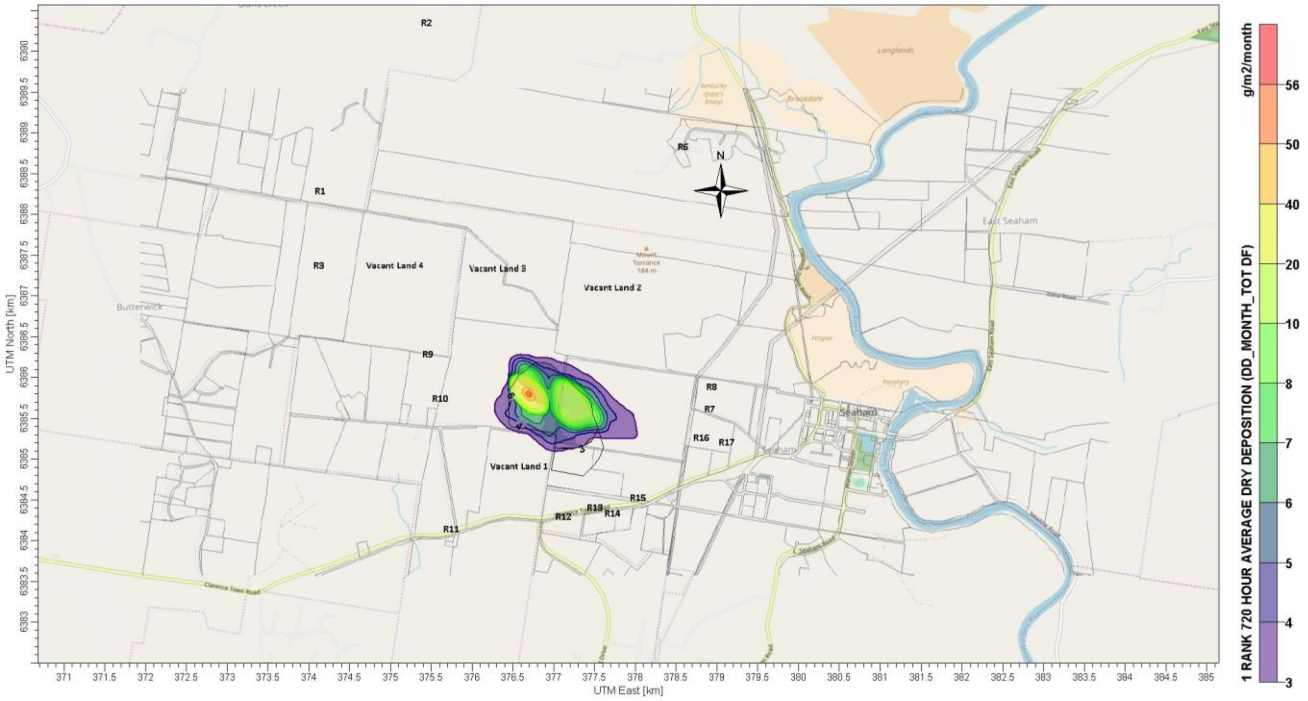
Comment:
Stage 1 operations in relation to the future quarry boundary and processing area.
Includes background concentration of 8.1 µg/m³



Pollutant:	Averaging Period:	Percentile:	Criteria:
TSP (Total)	Annual	100th	90 µg/m³

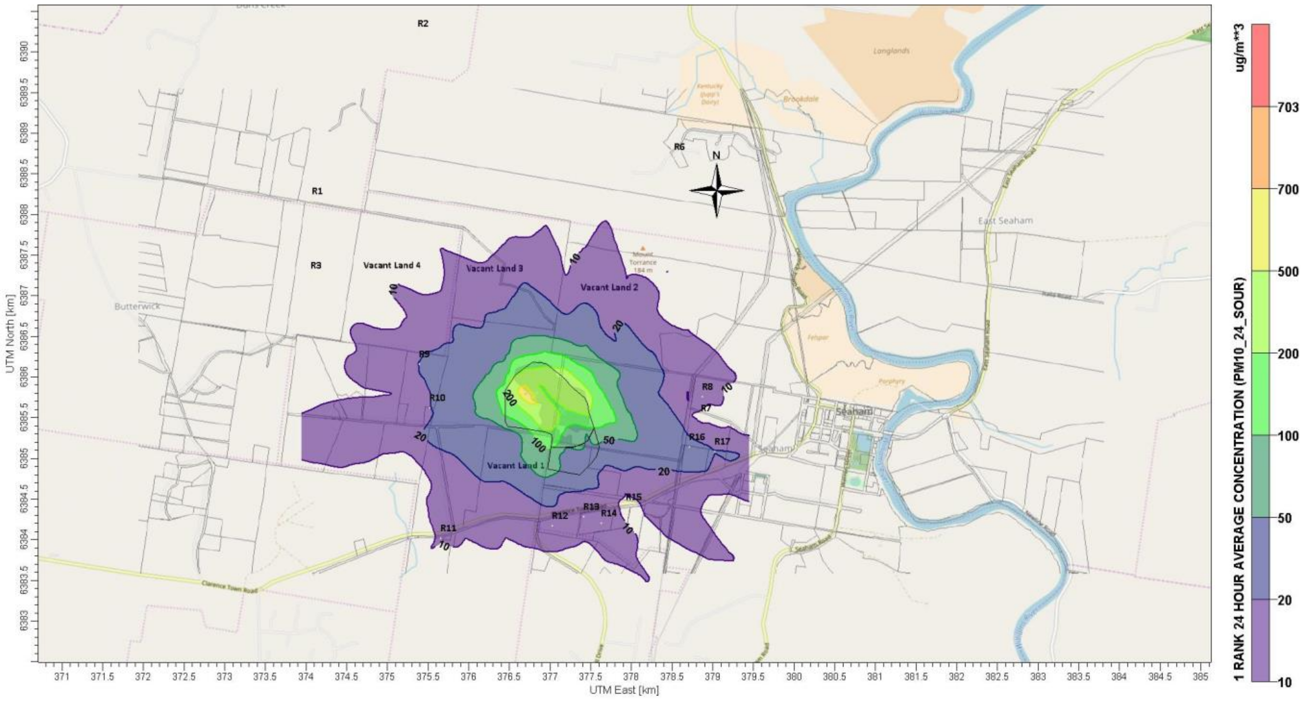
Comment:
Stage 1 operations in relation to the future quarry boundary and processing area.
Includes background concentration of 41.8 µg/m³

C.3 STAGE 2



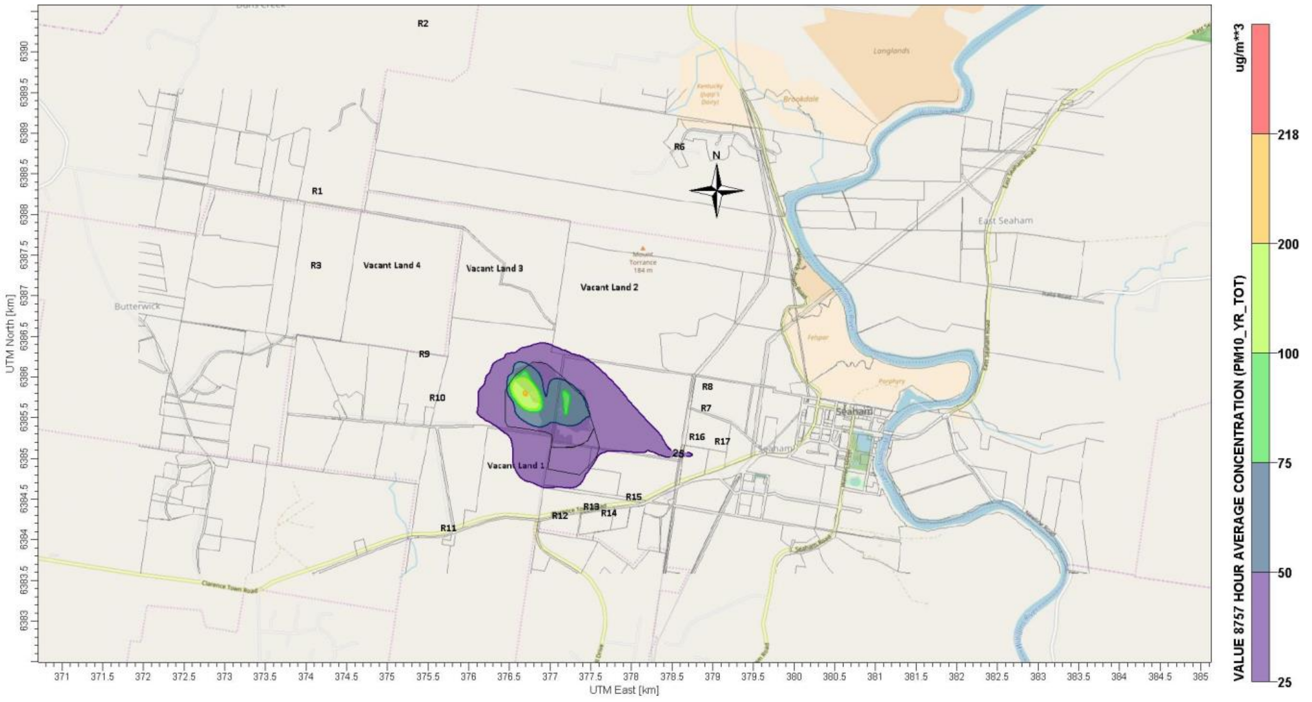
Pollutant:	Averaging Period:	Percentile:	Criteria:
Dust Deposition	Month	100th	4 g/m^2/month

Comment:
Stage 2 operations in relation to the future quarry boundary and processing area. Includes background of 2.1 g/m^2/month



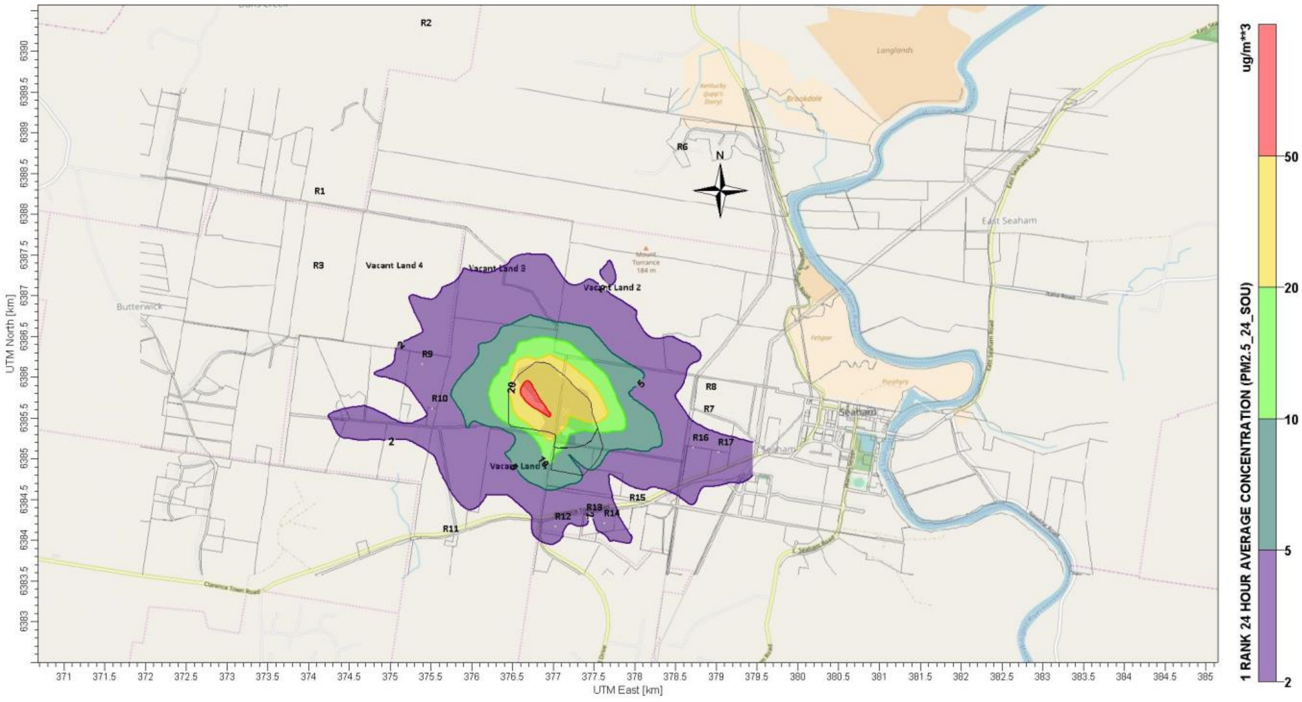
Pollutant: PM10 (Incremental)	**Averaging Period:** 24 hour	**Percentile:** 100th	**Criteria:** 50 µg/m^3

Comment:
Stage 2 operations in relation to the future quarry boundary and processing area



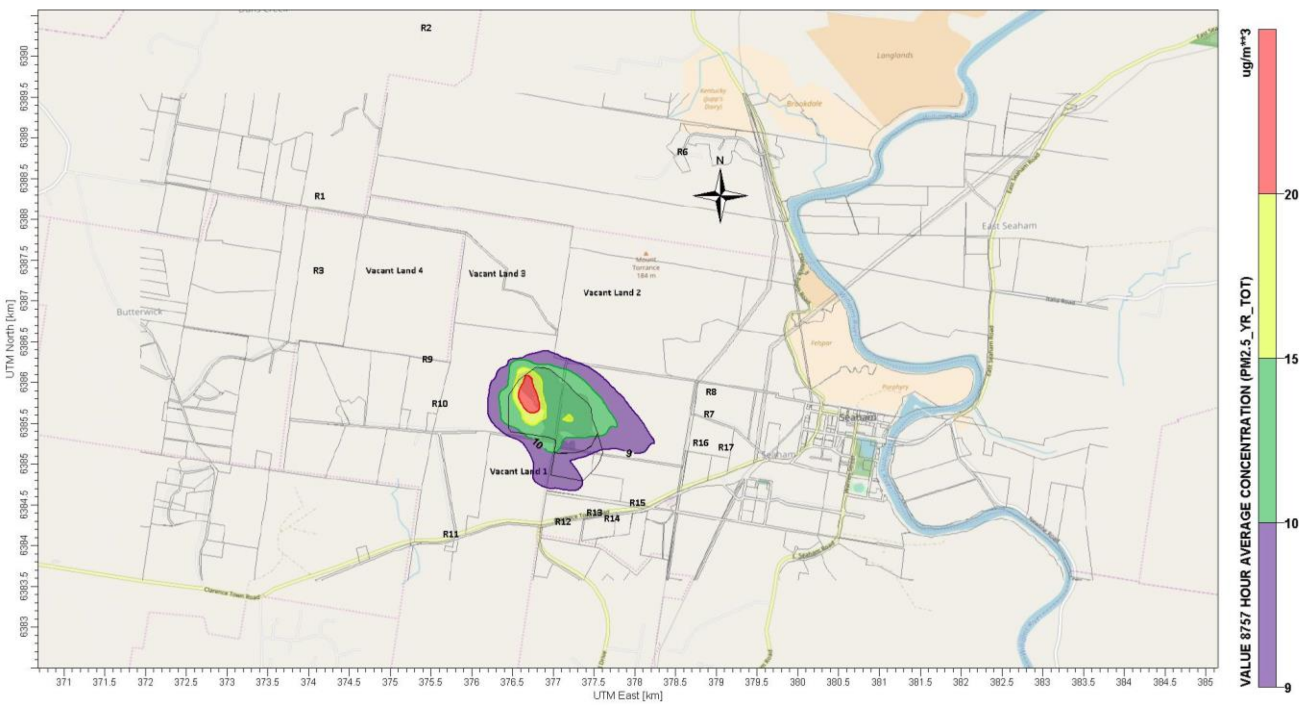
Pollutant: PM10 (Total)	Averaging Period: Annual	Percentile: 100th	Criteria: 30 µg/m³

Comment:
Stage 2 operations in relation to the future quarry boundary and processing area.
Includes background concentration of 20.9 µg/m³



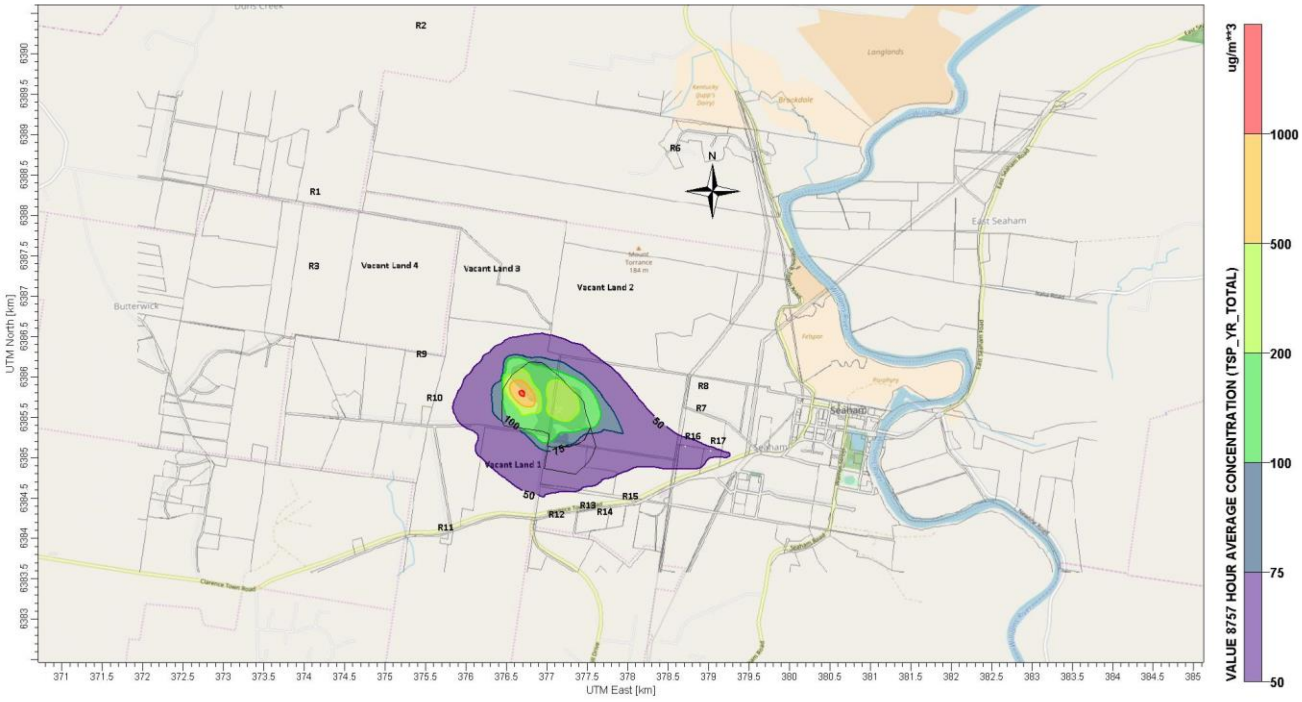
Pollutant:	Averaging Period:	Percentile:	Criteria:
$PM_{2.5}$ (Incremental)	24 hour	100th	25 µg/m^3

Comment:
Stage 2 operations in relation to the future quarry boundary and processing area



Pollutant:	Averaging Period:	Percentile:	Criteria:
$PM_{2.5}$ (Total)	Annual	100th	8 µg/m^3

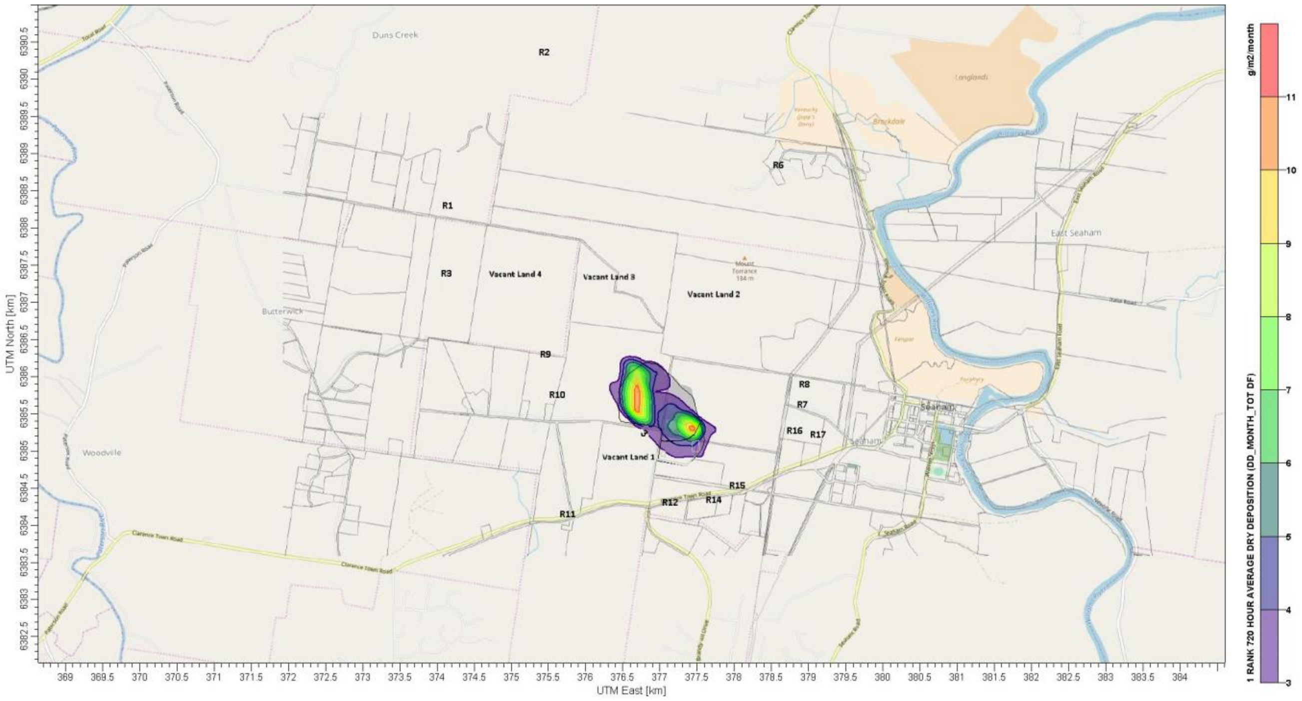
Comment:
Stage 2 operations in relation to the future quarry boundary and processing area.
Includes background concentration of 8.1 µg/m^3



Pollutant: TSP (Total)	**Averaging Period:** Annual	**Percentile:** 100th	**Criteria:** 90 µg/m³

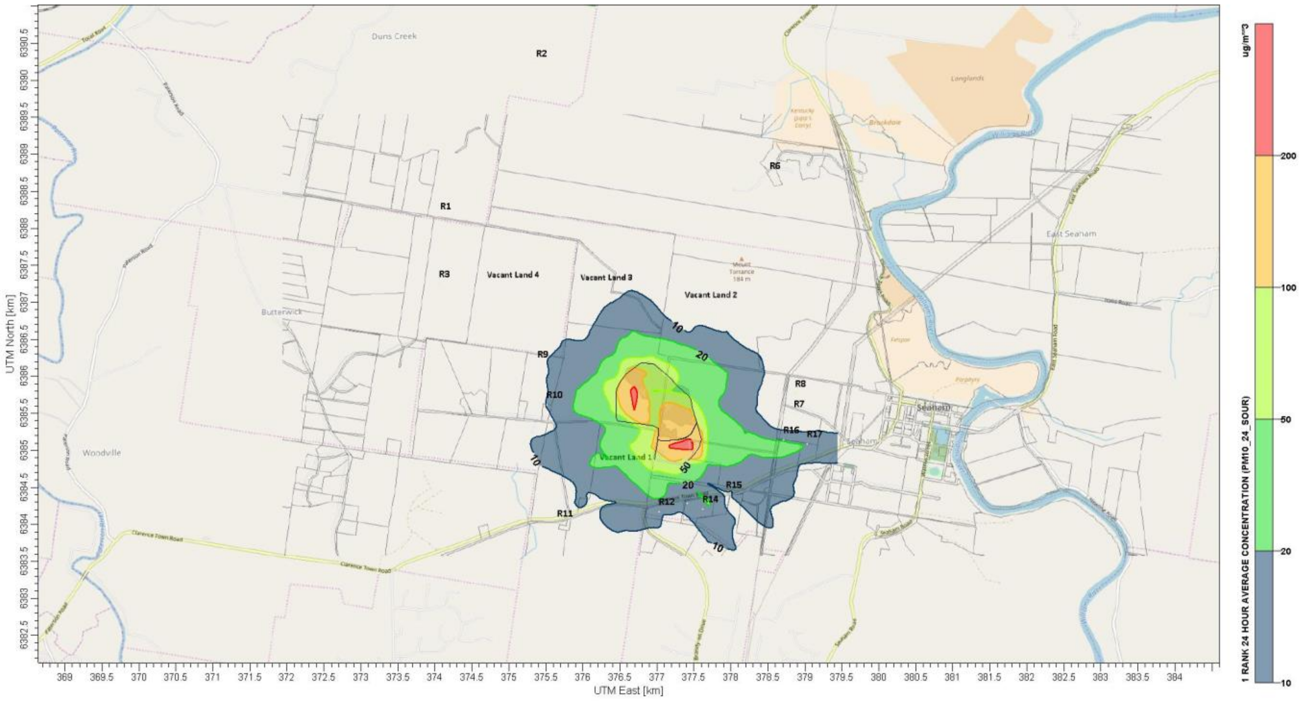
Comment:
Stage 2 operations in relation to the future quarry boundary and processing area.
Includes background concentration of 41.8 µg/m³

C.4 STAGE 4



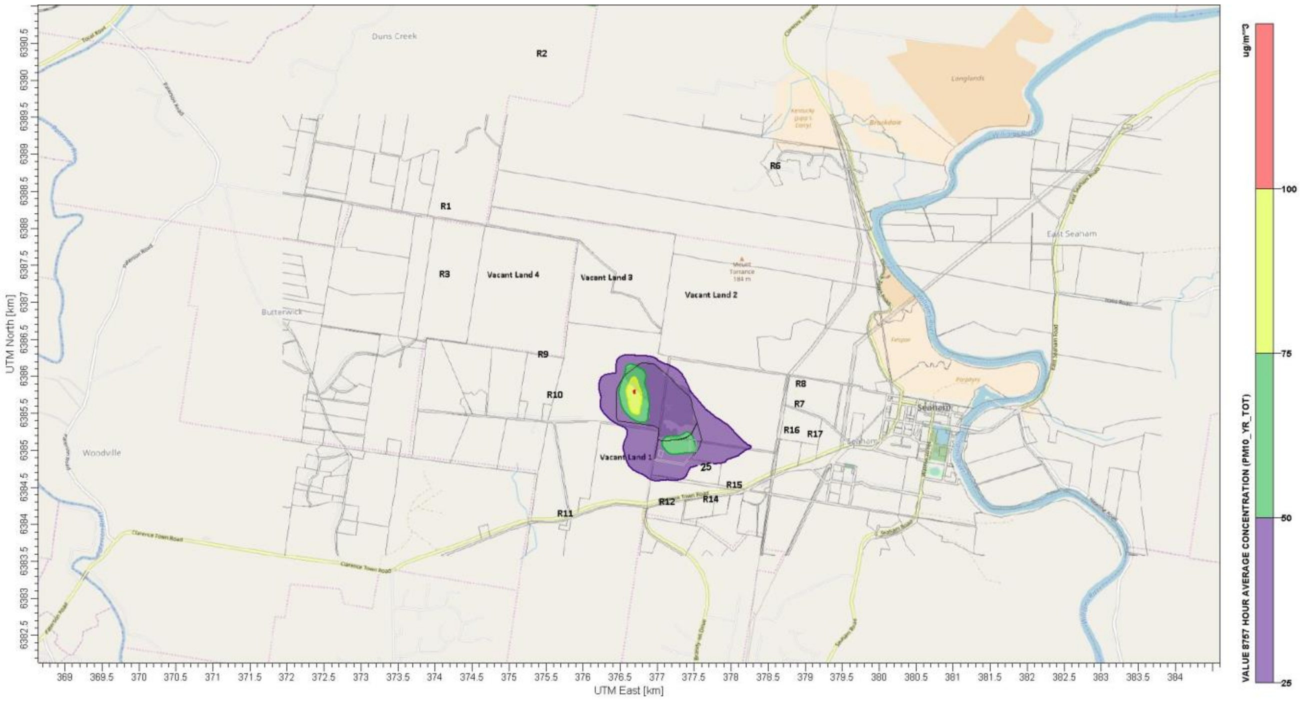
Pollutant: Dust Deposition	Averaging Period: Month	Percentile: 100^{th}	Criteria: 4 g/m^2/month

Comment:
Stage 4 operations in relation to the future quarry boundary and processing area. Includes background of 2.1 g/m^2/month



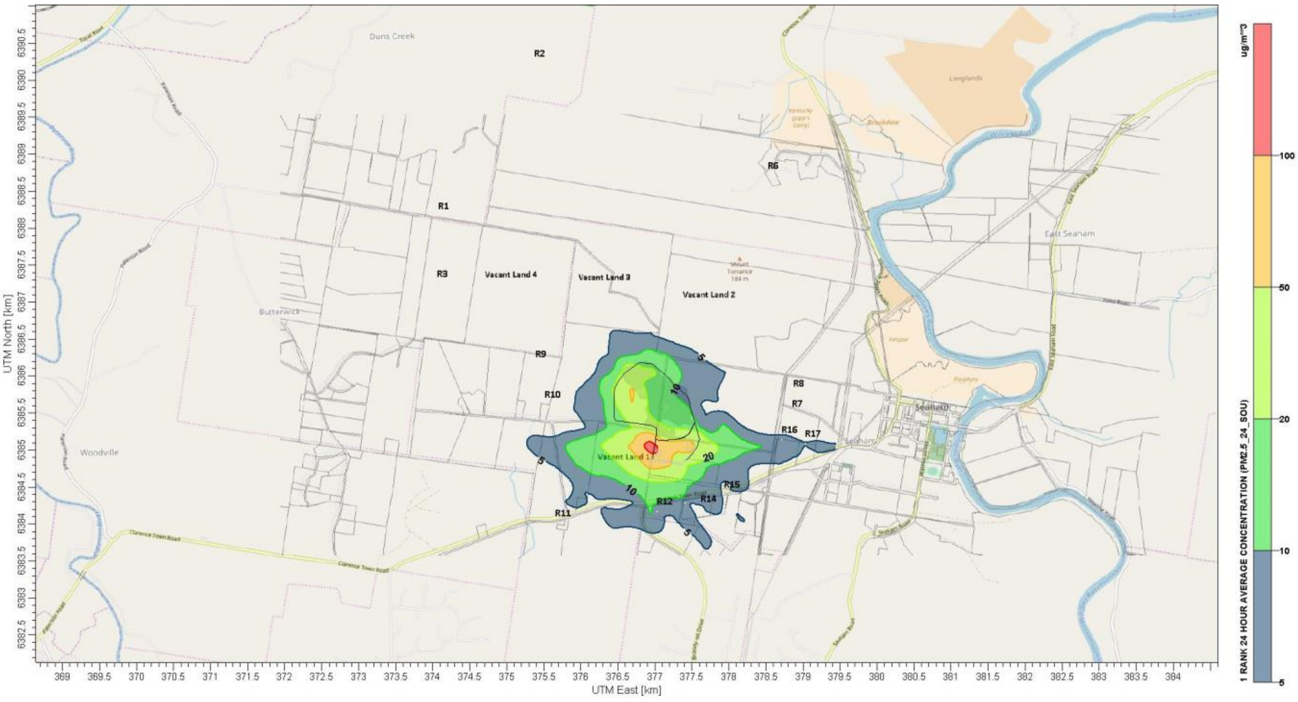
Pollutant:	Averaging Period:	Percentile:	Criteria:
PM_{10} (Incremental)	24 hour	100th	50 µg/m³

Comment:
Stage 4 operations in relation to the future quarry boundary and processing area



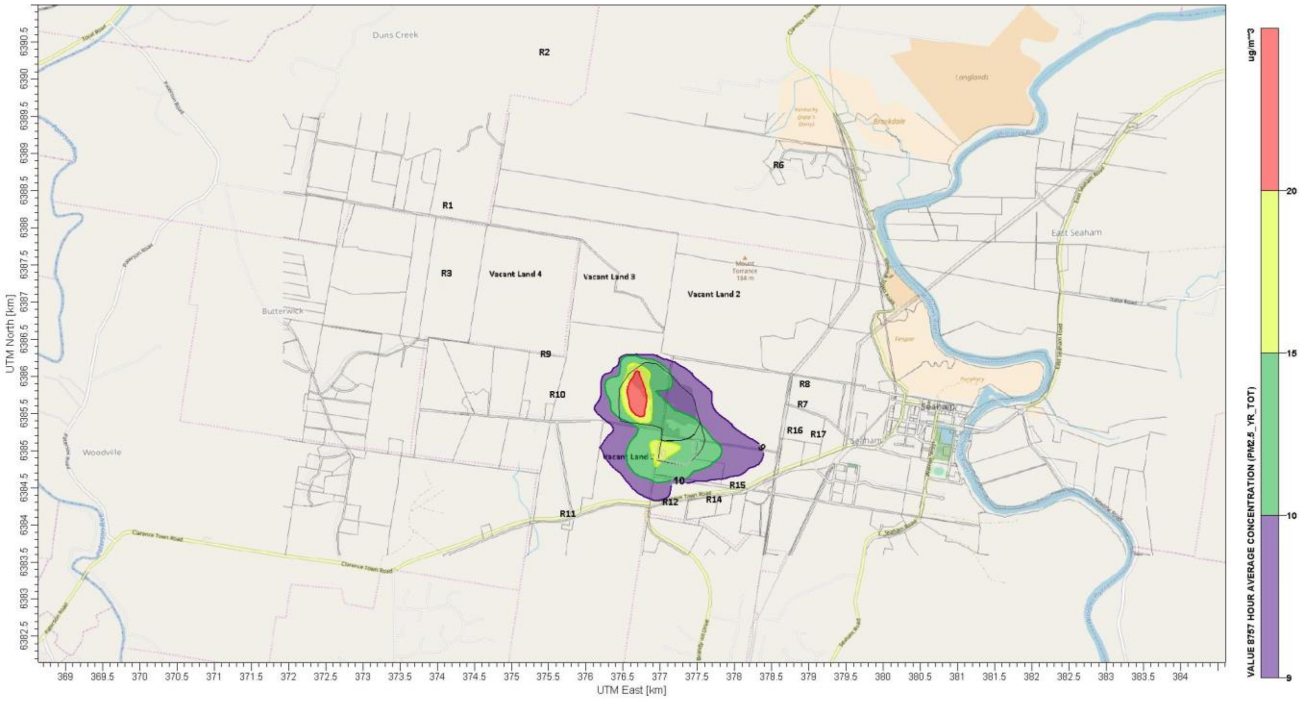
Pollutant: PM10 (Total)	**Averaging Period:** Annual	**Percentile:** 100th	**Criteria:** 30 µg/m³

Comment:
Stage 4 operations in relation to the future quarry boundary and processing area.
Includes background concentration of 20.9 µg/m³



Pollutant:	Averaging Period:	Percentile:	Criteria:
$PM_{2.5}$ (Incremental)	24 hour	100th	25 µg/m^3

Comment:
Stage 4 operations in relation to the future quarry boundary and processing area



Pollutant:	Averaging Period:	Percentile:	Criteria:
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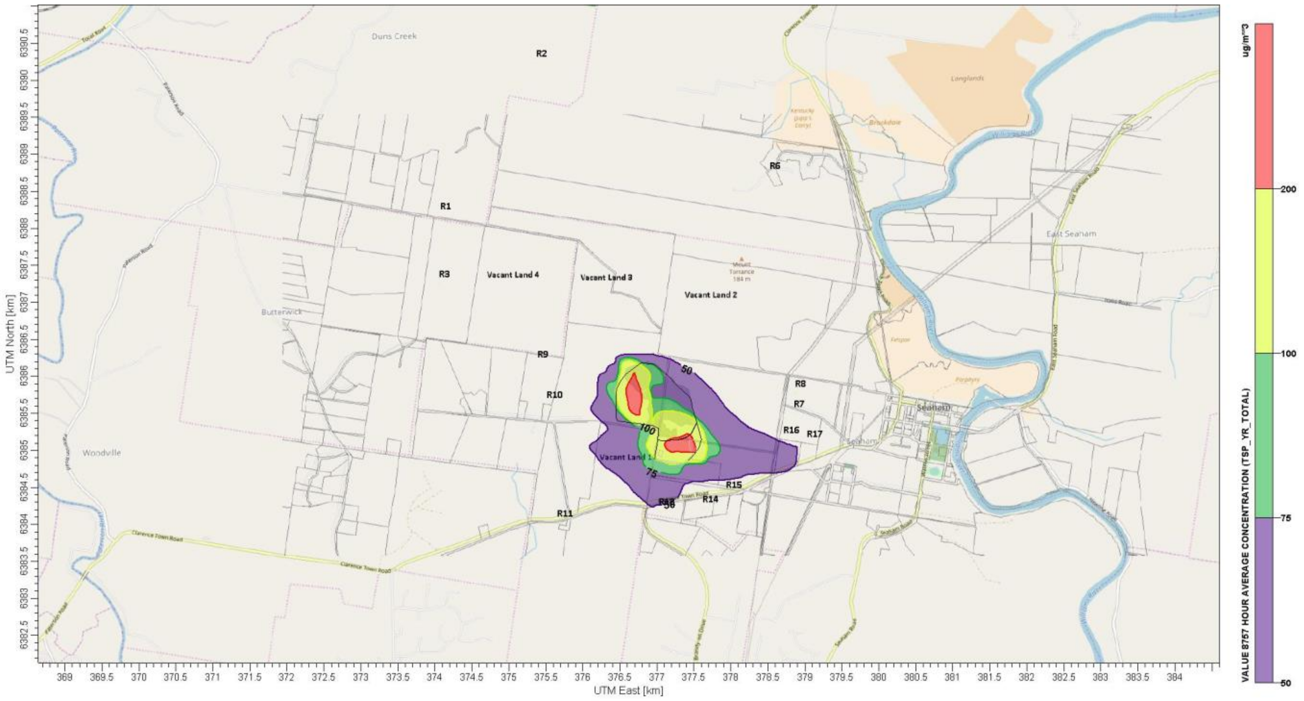
Comment:
Stage 4 operations in relation to the future quarry boundary and processing area.
Includes background concentration of 8.1 µg/m^3



Pollutant:	Averaging Period:	Percentile:	Criteria:
TSP (Total)	Annual	100th	90 µg/m³

Comment:
Stage 4 operations in relation to the future quarry boundary and processing area.
Includes background concentration of 41.8 µg/m³

Appendix D: GREENHOUSE GAS ASSESSMENT

INTRODUCTION

This assessment determines the carbon dioxide equivalent (CO_2-e) emissions from the expansion of the BHQ according to international and Federal guidelines.

BACKGROUND

Greenhouse gases (GHG's) are a natural part of the atmosphere; they absorb and re-radiate the sun's warmth, and maintain the Earth's surface temperature at a level necessary to support life. Human actions, particularly burning fossil fuels (coal, oil and natural gas), agriculture and land clearing, are increasing the concentrations of the greenhouse gases. This is the enhanced greenhouse effect, which is contributing to warming of the Earth.

Greenhouse gases include water vapour, carbon dioxide (CO_2), methane, nitrous oxide and some artificial chemicals such as chlorofluorocarbons (CFCs). Water vapour is the most abundant greenhouse gas. These gases vary in effect and longevity in the atmosphere, but scientists have developed a system called Global Warming Potential to allow them to be described in equivalent terms to CO_2 (the most prevalent greenhouse gas) called equivalent carbon dioxide emissions (CO_2-e). A unit of one tonne of CO_2-e (t CO_2-e) is the basic unit used in carbon accounting. An emissions inventory, or 'carbon footprint', is calculated as the sum of the emission rate of each greenhouse gas multiplied by the global warming potential.

LEGISLATION OVERVIEW

The National Greenhouse and Energy Reporting Act 2007 (NGER Act) established a national framework for corporations to report greenhouse gas emissions and energy consumption. Registration and reporting is mandatory for corporations that have energy production, energy use or greenhouse gas emissions that exceed specified thresholds.

METHODOLOGY

The Department of the Environment (DOE) monitors and compiles databases on anthropogenic activities that produce greenhouse gases in Australia. The DOE has published greenhouse gas emission factors for a range of anthropogenic activities. The DOE methodology for calculating greenhouse gas emissions is published in the National Greenhouse Accounts (NGA) Factors workbook (Department of Environment, 2014). This workbook is updated regularly to reflect current compositions in fuel mixes and evolving information on emission sources.

The scope that emissions are reported, as defined by the NGA Factors Workbook is determined by whether the activity is within the organisation's boundary (Scope 1 – Direct Emissions) or outside the organisation's boundary (Scopes 2 and 3 – Indirect Emissions). The scopes are described below:

- Scope 1 Emissions: Direct (or point-source) emission factors give the kilograms of carbon dioxide equivalent (CO_2-e) emitted per unit of activity at the point of emission release (i.e. fuel use, energy use, manufacturing process activity, mining activity, on-site waste disposal, etc.).
- Scope 2 Emissions: Indirect emissions from the generation of the electricity purchased and consumed by an organisation as kilograms of CO_2-e per unit of electricity consumed.
- Scope 3 Emissions: Indirect emissions for organisations that:
  a. Burn fossil fuels: to estimate their indirect emissions attributable to the extraction, production and transport of those fuels; or
  b. Consume purchased electricity: to estimate their indirect emissions from the extraction, production and transport of fuel burned at generation and the indirect emissions attributable to the electricity lost in delivery in the transmission and distribution network.

Scope 1 emissions include those from fuel use by vehicles, coal burnt in boilers and methane from wastewater systems. Scope 2 emissions are from any purchased electricity. Scope 3 emissions are from the emissions resulting from the energy required to manufacture products such as coal, diesel and equipment.

Emission factors used in this assessment have been derived from either the Department of Environment, site-specific information or from operational details obtained from similar emission sources.

The majority of the emission factors used in this report has been sourced from the NGA Factors Workbook (Department of Environment, 2014) as indicated in ***Table E1***.

Table E1: Emission Factors

Scope	Emission Source	Emission Factor	Source
1	Combustion emissions from petrol	1.08 t CO_2-e / kL	NGA Factors Workbook, 2014
	Combustion emissions from diesel (stationary)	2.68 t CO_2-e / kL	NGA Factors Workbook, 2014
	Combustion for transport (general)	2.69 t CO_2-e / kL	NGA Factors Workbook, 2014
2	Purchased electricity	0.87 kg/CO_2-e/kWh	NGA Factors Workbook, 2014
3	Purchased electricity	0.19 kg/CO_2-e/kWh	NGA Factors Workbook, 2014
	Diesel consumption	0.2 t CO_2-e/kL	NGA Factors Workbook, 2014
	Petrol consumption	0.2 t CO_2-e/kL	NGA Factors Workbook, 2014
	Ethanol fuel consumption	0.006 CO_2-e/kL	NGA Factors Workbook, 2014

QUANTIFICATION OF EMISSIONS

The operation of the BHQ will result in GHG emissions from power generation, mobile plant use, staff travel, and product transport fuel emissions.

ANFO

Scope 1 emissions are also produced by ANFO. The Mining Association of Canada provides an emission factor of 0.189 tonnes carbon dioxide per tonne. Based on information provided by Hanson relating to the amount of area blasted at Brandy Hill at present, it has been calculated that for 1.5 Mtpa, 8 tonnes of explosive will be used per annum. The calculated CO_2 emissions are 1.5 tonnes per annum and 45 tonnes CO_2 over the 30 year life of the quarry.

PURCHASED POWER

Data provided by Hanson details that the annual electricity usage for 2013 was 1,527,421 kWh. Using the State emission factors for Scope 2 (0.87 CO_2-e/kWh) and Scope 3 (0.19 CO_2-e/kWh). Annual Scope 2 and Scope 3 emissions of CO_2-equivalents from the consumption of purchased electricity are presented in ***Table E2***.

Table E2: Purchased Electricity Emissions

Production Rate	Scope	Annual Usage (kWh)	Annual Emissions (t CO_2-e)
0.7 Mtpa	2 (indirect)	1,527,421	1,328.9
	3 (embodied)	1,527,421	290.2
1.5 Mtpa	2 (indirect)	3,273,045	2,847.6
	3 (embodied)	3,273,045	621.9

It can be seen that the current CO_2-e emissions are 1,619.1 tonnes whilst the proposed expansion of BHQ is 3,469.4 tonnes.

EQUIPMENT FUEL

Annual fuel consumption for mobile plant for 2013 has been provided by Hanson. The calculated CO_2-e emissions for the current and future emissions are presented in ***Tables E3*** and ***E4***.

Table E3: Current Machine Equipment Fuel Emissions (CO_2-e tonnes)

Emission Source	Scope	Annual Usage (kL)	Annual Emissions (t CO_2-e)
Machine Fuel – Diesel	1 (direct)	408.3	1,095.4
	3 (embodied)	408.3	83.5
Machine Fuel – Petrol	1 (direct)	0.4	0.43
	3 (embodied)	0.4	0.08
Machine Fuel – E10	1 (direct)	0.02	0
	3 (embodied)	0.02	0
Annual CO_2-e Emissions (tonnes)			**1,179.4**

Table E4: Future Machine Equipment Fuel Emissions (CO_2-e tonnes)

Emission Source	Scope	Annual Usage (kL)	Annual Emissions (t CO_2-e)
Machine Fuel – Diesel	1 (direct)	807.97	2,347.3
	3 (embodied)	807.97	179.0
Machine Fuel – Petrol	1 (direct)	0.85	0.92
	3 (embodied)	0.85	0.17
Machine Fuel – E10	1 (direct)	0.04	0
	3 (embodied)	0.04	0
Annual CO_2-e Emissions (tonnes)			**2,527.4**

PRODUCT TRANSPORTATION AND STAFF TRAVEL

Data provided by Hanson determined that currently there are 150 truck movements relating to production per day. It has been assumed that the fuel consumption is 30 L/100 km and an average return journey is a distance of 80 km. Staff travel has been estimated based on current staff (22) travelling individually to site and a return journey of 40 km and a fuel consumption of 10 L/100 km. The expansion of the quarry will require approximately 30 staff.

The concrete plant will produce 15,000 tonnes per year and will require an additional 2,727 additional trips per annum.

Table E5: Current Transportation Emissions (CO_2-e tonnes)

Emission Source	Scope	Annual Usage (kL)	Annual Emissions (t CO_2-e)
Product Transport	1 (direct)	1,260	3,380.2
	3 (embodied)	1,260	257.8
Staff Travel	1 (direct)	32.12	73.7
	3 (embodied)	32.12	5.8
Annual CO_2-e Emissions (tonnes)			**3,717.5**

Table E6: Future Transportation Emissions (CO_2-e tonnes)

Emission Source	Scope	Annual Usage (kL)	Annual Emissions (t CO_2-e)
Product Transport	1 (direct)	2,700	7,243.3
	3 (embodied)	2,700	552.4
Staff Travel	1 (direct)	43.8	100.5
	3 (embodied)	43.8	7.9
Cement Plant Trucks	1 (direct)	65.5	175.6
	3 (embodied)	65.5	13.4
		Annual CO_2-e Emissions (tonnes)	**8,093.1**

SUMMARY

The purpose of this report is to evaluate the GHG emissions from the operation of BHQ. This assessment has found:

- Current CO_2-equivalent emissions are estimated to be 6,516 tonnes per year with the highest contribution from product transportation;
- Increasing production to 1.5 Mtpa will increase the estimated CO_2-equivalent emissions to 14,090 tonnes per annum.

A breakdown of the emissions per annum is presented in ***Table E7***.

Table E7: Annual Emissions Breakdown

Phase	Activity	CO_2-e Emissions (tonnes)
Current (0.7 Mtpa)	Machine Fuel	1,179.4
	Electricity	1,619.1
	Product and staff transportation	3,717.5
	Total	**6,516.0**
Future (1.5 Mtpa)	Machine Fuel	2,527.4
	Electricity	3,469.4
	Product and staff transportation	8,093.1
	Total	**14,089.9**

Calculating the GHG emissions for the life of the BHQ, based on an extraction rate of 1.5 Mtpa for 30 years the following GHG emissions are expected:

- Scope 1 emissions: 296,072.5 tonnes CO_2-equivalent;
- Scope 2 emissions: 85,426.5 tonnes CO_2-equivalent; and
- Scope 3 emissions: 41,242.5 tonnes CO_2-equivalent.

In 2012, the reported net GHG emissions for Australia was 558 Mt CO_2-e (Department of the Environment, 2013) are compared to the Scope 1 emissions from BHQ, the lifetime emissions from BHQ will represent approximately 0.0005% of total emissions.

A reduction in GHG emissions can be achieved through the reduction in consumption of fuel. This can be achieved through the consideration of haulage distances within the pit, mobile plant operational time and the amount of purchased electricity.

The potential installation and operation of more efficient plant during the relocation of the processing plant will assist in BHQ reducing their GHG emissions; however these potential reductions in energy consumption have not been calculated in this assessment as it is unclear if plant upgrades will occur.

Appendix 7

Updated Blast Impact Assessment – Vipac Engineers & Scientists Ltd – September 2018

(Total No. of pages including blank pages = 16)

* A colour version of this Appendix is available on the digital version of this document

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Vipac Engineers & Scientists

Hanson Construction Materials

Hanson - Brandy Hill Quarry

Updated Blast Impact Assessment

29N-14-0060-TRP-517408-6

7 September 2018

Updated Blast Impact Assessment
Hanson - Brandy Hill Quarry

DOCUMENT NO: 29N-14-0060-TRP-517408-6	**REPORT CODE:** TRP
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REVIEWED BY: Reviewer:	Peter Teague **Reviewing Acoustic Consultant**	Date: 7 Sep 2018
AUTHORISED BY:	Darren Van Twest **Director**	Date: 7 Sep 2018

REVISION HISTORY

Revision No.	Date Issued	Reason/Comments
0	18 Nov 2014	Initial Issue
1	30 Mar 2015	Minor Amendments
2	15 Apr 2015	Final
3	10 Dec 2015	Adequacy Review
4	8 Sep 2017	EPA Responses
5	29 Jun 2018	EPA Responses
6	7 Sep 2018	Final report

DISTRIBUTION

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EXECUTIVE SUMMARY

Vipac Engineers and Scientists Ltd (Vipac) was commissioned by Hanson Construction Materials to conduct a Blast Impact Assessment for the proposed expansion of the existing Brandy Hill Quarry, at 979 Clarence Town Road, NSW. Ground vibration and airblast overpressure are two common environmental effects of blasting that can cause human discomfort.

The proposed expansion will involve extending the life of the quarry to allow for extraction of additional resources up to 1.5 million tonnes per annum. The proposed extraction area extension is approximately 1,000m by 900m. In order to accommodate the proposed extraction area, it is proposed to relocate the existing plant infrastructure approximately 500m south of the current location.

All noise sensitive receivers are located 860m or more from the nearest future quarry pit boundary. Noise sensitive receivers are located to the west, south and east of the quarry.

This report presents the results of historical ground vibration and airblast overpressure measurements that have been carried out at Brandy Hill quarry and provides worst case predictions for future blasting based on this data. The future blast impacts are assessed according to the EPA Environmental Protection Licence Conditions.

The assessment finds that blast impacts from the proposed quarry extension can be readily controlled within acceptable values using existing blast practices. This is because the minimum separation distance between the quarry pit and the nearest receiver is sufficient for adequate control of the propagation of ground vibration and airblast overpressure. Analysis of historical data shows that compliance with the environmental conditions has been achieved. Consideration of future blast impacts shows that the acceptable levels can be achieved using typical blast designs and good blasting practice.

It is recommended that all blasting conducted at the proposed quarry site be monitored using best practices, with monitors located as close as practical to the sensitive receivers, between the blast and the receiver.

A Blast Management Plan should be implemented to ensure compliance with the EPA EPL Conditions. It includes the use of routinely updated vibration and overpressure data in the design of blasts, which is a vital step in managing impacts in sensitive areas.

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1 INTRODUCTION

Vipac Engineers and Scientists Ltd (Vipac) was commissioned by Hanson Construction Materials to conduct a Blast Impact Assessment for the proposed expansion of the existing Brandy Hill Quarry, at 979 Clarence Town Road, NSW. According to AS2187.2 (Explosives -Storage and use Part 2: Use of explosives), ground vibration and airblast overpressure are two common environmental effects of blasting that can cause human discomfort.

This report presents the results of historical ground vibration and airblast overpressure measurements that have been carried out at Brandy Hill quarry and provides worst case predictions for future blasting based on this data. The future blast impacts are assessed according to the EPA Environmental Protection Licence (EPL 1879) Conditions. Conclusions and recommendations are provided within this report.

2 PROJECT DESCRIPTION

2.1 SITE LOCATION

The Brandy Hill Quarry is located at 979 Clarence Town Road, Seaham, which is a suburb within the Port Stephens local government area in the Hunter Region of New South Wales. The quarry site is located approximately 12km north-west of Raymond Terrace, 3.5km west of Seaham and approximately 175km north of Sydney.

2.2 EXISTING QUARRY OPERATION

The quarry is located on a property that is approximately 554 hectares in area of which 18.6ha is occupied by the pit, 11.1ha by the plant and 5.3ha occupied by the stockpile area. The surrounding area is predominately zoned as rural landscape with minimal primary production. The quarry produces approximately 620,000 tonnes of material per year. Approximately 20 to 25 blasts will occur per annum. Road access to the quarry site is off Clarence Town Road at the intersection with Brandy Hill Drive.

Vipac understands that blasting operations typically occur within the hours of 9am to 5pm (Monday to Saturday).

2.3 PROPOSED EXPANSION

The proposed expansion will involve extending the life of the quarry to allow for extraction of additional resources up to 1.5 million tonnes per annum. The proposed extraction area extension (see ***Figure 1***) includes resources beneath part of the existing quarry infrastructure area. The proposed quarry pit is approximately 1,000m (East - West) by approximately 900m (North – South). In order to accommodate the proposed extraction area, it is proposed to relocate the existing plant infrastructure approximately 500m south of the current location, as shown in ***Figure 2***.

2.4 NOISE SENSITIVE RECEIVERS

A list of the nearest potentially affected noise sensitive receivers to the quarry is provided below in ***Table 1***. The table lists the minimum distance from the residential structure to the **maximum proposed future quarry pit**, as opposed to the overall quarry site boundary which includes the processing areas, weighbridge and workshop/maintenance areas etc. All noise sensitive receivers are located 860m or more from the **nearest future quarry pit boundary**. A separation distance of approximately 800 to 1,000m is usually an acceptable buffer for blast impacts from quarries. The location of the properties is illustrated in ***Figure 3*** and ***Figure 4***.

Noise sensitive receivers are located to the west, south and east of the quarry. The locations of existing blast monitoring sites are shown in ***Figure 4***.

The distances presented in ***Table 1***below differ from the distances stated in the Noise & Vibration Impact Assessment report (refer to ***Table 3*** of the Noise & Vibration Impact Assessment report) as the distances presented in the Noise & Vibration Impact Assessment report refer to the separation distance from the residential properties to the overall site boundary of the quarry, and take account of the proposed expansion area of the quarry and the relocation of the processing plant to the south of the current positon of the processing plant.

This Blasting Impact Assessment has taken into consideration the separation distances from the future quarry pit boundary as this delineates the extent of the area where blasting will be undertaken. No blasting is proposed to be undertaken in the designated area to which the fixed processing plant will be relocated. Therefore the distances from the properties to the overall quarry site boundary are not applicable to the Blasting Impact Assessment in this context, but have been taken into consideration as presented in the Noise & Vibration Impact Assessment report.

Table 1: Noise Sensitive Receivers

Property ID	Distance approx. (m)	Address	Description
L01 (R09)	1,110	13 Giles Road, Seaham	Residential property
L02 (R10)	950	13B Giles Road, Seaham	Residential property
L03 (R13)	960	994 Clarence Town Road, Seaham	Residential property
L04 (R14)	860	1034 Clarence Town Road, Seaham	Residential property
L05 (R16)	980	1094 Clarence Town Road, Seaham	Residential property and poultry farm to rear
L06 (R17)	1,160	1189 Clarence Town Road, Seaham	Residential property
L07 (R07)	1,310	13 Mooghin Road, Seaham	Residential property

Livestock infrastructure is identified nearby to receivers L05 (at approximately 1100m) and L07 (at approximately 1600m). These sites are identified in ***Figure 4*** by a red “L” symbol.

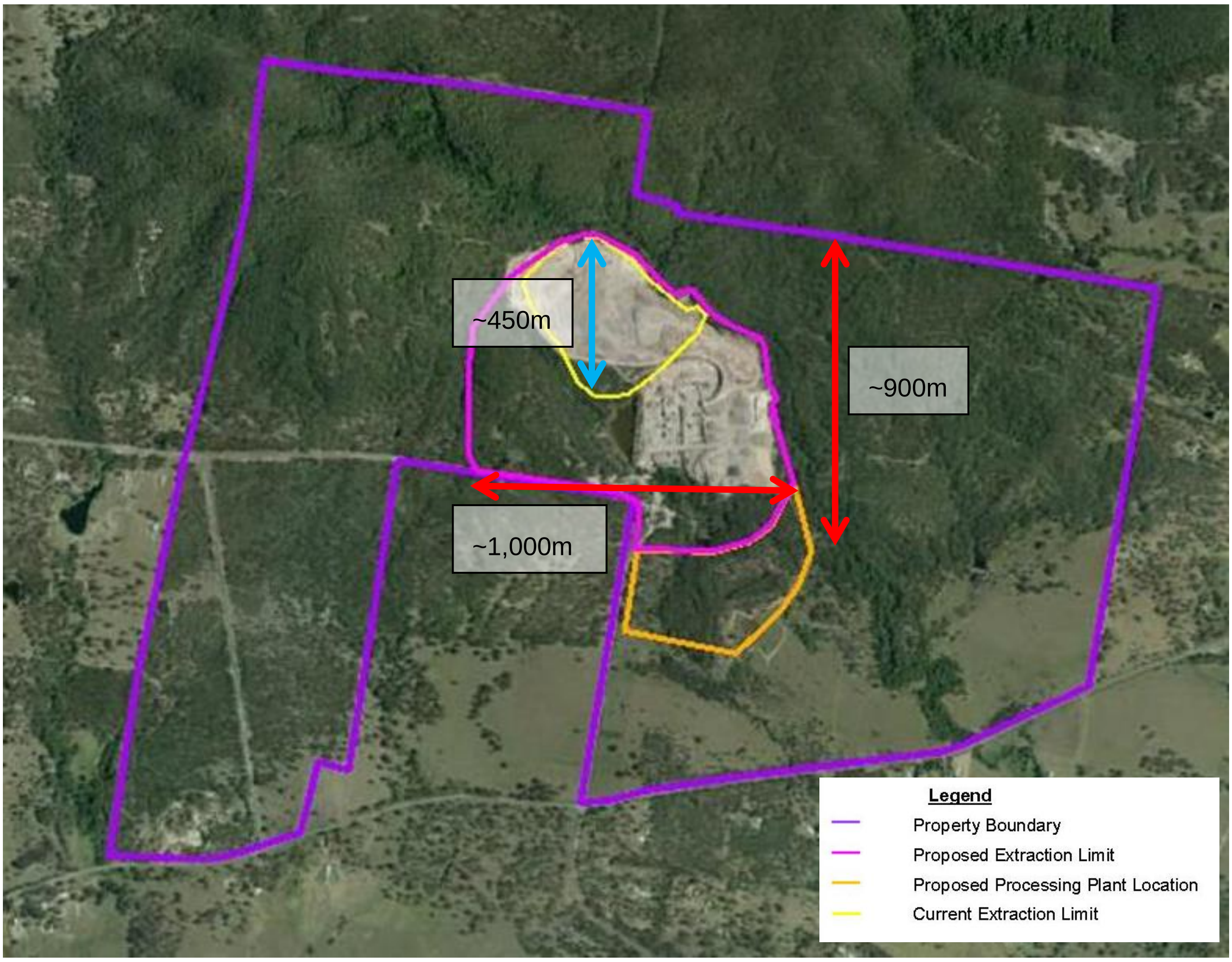

Figure 1: Current extraction area (yellow) with proposed extraction area (purple)

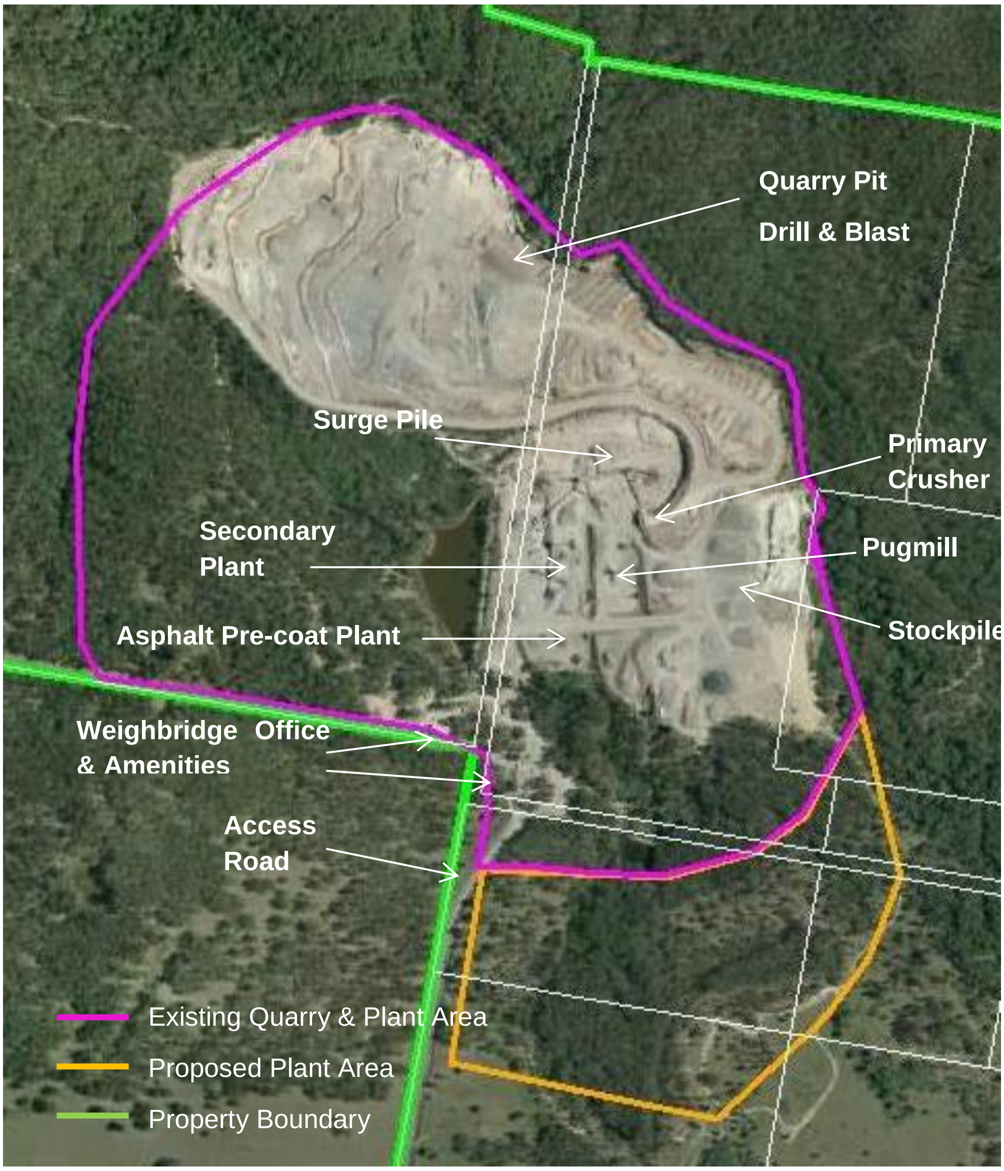

Figure 2: Current Infrastructure Area with proposed Plant Infrastructure Area

The location of the existing plant infrastructure is illustrated in the aerial photograph shown above in ***Figure 2***. It should be noted that as part of the proposed quarry expansion plans, the existing plant infrastructure will be relocated to the area outlined above in orange (i.e. the Proposed Plant Area).

Figure 3: Location of Sensitive Receptors (L01 (R09) & L02 (R10))

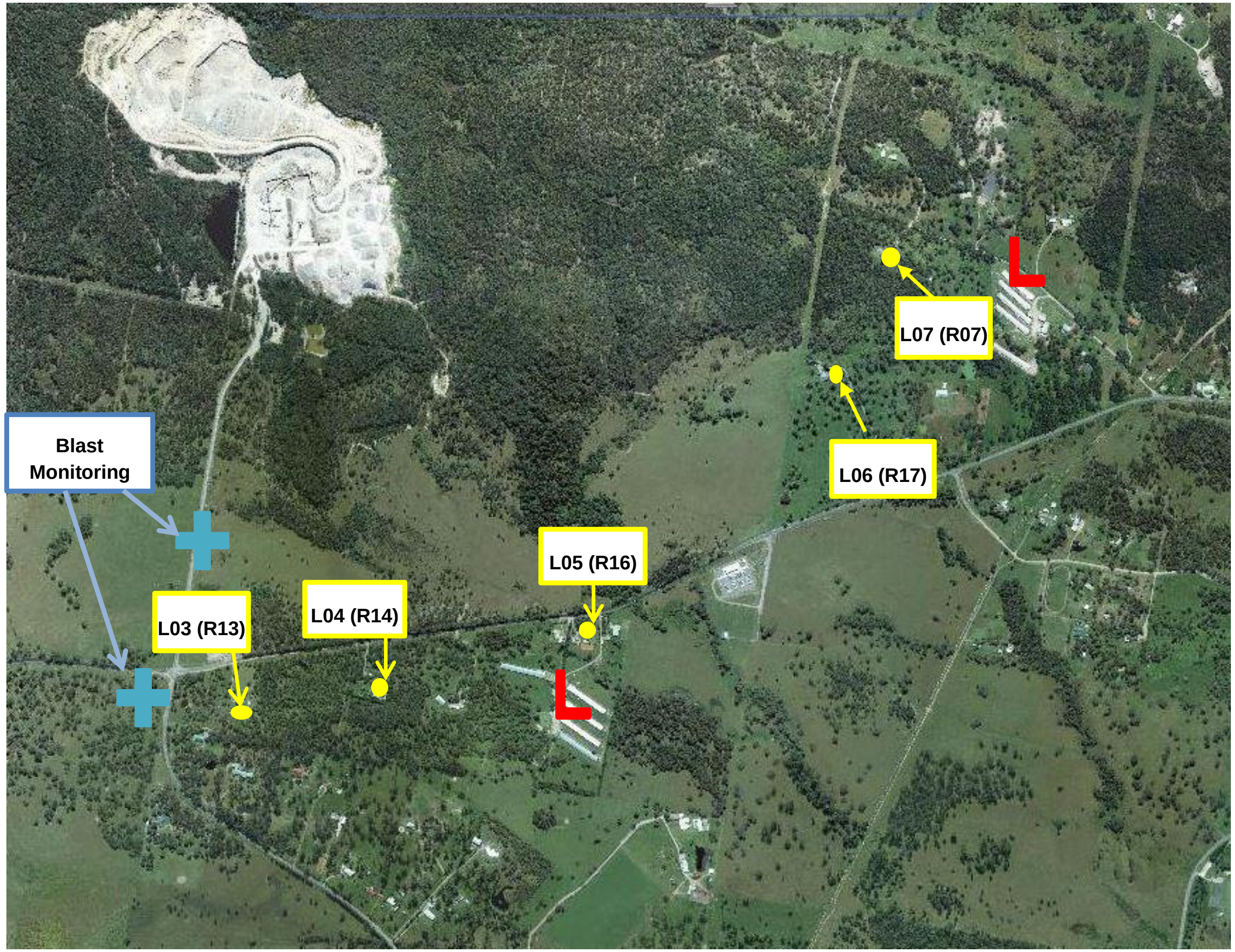

Figure 4: Location of Sensitive Receptors (L03 (R13), L04 (R14), L05 (R16), L06 (R17) & L07 (R07)) & Blast Monitoring Locations

3 HISTORICAL BLAST IMPACT MEASURMENTS

Blast impacts from the quarry have been measured by an independent specialist monitoring company for several years, as shown in ***Figure 4***. Data from the blasts has been reported and provided to Vipac for analysis. The records show that compliance with the Environmental Conditions has been achieved.

***Figure* 5** shows a graph of the measured ground vibration (Peak Particle Velocity, PPV in mm/s) versus the scaled distance from the blast. Most measurements were taken at locations representative of the nearest receivers (between 1000m to 1500m) with some at nearer control points (between 500m to 600m). It is noted that the high PPV event (at 55 mm/s) was a test charge measured at a close distance of 36m. The 95th percentile relationship for the data is also shown in the figure. It corresponds to parameter values of K=4000 and n=1.6 for the standard ground vibration propagation equation (see AS2187.2) shown below:

$$PPV = K\left(\frac{Dist}{\sqrt{Wt}}\right)^{-n},$$

where *PPV* is the peak particle vibration level (vector sum, measured in mm/s),

Dist is the distance between the monitoring point and the nearest blasthole and

Wt is the maximum weight of explosive per blasthole (kg).

The data indicates that ground vibration will be less than 5mm/s at 860m for 95% of blasts when the MIC (Mass Instantaneous Charge) of the blast is less than 175kg (see dotted line in ***Figure* 5**).

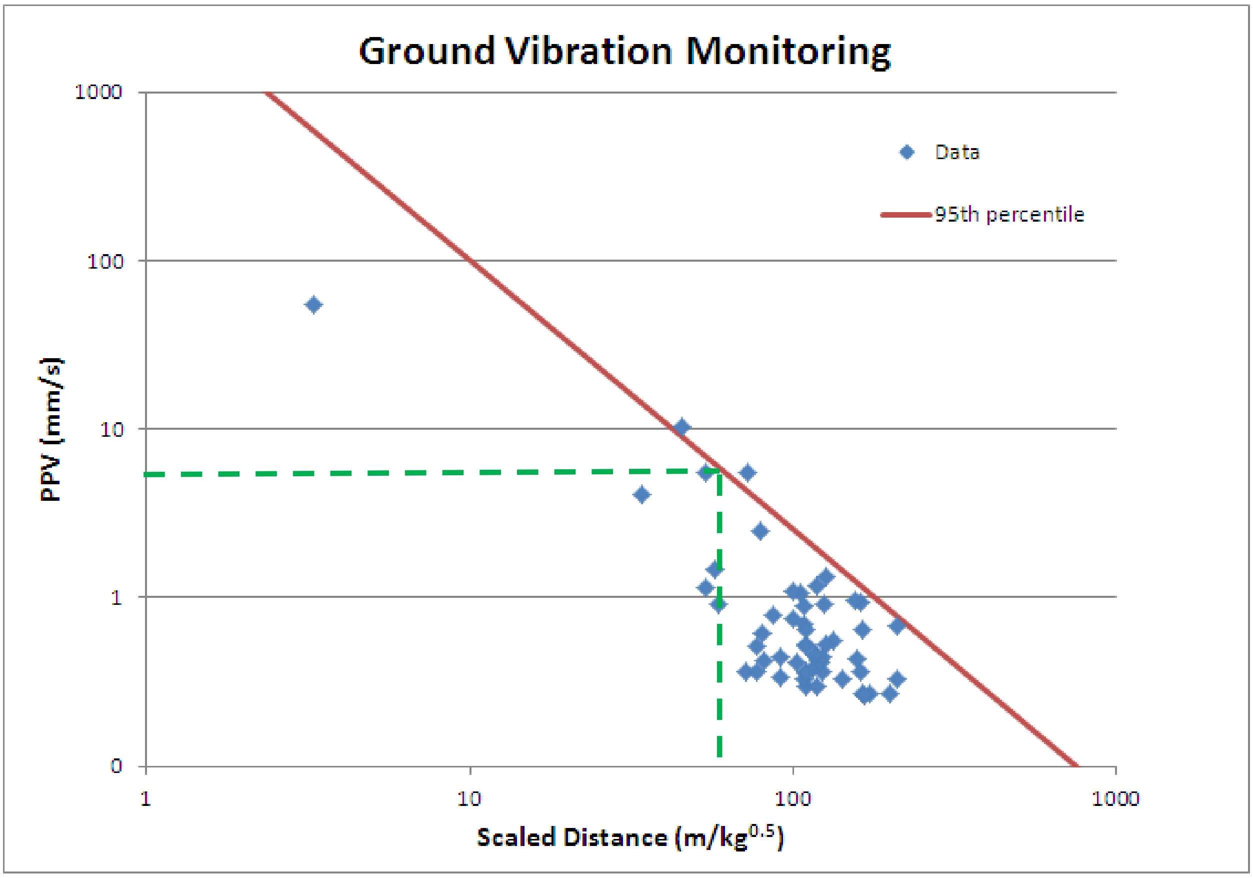

Figure 5: Vibration vs scaled distance for data collected during Brandy Hill blasts

Figure 6 shows a graph of the measured airblast overpressure (in dB_{linear}) versus the relevant scaled distance (cubed root weighting) from the blast. The 95th percentile relationship for the data is also shown in the figure. It corresponds to parameter values of *dBL* = log Ks = 172 and β =log a =24 for the standard airblast overpressure propagation equation (see AS2187.2) shown below:

$$Op_{dBL} = dBL - \beta \times Log\left(\frac{Dist}{\sqrt[3]{Wt}}\right)$$

Typically, overpressure regression analysis provides poor predictability, primarily due to the many other factors which affect the peak measured levels, the most important of which include delay timing, direction of pattern initiation, topographical barriers, and direction of receiver relative to the free face. Considering that the blast face will be directed opposite to the nearest receivers, the parameter *dBL* has been modified to determine the acceptable MIC for airblast.

The data indicates that airblast overpressure will be less than 115dBL at 860m behind the blast face for 95% of blasts when the MIC of the blast is less than 175kg (see dotted line in ***Figure 6***).

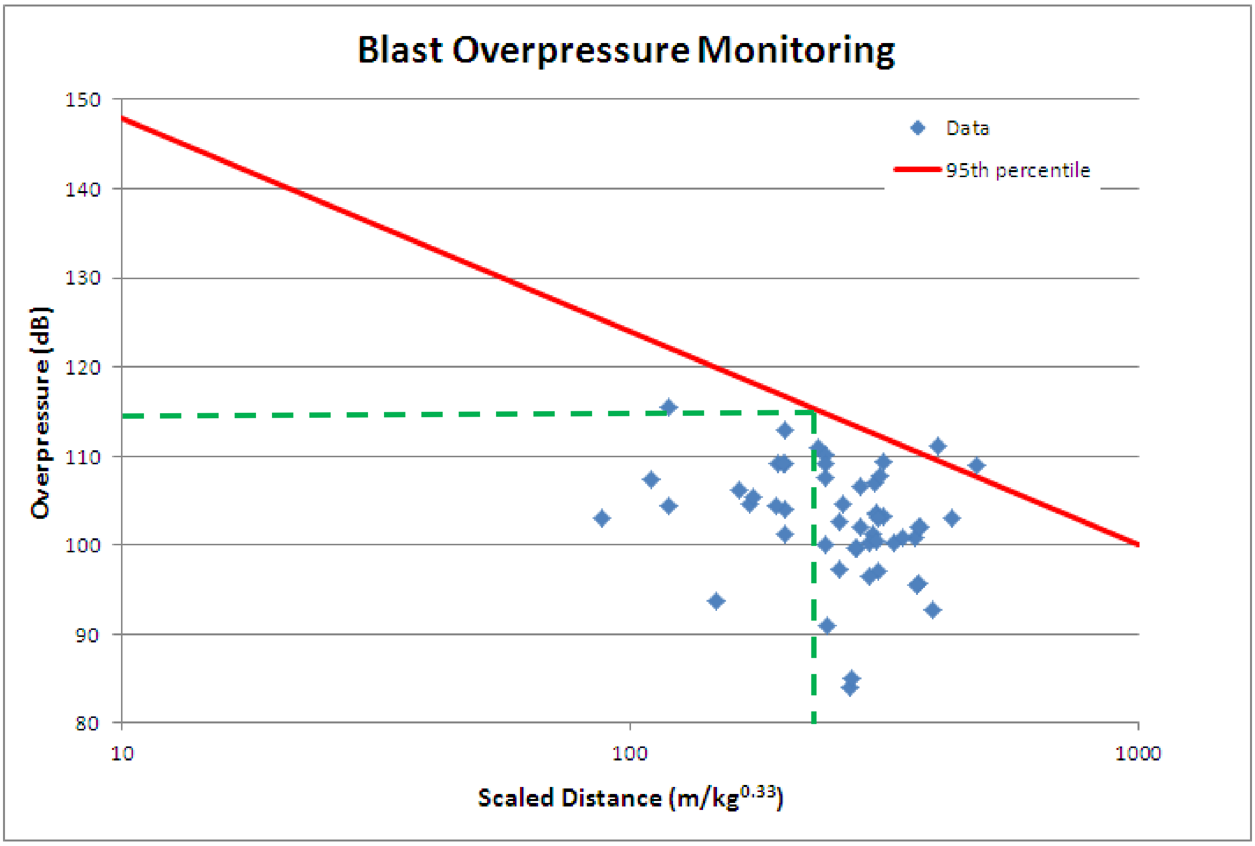

Figure 6: Overpressure vs scaled distance for data collected during Brandy Hill blasts

Predictions of ground vibration and airblast overpressure at receiver locations are provided in ***Table 2***.

Table 2: 95% Percentile Predictions at Receivers for MIC of 145 kg (expected) and 175 kg (limit)

Property ID	Distance approx. (m)	PPV (mm/s)	Overpressure (dB)	PPV (mm/s)	Overpressure (dB)
		Expected maximum MIC of 145kg		MIC limit of 175 kg	
L01 (R09)	1,110	2.9	110	3.3	111
L02 (R10)	950	3.7	112	4.3	113
L03 (R13)	960	3.6	112	4.2	113
L04 (R14)	860	4.3	113	5.0	114
L05 (R16)	980	3.5	112	4.1	112
L06 (R17)	1,160	2.7	110	3.1	110
L07 (R07)	1,310	2.2	109	2.6	109
Nearest livestock	1,100	2.9	110	3.3	111

The predictions of ground vibration and airblast overpressure at receiver locations are more conservative than the measurement based data. It shows an MIC limit of 175kg in order to meet the vibration and overpressure criteria at the nearest receiver.

4 CRITERIA

4.1 EPA CONDITIONS

The Environmental Protection Licence conditions for the quarry specify limit conditions for blasting (Environmental Protection Licence EPL 1879). The maximum overpressure level and maximum ground vibration peak particle velocity level are defined and are identical with the ANZEC guidelines (see Section 4.2).

The conditions also require that all blasts be monitored at or near the nearest residence or noise sensitive location that is likely to be most affected by the blast.

4.2 ANZECC

The Australian and New Zealand Environment Council (ANZEC) provides the following guidelines to minimise the annoyance due to blasting overpressure and ground vibration.

- The recommended maximum level for airblast overpressure is 115 dBL. This level may be exceeded on up to 5% of the total number of blasts over a period of 12 months. However, the level should not exceed 120 dBL at any time.
- The recommended maximum level for ground vibration is 5 mm/s peak particle velocity. This level may be exceeded on up to 5% of the total number of blasts over a period of 12 months. However, the level should not exceed 10 mm/s peak particle velocity at any time.

4.3 AS2187.2

Appendix J of AS2187.2 provides information on ground vibration and airblast overpressure from blasting. Guidance is provided for the measurement, prediction and control of blast impacts. The importance of blast management and blast monitoring records in minimising blast impacts is stated.

4.4 LIVESTOCK

Noise and vibration criteria for poultry livestock are not available. Studies have shown adverse effects at levels greater than human criteria, i.e. 115dB and 5 mm/s. The maximum predictions for poultry livestock infrastructure are less than these values (see Table 2). Therefore, it is predicted that quarry blasts will not adversely affect livestock or the livestock infrastructure.

5 BLASTING DETAILS

The assumed blast design parameters pertinent to the anticipated future vibration and overpressure impacts are:

- bench height = 10 to 15 m, sub-drill 0.5 m;
- blasthole diameter = 89 to 102 mm;
- explosive type = Rioflex (1.2 -1.3 density g/cc in hole);
- stemming length 3 to 3.5 metres.

Based on the information above, blasts will typically contain up to 145 kg of explosive per blasthole. The range is 55 to 145 kg. The maximum instantaneous charge (MIC) should therefore be kept below the required limit of 175 kg from Section 3.

6 BLAST IMPACT ASSESSMENT

Blast impacts from the proposed quarry extension can readily be controlled within acceptable values using existing blast practices. This is because the minimum separation distance between the quarry pit and the nearest receiver is sufficient for adequate control of the propagation of ground vibration and airblast overpressure. Analysis of historical data shows that compliance with the environmental conditions has been achieved. Consideration of future blast impacts shows that the acceptable levels can be achieved using typical blast designs and good blasting practice.

It is predicted that livestock will experience acceptable vibration and airblast overpressure levels.

It is recommended that all blasting conducted for the Project is monitored using best practices and with monitors located as close as practical (between the blast and the receiver) to the sensitive receivers nominated for blast monitoring. Appropriate attention must also be directed to those receivers located forward of the free face which may experience peak overpressure levels higher than those measured at the nearest receiver located behind the free face. Where a roving monitor is used in response to community concerns, geophones must be well coupled to firm ground, or bonded to solid rock outcrops. A Blast Management Plan (BMP) should be implemented to ensure compliance with the EPA EPL Conditions. The BMP should state that blasting operations should align with the ANZEC Guidelines and should not occur outside the hours of 9am to 5pm (Monday to Saturday). It is recommended that the BMP include current vibration and overpressure data in the design of blasts, which is a vital step in managing impacts in sensitive areas.

Appendix 8

Biodiversity Assessment Report – Biosis Pty Ltd – November 2017

(Total No. of pages including blank pages = 200)

* A colour version of this Appendix is available on the digital version of this document

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Brandy Hill Quarry Expansion

Biodiversity Assessment Report

Updated Final Report prepared for Hanson Construction Materials Pty Ltd

5 November 2017

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Glossary

AFD	Australian Faunal Directory
ANZECC	Australian and New Zealand Environment and Conservation Council
APZ	Asset Protection Zone
ARMCANZ	Agriculture and Resources Management Council of Australia and New Zealand
BAR	Biodiversity Assessment Report
BBAM	BioBanking Assessment Methodology
BMP	Biodiversity Management Plan
BHQ	Brandy Hill Quarry
BOM	Bureau of Meteorology
CMA	Catchment Management Authority
CBD	Central Business District
CkPoM	Comprehensive Koala Plan of Management
DA	Department Application
DBH	Diameter at Breast Height
DO	Dissolved Oxygen
DoE	Department of the Environment
DPE	Department of Planning and Environment
DPI	Department of Primary Industries
DGEARs	Director General Environmental Assessment Requirements now called Secretary's Environmental Assessment Requirements (SEARs)
EC	Electrical Conductivity
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement

EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
FM Act	*Fisheries Management Act 1994*
GDEs	Groundwater Dependent Ecosystems
GIS	Geographic Information System
GPS	Global Positioning System
HBT	Hollow-bearing Tree
IBRA	Interim Biogeographic Regionalisation for Australia
KTP	Key Threatening Process
LEP	Local Environment Plan
LGA	Local Government Area
LHCREMS	Lower Hunter & Central Coast Regional Environmental Management Strategy
Matters of NES	Matters of National Environmental Significance listed under the EPBC Act
NSW	New South Wales
NV Act	*Native Vegetation Act 2003*
NW Act	*Noxious Weed Act 1993*
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
Project area	The Project area comprises the study area and the current Brandy Hill Quarry working and is the subject of the SSD Project Application
PVP	Property Vegetation Plan
REF	Review of Environmental Factors
RoTAP	Rare or Threatened Australian Plants
SEPP 44	State Environmental Planning Policy No. 44 – Koala Habitat Protection
SIC	Significant Impact Criteria

SIS	Species Impact Statement
SIX	Spatial Information eXchange
SPRAT	Species Profile and Threats Database
SSD	State Significant Development
study area	The study area, defined by the extent of vegetation clearance required to support the Project
Tg value	The ability of a species to respond to improvements in site or habitat values, determined by the Office of Environment and Heritage.
TSC Act	*Threatened Species Conservation Act 1995*
TSPD	*Threatened Species Profile Database*
Vegetation Zone	An area of native vegetation on a development site that is the same PCT and has a similar broad condition state
VIS	Vegetation Information System

Foreword

This Biodiversity Assessment Report (BAR) is an updated version of the BAR that was submitted to the Department of Planning and Environment with the Environmental Impact Statement (EIS) to support a development application for the Brandy Hill Quarry Extension (SSD 5899). Biosis Pty Ltd was commissioned to undertake a biodiversity assessment and prepare a BAR for the application that addressed the Director General's Environmental Assessment Requirements (DGEARs). The development application, EIS and BAR as well as other supporting assessments were placed on public exhibition from 10 March to 9 April 2017. Submissions relating to biodiversity were received from a range of regulatory agency stakeholders and members of the public.

Following the exhibition period, DPE requested that Hanson provide a response to the Government agency and public submissions. Hanson commissioned Biosis to undertake further assessment and provide additional information on the following matters.

- Further clarification of sampling methods and survey effort per stratification unit.
- The occurrence and extent of Rusty Greenhood *Pterostylis chaetophora* within the project area.
- Minor adjustments to the data applied in the calculation of biodiversity credits requiring the credit calculator to be re-run. No changes to the outcomes of the assessments resulted from this change.
- The potential impacts of vegetation removal on Koala *Phascolarctos cinereus* movement corridors and impacts to connectivity.
- Quantification of the number of hollow-bearing trees to be removed.
- Clarification of survey methods for the Brush-tailed Phascogale (*Phascogale tapoatafa*).
- Further information concerning indirect impacts and edge effects.

This BAR has been updated since the public exhibition period to incorporate the results of additional assessment. Additional assessments undertaken, and presented herein, included:

- Targeted surveys for Rusty Greenhood in accordance with the *NSW Threatened Plant Survey Guidelines* (OEH 2016). Surveys were undertaken on 12 October 2017 by Samuel Luccitti (Biosis) and Belinda Pignone (Hanson) on 13 of October 2017 by Samuel Luccitti, Belinda Pignone and Alejandro Barreto (Biosis). Local flowering of Rusty Greenhood was confirmed prior to survey through a visit to a known population in the vicinity of the study area with OEH officers Steve Lewer and Paul Hellier.
- Investigation of the impacts of vegetation removal on connectivity of Koala habitat and liaising with local experts on the species. Biosis liaised with recognised Koala expert, Steve Phillips and Council Ecologist, to obtain the most up to date information available pertaining to the Koala population(s) within and surrounding the study area. This information was provided in response to submissions.

All other sections of the BAR remain unchanged from the originally exhibited version.

Summary

Hanson Construction Materials Pty Ltd (Hanson) is seeking approval to expand the existing Brandy Hill Quarry (BHQ), located at 979 Clarence Town Road, Seaham (Figure 1) to increase the rate of production by 1.5 million tonnes per annum (the Project). The Project has been deemed a State Significant Development (SSD) under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The existing BHQ is a major local supplier of Rhyodacite hard rock aggregates to the region (Hanson 2012). Currently, the site encompasses 561 hectares across 22 lots of land privately owned by Hanson. The proposed BHQ Expansion Project will increase this area by a further 53.67 hectares.

This Biodiversity Assessment Report (BAR) is being prepared to support Hanson's Environmental Impact Statement (EIS). In line with the Secretary's Environmental Assessment Requirements issued on 11 November 2014 the Project is being assessed under the *NSW OEH interim policy on assessing and offsetting biodiversity impacts, State significant development (SSD) and State significant infrastructure (SS/) projects* (OEH 2011) and this report has been prepared in accordance with the NSW BioBanking Assessment Methodology (OEH 2014).

The study area encompasses 48.62 hectares of native vegetation, while the remaining 5.03 hectares consist of waterways (dams) and cleared areas i.e. roads, buildings and carparks located within the Hanson Property Boundary (Figure 1). Also within the Hanson Property Boundary features Deadmans Creek which meanders along the north eastern Project area boundary before its confluence with Williams Creek which flows south and joins the Hunter River.

Ecological values

Key ecological values identified within the study area include:

- Presence of Deadman's Creek, a third order stream, immediately adjacent to but outside the study area, and presence of a first order section of Bartie's Creek within the study area.
- A total of six Plant Community Types (PCTs) covering 48.62 hectares.
- The identification of two threatened ecological communities, including:
  - 0.67 hectares of Swamp Sclerophyll Forest On Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions.
  - 1.67 hectares of Hunter lowland Redgum forest in the Sydney Basin and NSW North Coast Bioregions.
- 45.8 hectares of Koala habitat across the study area.

Recommendations

The primary measure for the development to minimise impacts to ecological values outlined above where possible and avoid any impact to surrounding adjoining vegetation. Where vegetation losses are unavoidable for the development offsets are proposed in alignment with the interim policy (OEH 2011).

Project specific recommendations include:

- Development of a Biodiversity Management Plan (BMP) to guide; pre-clearance surveys, onsite management of water, threatened fauna such as Koala, noxious weeds, personnel inductions as well management of other native threatened and non-threatened fauna.

- Vegetated boundaries of the Project area to be clearly fenced off and signed posted to exclude access from personnel or equipment. Exclusion fencing to be discussed during all site inductions and routinely checked by an environmental representative.
- Hanson to develop a strict erosion and sediment control plan for the expansion to ensure that erosion and sediment is contained on site.
- Noxious weeds, Fire weed and Pampas Grass to be sprayed and/or removed and appropriately disposed of in an appropriate waste facility as required by NSW DPI through the Port Stephens Council under the NW Act.
- Where possible, implement a minimum 30 metre buffer to Deadmans creek to the east of the study area.
- Minimise the removal of native vegetation adjacent to waterbodies and watercourses.
- Lighting associated with night works to be directed away from adjoining vegetation (to be retained).
- A Biodiversity Offset Strategy has been prepared and is presented in Section 8. Hanson propose to meet their credit requirements by purchasing and retiring credits under the NSW BioBanking scheme. Upon approval Hanson proposes to fulfil its credit obligations.

Government legislation and policy

An assessment of the Project against key biodiversity legislation and policy is provided and summarised below (Table 1).

Table 1 Key biodiversity legislation and policy

Legislation / Policy	Relevant ecological feature on site	Permit / Approval required
Environment Protection and Biodiversity Conservation Act 1999	Seven Significant Impact Criteria Assessments were prepared for the following species (Appendix 6): • Small-flower Grevillea • Tall Knotweed • Koala • Grey-headed Flying-fox • Spotted-tail Quoll • Regent Honeyeater • Swift Parrot	These assessments determined that a significant impact was unlikely to result from the Project for all species except the Koala. The Koala has been recorded within the study area. The project has been referred to the Commonwealth department of the Environment and Energy and has been declared a controlled action.
Threatened Species Conservation Act 1995	Two EECs: • Hunter Lowland Redgum Forest • Swamp Sclerophyll Forest on Coastal Floodplains Habitat for the Koala.	The project has been assessed in accordance with the BioBanking Assessment methodology (BBAM) with offsets provided in accordance with the interim policy (OEH 2011). No further permits or approvals are required.
Fisheries Management Act 1994	No habitat for *Fisheries Management Act 1994* (FM Act). listed species was located within the study area.	No further permits or approvals required.

Legislation / Policy	Relevant ecological feature on site	Permit / Approval required
Noxious Weeds Act 1993	The following noxious weeds are present within the study area: • Fireweed (Class 4) • Pampas Grass (Class 3)	Land owners within the study area have an obligation under the *Noxious Weeds Act 1993* to control all noxious weeds on their land according to the specified control class.

Note: Guidance provided in this report does not constitute legal advice.

Stage 1 – Biodiversity assessment

1 Introduction

1.1 Project background

Hanson Construction Materials Pty Ltd (Hanson) is seeking approval to expand the existing Brandy Hill Quarry (BHQ), located at 979 Clarence Town Road, Seaham, to increase the rate of production by 1.5 million tonnes per annum (the Project). The Project has been deemed a State Significant Development (SSD) under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Biosis Pty Ltd was commissioned to undertake a biodiversity assessment and prepare a Biodiversity Assessment Report (BAR) for the Project which would support the Environmental Impact Statement (EIS) and cover the requirements for the Project as set out by the Director General's Environmental Assessment Requirements (DGEARs) (SSD 5899), issued by DPE on 9 July 2015.

1.2 Development proposal

The existing BHQ was approved by Port Stephens Shire Council (Development Application No 1920) on the 22 December 1983. The quarry is a major local supplier of Rhyodacite hard rock aggregates to the region (Hanson 2012). Currently, the site encompasses 561 hectares across 22 lots of land privately owned by Hanson. Of this, 18.6 hectares are occupied by the existing quarry, 11.1 hectares by the plant and 5.3 hectares by the stockpile area.

The proposed BHQ Expansion Project, covering a further 53.67 hectares, will involve:

- Expanding the existing quarry to extract and process up to 1.5 million tonnes of hard rock material a year for 30 years.
- Use of blasting (8 am to 5 pm weekdays).
- Constructing and operating additional infrastructure including a concrete batching plant (15,000 m^3 per year), mobile pug mill and pre-coat plant.
- 24 hour operations, sales and despatch.
- Transporting quarry products off-site and receiving 20,000 tonnes of concrete waste for recycling via public roads.
- Site rehabilitation.

The proposed quarry expansion is permissible as the subject land is zoned 1(a) Rural Agricultural "A" Zone as outlined within the Port Stephens Local Environmental Plan 2000 (LEP 2000).

1.3 Site description

The study area is located within the Upper Hunter subregion of the North Coast Interim Biogeographic Regionalisation for Australia (IBRA) bioregion in NSW. The development site is situated on a low ridge on the eastern flank of Brandy Hill, approximately 3.5 kilometres west of Seaham and 175 kilometres north of Sydney (Figure 1).

The BHQ is located north of Clarence Town Road on land owned by Hanson, and includes the following lots:

- Lot 100 DP 712886

- Lot 101 DP 712886
- Lot 56 DP 752487
- Lot 59 DP 752487
- Lot 58 DP 752487
- Lot 57 DP 752487
- Lot 36 DP 752487
- Lot 236 DP 752487
- Lot 19 DP 752487
- Lot 20 DP 752487
- Lot 21 DP 752487
- Lot 1 DP 737844
- Lot 2 DP 737844

The study area, which includes the proposed expansion footprint, is located to the south and west of the existing quarry (Figure 2).

Brandy Hill is an elevated suburb of the Port Stephens Local Government Area (LGA) and primarily consists of large, residential blocks overlooking the lower Hunter River floodplain. The Hunter River forms a prominent feature to the south of the study area and is a major river system in NSW joined by ten tributaries upstream and an additional thirty-one tributaries downstream providing significant flora and fauna habitat for the region.

1.4 Information sources

1.4.1 Publications and databases

In order to provide a context for the study area, information about flora and fauna from within 10 kilometres (the 'locality') was obtained from relevant public databases. Aquatic fauna records were searched from Hunter/Central Rivers Catchment Management Authority (CMA) management area.

Records from the following databases were collated and reviewed:

- Department of Environment and Energy (DoEE) Protected Matters Search Tool for matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).
- NSW BioNet - the database for the Atlas of NSW Wildlife.
- NSW Department of Primary Industries (DPI) Threatened and protected species – records viewer.
- PlantNET (The Royal Botanic Gardens and Domain Trust 2013) for Rare or Threatened Australian Plants (RoTAP).
- BirdLife Australia, the New Atlas of Australian Birds 1998-2013 (BirdLife Australia 2014).
- Groundwater Dependent Ecosystems Atlas. Australian Government's Bureau of Meteorology (Bureau of Meteorology 2014).
- Noxious weed declarations for Port Stephens Council. NSW Department of Primary Industries (DPI 2014a)

Relevant literature and vegetation mapping were reviewed, including:

- OEH Vegetation Information System (VIS) Mapping through the Spatial Information eXchange (SIX) Vegetation Map Viewer.
- Vegetation Survey, Classification and Mapping, Lower Hunter & Central Coast Regional Biodiversity Conservation (LHCCREMS 2003).
- Plant Community Types for the Hunter-Central Rivers Catchment Management Authority – reviewed via the Spatial Information eXchange (SIX) vegetation Map Viewer.
- Port Stephens Comprehensive Koala Plan of Management (Port Stephens Council 2002).
- Seasonal Threatened Plant Survey Brandy Hill Investigation Area (Anderson Environment & Planning 2013).
- NSW State Groundwater Dependent Ecosystem Policy (DLWC 2002).
- Environmental Impact Statement for a hard rock quarry and processing plant at Brandy Hill near Seaham (Resource Planning 1983).
- Policy and Guidelines - Aquatic Habitat Management and Fish Conservation (DPI 2013a).
- Policy and guidelines for fish habitat conservation and management (DPI 2013b).
- Key Fish Habitat maps: Port Stephens LGA. NSW Department of Primary Industries (DPI 2014b).

1.4.2 Spatial data

Spatial data showing the proposed expansion footprint and existing quarry were supplied by Hanson.

Aerial photography were sourced from NearMaps (dated 2014). Mapping was conducted using hand-held (uncorrected) GPS units (GDA94) and aerial photo interpretation of recently captured, high resolution imagery. The accuracy of this mapping is therefore subject to the accuracy of the GPS units (generally ± 7 metres) and dependent on the limitations of aerial photo rectification and registration.

Mapping has been produced using a Geographic Information System (GIS). Electronic GIS files containing the relevant flora and fauna spatial data are available; however this mapping may not be sufficiently precise for detailed design purposes.

1.5 Additional legislative requirements

The Project has been assessed against key biodiversity legislation and government policy, including:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- *Environmental Planning and Assessment Act 1979* (EP&A Act)
- *Threatened Species Conservation Act 1995* (TSC Act)
- *Fisheries Management Act 1994* (FM Act)
- *Water Management Act 2000* (WM Act)
- *Native Vegetation Act 2003* (NV Act)
- *Noxious Weeds Act 1993* (NW Act)

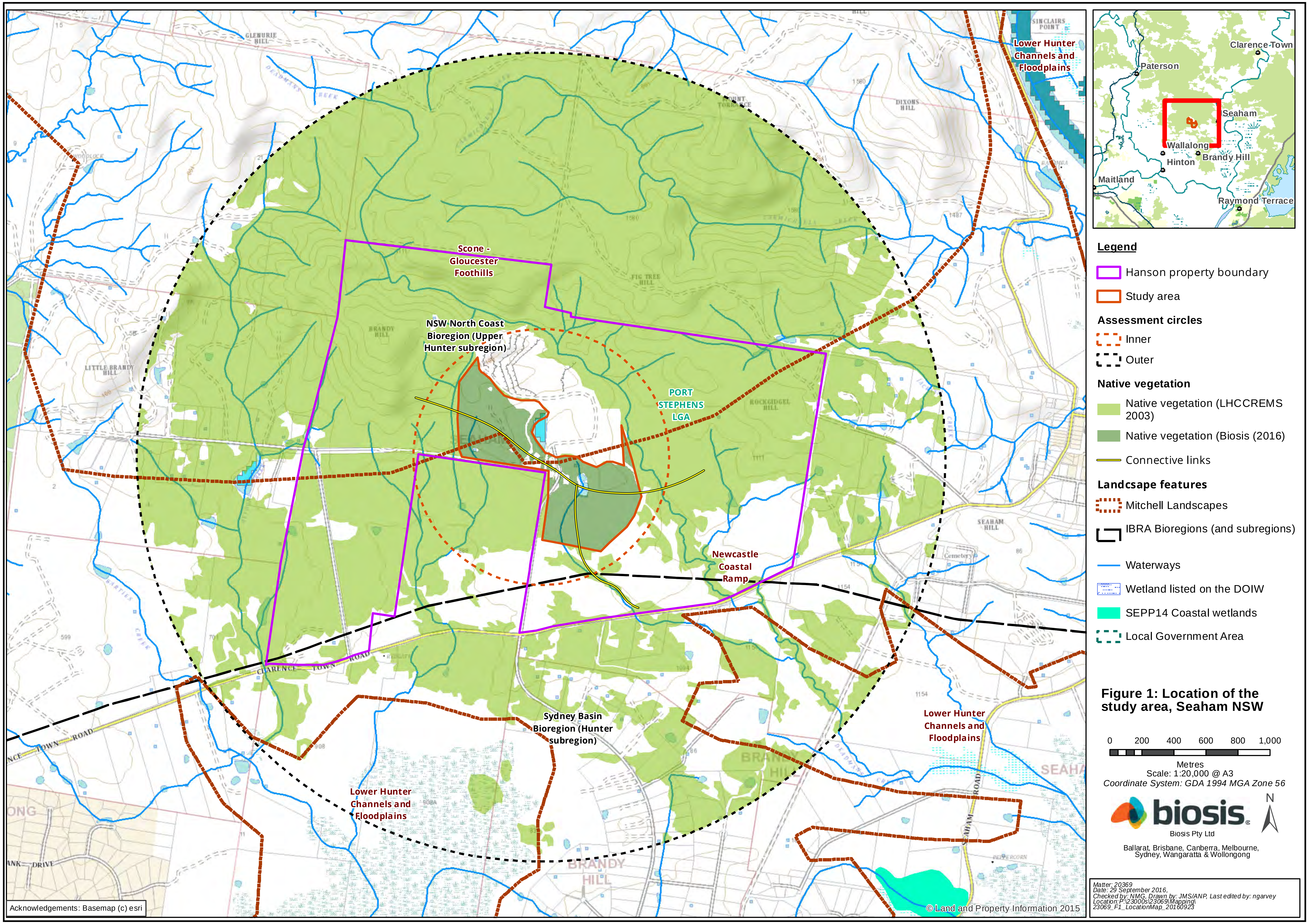

Figure 1: Location of the study area, Seaham NSW

Legend

Project area

Study area

Cadastre

Streams

1st Order

2nd Order

3rd Order

Stream buffers

Local wetland

Dam

Local wetland buffer

Figure 2: Site Map

0 50 100 150 200 250

Metres

Scale: 1:5,500 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

biosis.

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Melbourne, Sydney, Wangaratta & Wollongong

Matter: 18371
Date: 20 September 2016,
Checked by: EC, Drawn by: JMS/ANP, Last edited by: apritchard
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2 Legislative context

This section provides an overview of key biodiversity legislation and government policy considered in this assessment. Where available, links to further information are provided. This section does not describe the legislation and policy in detail and guidance provided here does not constitute legal advice.

2.1 Commonwealth

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act is the Australian Government's key piece of environmental legislation. The EPBC Act applies to developments and associated activities that have the potential to significantly impact on Matters of National Environmental Significance (NES) protected under the Act.

Nine Matters of NES are identified under the EPBC Act:

- world heritage properties
- national heritage places
- wetlands of international importance (also known as 'Ramsar' wetlands)
- nationally threatened species and ecological communities
- migratory species
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mining)
- a water resource, in relation to coal seam gas development and large coal mining development.

Under the EPBC Act, activities that have potential to result in significant impacts on Matters of NES must be referred to the Commonwealth Minister for the Environment for assessment.

Matters of NES relevant to the current Project include nationally threatened species and ecological communities, migratory species and Ramsar wetlands. Threatened communities are discussed in Section 4, while threatened species are outlined in Section 5 and Appendix 5. Ramsar wetlands are considered in Section 3.2. Significant impact criteria (SIC) assessments are provided in 7 .

An assessment of potential impacts to all Matters of NES under the provisions of the EPBC Act, and whether referral of the Project to the Commonwealth Minister for the Environment for assessment is required, provided in Section9.1.

2.2 State

2.2.1 Environmental Planning and Assessment Act 1979

The EP&A Act was enacted to encourage the proper consideration and management of impacts of proposed development or land-use changes on the environment (both natural and built) and the community. The EP&A Act is administered by the NSW Department of Planning and Environment (DP&E).

The EP&A Act provides the overarching structure for planning in NSW; however is supported by other statutory environmental planning instruments. Sections of the EP&A Act of primary relevance to the natural environment are outlined further below.

Assessment of Significance (Section 5A)

Section 5A of the EP&A Act requires proponents and consent authorities to consider if a development will have a significant effect on threatened species, populations or communities listed under the TSC Act and FM Act. Section 5A (and Section 9A of the TSC Act) outlines seven factors that must be taken into account in an Assessment of Significance (formally known as the "7-part test"). Where any Assessment of Significance (AoS) determines that a development will result in a significant effect to a threatened species, population or community a Species Impact Statement (SIS) is required.

As the Project was assessed in accordance with the BioBanking Assessment Methodology (OEH 2014a) AoS's were not undertaken for the Project.

Local Environment Plans (Part 3 Division 4)

Local Environment Plans (LEP) apply either to the whole, or part of, a Local Government Area and make provision for the protection or utilisation of the environment through zoning of land.

The study area is subject to the Port Stephens Local Environment Plan 2013 and is zoned RU2 Rural Landscape. This zoning provides for:

- To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.
- To maintain the rural landscape character of the land.
- To provide for a range of compatible land uses, including extensive agriculture.

Elements of the LEP objectives are relevant to this assessment and are discussed further in the main EIS.

State Environmental Planning Policies (Part 3 Division 2)

State Environmental Planning Policies (SEPPs) outline policy objectives relevant to state wide issues. SEPPs relevant to the current development are discussed below.

State Environmental Planning Policy No 44—Koala Habitat Protection

SEPP 44 aims to encourage the conservation and management of natural vegetation areas that provide habitat for koalas to ensure permanent free-living populations will be maintained over their present range and to reverse the current trend of koala-population decline. It applies to areas of native vegetation greater than one hectare and in councils listed in Schedule 1 to the SEPP.

SEPP 44 does not apply to Projects that are being assessed as SSD. However, SEPP 44 Koala habitat definitions have been used to determine whether potential and/or core Koala habitat areas (as defined under SEPP 44) occur within the study area.

2.2.2 Threatened Species Conservation Act 1995

The TSC Act is the key piece of legislation providing for the protection and conservation of biodiversity in NSW through the listing of threatened species, populations and ecological communities and the declaration and mapping of their critical habitats, as well as the identification of key threatening processes.

The TSC Act also establishes a system for biodiversity certification and establishes the Biodiversity Banking and Offsets Scheme.

Biodiversity Banking and Offsets Scheme

Part 7A of the TSC Act establishes the Biodiversity Banking and Offsets Scheme, which enables the establishment of biodiversity banking sites, the creation and trading of biodiversity credits and the use of credits to offset development otherwise impacting on biodiversity values. Development for which a BioBanking statement is issued is taken to be development that is not likely to significantly affect any threatened species, population or ecological community under this Act, or its habitat.

This assessment was undertaken using the BioBanking Assessment Methodology (OEH 2014a); however, a BioBanking statement is not being sought for the development. As per the input from the NSW Office of Environment and Heritage (OEH) the BioBanking Assessment Methodology has been used to assess the impacts of the Project and to determine required offsets.

Threatened species and communities are discussed in Sections 5 and 4 respectively, with a list of threatened species considered during the assessment and their likelihood of occurrence in the study area provided in Appendix 5. Biodiversity credit requirements are outlined in Section 7

2.2.3 Fisheries Management Act 1994

The FM Act provides for the protection and conservation of aquatic species and their habitat throughout NSW. Impacts to threatened species, populations and communities, and critical habitats listed under the FM Act must be assessed through the AoS process under Section 220ZZ of the FM Act and Section 5A of the EP&A Act (see Section2.2.1). There are seven key threatening processes (KTPs) listed under the FM Act.

Two key objectives of the FM Act are to; conserve fish stocks and key fish habitats, and conserve threatened species, populations and ecological communities of fish and marine vegetation. When reviewing applications, Department of Primary Industries (DPI) will assess the likelihood of impacts to waterways in relation to their sensitivity (TYPE) and waterway class (CLASS).

Aquatic habitats and threatened species are outlined in Section 5.4.3. An assessment of the Project against the requirements of the FM Act is provided in Section 9.2.

2.2.4 Native Vegetation Act 2003

The NV Act provides for, encourages and promotes the management of native vegetation on a regional basis and regulates the clearing of native vegetation on land in NSW. Under the NV Act no clearing of native vegetation is allowed except in accordance with prior development consent from the relevant Council or under a Property Vegetation Plan (PVP) approved by the relevant Catchment Management Authority.

The Project is being assessed as SSD under the EP&A Act, and as such the provisions of the NV Act do not apply.

2.2.5 Noxious Weeds Act 1993

The NW Act was enacted to provide for the identification, classification and control of noxious weeds. The NW Act aims to reduce the negative impact of weeds on the economy, community and environment of NSW by:

- Establishing control mechanists to prevent the establishment of significant new weeds in NSW.
- Preventing, eliminating or restricting the spread of particular significant weeds in NSW.
- Effectively managing widespread significant weeds in NSW.

Plants declared as noxious weeds are currently listed under Noxious Weeds (Weed Control) Order 2014 published in the NSW Government Gazette No. 23. The NW Act is supported by a number of regulations and is administered by the DPI. Noxious weeds are discussed further in Section 9.3.

3 Landscape

3.1 Bioregions and landscapes regions

The study area occurs within the North Coast IBRA bioregion and the Upper Hunter IBRA subregion (Figure 1). The Upper Hunter IBRA subregion covers the entire development site and is the subregion is used in this assessment. The Hunter IBRA subregion and Sydney Basin IBRA region are located to the south of the study area, and within the inner assessment circle (Figure 1).

The majority of the study area is located within the Newcastle Coastal Ramp Mitchell Landscape and this is the Mitchell Landscape identified in the assessment. The northern portion of the study area is located within the Scone-Gloucester Foothills Mitchell Landscape, while the Lower Hunter Channels and Floodplains Mitchell Landscapes is located to the south of the study area within the outer assessment circle (Figure 1).

3.2 Waterways and wetlands

The study area is located within the Hunter River catchment. The Hunter is the largest coastal catchment in NSW, with an area of about 21,500 square kilometres. Elevations across the catchment vary from over 1,500 metres in the high mountain ranges north of the catchment, to less than 50 metres on the floodplains of the lower valley.

The study area is within the catchment of two local waterways; Deadmans Creek and Barties Creek. Deadmans Creek is a tributary of Williams Creek which flows south to its confluence with the Hunter River approximately 10 kilometres south of the study area. It is located outside of the study area, immediately to the east, where the creek is a third order (Strahler 1957) ephemeral stream flowing from north to south (Figure 1) with a first order tributary of Deadmans Creek located within the eastern section of the study area (Figure 2). The southern downstream portion of Deadmans Creek was flowing during the winter survey (Plate 1); however upstream sections to the north were dry (Plate 2). During the spring survey, the entire creek line was found to be dry, highlighting the ephemeral nature of this minor creek. In the study area, the tributary of Deadmans Creek forms an eroded channel that was dry during the assessment period (Plate 3).

Barties Creek is a tributary of the Hunter River, with the confluence of these two waterways approximately 7 kilometres south of the study area. The headwaters of this waterway are located within and to the west of the study area (Figure 1), with a first order (Strahler 1957) section of the waterway located within the western section of the study area (Figure 2). In the study area this creek is highly ephemeral and was observed to be dry during the survey periods.

Plate 1 Deadmans Creek adjacent to the study area

Plate 2 Deadmans Creek upstream of the study area

Plate 3 Deadmans Creek adjacent to the study area

A large man-made storage dam is located in the centre of the study area. It is bound on all sides by vehicle access roads, with a narrow strip of riparian vegetation. Macrophytes were noted along the edges of the dam which provide breeding and refuge habitat for frogs and fish. Three smaller settlement dams are located to the east of this larger dam.

3.3 Native vegetation extent

In order to encompass the entire impact area, an inner assessment circle of 200 hectares and an outer assessment of 2000 hectares have been used. Vegetation cover is shown in Figure 1 and Table 2.

A large portion of the outer assessment circle to the north of the study area is vegetated, whilst south of Clarence Town Road has been partially cleared. Within the inner assessment circle, the study area contains a number of areas that have been cleared as a part of previous approvals for the Brandy Hill Quarry. These areas include the site office and carpark facility, the workshop and yard, the load inspection area and a number of access roads. Assessment of landscape value

3.4 Assessment of landscape value

Landscape value has been calculated using the method for site-based developments, outlined in Appendix 4 of the BBAM (OEH 2014a).

3.4.1 Assessment of the current extent of native vegetation cover

The amount of native vegetation within the inner and outer assessment circles has been derived from the highest resolution vegetation mapping available. In this instance the Lower Hunter and Central Coast Regional Environmental Management Strategy (LHCCREMS 2003) mapping was used to determine vegetation extent outside the study area, with irrelevant or exotic vegetation map units discounted. Detailed mapping undertaken for this assessment was used within the study area. To determine proportion of native vegetation following the Project, the area of native vegetation within the study area was subtracted from the pre-expansion calculations. The values that were calculated using GIS are outlined in Table 2.

Table 2 Extent of native vegetation cover before and after development

Assessment Circle	Before Development		After Development	
	Area (ha)	Per cent	Area (ha)	Per cent
Outer assessment circle	1394	70 (66-70)	1340	67 (66-70)
Inner assessment circle	144	72 (71-75)	90	45 (41-45)

3.4.2 Assessment of connectivity value

The study area does not support any of the following:

- An area identified as being part of a state significant biodiversity link.
- A riparian buffer 50 metres either side of a 6th order stream.
- A riparian buffer 50 metres around an important wetland or estuarine area.
- An area identified as being part of a regionally significant biodiversity link.
- A riparian buffer 20 metres either side of a 4th or 5th order stream,

Therefore, the proposed development will not impact on any state significant biodiversity links or regionally significant biodiversity links.

Connectivity is the measure of the degree to which areas of native vegetation are linked to other areas of vegetation. The connectivity value of the study area was assessed in accordance with Appendix 4 of the BBAM. The study area was assessed as being part of two connective links (Figure 1). One connective link runs east to west within the southern portion of the study area and provides connectivity between patches of vegetation to the east and west of the quarry. The connectivity width assessment determined that the most limiting width within this connective link is 340 metres, placing it in the >100-500 metres (wide) linkage width class. A second connective link runs connects the first connective link to remnant native vegetation to the south of the study area. The most limiting width for this connective link currently occurs outside the study area with a width of approximately 27 metres, placing it in the >5-30 metres (narrow) width class. This is the most limited connective link and was used in the current assessment. It is worth noting that this connective link is transected by Clarencetown Road, south of the quarry, with no connective structures. Following development both connective links will be removed by the Project, reducing the width class to 0-5 metres (very narrow).

Table 3 outlines the linkage condition both before and after development.

Table 3 Connectivity condition classes

Strata	Before Development	After Development
Overstorey condition	PFC at BM	No native overstorey
Midstorey/Ground cover condition	PFC of midstorey/ground cover at BM	No midstorey/groundstorey cover

Based on this assessment the loss of linkage condition/width score is 12.

3.4.3 Assessment of patch size

Patch size was assessed using a Geographic Information System (GIS). All vegetation not defined as low condition and separated by a distance of less than 100 metres (woody vegetation) or less than 30 metres (grasslands) was mapped sequentially using a selection process in ArcGIS software.

Using this method, vegetation within the study area forms part of a large expanse of relatively intact native bushland that extends approximately 14 kilometres north towards the town of Martins Creek. The study area was assessed as having a patch size of > 1001 hectares. All vegetation zones within the study area have a patch size greater than 1000 hectares and therefore sits within the extra large patch size class.

4 Native vegetation

The extent of native vegetation within the study area was determined using Section 5 of the BBAM (OEH 2014a).

General classification of native vegetation in NSW used in this report is based on the Vegetation Information System (VIS) classification. Vegetation communities are separated into Plant Community Types (PCTs) based on the form, floristic composition landscape position, soils and geographical location. Information on the PCTs is accessed through the VIS database which contains all of the information required to positively identify a given community. This system is based on the Keith (2004) system which uses three groupings of vegetation: vegetation formation, vegetation class and vegetation type, with vegetation type the finest grouping. Most PCTs have an equivalent vegetation type and both have been referred to in the first instance.

Detailed mapping of vegetation within the study area was undertaken for this assessment. The methodology is outlined in Section 4.1 and results presented in Section 4.2.

4.1 Methods

4.1.1 Site investigation

An initial flora assessment of the study area was undertaken in winter from the 11 to 15 August 2014 by two ecologists. An additional flora assessment was undertaken in spring on the13 and 14 November 2014 by two ecologists.

Detailed mapping of vegetation communities was undertaken on during the initial assessment with minor revision during the second visit. Vegetation mapping was conducted using hand-held (uncorrected) GPS units and aerial photo interpretation. The accuracy of this mapping is therefore subject to the accuracy of the GPS units (generally ± 5 metres) and dependent on the limitations of aerial photo rectification and registration. Mapping has been produced using a GIS.

Delineation of PCTs was undertaken by walking the boundaries of these communities. Areas containing dams, sealed roads or no vegetation cover were excluded from the vegetation mapping. Identification of PCTs within the study area was confirmed using descriptions provided in the VIS and through analysis of dominant species.

PCTs were stratified into vegetation zones based on condition (low or moderate/good) and ancillary code (where relevant). Following stratification of vegetation zones, site value was assessed using plot and transect survey data, as per the methodology outlined in Section 5 of the BBAM (OEH 2014a). Surveys included:

- A 20 metre x 50 metre quadrat and 50 m transect for assessment of site attributes.
- A 20 metre x 20 metre quadrat, nested within the quadrat outlined above, for full floristic survey to determine native plant species richness.

The minimum number of plots/transects per vegetation zone was determined using Table 3 of OEH (2014a). A total of 19 plots/transects were completed within the study area (Figure 3). Spot locations for incidental observations and random meanders (Cropper 1993) were also used to determine the vegetation types present within the study area. The general condition of native vegetation was observed as well as the effects of current seasonal conditions. Notes were made on specific issues such as noxious weed infestations, evidence of management works, current grazing impacts and the regeneration capacity of the vegetation.

A list of flora species was compiled for each vegetation type (Appendix 3). Records of threatened flora species will be submitted to OEH for incorporation into the Atlas of NSW Wildlife.

4.2 Results

4.2.1 Vegetation description

The vegetation of the Project area comprises either grassy, shrub/grassy or shrubby open forest with one swamp forest vegetation community (Table 4).

Table 4 Plant Community Types of the study area and corresponding formation and class (Keith 2004)

Plant community type	Vegetation formation	Vegetation class
HU814 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter (PCT 1600)	Dry Sclerophyll Forest (Shrub/grass sub-formation)	Hunter-Macleay Dry Sclerophyll Forests
HU816 Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter (PCT 1602)	Dry Sclerophyll Forest (Shrub/grass sub-formation)	Hunter-Macleay Dry Sclerophyll Forests
HU591 Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion (PCT 1064)	Forested Wetlands	Coastal Swamp Forests
HU806 Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (PCT 1592)	Dry Sclerophyll Forest (Shrub/grass sub-formation)	Hunter-Macleay Dry Sclerophyll Forests
HU812 Forest Red Gum grassy open forest on floodplains of the Lower Hunter (PCT 1598)	Forested Wetlands	Coastal Floodplain Wetlands
HU798 White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley (PCT 1584)	Wet Sclerophyll Forest (Grassy sub-formation)	Northern Hinterland Wet Sclerophyll Forests

4.2.2 Plant community types

A total of six distinct PCTs were identified in the study area. All native vegetation within the study area was deemed to be in moderate/good condition with all PCTs in the same broad condition. Thus, no ancillary codes were assigned and the six PCTs were identified as individual vegetation zones (Figure 3). A summary of these is provided inTable 5, with a detailed description of each of the identified PCTs in Table 6 to Table 9 below.

In addition to the native PCTs identified two non-vegetated map units were recorded including; *Cleared* and *Water* (Figure 3). The Water map unit is comprised of the man made storage and settlement dams that occur in the central portion of the study area. The Cleared map unit is comprised of access roads, haul roads, carparks and maintenance areas that are devoid of all vegetation.

Table 5 PCT and corresponding vegetation zones mapped within the study area.

Vegetation zone (VZ)	Plant community type	Condition	Ancillary code	Area (ha)
VZ1	HU814 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter (PCT 1600)	Moderate-Good	No ancillary code assigned	17.1
VZ2	HU816 Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter (PCT 1602)	Moderate-Good	No ancillary code assigned	25.9
VZ3	HU591 Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin (PCT 1064)	Moderate-Good	No ancillary code assigned	0.67
VZ4	HU806 Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (PCT 1592)	Moderate-Good	No ancillary code assigned	1.12
VZ5	HU812 Forest Red Gum grassy open forest on floodplains of the Lower Hunter (PCT 1598)	Moderate-Good	No ancillary code assigned	1.67
VZ6	HU798 White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley (PCT 1584).	Moderate-Good	No ancillary code assigned	2.16
TOTAL				48.62

Table 6 Vegetation zone 1 community description

Vegetation zone 1: Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter	
PCT ID	1600
Biometric vegetation type ID	HU814
Extent within Project area (hectares)	Approximately 17.1 hectares of HU814 was recorded within the study area, predominantly in the southwestern portion.
Estimate of percent cleared value of PCT	66%

Description	HU814 is characterized by a canopy of Spotted Gum *Corymbia maculata*, Narrow Leaved Ironbark *Eucalyptus crebra,* Grey Box *Eucalyptus moluccana* and, to a lesser extent, Red Ironbark *Eucalyptus fibrosa* and Forest Red Gum *Eucalyptus tereticornis.* Prickly Leaved Paperbark *Melaleuca nodosa* formed dense thickets through the southern central portion of the study area. Grey Box was more abundant in the eastern portion with Forest Red Gum more prevalent to the west. Where canopy has been historically thinned and cleared in some areas, pockets of derived native grasslands were identified. Given that these areas still meet the threshold of moderate/good condition and these formed small pockets scattered amongst the more intact vegetation, stratification of this vegetation into a separate vegetation zone was not considered appropriate. The shrub strata composition was largely similar to that observed in HU816, with prickly shrubs such as Prickly Beard-heath *Leucopogon juniperinus*, Gorse Bitter Pea *Daviesia ulicifolia*, Prickly Moses *Acacia ulicifolia* and Native Blackthorn *Bursaria spinosa* dominant. Native understory species included Wiry Panic *Entolasia stricta*, Threeawn Speargrass *Aristida vagans*, Forest Hedgehog Grass *Echinopogon ovatus*, Blady Grass *Imperata cylindrica*, Wallaby Grass *Rytidosperma fulva,* Barbed Wire Grass *Cymbopogon refractus,* Weeping Grass *Microlaena stipoides*, Raspwort *Gonocarpus teucrioides*, Leafy Purple-flag *Patersonia glabrata* Spiny-headed Mat-rush *Lomandra longifolia*, Whiteroot *Pratia purpurascens*, Native Geranium *Geranium solanderi*, Kidney Weed, *Goodenia bellidifolia*, Germander *Gonocarpus teucrioides* and *Dianella prunina.*
Vegetation Formation and Class	Dry Sclerophyll Forest (Shrub/grass sub-formation) Hunter-Macleay Dry Sclerophyll Forests
Condition	The community is in moderate/good condition for the purpose of this assessment, and was considered to be in moderate condition overall based on the relatively low level of exotic species recruitment, particularly in the less edge affected areas. At the southern extent of the study area, historic clearing for grazing has lead to lower density canopy of lower age class trees. Furthermore, exotic grasses and herbs such as Narrow-leafed Carpet Grass *Axonopus fissifolius*, Scarlet Pimpernel *Anagallis arvensis* and Rhodes Grass *Chloris gayana* were noted.
Justification of evidence used to identify a PCT	The vegetation observed was considered to best fit HU814 based on the co-dominance of Spotted Gum, Narrow-leaved Ironbark Grey Box and Red Ironbark in the canopy, the presence of a suite of characteristic shrub and ground cover species and occurrence on hillsllopes.
Threatened ecological community	Commonwealth EPBC Act: Not listed NSW TSC Act: Not listed Justification: HU814 was considered to align with the final determination for the EEC Lower Hunter Spotted Gum –Ironbark Forest in the Sydney Basin Bioregion based on the species composition of the canopy, which had a higher influence of Red Ironbark, and the presence of Prickly-leaved Paperbark thickets which are characteristic of the EEC (NSW Scientific Committee 2011a). However, as the study area is located within the North Coast Bioregion it does not align with the final determination of this EEC (NSW Scientific Committee 2011a).

Picture: Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter	

Table 7 Vegetation zone 2 community description

Vegetation zone 2: Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	
PCT ID	1602
Biometric vegetation type ID	HU816
Extent within Project area (hectares)	Approximately 25.9 ha of HU816 was recorded across the majority of the study area. This PCT extends across the elevated ridges in both the northern and southern section, grading into other Spotted Gum – Ironbark variants on the lower slopes.
Estimate of percent cleared value of PCT	54%
Description	HU816 is characterised by a canopy of Spotted Gum, Narrow-leaved Ironbark and White Mahogany *Eucalyptus acmenoides* which was dominant in a number of locations. Other canopy species were recorded throughout the community; however these three were typically dominant. Other recorded canopy species include White Stringybark *Eucalyptus globoidea*, Sydney Red Gum *Angophora costata*, Red Ironbark and Rough-barked Apple *Angophora floribunda* in the south-eastern portion of the study area and Grey Gum *Eucalyptus punctata* and Grey Ironbark *Eucalyptus siderophloia* in the north-western portion of the study area. Where the influence of exotic species was low, HU816 typically had an open understory of shrubs including Prickly Beard-heath, Gorse Bitter Pea, Prickly Moses, Hickory Wattle *Acacia implexa*, Large Mock-olive *Notelaea longifolia*, Native Blackthorn and Coffee Bush *Breynia oblongifolia.* Native herbs, grasses and graminoids recorded include; Wiry Panic, Brown's Lovegrass *Eragrostis brownii*, Blady Grass, Weeping Grass, Wattle Matt-rush *Lomandra filiformis*, Spiny-headed Mat-rush, Stinkweed *Opercularia diphylla*, Pomax *Pomax umbellata*, Thyme

	Spurge *Phyllanthus hirtellus*, Whiterood and Kidney Weed *Dichondra repens*.
Vegetation Formation and Class	Dry Sclerophyll Forest (Shrub/grass sub-formation) Hunter-Macleay Dry Sclerophyll Forests
Condition	The community is in moderate/good condition for the purpose of this assessment, and was considered to be in moderate condition overall based on the relatively low level of exotic species recruitment. Lantana *Lantana camara* was noted as a problematic weed, forming relatively dense stands in places, particularly in the south-eastern portion of the study area.
Justification of evidence used to identify a PCT	The vegetation observed was considered to best fit HU816 based on the dominance of Spotted Gum and Narrow-leaved Ironbark in the canopy, and the presence of a suite of characteristic shrub and ground cover species.
Threatened ecological community	Commonwealth EPBC Act: Not listed NSW TSC Act: Not listed Justification: the VIS database notes that HU816 can form a part of the endangered ecological community (EEC) Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion. However, since the study area is located within the North Coast Bioregion it does not align with the final determination of this EEC (NSW Scientific Committee 2011a).
Picture: Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	

Table 8 Vegetation zone 3 community description

Vegetation zone 3: Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion.	
PCT ID	1064
Biometric vegetation type ID	HU591

Extent within Project area (ha)	Approximately 0.67 ha of HU591 was recorded within the study area, immediately upstream of the three settlement dams in the south-eastern portion of the study area. The patch is bisected by a small drainage channel the flows north to south, into the first settlement dam.
Estimate of percent cleared value of PCT	75%
Description	HU591 was characterized by a canopy of Swamp Oak *Casuarina glauca* and Forest Red Gum with scattered Narrow-leaved Ironbark and White Stringybark on the outer fringes. Prickly-leaved Tea Tree *Melaleuca styphelioides* was characteristic of the midstorey along with Cheese Tree *Glochidion ferdinandi*, Hickory Wattle *Acacia falcata,* Golden Wattle *Acacia longifolia*, Native Blackthorn, Prickly Moses and Hairy Clerodendrum *Clerodendrum tomentosum.* The understory was typically comprised of native grassed forbs and vines including; Wiry Panic Grass, Blady Grass, Two-colour Panic Grass *Panicum simile*, Old Man's Beard *Clematis aristata,* Whiteroot, Wombat Berry *Eustrephus latifolius*, Scrambling Lily *Geitonoplesium cymosum*, Snake vine *Stephania japonica*, Small St John's Wort *Hypericum gramineum*, Indian Pennywort *Centella asiatica* and Common Silkpod *Parsonsia straminea.* Sedges were common throughout the drainage channel with recorded species including Rough Saw-sedge *Gahnia aspera,* Bare Twigrush *Baumea juncea, Eleocharis acuta* and *Schoenoplectus validus.*
Vegetation Formation and Class	Forested Wetlands Coastal Swamp Forests
Condition	HU591 is in moderate to good condition for the purpose of the FBA, and was considered to be in moderate condition overall based on the edge affected nature of the patch. The community was recorded adjacent to the heavily disturbed stockpile area which has allowed recruitment of exotic species within this wetter, more nutrient enriched community. Species recorded include Fireweed *Senecio madagascariensis,* Fleabane *Conyza* sp., Common Sowthistle *Sonchus oleraceus,* Cobbler's Pegs *Bidens pilosa,* Catsear *Hypochaeris radicata* and the grasses Pampas Grass *Cortaderia selloana,* Rhodes Grass and Slender Pigeon Grass *Setaria gracilis.*
Justification of evidence used to identify a PCT	This vegetation community was determined to align with HU591 based on the presence of Swamp Oak and Forest Red Gum in the canopy and the dominance of Prickly-leaved Tea Tree in the midstorey. Additionally, the landscape position is consistent with poorly drained sites along creek banks. The patch of HU591 was relatively small and it graded into the HU816 as the soils became drier away from the drainage line. As such species composition shifted towards a higher influence of Ironbarks and Spotted Gum in this transitional zone.
Threatened ecological community	Commonwealth EPBC Act: Not listed NSW TSC Act: Endangered Justification: HU591 was considered to align with the final determination for the EEC Swamp Sclerophyll Forest On Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (NSW Scientific Committee 2004). This was based on the species composition of the canopy which had a high influence of Swamp Oak and Forest Red Gum with a dominance of Prickly-leaved Tea Tree in the midstorey and Blady Grass as a ground cover.

Picture: Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley	

Table 9 Vegetation zone 4 community description

Vegetation zone 4: Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	
PCT ID	1592
Biometric vegetation type ID	HU806
Extent within Project area (ha)	Approximately 1.12 hectares of HU806 was recorded within the study area, along the northern boundary of the south-eastern portion of the study area. This community forms a small patch that adjoins HU816 but that is floristically distinct.
Estimate of percent cleared value of PCT	44%
Description	HU806 was characterized by an overstory dominated by Red Ironbark with scattered Spotted Gum. Red Ironbark was recorded as an associated canopy species elsewhere in the study area but not at the same abundance that was noted within HU806. Shrub and understory stratum species composition was similar to other grassy woodlands within the study area. Species recorded include Prickly Beard-heath, Prickly-leaved Paperbark, Downy Dodder-laurel *Cassytha pubescens*, Many-flowered Mat-rush *Lomandra multiflora*, Coffee Bush, Wiry Panic, Blady Grass, Threeawn Speargrass, Barbed Wire Gras, Wiry Panic, Blady Grass, Kangaroo Grass *Themeda australis,* Narrow-leaved Geebung *Persoonia linearis*, Sandfly Zieria *Zieria smithii* and Kurrajong *Brachychiton populneus*.
Vegetation Formation and Class	Dry Sclerophyll Forest (Shrub/grass sub-formation) Hunter-Macleay Dry Sclerophyll Forests

Condition	HU806 is in moderate/good condition for the purpose of this assessment, and was considered to be in moderate condition overall based on the edge affected nature of the patch. The community was recorded adjacent to a recently expanded access track along the north-eastern edge of the study area. Exotic species recorded were limited to patches of Lantana scattered throughout.
Justification of evidence used to identify a PCT	The dominance of Red Ironbark in the canopy was the driving factor in the delineation of HU806. Elsewhere in the study area Narrow-leaved Ironbark has been more dominant; however this was far less abundant within this community.
Threatened ecological community	Commonwealth EPBC Act: Not listed NSW TSC Act: Not listed Justification: HU806 was considered to align with the final determination for the EEC Lower Hunter Spotted Gum –Ironbark Forest in the Sydney Basin Bioregion based on the species composition of the canopy which had a high influence of Red Ironbark in the canopy and Prickly-leaved Paperbark in the shrub strata. However, as the study area is located within the North Coast Bioregion it does not align with the final determination of this EEC (NSW Scientific Committee 2011a).
Picture: Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	

Table 10 Vegetation zone 5 community description

Vegetation zone 5: Forest Red Gum grassy open forest on floodplains of the lower Hunter	
PCT ID	1598
Biometric vegetation type ID	HU812
Extent within Project area (ha)	Approximately 1.67 hectares of HU812 was recorded within the study area, predominantly fringing the bank of the large dam in the centre of the study area. This community occurred on lower slopes on soils where alluvial deposits are more prevalent.

Estimate of percent cleared value of PCT	Unknown
Description	HU812 was characterized by a tall canopy of Forest Red Gum, Rough-barked Apple and Grey Ironbark with scattered Grey Gum intergrade *Eucalyptus punctata X canaliculata* and Broad-leaved White Mahogany *Eucalyptus umbra.* Species composition of the shrub strata was similar to the grassy woodland communities within the study area, species include; Prickly Beard-heath, Prickly Moses, Dolly Bush *Cassinia aculeata*, Swamp Wattle *Acacia elongata*, Large Mock-olive, Sandfly Zieria, Coffee Bush, Cheese Tree, Native Blackthorn, Narrow-leaved Geebung and Kurrajong. Native grasses were common in the understoery, including Bordered Panic, Wiry Panic and Blady Grass in addition to the native forbs, vines and gaminoids Small-leaf Glycine *Glycine microphylla*, Whiteroot, Wattle Matt-rush, Wombat Berry, *Dianella caerulea* var. *cinerascens* and Water Vine.
Vegetation Formation and Class	Forested Wetlands Coastal Floodplain Wetlands
Condition	HU812 is in moderate to good condition for the purpose of this assessment, and was considered to be in moderate condition overall based on the edge affected nature of the patch. The community was recorded between an existing dam and a haul road leading to the quarry. As such, weed recruitment has lead to patches of Lantana scattered throughout.
Justification of evidence used to identify a PCT	This community was considered to be consistent with HU812 based on the species composition, particularly in the canopy, in conjunction with the landscape position on low slopes adjacent to a permanent waterbody.
Threatened ecological community	Commonwealth EPBC Act: Not listed NSW TSC Act: Endangered Justification: HU812 was considered to align with the final determination for the EEC Hunter lowland Redgum forest in the Sydney Basin and NSW North Coast Bioregions (NSW Scientific Committee 2002). The justification for this was the dominance of Forest Red Gum in the canopy, in addition to other characteristic species in each stratum. Landscape position attributes were also equivalent, with HU812 occurring on the lower slopes and flats adjacent to a permanent water body.

Picture: Forest Red Gum grassy open forest on floodplains of the lower Hunter	

Table 11 Vegetation zone 6 community description

Vegetation zone 6: White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	
PCT ID	1584
Biometric vegetation type ID	HU798
Extent within Project area (ha)	Approximately 2.16 ha of HU798 was recorded within the study area, in the north-western portion. This community was recorded within moist gullies between ridgelines, typically adjacent to ephemeral drainage lines and seepage points.
Estimate of percent cleared value of PCT	42%
Description	HU798 was characterized by a dense canopy of Grey Myrtle *Backhousia myrtifolia* with an understory of mesic shrubs, vines and epiphytes. Emergent sclerophyllous canopy species including White Mahogany, Grey Gum and Spotted Gum were scattered amongst the community. Dominant shrubs included Creek Sandpaper Fig *Ficus coronate*, Large Mock-olive, Cheese Tree, White Supplejack *Ripogonum album*, Willow Bottlebrush *Callistemon salignus,* Rough Fruit Pittosporum *Pittosporum revolutum* and *Myrsine variabilis*. Vines and scramblers were common throughout HU798, with recorded species including Water Vine *Cissus Antarctica*, Lawyer Vine *Smilax australis*, Milk Vine *Marsdenia rostrata,* Giant Water Vine *Cissus hypoglauca*, Settler's Twine *Gymnostachys anceps*, Scrambling Lily and Sweet Morinda *Morinda jasminoides.* The understory also contained a large number of ferns and their allies, including Elkhorn Fern *Platycerium bifurcatum*, Common Maidenhair *Adiantum aethiopicum, Pellaea paradoxa*, Giant Maidenhair *Adiantum formosum,* Rough Maidenhair *Adiantum hispidulum,* Swamp Water Fern

	Blechnum indicum and Prickly Rasp Fern *Doodia aspera.*
Vegetation Formation and Class	Wet Sclerophyll Forest (Grassy sub-formation) Northern Hinterland Wet Sclerophyll Forests
Condition	The community is in moderate/good condition for the purpose of this assessment, and was considered to be in good condition overall based on the low level of exotic species recruitment. The area of HU798 recorded on the western boundary was less edge affected than that recorded closer to the existing quarry on the northern boundary. Species richness was below benchmark, potentially indicating some level of historic disturbance.
Justification of evidence used to identify a PCT	The observed vegetation community was determined to align with this PCT based on the close correlationof the floristics, in conjunction with the landscape position (gullies and lower slopes of the Central and Lower Hunter Valley).
Threatened ecological community	Commonwealth EPBC Act: Not listed NSW TSC Act: Not listed Justification: HU798 was assessed against the profile and final determination for the vulnerable ecological community (VEC) Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions. Close consideration of these documents determined that HU798 is not consistent based on the canopy and shrubstorey floristics. Furthermore, the study area is outside of the typical range of this community, which typically occurs further north on the carboniferous sediments of the Barrington footslopes.
Picture: White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	

4.2.3 Site value scores

Plots and transect survey data was entered into the BioBanking credit calculator to determine site value scores. Plot and transect survey data is presented in 2. Current site value for each vegetation zone is outlined in Table 12.

Table 12 Site value scores for all Vegetation Zones.

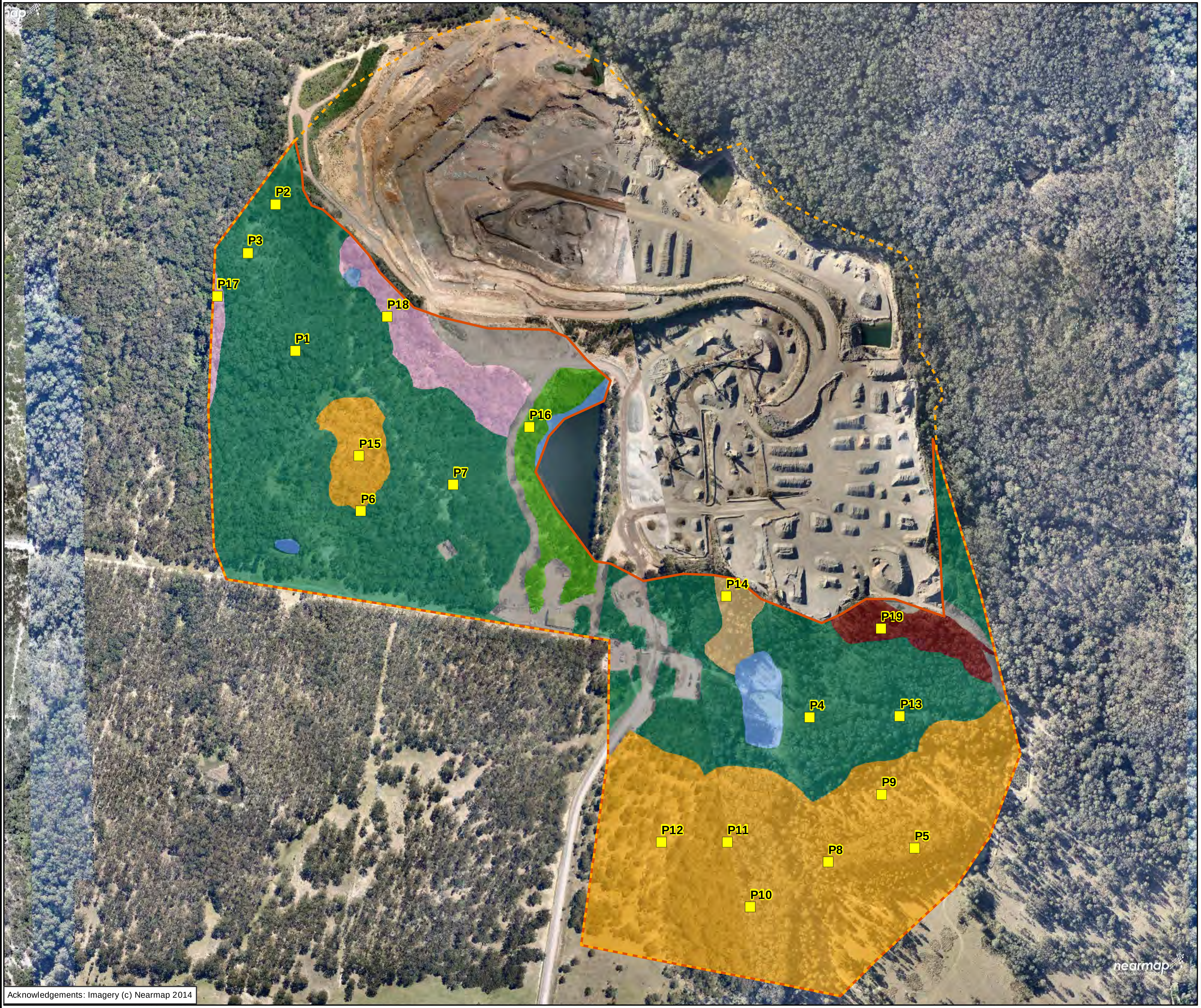
Vegetation zone	Plant community type	Area (ha)	Site score
01	HU814 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter (PCT 1600)	17.1	69.27
02	HU816 Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter (PCT 1602)	25.9	69.27
03	HU591 Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion (PCT 1064)	0.67	84.67
04	HU806 Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (PCT 1592)	1.12	68.23
05	HU812 Forest Red Gum grassy open forest on floodplains of the Lower Hunter (PCT 1598)	1.67	81.33
06	HU798 White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley (PCT 1584)	2.16	55.90

4.3 Threatened Ecological Communities

Two endangered ecological communities (EECs) listed under the TSC Act have been identified within the study area, including:

- . Swamp Sclerophyll Forest On Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (0.67 hectares).
- Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions (1.67 hectares).

Justification for the determination of these EECS is provided in Table 8 and Table 10 respectively.



Legend

- Study area
- Project area
- Flora plot and transect

Plant Community Types

- VZ1 - HU814 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter (PCT 1600)
- VZ2 - HU816 Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter (PCT 1602)
- VZ3 - HU591 Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin (PCT 1064)
- VZ4 - HU806 Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (PCT 1592)
- VZ5 - HU812 Forest Red Gum grassy open forest on floodplains of the Lower Hunter (PCT 1598)
- VZ6 - HU798 White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley (PCT 1584)
- Cleared
- Water

Figure 3: Vegetation Zones and BioBanking Plots/Transects

0 50 100 150 200 250

Metres

Scale: 1:5,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

biosis

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Melbourne, Sydney, Wangaratta & Wollongong

Matter: 23069
Date: 29 September 2016,
Checked by: EC, Drawn by: JMS/ANP, Last edited by: ngarvey
Location:P:\23000s\23069\Mapping
23069_F3_VegMapping_20160929

5 Threatened species

5.1 Methods

Initial flora and fauna assessments of the study area were undertaken in winter from the 11 to 15 August 2014 and in spring on the 13 and 14 November 2014. Additional targeted flora survey was completed on 12 – 13 October 2017. Weather observation for each survey data are shown in Table 13.

Table 13 Weather observations during flora and fauna surveys (Williamtown RAAF)

Survey date	Temperature (°C)		Rain (mm)
	Minimum	Maximum	
11 August 2014	4.6	15.3	0.2
12 August 2014	4.1	16.1	0
13 August 2014	8.8	17.2	0
14 August 2014	3.4	18.0	0
15 August 2014	6.3	18.5	0
13 November 2014	12.9	27.0	0
14 November 2014	14.9	40.1	0
12 October 2017	18.6	32.2	1.6
13 October 2017	12.5	27.9	0.2

5.1.1 Targeted threatened flora survey

Flora surveys have included a variety of survey techniques, including 20 x 20 metre quadrats, BioBanking plots/transect surveys, spot locations, random meanders and parallel transects. Targeted flora survey effort is shown in Figure 4.

The method for undertaking 20 x 20 metre quadrats and plots/transect surveys is outlined in Section 4.1.1. In addition, the site was traversed by random meander and included 14 person days across the entire study area.

Targeted survey for Rusty Greenhood *Pterostylis chaetophora* were undertaken on 12 October 2017 by Samuel Luccitti (Biosis) and Belinda Pignone (Hanson) and on 13 of October 2017 by Samuel Luccitti, Belinda Pignone and Alejandro Barreto (Biosis). Local flowering of Rusty Greenhood was confirmed prior to survey through a visit to a known population in the vicinity of the study area with OEH officers Steve Lewer and Paul Hellier.

Potential Rusty Greenhood habitat was identified based on a review of existing vegetation plot data, desktop review of the extent and topographic position of PCTs within the study area and subsequent field validation by Biosis ecologists. In consultation with OEH Assessment Officer Steve Lewer, a targeted survey plan covering areas of highest habitat potential was developed in accordance with NSW threatened plant survey guidelines (OEH 2016). Targeted surveys consisted of closely spaced (approximate 10 metres) parallel transects through suitable habitat.

5.1.2 Targeted threatened fauna survey

A habitat-based fauna assessment of the study area was undertaken in winter from the 11 to 15 August 2014, with an additional fauna assessment undertaken in spring on the 13 and 14 November 2014, to determine its values for fauna. These values were determined primarily on the basis of the types and qualities of habitat(s) present. All species of fauna observed during the assessment were noted and active searching for fauna was undertaken. This included direct observation, searching under rocks and logs, examination of tracks and scats and identifying calls. Particular attention was given to searching for threatened species and their habitats. Fauna species were recorded with a view to characterising the values of the study area.

Targeted surveys for fauna were undertaken in both August and November 2014, and included a wide variety of survey techniques consistent with the BBAM and the draft NSW *Threatened Biodiversity Survey and Assessment Guidelines* (DECC 2004). Targeted surveys were stratified on the basis of mapped vegetation zones and faunal habitats across the study area. Trap lines were located in the most suitable habitat for fauna (i.e largest areas of intact forest/woodland with understorey vegetation, shelter habitat etc).

This stratification method was considered adequate to achieve the objective of detecting targeted threatened fauna that may occur within the study area given:

- Trap lines were located in what was determined during initial habitat assessment as the habitat available for these species within the study area.
- The total areas covered by trap lines, spotlighting transects, biobanking transects (which were also diurnal bird survey points) and incidental traverses during the course of 3 surveys were considered to comprehensively assess all fauna habitat available within the study area.

Targeted surveys included survey within and adjacent to the study area to provide a context for any identified local populations given connectivity with larger areas of vegetation. Targeted survey methods and survey effort are outlined in Table 14, with survey locations shown in Figure 4.

Given a known Koala population occurs in the locality and individuals and scats were located during the winter and spring survey periods, a targeted Koala habitat assessment and survey was undertaken in accordance with the *EPBC Act Referral Guidelines for the vulnerable koala* (DoE 2014) using the Spot Assessment technique (SAT [Phillips and Callaghan 2011]). This assessment report is provided in Appendix 8.

Terrestrial fauna records will be submitted to OEH for incorporation into the NSW BioNet Wildlife Atlas and aquatic fauna records will be submitted to NSW DPI Fisheries.

Table 14 Summary of fauna survey effort.

Survey method	Target species	Description of survey methodology	Date	Survey effort	Adequacy against relevant guidelines
Elliot trapping	Brush-tailed Phascogale, Eastern Chestnut Mouse, Eastern Pygmy-possum, Common Planigale	A total of 25 small Elliot traps were placed approximately 10 metres apart along each of three transects, resulting in a total of 300 trap nights (75 traps x four nights). Elliot traps were baited with a mixture of peanut butter, rolled oats and honey.	11 to 15 August 2014	4 nights	In accordance with the recommended survey effort and methods outlined in the Threatened Biodiversity Survey and Assessment Guidelines (DECC 2004).
Motion-triggered cameras	Brush-tailed Phascogale, Eastern Chestnut Mouse, Eastern Pygmy-possum, Common Planigale	A total of six cameras were deployed for four nights during winter surveys (at each end of three Elliot trapping transects). A total of three cameras were deployed for two nights at various locations within the study area adjacent to dams (two cameras) and ephemeral drainage lines (1 camera). Cameras were baited with chicken carcasses.	11 to 15 August 2014	4 nights	Method used as an ethical alternative to cage trapping in accordance with the recommended survey effort and methods outlined in the Threatened Biodiversity Survey and Assessment Guidelines (DECC 2004).
Diurnal bird surveys	Red-backed Button-quail, Regent Honeyeater	A total of eight locations were surveyed in winter and eight locations (four of which were surveyed on two separate days) were surveyed in spring. Each diurnal bird survey was conducted for 0.5 hours by one ecologist. All birds seen and/or heard were recorded.	11 to 15 August 2014 and 12 to 14 November 2014	8 days	In accordance with the recommended survey effort and methods outlined in the following guidelines: • Threatened Biodiversity Survey and Assessment Guidelines (DECC 2004) • Survey guidelines for Australia's threatened birds (Commonwealth of Australia 2010)

Survey method	Target species	Description of survey methodology	Date	Survey effort	Adequacy against relevant guidelines
Nocturnal fauna surveys	Green and Golden Bell Frog, Barking Owl, Sooty Owl, Masked Owl, Powerful Owl, Bush Stone-curlew, Squirrel Glider, Yellow-bellied Glider, Koala, Spotted-tailed Quoll	Nocturnal fauna surveys consisted of spotlight transects and call playback. Spotlight searches for nocturnal amphibians, reptiles, birds and mammals were carried out along a total of three transects (surveyed from a moving vehicle) and at nine points (surveyed on foot). Spotlighting was undertaken by two ecologists using powerful (maximum 700 lumen) focused-beam hand-held torches. Call playback was employed at a total of 14 separate locations. Call playback involved playing of recorded calls of target threatened fauna species over a period of five minutes through a 10 watt minimum output megaphone. The broadcasting of calls was followed by a five minute listening period. Spotlighting was conducted following the final listening period.	12 and 13 August 2014 and 12 and 13 November 2014	6 nights	In accordance with the recommended survey effort and methods outlined in the following guidelines: • Threatened Biodiversity Survey and Assessment Guidelines (DECC 2004) • Threatened species survey and assessment guidelines: field survey methods – Amphibians (DECC 2009) • Survey guidelines for Australia's threatened amphibians, birds and mammals (Commonwealth of Australia 2010)
Ultrasonic call recording	Microbat species	Calls recorded were then analysed by a qualified and experienced ecologist, using appropriate software and call reference libraries.	12 and 13 November 2014	2 nights	In accordance with the recommended survey effort and methods outlined in the following guidelines: • Threatened Biodiversity Survey and Assessment Guidelines (DECC 2004)

Targeted Koala Surveys	Koala	Surveys were conducted by one ecologist with two field assistants for a maximum of eight hours per day. Points were selected systematically by overlaying a 200 metre interval grid over an aerial image of the study area. The intercept points of the grid were selected as potential survey sites. Potential survey points were discarded if they occurred in cleared land or within the quarry workings. A total of 29 points were surveyed. At each survey point searches for Koala scats within 1 metre of the trunk were undertaken of a central tree and the closest 29 surrounding trees with a diameter at breast height (DBH) for a maximum of two minutes. Each survey site was given a score based on the presence/absence of Koala scats at each tree. A map was then generated using this data showing relative levels of Koala activity as "High", "Medium" and "Low". In addition to scat searches, the central tree and all trees within a 25 metre radius (providing a total search area of 0.125 hectares) were surveyed for individual Koalas for a maximum of 5 minutes. The results of the Koala searches were used to determine a Koala population density estimate for the study area. The timing of the surveys was considered appropriate for detecting both Koalas and signs of Koala activity, as stipulated in the EPBC Act Referral Guidelines for the vulnerable koala (DoE 2014). The targeted survey was guided by key documents: • EPBC Act Referral Guidelines for the vulnerable koala (DoE 2014).	9 to 11 December 2014.	3 days	In accordance with the recommended survey effort and methods outlined in the following guidelines: • EPBC Act referral guidelines for the vulnerable koala (DoE 2014).

Survey method	Target species	Description of survey methodology	Date	Survey effort	Adequacy against relevant guidelines
		• The Spot Assessment Technique: a tool for determining localised levels of habitat use by Koalas Phascolarctos cinereus (Phillips and Callaghan 2011). • DRAFT NSW Threatened Biodiversity Survey and Assessment Guidelines (DEC 2004).			
Hollow-bearing tree and fallen log assessment	Pale-headed Snake	The relative abundance of hollow-bearing trees and fallen logs was obtained from within a total of 19 representative 20 x 50 metre plots across the study area using the BioBanking methodology. This methodology counts the total number of hollow-bearing trees within the plot, where hollows were visible from the ground. Fallen logs were recorded as the total length of logs ≥ 10 centimetre diameter within the plot. Active searching under rocks and logs and in hollows was undertaken to determine if any species were using these habitats.	11 to 15 August 2014 and 13 to 14 November 2014	7 days	In accordance with the BioBanking Assessment Methodology

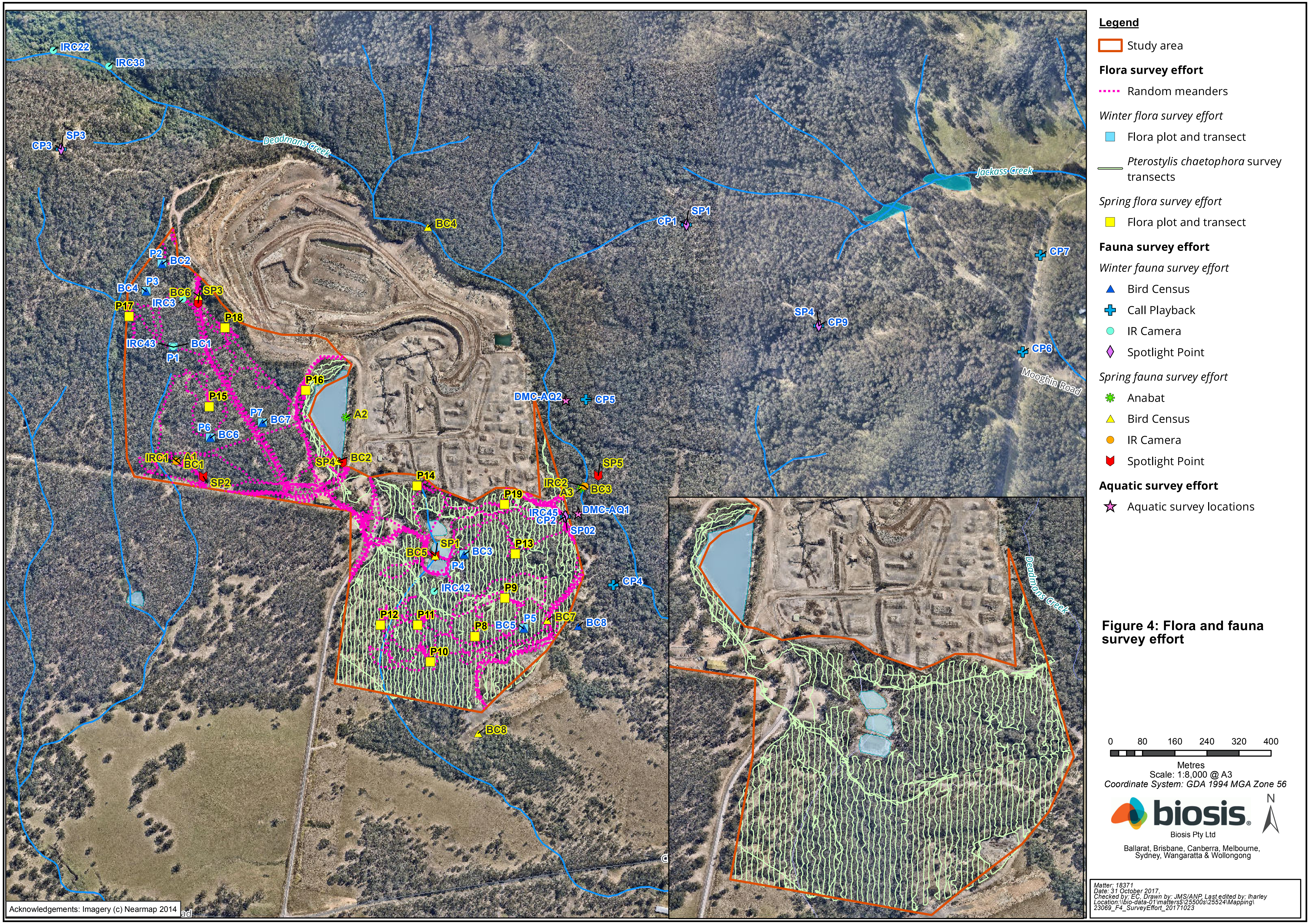


Figure 4: Flora and fauna survey effort

5.2 Geographic /habitat features

An assessment of the occurrence of geographic habitat features, in accordance with Section 6.3 of the BBAM (OEH 2014a), was undertaken along with a determination of whether impacts to these habitat features will result from the proposed development. The species generated by the calculator, along with the results of this assessment, are outlined in Table 15.

Table 15 Assessment of geographic habitat features within the study area.

Common name	Scientific name	Geographic feature present in study area	Feature	Justification
Green and Golden Bell Frog	*Litoria aurea*	Yes	land within 100 m of emergent aquatic or riparian vegetation	Suitable habitat present. Several permanent dams and Deadmans Creek support emergent and/or riparian vegetation.
Large-eared Pied Bat	*Chalinolobus dwyeri*	No	land containing escarpments, cliffs, caves, deep crevices, old mine shafts or tunnels	The study area does not support cliffs, caves, deep crevices or mine shafts suitable as roosting habitat for the Large-eared Pied Bat. The species was not recorded during targeted surveys in spring.
Heath Wrinklewort	*Rutidosis heterogama*	No	heath on sandy soils, or moist areas in open forest	The study area does not support heath on sandy soils or most areas in open forest.
Pale-headed Snake	*Hoplocephalus bitorquatus*	Yes	land within 40 m of watercourses, containing hollow-bearing trees, loose bark and/or fallen timber	Suitable habitat present. Riparian areas along Deadmans Creek to the east of the study area support hollow-bearing trees, loose bark and fallen timber.
Comb-crested Jacana	*Irediparra gallinacea*	No	land within 40 m of permanent wetlands with a good surface cover of floating vegetation	Although permanent waterbodies are present, these settling ponds do not support a good surface cover of floating vegetation.
Black Bittern	*Ixobrychus flavicollis*	No	land within 40 m of freshwater and estuarine wetlands, in areas of permanent water and dense vegetation or emergent aquatic vegetation	The study area does not support permanent wetlands with dense emergent aquatic vegetation

Common name	Scientific name	Geographic feature present in study area	Feature	Justification
Charmhaven Apple	*Angophora inopina*	No	land within 5 km of Wallaroo Nature Reserve in Upper Hunter CM	The study area is not located within 5km of Wallaroo Nature Reserve in Upper Hunter CMA. Not historically recorded within 5 kilometres of the study area.
Rusty Greenhood	*Pterostylis chaetophora*	Yes	land within seasonally moist, dry sclerophyll forest with a grass and shrub understorey.	Suitable habitat present. Several PCTs within the study area are dry sclerophyll forest with a grass and shrub understorey.

5.3 Ecosystem credit species

A list of ecosystem credit species predicted to occur within the study area, based on the PCTs present and generated by the calculator associated with the BBAM (OEH 2014a), along with an assessment of whether they occur within the study area is provided in Table 16. The potential for these species to occur within the study area was assessed in accordance with Section 6.3 of the BBAM (OEH 2014a).

Table 16 Assessment of ecosystem credit species within the study area.

Scientific Name	Common Name	TS offset multiplier	Habitat on site
Ninox connivens	Barking Owl	3	Yes
Melithreptus gularis* subsp. *gularis	Black-chinned Honeyeater (eastern subspecies)	1.3	Yes
Climacteris picumnus subsp. victoriae	Brown Treecreeper (eastern subspecies)	2	Yes
Stagonopleura guttata	Diamond Firetail	1.3	Yes
Falsistrellus tasmaniensis	Eastern False Pipistrelle	2.2	Yes
Mormopterus norfolkensis	Eastern Freetail-bat	2.2	Yes
Petroica phoenicea	Flame Robin	1.3	Yes
Callocephalon fimbriatum	Gang-gang Cockatoo	2	Yes
Calyptorhynchus lathami	Glossy Black-Cockatoo	1.8	Yes
Scoteanax rueppellii	Greater Broad-nosed Bat	2.2	Yes
Pomatostomus temporalis* subsp. *temporalis	Grey-crowned Babbler (eastern subspecies)	1.3	Yes
Melanodryas cucullata* subsp. *cucullata	Hooded Robin (south-eastern form)	1.7	Yes
Hieraaetus morphnoides	Little Eagle	1.4	Yes
Glossopsitta pusilla	Little Lorikeet	1.8	Yes
Tyto novaehollandiae	Masked Owl	3	Yes
Ninox strenua	Powerful Owl	3	Yes
Ptilinopus regina	Rose-crowned Fruit-dove	1.3	Yes
Petroica boodang	Scarlet Robin	1.3	Yes
Tyto tenebricosa	Sooty Owl	3	Yes
Chthonicola sagittata	Speckled Warbler	2.6	Yes
Dasyurus maculatus	Spotted-tailed Quoll	2.6	Yes
Petaurus norfolcensis	Squirrel Glider	2.2	Yes
Lathamus discolor	Swift Parrot	1.3	Yes

Scientific Name	Common Name	TS offset multiplier	Habitat on site
Neophema pulchella	Turquoise Parrot	1.8	Yes
Daphoenositta chrysoptera	Varied Sittella	1.3	Yes
Petaurus australis	Yellow-bellied Glider	2.3	Yes
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	2.2	Yes

The TS offset multiplier (or Tg value) for ecosystem credit species represents the ability of these species to respond to improvements in site or habitat values. Based on this assessment, all of the predicted ecosystem credit species are considered to have at least one habitat feature present within the study area, therefore the TS offset multipliers for each vegetation zone remain unchanged.

5.4 Species credit species

5.4.1 Flora species

A list of species credit species (flora) predicted to occur within the study area, based on the PCTs present, along with an assessment of whether the study area provides suitable habitat and whether the species will be impacted by the development is provided in Table 17. The potential for a species to occur within the study area was assessed in accordance with Section 6.5 of the NSW BBAM (OEH2014a).

A number of flora species were identified as candidate species for further assessment, in accordance with Section 6.5 of the NSW BBAM (OEH2014a). Targeted surveys for these species carried out as outlined in Section 5.1 did not record any threatened flora species within the study area.

Table 17 Species credit species (flora) and status within the study area

Common name	Scientific name	Habitat present in the study area	Justification	Recorded during targeted surveys	Impacted by development
Black-eyed Susan	*Tetratheca juncea*	Yes	Species not recorded during targeted survey in accordance with Section 6.6 of BBAM (OEH 2014a). No further assessment required.	No	No
Netted Bottle Brush	*Callistemon linearifolius*	No	Typically occurs in dry sclerophyll shrubby forest on sandstone. This associated vegetation was not present within the study area.	N/A	No
Slaty Red Gum	*Eucalyptus glaucina*	Yes	Species not recorded during targeted survey in accordance with Section 6.6 of BBAM (OEH 2014a). No further assessment required.	No	No
White-flowered Wax Plant	*Cynanchum elegans*	Yes	Species not recorded during targeted survey in accordance with Section 6.6 of BBAM (OEH 2014a). No further assessment required.	No	No
Rusty Greenhood	*Pterostylis chaetophora*	Yes	Species not recorded during targeted survey in accordance with Section 6.6 of BBAM (OEH 2014a). No further assessment required.	No	No

5.4.2 Fauna species

A list of species credit species (fauna) predicted to occur within the study area, based on the PCTs present, along with an assessment of whether the study area provides suitable habitat and whether the species will be impacted by the development is provided in Table 18. The potential for a species to occur within the study area was assessed in accordance with Section 6.5 of the BBAM (OEH 2014a).

A number of fauna species were identified as candidate species for further assessment, in accordance with Section 6.5 of the NSW BBAM (OEH 2014a). Targeted surveys for these species recorded the presence of Koala within the study area (refer to Appendix 8).

Table 18 Species credit species (fauna) and status within the study area.

Common name	Scientific name	Habitat present in the study area	Justification	Recorded during targeted surveys	Impacted by development
Brush-tailed Phascogale	*Phascogale tapoatafa*	Yes	Species not recorded during targeted survey in accordance with Section 6.6 of BBAM (OEH 2014a). No further assessment required.	No	No
Eastern Chestnut Mouse	*Pseudomys gracilicaudatus*	No	Suitable habitat in the form of heathlands, wet heath or swamps, does not occur within the study area.	N/A	No
Eastern Pygmy-possum	*Cercartetus nanus*	Yes	Species not recorded during targeted survey in accordance with Section 6.6 of BBAM (OEH 2014a). No further assessment required.	No	No
Golden Tipped Bat	*Kerivoula papuensis*	Yes	Species not recorded during targeted survey in accordance with Section 6.6 of BBAM (OEH 2014a). No further assessment required.	No	No
Green and Golden Bell Frog	*Litoria aurea*	Yes	Species not recorded during targeted survey in accordance with Section 6.6 of BBAM (OEH 2014a). No further assessment required.	No	No
Koala	*Phascolarctos cinereus*	Yes	Species recorded during targeted survey in accordance with Section 6.6 of BBAM (OEH 2014a). No further assessment required.	Yes	Yes
Pale-headed Snake	*Hoplocephalus bitorquatus*	Yes	Species not recorded during targeted survey in accordance with Section 6.6 of BBAM (OEH 2014a). No further assessment required.	No	No
Red-backed Button-quail	*Turnix maculosus*	No	Suitable habitat in the form of grasslands or grassy woodlands with an open ground layer near water are not present in the study area.	N/A	No
Regent Honeyeater	*Anthochaera phrygia*	Yes	Species not recorded during targeted survey in accordance with Section 6.6 of BBAM (OEH 2014a). No further assessment required.	No	No

5.4.3 Species polygon

The Koala was recorded within the study area during targeted surveys (see Appendix 8) and will be impacted by the Project. A species polygon was created in accordance with Section 6.5.1.19 of BBAM (OEH 2014a).

The Koala species polygon was determined using a combination of the Threatened Species Profile Database (TSPD) and targeted Koala survey results. Any PCTs where the Koala is predicted to occur by the TSPD, or any PCTs where more than 15 percent of the trees at any SAT location are considered Koala feed trees under State Environmental Planning Policy 44 – Koalas and Koala habitat (SEPP) or Port Stephens Council (2002) were mapped as Koala habitat.

The Koala species polygon is shown in Figure 5 and totals 45.8 hectares. This area was used to determine species credit requirements.

5.5 Aquatic habitat and threatened species

5.5.1 Aquatic survey methods

An aquatic habitat assessment (including *in situ* water quality measurement) was undertaken at two sites located along Deadmans Creek, adjacent to and downstream from the study area (Figure 4). The details of each site surveyed and the methods utilised are outlined below and shown in Table 19.

Water Quality Assessments

Water quality sampling was undertaken at two locations adjacent to the study area, one at the upstream extent and one immediately adjacent to the study area. The sampling site locations are outlined in Table 19. Sampling was carried out using a Horiba Multiparameter Water Probe, calibrated prior to sampling. Where possible, measurements were taken between 15 to 30 centimetres below the surface. Variables measured within Deadmans Creek included; pH, dissolved oxygen (DO), temperature, turbidity and electrical conductivity (EC). Water quality sampling provides an insight into current baseline conditions of aquatic habitats and assists in determining the suitability of habitats for fish and other aquatic biota.

Table 19 Water quality site codes and locations

Site Code	Location (decimal degrees)	Site Description
DMC-AQ1	-32.663236, 151.694585	Deadmans Creek at the upstream extent of the study area.
DMC-AQ2	-32.660686, 151.694286	Deadmans Creek alongside the study area.

Stream Order

The Strahler (1957) method was used to determine the stream order of Deadmans Creek flowing adjacent to the study area. The Maitland topographic map 1:25,000 (second edition 9232-4-S) was referred to when calculating stream order using the Strahler method.

HABSCORE

A HABSCORE assessment was completed at Deadmans Creek to provide a measure of the relative health of aquatic habitat. Barbour et al. (1999) describes HABSCORE as a 'visually based habitat assessment that evaluates the structure of the surrounding physical habitat that influences the quality of the water resource and the condition of the resident aquatic community'.

HABSCORE assessments utilise visually based habitat characteristics to classify the quality of the water resource and the condition of the resident aquatic community. HABSCORE's range from Poor to Optimal condition and reflect the current category condition of the water resource. Categories are derived from the sum of scores divided by the sum of the characters assessed. This provides an ecological indicator that produces information on the water resources available.

HABSCORE assessments are based on the presence and condition of the following features:

- Pool substrate characterisation.
- Pool variability.
- Channel flow status.
- Bank vegetation (score for each bank).
- Bank stability (score for each bank).
- Width of riparian zone (score for each bank).
- Epifaunal substrate / available cover.

The aquatic habitat within the study area was described in terms of four category types (Fairfull and Witheridge 2003, Barbour et al. 1999). The four categories used to evaluate habitat value were Optimal, Suboptimal, Marginal or Poor, as detailed below:

Optimal: watercourses that contain numerous large, permanent pools and generally have flow connectivity except during prolonged drought. They provide extensive and diverse aquatic habitat for aquatic flora and fauna;

Suboptimal: watercourses that contain some larger permanent and semi-permanent refuge pools, which would persist through prolonged drought although, become greatly reduced in extent. These watercourses should support a relatively diverse array of aquatic biota including some fish, freshwater crayfish and aquatic macroinvertebrates. There may also be some aquatic plant species present;

Marginal: watercourses that contain some small semi-permanent refuge pools which are unlikely to persist through prolonged drought. Flow connectivity would only occur during and following significant rainfall. These pools may provide habitat for some aquatic species including aquatic macroinvertebrates and freshwater crayfish; and,

Poor: water courses or drainages that only flow during and immediately after significant rainfall. Permanent or semi-permanent pools that could provide refuge for aquatic biota during prolonged dry weather are absent.

General observations were also recorded, including water characteristics such as flow rates and colour, the presence of spawning areas (e.g. gravel beds, riparian vegetation, snags), refugia (e.g. deep pools) and presence of natural or artificial barriers to fish passage and the type of existing waterway crossing (roads/culverts) if present.

5.5.2 Aquatic results

Site description

Deadmans Creek is ephemeral in nature and measured approximately two metres in width from bank to bank and 25 centimetres in depth from top of bank at the sampling locations adjacent to the study area. The creek was also assessed approximately 1.5 kilometres upstream of the study area but was found to be dry. The channel contained little in the way of true macrophytes; however large tussocks of Spiny-headed Mat-rush were recorded along the banks and in the channel. The substrate was predominantly sandy with a small amount of gravel and pebble material throughout. Some larger pools were scattered along the creek, however the channel was predominantly shallow with little flow at the time of survey. The riparian vegetation was dense in all strata, with an overstorey per cent foliage cover of approximately 60 per cent. Native Blackthorn formed a dense shrub stratum, with some large infestations of Lantana throughout the riparian corridor. Seasoned snags were uncommon; however, there were some leaf packs and smaller woody debris recorded. Undercut banks and overhanging vegetation provide sheltering habitat for fish, along the majority of the wetted creek.

Plate 4 DMC-AQ1 facing downstream

Plate 5 DMC AQ2 facing upstream

Fish habitat

The aquatic assessment focused on Deadmans Creek, a third order tributary (Strahler 1957) of Williams Creek which flows south to its confluence with the Hunter river approximately 10 kilometres south of the study area. Deadmans Creek is considered to provide Key Fish Habitat as defined by the NSW DPI (2014b) and is classified as a Class 3 minimal fish habitat, being a third order creek sustaining ephemeral flow and semi - permanent pools providing habitat for aquatic species (Fairfull and Witheridge 2003).

Aquatic fauna

Given that the survey effort focused on a habitat-based aquatic assessment, with no targeted surveys, aquatic fauna encounters were limited to incidental observations. As such, no aquatic fauna was recorded during the field survey. However, the survey resulted in general observations on the availability of limited habitat for aquatic fauna. Some shelter and nursery habitat was found to be available in the surveyed reach; however this is considered to be of limited value given the ephemeral nature of the creek. At the time of the spring survey, Deadmans Creek was found to be dry. Further, there were no disconnected pools to provide fish habitat during these drier months.

There are no FM Act listed threatened fish species previously recorded or are predicted to occur within the study area, therefore, a targeted aquatic habitat assessment was not required or undertaken. Instead, a more general habitat assessment was completed to determine any particular aquatic constraints and condition of Deadmans Creek as well as the manmade storage and settlement dams. It is important to note that Deadmans Creek falls outside the expansion area and flow impacts on the stream were already assessed in an aquatic ecological impacts and mitigation advice.

HABSCORE

The habitat features at both the upstream and downstream sampling locations are considered to be Optimal as assessed using the HABSCORE habitat assessment methodology (Barbour et al. 1999). The summary of results for the HABSCORE analysis is shown in Table 20.

Table 20 HABSCORE results for the surveyed reach

Characteristic	Score	
	DMC-AQ1	DMC-AQ2
Low Gradient		
Pool substrate characterisation	17	17
Pool variability	16	12
High and Low Gradient		
Channel Flow Status	16	14
Bank vegetation – Left	9	9
Bank vegetation – Right	8	8
Bank Stability – Left	9	9
Bank Stability - Right	9	9
Width of riparian zone – Left	10	10
Width of riparian zone - Right	9	8
Epifaunal substrate / available cover	17	15
HABSCORE Result	86%	79%
Rating	Optimal	Optimal

1 < 25 – Poor, 26 to 50 – Marginal, 51 to 75 – Suboptimal, >76 – Optimal

High scores were recorded for the majority of parameters at both sampling locations. The riparian vegetation score was high due to the presence of relatively undisturbed remnant bush land to the east of Deadmans Creek (left bank). The banks were generally well vegetated with few areas of bare ground. These well vegetated banks were generally stable with a looser sand substrate causing instability in some areas, particularly where erosion was evident. The pool variability score was lower at DMC-AQ2 where the reach was characterised by shallower sections of slow flow. The presence of some snags and leaf litter in conjunction with some overhanging riparian vegetation provides habitat for epifauna. The pool substrate composition was also generally high owing to the good mix of substrate sizes and the presence of cobble, pebble and gravels at both sites.

Water Quality

The physio-chemical water quality results for this survey are detailed in Table 21. The water quality data is compared with guideline values including ANZECC guidelines for the Protection of Aquatic Ecosystems (ANZECC 2000).

The weather during the survey was seasonally warm and sunny with cool water temperature of around 11 degrees. Oxygenation, turbidity and electrical conductivity levels were found to be within the ANZECC guidelines for lowland rivers. The pH values were within ANZECC guidelines for DMC-AQ1 but very slightly higher for DMC-AQ2.

Table 21 ANZECC guidelines and water quality data for the two assessment sites

Parameter	ANZECC Guideline	DMC-AQ1	DMC-AQ2
Temp (°C)	-	11.15	10.96
pH	6.5 – 8	7.97	8.06
Conductivity (mS/cm)	0.125-2.2	0.897	1.03
D.O. (ppm)	-	11.65	10.17
Saturation (%)	85– 110	109.6	95.2
Turbidity (NTU)	6 – 50	15.9	7.4

The water quality parameters measured provide a snapshot of conditions at a given point in time. Some of these parameters typically exhibit a high degree of temporal variation and can change substantially over small periods of time such as weeks, days and even hours, particularly in response to significant rainfall events. A second replicate of both the water chemistry data and HABSCORE was due to be collected during the spring survey effort; however Deadmans Creek was found to be dry along the entire length of the study area. It is likely that this was due to environmental factors as rainfall was below average for September, October and November.

Stage 2 – Impact assessment (biodiversity values)

6 Impact assessment (biodiversity values)

This section identifies the potential impacts of proposed development on the ecological values of the study area and includes recommendations to assist Hanson to design and construct a development that minimises impacts on biodiversity within and surrounding the study area.

This impact assessment is based on clearing of native vegetation and fauna habitat. It includes an assessment of all potential impacts arising from the Project, during construction and ongoing operation.

6.1 Avoidance and minimisation

6.1.1 Recommendations to avoid, minimise and mitigate impacts

Hanson has endeavoured to avoid and minimise ecological impacts associated with the proposed Project. Hanson has assessed the feasibility of using alternative quarry material, sites, extraction boundaries, operating hours and operation, and has endeavoured to avoid or minimise Project impacts, whilst maximising the economic recovery associated with material extraction. Table 22 outlines the recommended measures to be implemented before, during and after construction to avoid, minimise and mitigate the impacts of the Project, including action, outcome, timing and responsibility.

Table 22 Recommendations to minimise ecological impacts

Ecological Values	Project Impacts	Recommendations / Mitigation Measures	Responsibility
Native vegetation clearance	Removal of 48.62 hectares of native vegetation.	• Biodiversity Management Plan (BMP) to be prepared to outline the clearance procedure. • Pre clearance surveys will be conducted prior to any vegetation clearance in areas of identified threatened species habitat to ensure that threatened species are not present prior to vegetation removal. • Vegetated boundaries of the Project area to be clearly fenced off and signposted to ensure no access from personnel or equipment. • Exclusion fencing to be discussed during all site inductions. • Exclusion fencing to be routinely checked by quarry personnel. • Exclusion fence footings to be free of stockpiles soils and vegetation to allow routine checks and to ensure that the boundary fence and adjoining vegetation e.g. root zones of trees to be retained does not get smothered with soil. • A Biodiversity Offset Strategy has been prepared to offset the residual impacts to biodiversity arising from the Project (Section 8).	Environmental representative Project Ecologist
Impacts to Threatened Ecological Communities and threatened species habitat	• Removal of 0.67 hectares of Swamp Sclerophyll Forest. • Removal of 1.67 hectares of Hunter Lowland Redgum Forest. • Removal of 45.8 hectares of Koala habitat.	• BMP to be prepared to outline measures to avoid or mitigate impacts to EECs. • Pre clearance surveys will be conducted prior to any vegetation clearance to confirm presence/absence of EEC's prior to removal • A Biodiversity Offset Strategy has been prepared to offset the residual impacts to biodiversity arising from the Project (Section 8).	Environmental representative Project Ecologist
Adjoining vegetation and waterways	Erosion and sedimentation	• Hanson to develop a strict erosion and sediment control plan for the expansion to ensure that erosion and sediment is contained on site. • Sediment fencing to be placed inside the exclusion fencing and routinely checked for sediment breeches and to ensure structural integrity is maintained through vegetation clearance activities.	Environmental representative

Ecological Values	Project Impacts	Recommendations / Mitigation Measures	Responsibility
Koala	Displacement, loss of habitat and fatality of Koalas during construction and operation.	• BMP to be prepared to outline the clearance procedure, protocols for Koala finds and incidents and include an educational brochure for all workers to review prior to working at BHQ. • Ecologist to undertake pre-clearance surveys immediately prior to the removal of any vegetation to give the clearance go ahead. • Ecologist or fauna rescuer to be present during vegetation clearing to minimise impacts on Koalas displaced or injured during clearing. • A Biodiversity Offset Strategy has been prepared to offset the residual impacts to biodiversity arising from the Project (Section 8). • Fencing around remnant native vegetation. • Comply and enforce site speed limits. • Maintain general adherence to constructed site haul roads.	Environmental representative/Project Ecologist
Threatened fauna	Displacement, loss of habitat and fatality of threatened fauna during construction and operation.	• BMP to be prepared to outline the clearance procedure, protocols for threatened fauna finds and incidents and include an educational brochure for all workers to review prior to working at BHQ. • Ecologist to undertake pre-clearance surveys in accordance with the BMP immediately prior to the removal of any vegetation to give the clearance go ahead. • Ecologist or fauna rescuer to be present during vegetation clearing to minimise impacts on threatened fauna displaced or injured during clearing. • A Biodiversity Offset Strategy has been prepared to offset the residual impacts to biodiversity arising from the Project (Section 8).	Environmental representative/Project Ecologist
Pests and pathogens	Spread of noxious weeds due to soil disturbance and equipment movement. Spread of pathogens to adjoining native vegetation or fauna.	• Noxious weeds, including Fire weed and Pampas Grass recorded within vegetation clearance areas to be removed and management outlined in a BMP. These noxious weeds must be removed and appropriately disposed of in an appropriate waste facility as required by NSW DPI through the Port Stephens Council under the NW Act. • BMP to outline pathogen management controls associated with vehicle movements and vegetation clearance	Environmental representative

Ecological Values	Project Impacts	Recommendations / Mitigation Measures	Responsibility
In stream / aquatic habitat	Loss of, or alterations to, aquatic / in-stream habitat within and in the vicinity of the study area via hydrological change, deterioration in water quality, sedimentation and creation of threatened barriers to fish and other aquatic biota. Changes to aquatic fauna community structures due to alterations degradation/loss of riparian and in stream habitat.	• Within a relevant management plan, develop water management actions to prevent or mitigate the discharge of contaminated water arising from increased quarrying operations and manage potential water quality associated with new infrastructure. • Where possible, implement a minimum 30 metre buffer to Deadmans creek to the east of the study area. • Minimise the removal of native vegetation adjacent to waterbodies and watercourses. The existing dams to be developed would be excluded.	Environmental representative
Water quality downstream	Downstream impacts to the Hunter River.	• It is recommended for the appropriate plan for the site to include water quality management strategies in accordance with the ANZECC and ARMCANZ Guidelines (2000). • Water quality management strategies to cover management of water storage, dewatering and discharge of water to Deadmans Creek.	Environmental representative
Adjoining vegetation and fauna	24-hour operation causing noise, dust, vibration and lighting impact	• Lighting associated with night works to be directed away from adjoining vegetation. • Heavy vehicle/machinery use to be limited to standard hours of operation as per Project Approval conditions.	Environmental representative

The final Project footprint (impact area) is the entire study area, as shown in Figure 5.

6.1.2 Residual impacts

Following the implementation of the aforementioned mitigation measures, the residual impacts to biodiversity include:

- The removal of 48.62 hectares of native vegetation.
- The permanent removal of 1.67 hectares of HU812 – Forest Red Gum grassy open forest on floodplains of the lower Hunter (PCT 1598), equivalent to Hunter Lowland Redgum Forest EEC (TSC Act only).
- The permanent removal of 0.67 hectares of HN591- Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion (PCT 1064), equivalent to Swamp Sclerophyll Forest on CoastalEEC (TSC Act).
- Removal of 45.8 hectares of Koala habitat.

6.2 Impact summary

6.2.1 Impact to Red Flag areas

This section identifies red flag areas in accordance with Section 9.2 of the NSW Biobanking Assessment Methodology (OEH 0214). Red flag areas are mapped in Figure 5.

Landscape features

The study area does not support any 4th, 5th or 6th order streams, estuarine areas, important wetlands, or state or regional biodiversity links.

Native vegetation

HN591- Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion (PCT 1064) and HU812 – Forest Red Gum grassy open forest on floodplains of the lower Hunter (PCT 1598) have been mapped within the study area. HU591 and HU812 are equivalent to Swamp Sclerophyll Forest on Coastal Floodplain Forest and Hunter Lowland Redgum Forest respectively and both TECs under the TSC Act. Furthermore these PCTs are estimated to be more than 70 per cent cleared within the Hunter/Central Rivers CMA and are therefore eligible for red flag status for both of these criteria.

No other areas were red flags, as they are not considered >EECs and are less than 70 per cent cleared.

Threatened species and populations

The study area does not support threatened species or populations that cannot withstand further loss, a threatened species not previously recorded in the IBRA subregion or critical habitat listed under Section 55 of the TSC Act.

6.2.2 Highly cleared vegetation types

The BBAM defined highly cleared vegetation types as any PCT that is more than 90 per cent cleared within the relevant major catchment area. All PCTs identified on site are less than 75 per cent cleared within Hunter/Central Rivers major catchment area, therefore the Project will not impact on any highly cleared vegetation types.

6.2.3 Impacts to Plant Community Types

This section provides an assessment of PCTs requiring offsets in accordance with Section 9.3 of the BBAM (OEH2014a). PCTs requiring offsets are mapped in Figure 5.

Six Management Zones (identical to the Vegetation Zones) have been delineated (Table 23), based on the PCT, condition and future land use.

Table 23 Impacts to Plant Community Types, including Management Zones

Management zone	Vegetation zone	Total area (ha)	Plant Community Type	Condition	Ancillary code
MZ01	1	17.1	HU814 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter (PCT 1600)	Moderate/ Good	No ancillary code assigned
MZ02	2	25.9	HU816 Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter (PCT 1602)	Moderate/ Good	No ancillary code assigned
MZ03	3	0.67	HU591 Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin (PCT 1064)	Moderate/ Good	No ancillary code assigned
MZ04	4	1.12	HU806 Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (PCT 1592)	Moderate/ Good	No ancillary code assigned
MZ05	5	1.67	HU812 Forest Red Gum grassy open forest on floodplains of the Lower Hunter (PCT 1598)	Moderate/ Good	No ancillary code assigned
MZ06	6	2.16	HU798 White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley (PCT 1584).	Moderate/ Good	No ancillary code assigned

All vegetation within the development site and associated management zones (Figure 5, Table 23) will be cleared, with all site attribute scores set to 0 to represent total loss.

6.2.4 Impacts to threatened species

This section provides an assessment of threatened species requiring offsets in accordance with Section 9.3 of the BBAM (OEH2014a).

Based on the outcomes of Section 5.4, offsets are required for loss of 45.8 hectares of known habitat for Koala. The quantum of credits is outlined in Section 7. No other threatened species were determined to require offsets.

6.2.5 Areas not requiring assessment

This section provides an assessment of those areas that do not require an offset in accordance with Section 9.4 of BBAM (OEH 2014a). These areas include the following:

- Cleared areas that have been subject to varying levels of disturbance.
- Water bodies are considered areas not requiring assessment.
- These areas are shown in Figure 5 and do not require further assessment.

Legend

- Project area
- Study area
- Areas not requiring assessment
- Red flag area

Vegetation requiring offsets

- VZ1 - HU814 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter (PCT 1600)
- VZ2 - HU816 Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter (PCT 1602)
- VZ3 - HU591 Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin (PCT 1064)
- VZ4 - HU806 Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (PCT 1592)
- VZ5 - HU812 Forest Red Gum grassy open forest on floodplains of the Lower Hunter (PCT 1598)
- VZ6 - HU798 White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley (PCT 1584)

Species polygon

- Koala

Figure 5: Impact summary for the Project

0 50 100 150 200 250

Metres

Scale: 1:5,500 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Melbourne, Sydney, Wangaratta & Wollongong

Matter: 18371
Date: 30 September 2016,
Checked by: EC, Drawn by: JMS/ANP, Last edited by: ngarvey
Location:P:\23000s\23069\Mapping\23069_F5_ImpactSummary_20160920

7 Biodiversity credits

This section provides a summary of biodiversity credits required to impact on the biodiversity values within the study area, following consideration of measures to avoid, minimise and mitigate impacts.

Table 24 provides a summary of ecosystem credits resulting from the proposed development while Table 25 provides a summary of species credits resulting from the proposed development. The full credit profile is provided in Appendix 7.

Table 24 **Summary of ecosystem credits for all management zones**

Vegetation Zone	PC type code	Plant community type name	Red flag	Management zone area (ha)	Loss in landscape value	Loss in site value score	EEC offset multiplier	Credits req for TS	TS with highest credit req	TS offset multiplier	Ecosystem credits required
VZ1	HU814	Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter	No	17.1	22.40	69.27	1	984	Barking Owl	3	984
VZ2	HU816	Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	No	25.9	22.40	69.27	1	1491	Barking Owl	3	1491
VZ3	HU591	Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	Yes	0.67	22.40	84.67	3	46	Sooty Owl	3	46
VZ4	HU806	Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	No	1.12	22.40	68.23	1	64	Barking Owl	3	64
VZ5	HU812	Forest Red Gum grassy open forest on floodplains of the lower Hunter	Yes	1.67	22.40	81.33	3	111	Barking Owl	3	111
VZ6	HU798	White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	No	2.16	22.40	55.90	1	103	Barking Owl	3	103

Table 25 Summary of species credits for all management zones

Scientific name	Common name	Species polygon area (ha)	Red flag	TS offset multiplier	Species credits required
Phascolarctos cinereus	Koala	45.8	No	2.6	1191

8 Biodiversity Offset Strategy

8.1 Credit requirements

A total of 2799 ecosystem credits would be required to offset the impacts of the Project, as shown in Table 26.

Table 26 Ecosystem credits required to offset impacts of the Project

PC type code	Plant community type name	Management zone area (ha)	Ecosystem credits required
HU814	Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter	17.1	984
HU816	Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	25.9	1491
HU591	Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	0.67	46
HU806	Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	1.12	64
HU812	Forest Red Gum grassy open forest on floodplains of the lower Hunter	1.67	111
HU798	White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	2.16	103
TOTAL			**2799**

A total of 1191 Koala species credits would be required to offset the impacts of the Project, as shown in Table 27.

Table 27 Species credits required to offset impacts of the Project

Common name	Scientific name	Extent of impact (individuals)	Species credits required
Koala	*Phascolarctos cinereus*	45.8	1191
TOTAL			**1191**

8.2 Offset strategy

The Biodiversity Offset Strategy for the proposal would include the purchase and retirement of the required biodiversity credits. In line with the Secretary's Environmental Assessment Requirements issued on 11 November 2014 the Project is being assessed under the *NSW OEH interim policy on assessing and offsetting biodiversity impacts, State significant development (SSD) and State significant infrastructure (SS/) projects* (OEH 2011). Using these criteria credits are available for all PCTs within the study area. Credit requirements and proposed offset options are shown in Table 28. This includes an assessment of which tier of the OEH (2011) policy is being met.

Table 28 Required biodiversity credits and proposed offset options

Credit requirements				Offset options			
Ecosystem credits							
PCT code	**PCT name**	**Red flag?**	**Credits required**	**PCT code**	**PCT name**	**Credits available**	**Tier**
HU814	Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter	No	984	HU802	Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast	160	1
				HU815	Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter	55	1
				HU804	Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	769	1
HU816	Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	No	1491	HU804	Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	46	1
				HU804	Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	15	1
				HU815	Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter	295	1
				HU816	Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	1135	1

Credit requirements				Offset options			
HU591	Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	Yes	46	NR217	Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	46	3
HU806	Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	No	64	HU804	Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest, (HU804)	64	1
HU812	Forest Red Gum grassy open forest on floodplains of the lower Hunter	Yes	111	NR217	Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	45	3
				NR254	Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	66	3
HU798	White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	No	103	HU798	White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	103	1
Species credits							
Koala		No	1191	Koala		1191	1

Where possible, credits have been provided to meet Tier 1 (improve or maintain) outcome outlined in the interim policy (OEH 2011). This was achieved by providing credits as per the offset options outlined in the BioBanking credit report (Appendix 7). The offset strategy will fulfil the Tier 1 requirements for four of the six PCTs recorded within the study area.

Due to the presence of two EECs with a site value score of more than 34 (red flags) within the study area Tier 1 offsets could not be provided for HU591 and HU812. For these communities Tier 2 (no net loss) offsets were investigated. However, no offsets that meet the offset options outlined in the BioBanking credit report (Appendix 7) were found to be available. For these two PCTs variation criteria A, as outlined in the interim policy (OEH 2011) was applied to achieve a Tier 3 (mitigated net loss) outcome. Credits from the same vegetation formation and the same IBRA region were investigated. Both PCTs are part of the Forested Wetlands vegetation formation, and the study area is located within the NSW North Coast IBRA region. Preliminary offset investigations have identified available credits which satisfy the Project's offsetting requirements.

Koala credits will be purchased, fulfilling a Tier 1 outcome. This will ensure any offsets for the Koala fulfil the direct offset requirements of the EPBC Act Environmental Offsets Policy (DSEWPaC 2012)

Therefore, the variation rules do not apply.

All credit requirements can be fulfilled by purchasing and retiring credits. Upon approval Hanson proposes to fulfil its credit obligations.

9 Assessment of biodiversity legislation

9.1 Environment Protection and Biodiversity Conservation Act 1999

An assessment of the impacts of the proposed development on Matters of NES, against heads of consideration outlined in Matters of National Environmental Significance - Significant Impact Guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999 (DoE 2013), was prepared to determine whether referral of the Project to the Commonwealth Minister for the Environment is required. Matters of NES relevant to the Project are summarised in Table 29.

Table 29 Assessment of the Project against the EPBC Act.

Matter of NES	Project specifics	Potential for significant impact
Threatened species (flora and fauna)	Background research indicates that 15 flora species and 17 fauna species have been recorded or are predicted to occur in the locality. An assessment of the likelihood of these species occurring in the study area is provided in Appendix 5; Table 35 (flora) and Table 36 (fauna). This assessment determined that two flora species and three fauna had a moderate likelihood of occurrence in the study area, with one additional fauna species having a high likelihood of occurrence in the study area. The Koala was considered to have a high likelihood to occur and was recorded within the study area. The rest of these species are not considered to have a medium or high likelihood of occurrence within the study area.	The following threatened biota are considered to have the potential to occur within the study area: • Small-flower Grevillea • Tall Knotweed • Regent Honeyeater • Spotted-tailed Quoll • Swift Parrot • Grey-headed Flying-fox SIC assessments were prepared for these species (Appendix 6). These assessments determined that a significant impact was unlikely to result from the Project. The Koala was recorded within the study area and a SIC assessment was prepared (Appendix 6). This assessment concluded a significant impact was likely; hence an EPBC Referral has been prepared and submitted to DoEE and the project has been declared a controlled action. In accordance with the EPBC Act Offsets Policy (DSEWPaC 2012), offsets will be provided for this species. Credits are not required for any other species as the project will not result in a significant impact.
Threatened ecological communities	No EPBC Act EECs were recorded within the study area.	N/A
Migratory species	Thirty-one migratory species have been recorded or are predicted to occur in the locality (Table 37).	While some of these species would be expected to use the study area on occasion, some may do so regularly and others may be resident, the study area

Matter of NES	Project specifics	Potential for significant impact
		does not provide important habitat for an ecologically significant proportion of any of these species.
Wetlands of international importance (Ramsar sites)	There are 12 Ramsar sites in NSW, the closest to the study area being the Hunter Estuary Wetlands within the estuary at the mouth of the Hunter River.	The study area is located approximately 18 kilometres northwest of this Ramsar site and Deadmans Creek is a tributary of the Hunter River. However, as an ephemeral creek line, it is considered unlikely that the Project will have any direct impacts on this Ramsar Site. Deadmans Creek is also considered to provide only a minor contribution of flow into this Ramsar Site.

On the basis of potential for significant impacts on the Koala, the EPBC Act is triggered and referral of the proposed action to the Australian Government Minister for the Environment has been undertaken. The Project has been deemed a controlled action and is currently being assessed by DoEE.

9.2 Fisheries Management Act 1994

Based on the proposed impact area, and the lack of impact on waterways, no FM Act KTPS were considered to be relevant to the Project.

9.3 Noxious Weeds Act 1993

Exotic species were recorded across the entire study area and were particularly abundant at the southern extent. Two weeds listed as noxious within the Port Stephens LGA were recorded, the class and legal requirements of which are outlined in Table 30. Treatment for the noxious weeds listed above is recommended within NSW DPI (2011).

Table 30 Noxious weeds recorded within the study area.

Common Name	Scientific Name	Class	Legal Requirement
Pampas grass	*Cortaderia species*	3	*The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed*
Fireweed	*Senecio madagascariensis*	4	*The plant must not be sold, propagated or knowingly distributed*

10 Conclusion

This assessment has been completed in accordance with the BBAM (OEH 2014a) on behalf of Hanson.

The biodiversity assessment report of the BHQ SSD Project found that a total of 48.62 hectares native vegetation, comprising six PCTs and two EECs, and associated ecological values are likely to be impacted as result of the Project. The Project will result in impacts to 45.8 hectares of Koala habitat. In addition, the Project area falls close to one of the creek meanders of Deadmans Creek outside the study area, which ultimately joins with the Hunter River. Ecological values of the study area are outlined in Section 4.2, 5.3, 5.4, and 5.5.

The primary measure for the development to minimise impacts to ecological values outlined above is to avoid, where possible, any impact to surrounding adjoining vegetation and offset remaining residual impacts. Residual impacts, following implementation of recommendations to avoid and minimise impact are outlined in Section 6.1.

Impacts are summarised in Section 6.2. Ecosystem credits for all PCTs and species credits for the Koala will be required to offset the residual impacts of the Project. The impacts to native vegetation and species habitat will require retirement of 2799 ecosystem credits across six PCTs, and 1191 Koala credits, as summarised in Table 31.

Table 31 Summary of ecosystem credits requirements

PCT code	Plant community type name	Ecosystem credits required
HU814	Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter	984
HU816	Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	1491
HU591	Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	46
HU806	Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	64
HU812	Forest Red Gum grassy open forest on floodplains of the lower Hunter	111
HU798	White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	103
Koala	Koala	1191

A Biodiversity Offset Strategy has been prepared and is presented in Section 8. Hanson propose to meet their credit requirements by purchasing and retiring credits under the NSW BioBanking scheme. Upon approval Hanson proposes to fulfil its credit obligations.

An assessment of the Project against the requirements of key biodiversity legislation concluded that the Project will result in a significant impact to the Koala. Since the project has been deemed a controlled action under the EPBC Act, the project will require approval from the Commonwealth Department of Environment and Energy.

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Appendices

Appendix 1 Survey methods

A1.1 Nomenclature

The flora taxonomy (classification) used in this report follows the most recent Flora of NSW (Harden 1990, Harden 1991, Harden 1992, Harden 1993, Harden 2002). All doubtful species names were verified with the on-line Australian Plant Name Index (Australian National Botanic Gardens 2007). Flora species, including threatened species and introduced flora species, are referred to by both their common and then scientific names when first mentioned. Subsequent references to flora species cite the common names only, unless there is no common name, for which scientific name will be used. Common names, where available, have been included in threatened species tables and the complete flora list in Appendix 3.

Names of vertebrates follow the Census of Australian Vertebrates (CAVs) maintained by the Commonwealth Department of Environment (DoE) (DEWHA 2009a). In the body of this report vertebrates are referred to by both their common and scientific names when first mentioned. Subsequent references to these species cite the common name only.

A1.2 Permits and lisences

The flora and fauna assessment was conducted under the terms of Biosis' Scientific Licence issued by the Office of Environment and Heritage under the National Parks and Wildlife Act 1974 (SL100758, expiry date 31 March 2017). Fauna survey was conducted under approval 11/355 from the NSW Animal Care and Ethics Committee (expiry date 31 January 2017). The BioBanking Assessment was carried out by Accredited BioBanking Assessor Nathan Garvey (No. 0103).

Aquatic fauna survey was conducted under NSW DPI Fisheries - Licence Numbers PO05/0016 & OUT10/4198, NSW National Parks and Wildlife Act 1974 - License Number S10318 and a Certificate of Approval under the NSW Animal Research Act 1985.

A1.3 Limitations

Ecological surveys provide a sampling of flora and fauna at a given time and season. There are a number of reasons why not all species will be detected at a site during survey, such as species dormancy, seasonal conditions, ephemeral status of waterbodies and migration and breeding behaviours of some fauna. In many cases these factors do not present a significant limitation to assessing the overall biodiversity values of a site.

The current flora and fauna assessment was conducted in winter and spring during typical seasonal conditions considered adequate for the detection of target threatened species.

Database searches, and associated conclusions on the likelihood of species to occur within the study area, are reliant upon external data sources and information managed by third parties.

Appendix 2 Native vegetation data (BioBanking)

A2.1 Plot and transect summary

Table 32 Plot scores for each vegetation zone within the development site

Benchmark details	Site value score	Site attributes											
		Native plant species	Native over-storey cover	Native mid-storey cover	Native ground cover (grass)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Over-storey regen	Total length of fallen logs	Degraded (yes/no)	Out of benchmark
Vegetation zone 1													
Benchmark	N/A	>=38	15.0 to 40.0	4.0 to 40.0	30.0 to 60.0	3.0 to 15.0	10.0 to 25.0	N/A	>=1	1.00	>=10		
Plot 5	72.4	29	27.5	8.5	64	0	10	0	0	1	0		
Plot 8		26	30.5	1	74	2	18	0	0	1	0		
Plot 9		25	18	1	80	0	24	0	0	1	6		
Plot 10		28	32	3	62	10	28	11	0	1	54		
Plot 11		29	32.5	26.5	68	24	14	28	0	1	37		
Plot 12		20	23.5	0	90	2	26	6	0	1	6		
Plot 15		41	22.5	17.5	80	18	16	7	1	1	6		
Vegetation zone 2													
Benchmark	N/A	>=38	15.0 to 40.0	4.0 to 40.0	30.0 to 60.0	3.0 to 15.0	10.0 to 25.0	N/A	>=1	1.00	>=10		
Plot 1	76.56	36	52	16	62	36	78	14	0	1	6		
Plot 2		22	46	5	62	6	58	6	3	1	3		

Benchmark details	Site value score	Site attributes											
		Native plant species	Native over-storey cover	Native mid-storey cover	Native ground cover (grass)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Over-storey regen	Total length of fallen logs	Degraded (yes/no)	Out of benchmark
Plot 3		27	20	18	56	14	34	0	0	1	54		
Plot 4		26	27.5	2.5	24	8	48	30	0	1	6		
Plot 6		36	27.5	15	64	24	58	20	1	1	24		
Plot 7		35	30.5	8	22	24	42	6	2	1	40		
Plot 13		39	29.5	6.5	56	28	32	5	0	1	14		
Vegetation zone 3													
Benchmark	N/A	>=24	15.0 to 70.0	10.0 to 60.0	5.0 to 50.0	5.0 to 30.0	5.0 to 40.0	N/A	>=0	1.00	>=5		
Plot 14	84.67	31	15.0	19.5	34.0	6.0	32.0	28.50	0	0.50	3		
Vegetation zone 4													
Benchmark	N/A	>=38	15.0 to 40.0	4.0 to 40.0	30.0 to 60.0	3.0 to 15.0	10.0 to 25.0	N/A	>=1	1.00	>=10		
Plot 19	68.23	29	33.0	7.0	62.0	8	22.0	1.50	0	1.00	22		
Vegetation zone 5													
Benchmark	N/A	>=15	15.0 to 65.0	0.0 to 50.0	0.0 to 90.0	1.0 to 15.0	2.0 to 90.0	N/A	>=0	1.00	>=10		
Plot 16	81.33	33	29.5	15.0	54.0	10.0	34.0	8	1	0.75	56		
Vegetation zone 6													

Benchmark details	Site value score	Site attributes											
		Native plant species	Native over-storey cover	Native mid-storey cover	Native ground cover (grass)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Over-storey regen	Total length of fallen logs	Degraded (yes/no)	Out of benchmark
Benchmark	N/A	>=51	22.0 to 45.0	5.0 to 40.0	5.0 to 25.0	10.0 to 20.0	5.0 to 20.0	N/A	>=1	1.00	>=20		
Plot 17	55.90	28	70.0	17.0	0.00	18.0	68.0	0.00	13	0.66	0.00		
Plot 18		15	75.0	64.0	6.00	26.0	20.0	3.0	0	0.66	8		

Red cells indicate the site attributes that are below 50% of the benchmark, while blue cells represent those site attributes that are greater than 150% of the benchmark

Appendix 3 Flora

A3.1 Flora species recorded from the study area

Table 33 Flora species recorded from the study area

Family	Scientific Name	Common Name	VZ1	VZ2	VZ3	VZ4	VZ5	VZ6	Incidental
Acanthaceae	*Brunoniella australis*	Blue Trumpet		X					
Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair						X	
Adiantaceae	*Adiantum formosum*	Giant Maidenhair						X	
Adiantaceae	*Adiantum hispidulum*	Rough Maidenhair						X	
Adiantaceae	*Cheilanthes sieberi*	Rock Fern	X	X					
Adiantaceae	*Pellaea paradoxa*							X	
Anthericaceae	*Dichopogon strictus*	Chocolate Lily	X	X					
Anthericaceae	*Thysanotus sp*	Fringe-lily	X						
Apiaceae	*Centella asiatica*	Indian Pennywort			X				
Apocynaceae	*Marsdenia rostrata*	Milk Vine						X	
Apocynaceae	*Parsonsia straminea*	Common Silkpod		X	X		X		
Araceae	*Gymnostachys anceps*	Settler's Twine						X	
Araliaceae	*Polyscias sambucifolia*	Elderberry Panax					X		

Family	Scientific Name	Common Name	VZ1	VZ2	VZ3	VZ4	VZ5	VZ6	Incidental
Asteraceae	*Brachyscome multifida*	Cut-leaved Daisy	X						
Asteraceae	*Calotis lappulacea*	Yellow Burr-daisy	X						
Asteraceae	*Cassinia aculeata*	Dolly Bush					X		
Asteraceae	*Cassinia arcuata*	Sifton Bush		X					
Asteraceae	*Chrysocephalum apiculatum*	Common Everlasting	X						
Asteraceae	*Epaltes australis*	Spreading Nut-heads	X						
Asteraceae	*Lagenophora gracilis*	Slender Lagenophora	X						
Bignoniaceae	*Pandorea pandorana*	Wonga Wonga Vine	X	X		X			
Blechnaceae	*Blechnum indicum*	Swamp Water Fern			X				
Blechnaceae	*Doodia aspera*	Prickly Rasp Fern						X	
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak	X						
Casuarinaceae	*Casuarina glauca*	Swamp Oak			X				
Celastraceae	*Maytenus silvestris*	Narrow-leaved Orangebark		X		X		X	
Clusiaceae	*Hypericum gramineum*	Small St John's Wort			X				
Convolvulaceae	*Dichondra repens*	Kidney Weed	X	X	X				

Family	Scientific Name	Common Name	VZ1	VZ2	VZ3	VZ4	VZ5	VZ6	Incidental
Cyperaceae	*Baumea juncea*				X				
Cyperaceae	*Carex appressa*	Tall Sedge						X	
Cyperaceae	*Eleocharis acuta*				X				
Cyperaceae	*Gahnia aspera*	Rough Saw-sedge	X	X	X	X			
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge	X	X		X		X	
Cyperaceae	*Schoenoplectus validus*				X				
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower	X	X					
Dioscoreaceae	*Dioscorea transversa*	Native Yam						X	
Ericaceae	*Leucopogon juniperinus*	Prickly Beard-heath	X	X		X	X		
Ericaceae	*Trochocarpa laurina*	Tree Heath						X	
Fabaceae (Faboideae)	*Chorizema parviflorum*	Eastern Flame Pea	X						
Fabaceae (Faboideae)	*Daviesia ulicifolia*	Gorse Bitter Pea	X	X					
Fabaceae (Faboideae)	*Desmodium rhytidophyllum*			X					

Family	Scientific Name	Common Name	VZ1	VZ2	VZ3	VZ4	VZ5	VZ6	Incidental
Fabaceae (Faboideae)	*Desmodium varians*	Slender Tick-trefoil	X	X					
Fabaceae (Faboideae)	*Glycine clandestina*	Twining glycine	X	X					
Fabaceae (Faboideae)	*Glycine microphylla*	Small-leaf Glycine	X				X		
Fabaceae (Faboideae)	*Glycine tabacina*	Variable Glycine	X	X					
Fabaceae (Faboideae)	*Hardenbergia violacea*	False Sarsaparilla		X					
Fabaceae (Faboideae)	*Jacksonia scoparia*	Dogwood		X					
Fabaceae (Faboideae)	*Pultenaea flexilis*			X					
Fabaceae (Mimosoideae)	*Acacia elongata*	Swamp Wattle	X				X		
Fabaceae (Mimosoideae)	*Acacia falcata*		X	X	X	X		X	
Fabaceae (Mimosoideae)	*Acacia implexa*	Hickory Wattle	X				X		

Family	Scientific Name	Common Name	VZ1	VZ2	VZ3	VZ4	VZ5	VZ6	Incidental
Fabaceae (Mimosoideae)	*Acacia irrorata*	Green Wattle		X					
Fabaceae (Mimosoideae)	*Acacia longifolia*			X	X				
Fabaceae (Mimosoideae)	*Acacia ulicifolia*	Prickly Moses	X	X	X		X		
Flacourtiaceae	*Scolopia braunii*	Flintwood						X	
Geraniaceae	*Geranium solanderi*	Native Geranium		X					
Goodeniaceae	*Goodenia bellidifolia*		X						
Goodeniaceae	*Goodenia heterophylla*		X	X					
Haloragaceae	*Gonocarpus teucrioides*	Germander Raspwort		X					
Iridaceae	*Patersonia glabrata*	Leafy Purple-flag	X						
Iridaceae	*Patersonia sericea*	Silky Purple-Flag		X					
Juncaceae	*Juncus usitatus*		X						
Lamiaceae	*Clerodendrum tomentosum*	Hairy Clerodendrum			X				
Lauraceae	*Cassytha glabella*			X					

Family	Scientific Name	Common Name	VZ1	VZ2	VZ3	VZ4	VZ5	VZ6	Incidental
Lauraceae	*Cassytha pubescens*	Downy Dodder-laurel		X		X	X		
Lobeliaceae	*Pratia purpurascens*	Whiteroot	X	X	X		X		
Lomandraceae	*Lomandra filiformis*	Wattle Matt-rush	X	X			X		
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush		X		X			
Lomandraceae	*Lomandra multiflora*	Many-flowered Mat-rush	X	X		X	X		
Loranthaceae	*Amyema spp.*	Mistletoe	X	X					
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry	X	X	X		X	X	
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily	X	X	X	X		X	
Menispermaceae	*Sarcopetalum harveyanum*	Pearl Vine						X	
Menispermaceae	*Stephania japonica*	Snake vine			X				
Monimiaceae	*Wilkiea huegeliana*	Veiny Wilkiea						X	
Moraceae	*Ficus coronata*	Creek Sandpaper Fig						X	
Myrsinaceae	*Myrsine variabilis*			X				X	
Myrtaceae	*Angophora costata*	Sydney Red Gum	X	X					
Myrtaceae	*Angophora floribunda*	Rough-barked Apple					X		X

Family	Scientific Name	Common Name	VZ1	VZ2	VZ3	VZ4	VZ5	VZ6	Incidental
Myrtaceae	*Backhousia myrtifolia*	Grey Myrtle						X	
Myrtaceae	*Baeckea diosmifolia*	Fringed Baeckea				X			
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush						X	
Myrtaceae	*Corymbia maculata*	Spotted Gum	X	X		X		X	
Myrtaceae	*Eucalyptus acmenoides*	White Mahogany	X	X				X	
Myrtaceae	*Eucalyptus canaliculata*	Large-fruited Grey Gum		X					
Myrtaceae	*Eucalyptus crebra*	Narrow-leaved Ironbark	X	X	X	X	X		
Myrtaceae	*Eucalyptus fibrosa*	Red Ironbark	X	X		X	X		
Myrtaceae	*Eucalyptus globoidea*	White Stringybark		X	X				
Myrtaceae	*Eucalyptus moluccana*	Grey Box	X						
Myrtaceae	*Eucalyptus paniculata*	Grey Ironbark		X					
Myrtaceae	*Eucalyptus punctata*	Grey Gum		X				X	
Myrtaceae	*Eucalyptus punctata X canaliculata intergrade*						X		
Myrtaceae	*Eucalyptus siderophloia*	Grey Ironbark	X	X			X		

Family	Scientific Name	Common Name	VZ1	VZ2	VZ3	VZ4	VZ5	VZ6	Incidental
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum	X		X		X		
Myrtaceae	*Eucalyptus umbra*	Broad-leaved White Mahogany		X			X		
Myrtaceae	*Leptospermum polygalifolium*	Tantoon		X				X	
Myrtaceae	*Leptospermum sp*			X					
Myrtaceae	*Melaleuca nodosa*		X	X		X	X		
Myrtaceae	*Melaleuca styphelioides*	Prickly-leaved Tea Tree			X				
Oleaceae	*Notelaea longifolia*	Large Mock-olive	X	X			X		
Oleaceae	*Notelaea longifolia*	Large Mock-olive		X		X		X	
Oleaceae	*Notelaea ovata*			X					
Oleaceae	*Notelaea venosa*	Veined Mock-olive		X					
Orchidaceae	*Acianthus sp*			X					
Orchidaceae	*Corybas aconitiflorus*	Spurred Helmet Orchid		X					
Orchidaceae	*Cryptostylis sp*	Tartan Tongue Orchid		X					
Orchidaceae	*Cyanicula caerulea*	Blue Caladenia		X					
Orchidaceae	*Petalochilus curtisepalus*		X						

Family	Scientific Name	Common Name	VZ1	VZ2	VZ3	VZ4	VZ5	VZ6	Incidental
Orchidaceae	*Pterostylis concinna*	Trim Greenhood		X					
Orchidaceae	*Pterostylis sp*			X					
Phormiaceae	*Dianella caerulea*	Blue Flax-lily		X					
Phormiaceae	*Dianella caerulea var. cinerascens*		X	X	X		X		
Phormiaceae	*Dianella caerulea var. producta*		X	X	X	X	X	X	
Phormiaceae	*Dianella prunina*		X	X		X			
Phormiaceae	*Dianella revoluta*	Blueberry Lily	X	X	X	X			
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush	X	X		X	X		
Phyllanthaceae	*Glochidion ferdinandi*	Cheese Tree	X	X	X		X		
Phyllanthaceae	*Phyllanthus gunnii*			X					
Phyllanthaceae	*Phyllanthus hirtellus*	Thyme Spurge		X					
Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry	X	X					
Pittosporaceae	*Bursaria spinosa*	Native Blackthorn	X	X	X		X		
Pittosporaceae	*Citriobatus pauciflorus*	Orange Thorn		X					
Pittosporaceae	*Pittosporum revolutum*	Rough Fruit Pittosporum		X				X	

Family	Scientific Name	Common Name	VZ1	VZ2	VZ3	VZ4	VZ5	VZ6	Incidental
Poaceae	*Aristida vagans*	Threeawn Speargrass	X	X		X			
Poaceae	*Austrostipa pubescens*			X					
Poaceae	*Cymbopogon refractus*	Barbed Wire Grass	X	X		X			
Poaceae	*Cynodon dactylon*	Common Couch	X						X
Poaceae	*Dichelachne crinita*	Longhair Plumegrass	X						
Poaceae	*Echinopogon caespitosus*	Bushy Hedgehog-grass	X						
Poaceae	*Echinopogon ovatus*	Forest Hedgehog Grass	X	X					
Poaceae	*Entolasia marginata*	Bordered Panic		X			X		
Poaceae	*Entolasia stricta*	Wiry Panic	X	X	X	X	X		
Poaceae	*Eragrostis brownii*	Brown's Lovegrass	X	X					X
Poaceae	*Imperata cylindrica*	Blady Grass		X	X	X	X		
Poaceae	*Microlaena stipoides*	Weeping Grass	X	X					
Poaceae	*Oplismenus aemulus*		X	X					
Poaceae	*Oplismenus imbecillis*			X					
Poaceae	*Panicum simile*	Two-colour Panic	X	X	X				

Family	Scientific Name	Common Name	VZ1	VZ2	VZ3	VZ4	VZ5	VZ6	Incidental
Poaceae	*Rytidosperma fulva*	Wallaby Grass	X	X					
Poaceae	*Themeda australis*	Kangaroo Grass	X	X		X			
Polypodiaceae	*Platycerium bifurcatum*	Elkhorn Fern						X	
Proteaceae	*Hakea sericea*	Needlebush	X	X					
Proteaceae	*Persoonia linearis*	Narrow-leaved Geebung	X	X		X	X		
Ranunculaceae	*Clematis aristata*	Old Man's Beard			X				
Ranunculaceae	*Clematis glycinoides*	Headache Vine		X					
Rhamnaceae	*Alphitonia excelsa*	Red Ash		X					
Ripogonaceae	*Ripogonum album*	White Supplejack						X	
Rubiaceae	*Galium sp*	Goosegrass		X					
Rubiaceae	*Morinda jasminoides*	Sweet Morinda						X	
Rubiaceae	*Opercularia diphylla*	Stinkweed	X						
Rubiaceae	*Pomax umbellata*	Pomax	X						
Rutaceae	*Asterolasia correifolia*			X					
Rutaceae	*Crowea exalata*		X	X				X	

Family	Scientific Name	Common Name	VZ1	VZ2	VZ3	VZ4	VZ5	VZ6	Incidental
Rutaceae	*Zieria smithii*	Sandfly Zieria	X	X		X	X		
Santalaceae	*Exocarpos strictus*	Dwarf Cherry		X					
Sapindaceae	*Dodonaea triquetra*	Large-leaf Hop-bush	X						
Smilacaceae	*Smilax australis*	Lawyer Vine						X	
Smilacaceae	*Smilax glyciphylla*	Sweet Sarsparilla		X					
Solanaceae	*Solanum brownii*	Violet Nightshade	X	X		X			
Solanaceae	*Solanum prinophyllum*	Forest Nightshade	X	X			X	X	
Sterculiaceae	*Brachychiton populneus*	Kurrajong	X	X		X	X		
Vitaceae	*Cayratia clematidea*	Native Grape		X					
Vitaceae	*Cissus antarctica*	Water Vine		X			X	X	
Vitaceae	*Cissus hypoglauca*	Giant Water Vine		X				X	
Xanthorrhoeaceae	*Xanthorrhoea macronema*		X			X		X	
Xanthorrhoeaceae	*Xanthorrhoea minor*			X					
Apiaceae	*Ciclospermum leptophyllum*	Slender Celery			X				
Asteraceae	*Bidens pilosa*	Cobbler's Pegs			X				

Family	Scientific Name	Common Name	VZ1	VZ2	VZ3	VZ4	VZ5	VZ6	Incidental
Asteraceae	*Conyza spp.*	A Fleabane		X	X				
Asteraceae	*Erechtites valerianifolia*	Brazilian Fireweed			X				
Asteraceae	*Hypochaeris radicata*	Catsear			X				
Asteraceae	*Senecio madagascariensis*	Fireweed	X		X				X
Asteraceae	*Sonchus oleraceus*	Common Sowthistle			X				
Gentianaceae	*Centaurium erythraea*	Common Centaury			X				
Juncaceae	*Juncus acutus*				X				X
Myrsinaceae	*Anagallis arvensis*	Scarlet Pimpernel			X				
Oleaceae	*Olea europaea subsp. cuspidata*	African Olive							
Plantaginaceae	*Plantago lanceolata*	Lamb's Tongues	X						
Poaceae	*Axonopus fissifolius*	Narrow-leafed Carpet Grass	X						
Poaceae	*Chloris gayana*	Rhodes Grass			X				
Poaceae	*Cortaderia selloana*	Pampas Grass			X				
Poaceae	*Digitaria sp*			X					
Poaceae	*Panicum maximum*	Guinea Grass			X				

Family	Scientific Name	Common Name	VZ1	VZ2	VZ3	VZ4	VZ5	VZ6	Incidental
Poaceae	*Setaria gracilis*	Slender Pigeon Grass			X				
Poaceae	*Stenotaphrum secundatum*	Buffalo Grass							X
Verbenaceae	*Lantana camara*	Lantana	X	X	X	X	X	X	
Verbenaceae	*Verbena bonariensis*	Purpletop		X					
Vitaceae	*Vitis vinifera*	Grape Vine		X					

Appendix 4 Fauna

Fauna species in these tables are listed in alphabetical order within their taxonomic group.

A4.1 Fauna species recorded from the study area

Below is a list of fauna species recorded from the study area during the present assessment and a list of significant fauna species recorded or predicted to occur within 10 kilometres of the study area.

Notes to table:

EPBC Act:
EX - Extinct
CR - Critically Endangered
EN - Endangered
VU - Vulnerable
CD - Conservation dependent

TSC Act:	**FM Act:**
C1 – critically endangered	C1 – critically endangered
E1 – endangered species (Part 1, Schedule 1)	E1 – endangered
E2 – endangered population (Part 2, Schedule 1)	E2 – endangered
E4 – presumed extinct (Part 4, Schedule 1)	E4 – presumed extinct
V1 – vulnerable (Part 1, Schedule 2)	V1 – vulnerable

* - introduced species

Table 34 Vertebrate fauna recorded from the study area (current assessment)

Status	Scientific Name	Common Name	Quarry workings	Study area	Offset
Amphibians					
	Crinia signifera	Common Eastern Froglet		x	
	Litoria fallax	Eastern Sedge Frog		x	
	Litoria latopalmata	Broad-palmed Rocket-frog		x	
	Litoria nasuta	Striped Rocket-frog		x	
	Litoria peroni	Peron's Tree Frog		x	
	Litoria tyleri	Tyler's Tree Frog		x	
	Litoria wilcoxi	Stony Creek Frog		x	
	Pseudophryne bibroni	Bibron's Toadlet		x	
	Uperoleia laevigata	Smooth Toadlet		x	
Reptiles					
	Eulamprus quoyii	Eastern Water Skink		x	

Status	Scientific Name	Common Name	Quarry workings	Study area	Offset
	Morelia spilota	Carpet Python		x	
	Myzomela sanguinolenta	Scarlet Honeyeater		X	X
Birds					
	Acanthiza lineata	Striated Thornbill		X	X
	Acanthiza nana	Yellow Thornbill		x	
	Acanthiza pusilla	Brown Thornbill		x	
	Acanthiza reguloides	Buff-rumped Thornbill			
	Acanthorhynchus tenuirostris	Eastern Spinebill			X
	Accipiter cirrocephalus	Collared Sparrowhawk		X	
	Accipiter fasciatus	Brown Goshawk			
	Anas superciliosa	Pacific Black Duck		x	
	Anthochaera carunculata	Red Wattlebird		x	
Mi	*Ardea ibis*	Cattle Egret		x	
	Ardea intermedia	Intermediate Egret		x	
	Aythya australis	Hardhead		x	
	Cacomantis flabelliformis	Fan-tailed Cuckoo		X	
	Cacomantis flabelliformis	Fan-tailed Cuckoo		x	
	Chalcites lucidus	Shining Bronze-cuckoo		x	
	Chenonetta jubata	Australian Wood Duck		x	
	Colluricincla harmonica	Grey Shrike-thrush		X	X
	Coracina novaehollandiae	Black-faced Cuckoo-shrike		x	
	Coracina tenuirostris	Cicadabird		x	
	Cormobates leucophaea	White-throated Treecreeper		X	
	Corvus coronoides	Australian Raven	X	X	
	Cracticus nigrogularis	Pied Butcherbird		x	
	Cracticus tibicen	Australian Magpie	X	X	
	Cracticus torquatus	Grey Butcherbird	X	X	
	Dacelo novaeguineae	Laughing Kookaburra		X	
V	*Daphoenositta chrysoptera*	Varied Sittella		x	
	Dicaeum hirundinaceum	Mistletoebird		x	

Status	Scientific Name	Common Name	Quarry workings	Study area	Offset
	Egretta novaehollandiae	White-faced Heron		x	
	Eopsaltria australis	Eastern Yellow Robin		X	X
V	*Falco subniger*	Black Falcon	X	X	
	Geopelia humeralis	Bar-shouldered Dove		X	X
	Gerygone mouki	Brown Gerygone		X	X
V	*Glossopsitta pusilla*	Little Lorikeet		X	X
Mi	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	X	X	
	Hirundo neoxena	Welcome Swallow	X	X	
	Leucosarcia picata	Wonga Pigeon		X	
	Lichenostomus chrysops	Yellow-faced Honeyeater		x	
	Lichenostomus melanops	Yellow-tufted Honeyeater		x	
V	*Lophoictinia isura*	Square-tailed Kite		X	
	Malurus cyaneus	Superb Fairy-wren		X	
	Malurus lamberti	Variegated Fairy-wren		X	
	Meliphaga lewinii	Lewin's Honeyeater		X	X
	Melithreptus brevirostris	Brown-headed Honeyeater		X	
	Melithreptus lunatus	White-naped Honeyeater		X	X
Mi	*Monarcha melanopsis*	Black-faced Monarch		x	
	Myiagra rubecula	Leaden Flycatcher		x	
	Neochmia temporalis	Red-browed Finch		X	X
	Ninox novaeseelandiae	Southern Boobook			X
	Oriolus sagittatus	Olive-backed Oriole		x	
	Pachycephala pectoralis	Golden Whistler		X	X
	Pachycephala rufiventris	Rufous Whistler		x	
	Pardalotus punctatus	Spotted Pardalote		X	X
	Pardalotus striatus	Striated Pardalote		x	
	Petrochelidon nigricans	Tree Martin		x	
	Petroica rosea	Rose Robin		x	
	Phalacrocorax sulcirostris	Little Black Cormorant		x	
	Philemon corniculatus	Noisy Friarbird		X	
	Podargus strigoides	Tawny Frogmouth		X	X
	Psophodes olivaceus	Eastern Whipbird		X	X

Status	Scientific Name	Common Name	Quarry workings	Study area	Offset
	Rhipidura albiscapa	Grey Fantail		X	X
	Scythrops novaehollandiae	Channel-billed Cuckoo		x	
	Sericornis frontalis	White-browed Scrubwren		X	
	Smicrornis brevirostris	Weebill		X	
	Strepera graculina	Pied Currawong		x	
	Trichoglossus haematodus	Rainbow Lorikeet		x	
	Zosterops lateralis	Silvereye		X	X
Mammals					
	Acrobates pygmaeus	Feathertail Glider			X
	Antechinus stuartii	Brown Antechinus		X	X
*	*Canis lupus familiaris/dingo*	Dog/Dingo		x	
	Chalinolobus gouldii	Gould's Wattled Bat		x	
	Chalinolobus morio	Chocolate Wattled Bat		x	
	Macropus giganteus	Eastern Grey Kangaroo		x	x
	Macropus robustus	Euro		x	
	Macropus rufogriseus	Red-necked Wallaby	X	X	X
V	*Miniopterus australis*	Little Bentwing-bat		x	
V	*Miniopterus orianae oceanensis*	Eastern Bentwing-bat		x	
VU, V, E2	*Phascolarctos cinereus*	Koala	X	x	
	Pseudocheirus peregrinus	Common Ringtail Possum		x	
V, V	*Pteropus poliocephalus*	Grey-headed Flying-fox		x	
	Rattus fuscipes	Bush Rat			X
	Rhinolophus megaphyllus	Eastern Horseshoe Bat		x	
	Tachyglossus aculeatus	Short-beaked Echidna	x	x	x
	Tadarida australis	White-striped Freetail-bat	X	X	X
	Trichosurus vulpecula	Common Brushtail Possum		x	
	Vespadelus vulturnus	Little Forest Bat		x	
*	*Vulpes vulpes*	Red Fox		x	
	Wallabia bicolor	Swamp Wallaby		x	x

Appendix 5 Threatened species

A5.1 Threatened flora species

The following table includes a list of the threatened flora species and ecological communities that have potential to occur within the study area. The list of species is sourced from the NSW BioNet Wildlife Atlas (OEH 2014f) and the Protected Matters Search Tool (DoE 2014), accessed on 06/08/2014.

Examples of criteria for determining the likelihood of occurrence for threatened biota as a guide for writing the rationale for likelihood have been listed below.

Likelihood of occurrence	Potential criteria
High	• Species/ecological communities recorded in study area during current or previous assessment/s. • Aquatic species recorded from connected waterbodies in close proximity to the study area during current or previous assessment/s. • Sufficient good quality habitat is present in study area or in connected waterbodies in close proximity to the study area (aquatic species). • Study area is within species natural distributional range (if known). • Species has been recorded within 10 kilometres or from the relevant catchment/basin.
Medium	• Records of terrestrial biota within 10 kilometres of the study area or of aquatic species in the relevant basin/neighbouring basin. • Habitat limited in its capacity to support the species due to extent, quality, or isolation.
Low	• No records within 10 kilometres of the study area or for aquatic species, the relevant basin/neighbouring basin. • Marginal habitat present (low quality and extent). • Substantial loss of habitat since any previous record(s).
Negligible	• Habitat not present in study area • Habitat for aquatic species not present in connected waterbodies in close proximity to the study area. • Habitat present but sufficient targeted survey has been conducted at an optimal time of year and species wasn't recorded.

Table 35 Threatened flora species recorded/predicted within 10 kilometres of the study area

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
Allocasuarina defungens	Dwarf Heath Casuarina	EN	E1	#	Low	Not typically observed in grassy woodland communities and no tall heath on sandy soils within the study area. Also not historically recorded within 5 kilometres of the study area.	*Allocasuarina defungens* is found only in the Hunter/Central Rivers, and Northern Rivers Catchments, ranging from the Nabiac area, north-west of Forster, to Byron Bay on the NSW north coast. *Allocasuarina defungens* grows mainly in tall heath on sand, but can also occur on clay soils and sandstone. The species also extends onto exposed nearby-coastal hills or headlands adjacent to sandplains. Vegetation communities associated with the species, includes: Dry Scleropyhll Forests, Forested Wetlands, Grassy Woodlands, and Heathlands.
Angophora inopina	Charmhaven Apple	VU	V	#	Low	No potential habitat or associated species within the study area. Also not historically recorded within 5 kilometres of the study area.	Occurs in the Hunter/Central Rivers Catchment, endemic to the Central Coast region of NSW. Occurs in open woodland with a dense shrub understorey on deep white sandy soils over sandstone. Most frequently occuring in four main vegetation communities: (i) *Eucalyptus haemastoma*, *Corymbia gummifera*, *Angophora inopina* woodland/forest; (ii) *Hakea teretifolia, Banksia oblongifolia* wet heath; (iii) E*ucalyptus resinifera, Melaleuca sieberi, Angophora inopina* sedge woodland; (iv) *Eucalyptus capitellata, Corymbia gummifera, Angophora inopina* woodland/forest. Is lignotuberous, allowing vegetative growth to occur following disturbance. Flowering appears to take place principally between mid-December and mid-January, but is generally poor and sporadic.

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
Asperula asthenes	Trailing Woodruff	VU	V	2009/#	Low	A single recent record is located approximately 8 kilometres southwest of the study area. Typically this species is found in riparian vegetation aong creek banks. There are no creeklines within the study area, and Deadmans Creek, adjacent to the study area is a minor ephemeral creekline.	Found in damp areas often found growing along river banks.
Asterolasia elegans		EN	E1	#	Low	The study area is outside of the typical range for this species and none of the associated vegetation occurs within the study area.	Occurs north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby local government areas. Also likely to occur in the western part of Gosford LGA. Known from only six populations in the catchments of the Colo and Hawkesbury Rivers, only one of which is wholly within a conservation reserve. Found in sheltered forests on mid- to lower slopes and valleys which support sheltered forest on Hawkesbury Sandstone. The canopy at known sites includes *Syncarpia glomulifera, Angophora costata, Eucalyptus piperita, Allocasuarina torulosa* and *Ceratopetalum gummiferum*. The species is considered to be fire sensitive and reliant on seed germination after disturbance to maintain populations. A soil seedbank appears to be established by this species, so

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
							for a number of years following fire or other disturbance the species may not be apparent, but be present only as seed in the soil. The size of the seedbank depends not only on the amount of seed contributed by mature plants each season, but on the level of dormancy of the seed which can vary from year to year. The longevity of each crop of seed in the soil is perhaps 5 - 10 years.
Cryptostylis hunteriana	Leafless Tongue Orchid	VU	V	#	Low	Not previously recorded within 10 kilometres of the study area and none of the typical habitat preferences for this species were noted within the study area.	This species typically grows in swamp-heath on sandy soils chiefly in coastal districts but has also been recorded on steep bare hillsides. Within the Central Coast bioregion, this species has been recorded within Coastal Plains Smooth-barked Apple Woodland and Coastal Plains Scribbly Gum Woodland. This species does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. The larger populations typically occur in woodland dominated by *Eucalyptus sclerophylla, E. sieberi, Corymbia gummifera* and *Allocasuarina littoralis*; appears to prefer open areas in the understorey of this community and is often found in association with the *Cryptostylus subulata*. It occurs in the following Catchment Management Regions Hawkesbury/Nepean, Hunter/Central Rivers, Northern Rivers and Southern Rivers. Inconsistent flowering times Dec-February; Jan-February (in Victoria)
Cymbidium canaliculatum	Tiger Orchid		E2	1926	Low	Outside of known range, this species is associated with the central and upper	Epiphytic orchid found in dry sclerophyll forest or woodland where it grows in tree hollows, in clumps of fern or sometimes on rocks.

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
						Hunter and not with the vegetation communities of the study area.	
Eucalyptus glaucina	Slaty Red Gum	VU	V	1998/#	Low	Typically found further west in the Central Hunter. Some marginal potential habitat occurs at the southern, flatter section of the study area however based on location and soil preferences it is considered unlikely to occur.	Occurs near Casino and from Taree to Broke where it is locally common but very sporadic. Found in grassy woodland on deep, moderately fertile and well watered soil.
Eucalyptus parramattensis subsp. decadens		VU	V	#	Low	No associated species or habitat within the study area and the species is not typically found this far north.	There are two separate meta-populations of *E. parramattensis subsp. decadens*. The Kurri Kurri meta-population is bordered by Cessnock/Kurri Kurri in the north and Mulbring/Abedare in the south. Large aggregations of the sub-species are located in the Tomalpin area. The Tomago Sandbeds meta-population is bounded by Salt Ash and Tanilba Bay in the north and Williamtown and Tomago in the south. Generally occupies deep, low-nutrient sands, often those subject to periodic inundation or where water tables are relatively high. It occurs in dry sclerophyll woodland with dry heath

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
							understorey. It also occurs as an emergent in dry or wet heathland. Often where this species occurs, it is a community dominant. In the Kurri Kurri area, *E. parramattensis subsp. decadens* is a characteristic species of 'Kurri Sand Swamp Woodland in the Sydney Basin Bioregion', an endangered ecological community under the TSC Act. In the Tomago Sandbeds area, the species is usually associated with the 'Tomago Swamp Woodland' as defined by NSW NPWS. Flowers from November to January.
Euphrasia arguta		CE	E4A	#	Low	The study area is south and east of the range of this species.	Grows in grassy areas near rivers.
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	VU	V	2005/#	Medium	Potential habitat and associated species were recorded within the study area.	Located in Hawkesbury/Nepean, Hunter/Central Rivers and Sydney Metropolitan Catchment. Sporadically distributed throughout the Sydney Basin with the main occurrence centred in Picton, Appin, Wedderburn and Bargo. Northern populations are found in the Lower Hunter Valley. To the west of Sydney, small populations occur at Kemps Creek & Voyager Point. *Grevillea parviflora ssp. parviflora* grows on sandy clay loam soils, often with ironstone gravels. Soils are mostly derived from Tertiary sands or alluvium and from the Mittagong Formation with alternating bands of shale and fine-grained sandstones. *Grevillea parviflora subsp. parviflora* is found on crests, upper slopes or flat plains in both low-lying areas and on higher topography. The plant prefers open habitat conditions with the largest populations in open woodland and along exposed roadside areas.

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
							G. parviflora subsp. parviflora has been recorded in a range of vegetation types from heath and shrubby woodland to open forest. Canopy species vary greatly with community type but generally are species that favour soils with a strong lateritic influence including *Eucalyptus fibrosa, E. parramattensis, Angophora bakeri* and *Eucalyptus sclerophylla*. Flowering has been recorded between July - December as well as April-May.
Maundia triglochinoides			V	2009	Medium	Previously recorded close to the study area and potential habitat in the form of dams and a creek.	*Maundia triglochinoides* is restricted to Coastal NSW and extending into southern Queensland. The current southern limit is Wyong; former sites around Sydney are now extinct. Catchment Regions include Hunter/Central Rivers, Northern Rivers and Sydney Metro
Melaleuca biconvexa	Biconvex Paperbark	VU	V	#	Low	Not previously recorded within 10 kilometres of the study area and limited habitat present within the study area.	Biconvex Paperbark is only found in NSW, with scattered and dispersed populations found in the Jervis Bay area in the south and the Gosford-Wyong area in the north. Catchment regions include: Hunter/Central Rivers, Hawkesbury/Nepean, Southern Rivers, and Northern River Catchments. Biconvex Paperbark generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects. Flowering occurs over just 3-4 weeks in September and October.
Persicaria elatior	Tall Knotweed	VU	V	1996/#	Medium	Previously recorded close to the study area and potential	Tall Knotweed has been recorded in south-eastern NSW (Mt Dromedary (an old record), Moruya State Forest near Turlinjah, the Upper Avon River catchment north of

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
						habitat in the form of dams and a creek.	Robertson, Bermagui, and Picton Lakes. In northern NSW it is known from Raymond Terrace and the Grafton area (Cherry Tree and Gibberagee State Forests). The species also occurs in Queensland. This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.
Phaius australis	Southern Swamp Orchid	EN	E1	#	Low	Not previously recorded within 10 kilometres of the study area and no potential habitat was recorded.	Occurs in Queensland and north-east NSW as far south as Coffs Harbour. Historically, it extended farther south, to Port Macquarie. Found in swampy grassland or swampy forest including rainforest, eucalypt or paperbark forest, mostly in coastal areas.
***Prasophyllum* sp. Wybong**	A Leek Orchid	CE		#	Low	Not previously recorded within 10 kilometres of the study area and no potential habitat was recorded.	Leek orchids are generally found in shrubby and grassy habitats in dry to wet soil. *Prasophyllum* sp. Wybong is known to occur in open eucalypt woodland and grassland. *Prasophyllum* sp. Wybong is endemic to NSW. It is known from seven populations in eastern NSW near Ilford, Premer, Muswellbrook, Wybong, Yeoval, Inverell and Tenterfield. *Prasophyllum* sp. Wybong occurs within the Border Rivers (Gwydir, Namoi, Hunter), Central Rivers and Central West Natural Resource Management Regions. The species occurs within the Sydney Basin, New England Tablelands, Brigalow Belt South and NSW South Western Slopes Interim Biogeographic Regionalisation for Australia Bioregions.
Pterostylis gibbosa	Illawarra Greenhood	EN	E1	#	Low	This species has not historically been recorded	Known from a small number of populations in the Hunter region, the Illawarra region and the Shoalhaven region. It is apparently extinct in western Sydney which is the area

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
							where it was first collected (1803). All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage. In the Illawarra region, the species grows in woodland dominated by *Eucalyptus tereticornis, E. longifolia* and *Melaleuca decora*. Near Nowra, the species grows in an open forest of *Corymbia maculata, E.tereticornis* and *E. paniculata*. In the Hunter region, the species grows in open woodland dominated by *E. crebra*, Forest Red Gum and *Callitris endlicherii*. The Illawarra Greenhood is a deciduous orchid that is only visible above the ground between late summer/spring, and only when soil moisture levels can sustain its growth. The leaf rosette grows from an underground tuber late summer, followed by the flower stem in winter. The Illawarra Greenhood can survive occasional burning/grazing because of its capacity to reshoot from an underground tuber.
Streblus pendulinus	Whalebone Tree	EN		#	Low	No suitable rainforest habitat within the study area.	The species is found in warmer rainforests, chiefly along watercourses. The altitudinal range is from near sea level to 800 m above sea level. The species grows in well developed rainforest, gallery forest and drier, more seasonal rainforest.

* - habitat descriptions have been adapted by qualified ecologists (botanists) from the DoE Species Profile and Threats (SPRAT) Database, OEH Threatened Species online profiles and the NSW Scientific Committee final determinations for listed species, references within the above table are provided within the report reference list.

A5.2 Threatened fauna species

The following table includes a list of the threatened fauna species that have potential to occur within the study area. The list of species is sourced from the NSW BioNet Wildlife Atlas (OEH 2014f), BirdLife Australia data search (Birdlife Australia 2014) and the Protected Matters Search Tool (DoE 2014), accessed on 06/08/2014.

Notes to table:

#	species predicted to occur by the DoE database (not recorded on other databases)
##	species predicted to occur based on natural distributional range and suitable habitat despite lack of records in the databases searched
Year	recorded on databases listed above
2014	recorded during current survey

Likelihood of occurrence	Potential criteria
High	• Species recorded in study area during current or previous assessment/s. • Aquatic species recorded from connected waterbodies in close proximity to the study area during current or previous assessment/s. • Sufficient good quality habitat is present in study area or in connected waterbodies in close proximity to the study area (aquatic species). • Study area is within species natural distributional range (if known). • Species has been recorded within 10 kilometres or from the relevant catchment/basin.
Moderate	• Records of terrestrial species within 10 kilometres of the study area or of aquatic species in the relevant basin/neighbouring basin. • Habitat limited in its capacity to support the species due to extent, quality, or isolation.
Low	• No records within 10 kilometres of the study area or for aquatic species, the relevant basin/neighbouring basin. • Marginal habitat presents (low quality and extent). • Substantial loss of habitat since any previous record(s).
Negligible	• Habitat not present in study area • Habitat for aquatic species not present in connected waterbodies in close proximity to the study area. • Habitat present but sufficient targeted survey has been conducted at an optimal time of year and species wasn't recorded.

Table 36 Threatened fauna species recorded/predicted within 10 kilometres of the study area

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
Birds							
Anseranas semipalmata	Magpie Goose		V	2013	Low	Not recorded during targeted winter and spring surveys. No suitable wetland habitat was recorded within the study area.	Mainly found in shallow wetlands (less than 1 m deep) with dense growth of rushes or sedges. They are often seen walking and grazing on land; feeds on grasses, bulbs and rhizomes. Breeding can occur in both summer and winter dominated rainfall areas and is strongly influenced by water level. Nests are formed in trees over deep water; breeding is unlikely in south-eastern NSW. Often seen in trios or flocks on shallow wetlands, dry ephemeral swamps, wet grasslands and floodplains; roosts in tall vegetation.
Anthochaera phrygia	Regent Honeyeater	EN	E4A	2012/#	Medium	Not recorded during targeted surveys in winter and spring. Suitable forage habitat present. Recorded from the locality of the study area.	A semi-nomadic species occurring in temperate eucalypt woodlands and open forests. Most records are from box-ironbark eucalypt forest associations and wet lowland coastal forests. Key eucalypt species include Mugga Ironbark, Yellow Box, Blakely's Red Gum, White Box and Swamp Mahogany. Also utilises: E. microcarpa, E. punctata, E. polyanthemos, E. mollucana, Corymbia robusta, E. crebra, E. caleyi, C. maculata, E. mckieana, E. macrorhyncha, E. laevopinea and Angophora floribunda. Nectar and fruit from the mistletoes A. miquelii, A. pendula, A. cambagei are also eaten during the breeding season. Regent Honeyeaters usually nest in horizontal branches or forks in tall mature eucalypts and sheoaks. Also nest in mistletoe haustoria. An open cup-shaped nest is constructed of bark, grass, twigs and wool by the

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
							female.
Botaurus poiciloptilus	Australasian Bittern	EN	E1	2004/#	Low	Not recorded during targeted winter and spring surveys. No suitable wetland habitat was recorded within the study area.	The Australasian Bittern is distributed across south-eastern Australia. Often found in terrestrial and estuarine wetlands, generally where there is permanent water with tall, dense vegetation including Typha spp. and Eleoacharis spp.. Typically this bird forages at night on frogs, fish and invertebrates, and remains inconspicuous during the day. The breeding season extends from October to January with nests being built amongst dense vegetation on a flattened platform of reeds.
Burhinus grallarius	Bush Stone-curlew		E1	2006	Low	Not recorded during targeted surveys in winter/spring. Suitable habitat present but impacts from feral predators (cats and foxes) likely to be high.	Lightly timbered open forest and woodland, or partly cleared farmland with remnants of woodland, with a ground cover of short sparse grass and few or no shrubs where fallen branches and leaf litter are present.
Calidris ferruginea	Curlew Sandpiper		E1	2013	Low	Not recorded during targeted winter and spring surveys. No suitable wetland habitat was recorded within the study area.	Inhabits sheltered intertidal mudflats. Also non-tidal swamps, lagoons and lakes near the coast. Infrequently recorded inland.
Callocephalon fimbriatum	Gang-gang Cockatoo		V	1993	Low	Not recorded during targeted surveys. No	In summer, occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. Also occur in subalpine Snow Gum woodland and occasionally in temperate or regenerating

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
							forest. In winter, occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. It requires tree hollows in which to breed.
Calyptorhynchus lathami	Glossy Black-Cockatoo		V	2010	Low	Not recorded during targeted surveys in winter and spring. No stands of Allocasuarina sp. were recorded within the study area.	Inhabits forest with low nutrients, characteristically with key Allocasuarina species. Tends to prefer drier forest types. Often confined to remnant patches in hills and gullies. Breed in hollows stumps or limbs, either living or dead.
Chthonicola sagittata	Speckled Warbler		V	2013	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	This species occurs in eucalypt and cypress woodlands on the hills and tablelands of the Great Dividing Range. They prefer woodlands with a grassy understorey, often on ridges or gullies. The species is sedentary, living in pairs or trios and nests on the ground in grass tussocks, dense litter and fallen branches. They forage on the ground and in the understorey for arthropods and seeds. Home ranges vary from 6-12 hectares.
Circus assimilis	Spotted Harrier		V	2012	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	The Spotted Harrier is found throughout Australia but rarely in densely forested and wooded habitat of the escarpment and coast. Preferred habitat consists of open and wooded country with grassland nearby for hunting. Habitat types include open grasslands, acacia and mallee remnants, spinifex, open shrublands, saltbush, very open woodlands, crops and similar low vegetation. The Spotted Harrier is more common in drier inland areas, nomadic part migratory and dispersive, with movements linked to the abundance of prey species. Nesting occurs in open or

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
							remnant woodland and unlike other harriers, the Spotted Harrier nests in trees.
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)		V	2013	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	Lives in eucalypt woodlands, especially areas of relatively flat open woodland typically lacking a dense shrub layer, with short grass or bare ground and with fallen logs or dead trees present.
Daphoenositta chrysoptera	Varied Sittella		V	2014	High	Recorded within the study area during winter and spring surveys. Suitable habitat throughout the study area.	The Varied Sittella is a sedentary species which inhabits a wide variety of dry eucalypt forests and woodlands, usually with either shrubby understorey or grassy ground cover or both, in all climatic zones of Australia. Usually inhabit areas with rough-barked trees, such as stringybarks or ironbarks, but also in mallee and acacia woodlands, paperbarks or mature Eucalypts. The Varied Sittella feeds on arthropods gleaned from bark, small branches and twigs. It builds a cup-shaped nest of plant fibres and cobweb in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.
Dasyornis brachypterus	Eastern Bristlebird	EN	E1	#	Low	Not previously recorded within 10 kilometres of the study area and no potential habitat was observed.	Found in coastal woodlands, dense scrub and heathlands, particularly where it borders taller woodlands.
Ephippiorhynchus	Black-necked		E1	2014	Low	Not recorded during	Found in swamps, mangroves and mudflats. Can also

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
asiaticus	Stork					targeted winter and spring surveys. No suitable wetland habitat was recorded within the study area.	occur in dry floodplains and irrigated lands and occasionally forages in open grassy woodland. Nests in live or dead trees usually near water.
Epthianura albifrons	White-fronted Chat		V	2009	Low	Not recorded during targeted winter and spring surveys. No suitable habitat present.	Sydney Metropolitan CMA: The White-fronted Chat occupies foothills and lowlands below 1000 m above sea level. In NSW it occurs mostly in the southern half of the state, occurring in damp open habitats along the coast, and near waterways in the western part of the state. The White-fronted Chat is found in damp open habitats, particularly wetlands containing saltmarsh areas that are bordered by open grasslands or lightly timbered lands. Along the coastline, they are found in estuarine and marshy grounds with vegetation less than 1 m tall. The species is also observed in open grasslands and sometimes in low shrubs bordering wetland areas. Inland, the species is often observed in open grassy plains, saltlakes and saltpans that are along the margins of rivers and waterways. In Victoria White-fronted Chats have been observed breeding from late July through to early March. Nests are built in low vegetation and in the Sydney region nests have also been observed in low isolated mangroves. An Endangered Population occurs in the Sydney Metropolitan CMA area, at Newington Nature Reserve

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
							near Homebush and at Towra Point Nature Reserve.
Falco hypoleucos	Grey Falcon		E1	1993	Low	Not recorded within the study area during targeted surveys in winter and spring. No suitable habitat present.	Found over open country and wooded lands of tropical and temperate Australia. Mainly found on sandy and stony plains of inland drainage systems with lightly timbered acacia scrub.
Falco subniger	Black Falcon		V	2013	High	Recorded within the study area during winter and spring surveys. Suitable habitat throughout the study area.	Mainly occur in woodlands and open country where can hunt. Often associated with swamps, rivers and wetlands. Nest in tall trees along watercourses.
Glossopsitta pusilla	Little Lorikeet		V	2014	High	Recorded within the study area during winter and spring surveys. Suitable habitat throughout the study area.	Distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range in NSW, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Mostly occur in dry, open eucalypt forests and woodlands. They feed primarily on nectar and pollen in the tree canopy. Nest hollows are located at heights of between 2 m and 15 m, mostly in living, smooth-barked eucalypts. Most breeding records come from the western slopes.
Hieraaetus morphnoides	Little Eagle		V	2012	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study	The Little Eagle is most abundant in lightly timbered areas with open areas nearby providing an abundance of prey species. It has often been recorded foraging in grasslands, crops, treeless dune fields, and recently logged areas. The Little Eagle nests in tall living trees within farmland, woodland and forests.

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
						area.	
Irediparra gallinacea	Comb-crested Jacana		V	2012	Low	Not recorded during targeted winter and spring surveys. No suitable wetland habitat was recorded within the study area.	Occurs in freshwater wetlands, lagoons, Billabongs, swamps, lakes, rivers and reservoirs, generally with abundant floating aquatic vegetation.
Ixobrychus flavicollis	Black Bittern		V	2004	Low	Not recorded during targeted winter and spring surveys. No suitable wetland habitat was recorded within the study area.	The Black Bittern is found along the coastal plains within NSW, although individuals have rarely being recorded south of Sydney or inland. It inhabits terrestrial and estuarine wetlands such as flooded grasslands, forests, woodlands, rainforests and mangroves with permanent water and dense waterside vegetation. The Black Bittern typically roosts on the ground or in trees during the day and forages at night on frogs, reptiles, fish and invertebrates. The breeding season extends from December to March. Nests are constructed of reeds and sticks in branches overhanging the water.
Lathamus discolor	Swift Parrot	EN	E1	2012/#	Medium	Not recorded during targeted surveys in winter and spring. Suitable forage habitat present. Recorded from the locality of the study area.	The Swift Parrot occurs in woodlands and forests of NSW from May to August, where it feeds on eucalypt nectar, pollen and associated insects. The Swift Parrot is dependent on flowering resources across a wide range of habitats in its wintering grounds in NSW. Favoured feed trees include winter flowering species such as Swamp Mahogany Eucalyptus robusta, Spotted Gum Corymbia maculata, Red Bloodwood C. gummifera, Mugga Ironbark E. sideroxylon, and White Box E. albens. Commonly used lerp infested trees include Grey Box E. microcarpa, Grey

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
							Box E. moluccana and Blackbutt E. pilularis. This species is migratory, breeding in Tasmania and also nomadic, moving about in response to changing food availability.
Limosa limosa	Black-tailed Godwit		V	2012	Low	Not recorded during targeted winter and spring surveys. No suitable wetland habitat was recorded within the study area.	Mainly coastal, usually in sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats.
Lophoictinia isura	Square-tailed Kite		V	2013	High	Recorded within the study area during winter and spring surveys. Suitable habitat throughout the study area.	Typically inhabits coastal forested and wooded lands of tropical and temperate Australia. In NSW it is often associated with ridge and gully forests dominated by Eucalyptus longifolia, Corymbia maculata, E. elata, or E. smithii. Individuals appear to occupy large hunting ranges of more than 100 kilometres2. They require large living trees for breeding, particularly near water with surrounding woodland /forest close by for foraging habitat. Nest sites are generally located along or near watercourses, in a tree fork or on large horizontal limbs.
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)		V	1998	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	This species lives in a wide range of temperate woodland habitats, and a range of woodlands and shrublands in semi-arid areas.
Melithreptus gularis	Black-chinned		V	2011	Medium	Not recorded during	Found mostly in open forests and woodlands dominated

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
	Honeyeater (eastern subspecies)					targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	by box and ironbark eucalypts. It is rarely recorded east of the Great Dividing Range.
Neophema pulchella	Turquoise Parrot		V	2002	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	Occurs in open woodlands and eucalypt forests with a ground cover of grasses and understorey of low shrubs. Generally found in the foothills of the Great Divide, including steep rocky ridges and gullies. Nest in hollow-bearing trees, either dead or alive; also in hollows in tree stumps. Prefer to breed in open grassy forests and woodlands, and gullies that are moist.
Ninox connivens	Barking Owl		V	2008	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	Generally found in open forests, woodlands, swamp woodlands and dense scrub. Can also be found in the foothills and timber along watercourses in otherwise open country. Territories are typically 2000 ha in NSW habitats.
Ninox strenua	Powerful Owl		V	2013	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	The Powerful Owl occupies wet and dry eucalypt forests and rainforests. It may inhabit both un-logged and lightly logged forests as well as undisturbed forests where it usually roosts on the limbs of dense trees in gully areas. Large mature trees with hollows at least 0.5 m deep are required for nesting. Tree hollows are particularly important for the Powerful Owl because a large proportion of the diet is made up of hollow-dependent

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
							arboreal marsupials. Nest trees for this species are usually emergent with a diameter at breast height of at least 100 cm. It has a large home range of between 450 and 1450 ha.
Oxyura australis	Blue-billed Duck		V	2007	Low	Not recorded during targeted winter and spring surveys. No suitable wetland habitat was recorded within the study area.	Almost wholly aquatic, preferring deep water in large, permanent wetlands with an abundant aquatic flora.
Pachycephala olivacea	Olive Whistler		V	2012	Low	Not recorded during targeted winter and spring surveys. No suitable habitat was recorded within the study area.	Found in a range of habitats including alpine thickets, wetter rainforest/woodlands, riparian vegetation and heaths.
Pandion cristatus	Osprey		V	1992	Low	Not recorded during targeted winter and spring surveys. No suitable wetland habitat was recorded within the study area.	Found in coastal waters, inlets, estuaries and offshore islands. Occasionally found 100 kilometres inland along larger rivers. It is water-dependent, hunting for fish in clear, open water. The Osprey occurs in terrestrial wetlands, coastal lands and offshore islands. It is a predominantly coastal species, generally using marine cliffs as nesting and roosting sites. Nests can also be made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.
Petroica boodang	Scarlet Robin		V	2013	Medium	Not recorded during targeted surveys in	During the breeding season the Scarlet Robin is found in eucalypt forests and temperate woodlands, often on

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
						winter and spring. Suitable habitat present. Recorded from the locality of the study area.	ridges and slopes. During autumn and winter it moves to more open and cleared areas. It has dispersive or locally migratory seasonal movements. The Scarlet Robin forages amongst logs and woody debris for insects which make up the majority of its diet. The nest is an open cup of plant fibres and cobwebs, sited in the fork of a tree (often a dead branch in a live tree, or in a dead tree or shrub) which is usually more than 2 m above the ground. It is conspicuous in open and suburban habitats.
Petroica phoenicea	Flame Robin		V	2005	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	Flame Robins are found in a broad coastal band from southern Queensland to just west of the South Australian border. The species is also found in Tasmania. The preferred habitat in summer includes moist eucalyptus forests and open woodlands, whilst in winter prefers open woodlands and farmlands. It is considered migratory. The Flame Robin breeds from about August to January.
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)		V	2014	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	The Grey-crowned Babbler is found in dry, open forests, scrubby woodlands, trees bordering roads and farmland with isolated trees.
Ptilinopus magnificus	Wompoo Fruit-Dove		V	2009	Low	Not recorded during targeted winter and spring surveys. No suitable habitat present.	Mainly occurs in large undisturbed patches of tall tropical or subtropical rainforest. Occasionally occurs in patches of monsoon forest, closed gallery forest, wet sclerophyll forest, tall open forest, open woodland or vine thickets

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
							near rainforest.
Ptilinopus regina	Rose-crowned Fruit-Dove		V	2007	Low	Not recorded during targeted winter and spring surveys. No suitable habitat present.	Occurs in tall tropical and subtropical, evergreen or semi-deciduous rainforest, especially with dense growth of vines. Prefers large patches of rainforest, but sometimes occurs in remnant patches surrounded by suboptimal habitat including farmlands.
Rostratula australis	Australian Painted Snipe	EN	E1	#	Low	Not recorded during targeted winter and spring surveys. No suitable wetland habitat was recorded within the study area.	Usually found in shallow inland wetlands including farm dams, lakes, rice crops, swamps and waterlogged grassland. They prefer freshwater wetlands, ephemeral or permanent, although they have been recorded in brackish waters.
Stagonopleura guttata	Diamond Firetail		V	2000	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	Found in a range of habitat types including open eucalypt forest, mallee and acacia scrubs. Often occur in vegetation along watercourses.
Sternula nereis nereis	Fairy Tern	VU		#	Negligible	Not previously recorded within 10 kilometres of the study area and no potential coastal habitat occurs.	The Fairy Tern nests on sheltered sandy beaches, spits and banks above the high tide line and below vegetation. This species will also frequent embayments, estuarine habitats, wetlands and mainland coastlines.
Stictonetta naevosa	Freckled Duck		V	2014	Low	Not recorded during targeted winter and spring surveys. No	The Freckled Duck breeds in permanent fresh swamps that are heavily vegetated. Found in fresh or salty permanent open lakes, especially during drought. Often

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
						suitable wetland habitat was recorded within the study area.	seen in groups on fallen trees and sand spits.
Turnix maculosus	Red-backed Button-quail		V	2010	Low	Not recorded during targeted surveys in winter and spring. No suitable habitat present.	Red-backed Button-quail inhabit grasslands, woodlands and cropped lands of warm temperate areas that annually receive 400 mm or more of summer rain. Observations of populations in other parts of its range suggest the species prefers sites near water, including grasslands and sedgelands near creeks, swamps and springs, and wetlands. Red-backed Button-quail usually breed in dense grass near water, and nests are made in a shallow depression sparsely lined with grass and ground litter.
Tyto longimembris	Eastern Grass Owl		V	1983	Low	Not recorded during targeted surveys in winter and spring. No suitable habitat present.	Occurs mainly in open tussock grassland, usually in treeless areas. Can also occur in marshy areas with tall dense tussocks of grass. Occasionally occurs in densely vegetated agricultural lands such as sugarcane fields.
Tyto novaehollandiae	Masked Owl		V	1952	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	The Masked Owl may be found across a diverse range of wooded habitat that provide tall or dense mature trees with hollows suitable for nesting and roosting. It has mostly been recorded in open forests and woodlands adjacent to cleared lands. They nest in hollows, in trunks and in near vertical spouts or large trees, usually living but sometimes dead. The nest hollows are usually located within dense forests or woodlands. Masked Owls prey upon hollow-dependent arboreal marsupials, but terrestrial mammals make up the largest proportion of

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
							the diet. It has a large home range of between 500 to 1000 ha.
Mammals							
Cercartetus nanus	Eastern Pygmy-possum		V	2005	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	Patchily distributed from the coast to the Great Dividing Range, and as far as Pillaga, Dubbo, Parkes and Wagga Wagga on the western slopes. Inhabits rainforest through to sclerophyll forest and tree heath. Banksias and myrtaceous shrubs and trees are a favoured food source. Soft fruits are eaten when flowers are unavailable and it also feeds on insects. Will often nest in tree hollows, but can also construct its own nest. Because of its small size it is able to utilise a range of hollow sizes including very small hollows. Individuals will use a number of different hollows and an individual has been recorded using up to 9 nest sites within a 0.5 ha area over a 5 month period. It is mainly solitary, and each individual uses several nests. Home ranges of males are generally less than 0.75 ha, and those of females are smaller.
Chalinolobus dwyeri	Large-eared Pied Bat	VU	V	2013/#	Low	Not recorded during targeted surveys in spring. No suitable habitat present.	Occurs from the Queensland border to Ulladulla, with largest numbers from the sandstone escarpment country in the Sydney Basin and Hunter Valley. Primarily found in dry sclerophyll forests and woodlands, but also found in rainforest fringes and subalpine woodlands. Forages on small, flying insects below the forest canopy. Roosts in colonies of between three and 80 in caves, Fairy Martin nests and mines, and beneath rock overhangs, but usually less than 10 individuals. Likely that it hibernates during the cooler months. The only known existing

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
							maternity roost is in a sandstone cave near Coonabarabran.
Dasyurus maculatus	Spotted-tailed Quoll	EN	V	2006/#	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	Occurs along the east coast of Australia and the Great Dividing Range. Uses a range of habitats including sclerophyll forests and woodlands, coastal heathlands and rainforests. Occasional sightings have been made in open country, grazing lands, rocky outcrops and other treeless areas. Habitat requirements include suitable den sites, including hollow logs, rock crevices and caves, an abundance of food and an area of intact vegetation in which to forage. Seventy per cent of the diet is medium-sized mammals, and also feeds on invertebrates, reptiles and birds. Individuals require large areas of relatively intact vegetation through which to forage. The home range of a female is between 180 and 1000 ha, while males have larger home ranges of between 2000 and 5000 ha. Breeding occurs from May to August.
Falsistrellus tasmaniensis	Eastern False Pipistrelle		V	2013	Medium	Not recorded during targeted surveys in spring. Suitable habitat present. Recorded from the locality of the study area.	Distribution extending east of the Great Dividing Range throughout the coastal regions of NSW, from the Queensland border to the Victorian border. Prefers wet high-altitude sclerophyll and coastal mallee habitat, preferring wet forests with a dense understorey but being found in open forests at lower altitudes. Apparently hibernates in winter. Roosts in tree hollows and sometimes in buildings in colonies of between 3 and 80 individuals. Often change roosts every night. Forages for beetles, bugs and moths below or near the canopy in forests with an open structure, or along trails. Has a large

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
							foraging range, up to 136 ha. Records show movements of up to 12 kilometres between roosting and foraging sites.
Kerivoula papuensis	Golden-tipped Bat		V	1999	Medium	Not recorded during targeted surveys in spring. Suitable habitat present. Recorded from the locality of the study area.	Occurs in a narrow band down the coast from Cape York to Eden, in moist, closed forest that receives high rainfall. Important habitat features includes forest ecotones, streams and an abundance of vines. Primarily feeds on web-building spiders. Most nightly movements occur within 2 kilometres of the roost. Roosts in the nests of Yellow-throated Scrubwren and Brown Gerygone, as well as in tree hollows, foliage and roofs of houses.
Miniopterus australis	Little Bentwing-bat		V	2013	High	Recorded within the study area during spring surveys. Suitable forage habitat present. No roosting or breeding habitat present (e.g. caves, culverts).	Occurs from Northern Queensland to the Hawkesbury River near Sydney. Roost sites encompass a range of structures including caves, tunnels and stormwater drains. Young are raised by the females in large maternity colonies in caves in summer. Shows a preference for well timbered areas including rainforest, wet and dry sclerophyll forests, Melaleuca swamps and coastal forests. The Little Bentwing bat forages for small insects (such as moths, wasps and ants) beneath the canopy of densely vegetated habitats.
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat		V	2010	High	Recorded within the study area during spring surveys. Suitable forage habitat present. No roosting or breeding habitat present (e.g. caves, culverts).	Occurs from Victoria to Queensland, on both sides of the Great Dividing Range. Forms large maternity roosts (up to 100,000 individuals) in caves and mines in spring and summer. Individuals may fly several hundred kilometres to their wintering sites, where they roost in caves, culverts, buildings, and bridges. They occur in a broad range of habitats including rainforest, wet and dry

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
							sclerophyll forest, paperbark forest and open grasslands. Has a fast, direct flight and forages for flying insects (particularly moths) above the tree canopy and along waterways.
Mormopterus norfolkensis	Eastern Freetail-bat		V	2013	Medium	Not recorded during targeted surveys in spring. Suitable habitat present. Recorded from the locality of the study area.	Distribution extends east of the Great Dividing Range from southern Queensland to south of Sydney. Most records are from dry eucalypt forests and woodland. Individuals tend to forage in natural and artificial openings in forests, although it has also been caught foraging low over a rocky river within rainforest and wet sclerophyll forest habitats. The species generally roosts in hollow spouts of large mature eucalypts (including paddock trees), although individuals have been recorded roosting in the roof of a hut, in wall cavities, and under metal caps of telegraph poles. Foraging generally occurs within a few kilometres of roosting sites.
Myotis macropus	Southern Myotis		V	2013	Medium	Not recorded during targeted surveys in spring. Suitable habitat present. Recorded from the locality of the study area.	Scattered, mainly coastal distribution extending to South Australia along the Murray River. Roosts in caves, mines or tunnels, under bridges, in buildings, tree hollows, and even in dense foliage. Colonies occur close to water bodies, ranging from rainforest streams to large lakes and reservoirs. They catch aquatic insects and small fish with their large hind claws, and also catch flying insects.
Petaurus australis	Yellow-bellied Glider		V	2005	Medium	Not recorded during targeted surveys in spring. Suitable habitat present. Recorded from the	Restricted to tall native forests in regions of high rainfall along the coast of NSW. Bago Plateau: Preferred habitats are productive, tall open sclerophyll forests where mature trees provide shelter and nesting hollows. Critical elements of habitat include sap-site trees, winter

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
						locality of the study area.	flowering eucalypts, mature trees suitable for den sites and a mosaic of different forest types. Live in family groups of 2-6 individuals which commonly share a number of tree hollows. Family groups are territorial with exclusive home ranges of 30-60 ha. Very large expanses of forest (>15,000 ha) are required to conserve viable populations.
Petaurus norfolcensis	Squirrel Glider		V	2008	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	Wagga Wagga and Barrenjoey peninsula (north syd): Sparsely distributed along the east coast and immediate inland areas as far west as Coonabarabran in the northern part of the state and as far west as Tocumwal along the southern border of the state. Generally occurs in dry sclerophyll forests and woodlands but is absent from dense coastal ranges in the southern part of its range. Requires abundant hollow-bearing trees and a mix of eucalypts, banksias and acacias. Within a suitable vegetation community at least one species should flower heavily in winter and one species of eucalypt should be smooth barked. They live in family groups of 2-10 individuals and maintain home ranges of 0.65 and 10.5 ha, varying according to habitat quality and food resource availability. Family groups occupy multiple hollows over time.
Petrogale penicillata	Brush-tailed Rock-wallaby	VU	E1	#	Low	Not previously recorded within 10 kilometres of the study area and no potential habitat was observed.	Occurs along the Great Dividing Range south to the Shoalhaven, and also occurs in the Warrumbungles and Mt Kaputar. Habitats range from rainforest to open woodland. It is found in areas with numerous ledges, caves and crevices, particularly where these have a

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
							northerly aspect. Individuals defend a specific rock shelter, emerging in the evening to forage on grasses and forbs, as well as browse in drier months. Home sizes range from 2-30 ha.
Phascogale tapoatafa	Brush-tailed Phascogale		V	2010	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	The Brush-tailed Phascogale had a scattered distribution centred around the Great Dividing Range. It prefers open forests with a sparse ground cover, but also inhabits mallee and rainforests. It feeds on insects and nectar, particularly in rough-barked trees. The Brush-tailed Phascogale will Nests and shelter in tree hollows, tree stumps and occasionally birds nests, and can use more than 40 nests in a year. Suitable tree hollows have entrances 25-40 mm wide. Females have exclusive territories of approximately 20 - 60 ha, while males have overlapping territories of up to 100 ha. Breeding occurs from May to July, after which all the males die.
Phascolarctos cinereus	Koala	VU	V, E2	2013	High	Species recorded within the study area during the current Biosis (2014) surveys.	Pittwater LGA and Hawks nest: In NSW the Koala mainly occurs on the central and north coasts with some populations in the western region. Koalas feed almost exclusively on eucalypt foliage, and their preferences vary regionally. Primary feed trees include Eucalyptus robusta, E. tereticornis, E. punctata, E. haemostoma and E. signata. They are solitary with varying home ranges. In high quality habitat home ranges may be 1-2 ha and overlap, while in semi-arid country they are usually discrete and around 100 ha.
Potorous tridactylus tridactylus	Long-nosed Potoroo	VU	V	#	Low	Not recorded during targeted surveys in	Cobaki Lakes and Tweed Heads West population: Occurs from Queensland to Victoria, normally within 50

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
						winter and spring. No habitat present.	kilometres of the coast. Inhabits coastal heath and wet and dry sclerophyll forests. Generally found in areas with rainfall greater than 760 mm. Requires relatively thick ground cover where the soil is light and sandy. Known to eat fungi, arthropods, fleshy fruit, seeds and plant tissue. It is solitary and sedentary, buts tends to aggregate in small groups. It has two breeding seasons, one in late winter-early spring and the other in late summer. This species appears to benefit from a lack of recent disturbance.
Pseudomys novaehollandiae	New Holland Mouse	VU		2005/#	Low	Not recorded during targeted surveys in winter and spring. No habitat present.	The New Holland Mouse currently has a disjunct, fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Across the species' range the New Holland Mouse is known to inhabit open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes. The home range of the New Holland Mouse can range from 0.44 ha to 1.4 ha. The New Holland Mouse is a social animal, living predominantly in burrows shared with other individuals. The species is nocturnal and omnivorous, feeding on seeds, insects, leaves, flowers and fungi, and is therefore likely to play an important role in seed dispersal and fungal spore dispersal. It is likely that the species spends considerable time foraging above-ground for food, predisposing it to predation by native predators and introduced species. Breeding typically occurs between August and January, but can extend into autumn.
Pseudomys oralis	Hastings River	EN	E1	#	Low	Not recorded during	Occurs in upland forests (at altitudes between 300-1250

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
	Mouse					targeted surveys in winter and spring. No habitat present.	m) from Barrington Tops to Queensland. Inhabits open forests and woodlands with a grass, sedge, rush or heath understorey. The Hastings River Mouse nests within cavities in root systems of trees, holes in the ground, rock piles, hollow logs and epiphytes near the ground. Native grasses and sedges for a large part of the diet. Legumes, seeds, fruits, moss, fungi and insects are also eaten. Females have a home range of 1 ha, and males up to 2 ha. The species occurs at low densities (often <per 1 ha).
Pteropus poliocephalus	Grey-headed Flying-fox	VU	V	2011/#	High	Species recorded within the study area during the current Biosis (2014) surveys.	Occurs along the NSW coast, extending further inland in the north. This species is a canopy-feeding frugivore and nectarivore of rainforests, open forests, woodlands, melaleuca swamps and banksia woodlands. Roosts in large colonies (camps), commonly in dense riparian vegetation. Bats commute daily to foraging areas, usually within 15 kilometres of the day roost although some individuals may travel up to 70 kilometres.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat		V	2009	Medium	Not recorded during targeted surveys in spring. Suitable habitat present. Recorded from the locality of the study area.	Found throughout NSW. They have been reported from southern Australia between January and June. Reported from a wide range of habitats throughout eastern and northern Australia, including wet and dry sclerophyll forest, open woodland, acacia shrubland, mallee, grasslands and desert. They roost in tree hollows in colonies of up to 30 (but more usually two to six) and have also been observed roosting in animal burrows, abandoned Sugar Glider nests, cracks in dry clay, hanging from buildings and under slabs of rock. It is high-flying, making it difficult to detect. It forages above the canopy of

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
							eucalypt forests, but comes lower to the ground in mallee or open country.
Scoteanax rueppellii	Greater Broad-nosed Bat		V	2010	Medium	Not recorded during targeted surveys in spring. Suitable habitat present. Recorded from the locality of the study area.	Occurs along the Great Dividing Range, generally at 500 m but up to 1200 m, and in coastal areas. Occurs in woodland and rainforest, but prefers open habitats or natural or human-made openings in wetter forests. Often hunts along creeks or river corridors. Flies slowly and directly at a height of 30 m or so to catch beetles and other large, flying insects. Also known to eat other bats and spiders. Roosts in hollow tree trunks and branches.
Vespadelus troughtoni	Eastern Cave Bat		V	2013	Medium	Not recorded during targeted surveys in spring. Suitable forage habitat present. Recorded from the locality of the study area.	Found in a broad band on both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. It roosts in small groups, often in well-lit overhangs and caves, mine tunnels, road culverts, and occasionally in buildings.
Reptiles							
Hoplocephalus bitorquatus	Pale-headed Snake		V	1994	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	Found in a variety of habitats from wet sclerophyll forest to dry eucalypt forest on the western slopes of NSW. Feeds largely on frogs and lizards.
Hoplocephalus bungaroides	Broad-headed Snake	VU	E1	#	Low	Not previously recorded within 10 kilometres of	Mainly occurs in association with communities occurring on Triassic sandstone within the Sydney Basin. Typically

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
						the study area and no suitable sandstone habitat occurs within the study area.	found among exposed sandstone outcrops with vegetation types ranging from woodland to heath. Within these habitats they generally use rock crevices and exfoliating rock during the cooler months and tree hollows during summer.
Amphibians							
Litoria aurea	Green and Golden Bell Frog	VU	E1	1992/#	Low	Not recorded during targeted surveys in winter and spring. No habitat present.	Most existing locations for the species occur as small, coastal, or near coastal populations, with records occurring between south of Grafton and northern VIC. The species is found in marshes, dams and stream sides, particularly those containing bullrushes or spikerushes. Preferred habitat contains water bodies that are unshaded, are free of predatory fish, have a grassy area nearby and have diurnal sheltering sites nearby such as vegetation or rocks , although the species has also been recorded from highly disturbed areas including disused industrial sites, brick pits, landfill areas and cleared land. Breeding usually occurs in summer. Tadpoles, which take approximately 10-12 weeks to develop , feed on algae and other vegetative matter. Adults eat insects as well as other frogs, including juveniles of their own species.
Mixophyes balbus	Stuttering Frog	VU	E1	#	Low	Not previously recorded within 10 kilometres of the study area and no suitable preferred habitat occurs within the study area.	This species is usually associated with mountain streams, wet mountain forests and rainforests. It rarely moves very far from the banks of permanent forest streams, although it will forage on nearby forest floors. Eggs are deposited in leaf litter on the banks of streams and are washed into the water during heavy rains.

* - habitat descriptions have been adapted by qualified ecologists (zoologists) from the DoEE Species Profile and Threats (SPRAT) Database, OEH Threatened Species online profiles and the NSW Scientific Committee final determinations for listed species, references within the above table are provided within the report reference list.

A5.3 Migratory species (EPBC Act listed)

Includes records from the following sources:

OEH NSW BioNet Wildlife Atlas (OEH 2014f; accessed on 06/08/2014)

DoE Protected Matters Search Tool database (DoE 2014; accessed on 06/08/2014)

BirdLife Australia data search (Birdlife Australia 2014)

Current survey

Bold denotes species recorded in the study area during the current assessment.

Table 37 Migratory fauna species recorded/predicted within 10 kilometres of the study area

Scientific name	Common name	EPBC Act	TSC Act	Most recent record
Anthochaera phrygia	Regent Honeyeater	EN	E4A	2012/#
Apus pacificus	Fork-tailed Swift			2004
Ardea ibis	Cattle Egret			2014
Ardea modesta	Eastern Great Egret			2014
Calidris acuminata	Sharp-tailed Sandpiper			2014
Calidris ferruginea	Curlew Sandpiper		E1	2013
Calidris melanotos	Pectoral Sandpiper			2009
Calidris ruficollis	Red-necked Stint			2013
Chalcophaps indica	Emerald Dove			2012
Charadrius bicinctus	Double-banded Plover			2006
Chlidonias leucopterus	White-winged Black Tern			2011
Gallinago hardwickii	Latham's Snipe			2013
Haliaeetus leucogaster	White-bellied Sea-Eagle			2013
Hirundapus caudacutus	White-throated Needletail			2013
Hydroprogne caspia	Caspian Tern			2013
Limosa lapponica	Bar-tailed Godwit			2012
Limosa limosa	Black-tailed Godwit		V	2012
Merops ornatus	Rainbow Bee-eater			2013
Monarcha melanopsis	Black-faced Monarch			2013
Myiagra cyanoleuca	Satin Flycatcher			2008
Numenius madagascariensis	Eastern Curlew			1993
Pandion cristatus	Osprey		V	1992

Scientific name	Common name	EPBC Act	TSC Act	Most recent record
Plegadis falcinellus	Glossy Ibis			2013
Pluvialis fulva	Pacific Golden Plover			2013
Rhipidura rufifrons	Rufous Fantail			2013
Rostratula australis	Australian Painted Snipe	EN	E1	#
Sterna hirundo	Common Tern			2011
Symposiachrus trivirgatus	Spectacled Monarch			2009
Tringa glareola	Wood Sandpiper			1986
Tringa nebularia	Common Greenshank			2012
Tringa stagnatilis	Marsh Sandpiper			2014

Appendix 6 Significant Impact Criteria assessments

The following Significant Impact Criteria (SIC) assessment has been prepared in accordance with the Matters of National Environmental Significance, Significant Impact Criteria guidelines 1.1 Environment Protection and Biodiversity Conservation Act (DoE 2013) for species determined to have a medium or greater likelihood of occurrence within the study area. This applied to a total of two flora species and five fauna species including:

- Small-flower Grevillea *Grevillea parviflora subsp. parviflora* (Vulnerable)
- Tall Knotweed *Persicaria elatior* (Vulnerable)
- Koala *Phascolarctos cinereus* (combined populations of Qld, NSW and the ACT) (Vulnerable)
- Grey-headed Flying-Fox *Pteropus poliocephalus* (Vulnerable)
- Spotted-tailed Quoll *Dasyurus maculatus maculatus* (SE mainland population) (Endangered)
- Blossom-dependent birds including:
  - Regent Honeyeater *Anthochaera Phrygia* (Critically Endangered)
  - Swift Parrot *Lathamus discolour* (Endangered)

Small-flower Grevillea Grevillea parviflora subsp. parviflora

Small-flower Grevillea *Grevillea parviflora subsp. parviflora* is listed as Vulnerable under the EPBC Act and Vulnerable under the TSC Act. It is a low spreading to erect shrub which sporadically occurs throughout the Sydney Basin (OEH 2013). Main occurrences of Small-flower Grevillea are located south of Sydney in the Appin – Wedderburn – Picton – Bargo districts associated with the Nepean and Georges Rivers and separately and in the Hunter within the Cessnock - Kurri Kurri area (particularly Werakata NP). Separate populations are also known from Putty to Wyong and Lake Macquarie on the Central Coast (OEH 2013). Generally, Small-flower Grevillea occurs on sandy clay loam soils often with lateritic ironstone gravels. Soils are derived from Tertiary sands or alluvium and from the Mittagong Formation with alternating bands of shale and fine grained sandstones (DoE 2015a). Small-flower Grevillea grows in range of vegetation types varying from heath and shrubby woodland to open forest however, it sometimes also occurs in open, slightly disturbed sites such as the edge of tracks (OEH 2013). In the Sydney area the species has been recorded in Shale Sandstone Transition Forest and Coastal Foothills Spotted Gum Ironbark Forest (NPWS 2002).

This vulnerable species has been assessed in accordance with the aforementioned significant impact guidelines (DoE 2013) using the following significant impact criteria:

- *Lead to a long-term decrease in the size of an important population of a species.*
- *Reduce the area of occupancy of an important population.*
- *Fragment an existing important population into two or more populations.*
- *Adversely affect habitat critical to the survival of a species.*
- *Disrupt the breeding cycle of an important population.*
- *Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.*
- *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.*

- *Introduce disease that may cause the species to decline, or*
- *Interfere substantially with the recovery of the species.*

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will lead to a long-term decrease in the size of an important population of a species

An 'important population' is defined by DoE (2013) as a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in Recovery Plans, and/or that are:

- Key source populations either for breeding or dispersal.
- Populations that are necessary for maintaining genetic diversity.
- Populations that are near the limit of the species range.

No individuals or important populations of small-flower Grevillea were recorded within the locality. The closest records of Small-flower Grevillea are approximately 10 kilometres east of the study area, near Wallaroo State Forest (OEH 2014f). However none of the populations within the Hunter-Central Rivers CMA are considered 'important populations'. Based on the lack of an important population in the locality, the Project will not lead to a long-term decrease in the size of an important population of Small-flower Grevillea.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will reduce the area of occupancy of an important population

No small-flower Grevillea was recorded within or immediately surrounding the study area and no important populations of Small-flower Grevillea were identified. The nearest location of Small-flower Grevillea is located approximately 10 kilometres east of the study area (OEH 2014f). Further, there are no recorded important populations in the locality. It is therefore considered an unlikely that the Project will reduce the area of occupancy of an important population of this species.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will fragment an existing important population into two or more populations

No important populations of Small-flower Grevillea were identified within the locality. The nearest location of an individual record was recorded approximately 10 kilometres from the study area and will not be fragmented by the proposed works.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will adversely affect habitat critical to the survival of a species

Despite none being identified during the winter and spring targeted survey, in total approximately 48.62 hectares of potentially suitable habitat will be cleared for the Project. However, within the Hunter-Central Rivers region, Small-flower Grevillea has been found associated with a number of vegetation formations, classes and types (OEH 2013). In particular, Small-flower Grevillea has been found within vegetation communities of Hunter-Macleay Dry Sclerophyll Forests, Coastal Floodplain Woodlands and Coastal Swamp Forest (identified within the study area)

Habitat clearing associated with the proposed works is unlikely to adversely affect habitat critical to the survival of the species given that the species is often associated with a wide range of vegetation formations classes and types occurring in the locality and given no individuals were found within the study area.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will disrupt the breeding cycle of an important population

There is no real chance or possibility of significant impact to Small-flower Grevillea as no individuals or important populations of Small-flower Grevillea were identified within the study area, hence disruptions to regeneration and dispersal are unlikely.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

In total approximately 48.62 hectares of potentially suitable habitat for Small-flower Grevillea will be cleared for the Project. However as some of this habitat contained Blady Grass *Imperata cylindrical* and Tick Bush *Kunzea ambigua* which are known to reduce the quality and availability of suitable habitat for Small-flower Grevillea (DoE 2015a) the habitat whilst being potential habitat is considered marginal. In addition, as this species was not located during targeted survey effort, habitat removal is unlikely to cause further decline of the species given that the habitat is marginal and no individuals were recorded.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

Exotic species, such as Lantana, as well as natives, such as Blady Grass and Tick Bush, considered harmful to Small-flower Grevillea were identified throughout the areas of impact (habitat to be cleared). It is therefore unlikely that the works will exacerbate the current proportion of these harmful species or result in a recruitment of other harmful species as this vegetation is planned for clearance. However, adjoining vegetation to be monitored for establishment of weeds as the Project begins and continues, and controlled as per Section 5 of the BAR.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will introduce disease that may cause the species to decline,

There are no known diseases at this current time, likely to impact Small-flower Grevillea.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result interfere substantially with the recovery of the species.

There is currently no recovery plan for this species. However, there is a targeted strategy for managing and assisting the recovery of Small-flower Grevillea. This has been developed within the site-managed species stream of the Saving Our Species program (OEH 2013). The site-managed species stream means that 5 management sites where conservation activities are needed most have been identified. The study area is not listed as a management site for Small-flower Grevillea as there is no population known to occur there. Therefore, the proposed clearing does not conflict with or interfere substantially with the recovery of the species.

Conclusion

Based on the above assessment the Project will not significantly impact Small-flower Grevillea as:

- The species was not recorded within the study area.

- There are no associated impacts to important populations of Small-flower Grevillea.
- Vegetation to be cleared is considered marginal and the nearest located individuals are located 10 kilometers east of the study area.

Tall Knotweed Persicaria elatior

Tall Knotweed *Persicaria elatior* is listed as Vulnerable under the EPBC Act and as Vulnerable under the TSC Act. It is an erect short-lived, herbaceous species with known individuals and/or populations occurring from the North Coast, Central Coast and South Coast Botanical Subdivisions in New South Wales (DoE 2015b). It prefers damp habitat including; coastal swamps, along watercourses, streams and lakes, swamp forest and disturbed areas (DoE 2015b). It is generally found associated with *Melaleuca linearifolia, Melaleuca quinquenervia, Lophostemon suaveolens, Casuarina glauca, Corymbia maculata, Pseudognaphalium luteoalbum* and *Polygonum hydropiper* (Quinn et al. 1995). Tall Knotweed grows rapidly, flowers and sets seeds within six months of germinating, flowering mostly in summer (Quinn et al. 1995).

This vulnerable species has been assessed in accordance with the aforementioned significant impact guidelines using the following significant impact criteria:

- *Lead to a long-term decrease in the size of an important population of a species.*
- *Reduce the area of occupancy of an important population.*
- *Fragment an existing important population into two or more populations.*
- *Adversely affect habitat critical to the survival of a species.*
- *Disrupt the breeding cycle of an important population.*
- *Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.*
- *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.*
- *Introduce disease that may cause the species to decline, or*
- *Interfere substantially with the recovery of the species.*

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will lead to a long-term decrease in the size of an important population of a species

An 'important population' is defined by DoE (2013) as a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in Recovery Plans, and/or that are:

- Key source populations either for breeding or dispersal.
- Populations that are necessary for maintaining genetic diversity.
- Populations that are near the limit of the species range.

No Tall Knotweed was recorded within the study area, however the dams and ephemeral wet soaks were considered to provide potential habitat for the species. The study area is not located at the limit of the range of Tall Knotweed, which is distributed from from Mt Dromedary in south east NSW to Grafton in the north. The closest records of Tall Knotweed is approximately 4 kilometres from the study area (OEH 2014i). The Project will therefore not lead to a long-term decrease in the size of an important population of Tall Knotweed.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will reduce the area of occupancy of an important population

No Tall Knotweed were recorded within the study area and no important populations of Tall Knotweed were identified within 10 kilometres from the study area (OEH 2014i). If the species is currently dormant within the seed bank or there are inconspicuous individuals present within the study area, the survey effort to date suggests that their occurrence limited in number and extent and not part of an important population. It is therefore considered unlikely that the Project will reduce the area of occupancy for an important population.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will fragment an existing important population into two or more populations

No individuals or important populations of Tall Knotweed were identified within the study area. Habitat for Tall Knotweed is typically ephemeral wet soaks, creek lines and dams. These features are usually scattered across the landscape and therefore fragmented in their distribution. The nearest population has recorded approximately 4 kilometres from the study area and will not become fragmented by the proposal.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will adversely affect habitat critical to the survival of a species

Habitat critical to the survival of a species is defined as areas that are necessary:

- For activities such as foraging, breeding, roosting, or dispersal.
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators).
- To maintain genetic diversity and long term evolutionary development.
- For the reintroduction of populations or recovery of the species or ecological community.

In total approximately 1.69 hectares of potentially suitable habitat will be cleared for the Project, including:

- 0.67 of Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion.
- 1.02 ha of offline dams.

Habitat clearing associated with the proposed works is unlikely to adversely affect habitat critical to the survival of the species given that no habitat fitting this description was recorded within the study area.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will disrupt the breeding cycle of an important population

Tall Knotweed appears to be short-lived however germinates readily and grows rapidly, setting seeds within six months of germination (DoE 2015b). There is no real chance or possibility of significant impact as no individuals or populations were identified within the study area, hence disruptions to regeneration and dispersal are unlikely.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

Approximately 1.69 hectares of potentially suitable habitat will be cleared for the proposal. There are larger areas of higher quality habitat within the broader region, already known to support individuals or populations of Tall Knotweed. Therefore, the proposal is unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The NSW threatened species profile for Tall Knotweed lists a number of species that are harmful to the species including:

- Longleaf Primrose Willow *Ludwigia longifolia.*
- Black-berry Nightshade *Solanum nigrum.*
- Buffalo grass *Stenotaphrum secundatum.*
- Grazers generally.

No individuals of Tall Knotweed were identified within the study area. Potential habitat for the species within the study area will be removed therefore the impacts of these harmful species will be negligible. On a broader scale, the Project is unlikely to cause the introduction or exacerbation of these harmful species into any existing populations of Tall Knotweed.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will introduce disease that may cause the species to decline,

There are no known diseases at this time, likely to impact Tall Knotweed.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result interfere substantially with the recovery of the species.

There is currently no recovery plan for this species. Furthermore the Project will not interfere substantially with the long-term recovery of this species given that a targeted strategy for managing and assisting the recovery of Tall Knotweed has been developed within the site-managed species stream of the Saving Our Species program (OEH 2013i). The site-managed species stream means that 5 management sites where conservation activities are needed most have been identified. The study area is not listed as a management site for Tall Knotweed which includes:

- Mallanganee - Kyogle LGA
- Gibberagee - Clarence Valley LGA
- Wanda wetlands - Port Stephens LGA
- Bevian swamp - Eurobodalla LGA
- An additional un-named translocation site.

Conclusion

Based on the above assessment the Project will not significantly impact Tall Knotweed as:

- No individuals were recorded within the study area.
- There are no associated impacts to important populations of Tall Knotweed.

- Vegetation to be cleared is considered marginal and the nearest located individuals are located 4 kilometers from the study area.

Koala Phascolarctos cinereus (combined populations of Queensland, New South Wales and the Australian Capital Territory)

The Koala is listed as Vulnerable under the EPBC Act and Vulnerable under the TSC Act. It is an arboreal folivore inhabiting eucalypt forests and woodlands throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia (DoE 2015c; OEH 2014j).

Habitat suitability and the home range of Koalas depends on the size and species of trees present, soil nutrients, climate and rainfall. Generally, home ranges are between 1 hectare and 500 hectares and dispersal distances vary from between 3.5 kilometres and 16 kilometres per day (DoE 2015c).

Koalas feed almost exclusively on the leaves of *Eucalyptus*, *Corymbia* and *Angophora* species, although it has been recorded feeding from other tree species including, on occasions, exotic species (DoE 2015c). Primary feed trees include; *Eucalyptus robusta, E. tereticornis, E. punctata, E. haemastoma* and *E. signata* (Department of Planning, 1995). Additional feed trees include some species of *Corymbia* spp., *Angophora* spp. and *Lophostemon* spp. (DoE 2015c).

Approximately 45.8 hectares of suitable Koala habitat was identified within the study area. Koalas and/or signs of Koala activity were recorded throughout the study area. However, the results of targeted surveys indicate that the study area supports a relatively low density of Koalas (≤ 0.1 Koala per hectare). Further, there was no evidence of breeding Koalas (e.g. females with young).

Is there is a real chance or possibility that the action will lead to a long-term decrease in the size of an important population of a species?

An 'important population' is defined by DoE (2013) as a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in Recovery Plans, and/or that are:

- Key source populations either for breeding or dispersal.
- Populations that are necessary for maintaining genetic diversity, and/or
- Populations that are near the limit of the species range.

Koalas were recorded twice within the study area during surveys. One individual was recorded during winter surveys, and one individual was recorded during spring surveys. It is uncertain whether this represents two records of the same individual or two separate animals. No Koalas were recorded during targeted surveys for this species in summer.

There was no evidence of breeding (in the form of females with young) recorded during the survey period. Targeted SAT surveys indicated that the study area supports only a low density of Koalas (≤0.1 Koala per hectare) (Appendix 4). Given the low population density and the absence of breeding females it is unlikely that the study area supports an important population of Koalas. The action will not therefore lead to a long-term decrease in the size of an important population of Koalas.

Is there a real chance or possibility that the action will reduce the area of occupancy of an important population?

As outlined above, Koalas within the study area do not represent an important population. The Project will not therefore reduce the area of occupancy of an important population.

Is there a real chance or possibility that the action will fragment an existing important population into two or more populations?

As outlined above, Koalas within the study area do not represent an important population. The Project will not therefore reduce the area of occupancy of an important population.

Is there a real chance or possibility that the action will adversely affect habitat critical to the survival of a species?

Habitat critical to the survival of a species or ecological community' is defined by DoE (2013) as areas that are necessary:

- for activities such as foraging, breeding, roosting, or dispersal.
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators).
- to maintain genetic diversity and long term evolutionary development.
- for the reintroduction of populations or recovery of the species or ecological community.

Such habitat may be, but is not limited to habitat identified within the recovery plan for the species and/or habitat listed on the Register of Critical Habitat maintained by the minister under the EPBC Act (DoE 2013).

To date, no areas of critical habitat have been listed for the Koala. However, in accordance with EPBC Act Referral Guidelines (DoE 2014) for the vulnerable Koala the removal of Koala habitat resulting from the Project will adversely affect habitat critical to the survival of the species.

Is there a real chance or possibility that the action will disrupt the breeding cycle of an important population?

As outlined above, Koalas within the study area do not represent an important population. The Project will not therefore reduce the area of occupancy of an important population.

Is there a real chance or possibility that the action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

Approximately 45.8 hectares of Koala habitat will be removed for the Project. It is therefore likely that the Project will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent the species is likely to decline locally.

Is there a real chance or possibility that the action will result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

Feral dogs *Canis lupus familiaris* were recorded within the study area during field surveys. Dog attack is known to be a significant cause of koala mortality (DoE 2015c). However, the Project is unlikely to result in an increase of invasive species, including feral dogs.

An action is likely to have a significant impact on a vulnerable species is there a real chance or possibility that the action will introduce disease that may cause the species to decline,

The most well-known disease affecting koala populations is associated with particular strains of *Chlamydia* (DoE 2015c). Many koalas carry *Chlamydia* but do not always show clinical symptoms, however for those that do, the symptoms include; eye, urinary tract, respiratory track and reproductive tract infections. It is unknown whether the two koalas identified within the study area, or individuals recorded in the broader area have this disease (DoE 2015c). Another well-known disease is Koala Retrovirus (KoRV). This disease is transmitted genetically and from koala to koala via close contact. Up to 100% of koalas in Queensland and NSW are thought to have KoRV (DoE 2015c). Neither of these diseases will increase or lead to species decline as a result of the Project.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result interfere substantially with the recovery of the species.

An approved recovery plan was prepared for the Koala in November 2008 (DECC 2008). The objectives of both the National Koala Conservation Strategy (ANZECC 1998) and the Approved Koala Plan (DECC 2008) are provided below:

- Objective 1: To conserve Koalas in their existing habitat.
- Objective 2: To rehabilitate and restore Koala habitat and populations.
- Objective 3: To develop a better understanding of the conservation biology of Koalas.
- Objective 4: To ensure that the community has access to factual information about the distribution, conservation and management of Koalas at a national, state and local scale.
- Objective 5: To manage captive, sick or injured Koalas and orphaned wild Koalas to ensure consistent and high standards of care.
- Objective 6: To manage over browsing to prevent both Koala starvation and ecosystem damage in discrete patches of habitat.
- Objective 7: To coordinate, promote the implementation, and monitor the effectiveness of the NSW Koala Recovery Plan across NSW.

The Project is likely to conflict with Objective 1.

Conclusion

Based on the above assessment it is likely that Koalas will be significantly impacted by the Project and as such, a Referral under the provisions of the EPBC Act is recommended for this species.

Grey-headed Flying-Fox Pteropus poliocephalus

The Grey-headed Flying-Fox *Pteropus poliocephalus* is listed as Vulnerable under the EPBC Act and as Vulnerable under the TSC Act. Grey-headed Flying-Fox is a canopy-feeding frugivore, blossom-eater and a nectarivore of rainforests, tall sclerophyll forests and woodlands, heaths and swamps, gardens and cultivated fruit crops (DoE 2015d).

They forage opportunistically, often at distances up to 30 kilometres from camps, and occasionally up to 60–70 kilometres per night, in response to patchy food resources (NSW Scientific Committee 2001). The species congregates in large numbers at roosting sites (camps). Individuals generally exhibit a high fidelity to traditional camps and return annually to give birth and rear offspring (OEH 2014k).

One Grey-headed Flying-fox was recorded foraging within the study area during current surveys. The study area provides approximately 48.62 hectares of suitable forage habitat for this species. However, suitable forage habitat is abundant throughout the wider locality.

No roosting or breeding camps of the Grey-headed Flying-fox were recorded within the study area during the current surveys.

Is there is a real chance or possibility that the action will lead to a long-term decrease in the size of an important population of a species?

An 'important population' is defined by DoE (2013) as a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in Recovery Plans, and/or that are:

- key source populations either for breeding or dispersal;
- populations that are necessary for maintaining genetic diversity; and/or
- populations that are near the limit of the species range.

During the field survey Grey-headed Flying Foxes were recorded within the study area. Additionally, background searches revealed that approximately 23 individuals had been previously recorded approximately 3.5 kilometres of the study area (OEH 2014f). The Project will remove 48.62 hectares of forage habitat for the Grey-headed Flying-fox. However, given the extent of suitable forage habitat in the locality, the mobility of the species and the absence of roost or breeding camps within or in proximity to the study area it is unlikely that the Project will adversely decrease the size of these populations.

Is there a real chance or possibility that the action will reduce the area of occupancy of an important population?

The study area is not considered to support an important population of the Grey-headed Flying-fox. Approximately 48.62 hectares of forage habitat will be cleared for the Project. This clearing is unlikely to significantly reduce the area of occupancy given that no known breeding or roosting camps were within the study area.

Is there a real chance or possibility that the action will fragment an existing important population into two or more populations?

Grey-headed Flying-foxes are highly mobile animals. Clearing of approximately 48.62 hectares of forage habitat will not fragment the local population.

Is there a real chance or possibility that the action will adversely affect habitat critical to the survival of a species?

'Habitat critical to the survival of a species or ecological community' is defined by DoE (2013) as areas that are necessary:

- For activities such as foraging, breeding, roosting, or dispersal.
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators).
- To maintain genetic diversity and long term evolutionary development.
- For the reintroduction of populations or recovery of the species or ecological community.

Such habitat may be, but is not limited to habitat identified within the recovery plan for the species and/or habitat listed on the Register of Critical Habitat maintained by the minister under the EPBC Act (DECCW 2009b; DoE 2013).

To date, no areas of critical habitat have been listed for the Grey-headed flying-fox. The study area provides forage habitat only for Grey-headed Flying-fox. There are many known examples of better quality and better-suited habitat within the broader area. Given that the Grey-headed Flying-foxes is a highly mobile species, habitat clearing associated with the Project is unlikely to adversely affect habitat critical to the survival of the species.

Is there a real chance or possibility that the action will disrupt the breeding cycle of an important population?

No known breeding or roosting camps of the Grey-headed flying-fox were found within the study area. Given that individuals generally exhibit a high fidelity to traditional camps and return annually to give birth and rear offspring (OEH 2014k), clearing of the vegetation in the study area would not disrupt the breeding cycle of the local population.

Is there a real chance or possibility that the action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

Approximately 48.62 hectares of forage habitat for Grey-headed flying-fox will be cleared for the Project. There are other suitable habitats within the broader region already known to support Grey-headed Flying-fox populations. Therefore, the Project is unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

There are no specific invasive species known to be harmful to Grey-headed Flying Foxes therefore the Project is unlikely to have a significant impact.

Is there is a real chance or possibility that the action will introduce disease that may cause the species to decline?

The effects of the diseases such as Australian bat Lyssavirus (ABL), Bat Paramyxovirus and Menangle Pig virus on the Grey-headed Flying-fox are unknown (DoE 2015d). However, the Project is unlikely to introduce disease that may cause species decline.

Is there a real chance or possibility that it will result interfere substantially with the recovery of the species?

There is a draft national recovery plan for the Grey-headed flying fox (DECCW 2009). Objectives of the recovery plan include:

- To reduce the impact of threatening processes.
- To arrest decline throughout their range.
- To conserve their functional roles in seed dispersal and pollination of native plants.
- To improve the comprehensiveness and reliability of information available to guide recovery.

- The Project is unlikely to conflict with any of these objectives and will therefore unlikely interfere substantially with the recovery of the species.

Conclusion

Based on the above assessment the Grey-headed Flying-fox is unlikely to be significantly impacted by the Project and as such, a Referral under the provisions of the EPBC Act is not recommended for this species.

Spotted-tailed Quoll Dasyurus maculatus maculatus (SE mainland population)

The Spotted-tailed Quoll *Dasyurus maculatus maculatus* (SE mainland population) is listed as Endangered under the EPBC Act and as Vulnerable under the TSC Act. It is a nocturnal, carnivorous marsupial with reddish-brown fur and distinctive white spots (DoE 2015e).

It is recorded across a range of habitat such as; rainforest, open forest, woodland, coastal heath, inland riparian forest, the sub-alpine zone to the coastline in eastern NSW, eastern Victoria, south-east and north-eastern Queensland and Tasmania (DoE 2015e; OEH 2014l).

Spotted-tailed Quolls use hollow-bearing trees, fallen logs, caves, rock outcrops and rocky-cliff faces as den sites and have an average litter size of five (OEH 2014l). They are a generalist predator, preying on; gliders, possums, small wallabies, rats, birds, bandicoots, rabbits, domestic foul, reptiles and insects (OEH 2014l).

Spotted-tailed Quolls were not recorded within the study area during the current surveys, despite the use of survey methods targeting this species. Given the proximity of records of the Spotted-tailed Quoll from the wider locality, combined with habitat assessment it is assumed that the Project will remove approximately 48.62 hectares of potential habitat for this species.

Is there a real chance or possibility that it will lead to a long-term decrease in the size of a population?

A 'population of a species' is defined under the EPBC Act as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:

- A geographically distinct regional population, or collection of local populations, or
- A population, or collection of local populations, that occurs within a particular bioregion.

- Despite targeted surveys, no Spotted-tailed Quolls were found within the study area. However, 30 recent Spotted-tailed Quoll records occur within 10 kilometres of the study area (OEH 2014f). Within the study area, approximately 48.62 hectares of suitable habitat for the Spotted-tailed Quoll will be cleared for the Project. However, clearing this habitat is unlikely to lead to a long-term decrease in the size of a population given that no population was identified within the study area, and there are known populations and alternative habitat within the broader area.

Is there a real chance or possibility that the action will reduce the area of occupancy of the species?

Vegetation clearance is likely to remove approximately 48.62 hectares of potentially suitable habitat for Spotted-tailed Quoll, however given that no individuals were observed during the field survey it is unlikely to reduce the area of occupancy of the species. There are known areas of occupancy within the wider locality that will not be impacted by the Project.

Is there a real chance or possibility that the action will fragment an existing population into two or more populations?

Despite targeted surveys, no Spotted-tailed Quolls were found within the study area. The removal of habitat is therefore not anticipated to have a significant impact causing population fragmentation.

Is there a real chance or possibility that the action will adversely affect habitat critical to the survival of a species?

'Habitat critical to the survival of a species' is defined by DoE (2013) as areas that are necessary:

- For activities such as foraging, breeding, roosting, or dispersal.
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators).
- To maintain genetic diversity and long term evolutionary development, or
- For the reintroduction of populations or recovery of the species or ecological community.

Such habitat may be, but is not limited to habitat identified within the recovery plan for the species and/or habitat listed on the Register of Critical Habitat maintained by the minister under the EPBC Act (DoE 2013).

To date, no areas of critical habitat have been listed for the Spotted-tailed Quoll. The Project will not therefore adversely affect habitat critical to the survival of the Spotted-tailed Quoll.

Is there a real chance or possibility that the action will disrupt the breeding cycle of a population?

The Spotted-tailed Quoll requires suitable den sites (such as hollow logs, tree hollows, rock outcrops or caves) for breeding (DoE 2015e; OEH 2014m). Within the study area, hollow-bearing trees and hollow logs provide potential breeding habitat for this species. The Spotted-tailed Quoll was not recorded within the study area during the current surveys. Although the study area provides suitable potential breeding habitat for this species, more extensive similar or better quality habitat occurs in the wider locality. Suitable habitat in surrounding lands will not be impacted by the Project.

Given the absence of records of this species and the occurrence of suitable habitat in the wider locality, the Project will not disrupt the breeding cycle of a population of the Spotted-tailed Quoll.

Is there a real chance or possibility that the action will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

In total approximately 48.62 hectares of potentially suitable habitat will be cleared for the Project. Habitat clearing associated with the Project is unlikely to adversely affect habitat critical to the survival of the species for the following reasons:

- The species is often associated with a wide range of vegetation formations, classes and types (OEH 2014l).
- The species is highly mobile and there are is other suitable habitat within the broader area.
- No individuals were recorded found within the study area.

Is there a real chance or possibility that the action will result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?

Despite targeted surveys, no Spotted-tailed Quolls were found within the study area. However, Red Foxes *Vulpes vulpes* and Dogs *Canis lupus familiaris,* which are major threats to the Spotted-tailed Quoll (DoE 2015e) were observed in the study area and may affect populations of Spotted-tailed Quolls within the broader area. The Project is unlikely to result in an increase of invasive species, including dogs and foxes.

Is there a real chance or possibility that the action will introduce disease that may cause the species to decline?

There are no known diseases likely to impact Spotted-tailed Quoll.

Is there a real chance or possibility that the action will interfere with the recovery of the species?

To date, there is currently no recovery plan for the Spotted-tailed Quoll however OEH lists 4 activities to assist with the recovery of this species:

- Consult with OEH/NPWS if Spotted-tailed Quolls are raiding poultry, rather than taking direct action.
- Consult with OEH/NPWS if poison baiting is planned in or near areas where Spotted-tailed Quolls are known or likely to occur.
- Undertake cat and fox control using poison-baiting techniques least likely to affect quolls.
- Retain and protect large, forested areas with hollow logs and rocky outcrops, particularly areas with thick understorey or dense vegetation along drainage lines.

- The Project is not considered to significantly impact or interfere with the recovery of Spotted-tailed Quolls.

Conclusion

Based on the above assessment the Spotted-tailed Quoll is unlikely to be significantly impacted by the Project and as such, a Referral under the provisions of the EPBC Act is not recommended for this species.

Blossom-dependent birds: Regent Honeyeater Anthochaera phrygia and Swift Parrot Lathamus discolor

The Regent Honeyeater *Anthochaera phrygia* is listed as Endangered under the EPBC Act and Critically Endangered under the TSC Act. The Regent Honeyeater inhabits temperate woodlands, open forests and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak (DoE 2015f; OEH 2014n).

It occurs mainly within vegetation communities that have a significantly high abundance and species richness of bird species as well as a large number of mature trees, high canopy cover and an abundance of mistletoes (OEH 2014n). They are distributed mainly in vegetation communities on inland slopes of south-east Australia but can sometimes be found in drier coastal woodlands and forests some years (OEH 2014n).

The Regent Honeyeater is a generalist forager, feeding on nectar from a wide range of *Eucalyptus* species and mistletoes (DoE 2015f; OEH 2014n).

The Swift Parrot *Lathamus discolor* is listed as Endangered under the EPBC Act and as Endangered under the TSC Act. The Swift Parrot is a highly nomadic species that inhabits dry sclerophyll eucalypt forests and woodlands in New South Wales (DoE 2015g; OEH 2014o). It migrates in response to food availability and seasonal changes. It is often recorded in New South Wales between May and August and breeds in Tasmania during the warmer seasons (DoE 2015g; OEH 2014o).

The Swift Parrot is mainly an arboreal forager, feeding on nectar (mainly from eucalypts) as well as psyllid insects and lerps, seeds and fruits. Favoured feed trees include winter-flowering species such as *Eucalyptus robusta, E. albens, E. sideroxylon*, *Corymbia maculata* and *C. gummifera*. Commonly used lerp-infested trees include *Eucalyptus microcarpa*, *E. moluccana* and *E. pilularis* (DoE 2015g).

Targeted surveys in winter and spring did not record the Regent Honeyeater or the Swift Parrot within the study area. Given the proximity of recent records combined with the results of habitat assessment it is considered that the Project will remove 48.62 hectares of potential foraging habitat for both of these species. However, more extensive areas of similar or better quality habitat for the Regent Honeyeater and the Swift Parrot occurs throughout the wider locality.

Is there a real chance or possibility that the action will lead to a long-term decrease in the size of a population?

A 'population of a species' is defined under the EPBC Act as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:

- A geographically distinct regional population, or collection of local populations, or

- A population, or collection of local populations, that occurs within a particular bioregion.

Despite targeted surveys, neither the Regent Honeyeater nor Swift Parrot were recorded within the study area. However, both species may occasionally utilise seasonal forage habitat within the study area, albeit infrequently. Wildlife Atlas data indicates that the closest record for the Regent Honeyeater is approximately 4.5 kilometres while the closest record for the Swift Parrot is 5 kilometres from the study area (OEH 2014o). Within the Hunter-Central region, both the Regent Honeyeater and Swift Parrot are associated with a range of vegetation formations, classes and types with extensively recorded 'known' distributions outside the study area. It is therefore considered unlikely that the Project will lead to a long-term decrease in the size of a population (OEH 2014n; OEH 2014o).

Is there a real chance or possibility that the action will reduce the area of occupancy of the species?

The study area does not lie at or near the limit of the area of occupancy of the Swift Parrot, which extends from south east Queensland through New South Wales, Victoria to South Australia and Tasmania (Pizzey and Knight 2012). In addition, the study area does not lie near the limit of the area of occupancy of the Regent Honeyeater, which extends from South-east Queensland to Victoria (Pizzey and Knight 2012). Given the absence of records of these species within the study area, the extent of suitable habitat in the wider locality and the high mobility of these species, it is considered unlikely that the proposal would reduce the area of occupancy of the Regent Honeyeater and/or Swift Parrot.

Is there a real chance or possibility that the action will fragment an existing population into two or more populations?

Clearing of approximately 48.62 hectares of potential forage habitat for the Project will not fragment an existing population of either species into two or more populations give:

- Regent Honeyeaters and Swift Parrots have not been recorded within the study area.
- Larger areas of similar or better quality forage habitat for these species occurs throughout the wider locality.
- The Regent Honeyeater and the Swift Parrot are highly mobile blossom nomads.

Is there a real chance or possibility that the action will adversely affect habitat critical to the survival of a species?

Approximately 48.62 hectares of potential forage habitat for the Regent Honeyeater and the Swift Parrot will be removed for the Project. Given the absence of records of these species within the study area and the extent of suitable forage habitat in the wider locality it is considered unlikely that the Project will adversely affect habitat critical to the survival of the Regent Honeyeater and/or the Swift Parrot.

Is there a real chance or possibility that the action will disrupt the breeding cycle of a population?

The Project will remove approximately 48.62 hectares of potential foraging habitat for the Regent Honeyeater and Swift Parrot. However, given the extensive habitat occurring outside the study area provided that both species are highly mobile (frequently migrating in response to food availability and seasonal changes) (DoE 2015f; DoE 2015g). It therefore considered unlikely that the Project would disrupt the breeding cycle of a population of either of these species.

Is there is a real chance or possibility that the action will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The Project will remove approximately 48.62 hectares of potential foraging habitat for the Regent Honeyeater and Swift Parrot. More extensive areas of similar or better habitat for these species occur in the wider locality. These species have not been recorded within the study area, and are both highly mobile species. It is therefore unlikely that the Project will modify, destroy, remove, isolate or decrease the availability or quality of habitat for either the Regent Honeyeater or the Swift Parrot to the extent that either of these species is likely to decline.

Is there is a real chance or possibility that the action will result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?

The Regent Honeyeater and Swift Parrot would be susceptible to predation by foxes and feral dogs (which were recorded within the study area) however the impact of predation from these species is noted as being low and is not a focus of recovery actions (DoE 2015f; DoE 2015g). The Project is unlikely to increase the number of invasive predatory species that will significantly impact on the Regent Honeyeater and/or Swift Parrot.

Is there a real chance or possibility that the action will introduce disease that may cause the species to decline?

There are no known diseases impacting Regent Honeyeater.

Infection by *Psittacine circoviral* (beak and feather) disease (PCD) affecting endangered psittacine species is listed as a key threatening process (DoE 2015g). Swift parrots are considered to have a high potential for being adversely impacted by PCD due to their low population numbers and the fact that PCD has been recorded in wild birds in New South Wales (DoE 2015g). The Project is unlikely to result in the introduction of PCD into the study area, or increase the incidence of PCD in birds in New South Wales.

Is there a real chance or possibility that the action will interfere with the recovery of the species?

A recovery plan exists for the Regent Honeyeater and was developed in 1999 (Menkhorst et al. 1999).

A national recovery plan for the Swift Parrot was developed in 2011 (Saunders and Tzaros 2011). The overall objective of the plan is to; prevent further population decline of the Swift Parrot, to achieve a demonstrable sustained improvement in the quality and quantity of Swift Parrot habitat and to increase carrying capacity. Main recovery actions implemented to achieve these objectives are (Saunders and Tzaros 2011):

- Objective 1: To identify and prioritise habitats and sites used by the species across its range, on all land tenures.
- Objective 2: To implement management strategies to protect and improve habitats and sites on all land tenures
- Objective 3: To monitor and manage the incidence of collisions, competition and Beak and Feather Disease (BFD).
- Objective 4: To monitor population trends and distribution throughout the range.

The Project is unlikely to conflict or interfere with the recovery of the Regent Honeyeater and/or the Swift Parrot.

Conclusion

Based on the above assessment the Regent Honeyeater and the Swift Parrot are unlikely to be significantly impacted by the Project and as such, a Referral under the provisions of the EPBC Act is not recommended for either of these species.

Appendix 7 Credit profile report

BioBanking credit report

This report identifies the number and type of credits required at a DEVELOPMENT SITE.

Date of report: 5/11/2017 Time: 11:54:39AM Calculator version: v4.0

Development details

Proposal ID:	0103/2016/3971D
Proposal name:	Brandy Hill Quarry Expansion BBA
Proposal address:	979 Clarence Town Road Seaham NSW 2324
Proponent name:	Hanson Construction Materials Pty Ltd
Proponent address:	Level 5 75 George Street Parramatta NSW 2150
Proponent phone:	02 9354 2638
Assessor name:	Samuel Luccitti
Assessor address:	8 Tate Street Wollonogng NSW 2500
Assessor phone:	02 4201 1059
Assessor accreditation:	237

Improving or maintaining biodiversity

An application for a red flag determination is required for the following red flag areas

Red flag	Reason
Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Forest Red Gum grassy open forest on floodplains of the lower Hunter	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	Vegetation type being > 70% cleared; or it contains an endangered ecological community;

The application for a red flag determination should address the criteria set out in the BioBanking Assessment Methodology. Please note that a biobanking statement cannot be issued unless the determination is approved.

Additional information required for approval:

☐ Change to percent cleared for a vegetation type/s

☐ Use of local benchmark

☐ Change negligible loss

☐ Expert report...

- [x] Request for additional gain in site value

- [ ] Predicted threatened species not on site
- [ ] Change threatened species response to gain (Tg value)

Ecosystem credits summary

Plant Community type	Area (ha)	Credits required	Red flag
Forest Red Gum grassy open forest on floodplains of the lower Hunter	1.67	111.22	Yes
Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	0.67	46.30	Yes
Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	25.90	1,491.00	No
Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	1.12	64.00	No
Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter	17.10	984.00	No
White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	2.16	103.00	No
Total	48.62	2,800	

Credit profiles

1. White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley, (HU798)

Number of ecosystem credits created	103
IBRA sub-region	Upper Hunter

Offset options - vegetation types	Offset options - CMA sub-regions
White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley, (HU798) Tallowwood - Small-fruited Grey Gum - Kangaroo Grass grassy tall open forest on foothills of the lower North Coast, (HU762) Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast, (HU770) Pink Bloodwood - Thin-leaved Stringybark - Grey Ironbark shrub - grass open forest on ranges of the lower North Coast, (HU772)	Upper Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter, (HU806)

Number of ecosystem credits created	64
IBRA sub-region	Upper Hunter

Offset options - vegetation types	Offset options - CMA sub-regions
Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter, (HU806) Melaleuca decora low forest of the central Hunter Valley, Sydney Basin Bioregion, (HU564) Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast, (HU619) Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast, (HU802) Spotted Gum - Broad-leaved Mahogany - Grey Gum grass - shrub open forest on Coastal Lowlands of the Central Coast, (HU803) Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest, (HU804) Red Ironbark - Spotted Gum - Prickly-leaved Paperbark shrubby open forest of the Lower Hunter, (HU807) Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter, (HU814) Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter, (HU815) Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter, (HU816) Grey Box - Grey Gum - Rough-barked Apple - Blakely's Red Gum grassy open forest of the central Hunter, (HU822)	Upper Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

3. Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter, (HU814)

Number of ecosystem credits created	984
IBRA sub-region	Upper Hunter

Offset options - vegetation types	Offset options - CMA sub-regions
Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter, (HU814) Melaleuca decora low forest of the central Hunter Valley, Sydney Basin Bioregion, (HU564) Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast, (HU619) Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast, (HU802) Spotted Gum - Broad-leaved Mahogany - Grey Gum grass - shrub open forest on Coastal Lowlands of the Central Coast, (HU803) Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter, (HU815)	Upper Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

4. Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter, (HU816)

Number of ecosystem credits created	1,491
IBRA sub-region	Upper Hunter

Offset options - vegetation types	Offset options - CMA sub-regions
Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter, (HU816) Melaleuca decora low forest of the central Hunter Valley, Sydney Basin Bioregion, (HU564) Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast, (HU619) Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast, (HU802) Spotted Gum - Broad-leaved Mahogany - Grey Gum grass - shrub open forest on Coastal Lowlands of the Central Coast, (HU803) Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest, (HU804) Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter, (HU806) Red Ironbark - Spotted Gum - Prickly-leaved Paperbark shrubby open forest of the Lower Hunter, (HU807) Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter, (HU814) Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open	Upper Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

forest of the central and lower Hunter, (HU815) Grey Box - Grey Gum - Rough-barked Apple - Blakely's Red Gum grassy open forest of the central Hunter, (HU822)	

5. Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion, (HU591)

Number of ecosystem credits created	46
IBRA sub-region	Upper Hunter

Offset options - vegetation types	Offset options - CMA sub-regions
Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion, (HU591) Melaleuca biconvexa - Swamp Mahogany - Cabbage Palm swamp forest of the Central Coast, (HU937)	Upper Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

6. Forest Red Gum grassy open forest on floodplains of the lower Hunter, (HU812)

Number of ecosystem credits created	111
IBRA sub-region	Upper Hunter

Offset options - vegetation types	Offset options - CMA sub-regions
Forest Red Gum grassy open forest on floodplains of the lower Hunter, (HU812) Coastal floodplain sedgelands, rushlands, and forblands of the North Coast, (HU532) Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion, (HU635) Parramatta red gum - Fern-leaved banksia - Melaleuca sieberi swamp woodland of the Tomaree Peninsula, (HU865) Prickly-leaved Paperbark - Flax-leaved Paperbark swamp forest on poorly drained soils of the Central Coast, (HU929) Cabbage Gum - Forest Red Gum - Flax-leaved Paperbark Floodplain Forest of the Central Coast, (HU934) Swamp Oak - Sea Rush - Baumea juncea swamp forest on coastal lowlands of the Central Coast and Lower North Coast, (HU941) Swamp Oak - Prickly Paperbark - Tall Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast, (HU942) Grey Gum - Red Gum - Paperbark shrubby open forest on coastal lowlands of the Northern Sydney Basin and Lower North Coast, (HU963)	Upper Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Species credits summary

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Koala	Phascolarctos cinereus	45.80	1,191

Appendix 8 Targeted Koala Survey Report

Brandy Hill Quarry Expansion

Targeted Threatened Species Survey –

Koala *Phascolarctos cinereus*

Prepared for Hanson Construction Materials Pty Ltd

05 November 2017

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1 Introduction

1.1 Background

Hanson Construction Materials Pty Ltd (Hanson) is seeking approval to expand the existing Brandy Hill Quarry located at 979 Clarence Town Rd, Seaham (the Project). The Project will be assessed against Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) as a State Significant Development (SSD). To support the design and approval of the Project, Hanson is preparing an Environmental Impact Statement (EIS).

While undertaking the flora and fauna assessments to support the EIS, Biosis identified the presence of the Koala *Phascolarctos cinereus* within the Project area. The Koala is listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act). The presence of Koalas within the Project area was deemed likely to trigger the requirement to submit a referral for impacts on Commonwealth Matters of National Environmental Significance (NES). A Significant Impact Criteria assessment was therefore undertaken for the Koala, and the results of the assessment confirmed that the Project was likely to result in a significant impact on Koalas.

Targeted Koala and Koala habitat utilisation surveys were recommended to provide additional information for inclusion with the Commonwealth EPBC Act referral for the Project. The need for additional targeted surveys is stipulated by the *EPBC Act referral guidelines for the vulnerable Koala* (Commonwealth of Australia 2014). Biosis Pty Ltd was commissioned by Hanson to undertake targeted Koala surveys to provide additional information to support the Commonwealth EPBC Act referral for the Project.

The following definitions apply to the Project and are used throughout this document:

The **Project area** includes the area that forms the SSD application as per Attachment 1 (Figure 1 and Figure 2) of the EPBC Referral.

The **study area** encompasses the area within the Project area comprising vegetation to be removed, as well as adjacent areas supporting potential Koala habitat (Figure 1 below).

The **Koala** refers to the combined populations of the Koala in Queensland, New South Wales and the Australian Capital Territory, which were determined to be a single population for the purposes of the Vulnerable listing for this species under the Commonwealth EPBC Act.

1.2 Scope of works

The scope of works for this study involved targeted surveys for the Koala using the Spot Assessment Technique (SAT) in conjunction with point searches for Koalas, in line with relevant species survey guidelines (DoE 2013). Surveys were undertaken in December to meet the optimal survey period for this species, and were conducted by an ecologist experienced in Koala survey methods. Following the field survey, the following tasks were completed:

- Identified and mapped koala habitat, activity and recorded the number and location of any Koalas observed.
- Prepared and analysed data in accordance with the SAT to determine habitat utilisation by Koalas within the study area.
- Prepared an EPBC Act referral for the Minister of the Environment.

This report was prepared to provide an addendum to the Biodiversity Assessment Report (Biosis 2015) prepared to support the EIS.

1.3 Objectives of the report

The occurrence of Koalas at the proposed quarry expansion at Brandy Hill was confirmed from sightings of Koalas in addition to detection of scats during both the winter and spring fauna assessments of the Project area. To provide DoE with adequate information to support the determination of whether Project, a state significant development (SSD) under the *Environmental Planning and Assessment Act 1979* (EP&A Act), may potentially become a 'controlled action', Biosis completed targeted Koala surveys using the SAT developed by the Australian Koala Foundation (Phillips and Callaghan 2011) in conjunction with point searches for Koalas.

The objectives of the survey were to establish population density and habitat utilisation within the Project area and the adjacent study area (vegetation to be cleared as part of the proposed SSD and surrounding suitable habitat).

The tasks of the project are identified as follows:

- Undertake a targeted Koala surveys and Koala activity surveys within the Project area and suitable adjoining habitat (study area).
- Determine the potential for the Project area to provide habitat for the Koala.

Given the scope of works outlined above, and relevant species survey guidelines and requirements for the Koala, this report documents the following:

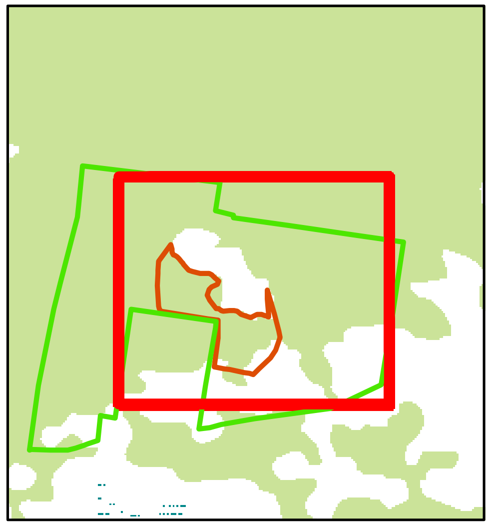
- Background information.
- Survey methodology.
- Survey limitations.
- Results of the field survey.
- Survey conclusion.

Following the survey an EPBC Act referral to the Minister has been prepared, of which this report forms Attachment B, including the details of the proposed SDD works and findings of the targeted Koala surveys and relevant components of the flora and fauna assessment.

1.4 Literature and database review

The following policies, documents and databases were reviewed to provide background information for this report:

- *EPBC Act Referral Guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capitol Territory)* (Commonwealth of Australia 2014).
- NSW BioNet - the database for the Atlas of NSW Wildlife (OEH 2015).
- State Environmental Planning Policy (SEPP) No. 44 – Koala Habitat Protection.
- *Port Stephens Comprehensive Koala Plan of Management* (CKPoM) (Port Stephens Council 2002).



Legend

- Koala Survey Grid 200m
- Koala Survey Grid Extent
- Vegetation clearing area

Figure 1: Study area and SAT survey points

0 75 150 225 300 375

Metres

Scale: 1:7,500 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

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Ballarat, Brisbane, Canberra, Melbourne, Sydney, Wangaratta & Wollongong

Matter: 19323
Date: 05 January 2015,
Checked by: CAC, Drawn by: LDM, Last edited by: jshepherd
Location:P:\19300s\19323\Mapping
19323_F3_KoalaSatSurvey

2 Background

2.1 Habitat and ecology

Koalas are generally solitary animals inhabiting eucalypt woodlands and forests. They have been known to feed on the foliage of more that 100 eucalypt and non-eucalypt species, though they prefer only a few browse species in any one location. Koalas are inactive for most of the day, spending most of their time in trees and feeding and moving between trees at night. They display complex social hierarchies and territories, with their home range varying between less than two hectares to several hundred hectares, depending on habitat quality (DoE SPRAT 2014).

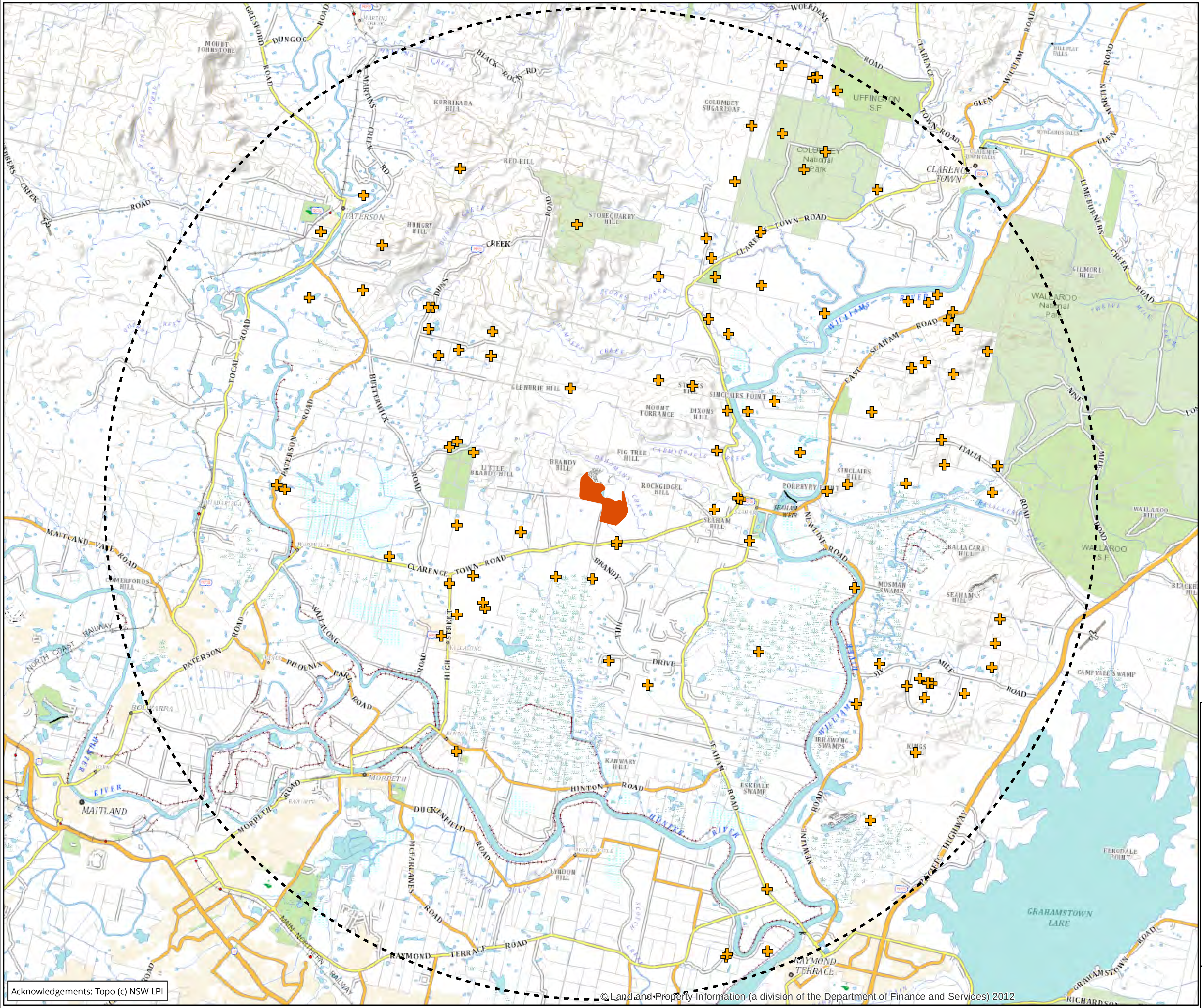
SEPP 44 defines potential Koala habitat as *"areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component"*. Core Koala habitat is defined as *"land with a resident population of Koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population"*.

SEPP 44 does not apply to Major Projects that are being assessed as SSD. However, SEPP 44 Koala habitat definitions have been used to determine potential and core Koala habitat areas for the study area. The Port Stephens CKPoM mapping was also used to identify Koala habitat within the study area.

2.2 Species distribution

The Koala has a sparse and fragmented distribution throughout the central and north coasts of NSW, and throughout eastern Australia from Queensland to the Eyre Peninsula in South Australia, with some populations occurring west of the Great Dividing Range (DoE SPRAT 2014).

NSW OEH Bionet data indicates a total of 6,749 Koala records from within the Port Stephens LGA, as at 20 January 2015 (OEH 2015). Figure 2 shows the locality of historical records of the species in the immediate locality of the study area (NSW OEH Bionet 2015).



Legend

- Koala records (OEH Bionet)
- Search area
- Study area

Figure 2: Koala records within 10km of the study area

0 | 860 | 1,720 | 2,580 | 3,440 | 4,300

Metres

Scale: 1:86,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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Location:P:\19300s\19323\Mapping\19323_F2_KoalaRecords

3 Methodology

All Biosis field surveys were conducted by a qualified and competent zoologist under the authority of a current NSW *National Parks and Wildlife Act, 1974* Scientific Licence (SL100758) to harm/trap/pick/hold/study protected fauna and native flora, and a current Animal Research Authority (ARA) (TRIM 14/271#4) issued under the NSW *Animal Research Act, 1985* Certificate of Approval by the Animal Ethics Committee (AEC) of the Director-General of NSW Agriculture to conduct fauna survey work carried out as part of Environmental Impact Statements, Species Impact Statements and general wildlife research.

3.1 Previous Surveys

Comprehensive flora and fauna surveys were conducted within the study area in winter and spring. These surveys included vegetation mapping (identifying the occurrence of Koala feed trees) and targeted threatened fauna searches, including diurnal and nocturnal searches for Koalas. Methods used to search for Koalas included:

- Diurnal searches of trees for Koalas within bird census and BioBanking plots.
- Diurnal incidental searches beneath Koala feed trees within bird census and vegetation survey plots for signs of Koalas (scats and scratches).
- Diurnal incidental searches of trees for Koalas and signs of Koala activity while traversing the Project area and the study area.
- Nocturnal spotlighting and call playback for Koalas throughout the Project area and study area.

3.2 Current SAT and point surveys

Targeted Koala and Koala activity surveys were conducted 9 to 11 December 2014. Surveys were conducted by 3 or 4 staff for a maximum of 8 hours on each day. The timing of the surveys was considered appropriate for detecting both Koalas and signs of Koala activity as stipulated in the Draft Koala Referral Guidelines (DoE 2013). The targeted survey was guided by key documents:

- *Draft EPBC Act referral guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capital Territory)* (DoE 2013).
- The *Spot Assessment Technique: a tool for determining localised levels of habitat use by Koalas Phascolarctos cinereus* (Phillips and Callaghan 2011).
- DRAFT NSW *Threatened Biodiversity Survey and Assessment Guidelines* (DEC 2004).
- Department of the Environment's (DoE) Species Profile and Threats Database (SPRAT).

Koala SAT and point survey locations were selected using a systematic grid-based approach. A 200m interval grid was placed over a map of the Project and study areas and the intercept points of the grid were used as potential survey sites. Figure 1 shows the location of potential Koala SAT survey points.

From the potential points, final survey sites were selected based on:

- The proximity of each potential survey site to Koala habitat (i.e. sites in cleared land or the operating quarry area were not selected).

- The location of the points within or immediately adjacent to the Project area.
- The total number of sites that could be adequately sampled during field surveys.

At each site surveyed a combination of two survey methods were employed. These were the SAT methodology and Koala point searches. Methods for each are described below.

3.2.2 SAT surveys

The SAT methodology employed was as described by Phillips and Callaghan (2011). At each point surveyed, a central tree was chosen (usually a preferred Koala feed tree if present). The base of this and the nearest 29 trees (> or = 100mm diameter at breast height) were searched for Koala scats by one observer for up to 2 minutes per tree. Searches were conducted within 1 metre from the base of the tree, and were conducted on the surface as well as beneath leaf litter (using a small hand-held rake). If Koala scats were detected the tree was scored as a "1". If no scats were detected within 2 minutes the tree was scored as a "0". The total score was then added for 30 trees to determine the activity value of the site.

In accordance with the methodology described by Phillips and Callaghan (2011) the Project area was mapped as "East Coast – low abundance". This was primarily based on Koala density estimates obtained during previous and current surveys, indicating that the Project area is likely to support less than 0.1 Koalas per hectare. The activity scores for East Coast – low abundance are as follows:

- 0 – 2 scats recorded – "Low" activity.
- 3 scats recorded – "Medium" activity.
- 4 – 30 scats recorded – "High" activity.

For the purposes of the assessment, "Low" activity areas (including areas where no scats were recorded) are considered to be used only infrequently by Koalas. Areas of "Medium" and "High" activity are considered to represent preferred Koala habitat within the Project area and the study area.

3.2.3 Koala point surveys and population density estimate

At each of the survey points selected, a total of 5 minutes was spent searching all vegetation (from ground to canopy) within a 25 metre radius of the central tree for any Koalas present. Any Koalas recorded within the 25 metre radial search were used in calculations of population density for the Project area. Any Koalas recorded outside of the 25 metre radial search area were counted as incidental records only, and were not used in population density estimates.

Each 25 metre radial search equated to a total of 0.125 hectares. The total search area for Koala population density estimates was therefore 0.125 hectares multiplied by the total number of sites surveyed. Thus the Koala population density for the study area was calculated using the total number of Koalas recorded within the 25 metre radial searches divided by the total area searched, and an estimate of the number of Koalas per hectare derived.

3.3 Survey limitations

General fauna surveys and targeted Koala surveys were conducted over three seasons in varying weather conditions. It is considered that this range of conditions was appropriate for detecting Koalas or signs of Koala activity throughout the study area.

The systematic grid based assessment provides a randomised approach to surveys. This method has the potential to over or under-estimate Koala activity if sites selected are co-incidentally over or under-utilised compared to remaining parts of the study area. A relatively large number of sites were sampled to ensure the study area was adequately sampled.

4 Results

4.1 Desktop assessment and previous surveys

Figure 2 shows Koala records are known from the wider locality. Anecdotal reports from Brandy Hill Quarry staff indicate low abundance of Koalas over many years of operations.

Results of previous surveys indicate presence of one individual in winter and one individual in spring surveys (see Figure 3).

No breeding female Koalas were recorded during previous surveys. Under SEPP 44 the Project would therefore be defined as "potential" Koala habitat. The Port Stephens CKPoM maps the Project as supporting areas of "Preferred" and "Marginal" Koala habitat.

4.2 SAT surveys

Figure 1 and Figure 3 shows the locations of SAT survey points surveyed and the activity levels recorded at each SAT survey point. A total of 29 SAT points were surveyed. The data collected during the SAT surveys is included in Appendix 1.

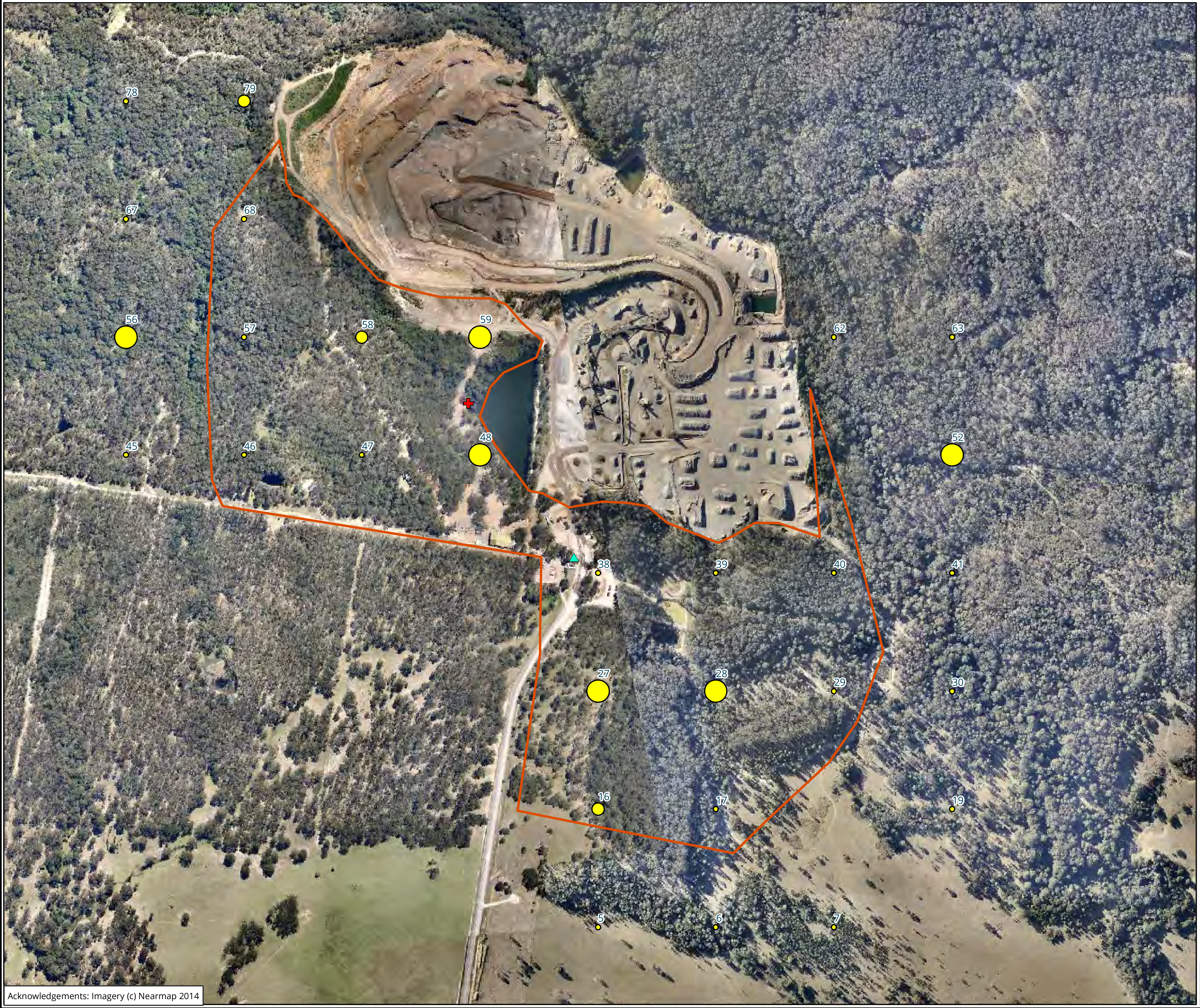
The East Coast low abundance category chosen based on the population density estimate calculated in Section 4.3 below as well as previous survey records.

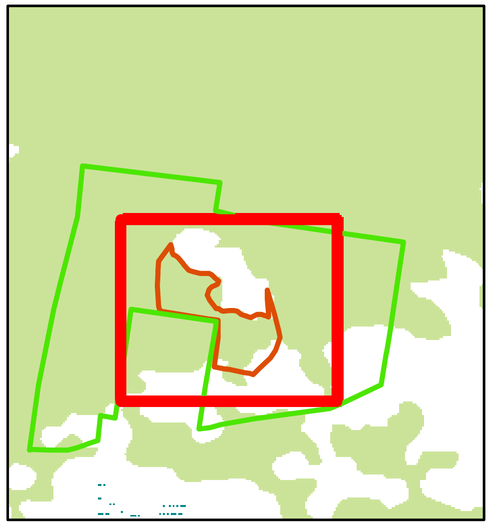
Mapping shows 6 High (between 4 and 30 trees with scats) and 3 Medium (3 trees with scats) activity sites within the study area, with the remaining 20 sites surveyed within the study area showing low (0 to 2 trees with scats) activity levels. With the exception of two outlying "High" sites to the east and west of the Project area, the SAT data indicates that the major areas of Koala activity occur within the Project vegetation clearing area. A band of High and Medium activity occurs from northwest to southeast, indicating a potential Koala activity corridor through the Project area (see Figure 3).

4.3 Koala point surveys and population density estimate

At each SAT point surveyed (see Figure 3) searches were conducted for individual Koalas within a 25m radius of the central tree chosen for the SAT surveys. No Koalas were recorded at any of the 29 survey points searched during the SAT surveys.

During the surveys a total of 3.6 hectares (29 x 0.125 hectares) of Koala habitat were searched for Koalas. This includes a search of 1.9 hectares (15 x 0.125 hectares) within the Project area. Although it is not possible to estimate actual Koala population density based on the Koala point surveys it can be assumed that the population within the Project area would be <0.1 Koalas per hectare of habitat present.





Legend

Vegetation clearing area

Koala records

- August 2014
- November 2014

Koala Activity

- Low
- Medium
- High

Figure 3: Koala activity and records

0 60 120 180 240 300

Metres

Scale: 1:6,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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19323_F4_KoalaActivity_20141219

5 Discussion and recommendations

Koalas were recorded by Biosis within the project boundary on two separate occasions however neither record was during the Koala point surveys. Combined with the low numbers of Koala records from previous surveys and anecdotal observations of long-term staff at the Brandy Hill Quarry this indicates that, despite activity levels shown in the SAT data, the Project area currently supports only a low density of Koalas. The relatively high activity levels in parts of the Project may therefore indicate frequent use by a small number of individuals.

The Project area supports up to 48.65 hectares of Koala habitat, all of which would be removed for the Project. The total area of the site owned by Hanson is 561 hectares and large tracts of this land to the north east, north west and west of the proposed development area will be retained. Based on available vegetation mapping these areas contain similar habitat opportunities for Koala as those available within the project boundary. Land to the immediate north and north west of the Hanson property boundary is the subject of two separate Biobanking Agreements and will be conserved in perpetuity under provisions of the NSW Threatened Species Conservation Act 1995 (TSC Act). Under the terms of these Biobanking Agreements, management measures will be undertaken which improve the condition of native vegetation and hence Koala habitat. It is therefore unlikely that removal Koala habitat for the Project will result in a significant reduction in the area of occupancy of Koalas in the locality, given the area of suitable habitat that will remain in adjacent land.

Koala habitat mapping provided in the Port Stephens Councils CKPoM indicates that a narrow strip of preferred Koala habitat occurs to the east of the project, providing an opportunity for north-south movement of Koalas between the population of Koalas at Brandy Hill to the south and the biobank sites located to the north of the project. This north-south corridor will not be impacted by the project. Based on Koala records from the OEH database it is likely that Koala movement occurs north-west to south-east along a corridor of habitat located to the west of the project. It is therefore considered unlikely that extension of the project to the south of the current quarry would result in a significant barrier to Koala movement in the wider locality.

To date, no areas of Commonwealth identified "critical habitat" have been listed for the Koala. However, in accordance with the *EPBC Act Referral Guidelines for the vulnerable listed Koala* (Commonwealth of Australia 2014) removal of Koala habitat resulting from the Project has potential to adversely affect "habitat critical to the survival of the species".

As recommended in the Referral Guidelines, a Koala habitat appraisal has been completed to assess impacts of the Project on Koalas (see Appendix 2). The Koala habitat appraisal determined that the Project achieved a total habitat assessment score of 9. In accordance with Referral Guidelines, the Project is therefore likely to result in adverse effects on habitat critical to the survival of the Koala given the Project will:

- *Impact on an area supporting habitat critical to the survival of the Koala (a habitat score of > or = 5).*
- *Require clearing of > or = 20 hectares of habitat containing known Koala food trees in an area with a habitat score > or =8.*

Based on the results of previous surveys (Biosis 2015) as well as the current SAT and Koala point surveys, combined with the results of the Koala habitat appraisal and the Significant Impact Criteria assessment of which a significant impact to Koala was determined to be likely (Biosis 2015), it is therefore recommended that a Referral under the Commonwealth EPBC Act for impacts on Matters of NES (Koalas) be submitted for the Project. This document has therefore been prepared to supplement the EPBC Act referral for Koalas.

Should the Project proceed, the following recommendations are made to minimise potential impacts on Koalas, resulting from the Project:

- A Biodiversity Management Plan (incorporating management measures for Koalas) should be prepared to outline the clearance procedure (including protection measures for adjacent vegetation), protocols for Koala finds and incidents and include an educational brochure for all workers to review prior to working on the Project.
- An ecologist should undertake pre-clearance surveys within the Project area immediately prior to the removal of any vegetation to give the clearance go ahead.
- An ecologist or fauna rescuer to be present during vegetation clearing to minimise impacts on Koalas displaced or injured during clearing.
- An ecologist or regional Koala care group should be contacted if any Koalas are injured and/or distressed during the construction and operation phases of the Project.
- Low site speed limits should be established on site to reduce the potential for vehicle impacts on Koalas. All drivers working on the Project should be made aware of Koalas and instructed to take precautions when driving on site.

6 References

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7 Appendices

7.1 Appendix 1 – SAT data sheets

Spot: Spotted Gum   Creb: E. crebra   Fib: E. fibrosa   RG: E. tereticornis

Koala SAT Survey Data Sheet   Mel: Melaleuca sp.

Project: Brandy Hill Quarry   **Matter No.:** 19323

biosis

SAT ID: 38	Date: 9-12-14	Staff: CAC + J Hanson	GPS:	East:
	Time: 0945		WP: 1077	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	E-creb	Creb	Creb	Fibrosa	Fib	Creb	Creb	Fib	Creb	Creb	Fib	Creb	Creb	Creb	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Creb	Spot	Creb	Creb	Creb	Fib	Spot	Creb	Creb	Creb	Creb	Creb	Spot	Fib	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

Ø

SAT ID: 39	Date: 9-12-14	Staff: CAC + J Hanson	GPS:	East:
	Time: 1010		WP: 1078	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	RG	Spot	Creb	Creb	Creb	Creb	Creb	Creb	RG	Creb	Spot	RG	Creb	Creb	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Creb	Creb	Creb	Creb	Spot	Spot	Spot	RG	Creb	RG	Creb	RG	Creb	Spot	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

1

SAT ID: 40	Date: 9-12-14	Staff: CAC + J Hanson	GPS:	East:
	Time: 1045		WP: 1079	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Creb	Creb	Creb	Creb	Creb	Creb	Creb	Spot	Creb	Creb	Creb	Creb	Creb	Creb	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Creb	Creb	Creb	Mel	Creb	Creb	Creb	Creb	Creb	Creb	Creb	Creb	Creb	Creb	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

Ø

Page: 1

GB: E. moluccana Fib: E. fibrosa Mel: Melaleuca sp. Stri – Stringbark sp.

Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis.

SAT ID: 29	Date: 9-12-14	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 1115		WP: 1080	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	GB	GB	GB	GB	Fib	Fib	Fib	GB	GB	GB	Mel	Spot	Fib	Spot	Fib
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	GB	GB	GB	Fib	GB	RG	Spot	Fib	Creb	Fib	Creb	Fib	Fib	Stri	Stri
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

Ø

SAT ID: 27	Date: 9-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1230		WP: 1081	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	RG	RG	RG	RG	RG	RG	RG	RG	RG	RG	Creb	GB	GB	Spot	RG
No. scats:	Ø	Ø	Ø	1	Ø	Ø	1	1	Ø	Ø	Ø	1	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	GB	GB	RG	GB	GB	Creb	RG	RG	RG	RG	RG	RG	RG	RG	RG
No. scats:	1	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	1

No. Koalas recorded within 25m radial search (5 minutes): Ø

7

SAT ID: 28	Date: 9-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1300		WP: 1082	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Creb	Spot	Creb	Spot	Spot	GB	Creb	GB	Spot	GB	Creb	Spot	GB	Spot	GB
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	1	1	Ø	1	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Mel	Spot	GB	Spot	Spot	GB	GB	Mel	GB	Creb	Spot	GB	GB	GB	Creb
No. scats:	1	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1

No. Koalas recorded within 25m radial search (5 minutes): Ø

6

Cas- Casuarina glauca   Ang - Angophora floribunda

Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry   **Matter No.:** 19323

biosis

SAT ID: 17	Date: 9-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1320		WP: 1083	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Fib	RG	Spot	Fib	Spot	Creb	Spot	Spot	Creb	Spot	Spot	Spot	Fib	Spot	Spot
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Creb	Spot	Spot	Fib	Creb	Spot	Fib	Spot	Spot	RG	Creb	Spot	Spot	Spot	Creb
No. scats:	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

2

SAT ID: 6	Date: 9-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1345		WP: 1084	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Cas	Ang	RG	RG	RG	Ang	RG	RG	Cas	Ang	RG	Ang	Ang	Cas	Cas
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	0	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Ang	Ang	Cas	Cas	Cas	Ang	Ang	Ang	RG	Ang	RG	RG	Ang	RG	RG
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

Ø

SAT ID: 5	Date: 9-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1405		WP: 1085	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

Ø

Page: 3

GG: Grey Gum

Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID: 16	Date: 9-12-14	Staff: CAC + 2 Hanso	GPS:	East:
	Time: 1425		WP: —	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Mel	Mel	Mel	Creb	Spot	Mel	Mel	Mel	Spot	RG	RG	Mel	Mel	RG	Mel
No. scats:	Ø	Ø	Ø	Ø	~~Ø~~ 1	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Mel	Mel	Mel	Mel	GB	Creb	Spot	Spot	Creb	Mel	Mel	Mel	Mel	Creb	Spot
No. scats:	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

3

SAT ID: 48	Date: 9-12-~~14~~	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1520		WP: 1086	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Spot	Spot	Creb	Creb	RG	RG	Creb	Creb	GG	GB	Spot	Creb	Mel	Stri	Stri
No. scats:	Ø	Ø	Ø	Ø	1	Ø	Ø	~~Ø~~ 1	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	GB	RG	Spot	Creb	Creb	GG	Creb	Creb	GB	Spot	RG	Stri	GB	GB	Spot
No. scats:	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø

No. Koalas recorded within 25m radial search (5 minutes):

4

SAT ID: 59	Date: 9-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1540		WP: 1087	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	RG	Stri	RG	Mel	RG	Creb	Stri	RG	Creb	GG	GG	Stri	RG	Creb	GG
No. scats:	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Creb	Creb	Creb	Stri	Creb	GG	GG	Creb	Creb	Ang	Ang	GG	GG	Stri	Stri
No. scats:	1	1	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

5

Page: ~~2~~ 4

Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID: 47	Date: 10-12-14	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 0800		WP: 1088	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Ceb	Stri	Stri	Stri	Spot	Stri	Spot	Stri	Spot	Ceb	Spot	Spot	Acac.	Stri	Acac.
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Ceb	Stri	Stri	Spot	Spot	GG	Spot	Ceb	Spot	Spot	Stri	Stri	Stri	Spot	Spot
No. scats:	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

1

SAT ID: 58	Date: ~~0815~~ 10-12-14	Staff: CAC +3 Hanson	GPS:	East:
	Time: 0815		WP: 1089	North:

Tree no.:	1	2	3	4	R~~5~~G	6	7	8	9	10	11	12	R 13 G	14	15
Sp:	Ceb	Ceb	Stri	Stri	~~[illegible]~~	Ceb	Spot	Ceb	Ceb	Ceb	Stri	Ceb	~~[illegible]~~	Ceb	Stri
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	1	1	Ø	Ø	Ø	Ø	Ø	0	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Stri	Ceb	Stri	Stri	Ceb	~~[illegible]~~ RG	Kurrajong	~~[illegible]~~ RG	Kurra.	Kurra.	Stri	Ceb	Ceb.	Spot	Stri
No. scats:	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

3

SAT ID: 57	Date: 10-12-14	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 0840		WP: 1090	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Stri	GG	Stri	Spot	Spot	Stri	Stri	Stri	Kurra.	Stri	GG	Spot	Spot	Stri	GG
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Spot	Spot	Spot	Stri	Ceb	Stri	GG	Stri	Stri	Stri	GG	Stri	Stri	Stri	Stri
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

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Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis.

SAT ID: 68	Date: 10-12-14 Time: 0855	Staff: CAC + 3 Hanson	GPS: WP: 1091	East: North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Creb	Spot	Creb	RG	Stri	RG	Creb	Spot	Spot	RG	Stri	Spot	Stri	Stri	Creb
No. scats:	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Spot	Stri	Kurra	RG	Creb	Kurra	Spot	Stri	Stri	Spot	Creb	Stri	Creb	Creb	Spot
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

2

SAT ID: 79	Date: 10-12-14 Time: 0920	Staff: CAC + 3 Hanson	GPS: WP: 1092	East: North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	RG	RG	Creb	Stri	Kurra	RG	RG	Spot	RG	Stri	RG	Creb	Creb	RG	RG
No. scats:	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Stri	Fib	RG	Creb	Stri	RG	RG	Stri	Creb	Creb	Stri	RG	RG	Stri	Stri
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

3

SAT ID: 78	Date: 10-12-14 Time: 0940	Staff: CAC + 3 Hanson	GPS: WP: 1093	East: North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Stri	Stri	Stri	Kurra	RG	RG	Creb	Stri	Stri	Stri	RG	Spot	Stri	RG	Stri
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Creb	Stri	Stri	Spot	Stri	Spot	RG	Stri	Creb	Stri	Stri	Creb	Stri	Stri	Stri
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

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Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID: 46	Date: 10-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1110		WP: 1094	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Creb	Spot	Stri	Spot	Spot	Stein	GG	GG	Spot	Spot	Spot	Stri	Spot	Stri	Spot
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Sp:	GG	GG	Stri	Stri	GG	GG	Spot	GG	GG	Spot	GG	Spot	GG	Stri	GG
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

Ø

SAT ID: 45	Date: 10-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1130		WP: 1095	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Fib	Mel	Stri	Stri	RG	RG	Fib	Fibr	RG	Fib	Fib	Fib	RG	RG	RG
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Sp:	Spot	Fib	Fib	Fib	RG	Mel	Stri	RG	Fib	Fib	Fib	Mel	Fib	Stri	Spot
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

Ø

SAT ID: 56	Date: 10-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1145		WP: 1096	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Stri	Stri	Stri	Stri	Stri	Stri	Stri	Stri	Stri	RG	Stri	Creb	Stri	Stri	Spot
No. scats:	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Sp:	Spot	Creb	Creb	Stri	Spot	Kurra	Stri	Creb	Stri	Stri	Stri	Creb	Stri	Stri	Stri
No. scats:	Ø	Ø	Ø	1	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

4

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Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID: 67					Date: 10-12-14			Staff: CAC +2 Hanson		GPS:		East:			
					Time: 1200					WP: 1097		North:			
Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Creb	Creb	Creb	Creb	RG	Spot	Stri	RG	RG	Spot	Creb	RG	Mel	Stri	Kurra
No. scats:	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Spot	RG	RG	Stri	Creb	Stri	Stri	RG	Stri	RG	Stri	RG	Stri	RG	Stri
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
No. Koalas recorded within 25m radial search (5 minutes): Ø															

1

SAT ID: 62					Date: 10-12-14			Staff: CAC + 2 Hanson		GPS:		East:			
					Time: 1345					WP: 1098		North:			
Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Creb	Mel	Stri	Mel	Stri	Creb	Creb	Mel	Mel	Stri	Mel	Creb	Creb	Mel	Stri
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Creb	Mel	Creb	Stri	Stri	Mel	RG	Stri	Mel	Creb	Stri	RG	RG	Stri	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
No. Koalas recorded within 25m radial search (5 minutes): Ø															

Ø

SAT ID: 63					Date: 10-12-14			Staff: CAC + 2 Hanson		GPS:		East:			
					Time: 1405					WP: 1099		North:			
Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Spot	RG	GG	GG	GG	Creb	Stri	Creb	Spot	GG	Stri	GG	RG	GG	GG
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	GG	GG	GG	Creb	GG	Spot	Spot	GG	Spot	GG	GG	Spot	Spot	GG	GG
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
No. Koalas recorded within 25m radial search (5 minutes): Ø															

1

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Coach - Coachwood

Koala SAT Survey Data Sheet

biosis

Project: Brandy Hill Quarry **Matter No.:** 19323

SAT ID: 52			Date: 10-12-14			Staff: CAC + Z Hanson			GPS:		East:				
			Time: 1420						WP: 1100		North:				
Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Fib	Fib	Creb	Fib	Fib	Creb	Fib	Creb	Fib	Mel	Stri	RG	Creb	Fib	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	1	Ø	Ø	Ø	Ø	1	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Creb	Mel	RG	Mel	GG	Creb	Creb	RG	Creb	Spot	Creb	Creb	RG	Creb	Creb
No. scats:	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
No. Koalas recorded within 25m radial search (5 minutes): Ø															

4

SAT ID:			Date:			Staff:			GPS:		East:				
			Time:						WP:		North:				
Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	~~Creb~~	~~Mel~~	~~RG~~	~~Mel~~											
No. scats:	~~Ø~~	~~Ø~~	~~Ø~~	~~Ø~~											
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:															
No. scats:															
No. Koalas recorded within 25m radial search (5 minutes):															

SAT ID: 41			Date: 10-12-14			Staff: CAC + Z Hanson			GPS:		East:				
			Time: 1500						WP: 1101		North:				
Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Coach	Kurra	Spot	GG	Stri	Stri	Stri	Coach	Spot	Stri	Spot	Stri	Stri	Creb	Mel
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	GG	Spot	GG	Stri	Mel	Mel	Mel	Mel	Spot	Creb	Creb	Mel	Mel	Spot	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
No. Koalas recorded within 25m radial search (5 minutes): Ø															

Ø

Alph: Alphitonia excelsa (Red Ash)

Ang: Angophora floribunda

Koala SAT Survey Data Sheet biosis

Project: Brandy Hill Quarry **Matter No.:** 19323

+Black-faced Monarch
+Leaden F-catcher
Seen

SAT ID: 30	Date: 11-12-14	Staff: CAC + Z Hanson	GPS:	East:
	Time: 0940		WP: 1102	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Spot	Creb	Stri	Creb	Creb	Creb	Stri	RG	Spot	Spot	Creb	Creb	Alph	Stri	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Alph	RG	Alph.	Creb	RG	Creb	GG	Creb	Creb	Stri	RG	Cas.	Spot	Creb	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

1

SAT ID: 19	Date: 11-12-14	Staff: CAC + Z Hanson	GPS:	East:
	Time: 1005		WP: 1103	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Creb	RG	Creb	Creb	RG	Creb	Stri	RG	Stri	Stri	Stri	Stri	RG	Creb	RG
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	RG	RG	Fib	RG	Fib	RG	Creb	Creb	RG	RG	RG	RG	RG	RG	RG
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

1

SAT ID: 7	Date: 11-12-14	Staff: CAC + Z Hanson	GPS:	East:
	Time: 1035		WP: 1104	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Ang	Cas	Cas	Cas	Ang	Cas	Ang	Cas	Cas	Cas	Creb	Mel	Mel	RG	Ang
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Cas	Cas	Mel	Cas	Cas	Creb	Cas	Ang	Mel	Cas	Ang	Cas	Mel	Cas	Mel
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

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7.2 Appendix 2 – Koala habitat appraisal

Koala habitat appraisal - Brandy Hill Quarry expansion		
Action: Quarry expansion in the Lower Hunter, NSW Context: Coastal (East Coast - low abundance)		
Associated infrastructure: Additional quarry areas		
Primary impacts: Vegetation clearing, vehicle strike		
Impact area size: 97 hectares		
Attribute	**Score**	**Habitat appraisal**
Koala occurrence	2	Koala records known from the locality for the study area
		Biosis conducted targeted Koala surveys in winter and spring 2014 using diurnal and nocturnal searches and call playback. A total of 2 Koalas was recorded within the Project area.
		Biosis conducted targeted SAT and Koala point surveys in summer 2014 to determine Koala population density estimate. No Koalas were recorded during this period.
Vegetation structure and composition	2	Comprehensive vegetation mapping undertaken by Biosis in winter and spring 2014 mapping all vegetation within the study area. All forest and woodland communities present support 2 or more Koala food tree species.
Habitat connectivity	2	Koala habitat present is a component of an area of suitable habitat > 1,000 hectares
Key existing threats	2	No evidence of recent or regular Koala fatalities from vehicle strikes or dog attacks
Recovery value	1	Uncertain whether the habitat present is important for achieving the interim recovery objectives for Koalas.
Total	9	Based on the area of habitat to be cleared and total habitat score a Commonwealth referral under the EPBC Act is recommended.

Appendix 9

Correspondence with RMS – dated 31 May 2018 and 8 August 2018

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Hanson Construction Materials Pty Ltd
ABN 90 009 679 734
Level 18
2 - 12 Macquarie Street
Parramatta NSW 2150
Tel +612 9354 2600
Fax +612 9325 2695
www.hanson.com.au

31 May 2018

Mr Mark Morrison
Manager, Network & Safety Services
Hunter Region
Roads and Maritime Services
Locked Bag 30
Newcastle NSW 2300

Dear Mark,

Re: Review of Speed Limit on Clarence Town Road in the Vicinity of Seaham and Brandy Hill

I am writing to follow up my previous emails regarding a review of the speed limit at Clarence Town Road in the vicinity of Seaham and Brandy Hill. As you would be aware, Hanson own and operate the Brandy Hill Quarry located on Clarence Town Road. Transport operations at the Quarry principally access Brandy Hill Drive and Seaham Road but also deliver to destinations to the east and west of the Quarry. This requires heavy vehicles to cross Clarence Town Road or to use Clarence Town Road to reach their destinations. It is understood that Roads and Maritime Services use the *NSW Speed Zoning Guidelines* to establish speed limits in the State. However, under this guideline there is a process for review of speed limits. This process commences with an evaluation of the appropriateness of current speed limits, with review of the need for a change to take into consideration community views and concerns and changes in road use and the level of roadside activity (see Section 2.4 of the guidelines).

Hanson is in the process of applying for an extension to operations at the Brandy Hill Quarry. During our investigations for the extension, we have identified that one of the key concerns of the community is road safety. As Hanson and its consultants have investigated the road safety issues in the local area, we have become aware that one of the principal causes of road safety concern is the speed that vehicles travel on Clarence Town Road. This applies equally to light vehicles and heavy vehicles.

The local area of Seaham, Brandy Hill, Wallalong and Woodville have historically developed around the local road network, which was designed to connect regional areas such as Clarence Town, Dungog and areas further to the west with Maitland and the Pacific Highway. As the area has developed, traditional large lot rural land has progressively been subdivided and purchased for rural-lifestyle residential living. Brandy Hill Drive was originally developed to connect the Quarry to Raymond Terrace and the Pacific Highway and has progressively become an attractive residential area. Wallalong and Woodville are also the subject of densification and proposals for future residential development.

Hanson considers that the land use in the area has changed significantly over recent years. As more people move to the area, the likelihood of conflicts between road users and cyclists, pedestrians and school buses increases. Clarence Town Road remains useful as an arterial connection to urban areas, however there is significantly more local use of the road network for short distance journeys. Hanson has established a range of internal management procedures to reduce the risk of conflicts between transportation operations and road users. This includes the use of a Driver's Code of Conduct and regular internal 'toolbox' meetings to discuss any changes to the local road network. However, road safety in the local area would be improved by a reduced speed limit for all road users on Clarence Town Road.

Hanson has been operating in the area for many years and intends to operate for many more. On behalf of the Hanson, I request that you consider the views of the local community and the change in land use in deciding to commence a review of the speed limit on Clarence Town Road. From the perspective of Quarry operations, it is considered that a reduction to at least 80km/hr would be highly beneficial to local road safety.

Yours sincerely,

HANSON CONSTRUCTION MATERIALS PTY LTD

ANDREW DRIVER
Development Manager

Transport
Roads & Maritime Services

CR1018/002610
SF2018/088290

8 August 2018

Mr Andrew Driver
Development Manager
Hanson Construction Materials Pty Ltd
Level 18, 2-12 Macquarie Street
PARRAMATTA NSW 2150

Dear Andrew

CLARENCE TOWN ROAD BRANDY HILL - SPEED ZONING

Thank you for your letter of 31 May 2018 in regard to concerns relating to the current speed zoning on Clarence Town Road at Brandy Hill.

RMS apologises for the delay in responding.

As you are aware, Roads and Maritime Services (RMS) conducts speed zone reviews and uses the NSW Speed Zone Guidelines (2011) to determine if changes to permanent speed limits are required, based on a number of factors including road function, roadside development, road characteristics (alignment, number of regularly used accesses, lane widths etc) as well as traffic characteristics and crash history.

RMS also consults with Council and the NSW Police Force as part of every speed zone review and information from those stakeholders is considered in formulating the recommended changes. While RMS does not consult directly with the public before recommendations are made, the community is advised of the approved changes before the changes are implemented. This includes temporary electronic signage placed on site prior to the signs and markings being changed.

RMS is currently conducting a speed limit review on several roads in this area, including Clarence Town Road from Woodville to Seaham (which includes the Brandy Hill area). Your concerns in regard to Clarence Town Road will be considered as part of the current review and RMS appreciates your interest in road safety.

For more information, please contact Mr John Carey, Network and Safety Officer on (02) 4908 7587.

Yours sincerely

Ken Saxby
Network & Safety Services Manager Hunter

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Appendix 10

Drivers Code of Conduct – Brandy Hill Quarry

(Total No. of pages including blank pages = 16)

* A colour version of this Appendix is available on the digital version of this document

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Hanson Quarries

Brandy Hill Quarry

Drivers Code of Conduct

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Figure 1: Transport routes and locations of bus stops along Clarence Town Road and Brandy Hill Drive. -------- 7

1. General Requirements

Heavy vehicle drivers hauling from Brandy Hill Quarry must:

- Have undertaken a site induction carried out by an approved member of the Quarry staff or suitably qualified person under the direction of the Quarry management;
- Participate in regular toolbox meetings with appropriate supervisor/manager;
- Hold a valid driver's licence for the class of vehicle that is operated;
- Operate the vehicle in a safe manner within and external to the Quarry site; and
- Comply with the direction of authorised site personnel when within the site.

2. Heavy Vehicle Speed

Increased speed means an increase in the risk of a crash and as well as an increase in severity if an accident occurs. A study undertaken for the Australian Transport Safety Bureau found that travelling 10 km/h faster than the average traffic speed can more than double the risk of involvement in a casualty accident (Kloeden, Ponte, & McLean, 2001).

There are two types of speeding:

1. Where a heavy vehicle travels faster than the posted speed limit; and
2. Where a driver travels within the speed limit but because of road conditions (e.g. fog or rain) this speed is inappropriate.

All posted speed limits within the Quarry site are to be strictly adhered to at all times. The speed limits are:

- Quarry Driveway – 60km/hr
- Haul Road – 45km/hr
- within the Quarry (plant/sales yard) – 25km/hr

Vehicle speed on public roads is enforced by the NSW Police Service. There are three types of penalties established under HVNL:

- Infringeable offences – an offence which results in the issue of an infringement notice. It gives the person issued the notice the option of either paying the penalty set out in the notice or electing to have the matter dealt with by a court.
- Court imposed penalties – some offences (general more serious) are not infringeable and must be dealt with by a court. The HVNL sets out the maximum penalty level that the court may apply.
- Demerit points – are managed through each state and territories' road traffic law (NHVR, Penalties and infringements, 2017).

For more information, please the National Heavy Vehicle Regulator website (https://www.nhvr.gov.au/law-policies/penalties-and-infringements).

All heavy vehicle drivers operating out of the Brandy Hill Quarry are to observe the posted speed limits, with speed adjusted appropriately to suit the road environment and prevailing weather conditions, to comply with the NSW Road Rules & Heavy Vehicle National Law. The vehicle speed must be appropriate to ensure the safe movements of the vehicle based on the vehicle configuration.

3. Heavy Vehicle Driver Fatigue

Driver fatigue or drowsy driving is a safety hazard for the road transport industry. The main causes of fatigue are not enough sleep, driving at night (during sleeping hours) and working or being awake for a long time (NHVR, 2017). It is one of the biggest causes of accidents for heavy vehicle drivers. National heavy vehicle driver fatigue laws apply to fatigue-regulated heavy vehicles, which are:

- A vehicle with a Gross Vehicle Mass (GVM) of over 12t
- A combination when the total of the GVM is over 12t
- A truck or a combination including a truck, with a GVM of over 12t with a machine or implement attached.

Under the law, working hour options for fatigue management are:

- Standard hours
- Basic fatigue management
- Advanced fatigue management

All heavy vehicle drivers operating out of the Brandy Hill Quarry are to be aware of their adopted Fatigue Management Scheme and operate within its requirements. By law, all drivers have a duty to not drive a fatigue-regulated heavy vehicle on a road while impaired by fatigue.

4. Heavy Vehicle Compression Braking

Compression braking by heavy vehicles is a source of irritation to the community and can generate numerous complaints from residents, especially at night when residents are sensitive to noise. There are instances compression braking is required for safety reasons, however when passing through or adjacent to residential areas, a reduction in the speed of the vehicle is recommended. This will allow the avoidance of compression breaking at all times.

All heavy vehicle drivers operating out of the Brandy Hill Quarry are to minimise the use of compression brakes, so as not to create excessive noise that could disturb local residents, where possible. Compression braking within or adjacent to residential areas should only be used if required for safety reasons.

5. Heavy Vehicle Noise

Hanson trucks normal hours of transport are 6:30am to 4:30pm, subject to customer demands and operational requirements. Due to truck maintenance, driver training and truck type selection, Hanson trucks are permitted to enter and leave outside of stated hours, as may be required to meet project requirements.

Weighbridge operation for all contractors is 6.30am to 4.30pm, subject to customer demands and operational requirements. No contracted trucks will be ticketed outside these hours. In the unusual circumstance that a contractor requires entry into the Quarry site outside of these hours, Hanson will assess that the contractor truck is designed and maintained to no less standard than trucks within the Hanson fleet and is operated in line with the principles of noise mitigation to local residents.

6. Covering Loads

Loose material on the road surface has the potential to cause road crashes and vehicle damage. Uncovered loads represent the greatest risk to loose material on the road.

All trucks arriving at or departing from the Brandy Hill Quarry, whether loaded with material or not, are required to have an effective cover over their load for the duration of the trip. The load cover may be removed upon arrival at the delivery site.

All care is to be taken to ensure that all loose debris from the vehicle body and wheels are removed prior to leaving the site. Drivers must ensure that following tipping that the tailgate is locked before leaving the site.

Quarry Management is to monitor loose material on the side of the haulage route from Quarry operations and take appropriate action (removal or suppression) regularly.

7. Heavy Vehicle Departure and Arrival

Heavy vehicles travelling in close proximity on dual lane public roads can be of concern to light vehicle drivers as well as increasing noise through or adjacent to residential areas. To alleviate public concern and increase road safety, heavy vehicles leaving the Quarry should try to be separated by a minimum, 1.5 minute interval.

It is difficult to schedule arrivals to the Quarry (except at the commencement of work for the day) due to the different directions of approach from external jobs and the varying job completion times, however, when a driver becomes aware, through visual contact or two-way contact between trucks, that they will arrive at approximately the same time then they are to ensure that there is a suitable gap between vehicles.

To alleviate public concern and increase road safety, heavy vehicles leaving the Brandy Hill Quarry should try to be separated by a minimum, 1.5 minute interval.

7.1. Safety initiatives for residential areas and school zones

All drivers are to show respect for our neighbours in the Seaham and Brandy Hill areas. Care is to be taken around school bus stops in the morning (6:45am to 8:30am) and afternoon (2:45pm to 4:30pm) periods (see **Figure 1**). Drivers are to be mindful of children being dropped off and/or picked up in and around Seaham and Brandy Hill areas during these hours. Drivers are to comply with 40km/h speed limit for traffic passing a school bus as well as within school zones.

Brandy Hill Drive is an 80km speed zone. Please give pedestrians using Brandy Hill Drive a wide berth and be aware of the pedestrians' safety, road users' safety and their own safety at all times.

7.2. Primary haulage routes

The primary haulage routes are shown on **Figure 1**, with critical locations highlighted.

Heavy vehicle drivers are to carefully plan their routes so that State and regional roads are given priority for route selection. Local roads should only be used if there is no other option or in an emergency situation. To be considerate of our neighbours, short cuts and deviations should not be used when delivering Quarry products.

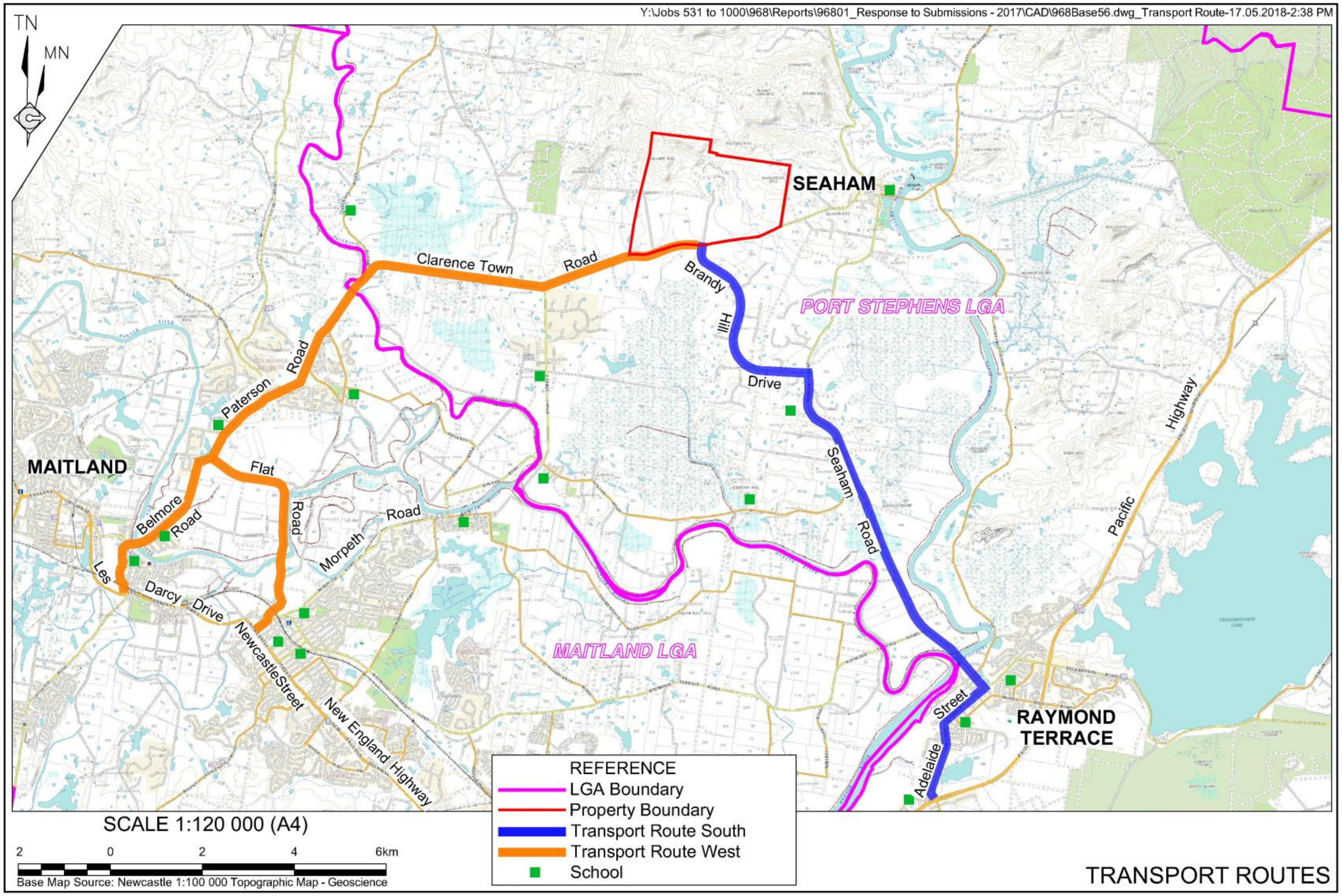

Figure 1: Transport routes and locations of bus stops along Clarence Town Road and Brandy Hill Drive.

8. Heavy Vehicle Breakdown and Incidents

In the case of a breakdown the vehicle must be towed to the nearest breakdown point as soon as possible. All breakdowns must be reported to the RMS TMC (Transport Management Centre) on 131 700 and the vehicle protected in accordance with the Heavy Vehicle Drivers handbook.

If there is a product spill while loading/unloading or en-route to and from the Quarry, the driver must:

1. Immediately warn persons in the area who may be at risk;
2. Inform their shift supervisor/owner. If the vehicle is owned or contracted by Hanson Construction Materials Pty Ltd, the Brandy Hill Quarry Manager must be immediately informed so that emergency services can be contacted and a clean-up initiated;
3. All spills must be adequately cleaned up and waste disposed of in an acceptable and environmental manner;
4. Put out warning triangles where it is safe to do so;
5. Contact the NSW Police Service.

To ensure that traffic impacts are minimised in the event of an incident, rapid response from the haulage company is required. In order to ensure rapid response to incidents, drivers are encouraged to contact the RMS TMC on 131700, as soon as the stranded vehicle and load is safely secured.

9. Compliance Measures and Monitoring

The document is to be signed by individual drivers and a Hanson Construction Materials Pty Ltd authorised representative at the time when heavy vehicle haulage drivers attend their site induction or shortly thereafter.

To assist in the orderly resolution of complaints, Quarry management will keep a register itemising all reported incidents relating to complaints in regard to heavy vehicle driver conduct external to the Quarry site.

The incident register is to include (where possible):

1. Date of the complaint.
2. Time of the complaint.
3. Name of the complainant (if available).
4. How the complaint was received.
5. Detailed description of the complaint (including location, driver/heavy vehicle details).
6. What / when actions were taken to resolve the issue; and
7. The reply to the person / organisation that made the complaint.

Once the Quarry Manager is satisfied that the complaint is substantiated, an investigation of the location and causes of the complaint will be undertaken. Following investigation of the issue, the Quarry Manager will provide feedback to the complainant that details the investigations undertaken, the result of the investigation and measures implemented to ensure that operations remain compliant. A description of any follow-up investigations and the response provided to the complainant will also be recorded in the *Complaints Register* upon closure of the issue.

The incident register is to be made available, upon request, to an authorised State Government officer or Council officer.

In addition to the register, any breach of the Code of Conduct will result in the offending driver being placed on a **Driver's Code of Conduct Disciplinary Action Register**.

There are 3 stages to the process:

1st Warning – Driver will be warned for the breach, entered into the register and re-inducted.

2nd Warning – Driver will be warned for the breach, entered into the register, re-inducted and the company of the driver will be notified that a second breach of the site rules has occurred by the offending driver. The result of this second breach will result in the driver being banned from the site for a period to be determined by management, depending on the severity of their actions.

3rd Warning – The driver will be banned and the company of the driver will be notified of the ban period imposed on the driver.

9.1. Monitoring Measures

Hanson staff will undertake formal observations of compliance at three monthly intervals and will document and undertake any remedial actions with employees, heavy vehicle drivers or haulage companies that may be necessary as a result of these observations.

10. Emergency Contact Numbers

- RMS Transport Management Centre – **131 700**
- Port Stephens Council **– (02) 4988 0255**
- Quarry Management **– (02) 4988 6166**
- Complaints Line **– 1800 882 478**
- NSW Police Service (Northern Region) **–** (**02) 4934 0200**
- Transport Shift Manager – **(02) 9660 0441**

11. Code of Conduct Induction

To all Truck Drivers Entering Brandy Hill Quarry

- Weighbridge operating hours for all contractors is 6.30am to 4.30pm, unless otherwise notified by Management. Hanson fleet trucks are permitted at earlier times as required. Non-Hanson trucks to this site are not permitted on Brandy Hill Drive prior to 6:30 am, unless otherwise advised.

- All heavy vehicle drivers operating out of the Brandy Hill Quarry are to observe the posted speed limits, with speed adjusted appropriately to suit the road environment and prevailing weather conditions, to comply with the NSW Road Rules & Heavy Vehicle National Law. The vehicle speed must be appropriate to ensure the safe movements of the vehicle based on the vehicle configuration.

- The speed limit along the Haul Road is 45km/hr. The speed limit along the Quarry Driveway is 60km/hr. The speed limit in and around the plant and sales yard is 25 km/hr. When exiting at Clarence Town Road intersection, all trucks must come to a complete stop.

- On entering the Quarry, trucks must communicate via UHF 10 to the Weighbridge Operator or Sales Loader, what products they want. Conversations MUST be kept to a minimum. Change to UHF9 at stop sign when entering Floors 1 & 2. Call up on UHF to let Pit Operators know your movements. Watch out for Heavy Machinery working.

- Drivers are expected to give way to all oncoming vehicles, paying particular attention to Quarry sales loaders and equipment. Trucks must give way to loaders and dump trucks at all times.

- Truck Drivers loading at the stockpiles should remain in their cabins. No children are permitted on site without prior permission from the Operations Manager per Hanson Directive.

- Whilst waiting to be loaded, if drivers exit their cabin they must be cautious of other vehicles moving between and behind stockpiles. Drivers must be wearing adequate PPE such as high visibility clothing, long sleeve shirt and long pants, safety boots and a safety helmet, as per Hanson Directive.

- If undertaking a U-turn or reversing into the appropriate stockpile area, trucks must use all appropriate means of communicating their movements.

- Due to space limitations around loading areas, trucks are expected to slow down to a speed which will ensure they are able to stop quickly if required. Visibility may be reduced around stockpiles, take extra care in these areas.

- To alleviate public concern and increase road safety, heavy vehicles leaving the Brandy Hill Quarry should try to be separated by a minimum, 1.5 minute interval.

- All trucks arriving at or departing from the Brandy Hill Quarry, whether loaded with material or not, are required to have an effective cover over their load for the duration of the trip. The load cover may be removed upon arrival at the delivery site. Tarp in designated area, NOT on weighbridge. Tarping, load and vehicle inspections to be done at work platforms after the weighbridge. No driver is to climb into or onto the back of truck bodies or trailers.

- All care is to be taken to ensure that all loose debris from the vehicle body and wheels are removed prior to leaving the site. Drivers must ensure that following tipping that the tailgate is locked before leaving the site. Never drive with the body in a raised position.

- All drivers are to show respect for our neighbours in the Seaham and Brandy Hill areas. Take care around bus stops in the mornings and afternoons. Brandy Hill Drive is an 80km speed zone. Please give pedestrians using Brandy Hill Drive a wide berth, be aware of their safety and other road users.

- All heavy vehicle drivers operating out of the Brandy Hill Quarry are to minimise the use of compression brakes, so as not to create excessive noise that could disturb local residents, where possible. Compression braking within or adjacent to residential areas should only be used if required for safety reasons.

- Heavy vehicle drivers are to carefully plan their routes so that State and regional roads are given priority for route selection. Local roads should only be used if there is no other option or in an emergency situation. To be considerate of our neighbours, short cuts and deviations should not be used when delivering Quarry products.

- Be conscious of Hanson's seven lifesaving rules:
    1. You must be inducted and competent to operate on our sites.
    2. When working at heights, protect yourself and others below you.
    3. Always use positive isolation, lockout and tag before working on plant and equipment.
    4. Guarding must be in place at all times and replaced immediately following any work on plant and equipment.
    5. Wear your seat belt.
    6. Never text or use a hand held phone whilst driving.
    7. Report all injuries, incidents and hazards to your supervisor/ manager.

- All heavy vehicle drivers operating out of the Brandy Hill Quarry are to be aware of their adopted Fatigue Management Scheme and operate within its requirements. By law, all drivers have a duty to not drive a fatigue-regulated heavy vehicle on a road while impaired by fatigue.

- Failure to comply with the above will result in immediate removal from site.

12. Declaration

DECLARATION

I, the undersigned, hereby agree to abide by Hanson Construction Materials Pty Ltd Driver Code of Conduct for the transportation of Quarry products from the Brandy Hill Quarry, Clarence Town Rd, Seaham NSW to their final destination/s in a safe manner. I have read and understand the requirements outlined in the attached document and will, to the best of my ability, comply and assist with their implementation, requirements and ongoing administration.

The subject document to which this declaration relates is attached as part of the overall document and signing of this declaration confirms that signee has read and understood the entire document:

TRUCK DRIVER

Full Name: ____

Organisation: ____

Signature: ____

Date: ____

HANSON CONSTRUCTION MATERIALS PTY LTD

Company Witness: ____

Date: ____

13. Complaints Register

Brandy Hill Quarry Complaints Register

DATE to DATE

No.	Date	Time	Name	Nature of Complaint	Complaint Comments	Action / Follow-up Taken

Last Updated by PS -16/04/2018

14. References

Kloeden, C., Ponte, G., & McLean, A. (2001). *Travelling Speed and the Risk of Crash Involvement on Rural Roads.* Adelaide: Department of Transport and Regional Services.

NHVR. (2017). *About fatigue management*. Retrieved November 24, 2017, from National Heavy Vehicle Regulator: https://www.nhvr.gov.au/safety-accreditation-compliance/fatigue-management/about-fatigue-management

NHVR. (2017). *Penalties and infringements*. Retrieved November 23, 2017, from National Heavy Vehicle Regulator: https://www.nhvr.gov.au/law-policies/penalties-and-infringements

Appendix 11

Brandy Hill Quarry: Community Support & Sponsorship Policy

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Brandy Hill Quarry - Community Support & Sponsorship Policy

Purpose

The purpose of this policy is to provide transparency and clarity for all stakeholders, on the guidelines for support and sponsorship to the community, groups and individuals by Hanson's Brandy Hill Quarry.

Principles

- The primary method of support should ideally be via donation of materials produced by Hanson, namely quarry rock materials, and pre-mixed concrete.
- Support may extend to the direct purchase and supply of third party goods & services if practical and more appropriate; though cash payments are not provided, except in unusual circumstances.
- Support shall not be provided to groups who in turn provide cash donations or systematic payments (or similar) to individuals.

Priorities

- Support should be primary directed to activities and initiatives which leave a permanent positive legacy.
- Support shall be provided to youth organisations, including sporting clubs, where the support enables to the organisation to sustain its primary aim.
- Support may be provided either directly to, or indirectly via not-for-profit organisations who are directly facilitating help to, an individual who is in recognisable need of support.

Scope

- Support shall be prioritised to initiates where the benefit will be specifically and directly received in the local community.
- Support shall be directed towards organisation (or individuals) who are based in townships and villages local to the Brandy Hill Quarry, nominally centred on Seaham, and in the area bordered by Raymond Terrace, Clarence Town & Woodville.
- Total targeted annual support should be of a value of $0.01 per tonne sold (at a production rate of 1.5Mtpa contributions would equate to $15,000 annual support).

Process

- Those seeking support should write directly to the Quarry Manager, and provide relevant information which supports their request. Hanson will acknowledge representations made on behalf of the applicant. The Quarry Manager shall instigate Hanson normal internal approval process and will table all sponsorship requests to the VPA Committee via a time-suitable method.
- The default allocation of sponsorship should be at the direction of the VPA Committee. VPA Committee members are asked to openly disclose any association with the recipient/s before deliberating the merits, and this does not preclude the validity of the recipient. The VPA Committee are asked to consider all appropriate advice presented, and to assess each request based on the merits of the applications, in accordance with this guideline. In assessing the application, the VPA Committee shall consider a range of factors, such as the total expected annual value of all applications, history of the applicant, prevailing local issues, and the likely positive impact of support.
- An application made which is in line with the merits of this guideline, does not guarantee that support will be provided. Hanson would veto a VPA Committee recommendation of sponsorship if the annual level of funding is exhausted, or the sponsorship is at clear odds with the guideline. In the absence of VPA Committee recommendation, Hanson will continue to provide sponsorship, using this guideline.

The guideline may be reviewed from time to time for suitability, and consider input from the VPA Committee about the guideline.

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