Centennial Coal

CENTENNIAL COAL
NEWSTAN COLLIERY
ANNUAL REVIEW

March 2018

Centennial Coal
Environment Matters

Name of Operation	Newstan Colliery
Name of Operator	Centennial Newstan Pty Ltd
Development Consent/ Project Approval #	DA 73_11_98 and SSD-5145
Mining Lease #	Consolidated Coal Leases 727, 746, 763 and 764. Mining Leases 1380, 1452, 1480, 1586, and 1587. Mining Purposes Leases 304, 305, 327, 328. Private Lands Lease 497.
Name of Holder of Mining Lease	Centennial Newstan Pty Ltd
Water License #	
Name of Holder of Water License	Centennial Newstan Pty Ltd
MOP/RMP Start Date	August 2015
MOP/RMP End Date	August 2018
Annual Review Start Date	January 2017
Annual Review End Date	December 2017

I, Mick Cairney, certify that this audit report is a true and accurate record of the compliance status of Newstan Colliery for the period January 2017 to December 2017 and that I am authorized to make this statement on behalf of Centennial Newstan Pty Ltd.

Note:

a) *The Annual Review is an 'environmental audit' for the purposes of s122B(2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion) in an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, $1 million and for an individual, $250,000.*

b) *The Crimes Act 1900 contains other offences relating to false and misleading information: section 192G (intention to defraud by false or misleading statement – maximum penalty 5 years imprisonment); sections 307A, 307B and 307C (False or misleading applications/information/documents –maximum penalty 2 years imprisonment or $22,000,or both).*

Name of Authorised Reporting Officer	MICHAEL CAIRNEY
Title of Authorised Reporting Officer	MD + CEO
Signature of Authorised Reporting Officer	
Date	28.3.18

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1 STATEMENT OF COMPLIANCE

Table 1: Statement of Compliance

Were all conditions of the relevant approval(s) complied with?	
DA 73-11-98	Yes
SSD-5145	Yes
EPL 395	Yes
Mining Lease 1380	Yes
Mining Lease 1452	Yes
Mining Lease 1480	Yes
Mining Lease 1586	Yes
Mining Lease 1587	Yes

Table 2: Non-Compliances

Relevant Approval	Condition #	Condition summary	Compliance Status	Comment	Section addressed in Annual Review
No non compliances for the reporting period					

Note: Compliance Status Key for Table 3

Risk Level	Colour Code	Description
High		Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence
Medium		Non-compliance with: • Potential for serious environmental consequences, but is unlikely to occur; or • Potential for moderate environmental consequences, but is likely to occur
Low		Non-compliance with: • Potential for moderate environmental consequences, but is unlikely to occur; or • Potential for low environmental consequences, but is likely to occur
Administrative		Only to be applied where the non-compliance does not result in any risk of environmental harm (eg submitting a report to government later than required under approval conditions)

2 INTRODUCTION

The Northern Coal Logistics Project (NCL), owned and operated by Centennial Northern Coal Services Pty Limited (Northern Coal Services) and Centennial Newstan Pty Limited (Centennial Newstan) is located on the western side of Lake Macquarie approximately 140 kilometers north of Sydney in New South Wales. NCL comprises of the existing approved surface coal handling and processing facilities at the Newstan Colliery Surface Site and Mandalong Mine – Cooranbong Entry Site, along with existing private haul road and rail loading infrastructure (**Figure 1**).

For the purposes of this report Newstan will only be incorporated within this Annual Review. Cooranbong Site Services and Cooranbong Haul Road have been incorporated in the Mandalong Colliery Annual Review.

Figure 1: Regional Context

2.1 OVERVIEW

Newstan Colliery comprises the underground workings and surface infrastructure of:

- The Newstan Colliery underground workings;
- The Newstan Colliery surface infrastructure; and
- The Northern Coal Services Coal Handling and Preparation Plant (CHPP) and associated infrastructure and rail loop.

Underground coal mining operations commenced in the area now known as Newstan Colliery in 1887 and continued under existing use rights until 1999. On 14 May 1999 the then Minister for Urban Affairs and Planning granted Development Consent DA 73-11-98 under Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act) for the Newstan Colliery Life Extension Project following the submission of the Newstan Colliery Life Extension Project EIS. This development consent enabled existing mining and mining related activities to continue, along with the expansion of mining into the "Life Extension Area" and upgrade of surface facilities at the Newstan Colliery Surface Site and Awaba Colliery Surface Site. Development Consent DA 73-11-98 has been modified on the following occasions, with the last modification approved in December 2015.

- 23 September 2007 to allow the mining of LW24 and the construction of a ventilation shaft at Awaba (**Mod 1**),
- 1 December 2009 to allow for the Washing of Mandalong Coal (**Mod 2**),
- 26 November 2010 to allow for the Washing of Awaba Coal **(Mod 3**),
- 16 March 2012 to allow for the recommencement of first workings, bord and pillar mining in an area referred to as Main West (**Mod 4**),
- 19 November 2012 to allow for washing up to 4 Mtpa of Mandalong coal, and to transport excavated material produced from the shafts at Awaba to Newstan Colliery (**Mod 5**),
- 7 January 2014 to adjust the approved Consolidated Consent Boundary in the Main West Mining Area to include the four excluded areas. The areas are proposed to be consolidated for administrative reasons to ensure all workings around the Main West Mining Area are regulated under Development Consent DA 73-11-98 (**Mod 6**), and
- 1 December 2015 to adjust the approval to prevent overlap of conditions with Development Consent SSD-5145. (**Mod 7**).

2.2 SCOPE

This Annual Review details the progress of environmental management covering Newstan Colliery for the period 1 January 2017 to 31 December 2017. The Annual Review has been prepared in accordance with the Newstan Colliery conditions of consent as detailed in SSD-5145 and DA 73-11-98.

The other operations covered by SSD-5145 are described in the Mandalong Annual Review required by SSD-5145.

2.3 SUMMARY OF WORKS

2.3.1 Newstan Colliery

The Newstan Colliery surface facilities area includes: offices, a workshop and bathhouse as well as equipment and materials storage areas. The Newstan Colliery has approval to produce up to 4.5 Mtpa of coal from the Newstan Colliery.

Newstan Colliery underground operations were put on care and maintenance in August 2014. There was no production in 2017 and none planned for 2018.

The underground operations were maintained during the January to December 2017 reporting period. No other construction activities were undertaken during the reporting period.

2.3.2 Northern Coal Services Coal Handling and Preparation Plant (CHPP)

The Newstan Colliery surface facilities area includes: offices, a workshop and bathhouse as well as coal handling infrastructure consisting of a coal preparation plant, truck loading bins and a rail loading facility.

The NCS has approval to produce handle and process up to 4.5 Mtpa of coal from the Newstan Colliery, up to 0.88 Mtpa of coal from the Awaba Colliery and up to 6 Mtpa from the Mandalong Mine. The CHPP also has approval to receive waste rock material from Mandalong Mine, Mandalong Southern Extension Project and Newstan Extension of Mining Project.

2.3.3 Mineral Processing

The coal handling and preparation plant (CHPP) processes Newstan ROM coal for domestic and export markets as well as coal from various other Centennial operations for the export market. Newstan has approval to process up to 8 million tonnes per annum of ROM coal through the Newstan CHPP. Newstan CHPP operations for the reporting period are summarised in Table 5.

Table 3: Centennial Newstan Environmental Contact Details

Name	Position	Email	Phone
Grant Watson	Mine Manager	Grant.Watson@centennialcoal.com.au	02 49560205
Nerida Manley	Environment & Community Coordinator	Nerida.Manley@centennialcoal.com.au	02 49560206

3 APPROVALS

Table 4: Environmental approvals held by Centennial Newstan.

Name	Description	Issued By	Expiry Date	Renewal Procedure
CCL727	Pit top, SREA, NREA & surrounds	Dept. Primary Industry (Mineral Resources)	11/08/2027	Manager Title and Property-North
MPL304	Part NREA	Dept. Primary Industry (Mineral Resources)	25/03/2035	Manager Title and Property-North

Name	Description	Issued By	Expiry Date	Renewal Procedure
MPL305	Water Tanks	Dept. Primary Industry (Mineral Resources)	25/03/2035	Manager Title and Property-North
ML1380	Mining Lease	Dept. Primary Industry (Mineral Resources)	18/09/2037	Manager Title and Property-North
ML1452	Mining Lease	Dept. Primary Industry (Mineral Resources)	06/07/2020	Manager Title and Property-North
ML1480	Part NREA	Dept. Primary Industry (Mineral Resources)	20/07/2023	Manager Title and Property-North
CCL764	Area between the rail loops and the haul roads	Dept. Primary Industry (Mineral Resources)	18/05/2021	Manager Title and Property-North
CCL763	Parcel land south of the pit top, including Stony Creek Pipeline,	Dept. Primary Industry (Mineral Resources)	09/06/2022	Manager Title and Property-North
PLL497	NA	Dept. Primary Industry (Mineral Resources)	24/08/2017	Manager Title and Property-North
CCL746	Area above underground workings, within Crown Land.	Dept. Primary Industry (Mineral Resources)	31/12/2028	Manager Title and Property-North
MPL327 *	Awaba Nitrogen Plant	Dept. Primary Industry (Mineral Resources)	05/08/2015	Manager Title and Property-North

Name	Description	Issued By	Expiry Date	Renewal Procedure
MPL328	Part Awaba Stockpile	Dept. Primary Industry (Mineral Resources)	05/08/2036	Manager Title and Property-North
ML1586	Mining Lease	Dept. Primary Industry (Mineral Resources)	13/10/2022	Manager Title and Property-North
ML1587	Surface area incl SREA.	Dept. Primary Industry (Mineral Resources)	23/10/2027	Manager Title and Property-North
Mine Operations Plan (MOP)	Summary of Mining and Processing Activities – Newstan and Awaba	NSW Trade & Investment – Division of Resources & Energy	2018	MOP approved for the period August 2015 – August 2016
Newstan Colliery Development Consent DA 73-11-98	Permits development and works to occur as described in the EIS	NSW Department of Planning & Environment	July 2020	Permits development and works to occur as described in the EIS
Centennial Norther Coal Services Development Consent SSD-5145	Receipt, handling, processing and transport of run-of-mine coal from Centennial Coal's underground operations at Mandalong Mine, Newstan Colliery and Awaba Colliery.	NSW Department of Planning & Environment	31/12/2045	Requires new development consent after expiry date.
Environmental Protection Licence 395	Permits scheduled activity "coal mining" and discharge of water from licensed discharge points.	Environment Protection Authority	Perpetual	Requires payment and Annual Return February each year

** A renewal application has been lodged with the Department of Industry - Division of Resources & Energy and as such the mining lease remains in full force at the time of drafting this report.*

3.1 DEVELOPMENT CONSENTS

Development Consent DA 73-11-98 for Newstan Colliery

In 1998, Powercoal Pty Limited, the (then) owners of Newstan, submitted an Environmental Impact Statement (Umwelt, 1998) to the New South Wales Department of Planning (DoP), seeking approval for the expansion of Newstan, in an area referred to as the Life Extension Area (LEA). On 14 May 1999, the then Minister for Urban Affairs and Planning, granted development consent under Part 4 of the EP&A Act for the Newstan Colliery Life Extension Area pursuant to Development Application DA 73-11-98. This development consent has since been modified on the following occasions:

- 23 September 2007 to allow the mining of LW24 and the construction of a ventilation shaft at Awaba (Mod 1),
- 1 December 2009 to allow for the Washing of Mandalong Coal (Mod 2),
- 26 November 2010 to allow for the Washing of Awaba Coal (Mod 3),
- 16 March 2012 to allow for the recommencement of first workings, bord and pillar mining in an area referred to as Main West (Mod 4),
- 19 November 2012 to allow for washing up to 4 Mtpa of Mandalong coal, and to transport excavated material produced from the shafts at Awaba to Newstan Colliery (Mod 5),
- 7 January 2014 to adjust the approved Consolidated Consent Boundary in the Main West Mining Area to include the four excluded areas. The areas are proposed to be consolidated for administrative reasons to ensure all workings around the Main West Mining Area are regulated under Development Consent DA 73-11-98 (Mod 6), and
- 1 December 2015 to adjust the approval to prevent overlap of conditions with Development Consent SSD-5145. (Mod 7).

This development consent applies to the Pit Top Area, Coal Handling and Preparation Plant (CHPP), stockpile areas, the rail loop, haulage roads, Northern Reject Emplacement Area (NREA) including the tailings dam and water management dams, Southern Reject Emplacement Area (SREA) and underground operations, including the ventilation site at Awaba.

An application was made under Section 100 of the *Coal Mine Health and Safety Act 2002* on 27 November 2006 to construct stages two through to five of the Southern Reject Emplacement Area (SREA) tailings storage facility. Approval was granted by the chief inspector of coal mines on 10 January 2007.

Development Consent SSD-5145 for Northern Coal Services Project

Development Consent SSD-5145 for the Northern Coal Services Project was approved by the Department of Planning & Environment (DPE) on 29 September 2015. The approval consolidates the receipt, handling, processing and transport of run-of-mine coal from Centennial Coal's underground operations at Mandalong Mine, Newstan Colliery and Awaba Colliery.

The surface infrastructure and operations at the Cooranbong Entry Site are part of the Northern Coal Services Project SSD-5145, however continue to be managed by Centennial Mandalong.

3.2 MINING AUTHORITIES

Newstan Colliery holding comprises a number of leases as shown in **Table 4.**

3.3 ENVIRONMENT PROTECTION LICENCE

Centennial Newstan holds Environment Protection Licence (EPL) 395 under the Protection of the Environment Operations Act 1997.

3.4 AUTHORISATIONS & EXPLORATION LICENCES

The Newstan Colliery holding comprises a number of leases as shown in **Table 4**.

The Newstan Awaba MOP Complex was approved by DRE in August 2015 and is approved until August 2018.

3.5 CONSENT CONDITIONS – ANNUAL REVIEW REQUIREMENTS

Schedule 5 Condition 11 of SSD-5145 and Schedule 2 Condition 9.1 of DA 73-11-98 (MOD 7) include the requirement for an Annual Review.

The 2015 Annual Review was provided to DPE, DRE, LMCC, NOW, EPA, NPWS and the Newstan Colliery CCC consistent with DA 73-11-98 condition 9.1.

4 OPERATIONS SUMMARY

Table 5: Production Summary

Material	Approved Limit (and source)	Previous Reporting Period (Actual)	This Reporting Period (Actual)	Next Reporting Period (Forecast)
ROM Coal	4.5 Mtpa	0.888	1.732	1.85
Saleable product	4.5 Mtpa	0.817	1.617	1.70
Transport (rail)	8 Mtpa	0.769	1.675	1.70
Hours of operation	24/7	24/7	24/7	24/7

Production figures in Table 5 consist only of coal from Mandalong which may also be included in the Mandalong Annual Review. No coal was extracted from Newstan during the reporting period. 2852 tonnes of product coal were trucked to Eraring during the reporting period. No coal was extracted from Newstan Colliery during the reporting period.

4.1 EXPLORATION

There was no exploration drilling in 2017.

Five exploration drill holes were completed in the 2011 calendar year as part of the Newstan exploration programme. Twenty-two exploration drill holes (including two large diameter drill holes) were completed in the 2010 calendar year. All drill sites completed in 2011 and 2010 have been rehabilitated.

A modification to the Newstan Stage 1 Exploration Area for an additional eighteen exploration drill sites was granted by Industry and Investment NSW (I&I) on 9 April 2009. Approval for the Newstan Lochiel Stage 2 exploration area was granted by I&I on 13 July 2009, approving fourteen exploration drill sites. A modification to both the Stage 1 and Stage 2 Newstan Lochiel exploration areas was granted by I&I on 4 November 2009, approving the development of four large diameter drill holes across the two exploration areas.

5 ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

The DPE in a letter dated 27 February 2017 considered the 2016 Annual Review to be generally in accordance with the conditions of approval. The DPE identified a number of items to be addressed in the 2016 Annual Review as detailed in **Table 6**.

The DRE in a letter dated 27 February 2017 considered the 2015 Annual Review to be to the satisfaction of the Minister and Secretary. The DRE identified a number of items to be documented in the Annual Review as detailed in **Table 6**.

Table 6: Actions from Previous Annual Review

Action Required	Requested By	Action Taken	Where addressed in Annual Review
The re contouring and revegetation of the old reject emplacement areas in the NREA are documented in the AEMR	Department of Planning & Environment - DRE	LIDAR flown December 2017. To be updated in 2018 AEMR	NA
Rehabilitation of sinkholes documented in the AEMR	Department of Planning & Environment - DRE	Sinkhole rehabilitation provided within the Awaba AEMR	NA
The Department requests that results of monitoring undertaken against the completion criteria as presented in the MOP is reported in the rehabilitation section of future AEMR's	Department of Planning & Environment - DRE	Revised MOP approved for March 2018 – July 2020. Monitoring to	NA
Provide native mix composition to the	Department of Planning &	Native seed mix provided to the	NA

Action Required	Requested By	Action Taken	Where addressed in Annual Review
Department by 20 July 2017	Environment - DRE	Department July 2017	
Weeds observed around discharge area point are to be managed under Council Regulations by next AEMR	Department of Planning & Environment - DRE	A weed action plan has been implemented for 2018	NA

6 ENVIRONMENTAL PERFORMANCE

Schedule 2 Condition 9 of DA 73-11-98 and Schedule 5 Condition 11of SSD-5145 require the presentation and discussion on all monitoring required under the Development Consents and other approvals. **Table 7** includes a summary of the monitoring required by the Development Consents, current status and report section in the Annual Review.

Table 7: Summary of Monitoring Requirements

Monitoring Type	Status	Report Section
Noise Monitoring	Quarterly	**Section 6.1**
Air Quality Monitoring	Ongoing	**Section 6.2**
Meteorological Monitoring	Ongoing	**Section 6.7**
Surface Water Monitoring Groundwater Monitoring	Ongoing Ongoing	**Section 7.1** **Section 7.2**
Rehabilitation Monitoring	Annual survey	**Section 8**

6.1 NOISE

The Northern Region Noise Management Plan has been developed to ensure that operational and construction noise impacts on the local community are minimised and appropriate management measures are identified and response protocols detailed should noise criteria be exceeded and to comply with statutory approval conditions. The plan was submitted to the DPE for approval in July 2016.

Quarterly attended noise monitoring was conducted to assess operational noise levels compared to the noise limits specified by Schedule 3 Condition 2 of.SSD-5145.

Operator attended noise surveys were conducted during February, May, September and November 2017 at each of the seven (7) locations during day, evening and night periods to determine the character and relative contribution of ambient noise sources and mine contributions.

The Newstan EIS predictions for noise found that the noise emission levels at NC1 and NC2 were below or marginally (1 dBA) above the then daytime (39 dBA) and night-time (38 dBA) assessment criteria during calm and adverse weather conditions.

Noise emissions levels at NC4 and NC5 are below or only marginally (2dBA) above the then daytime (37 dBA) and night time (35 dBA) assessment criteria during calm conditions. During adverse weather conditions noise emissions may be up to 4 dBA (daytime) and 6 dBA (night time) above the assessment criteria when using the front end loader.

The Main West EA found that the potential noise impacts are predicted to meet the project specific noise criteria at all resident locations, with the exception of NC3. The NC3 site was predicted to have a 2 dBA exceedance of project specific noise criteria (35 dBA night time) under a temperature inversion.

The Northern Coal Services EIS found that the potential noise impacts are predicted to meet the project specific noise criteria at all resident locations, with the exception of NC3. The NC3 site is predicted to exceed the project specific noise criteria by up to 1dBA during night time calm conditions and by up to 4dBA during night time temperature inversions for the current existing and approved operations.

In order to minimise noise generated by train operations at Newstan Colliery, the following operating procedures have been implemented, except in emergency situations.

1. The procurement of a fleet of new locomotives has allowed for the elimination of bank engines and the use of BRM new generation locomotives. They are considerably quieter and environmentally friendly.
2. No bank engines are now being used.
3. The use of the Locomotive horn at level crossings at Newstan Colliery is restricted to EMERGENCY use only. The headlight and ditch lights shall be used to provide adequate warning.
4. The use of the Locomotive horn prior to moving the train at Newstan Colliery is restricted to EMERGENCY use only.
5. All shunting shall be carried out with radio communication. The use of the locomotive horn is prohibited.
6. Train ‘run-ins’ and ‘run-outs’ shall be managed professionally by the train crew, ensuring correct use of the automatic (train) brake and independent brake. Four new locomotives are now required where previously six or seven were needed. The new locomotives were delivered throughout 2012/2013.
7. A 6 metre high bund wall was constructed at the south-eastern end of the Rail Loop stockpile in 2012.

6.1.1 Summary of Noise Monitoring Results

Global Acoustics Pty Ltd, were engaged by Centennial Newstan to conduct quarterly noise compliance assessments for the Newstan Colliery in accordance with the Development Consent criteria.

Table 8: Summary of Noise Monitoring

Monitoring Quarter	Compliance status
Quarter 1 February	Activities from Newstan Colliery complied with the relevant development consent noise limits during the Q1 monitoring at all monitoring locations.
Quarter 2 May	Activities from Newstan Colliery complied with the relevant development consent noise limits during the Q2 monitoring at all monitoring locations, with the exception of NC3 and NC7 during the night period (details in the May report).
Quarter 3 August	Activities from Newstan Colliery complied with the relevant development consent noise limits during the Q3 monitoring at all monitoring locations.
Quarter 4 November	Activities from Newstan Colliery complied with the relevant development consent noise limits during the Q4 monitoring at all monitoring locations.

6.1.2 Newstan Shaft Site (Awaba) Noise Monitoring

The requirements for the Newstan Ventilation Shaft Site at Awaba impact assessment criteria are included in the Table 9 in accordance with Newstan's Development Consent condition 6.4 D and the Newstan Colliery Modification of Development Consent Statement of Environmental Effects (2007).

Table 9: Newstan shaft site noise monitoring criteria

	Noise Criteria $L_{Aeq(15\ minute)}$ Noise Goals (dBA)		
Location	**Day**	**Evening**	**Night**
All privately owned residences	38 dBA	40 dBA	36 dBA

No noise monitoring was conducted during the reporting period due to no operational activities occurring at the Newstan ventilation shaft site at Awaba.

6.2 AIR QUALITY

The Northern Region Air Quality and Greenhouse Gas Management Plan has been developed to ensure that operational and construction air quality impacts on the local community are minimised, appropriate management measures identified and response protocols detailed should air quality criteria be exceeded and to comply with statutory approval conditions. The plan was submitted to the DPE for approval in July 2016.

6.2.1 Dust Deposition Gauges

Originally there was a total of 9 depositional dust gauges located around the Newstan Colliery pit top facilities and Fassifern. Dust gauge 8 was decommissioned in 2005 due to the tree growth in the private garden that the gauge was located in (no longer compliant with the relevant standard) and continual vandalism by school children. Dust Gauge 7 was removed and decommissioned by a private land owner to allow fill to be placed in the owner's horse paddock. Dust Gauge 7 was re-instated in August 2009 to the south-east of Newstan Colliery at the Fassifern Archery Complex.

Newstan currently has eight depositional dust gauges located around the Colliery pit top facilities, NREA, SREA and Fassifern. The following graph, Figure 2, displays Newstan's Monthly Rolling Annual Average Dust Deposition in 2017 (Insoluble Solids).

The Newstan Life Extension EIS results for DG's 1 to 8 found the monthly averages and annual averages were below 2 g/m2/month, which is within the EPA goal of 4 g /m2/month annual average. The EIS states that increases between 1 and 2 g/m2/month due to the Newstan extension would therefore be acceptable given the existing deposition levels. Annual average dust deposition rates due to existing operations were predicted to be approximately 1 g/m2/month or less at Fassifern and surrounding districts.

Table 10: Summary of depositional dust results between January 2017 and December 2017 surrounding Newstan Colliery.

	Insoluble Solids (Combustible Matter + Ash) g/m^2/month							
	DG1	**DG2**	**DG3**	**DG4**	**DG5**	**DG6**	**DG7**	**DG9**
Long Term Average	1.3	3.2	1.4	2.0	4.0	1.9	3.7	2.4
Average 2017 (Reporting Period)	1.9	1.1	1.8	4.3	1.0	1.3	2.7	0.8
Air Quality Criteria	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0

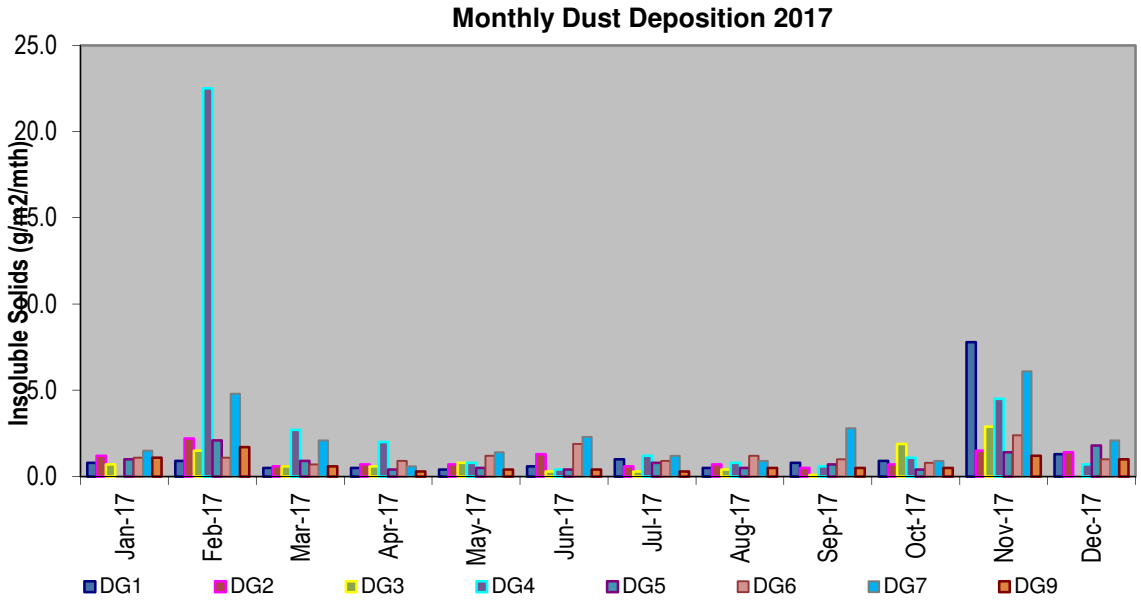

Figure 2: Newstan Monthly Dust Deposition 2017

All particulate dust gauges recorded an annual average particulate monitoring result below the development consent limit of 4g/m2/month for the annual averaging period.

Dust gauge 1 has remained relatively stable since 2001, while the results for dust gauges 2, 5, 6, 7 and 9 have decreased. Some high results at dust gauges 3 and 4 have resulted in an increasing trend due to spikes in 2012, 2015 and 2017. Visual inspections of the samples showed that approximately 90% of the samples were insect matter and or bird droppings.

Dust monitoring locations are provided in Plan NS3332.

6.2.2 High Volume Dust Sampling

The EIS states that the annual average TSP levels are predicted to be approximately 10 µg/m3 at Wakefield and Fassifern. This is less than measured background levels indicating that other local dust sources may also be contributing to TSP levels in the area. Predictions for the expansion up to 3 mtpa using the front end loader method showed an annual average TSP concentrations at the nearest residence to the northwest of the existing emplacement area increase by 5 µg/m3 above those predictions made for the existing case. Emissions were not predicted to cause exceedances of the air quality goal of 90 µg/m3 (annual average for TSP). Assuming that approximately 50% of total TSP is PM10, the annual average goal of 50 µg/m3 is not predicted to exceed after the initial expansion for PM10.

The Main West Mining Project EA states that the results of dispersion modelling indicate no potential for exceedance of the annual average TSP and PM10 assessment criteria at the nearest non-project related receptors. The dispersion modelling predicted a likelihood of exceedances at the nearest sensitive receptor of regulatory guidelines for PM10 as a 24 hour average. Background concentrations of PM10 also contribute significantly to predicted likelihood of exceedances of 24 hour PM10.

High volume dust sampling was undertaken to monitor dust deposition rates and concentrations of Total Suspended Particulates (TSP) and Suspended Particles PM10 and PM2.5.

The Hill Top High Volume dust sampling point (HVS1) is located to the north of the NREA near Culgan's property. The Water Tank High Volume Dust Sampling point (HVS2) is located to the south of Newstan Colliery near the Fassifern Railway Station. It was not possible to locate the southern high volume dust sampler at the Fassifern Public School as required by the Development Consent DA 73-11-98, due to the need to undertake extensive tree clearing at the school. The site chosen is located closer to the mine site.

Table 11 displays the annual average PM10 (ug/m3) at HVS1 and HVS2 since monitoring commenced in 2007, while Table 12 shows the Annual Average TSP. Table 11 demonstrates a significant reduction in the annual average PM10 levels at the Newstan Colliery since 2007, especially at HVS2.

Table 11: Annual Average PM10 (ug/m3) at HVS1 and HSV2

Annual Average PM10 (ug/m3)		
Year	**Hill Top (HVS1)**	**Water Tank (HVS2)**
2007	18.6	25.6
2008	16.0	25.8
2009	16.6	19.4
2010	11.6	16.2
2011	14.3	17.7
2012	12.5	17.0
2013	13.3	16.1
2014	11.9	14.7
2015	11.5	12.8
2016	11.0	12.4
2017	11.5	12.4

Table 12: Annual Average TSP (ug/m3) at HVS1 and HSV2

Annual Average TSP (ug/m3)		
Year	**Hill Top (HVS1)**	**Water Tank (HVS2)**
2007	32.2	47.3
2008	33.0	53.2
2009	31.5	38.5
2010	22.5	30.3
2011	24.2	33.7
2012	21.2	34.3

Annual Average TSP (ug/m3)		
Year	Hill Top (HVS1)	Water Tank (HVS2)
2013	22.3	29.3
2014	21.4	27.9
2015	17.9	24.0
2016	18.0	20.3
2017	20.1	20.9

Newstan's Development Consent specifies the following criteria for TSP or PM10.

Table 13: Development Consent Long Term Impact Assessment Criteria for Particulate Matter

Pollutant	Averaging Period	Criterion
Total suspended particulate (TSP) matter	Annual	90 µg/m^3
Particulate matter <10 µm (PM_{10})	Annual	30 µg/m^3

Table 14: Development Consent Short Term Impact Assessment Criteria for Particulate Matter

Pollutant	Averaging Period	Criterion
Particulate matter <10 µm (PM_{10})	24 hour	50 µg/m^3

Figure 3 displays the rolling annual average and 24 hour results for high volume dust sampling results for PM10. Figure 4 displays the Rolling Annual average and the 24 hour results for TSP at the Hill Top Location (HVS1) and Water Tank Location (HVS2).

The rolling annual average results for both locations were below the criteria for TSP of 90 µg/m3 (annual average), and PM10 of 30 µg/m3 (annual average) during the reporting period.

The Newstan EPL 395 requires a sampling frequency for high volume air samplers to be every 6 days for TSP and PM10 at the two monitoring locations.

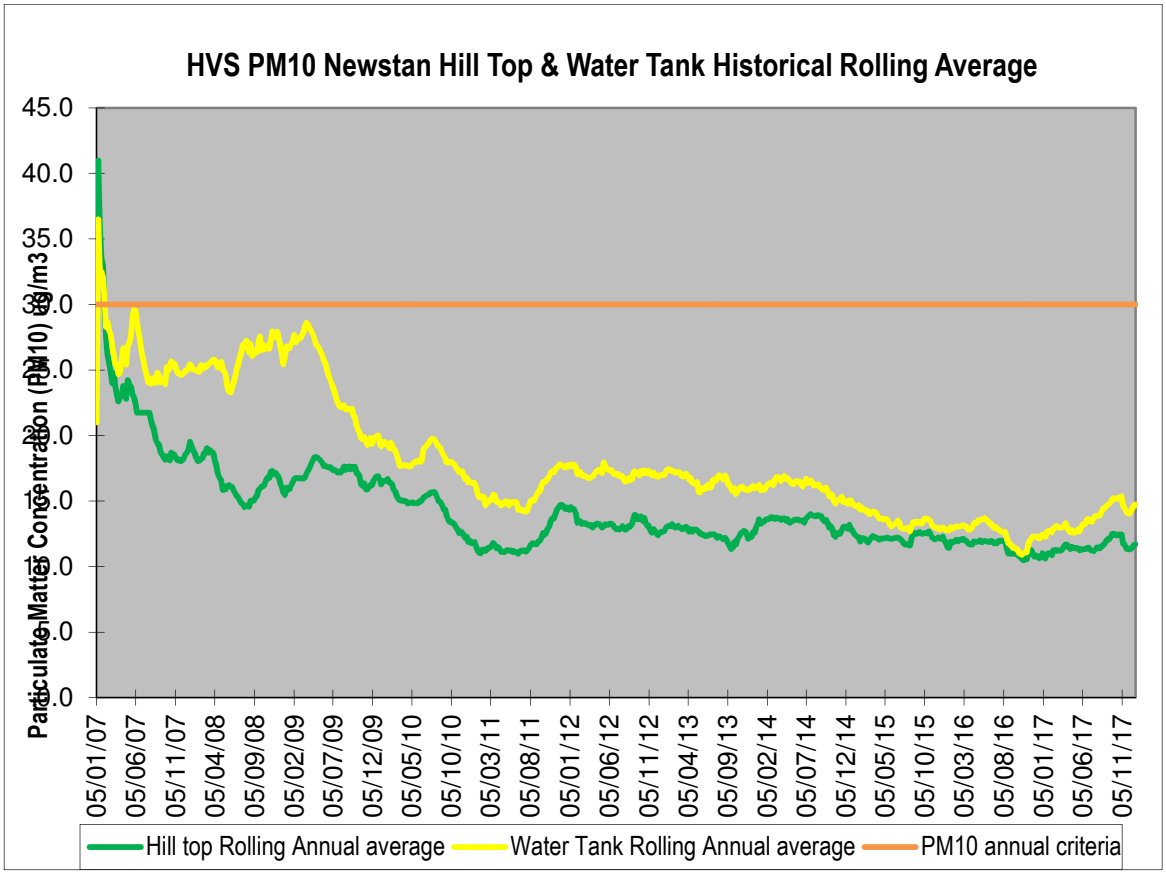

Figure 3: Newstan Rolling Annual Average for High Volume Dust Sampling for PM10

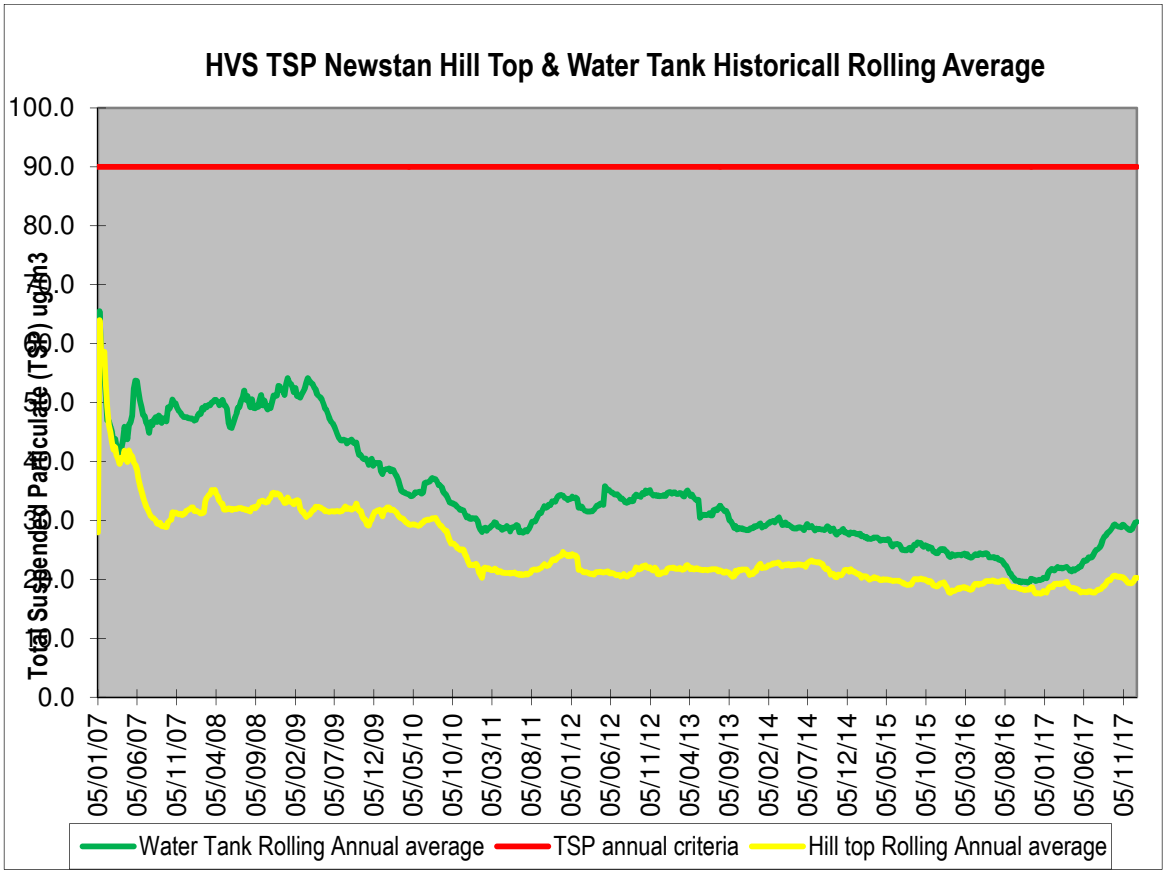

Figure 4: Newstan Rolling Annual Average for High Volume Dust Sampling for TSP

Figure 5 displays the 24 hour results for high volume dust sampling results for PM2.5 during the reporting period. The annual average high volume dust for PM2.5 was 5.3µg/m3 and 6.8µg/m3 for Hill Top and Water Tank respectively.

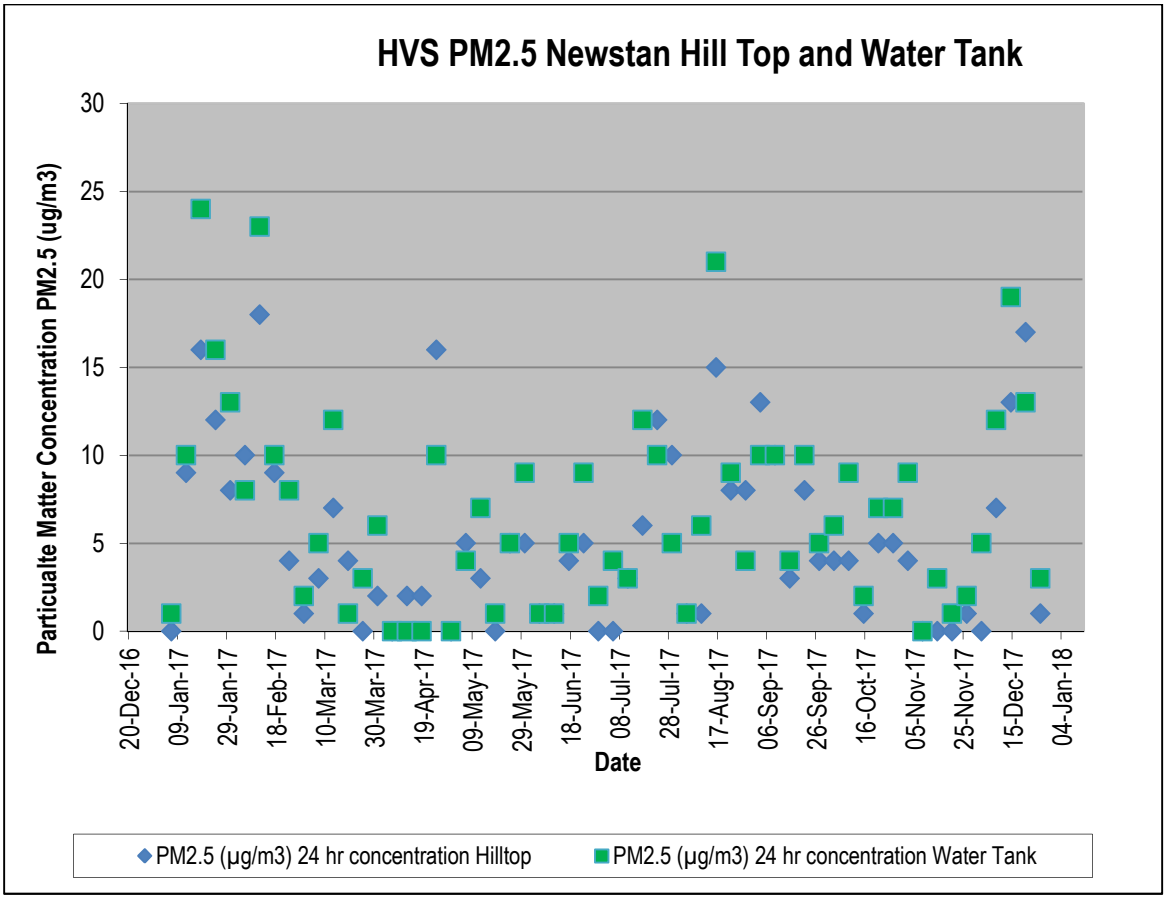

Figure 5: Newstan High Volume Dust Sampling for PM2.5

6.2.3 Greenhouse Gas Monitoring

Table 15 provides a summary of Newstan's main Greenhouse Gas emissions for the 2017 AEMR reporting period. The Post Mining Activities has been included for the first time in 2015.

Table 15: Greenhouse Gas Emissions FY2012 - FY2017

Emissions Summary (CO2-eT)						
	FY2012	FY2013	FY2014	FY2015	FY2016	FY2017
Electricity	31,566	31,391	28,960	18,556	10,624	13,628
Diesel	4,032	2,978	2,194	1,612	889	2,041
Fugitives – CH4	70,173	121,292	118,170	97,525	100,000	52,943
Fugitives – CO2	825	1581	910	1,077	1,020	724
Post Mining Activities*			9,691	2,084	0	0
Total of above GHG Emissions (tonnes)	**106, 596**	**157,243**	**159,925**	**122,736**	**112,533**	**69336**

* Note Emissions from Post Mining activities (e.g. surface stockpile), previously not included in the AEMR.

6.3 SUBSIDENCE

Newstan Colliery did not mine coal in 2017. Yearly Subsidence Monitoring was carried out above the Main West Area (first workings only mining) in November and December 2017. Survey monitoring points levelled were on Transgrid transmission towers above the mine workings area, part of the old LW24B cross line, and MW Line 1 – which follows the edge of a bush track above 304 and Main West 4 Panels.

Subsidence modelling predictions for this first workings mining method were for up to 20mm. It is generally accepted that there can be up to +/-20mm of natural ground movement – due to the natural expansion and contraction of soils and clays. Note that when mining coal - a 100m mining barrier was maintained around Tension Tower #18 on Transmission Line 93.

The Monitoring of Transmission Towers in the first workings area show subsidence between +5 to -16mm after first workings mining. Monitoring along part of LW24B (XL21-44) shows subsidence between +2 to -21mm following first workings mining.

Monitoring along the bush track shows subsidence between +6 to -24mm. Monitoring points 1MW13-18 (-22mm to -24mm) are located in a low lying area.

Note that survey field method accuracy is +/- 5mm.

No visible signs of subsidence were observed while carrying out these surveys.

Newstan and Awaba Colliery have a joint rehabilitation program. In 2017 a series of sinkholes in the same locality above the Awaba workings were rehabilitated in accordance with the approved Awaba Colliery Sinkhole Management Plan which outlines a methodology for the effective rehabilitation and maintenance of sinkholes. The 2017 sinkhole rehabilitation activities are reported within the Awaba Colliery AEMR. Any sinkholes or subsidence cracks identified are added to the rehabilitation program and they are rehabilitated in accordance to environmental and public safety risk.

Sinkholes associated with underground mining generally occur in areas that have a shallow depth of cover (less than 50m), weak overburden and geological discontinuities. Subsidence Rehabilitation will be ongoing during 2018.

6.4 BIODIVERSITY

The Northern Region Biodiversity Management Plan has been developed to guide the management of terrestrial and aquatic biodiversity at a regional scale and to comply with statutory approval conditions. The plan was submitted to the DPE for approval in December 2016. Various biodiversity monitoring programs have been established to assess biodiversity impacts and inform implementation of adaptive management measures for improved environmental outcomes.

6.4.1 Annual Flora and Fauna Monitoring

Condition 3.4 and 8.5 of Development Consent DA 73-11-98 require an Annual Ecological Monitoring Program at Newstan Colliery. Surveys conducted over the site targeted birds, microbats and invertebrates along with habitat.

This report can be found in Appendix 3.

6.4.2 Tetratheca juncea

The Longwall TJ transect monitoring ceased in 2014.

Annual Tetratheca juncea monitoring within the NREA and SREA creased in 2017.

6.5 HERITAGE

In 2012 Centennial Coal developed the Centennial's Northern Holdings Aboriginal Cultural Heritage Management Plan. This document aims to provide a consistent approach to consultation between Centennial and the Aboriginal community as well as identify standard Aboriginal cultural heritage monitoring and management requirements. A revised Northern Region Aboriginal Cultural Heritage Management Plan was submitted to DPE in July 2016 and was approved on 15 September 2016.

The LEA EIS identified rock shelters within sandstone outcrops on ML1452 to the east of current mining operations. It also suggested that there may be potential sites along Lords Creek that may be impacted by subsidence repair works in Lords Creek. Mining has not occurred in the eastern sections of ML1452 therefore there has been no potential for impact on the rock shelters. LW24 and 25 were shortened such that no mining occurred under Lords Creek hence the need to undertake subsidence repair works in Lords Creek is negated.

The LW24 SEE identified a scar tree approximately 400m north-west of LW24. This scar tree has not been impacted by mining operations.

Due to Newstan Colliery being on care and maintenance during the reporting period, no pre and post mining monitoring was required to be conducted to assess any impacts on archaeological heritage as a result of mine subsidence.

6.6 WASTE

All opportunities for waste avoidance and minimisation are considered by all staff and contractors across all areas including; contracts, purchasing, equipment procurement and waste generation processes.

Waste oil and greases are stored in tanks and drums within bunded areas for removal by a licenced waste management contractor for recycling or disposal. Oil water separation is achieved by the use of hydro-cyclone oil water separators at Newstan flows from vehicle work and storage areas and the wash down bays.

Hydrocarbon spill kits are inspected monthly by a licenced waste management contractor and re-stocked as required. Oily rag bins and oil filter bins are also serviced on a monthly basis.

Office paper and cardboard is collected and recycled by a licenced waste management contractor. Metals are collected and stored in steel bins onsite prior to removal. In 2017, a total of 30 tonnes of scrap steel was recycled. This compares with 199 tonnes recycled in 2016 due to a clean up undertaken within the reporting period.

General refuse and non-recyclable materials are sorted and stored in 15m steel bins. The material was collected by a licenced waste management contractor for disposal. In 2017, 49 tonnes of refuse material was taken off-site for disposal.

Of the total waste collected at Newstan in 2017 (85 tonnes), approximately 42% was recycled including steel, plastics, liquid waste, oils, paper and cardboard, filters grease, oily rags and oil filters. This compares with a recycling result of 77% in 2016.RAINFALL MONITORING RESULTS

The total monthly rainfall data is shown below in Table 16.

Table 16: Rainfall at Newstan Colliery for the Period January 2017 to December 2017.

2017 Month	Newstan Colliery Total Rainfall (mm)
January	74
February	141
March	336
April	49.83
May	18.5
June	135.5
July	7
August	6
September	1
October	190.5
November	11
December	46
Total	1016.33

A total of 1016.33 mm of rainfall was recorded at Newstan Colliery during the reporting period. The total annual rainfall for 2017 was less than the total rainfall recorded in 2016 (1051.10). The wettest period was in March 2017 recording 336mm.

7 WATER MANAGEMENT

7.1 SURFACE WATER MANAGEMENT

Water monitoring is undertaken in accordance with the Revised Water Management Plan, Development Consent and Environment Protection Licence 395 requirements. Newstan Colliery's Environmental Protection Licence (EPL) was last varied on 17 November 2015.

The basis of the mine's water management is based on reuse of water on site including sediment laden runoff contained in sediment dams.

Water runoff is concentrated via a network of kerb and guttering, collection sumps, pipes and drains, sediment sumps and pollution control dams. Water is then pumped to Connolly's Dam for reuse in the coal preparation plant.

An assessment of the potential impact on LT Creek and Lords Creek was undertaken for the Main West Project Approval. The Newstan Colliery pit top lies within the upper catchment of LT Creek. The creek consists of a North Arm and South Arm that combine within the residential/ commercial area of Fassifern before flowing into Fennell Bay on the western side of Lake Macquarie. LT Creek is originally an ephemeral system but discharges into LT creek have continued for over 35 years and the North Arm has been receiving water from the underground mine water storage since 2001 via LDP001; this has resulted in a continuous baseflow within LT Creek.

The Newstan Colliery, Surface Water Quality Assessment examined the existing surface water quality in order to determine background and baseline values for the watercourses associated with discharge from Newstan Colliery's operations. The assessment found that downstream water quality in LT Creek has generally been slightly to moderately alkaline and brackish, and generally within the background trigger value limits for LT Creek (North Arm).

Underground mining in the Main West Area was within the catchment of Lords Creek. Lords Creek is a tributary of Jigadee Creek, Jigadee Creek drains to Dora Creek, which is a major tributary of Lake Macquarie. Surface impacts have been negligible and cannot be measured. The potential surface water impacts associated with Main West have been identified and assessed. It is concluded that surface impacts to Lords Creek are negligible.

The underground water management system at Newstan Colliery involves mine water injections into, and extractions out of, an underground mine water storage. The underground storage is a combination of the goaf in the Great Northern and Fassifern seam workings at Newstan Colliery. The Water Management Plan reports that the existing outputs from the underground water system are:

- extraction of water from the underground storage via the Fassifern No. 1 borehole (up to 11.0 ML/day); and
- discharge through the underground emergency discharge pipeline (known as the "Stony Creek pipeline" & EPL Point 17).

Water extracted from underground storage is transferred and discharged to the North arm of LT Creek via LDP001. Investigations by GHD have identified that underground

water extraction (via the Fassifern No. 1 borehole) of 11 ML/day is required under operational conditions to maintain the underground water level at least 2 metres below the invert of the Stony Creek pipeline (EPL Point 17). Newstan Colliery received an EPL variation in October 2012 to increase the volume of water discharged through LDP001 from the current EPL limit of 7 ML/day to 11 ML/day. This variation also included discharge limits for a range of pollutants. All 2017 non-compliances associated with the EPL are documented in Section 11.

In 2014 Newstan commissioned the Clean Water Plant at Newstan Colliery. This allows Newstan to treat water from the surface and the Fassifern Seam, prior to discharging through LDP001. The CWP employs coagulation, flocculation, sedimentation, and filtration treatment to reduce the turbidity, concentration of total suspended solids (TSS) and as a by-product also reduce the total (unfiltered) metal concentrations before water is discharged to LT Creek via LDP001. Water that was previously transferred directly from the Fassifern Underground Storage to LDP001 is now directed to McKendry's Dam and treated by the CWP at a maximum rate of 14 ML/day. Water treated by the CWP may also be used to supply mining processes and the CPP at Newstan. The CWP does not remove all total metals and dissolved metals.

With the increase in LDP001 volume discharge and the installation of the CWP, Newstan Colliery has generally been able to maintain the Fassifern Storage at a low level.Figures 6, 7, 8 and 9 show the pH, total suspended solids (TSS), oil & grease & conductivity for discharge waters through LDP001 in 2017. Note: If results are less then the limit of reporting, a value of 0 is put in for the development of the below graphs.

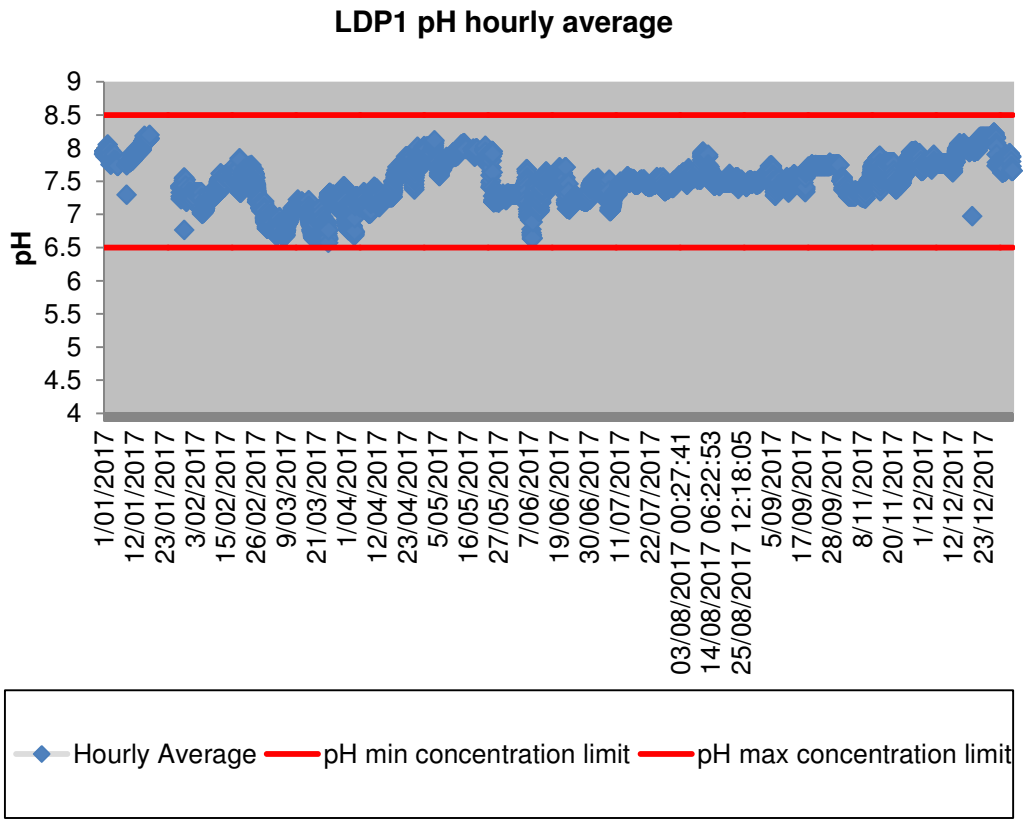

Figure 6: LDP001 pH Result 2017

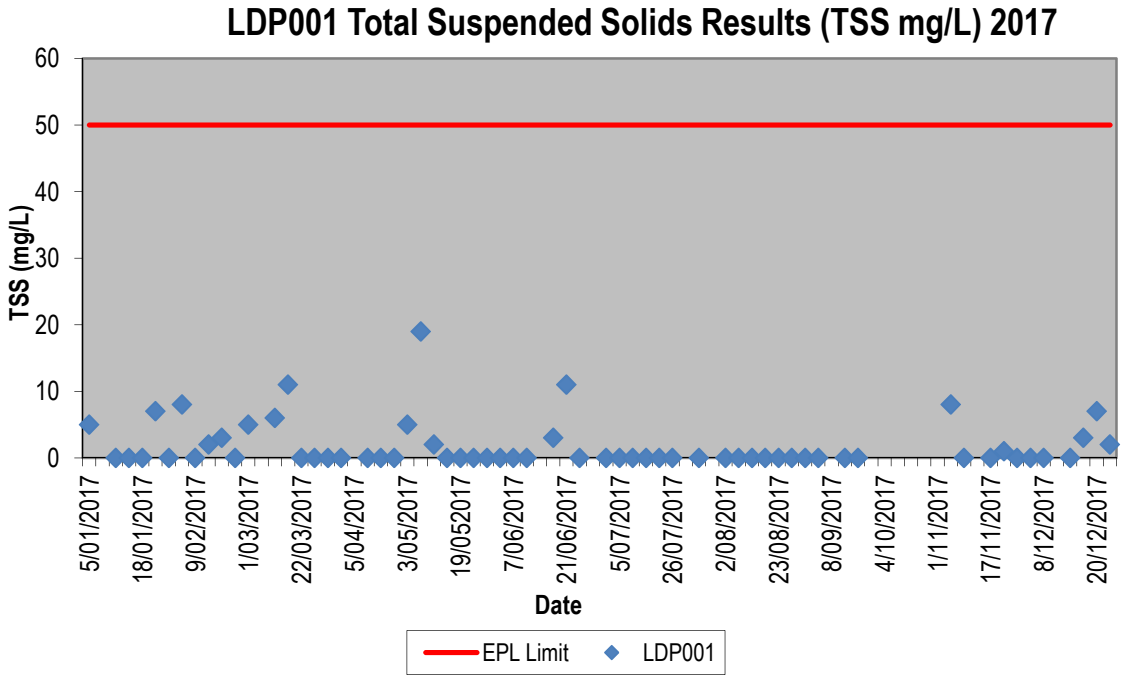

Figure 7: LDP001 Total Suspended Solids Result 2017

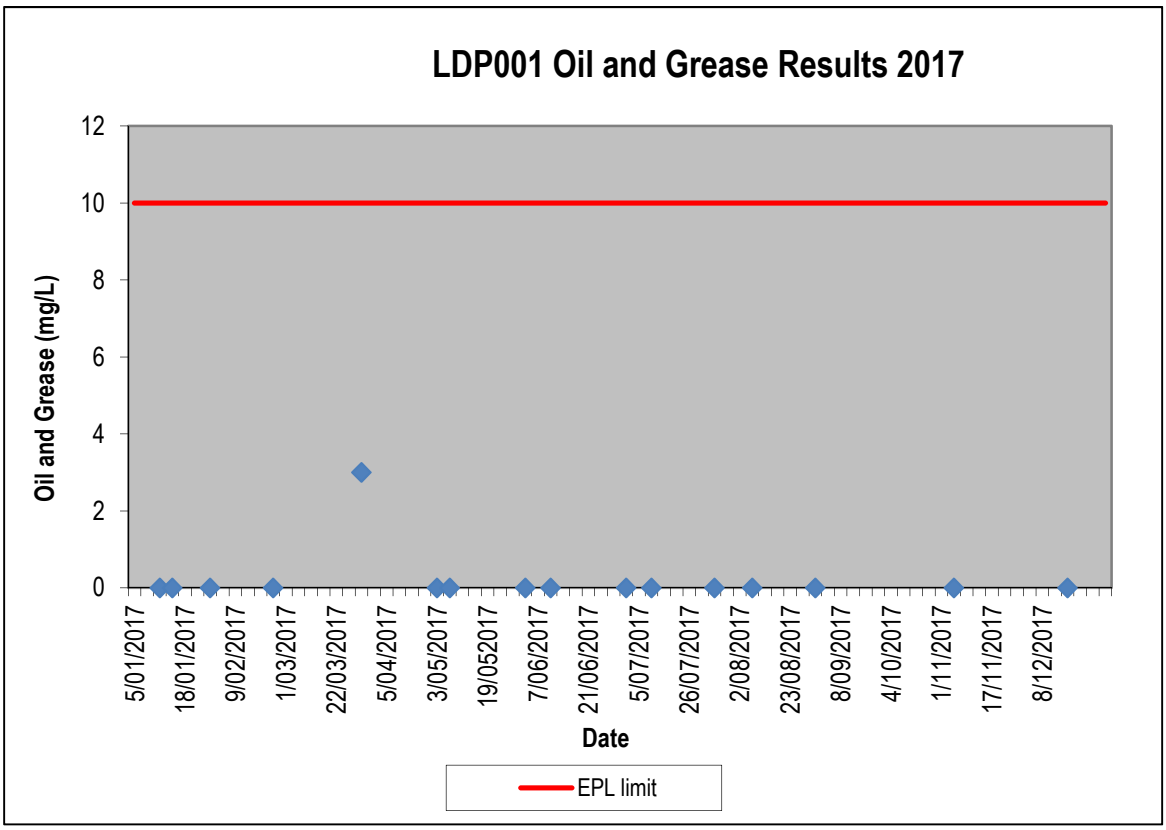

Figure 8: LDP001 Oil and Grease Result 2017

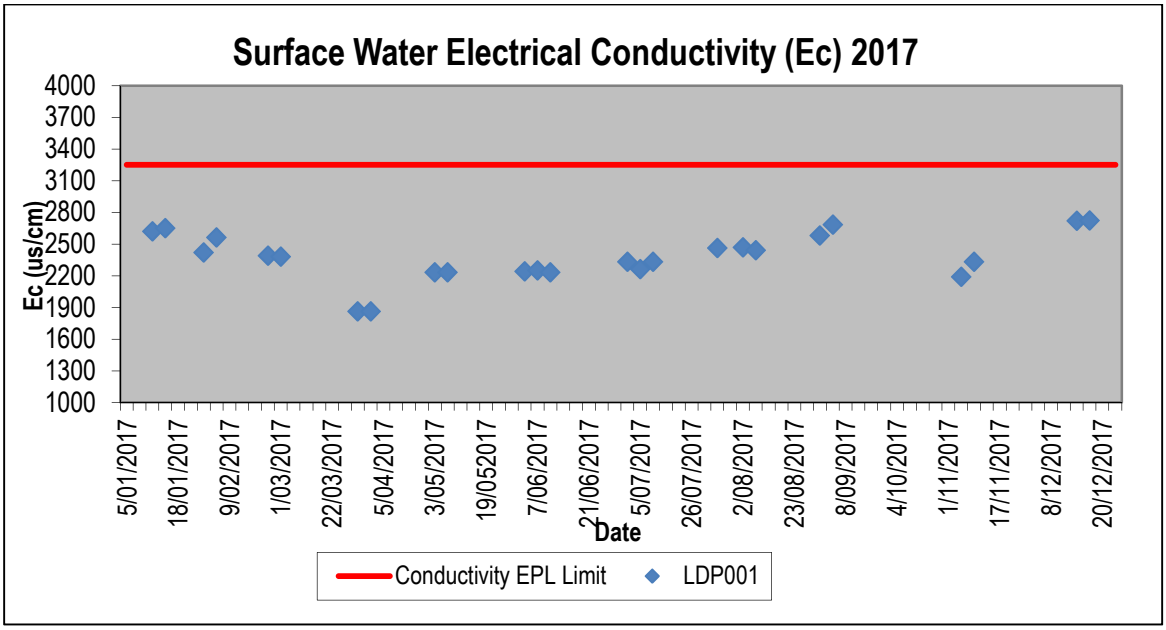

Figure 9: LDP001 Electrical Conductivity Result 2017

An historical overview of monitoring results (including metals) is provided in the report in Appendix 2. Surface monitoring locations are provided in Plan– NS2541A.

A summary of the water volume and quality data of EPL monitoring points can be found in Table 17 and Table 18. . All parameters in Table 17 and Table 18 were within EPL limits.

Table 17: Licenced Discharge Points Volume

Frequency	Licenced discharge point	No. of measurements made	Lowest result (ML/day)	Mean result (ML/day)	High result (ML/day)
Daily during any discharge	LDP001	292	0	5.281	10.852
Daily during any discharge	LDP002	No discharge occurred during reporting period			
Daily during any discharge	LDP017	No discharge occurred during reporting period			

Table 18: LDP001 Water Quality Summary

Pollutant	Unit of measure	No. of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Aluminium (dissolved)	milligrams per litre	12	24	LOR	0.0005	0.006
Arsenic (dissolved)	milligrams per litre	12	24	LOR	0.0001	0.003
Barium (dissolved)	milligrams per litre	12	24	0.074	0.1080	0.152
Bicarbonate alkalinity	milligrams per litre	12	38	390	596.0789	710
Boron (dissolved)	milligrams per litre	12	24	0.14	0.2204	0.39
Cadmium (dissolved)	milligrams per litre	12	24	LOR	0.0000	0.0001
Calcium (dissolved)	milligrams per litre	12	24	16.5	26.8792	36
Chloride (dissolved)	milligrams per litre	12	24	130	390.6667	536
Chromium (total)	milligrams per litre	12	24	LOR	0.0001	0.001

Pollutant	Unit of measure	No. of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Cobalt (dissolved)	milligrams per litre	12	24	LOR	0.0001	0.0004
Conductivity	Microsiemens per centimetre	Continuous	Continuous	1860	2362.9167	2720
Copper (dissolved)	milligrams per litre	12	24	LOR	0.0012	0.003
Iron (dissolved)	milligrams per litre	12	24	LOR	0.0010	0.013
Lead (dissolved)	milligrams per litre	12	24	LOR	0.0006	0.002
Lithium (dissolved)	milligrams per litre	12	24	0.096	0.1370	0.179
Magnesium	milligrams per litre	12	24	7	10.1817	13
Manganese (dissolved)	milligrams per litre	12	24	LOR	0.0002	0.0012
Mercury (dissolved)	milligrams per litre	12	24	LOR	0.00	LOR
Molybdenum (dissolved)	milligrams per litre	12	24	0.011	0.0201	0.0325
Nickel (dissolved)	milligrams per litre	12	24	0.006	0.008	0.01
Nitrogen (total)	milligrams per litre	12	24	LOR	0.291	0.9
Oil and Grease	milligrams per litre	12	15	LOR	0.200	3
pH	pH	Continuous	Continuous	1.764	7.504	8.233
Phosphorus (total)	milligrams per litre	12	24	LOR	0.001	0.01
Potassium (dissolved)	milligrams per litre	12	24	3	4.162	5.8
Selenium (total)	milligrams per litre	12	24	LOR	0.000	0.0014
Sodium	milligrams per litre	12	24	362	510.3	600
Sulfate	milligrams	12	19	54	83.52	116

Pollutant	Unit of measure	No. of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
(dissolved)	per litre					
TKN-N	milligrams per litre	12	24	LOR	0.088	0.8
Total sulfate	milligrams per litre	12	24	32	86.08	116
Total suspended solids	milligrams per litre	52	57	1	4.964	19
Turbidity	Nephelometric turbidity units	Continuous	Continuous	0.1	0.336	0.9
Zinc (dissolved)	milligrams per litre	12	24	LOR	0.002	0.01

The Water Management Plan was revised and submitted to the DPE for approval in July 2016. The Mine Water Discharges Management Plan was submitted to the DPE for approval in September 2016.

7.2 GROUNDWATER MANAGEMENT

Newstan has eighteen groundwater monitoring bores that were installed to establish groundwater baseline conditions for the proposed Awaba Open Cut Mine. Even though the application for the Awaba Open Cut Mine was withdrawn, it was determined appropriate to continue monitoring the groundwater bores to determine the impact of longwall mining on the groundwater levels and quality. Biannual analyses monitoring and reporting of water level, pH and electrical conductivity (EC) is undertaken.

The EIS states that in the Eastern part of the Life Extension Area (LEA) where the depth of cover ranges up to 400 metres, the height of interconnected fracturing of 80 metres is considered to have very low to negligible probability of tapping into any surface alluvial aquifers. In the far western part of the LEA with the depth of cover reduced to as low as 50 metres in the vicinity of Palmers Creek, there is an increased potential for drainage of alluvium aquifers into the mine workings.

It was considered that the potential for significant mine water inflows from the surface alluvial deposits is minimal and the rate of water inflow into the mine in the proposed LEA should be similar to that experiences from the earlier workings in the existing Newstan Colliery.

The SEE subsidence predictions for LW24, and the general concept of strata disturbance above longwall mines, indicates that vertical fracturing may extend to a height of 100m above LW24. Therefore the shallow aquifers within the SEE boundary may potentially be impacted where the depth of cover between the longwall panel and base of alluvium is less than 100m. The cover thickness review indicated that the thickness is greater than 100m over the whole of LW24. It was considered that there is minimal risk of impacting the alluvium of Lords Creek.

In all subsided areas there may be shallow surface cracking. Where this occurs beneath saturated alluvium of regolith and does not provide hydraulic connection to the mine, there is still potential for short-term loss of alluvium /regolith groundwater in this zone of increased permeability. This may lead to very temporary, minor lowering of groundwater levels that will only persist for as long as is required to fill the new void cracks.

Where the Main West Area underlies the Lords Creek alluvium (north-eastern section), the depth of cover is approximately 70 – 90 metres. At this depth of cover it is very unlikely that fractures would develop and that there would be loss of groundwater from the alluvium for the past bord and pillar mining.

Any reduction in groundwater levels within the Lords Creek alluvium is also unlikely, based on the predicted subsidence calculations. It is predicted that the vertical subsidence above the proposed Main West mine area will be less than 20 millimetres and that surface impacts will be negligible and cannot be measured.

Monitoring of groundwater levels within Lords Creek alluvium indicates that recent mining, using longwall mining methods, adjacent to the Main West Area has not resulted in a reduction in groundwater levels or a loss of groundwater from the alluvium.

Therefore it is unlikely that the bord and pillar workings within the Main West Area will impact the groundwater in the overlying Lords Creek alluvium. It is not anticipated that mining within the Western Zone will impact on alluvial groundwater or groundwater-dependent ecosystems.

The Modification to Development Consent (DA-73-11-95 Mod 4) in 2012 required the preparation of a Groundwater Monitoring Program for the Main West Mining Area. This management plan has been submitted for approval. This monitoring plan stipulates quarterly monitoring of MB10, MB11, MB12, MB13 & MB15 for depth to water, conductivity and pH which commenced in 2013.

The shallow bores are purged and sampled with foot valves and tubing dedicated to each bore, whereas the deeper bores (MB02-MB06, MB16 and MB18), monitoring the coal seam aquifers, are sampled with a Bennett Auto Sample Pump with tubing dedicated to each well.

Baseline water samples were collected from the installed bores during the first sampling round in October 2005. Subsequent monthly sampling to date has involved measurement of water level and field measurement of pH and EC.

Table 19: Alluvial Aquifer Results for 2017

Alluvial Aquifers									
Monitoring Bore		**MB9**	**MB10**	**MB11**	**MB12**	**MB13**	**MB14**	**MB15**	**MB17**
Groundwater Level (Baseline)	mbgs	0.96	3	2.52	5.33	4.88	3.73	5.88	2.63
Groundwater Level (Historical Average)	mbgs	1.42	2.60	2.51	4.86	4.72	3.51	3.98	2.77
Groundwater Level (2017)	mbgs	1.55	2.70	2.83	3.93	4.95	3.64	2.97	2.99
Chemical Parameters									
pH (Baseline)	pH unit	7.16	5.98	5.85	6.2	6.55	6.33	5.71	6.53
pH (Historical Average)	pH unit	5.76	6.16	6.12	6.58	6.57	6.43	6.03	6.19
pH (2017)	pH unit	5.92	6.63	7.05	7.09	6.89	6.78	6.55	6.85
Electrical Conductivity (Baseline)	uS/cm	300	1000	2400	1000	600	580	100	225
Electrical Conductivity (Historical	uS/cm	255.93	1404.55	3511.2	1436.25	811.44	475.78	299.73	192.56

Alluvial Aquifers									
Monitoring Bore		MB9	MB10	MB11	MB12	MB13	MB14	MB15	MB17
Average)									
Electrical Conductivity (2017)	uS/cm	229	1078.25	3760	1017.25	1130	399	295	207.5

Graphs of water level, pH and EC trends for the history of the bores are shown on Figures 10, 11 and 12 respectively.

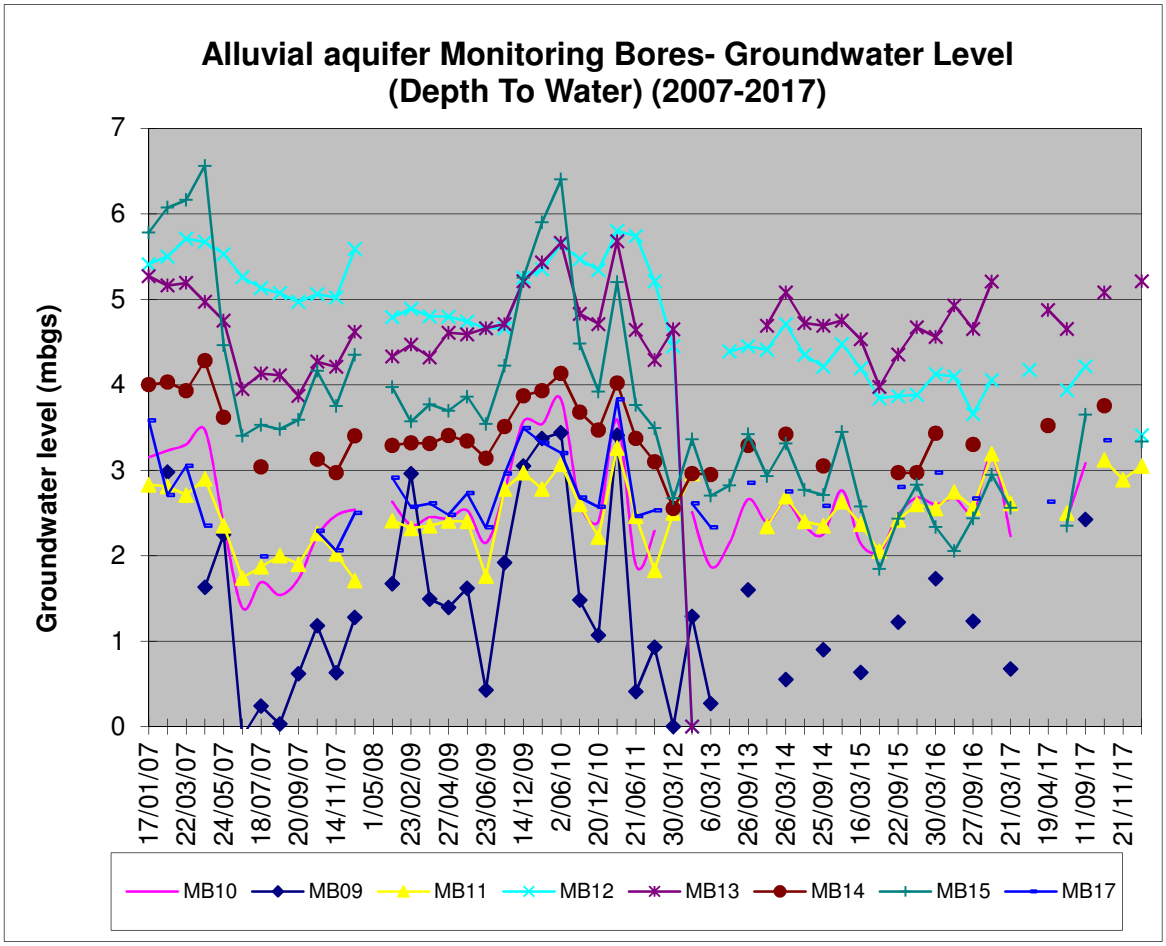

Figure 10: Alluvial aquifer monitoring bores – level trends (2007 – 2017)

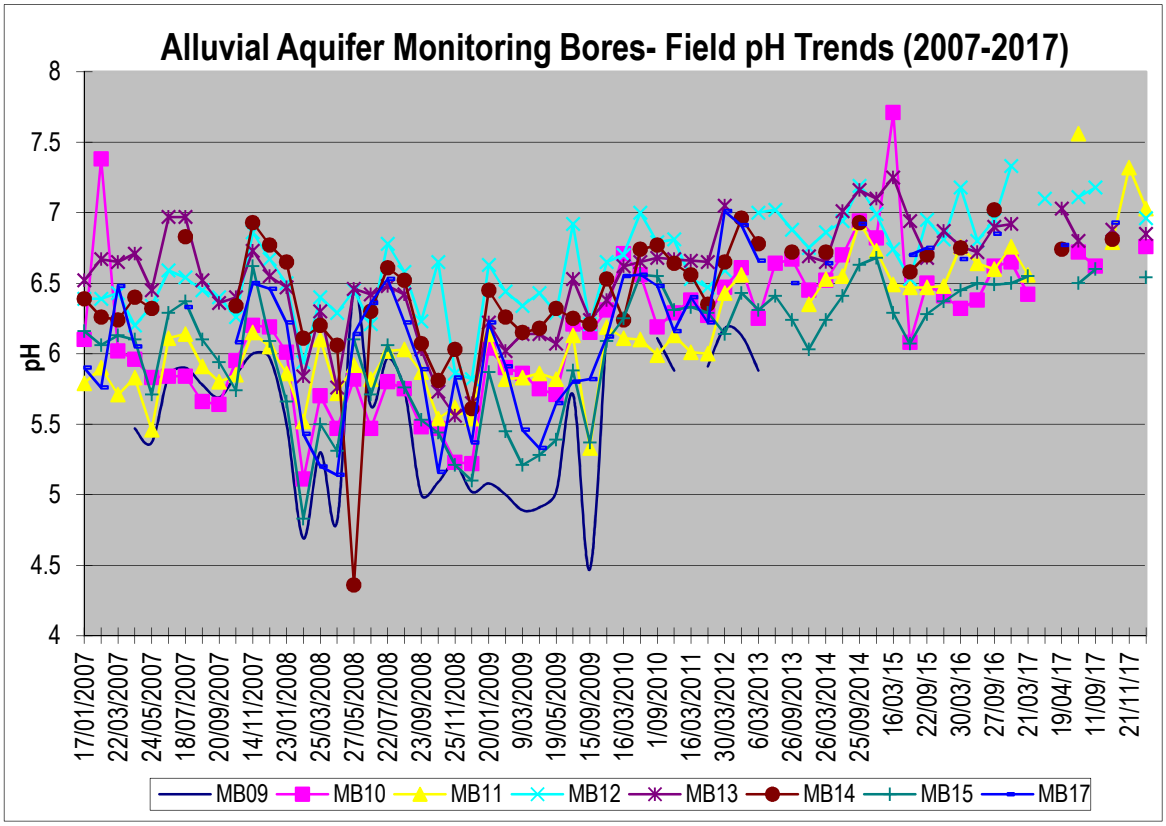

Figure 11: Alluvial aquifer monitoring bores – pH trends (2007 – 2017)

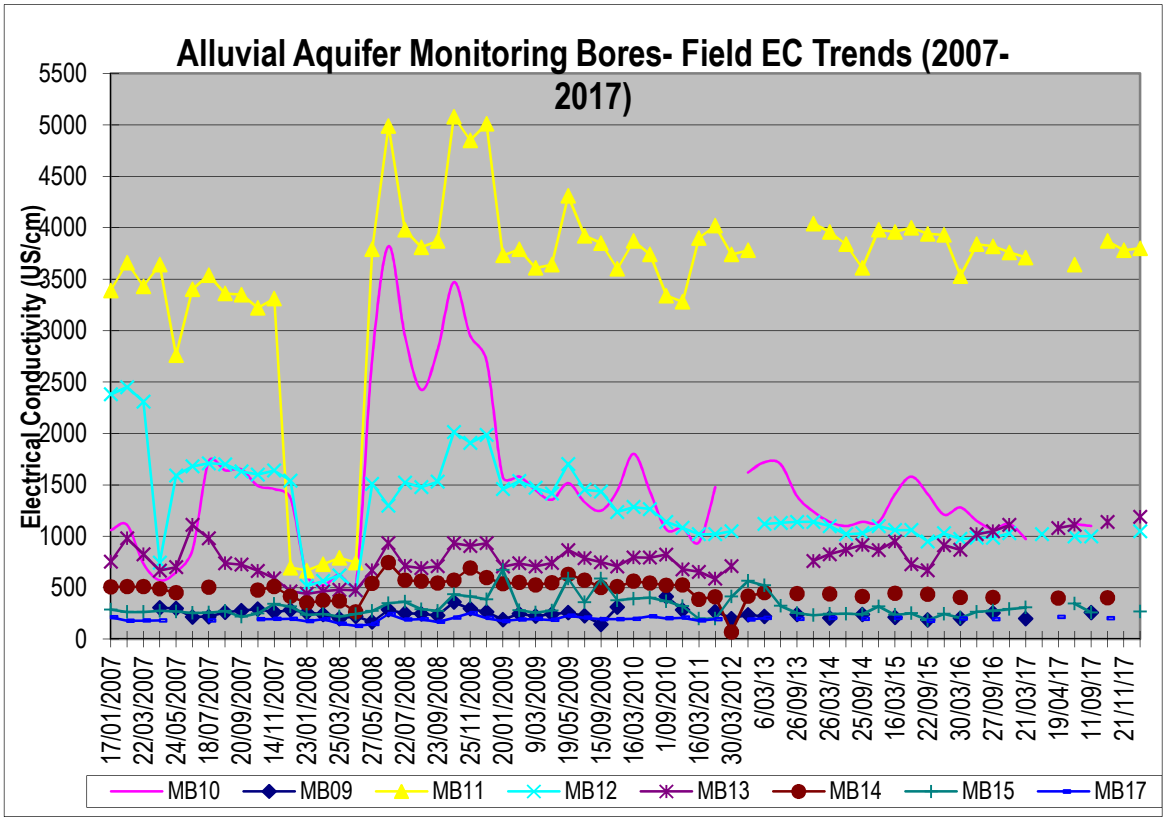

Figure 12: Alluvial aquifer monitoring bores – Ec trends (2007 – 2017)

The water levels indicate that generally the aquifer levels are higher then baseline and the average water levels over the historical monitoring period. The data indicates a slightly acidic to neutral pH generally in the range of 6.5 to 7.6 for 2017 for the alluvial groundwater, which is similar to baseline and historical data. The electrical conductivity (EC) has a wide range of 308-3870µS/cm. This large range may reflect the recharge source of the alluvial groundwater at the monitoring locations by either;

- direct surface infiltration from rainfall, giving relatively low EC readings; or
- upward leakage or lateral flow from the Permian sediments into the alluvium, giving higher EC readings.

Figure 12 indicates that monitoring bore MB11 has relatively high EC levels (although variable), ranging from 666 to 5080 µS/cm. The EC of the remainder of the bores is generally less than 2000µS/cm.

Table 20: Coal Seam Bedrock Aquifer Results for 2017

Coal Seam										
Monitoring Bore		**MB1**	**MB2**	**MB3**	**MB4**	**MB5**	**MB6**	**MB16**	**MB18**	**MB19**
Groundwater Level (Baseline)	mbgs	29.78	11.25	9.9	22.01	24.35	45.17	33.28		
Groundwater Level (Historical Average)	mbgs	30.02	11.45	10.71	20.03	24.15	44.74	33.42	19.37	21.94
Groundwater Level (2017)	mbgs	NA	NA	13.53	18.88	23.91	45.51	33.92	NA	28.01
Chemical Parameters										
pH (Baseline)	pH unit	6.79	6.53	6.73	5.64	6.39	6.51	6.1		
pH (Historical Average)	pH unit	6.88	6.01	7.22	5.33	6.26	6.59	5.97	7.11	6.70
pH (2017)	pH unit	NA	NA	7.71	5.22	6.50	6.89	6.41	NA	NA
Electrical Conductivity (Baseline)	uS/cm	3020	1620	652	291	1820	1440	780		
Electrical Conductivity (Historical Average)	uS/cm	2820	1340	1255.271	218.0656	1713.525	1292	614.0678	2048.526	1780.083
Electrical Conductivity (2017)	uS/cm	NA	NA	1413.333	385.6667	1826.667	1340	441.6667	NA	NA

Graphs of water level, pH and EC trends for the history of the bores are shown on Figures 13, 14, and 15 respectively.

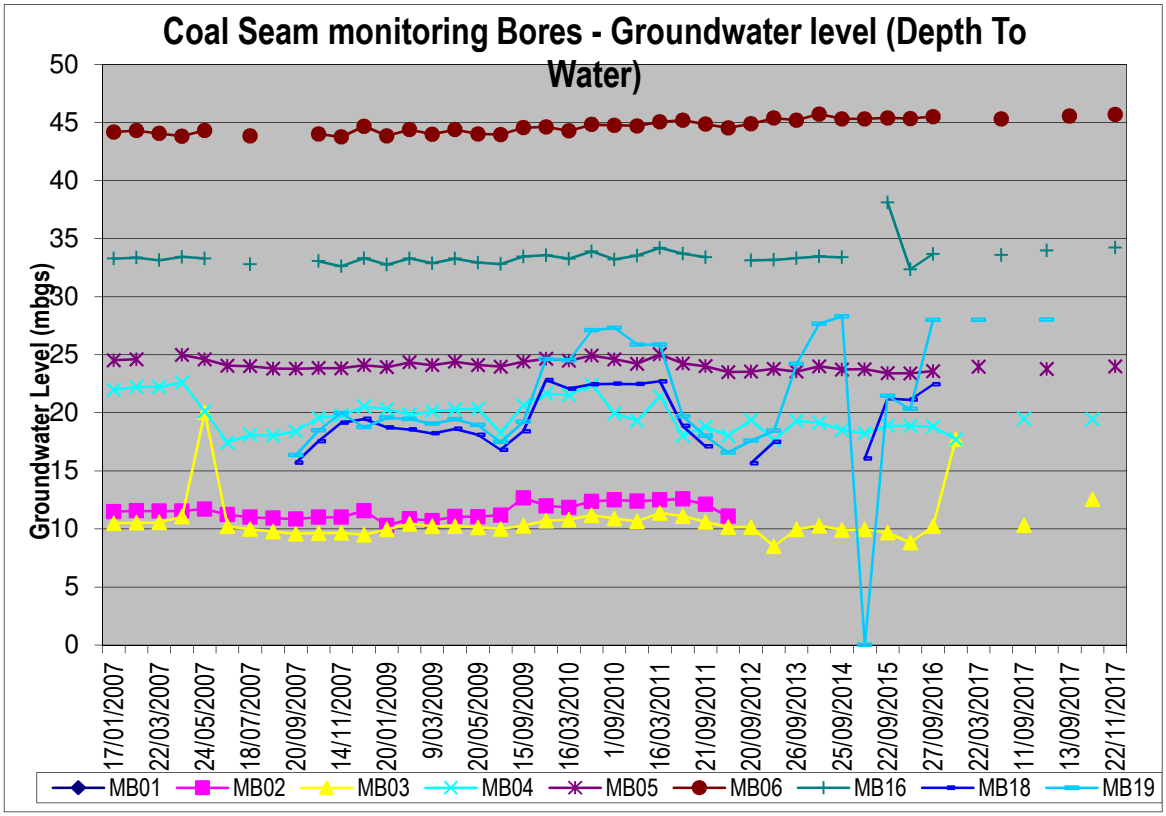

Figure 13: Coal Seam monitoring bores – level trends (2007 -2017)

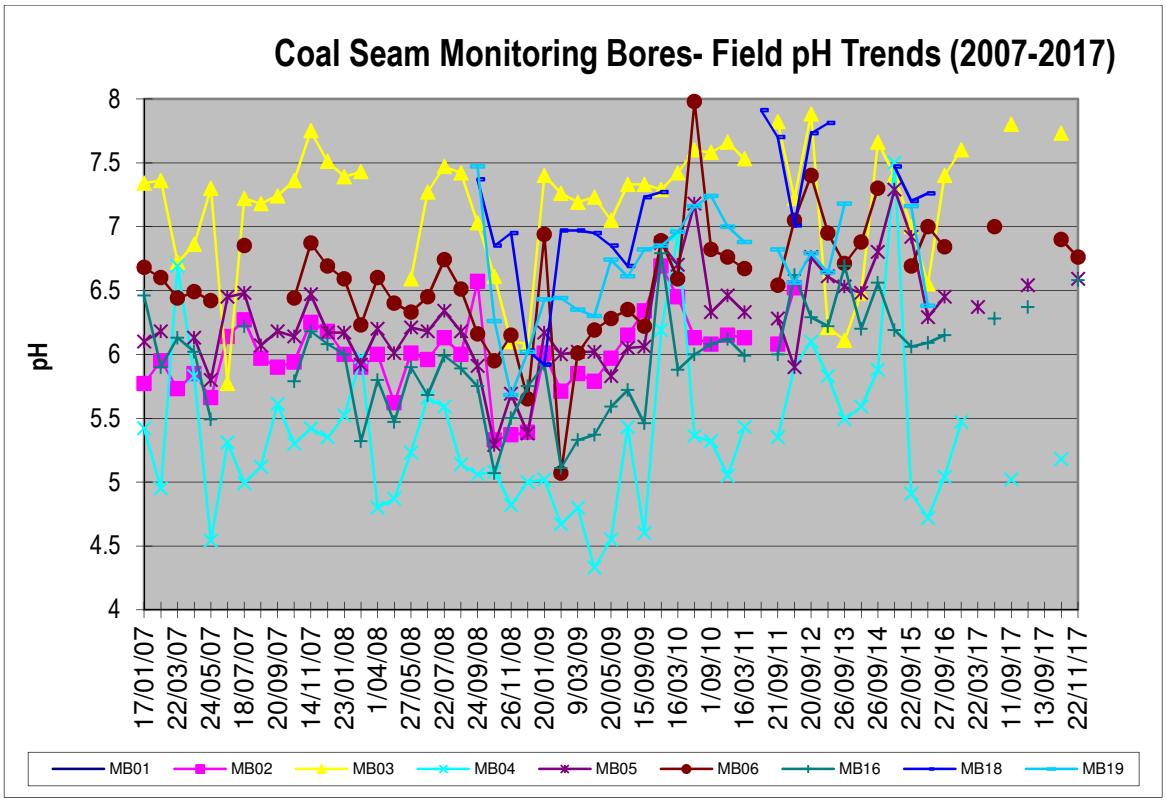

Figure 14: Coal Seam monitoring bores – pH trends (2007 -2017)

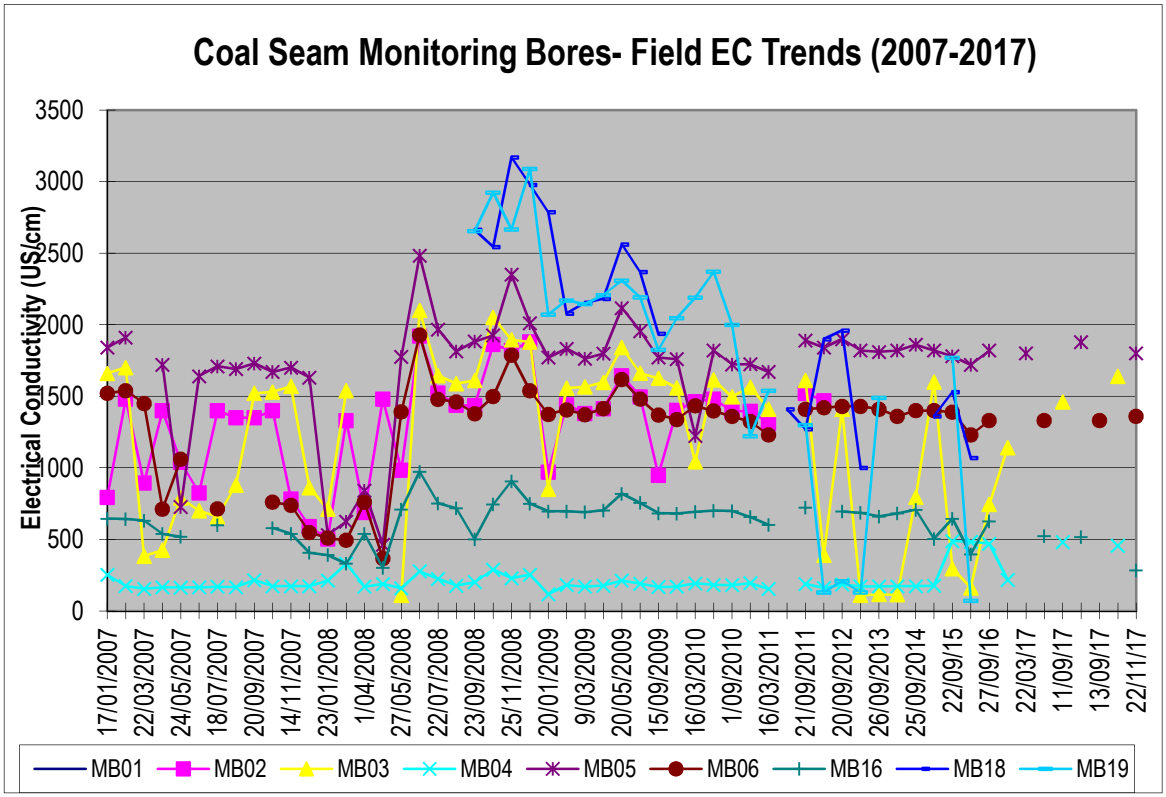

Figure 15: Coal Seam monitoring bores – Ec trends (2007 -2017)

The water levels within the Coal Seam bores were generally stable in 2017. The pH trends shown on Figure 14 indicate that groundwater from the coal seams were quiet variable, ranging from 5.02 to 7.8 during 2017. This could be a result of direct filtration into the shallower bores such as MB18.

Groundwater samples collected from the coal seam monitoring bores have a variable EC with the average conductivities ranging from 218µS/cm to a high of 1880µS/cm in 2017 as shown on Figure 15.

7.3 Water Budget

Newstan utilises potable and recycled water for surface operations and recycled water from dams and old workings for underground operations.

Potable water is used in the bathhouse and amenity systems. All other operations utilise recycled water from the colliery dams, Fassifern No 1. Bore, and the Clean Water Plant. The Clean Water Plant at Newstan Colliery commenced operating in December 2013.

The average volume of water discharged from LDP001 during the reporting period was 7.77 5.29 ML per day with a total of approximately 1843.37 ML being discharged for the year. Water from LDP001 discharges to the By-wash Dam where it is allowed to discharge to LT Creek.

A summary of discharges recorded by Newstan Colliery is provided in Table 22.

Table 21: Discharge Data Recorded by Newstan for 2017

Discharge Point	Total Annual Discharge (ML)
LDP001	1843.370
LDP002	0
EPL Point 17 Stony Creek Pipeline	0

8 REHABILITATION

8.1 Buildings

No additional buildings were undertaken during the report period at Newstan. No buildings were removed during the reporting period.

8.2 Rehabilitation of Disturbed Land

The NREA tailings dam is approximately 70% capped at the end of the reporting period. These works are planned to continue in the 2018 reporting period when waste rock / chitter material becomes available. The NREA tailings dam also serves as an emplacement area for waste rock / chitter material. Coarse rejects are transported by truck from the CPP to the NREA where it is used as a rehabilitation capping material, as well as an emplacement area for course rejects material.

Progressive stabilisation and rehabilitation of disturbed areas is undertaken with all land disturbance activities associated with the Newstan Colliery activities.

Re-contouring of the old reject emplacement areas in the NREA continued during the reporting period. Capping and revegetation of this area was also undertaken during the reporting period, and seeding of rehabilitation growth media with a native species mix of an area of approximately 2.1ha completed.

In accordance with the current approved MOP Rehabilitation inspections will be undertaken to check for:

- Evidence of soil erosion;
- Evidence of cap slumping / settlement;
- Highwall instability (SREA)
- Slope instability
- The presence of declared weeds.

Rehabilitation monitoring will include flora and fauna monitoring methodologies as per the Flora & Fauna Management Plan, as well as any observed occurrences of invertebrate recolonisation (ants, soil faunal communities establishing). This monitoring commenced annually in 2015 and will continue until completion criteria have been satisfied.

Maintenance will be undertaken as required until the rehabilitation success criteria has been achieved, and continued until lease surrender.

Table 23 displays a rehabilitation summary for the Newstan Colliery.

Table 22: Newstan Awaba Rehabilitation Summary

Domain	Area Affected / Rehabilitated (ha)	
	Total Area at MOP start (Plan 3A)	Total Area at end of reporting period
Mine Lease Area		
Mine Lease(s) Area	3989.9	3989.9
Domain 1: Infrastructure Area		
Active Mining Area	102	102
Decommissioning	-	-
Landform Establishment	-	-
Growth Medium Development	-	-
Ecosystem and Land Use Establishment	-	-
Ecosystem and Land Use Sustainability	-	-
Relinquished Lands	-	-
Total	102	102
Domain 2: Tailings Storage Facility		
Active Mining Area	56.2	54.1
Decommissioning	-	-
Landform Establishment	7.0	7.0
Growth Medium Development	-	-
Ecosystem and Land Use Establishment	11.7	13.8
Ecosystem and Land Use Sustainability	20.8	20.8
Relinquished Lands	-	-
Total	95.7	95.7
Domain 3: Water Management Area		
Active Mining Area	11.8	11.8
Decommissioning	-	-
Landform Establishment	-	-
Growth Medium Development	-	-

Domain	Area Affected / Rehabilitated (ha)	
	Total Area at MOP start (Plan 3A)	Total Area at end of reporting period
Ecosystem and Land Use Establishment	-	-
Ecosystem and Land Use Sustainability	-	
Relinquished Lands	-	-
Total	11.8	11.8
Domain 5: Stockpiled Material		
Active Mining Area	12.0	12.0
Decommissioning	-	-
Landform Establishment	-	-
Growth Medium Development	-	-
Ecosystem and Land Use Establishment	-	-
Ecosystem and Land Use Sustainability	-	-
Relinquished Lands	-	-
Total	12.0	12.0-
Domain 8: Underground Mining Area		
Active Mining Area	0 (Area above workings is 5088 ha)	0
Decommissioning	-	-
Landform Establishment	-	-
Growth Medium Development	-	-
Ecosystem and Land Use Establishment	-	-
Ecosystem and Land Use Sustainability	-	-
Relinquished Lands	-	-
Total	-	-

* Estimate only

8.3 Rehabilitation Trials and Research

No rehabilitation trials or research was undertaken at Newstan Colliery during the reporting period. Rehabilitation works undertaken to date on the NREA and SREA have proven successful therefore negating the need to undertake rehabilitation trials.

Analogue Rehabilitation areas were chosen in 2014 in accordance with the Flora & Fauna Management Plan to provide comparative data for the Rehabilitation of the Newstan Colliery lease area. Monitoring at these locations commenced in 2015. The areas chosen include historical rehabilitation site in the NREA, and the Fauna Corridor to the west of the Colliery. The Annual Monitoring Report can be found in Appendix 3.

9 COMMUNITY CONSULTATION

A Community Consultative Committee (CCC) has been in place at Newstan since 1999. In 2011 Awaba Colliery was joined into the Newstan Colliery CCC. The Committee generally meets quarterly to review the environmental performance of the mine and other relevant matters. Minutes of the meeting are kept and distributed by the independent Chairman. The minutes are also available on the Centennial Newstan website. Meetings of the Newstan and Awaba Colliery CCC were held in March, July and November during the reporting period.

9.1 Community Sponsorship

Newstan Colliery continues to support the local community through various sponsorship avenues in 2017.

9.2 Community Complaints

There was one community complaint regarding Newstan Colliery operations during the 2017 reporting period.

Table 23: Newstan Complaints 2017

Record of Complaints				
Site	**Date & Time of Complaint**	**Complaint Method**	**Nature of Complaint**	**Newstan/Awaba Response**
Newstan	11/04/2017 10:06am	Email	Noise	Minimise use of vibrator. Connect hose from pump exhaust to bore hole.

The Newstan community complaints and enquiries line is in place and contactable on 1800 247 662. Callers are directed to the Environment and Community Coordinator.

Table 24: Newstan Complaints Summary 2010 - 2017

Record of Complaints	
Year	**Total**
2010	21
2011	19
2012	5
2013	6
2014	0
2015	0
2016	2
2017	1

10 INDEPENDENT AUDIT

An Independent Environmental Audit of Newstan's operations was completed by MCW Environmental Pty Ltd in May 2015. An action plan was prepared in response to the recommendations listed in the 2015 and was provided to the Department of Planning and Environment. A summary of progress against the Action Plan items is provided Table 26.

Table 25: Newstan Colliery Independent Environmental Audit Action Plan 2015

Title	Condition No	Requirement	Comments	Compliance/ Recommendations	Newstan Comments	Updates since audit
DA-73-11-98	1	**General** There is an obligation on the Applicant to prevent and minimise harm to the environment throughout the life of the project. This requires that all practicable measures are to be taken to prevent and minimise harm that may result from the construction, operation and, where relevant, decommissioning of the development.	Newstan has developed an Environmental Management Strategy and a number of Environmental Management Plans outlining the systems, processes and measures in place to prevent and /or minimise harm to the environment from Newstan operations. Other than where issues have been identified, in general the site appeared to be implementing its management system. An assessment of the implementation of the various management plans was conducted and is presented under the relevant Conditions and in the main section of this report. In 2013 Newstan constructed a Clean Water Plant (CWP) which it commissioned in early 2014. The CWP uses coagulation, flocculation, sedimentation and filtration to reduce turbidity and concentration of TSS prior to discharge to LT Creek via LDP001. Water that was previously discharged directly from the Fassifern underground Storage is now directed to and treated by the CWP as is surface runoff on-site. Newstan submitted the CWP project for the Engineers Australia Excellence Awards and the Australian Water Association Industry Awards in 2014 for leading practice incorporating extremely efficient design, full automation and low maintenance operation. During the audit period Newstan recorded a number of non-compliances and reportable incidents. Newstan was issued with two Penalty Infringement Notices (PINs) by the EPA for exceedances of TSS concentratrion limits at Point 1 and Point 2 on the 20.12.13. Newstan requested that the EPA review the PINS by letter dated 13.01.14 and they were subsequently revoked by the EPA. At the time of the audit, Newstan and the EPA were in arbitration over licence conditions. Incidents are discussed further in the main section of this report. While there was general compliance with the condition, on the basis of the reportable incidents occurring and the PINs issued by the EPA during the audit period,	Non-compliant Refer to recommendations made throughout the report.	Noted and addressed below. As discussed in depth with the auditors, the PINs issued to Newstan by the EPA were revoked. Newstan does not agree it is non-compliant against this condition due to the issuing of PINs by the EPA as shown by the evidence provided.	

Title	Condition No	Requirement	Comments	Compliance/ Recommendations	Newstan Comments	Updates since audit
			Newstan are considered non-compliant with the condition.			
DA-73-11-98 3.2 (e)		(d) The Applicant shall also prepare the following environmental management plans: - Archaeology and cultural management plan (refer condition 3.3) - Flora and fauna management plan (refer condition 3.4) - Erosion and sediment control plan (refer condition 3.5(a)) - Soil stripping management plan (refer condition 3.5(c)) - Landscape management plan (refer condition 3.7) - Bushfire management plan (refer condition 3.8) - Land management plan (refer condition 3.9(a)) - Wetland management plan (refer condition 3.9 (c)) - Site water management plan (refer condition 4.1) - Dust management plan (refer condition 6.1) - Noise management plan (refer condition 6.4(d)) (e) The management plans are to be revised/updated at least every 5 years or as otherwise directed by the Director-General in consultation with the relevant government agencies. They will reflect changing environmental requirements or changes in technology/operational practices. Changes shall be made and approved in the same manner as the initial environmental management plan. The plans shall also be made publicly available at LMCC within two weeks of approval of the relevant government authority.	(e) The following plans had not been revised and approved within the 5 year timeframe: - Environmental Management Strategy (2010) (revised and submitted in 2014, awaiting DPE approval) - Erosion and Sediment Control Plan (2006) - Soil Stripping Management Plan (2010) - Bushfire Management Plan (2009) - Land Management Plan (2010) - Water Management Plan (2006) (revised in 2009 and called the Revised Water Management Plan – RWMP however this has not been approved by the DP&E). On the basis of the above plans not been revised /approved in the last 5 years, this condition has been assessed as non-compliant.	Non-compliant **REC 04 NEWSTAN IEA 2015:** Review, update and/or seek approval of the following environmental management plans: - Environmental Management Strategy - Erosion and Sediment Control Plan (2006) - Soil Stripping Management Plan (2010) - Bushfire Management Plan (2009) - Land Management Plan (2010) - Water Management Plan Refer also to discussion of improvement opportunities of individual plans in main report.	Noted and addressed below.	

Title	Condition No	Requirement	Comments	Compliance/ Recommendations	Newstan Comments	Updates since audit
DA-73-11-98 3.3 (A)		**Heritage Assessment and Management** (A) The Applicant shall prior to construction of surface facilities or secondary workings within identified areas of archaeological sensitivity within the LEA: (i) Prepare an archaeology and cultural management plan which shall include, but not be limited to: (a) identification of any future salvage, excavation, monitoring, and protection of any heritage and archaeological items, within the area of the surface facilities, particularly the waste emplacement and coal stockpile areas, Awaba Colliery, and the area within the LEA prior to and during development; (b) measures to undertake test excavations along Lords Creek to verify the archaeological potential of those areas identified as having low archaeological sensitivity at least one year prior to finalisation of the route of channelisation or other proposed works along Lords Creek; c) details of proposed investigations of rock shelters and grinding groove sites identified as having potential to contain archaeological deposit to be undertaken prior to mining being undertaken in the vicinity of the identified sites. The investigation will include test excavations undertaken in accordance with a permit issued under section 87 of the National Parks and Wildlife Act 1974, under a research design which is acceptable to the Aboriginal community and OEH; (d) measures to protect Aboriginal sites from subsidence and mine working impacts, in consultation with OEH, the Aboriginal community and local residents to ensure integration of measures to protect Aboriginal sites; (e) identification and documentation of Aboriginal cultural heritage issues; (f) details of a monitoring program to	(A) Centennial Coal prepared an Aboriginal Cultural Heritage Management Plan (ACHMP) for its Northern Holdings which includes Newstan, Awaba, Myuna, Mannering and Mandalong mines. This Plan was approved by the DP&E by letter dated 26.11.12. In its letter the DP&E stated that the plan addresses the specific requirements of the development consent relating to Aboriginal heritage management. The Plan was developed in consultation with the various Aboriginal parties who had registered an interest to participate in the consultation processes for projects across Centennial's northern operations as well as OEH, LMCC and the CCC. A summary of the consultation process is presented in the ACHMP Aboriginal Consultation Log dated November 2012. An assessment of the adequacy of the plan is included in the main report. Newstan has also prepared an Archaeology and Cultural Management Plan for non-Aboriginal heritage which was last approved in 2006. It was reported that Newstan is in the process of revising this Plan for DP&E approval.	A (i) (b-f) Compliant A (i) (a) Non-compliant (non-Aboriginal) **REC 02 NEWSTAN IEA 2015:** Update the 2006 Archaeology and Cultural Management Plan to address the requirements of this Condition for non-Aboriginal heritage and cultural management.	Recommendations to be considered when updating the Archaeology and Cultural Heritage Management Plans.	A revised Northern Region Aboriginal Cultural Heritage Management Plan was submitted to DPE in July 2016 and was approved on 15 September 2016.

Title	Condition No	Requirement	Comments	Compliance/ Recommendations	Newstan Comments	Updates since audit
		document the effects of subsidence and mining works on Aboriginal sites and areas of archaeological sensitivity. The plan shall be prepared in consultation with OEH, the Local Aboriginal Land Council, LMCC, and to the satisfaction of the Director-General, and shall be considered by the Applicant when completing the final underground mine layout.				
DA-73-11-98 3.4(a)		**Flora and Fauna Assessment and Management** (a) The Applicant shall prior to commencement of any construction works for surface facilities in the relevant area or secondary workings within the LEA, prepare and implement a Flora and Fauna Management Plan for the management of flora and fauna issues for the areas of the proposed surface facilities and LEA. The Plan shall be prepared in consultation with OEH and LMCC, and to the satisfaction of the Director-General, and shall include but not be limited to: (i) a detailed assessment of the current characteristics and ecological values of existing ecosystems likely to be affected by the development; (ii) strategies to minimise the net loss of ecologically significant vegetation communities within DA area as a result of the development, including the provision of compensatory areas of equivalent ecological and habitat value where necessary; (iii) strategies to provide increased security for existing habitats and communities (including the strengthening of riparian communities, the management of Tetratheca juncea plants in the vicinity of the proposed surface facilities, particularly in and around the northern and southern reject emplacement areas), and LEA, and habitats	(a) The Flora and Fauna Management Plan was revised and submitted to the OEH and LMCC for consultation by letter dated 21.05.14. A letter was received from the OEH stating that it does not review management plans (11.06.14). No comments were received by the LMCC. The DP&E reviewed the plan and requested minor amendments (by email dated 22.07.14). The Plan was amended accordingly and approved by the DP&E by letter dated 25.08.14. Table 1 of the Plan lists where in the document these requirements have been addressed. A review of the adequacy of the management plans is provided in the main section of the report. <u>Implementation</u> No major clearing had occurred during the audit period. Some clearing was required for the installation of two permanent monitoring stations upstream and downstream of the mine water discharge that flows into an unnamed creek ultimately flowing into Stony Creek. Hunter Eco was engaged to assess the ecological impacts of the disturbance and conduct a 7-part test. Newstan's Permit to Clear or Disturb Land form had been completed and signed off by the Environment and Community Manager (dated 12.02.13). The revised Plan states that nest boxes will be erected to replace hollows which cannot be salvaged at a ratio of one box per hollow bearing tree. No nest boxes were installed during the audit period as no hollow bearing trees were reportedly removed.	Compliant (preparation) Non-compliant (implementation)	The Annual Ecological Monitoring Report has been undertaken since the audit which will satisfy this condition as being compliant.	Annual Monitoring Report conducted annually

Title	Condition No	Requirement	Comments	Compliance/ Recommendations	Newstan Comments	Updates since audit
		of other threatened species such as the Squirrel Glider and Threatened Bat Species identified in the species impact statement; (iv) strategies to manage the impact of surface water management, erosion and sediment control measures, and flooding mitigation measures on flora and fauna, including the impact of heavy machinery; (v) details of monitoring the mine's impacts on native vegetation and threatened fauna and flora, and outline contingency measures should impacts be identified as occurring (refer also condition 8.5); (vi) measures to monitor the impacts on threatened species populations shall address: 1. methods of clearing near existing vegetation and measures to protect existing vegetation from the edge affects. Consideration of buffers is essential, especially near drainage lines. 2. measures to reduce sediment into drainage lines. 3. subsidence impacts on Tetratheca juncea through a monitoring program. This program will be co-ordinated with a surveyed and levelled line to determine drops in the terrain, following mine subsidence; 4. development of a program to specifically monitor the success or otherwise of proposed ameliorative measures in relation to the threatened flora and fauna species over five years from the commencement of construction in the relevant area. The monitoring is to be undertaken by experienced Botanist(s)/ Zoologist(s). Annual progress reports and a final report outlining the implementation and success or otherwise of the ameliorative measures shall be included in the AEMR during the monitoring period. (vii) measures to maintain trees with denning	Weed management was undertaken by Hunter Land Management (HLM) for large areas and SNK for minor areas. A copy of HLM's weed spraying report for the 4-6th March 2015 was sighted. The 2006 Flora and Fauna Management included a requirement for - Monitoring of the condition and composition of vegetation communities in the subsidence area. - Monitoring of forest and woodland areas in the study area to ensure that habitat for native flora and fauna is maintained. - Undertake vegetation monitoring on an annual basis and report in the AEMR. - Monitoring of rehabilitation areas on an annual basis to assess the development and success of the rehabilitation and implement any necessary remedial works. - Following construction, surveys will be conducted for a period of five years to monitor the effect of the development on threatened fauna identified as occurring in the area. The 2012 IEA assessed this Condition as non-compliant on the basis that the above requirements of the Plan had not been implemented. This Plan was still relevant for part of the audit period (April 2012 to May 2014) prior to the approval of the revised plan. The revised Plan includes a comprehensive monitoring program including annual vegetation and fauna surveys and biennial habitat health assessment. At the time of the audit site inspection, Newstan was awaiting the draft report of the first annual ecological survey. Tetratheca juncea monitoring above longwalls 22-24 (in accordance with the previous version of the management plan) continued during the audit period (sighted reports for surveys conducted in 2012, 2013 and 2014). Whilst it is noted that the commencement of the monitoring program would demonstrate compliance with this requirement going forward, the lack of ecological			

Title	Condition No	Requirement	Comments	Compliance/ Recommendations	Newstan Comments	Updates since audit
		hollows for the protection of threatened arboreal fauna species such as the Squirrel Glider and small Bats. In the event that trees and/or nesting value relevant to these species are felled and tree hollows relocated to augment habitat, and/or in the event that individual animals are captured and relocated during construction, this work shall be undertaken by a Zoologist with knowledge and experience in the implementation of such ameliorative techniques for these species; (viii) a large scale plan showing quadrat number locations for Tetratheca juncea together with a table showing sub-population sizes and their relevant co-ordinates. In particular, this information is required where populations will be lost by the Northern and Southern Reject Emplacement Areas; (ix) strategies to maintain and enhance wildlife corridors around and through the site for the movement of fauna particularly for arboreal mammals, small birds, and squirrel gliders. (x) development of a protocol for identifying and managing significant impacts on any threatened flora and fauna species not identified in the EIS, during development through construction or operation of the coal mine.	monitoring (with the exception of Tetratheca juncea) during the audit period in accordance with the 2006 Plan has resulted in this Condition being assessed as non-compliant with regards to implementation.			
DA-73-11-98 3.4(e)		(e) Any fencing of native vegetation which is to be retained shall not consist of barbed wire fencing.	Most of the fencing used on site is barbed wire boundary fencing to deter unauthorised access onto the site. It was reported that native vegetation to be retained is generally not fenced. The extent of the use of barbed wire fencing was not able to be determined during the audit site inspection.	Indeterminate	Noted.	
DA-73-11-98 3.5 (a)		a) The Applicant shall prepare Erosion and Sediment Control Plans for the surface facilities, particularly the waste reject emplacement areas, and the LEA in consultation with LMCC and to the	Newstan had prepared an Erosion and Sediment Control Plan (ESCP) in 2006 prior to the commencement of work in the relevant areas. Consultation and approval of the 2006 plan was assessed in previous IEA.	Non-compliant **REC 05 NEWSTAN IEA 2015:** Revise the ESCP to	Noted. Erosion and Sediment Control	The Erosion and Sediment Control Plan was revised

Title	Condition No	Requirement	Comments	Compliance/ Recommendations	Newstan Comments	Updates since audit
		satisfaction of DWE and Director-General, and submit these Plans to the EPA as part of applications for a licence under the Protection of the Environment Act. The Plans shall be prepared and implemented prior to the commencement of work in the relevant areas.	The ESCP was revised in 2012 and a Draft submitted to LMCC for consultation by letter dated 21.12.12. The LMCC conducted a site visit to assist in assessing the Plan and provided comments by letter dated 15.02.13. Newstan was yet to revise the plan to address the LMCC comments and seek approval of the revised plan. On the basis that the 2012 Plan was yet to be approved and the 2006 approved plan no longer reflecting the operations taking place at the time of the audit site inspection, this requirement has been assessed as non-compliant.	incorporate LMCC comments and changes that have occurred on site since 2012 and obtain relevant approvals.	Plan to be updated and resubmitted for approval.	and submitted to the DPE for approval in July 2016.
DA-73-11-98 3.5 (b)		(b) The Erosion and Sediment Control Plans shall include: (i) consideration and management of erosion and sedimentation of surface watercourses/water bodies, including LT Creek and all creeks within the LEA; and (ii) consideration of LMCC's Erosion and Sediment Control Policy and Code of Practice. (iii) a program for reporting on the effectiveness of the sediment and erosion control systems and performance against objectives contained in the approved erosion and sediment control management plans, and EIS. (refer also condition (d) (i) below)	The LMCC comments on the Draft 2012 ESC stated that the plan generally complies with the requirements of the "Blue Book" however it requested that minimum design criteria for the sediment basins be changed from the 90th percentile to the 95th percentile to reflect the sensitivity of the receiving environment. The LMCC also requested that the plan include more recent figures at a scale showing finer detail (1:2000 – 1:5000 was recommended). As discussed above at the time of the audit site inspection the Plan had not been revised to incorporate the LMCC comments and reflect changes that have occurred on site since 2012. On this basis this requirement has been assessed as non-compliant. Refer also to assessment of adequacy in the main section of this report.	As above	Noted. Erosion and Sediment Control Plan to be updated and resubmitted for approval.	The Erosion and Sediment Control Plan was revised and submitted to the DPE for approval in July 2016.
DA-73-11-98 4.1 (a)		**Water Management** (a) The Applicant shall: prior to the commencement of construction of each of the new surface facilities at Newstan Colliery, and prior to first workings within the LEA, prepare water management plans for the relevant developments, in consultation with DWE, EPA, LMCC, and DRE and to the satisfaction of the Director-General, which shall include, but not be limited to, the following matters: (i) management of the quality and quantity of surface and ground water within the areas	The Water Management Plan was prepared and approved by the DP&E on the 28.09.06. The 2006 plan was reviewed during previous IEAs in 2006 and 2009. In 2008 a Pollution Reduction Program (PRP) was added to Newstan's EPL requiring a Revised Water Management Plan (RWMP) (this was later removed by variation dated 13.07.11). The 2012 IEA assessed the consultation requirements of this plan however at the time, the Plan (Revision 9) was yet to be approved by DP&E. The RWMP has not been updated since 2009 and has not been approved by the DP&E. On this basis, this	a) Non-compliant **REC 03 NEWSTAN IEA 2015:** Revise the RWMP to reflect the changes that have occurred on site since this time (2009) and obtain relevant approvals of the document.	The WMP is required to be updated as part of the NCLP which is required to be submitted for approval to DoPE by March 2016. This will satisfy this condition as being compliant by the next audit.	The Water Management Plan was revised and submitted to the DPE for approval in July 2016.

Title	Condition No	Requirement	Comments	Compliance/ Recommendations	Newstan Comments	Updates since audit
		covered by the water management plans, which shall include preparation of monitoring programs as provided by CoC 8.2. (ii) management of stormwater and general surface runoff diversion to ensure separate effective management of clean and dirty water; (refer also condition 3.5 (d) (ii)). (iii) measures to prevent the quality of any surface waters being degraded below the relevant water quality prior to construction, particularly in LT Creek and all creeks within the LEA due to the operation of the mine workings; (iv) investigation into opportunities to reduce the mine water discharge into LT Creek in consultation with the EPA and include the results of such investigations in the Annual Environmental Management Report; (v) identification of any possible adverse effects on water supply sources of surrounding land holders, as a result of the underground mining operations in the LEA and surface mine works, and implementation of mitigation measures as necessary; (vi) identification of changes in flow of surface waters including all creeks within the LEA, particularly in Lord's Creek, due to subsidence, and LT Creek particularly due to the southern and northern waste emplacement areas and coal stockpiling areas; (vii) identification of any stream rehabilitation works required to ameliorate subsidence effects on stream flows within Lords Creek; (viii) contingency plans for managing adverse impacts of the development on surface and groundwater quality, including the matter in condition 4.1(d)(iv); (ix) identification of the fresh quality groundwater resources within the project area, including the development of appropriate protection strategies;	condition has been assessed as non-compliant. The 2012 IEA reviewed the RWMP and found it to generally include the matters outlined in this CoC with the following exceptions: (xi) Plan states that monitoring in the vicinity of natural watercourses and longwall mining areas is undertaken on a continual basis. The Plan should be more specific about what type of monitoring is undertaken and at what frequency. (xiii) The Plan refers to Centennial's EMS as a means for reporting and recording against environmental performance. The Plan should include a program for specifically assessing and reporting against the effectiveness of the water management system and performance against RWMP objectives and EIS. Since the above review, the following changes have occurred on site relating to water management: - construction and operation of the CWP - upgrade of the FPCD - increase to the daily discharge limit from LDP 1 - Stony Creek pipeline now a licensed discharge point (Point 7) The RWMP does not reflect the above changes as well as the recommendations from the previous IEA. Further details of the adequacy of the plan and opportrunities for improvement are provided in the main section of this report.			

Title	Condition No	Requirement	Comments	Compliance/ Recommendations	Newstan Comments	Updates since audit
		(x) projection of potential groundwater changes during mining (short term) and post-mining (long term) with particular attention given to the affect of changes to groundwater quality and mobilisation of salts; (xi) a monitoring and remediation strategy for all streams which may be adversely affected by subsidence including bed fracturing and/or degradation of the stream channel. Where the monitoring indicates any adverse impacts due to mining, the company shall implement the remediation strategy to the satisfaction of DWE. (xii) consideration of the State Wetlands Management Policy for all significant downstream wetlands that may be effected by mining activity within the LEA or the relevant area. (xiii) a program for reporting on the effectiveness of the water management systems and performance against objectives contained in the approved site water management plans, and EIS;				

Title	Condition No	Requirement	Comments	Compliance/ Recommendations	Newstan Comments	Updates since audit
DA-73-11-98 4.1 (c)		c) obtain a license with DWE under part 5 of the Water Act (1912) prior to construction of all new excavations, test bores and production bores (including dewatering bores) that intersect the groundwater.	c) The previous IEA reported that Newstan proposed (letter dated 09.07.10) to relinquish the 25 monitoring bore licences held (listed in Table 1 of the letter) and replace them with licenses with alternative conditions for 16 of the bores (listed in Table 2 of the letter). Newstan also applied for monitoring bore licences for two existing bores (listed in Table 3 of the letter). In addition, Newstan proposed to relinquish the extraction licence applying to the By-wash Dam and extraction from LT Creek as several conditions of the licence were considered to no longer be valid and requested that a new licence be issued. Newstan also applied for an additional 3 extraction licences. It was reported in the 2012 IEA that, despite numerous repeated requests, no response was provided by NOW. Further to the above, during this audit period, the licence application was re-submitted on the 16.10.13. A meeting was held with NOW on the 15.02.15 at which Newstan was requested to provide additional information. On the basis that the resolution of the licence relinquishment and additional licence application is unknown this condition has been assessed as Indeterminate.	c) Indeterminate **REC 06 NEWSTAN IEA 2015:** Continue to work with NOW to resolve groundwater extraction licence relinquishment and additional licence application.	Newstan will continue to correspond with NOW to obtain water licences for Newstan Colliery.	Ongoing
DA-73-11-98 4.1		**General Terms of Approval EPA** (ii) Discharge Concentration Limits The Applicant shall only discharge water from the development in accordance with the provisions of a current Environmental Protection Licence.	(ii) Newstan reported exceedances of the discharge concentration limits specified by its EPL during the audit period. Refer to assessment of compliance with EPL.	(ii) Non-compliant Refer to recommendations in main section of report and EPL compliance assessment table	Newstan has continued to progress upgrades to the water management system since the last audit most notably with the construction of the Clean Water Plant in 2013.	
DA-73-11-		**Assessment of LT Creek and Water Re-use Options** The Applicant shall undertake an	Newstan commissioned GHD to undertake an assessment of water quality and stream health to meet	Non-compliant **REC 07 NEWSTAN IEA**	Newstan to resubmit the LT	No further action

Title	Condition No	Requirement	Comments	Compliance/ Recommendations	Newstan Comments	Updates since audit
98 4.2		assessment of water quality and stream health in LT Creek and mine water re-use options to the satisfaction of the Director-General. This assessment must: (a) be prepared in consultation with the CCC, EPA, NOW and LMCC and be submitted to the Director-General by the end of March 2013 for approval; (b) review the history of operations at Newstan Colliery and describe any historical impacts from discharges from the Colliery on water quality and stream health in LT Creek; (c) identify the source(s) of exceedances of ANZECC water quality criteria for waters discharged from the site; (d) establish appropriate water quality criteria for waters discharged from the site; (e) identify any reasonable and feasible options for the improvement of water management at Newstan Colliery including water treatment, re-use or transfer; and (f) provide a proposed timetable for the implementation of reasonable and feasible measures identified in (d) above.	the requirements of this Condition. The Draft report (LT Creek Water Quality and Newstan Reuse Assessment March 2013) was submitted for consultation to the CCC, EPA, NOW and LMCC by letters dated 20.03.13. It was reported that no comments were received from any of the agencies and the report was submitted to the DP&E for approval on the 28.03.13. The DP&E reportedly requested further consultation with the agencies and so letters were sent to the EPA, LMCC and NOW asking if further information was required. It was reported that the Environment and Community Coordinator had a meeting with the LMCC to discuss the report in December 2013 however no further action has been taken since this time. It was reported that Newstan intends to resubmit the report to the DP&E for approval. On the basis of this report not being resubmitted to the DP&E, nor approved by the DP&E this Condition has been assessed as non-compliant.	**2015:** Re-submit the LT Creek Water Quality and Newstan Reuse Assessment Report (March 2013) to the DP&E for approval. If required, work with DP&E to achieve approval.	Creek Water Quality and Newstan Reuse Assessment Report to DP&E.	required – no longer a condition in DA-73-11-98 (MOD7).
DA-73-11-98 6.4A		**Operational Noise Criteria** The Applicant shall ensure that noise from the development (excepting the Newstan ventilation shaft site at Awaba) does not exceed the noise criteria in Table 4.	The operational noise criteria specified by this CoC came into effect with MOD 4 on the 16.03.12. Newstan reported exceedances with these criteria in the 2012, 2013 and 2014 AEMRs as summarised in the noise section of the main report. No exceedances were recorded at any monitoring locations during any periods in December 2014 and Quarter 1 2015 (reviewed noise monitoring reports by Global Acoustics). Based on the non-compliances reported, this Condition has been assessed as non-compliant. Further discussion of measures implemented to minimise noise is provided under Condition 6.4B below and in the main section of this report.	Non-compliant	Noted. Newstan Colliery has continued to implement operational upgrades to decrease noise from its operations including the installation of triple vf drives throughout the washery.	Newstan is continuing to calibrate the real time noise monitor and optimise the system to assist site management of noise.

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		Table 4: Noise criteria **Location** / **Shoulder dB(A)** $L_{Aeq(15\ min)}$ / **Day dB(A)** $L_{Aeq(15\ min)}$ / **Evening dB(A)** $L_{Aeq(15\ min)}$ NC1 – Davis: 35 / 35 / 35 NC2 – Culgan: 38 / 38 / 35 NC3 – Orrock: 39 / 39 / 37 NC4 – Phelps: 35 / 35 / 35 NC5 – Parnell: 35 / 35 / 35 NC6 – Fassifern Primary School: N/A / 35 / N/A Notes: *-To interpret the locations referred to in Table 4, see Figure 1 in Appendix 2; and* *-Noise generated by the development is to be measured in accordance with the relevant* *requirements and exemptions (including certain meteorological conditions) of the NSW Industrial* *Noise Policy.* *- Day is defined as the period from 7am to 6pm;* *- Evening is defined as the period from 6pm to 10pm;* *- Night is defined as the period from 10pm to 6am: and* *- Shoulder is defined as the period from 6am to 7am.* However, these criteria do not apply if the Applicant has an agreement with the relevant owner/s of these residences/land to generate higher noise levels, and the Applicant has advised the Department in writing of the terms of this agreement.			Newstan has also installed a real time noise monitor which will assist the site to manage noise from its operations.	

Title	Condition No	Requirement	Comments	Compliance/ Recommendations	Newstan Comments	Updates since audit
DA-73-11-98 6.4B		**Operating Conditions** The Applicant shall: (ii) regularly assess the real-time noise monitoring and meteorological forecasting data and relocate, modify, and/or stop operations on site to ensure compliance with the relevant conditions of this consent; (iii) minimise the noise impacts of the development during temperature inversions;	(ii) At the time of the audit, the real-time noise monitor was yet to be installed. It is understood that the original site nominated by Centennial's noise experts was not practical as it was not on land owned by Centennial and there was no power supply to the site. Centennial, in consultation with its experts have selected a new site on Centennial land (adjacent to the rail loop). These changes to the location of the monitoring location compounded to delays in installing the monitor. It was reported that the monitor had been ordered at the time of the audit and civil works had commenced to lay power to the site, however on the basis that it was not operational during the audit period, this Condition has been assessed as non-compliant. It was reported that the real time noise monitor is scheduled to be operational by the end of July 2015. (iii) During attended monitoring, consultants use the data logged by the on-site meteorological station to identify temperature inversions. However this is done and provided to Newstan with the quarterly noise monitoring reports and is therefore not able to be used to minimise impacts during the temperature inversion. On this basis, this requirement has been assessed as non-compliant. It was reported that updates were going to be made to the meteorological station so that it can have these capabilities in the future.	(ii) Non-compliant (iii) Non-compliant	The real time noise monitor has been installed and is currently in a calibration phase.	Newstan is continuing to calibrate the real time noise monitor and optimise the system to assist site management of noise.
DA-73-11-98 8.2		**Surface and Groundwater** (a) (ii) The Applicant shall prepare a detailed monitoring program in respect of ground and surface water quality and quantity, including water in and around the Newstan mine site, Northern and Southern Emplacements, and LEA, and also consistent with condition 4.1(b)(iv), during construction works, mine operations and post mine operations in consultation with DWE, EPA, and to the satisfaction of the Director-General. The monitoring program shall also include surveys of drainage channels within the LEA to update	(a) ii) The surface water monitoring program is included within the Revised Water Management Plan (RWMP, 2009). The RWMP was prepared in consultation with the OEH and NOW and submitted to the DP&E for approval, however was not formally approved by the DP&E (refer also to CoC 4.1). On the basis that the RWMP and the Plan has not been approved by the DP&E and has not been updated since 2009 this part of the condition is considered Indeterminate.	(a) (ii) Indeterminate **REC 03 NEWSTAN IEA 2015:** Revise the RWMP to reflect the changes that have occurred on site since 2009 and continue to seek relevant approvals of the Plan from DP&E. **REC 08 NEWSTAN IEA 2015:** Update the surface water	The WMP is required to be updated as part of the NCLP which is required to be submitted for approval to DoPE by March 2016. This will satisfy this condition as being compliant by the next audit.	The Water Management Plan was revised and submitted to the DPE for approval in July 2016.

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		information obtained in the preparation of Property Subsidence Management Plans. The monitoring program shall be prepared prior to commencement of construction in the relevant area.		monitoring program in the RWMP to include the requirements of the current EPL.		

Title	Condition No	Requirement	Comments	Compliance/ Recommendations	Newstan Comments	Updates since audit
DA-73-11-98 8.5		**Flora and Fauna Monitoring** The Applicant shall prepare a detailed monitoring program of habitat areas, including any wetlands and aquatic habitats, during the development and for a period after the completion of the development to be determined by the Director-General in consultation with LMCC, OEH and DRE. The program shall monitor impacts attributable to the development and include monitoring of the success of any restoration or reconstruction works. The Applicant shall include the monitoring program in the Flora and Fauna Management Plan (condition 3.4). The Applicant shall carry out any further works required by the Director-General as a result of the monitoring. A summary of monitoring results shall be included in the AEMR.	The monitoring program is outlined in Section 5 of the Flora and Fauna Management Plan (2014). The program was expanded to include details of additional monitoring to address the requirements of Condition 3.4 that were not included in the previous version of the plan. This includes: - Annual Photo monitoring - Annual Vegetation surveys (species diversity, species abundance, dominant species and vegetation height and presence of dieback) - Annual Bird surveys - Annual Bat surveys - Annual General fauna (camera traps) - Biennial habitat health assessment The previous Plan (2006) committed to annual vegetation monitoring, monitoring of rehabilitation areas, subsidence areas and fauna surveys but did not include details on the type of monitoring proposed at what frequency and which locations. The 2012 IEA assessed this Condition as non-compliant on the basis that ecological monitoring (other than Tetratheca juncea) was not undertaken and made a number of recommendations relating to expanding the monitoring program and revising the Plan. During this audit period annual Tetratheca juncea surveys over longwalls 22-24 and in the NREA and SRE continued with the following reports sighted: - *Monitoring of Tetratheca juncea over longwalls 22-24 and in buffer areas NREA and SREA – 2013 season* (Hunter Eco, October 2013) - *Monitoring of Tetratheca juncea over longwalls 22-24 for years 2006-2014* (Hunter Eco, October 2014) - *Monitoring of Tetratheca juncea at the Northern and Southern Reject Emplacement Areas* (Hunter Eco, October 2014). However other ecological monitoring did not commence until 2015. At the time of the audit site inspection, Newstan was awaiting the draft report of the first annual ecological survey from the ecological consultants engaged to undertake this work (RPS). The auditors sighted the proposal provided by RPS to undertake the annual ecological survey and noted it included the monitoring committed to in the Plan. On the basis that ecological monitoring (with the exception of Tetratheca juncea) had not been undertaken during the audit period, this condition has	Non-compliant No action required as monitoring now commenced.	The Annual Ecological Monitoring Report has been undertaken since the audit which will satisfy this condition as being compliant.	Annual ecological monitoring conducted annually.

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DA-73-11-98 8.8 (ii) (g)		(ii) The Applicant shall, at its own expense: (g) forward a copy of these minutes to the Director-General; and	The CCC minutes were not forwarded to the DP&E.	(g) Non-compliant **REC 09 NEWSTAN IEA 2015:** Ensure CCC meeting minutes are forwarded to the DP&E.	Minutes to be forwarded to DP&E.	No further action required – no longer a condition in DA-73-11-98 (MOD7).
DA-73-11-98 8.9		**Independent Environmental Audit** (iii) Within 3 months of submitting the audit report to the Director-General, the Applicant shall review, and if necessary revise the strategies/plans/programs required under this consent to the satisfaction of the Director-General.	(iii) The Flora and Fauna Management Plan was still at a draft stage in December 2012, it was approved in August 2014. Other plans updated and approved during this audit period include: - Air Quality and Greenhouse Gas Management Plan (December 2012) - Noise Management Plan (December 2012) - Pollution Incident Response Management Plan (October 2014) Not all of the management plans were revised following the 2012 IEA to address the recommendations from the adequacy review (e.g RWMP and Aboriginal Cultural Heritage). Refer also to main section of report and Appendix B. On the basis of these actions remaining outstanding, this requirement has been assessed as non-compliant.	(iii) Non-compliant **REC 01 NEWSTAN IEA 2015:** Develop process for managing non-compliances identified from audits (internal and external),and closing out recommendations	Newstan will continue to manage its compliance through the site compliance database.	
EPL 395 L1.1		**Pollution of Waters** 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.	Newstan reported non-compliance with this condition in its 2012 and 2013 Annual Returns on the following occasions: - 6.03.12 to 7.09.12: unlicensed discharge to Stony Creek - 1.03.13: turbid water discharge from LDP002 - 18.11.13: turbid water discharge from LDP001 In addition, Newstan reported the following incidents to the EPA via the pollution hotline in 2015: - 09.04.15: seepage of water into LT Creek through electrical pit - 21.04.15 to 23.04.15: overflow of turbid water from	Non-compliant	Stony Creek has been licenced on the Newstan EPL since the date of the recorded non compliances. Newstan has continued to progress upgrades to the water management system since the	

Title	Condition No	Requirement	Comments	Compliance/ Recommendations	Newstan Comments	Updates since audit
			FPCD through LDP002 Based on the above incidents and related exceedance of the EPL criteria, this Condition was assessed as non-compliant during the audit period. Incidents and water management are discussed further in the main report.		last audit specifically with the construction of the Clean Water Plant in 2013.	
EPL 395 L2.1		**Concentration Limits** 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.	During the audit period Newstan recorded a number of exceedances of these concentration limits): In December 2013 / January 2014 Newstan commissioned a Clean Water Plant (CWP). The CWP uses coagulation, flocculation, sedimentation and filtration to reduce turbidity and concentration of TSS prior to discharge from LDP001. At the time of the audit Newstan was in arbitration with the EPA regarding the pollutant concentration limits imposed by this EPL. This is discussed further in the main report.	Non-compliant	Newstan has continued to progress upgrades to the water management system since the last audit specifically with the construction of the Clean Water Plant in 2013.	Newstan Colliery received an EPL variation in November 2015 with many amendments to concentration limits. This variation should lead to fewer concentration exceedances at site.
EPL 395 L3.1		**Volume and Mass Limits** For each discharge point or utilisation area specified below (by a point number), the volume/mass of: (a) liquids discharged to water; or; (b) solids or liquids applied to the area; must not exceed the volume/mass limit specified for that discharge point or area: Point 1: 11,000 kilolitres per day	In December 2013 Newstan installed a CWP and upgraded its pipeline and pumping system. The CWP allows for greater control of the water level within the Fassifern Seam and better management of surface water across the site using the CWP CITECT system. A v-notch weir was installed at LDP001 to monitor volume discharged. If the limit at LDP001 is reached, the discharge to LDP001 is switched off and alarms raised to investigate. Newstan personnel are able to log on to the CWP CITECT system and check dam levels, start / stop pumps etc. The Discharge limit at LDP001 was increased from 7,000 kL to 11,000 kL by EPL variation dated 15.10.12. Since this time, Newstan has reported the following exceedances with the volume limit:	Non-compliant	Upgrades to the water management system since the last audit through the installation of the clean water plant, are designed to prevent exceedances of concentration limits specified by the EPA by automation of the site water management	

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			- 2.03.13: 12,384 kL discharged following a significant rainfall event (152 mm in 27 hours prior to discharge). - 22 to 23.04.15: 11,519 kL discharged following major storm. While Newstan have been typically compliant with the condition, based on the two exceedences listed, Newstan are considered non compliant with this condition.		system.	
EPL 395 M2.2		Air Monitoring Requirements POINT 7,8,8,10,11,12,13,14 Pollutant / Units of measure / Frequ Particulates - Deposited Matter / grams per square metre per month / Month POINT 15,16 Pollutant / Units of measure / Frequ Particulate matter / micrograms per cubic metre / Every Total suspended particles / micrograms per cubic metre / Every	A non-compliance was reported with this Condition in the 2012 and 2013 EPL Annual Returns as the following air quality monitoring was not undertaken: - TSP at EPA Monitoring point 16-HVS2 on 09.01.12 - PM_{10} at EPA Monitoring point 16-HVS2 on 11.09.12 due to a power outage; - TSP at EPA Monitoring point 16-HVS2 on 11.09.12 due to a power outage; - Particulates – deposited matter at EPA Monitoring Point 13-D7 for the monthly sample of 20 March to 19 April 2012 due to vandalism of the dust gauge. - PM_{10} at EPA Monitoring point 16-HVS2 on the 15.03.15, 21.05.13 and 27.05.13 due to an electrical failure within the sampler - Particulates – deposited matter at EPA Monitoring Point 10-D4 for the monthly sample of 18 March to 18 April 2013 due to vandalism of the dust gauge. AM-19 refers to AS 3580.10.1-1991. Depositional dust monitoring was undertaken by AECOM. AECOM developed a procedure, Ambient Measurement Procedure – Dust Deposit Gauges which references AS 3580.1.1:2003. AM-18 refers to AS 3580.9.6-1990 and AM-15 refers to AS 2724.3-1984. The February 2015 Environmental Monitoring Report of TSP, PM_{10} and $PM_{2.5}$ provided by Carbon Based stated	Non-compliant	Upgrades have been made to the power supply to the HVAS to prevent power outages. Newstan will continue to manage airborne dust from site as per the AQ&GHG Management Plan.	

Title	Condition No	Requirement	Comments	Compliance/ Recommendations	Newstan Comments	Updates since audit
			that the following Australian Standards were used: - AS3580.9.3 for TSP - AS3580.9.6 for PM_{10} AS 3580.9.3 is not listed within the EPA publication, *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* however it is noted AS3580.9.6 has superseded AS 2724.3-1984 and the EPA publication has not been reviewed since January 2007. On the basis of the non-compliances reported in the 2012 and 2013 Annual Returns this condition was deemed non-compliant.			
EPL 395 M2.3		Water and/ or Land Monitoring Requirements *Summarised below (see EPL 365 for full requirements)* <u>Point 1 (LDP001)</u>: - Metals: weekly by composite sample. - Conductivity: daily by composite sample - Total suspended solids, oil and grease and pH: weekly by composite sample - Turbidity: weekly by grab sample <u>Point 2 (LDP002)</u> - Metals: weekly during any discharge by grab sample. - Conductivity, oil and grease, pH, total suspended solids and turbidity: within the first 6 hours of any discharge occurring; and every seven days thereafter for the duration of the discharge <u>Point 3, 4, 6, 20 (ambient water quality)</u> - Metals: monthly during discharge by grab sample.	A non-compliance was reported with this Condition in the 2012 and 2013 Annual Returns as the sampling method and frequency for LDP001 and Point 19 (WMP03) was not in accordance with the requirement. The Licence Variation dated 15.10.12 changed the sampling method from grab sampling to composite sampling and the frequency from weekly to daily. Newstan continued to use weekly grab sampling whilst it was in the process of procuring, installing and commissioning the composite samplers. These were installed in April 2013. The composite samplers at LDP001 and Point 19 were observed during the audit site inspection. <u>Note re Special Frequency 1</u> Newstan has developed a procedure (EWP002–Environmental Monitoring During Discharge Events) which outlines the step by step process for sampling during discharge events. This was reviewed by the auditors and considered to be a comprehensive and well written procedure. Some opportunities for improving the procedure were identified (refer to recommendations). It was reported that where Newstan is required to take a sample within the first 6 hours of any discharge occurring this is managed in the following way: - water levels are monitored in the CWP CITECT	Non-compliant **REC 10 Newstan IEA 2015** Update EWP002-Environmental Monitoring During Discharge Events, to include the plan referenced in the EPL for monitoring locations (plan NS3303). Also ensure procedure includes monitoring requirements for EPA Monitoring Point 20 (WMP 16) during discharge events).	Noted.	

Title	Condition No	Requirement	Comments	Compliance/ Recommendations	Newstan Comments	Updates since audit
		- Conductivity, oil and grease, pH, total suspended solids and turbidity: within the first 6 hours of any discharge occurring; and every seven days thereafter for the duration of the discharge Point 17 (Stony Ck Pipeline Outlet) -Metals: within the first 6 hours of any discharge occurring; and every seven days thereafter for the duration of the discharge - Conductivity, temperature and turbidity: continuously during any discharge (subject to the following note) - oil and grease, pH and total suspended solids: within the first 6 hours of any discharge occurring; and every seven days thereafter for the duration of the discharge Point 18 (ambient water quality) -Temperature: continuously during any discharge (subject to the following note – b) Point 19 (ambient water quality) - Metals: weekly by composite sample Note Special Frequency 1 means in the event of a discharge, a grab sample of the water discharged must be collected: a) within the first 6 hours of any discharge occurring; and b) every seven days thereafter for the duration of the discharge; Special Frequency 2 means continuous sampling during any discharge, subject to the following in respect of Point 17 and Point 18. (a) A continuous monitoring system will be	system; - If either the FPCD, Graunchs, Fassifern's storage or Connolly's dam gets to 80% an alarm sounds and an automated phone call is made to a prioritised list of Newstan personnel on rotation until someone answers the call. - Newstan personnel are able to log on to the CWP CITECT system and check dam levels, start / stop pumps etc. - if it becomes apparent that a discharge is imminent, the Environmental Coordinator takes the grab sample and stores it for pick up by AECOM for preparation and analysis by the laboratory as per Procedure EWP002. In 2015, the requirement for monitoring within the first 6 hours of any discharge was triggered during the following events: - 21.04.15 – overflow of Graunchs Dam through LDP001 - 21.04.15 – overflow of FPCD through LDP002 - 23.04.15 – overflow of Clean Water Dam In its written report for the 21-23 April 2015 incident to the EPA dated 5.05.15, Newstan stated the dates and times of the discharges and the dates and times sampling was undertaken. Based on this information Newstan undertook sampling within 6 hours of the discharges occurring at all but one location (Point 6) where it was deemed unsafe to collect samples late at night during extreme storm conditions. Samples were taken at this location at 8:45am the next day when it was safe to do so. Note re Special Frequency 2 (a) The continuous monitoring system was installed at Stony Creek on the 15.10.13. The EPA was notified of the completion of its installation by letter dated 8.11.13. The EPA was previously notified (by letter dated 11.03.13 that there would be a delay in the implementation of the monitoring system due to significant rain which raised the water levels in the Fassifern seam to within the 2m buffer of the inlet to the			

Title	Condition No	Requirement	Comments	Compliance/ Recommendations	Newstan Comments	Updates since audit
		implemented by 31 March 2013, weather permitting. It is noted that, to minimise the possibility of a flow of mine wastewater though the pipeline during installation and excavation works, the installation of continuous monitoring equipment will not commence until there is a two (2) metre buffer from the water level in the seam to the Stony Creek pipeline inlet. (b) In the event of a discharge occurring prior to the implementation of continuous monitoring being installed, hourly monitoring must be carried out. This monitoring will commence within the first six (6) hours of any discharge occurring.	Stony Creek pipeline. b) Newstan reported that Point 17 (Stony Creek pipeline) commenced discharging on the 22.03.13. This was prior to the continuous monitoring system being completed as discussed above. It was reported that for this event, environmental consultants AECOM were undertaking hourly monitoring to satisfy this condition. In addition Newstan reported that Point 17 commenced discharging on the 11.05.15 at 8:20am. By this stage the continuous monitoring system had already been installed. The auditors were provided with a spreadsheet ("Stony Creek 2015) which included the half hourly temperature, conductivity and turbidity monitoring data for Point 17 for the period 8 am 11.05.15 to 03.06.15. Based on the non-compliances reported by Newstan in 2012 & 2013 as indicated above, Newstan were considered to be non-compliant with this condition.			
EPL 395 U2.1		**PRP6 Macroinvertebrate and Eco-toxicological Monitoring Program** The licensee must implement an environmental monitoring program that will monitor the impacted sites of LT and Stony Creeks against control, where control means a system of the same Riverstyle™ (Brierley & Fryirs) as LT and Stony Creek monitoring reaches but not impacted by point source mining groundwater discharges or other major point source discharges. The monitoring program must be undertaken by a suitably qualified and experienced person and: a) include macroinvertebrate monitoring twice a year (Autumn and Spring) at: i) four or more locations downstream of LT Creek licensed discharge point 1 that includes site within the intertidal estuarine zone; and	At the time of the audit site inspection Newstan and the EPA were in arbitration and as advised by letter from Newstan's lawyers Ashurst Australia dated 18.05.15 it was agreed by both parties that Conditions U2 and E1 are not to have effect until the Court finally resolves the proceedings.	Not to have Effect – subject of arbitration at time of audit.	PRP 6 was completed on 23 October 2015 and has been removed from EPL395. An ongoing macroinvertebrate and ecotoxicological program has been established in accordance with Condition E1 of EPL395.	

Title	Condition No	Requirement	Comments	Compliance/ Recommendations	Newstan Comments	Updates since audit
		ii) two or more locations downstream of Stony Creek licensed discharge point 17 that includes a site within the intertidal estuarine zone; and iii) at a number of control locations that are the same Riverstyle™ (Brierley & Fryirs) as the impacted monitoring site reaches, which must include an estuarine non impacted site; b) include ecotoxicological assessment 3 times within a 6 month period from the date of the issue of this licence, with the timeframe between sampling events more than 7 weeks, that includes assessment of the toxic effects of the clean water treatment plant at licensed discharge point 1 to Eastern Rainbow Fish embryo development and post-hatch survival (10d exposure), freshwater shrimp (*Paratya austaliensis*) survival (10d exposure) and freshwater cladoceran *C.dubia* reproductive impairment (8d exposure); thence c) ecotoxicological assessment twice annually, with the timeframe between sampling events more than 4 months, that includes assessment of the toxic effects of the clean water treatment plant at licensed discharge point 1 to Eastern Rainbow Fish embryo development and post-hatch survival (10d exposure), freshwater shrimp (*Paratya austaliensis*) survival (10d exposure) and freshwater cladoceran C.dubia reproductive impairment (8d exposure). Note 1: Control does not mean 'natural' and unimpacted by humans in the context of this study.				

Title	Condition No	Requirement	Comments	Compliance/ Recommendations	Newstan Comments	Updates since audit
EPL 395 U2.2		The licensee must prepare an ecotoxicological report for monitoring undertaken at condition U2.1 b) that is prepared by a suitably qualified and experienced person. This report must be provided to the EPA's Regional Manager Hunter at Hunter.region@epa.nsw.gov.au within two months from completion of the ecotoxicological assessment in condition U2.1 b).	As above	Not to have Effect – subject of arbitration at time of audit.	PRP 6 was completed on 23 October 2015 and has been removed from EPL395. An ongoing macroinvertebrate and ecotoxicological program has been established in accordance with Condition E1 of EPL395.	
EPL 395 U2.3		The licensee must prepare a macroinvertebrate and ecotoxicological report prepared by a suitably qualified and experienced person that reports on the monitoring undertaken in Condition U2.1 a) and Condition U2.1 c). The report: a) must be provided to the EPA with the Annual Return (noting that from the commencement of this Licence, only the Spring macroinvertebrate monitoring would have taken place within the 2014 licence period); and b) analysis must incorporate, but must not be limited to a beyond before after control impact (beyond BACI) style assessment comparing impacted and control sites but also include an assessment of macroivertebrate assemblage dissimilarity between impacted and control sites highlighting the taxa / impact responsible for the majority of the dissimilarity. At the completion of two years and then three years of monitoring the macroinvertebrate and ecotoxicological report must incorporate temporal analysis of the preceeding data	As above	Not to have Effect – subject of arbitration at time of audit.	PRP 6 was completed on 23 October 2015 and has been removed from EPL395. An ongoing macroinvertebrate and ecotoxicological program has been established in accordance with Condition E1 of EPL395.	

Title	Condition No	Requirement	Comments	Compliance/ Recommendations	Newstan Comments	Updates since audit
		dating back to the commencement of the environmental study. This PRP must be completed by 27 February 2017.				
EPL 395 E1.1		**Special Conditions** **Water Treatment Plant Commissioning Study** The licensee must undertake a Water Treatment Plant (WTP) Commissioning Study for the Newstan Clean Water Treatment Plant prepared by a suitably qualified and experienced person. The study must: a) monitor daily inflow to the WTP and daily outflow from the WTP testing for the pollutants identified in condition U1.1 c), and including the total fraction of individual metals mentioned in condition U1.1 c) for 7 consecutive days; thence after b) monitor weekly inflow to the WTP and weekly outflow from the WTP testing for the pollutants identified in condition U1.1 c), for eight weeks (using a range of days of the week); and that this monitoring must include i) a range of volumetric throughputs to test treatment efficiencies and residence time. Note: The laboratory analytical tests must be able to test the pollutants (analytes) at an appropriate level of detection such that change can be detected. The results of "<LOR" are not acceptable in a commissioning study where the intention is	Newstan sought clarification (by letter dated 07.01.14) regarding the note in this condition re LOR reporting. It also advised the EPA that it would not be able to complete the report within the stipulated timeframe and sought an extension. Court proceedings have since commenced between Newstan and the EPA and as advised by letter from Newstan's lawyers Ashurst Australia dated 18.05.15 it was agreed by both parties that Conditions U2 and E1 are not to have effect until the Court finally resolves the proceedings.	Not to have Effect – subject of arbitration at time of audit.	This condition was removed from EPL 395 in November 2015.	

Title	Condition No	Requirement	Comments	Compliance/ Recommendations	Newstan Comments	Updates since audit
		to detect a reduction.				
EPL 395 E1.2		On completion of the monitoring identified in condition E1.1 the licensee must provide a report to the EPA, prepared by a suitably qualified and experienced person. The report must: a) analyse and report the efficiency of the clean water treatment plant in removing pollutants at a variety of flow rates and residence times and include near maximum flow rates that would be discharged in accordance with the maximum volumetric licence limit (11,000ML/day); c) compare and contrast the monitoring results to the targeted design treatment concentrations identified in Condition U1.1 c); and b) include recommendations of the most effective flow rate and the resultant treatment reductions that can be achieved. Note: The laboratory analytical tests must be able to test the pollutants (analytes) at an appropriate level of detection such that change can be detected. The results of "<LOR" are not acceptable in a commissioning study where the intention is to detect a reduction. The Report must be provided to the EPA's Manager Hunter Region at hunter.region@epa.nsw.gov.au within 3	As above	Not to have Effect – subject of arbitration at time of audit.	This condition was removed from EPL 395 in November 2015.	

Title	Condition No	Requirement	Comments	Compliance/ Recommendations	Newstan Comments	Updates since audit
		months of the issue of this licence variation (17 December 2014).				
CCL 764 2		**Environmental Harm** The proponent shall implement all practicable measures to prevent and/or minimise any harm to the environment that may result from the construction, operation or rehabilitation of the development.	Refer to DA 73-11-98 Condition 1	Non-compliant Refer to recommendations made throughout the report	Noted.	
CCL 764 18		**Prevention of Soil Erosion and Pollution** Operations must be carried out in a manner that does not cause or aggravate air pollution, water pollution (including sedimentation) or soil contamination or erosion, unless otherwise authorised by a relevant approval, and in accordance with an accepted Mining Operations Plan. For the purpose of this condition, water shall be taken to include any watercourse, waterbody or groundwaters. The lease holder must observe and perform any instructions given by the Director-General in this regard.	Newstan operates under an Environmental Protection Licence (EPL395) which outlines criteria for water quality discharges and monitoring requirements for dust and water quality. Refer to assessment of compliance with EPL. Newstan has developed a number of management plans to manage the environmental impacts of its operations, specifically a Revised Water Management Plan, Erosion and Sediment Control Plan and Air Quality and Greenhouse Gas Management Plan. Refer to main report for further discussion of these issues Newstan had undertaken significant works during the audit period to upgrade its water management system, including: - increasing the capacity of the Final Pollution Control Dam - completing the clean water diversion drain around the	Non-compliant	Noted.	

Title	Condition No	Requirement	Comments	Compliance/ Recommendations	Newstan Comments	Updates since audit
			SREA - installing a Clean Water Treatment Plant - upgrades to the pipeline and pumping system and increases in pumping capacity - upgrades to the CITECT system following construction of the CWP. The CWP CITECT system allows for remote management and movement of water across the site and incorporates alarms when trigger levels are reached. - increasing the daily discharge limit (volume) in its EPL from 7ML/day to 11 ML/day from LDP001. The previous IEA (2012) identified an area of erosion at the discharge of the clean water diversion drain where the northern arm drains into LT Creek. The IEA reported that the clean water diversion drain had diverted water into an undefined drainage line which has as a result eroded in some areas down to bedrock and potentially led to some sediment build up in LT Creek. During the audit site inspection on the 11.05.15, the auditors inspected this area and observed that works had been undertaken to extend the rock lined channel approximately, 10m, however the auditors were not able to gain access to the land (as this was private land) to observe the drainage line beyond this point. Newstan noted that no works had been undertaken beyond the area sighted due to it being on private land. No areas of significant erosion were observed during the site visit on the 11.05.15. On the basis of the non-compliances with the EPL relating to water pollution, Newstan is considered Non-compliant with this condition.			

Title	Condition No	Requirement	Comments	Compliance/ Recommendations	Newstan Comments	Updates since audit
ML 1452 33 (a)		**Catchment areas** - (a) Operations shall be carried out in such a way as not to cause any pollution of the Lake Macquarie Catchment Area.	(a) Newstan operates under an Environmental Protection Licence (EPL 395) which outlines criteria for water quality discharges and monitoring requirements for dust and water quality. Refer to assessment of compliance with EPL. Some aspects of the licence have not been complied with and some pollution events have been reported. While Newstan are generally compliant with this condition, on the basis of some events of pollution occurring, Newstan are considered Non Complaint with this condition. Full details are presented in the compliance assessment of the EPL.	(a) Non-compliant	Noted. Addressed in conditions of EPL.	

The next Independent Environmental Audit of the Newstan Colliery operations in accordance with SSD-5145 and DA 71-11-98 is required to be undentaken by 14 May 2018.

11 INCIDENTS AND NON-COMPLIANCES DURING THE REPORTING PERIOD

No incidents and non compliances were recorded during the reporting period.

12 ACTIVITES TO BE COMPLETED IN THE NEXT REPORTING PERIOD

Table 26: Activities to completed in the next reporting period

Newstan Colliery
Revision & update to Bushfire Management Plan. Revision & update to Land Management Plan. Revision & update to Landscape Management Plan.

Centennial Coal

Centennial Coal

HISTORICAL REVIEW FOR SURFACE WATER MONITORING AT NEWSTAN COLLIERY

Newstan Colliery

2017

Mining Leases
Owned and Operated by
Centennial Newstan Pty Ltd
ABN 68 101 508 865

Centennial Coal
Environment Matters

1. LDP001 ANALYTES

The discharge analytes for LDP001 have been included from 2010, as regular sampling of several analytes commenced at this time.

Where an outlier has caused the graph to become unreadable, a second graph has been added which excludes the outliers to provide more detail. All units in the graphs are in mg/L, with the exception of pH (pH units) and Conductivity (µS/cm).

The Environmental Protection Licence (EPL) 395 was modified in November 2015. These new limits have been included on the graphs. Where there is no longer a EPL limit the limit may be seen as 0. These metals are still required to be monitored as per EPL requirements. There are no discharge limits within the Newstan Development Consent (DA 73-11-98).

The majority of the water discharged through LDP001 was from an underground water storage called the Fassifern Seam. However if the rainfall exceeded the capacity of Graunch's Dam, this may also flow through LDP001. In 2013 a Clean Water Plant was commissioned at Newstan Colliery, and now the majority of the water discharged through LDP001 is treated through the CWP prior to discharge through LDP001.

While the limits only apply to either dissolved or total metals, both dissolved and total (where available and applicable) have been provided in the attached graphs to give an overall view of the water quality results from LDP001.

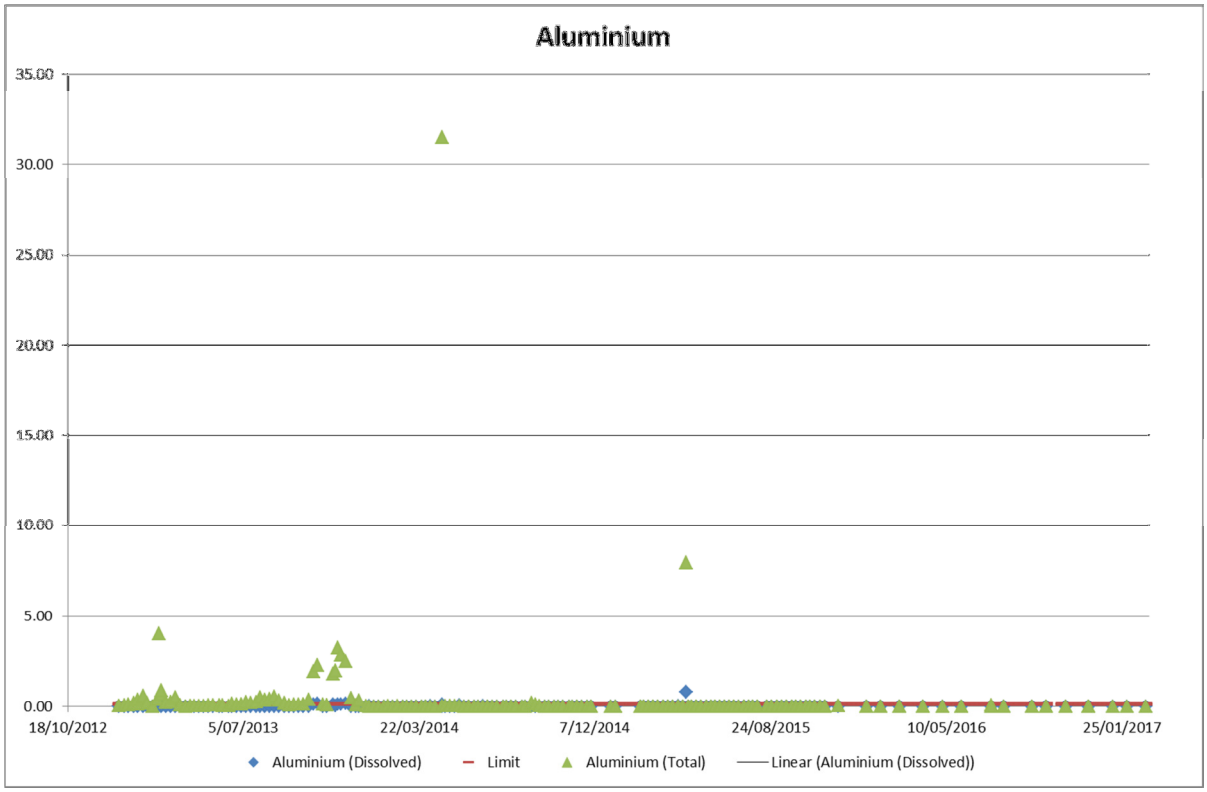
The following analytes are generally below the licence criteria, and have remained relatively stable since 2010: aluminium, barium, cadmium, copper, lead, manganese, mercury, nitrogen, oil & greases, phosphorus, selenium, TKN, and zinc.

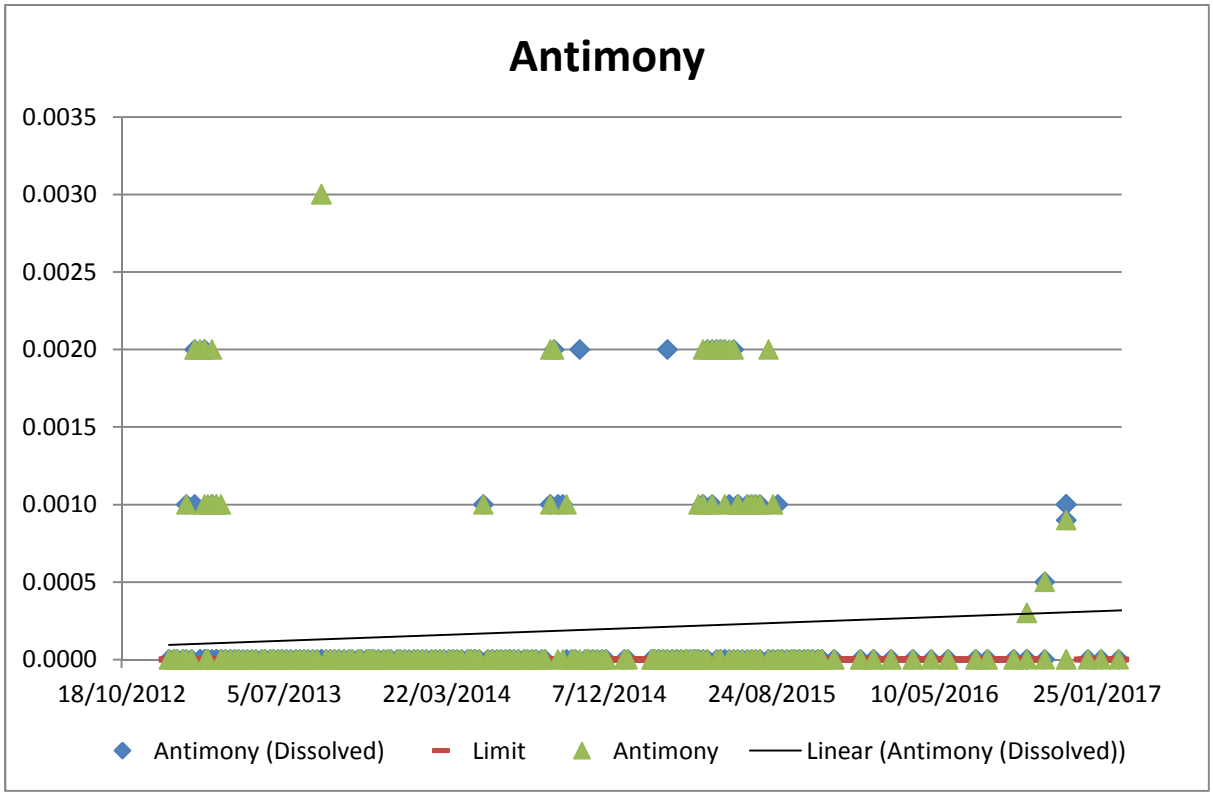
Note some lead results are above the limits, however this is due to contamination during the commissioning of the composite samplers, and are not licence exceedences. The results have been left in to provide a completed monitoring set.

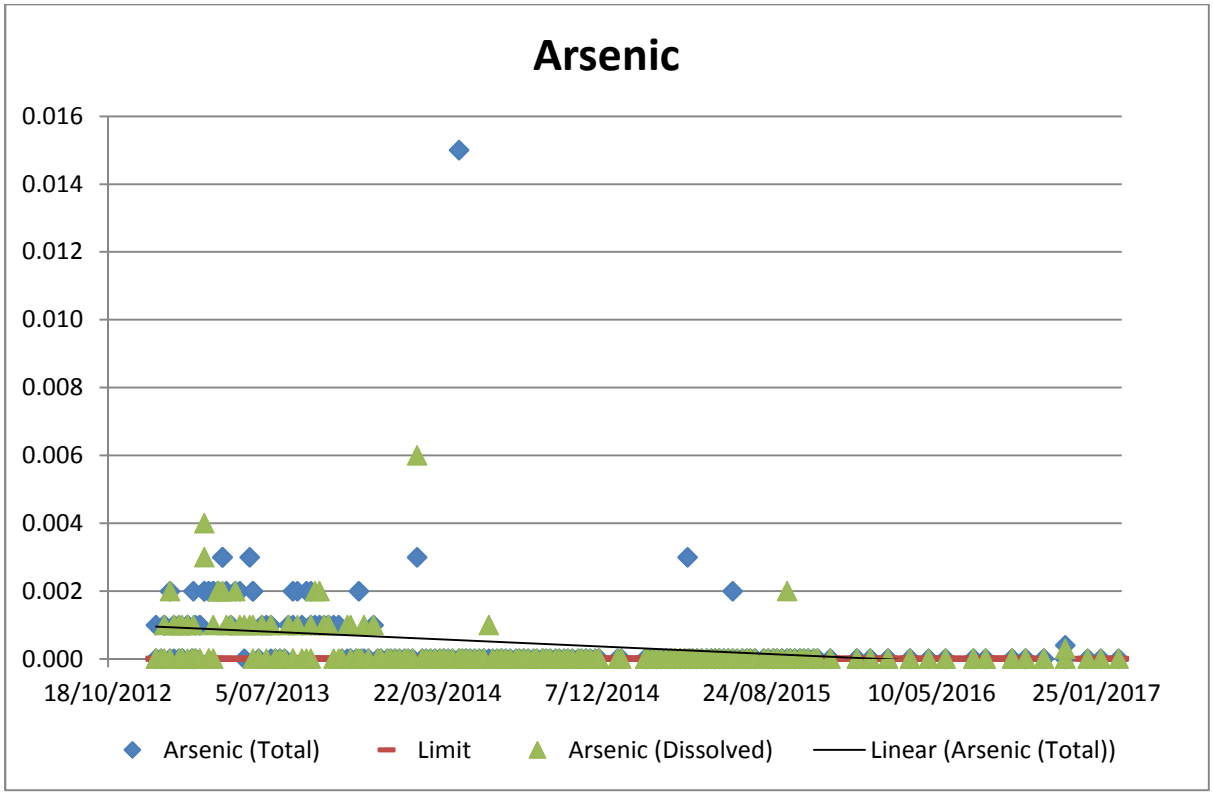
Bicarbonate alkalinity, boron, calcium, chromium, conductivity, molybdenum, nickel and silica are generally below the licence limits, and have a decreasing trend.

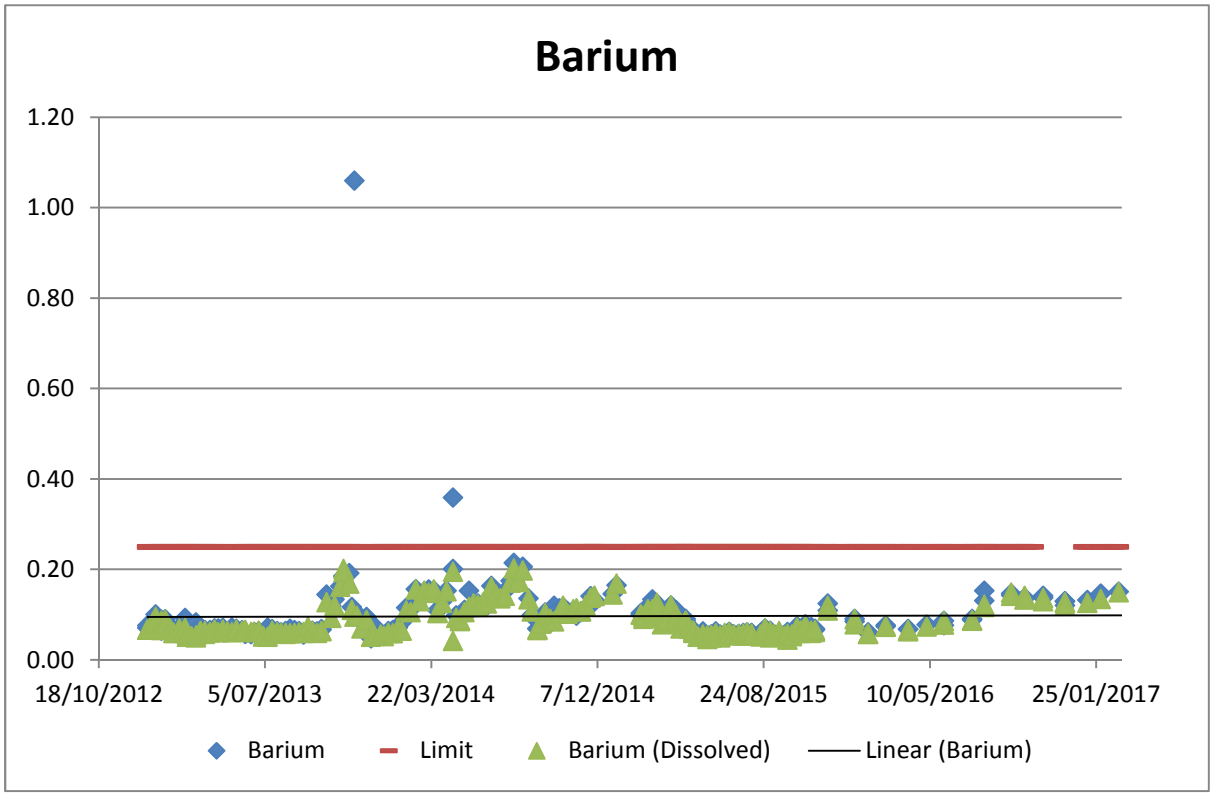
Sulphate exceeded the limits on several occasions in late 2012 and early 2013, however has been below the limit since mid 2013. The pH and chloride at LDP001 have been trending upwards over time, with lithium exceeding a few times in 2014.

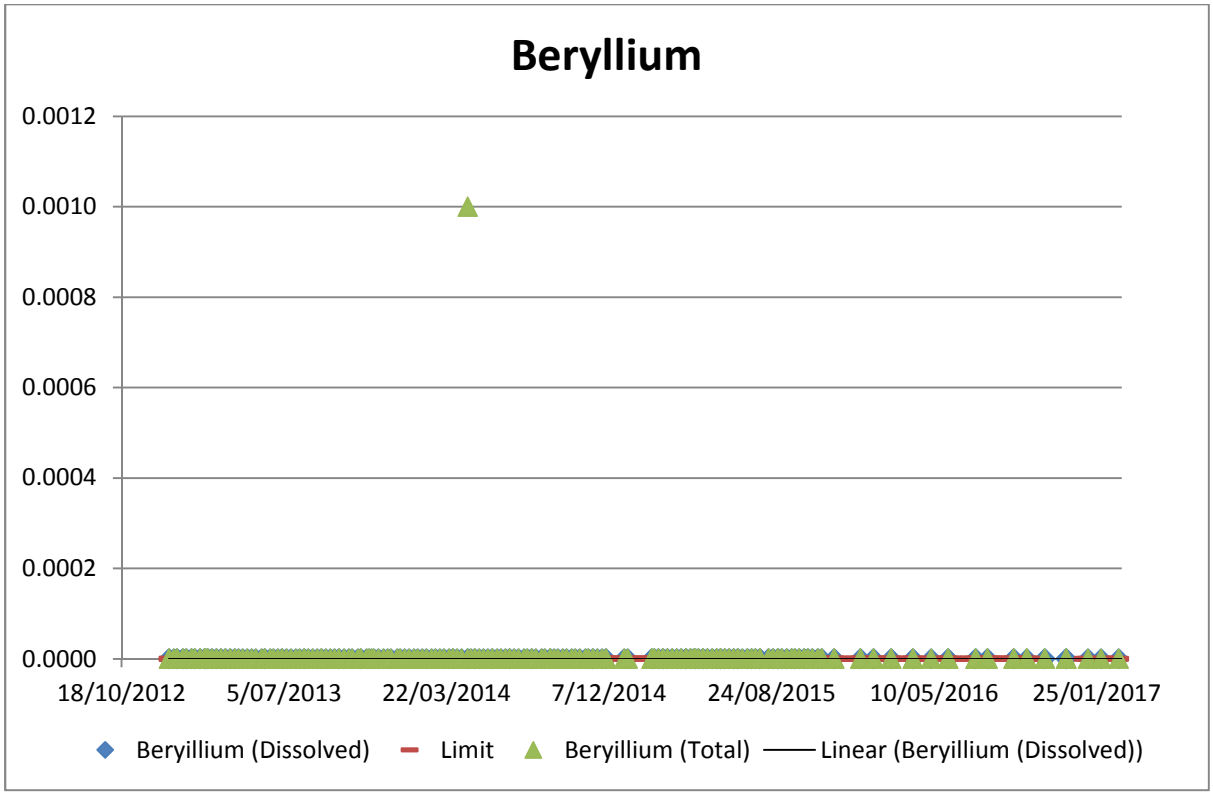
TSS may exceed the limits at times, but this generally aligns with overflows from Graunch's Dam through LDP001, rather then the water discharged from the underground Fassifern Seam.

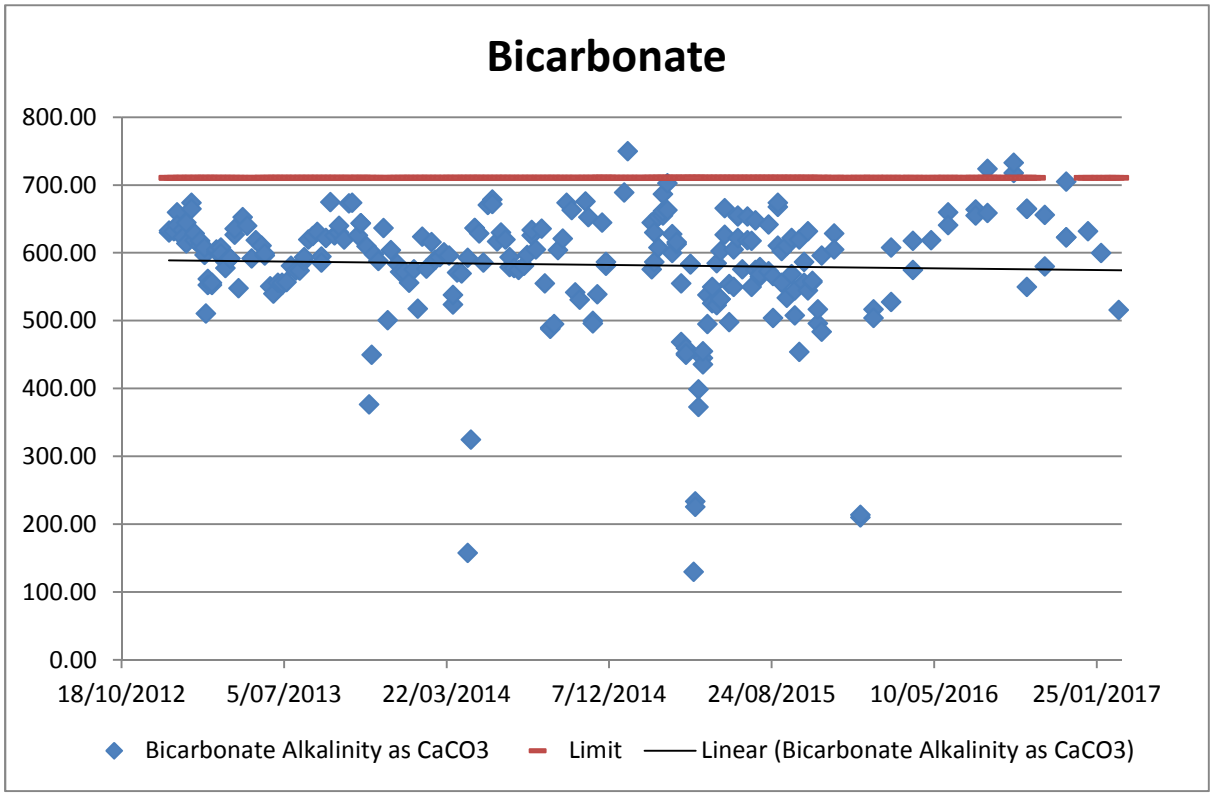

Aluminium
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
18/10/2012
5/07/2013
22/03/2014
7/12/2014
24/08/2015
10/05/2016
25/01/2017
Aluminium (Dissolved)
Limit
Aluminium (Total)
Linear (Aluminium (Dissolved))

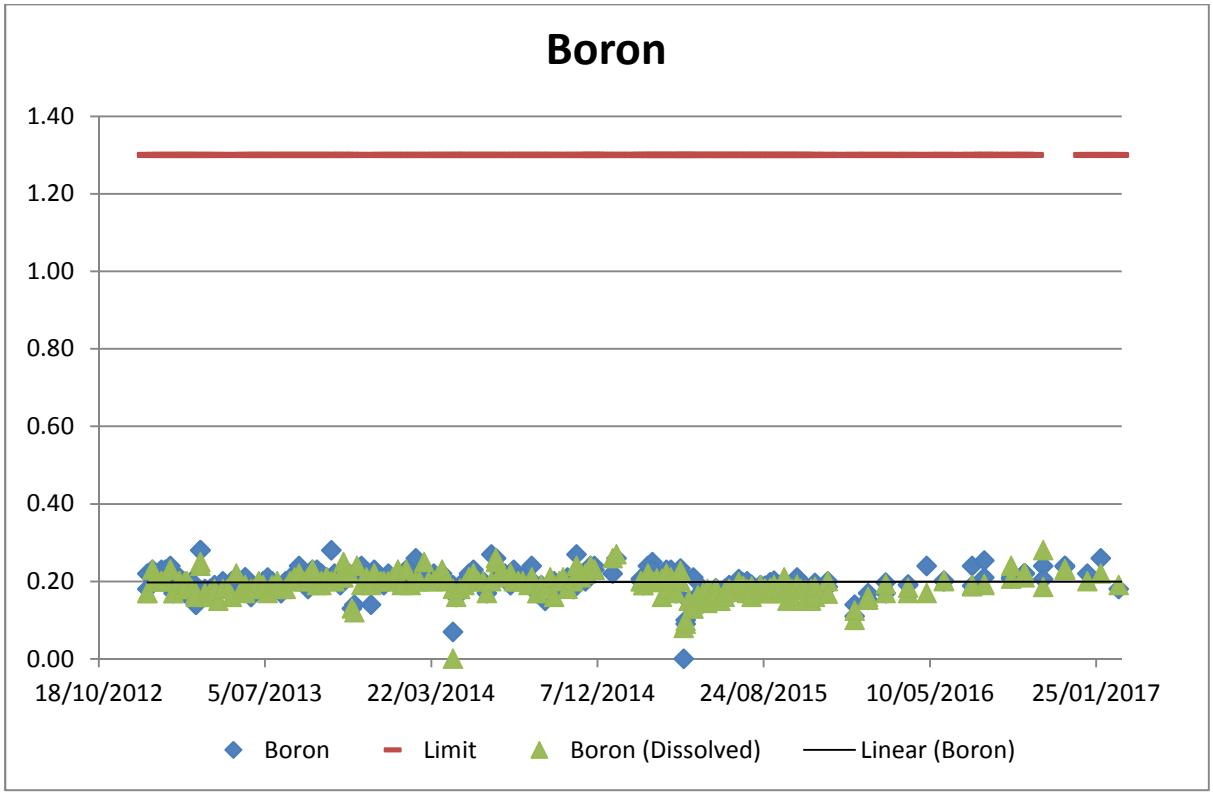

Antimony
0.0035
0.0030
0.0025
0.0020
0.0015
0.0010
0.0005
0.0000
18/10/2012
5/07/2013
22/03/2014
7/12/2014
24/08/2015
10/05/2016
25/01/2017
Antimony (Dissolved)
Limit
Antimony
Linear (Antimony (Dissolved))

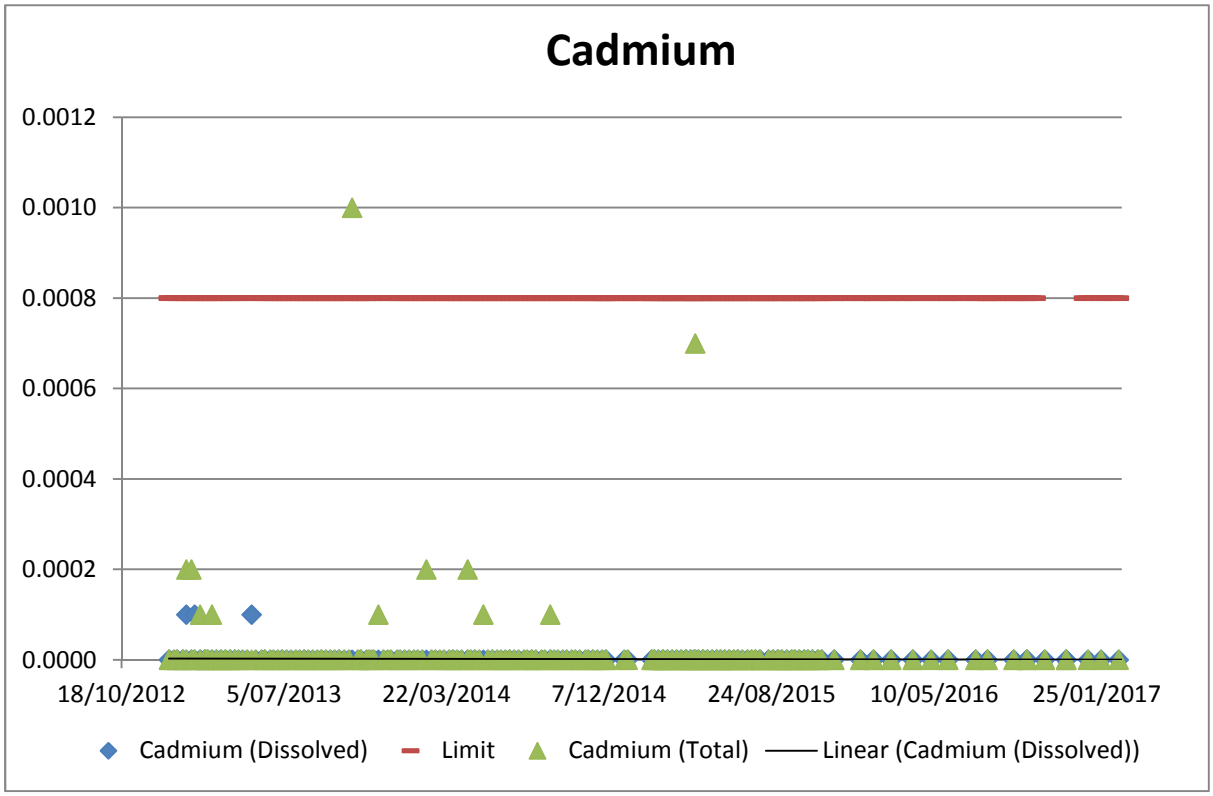

Arsenic
0.016
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
18/10/2012
5/07/2013
22/03/2014
7/12/2014
24/08/2015
10/05/2016
25/01/2017
Arsenic (Total)
Limit
Arsenic (Dissolved)
Linear (Arsenic (Total))

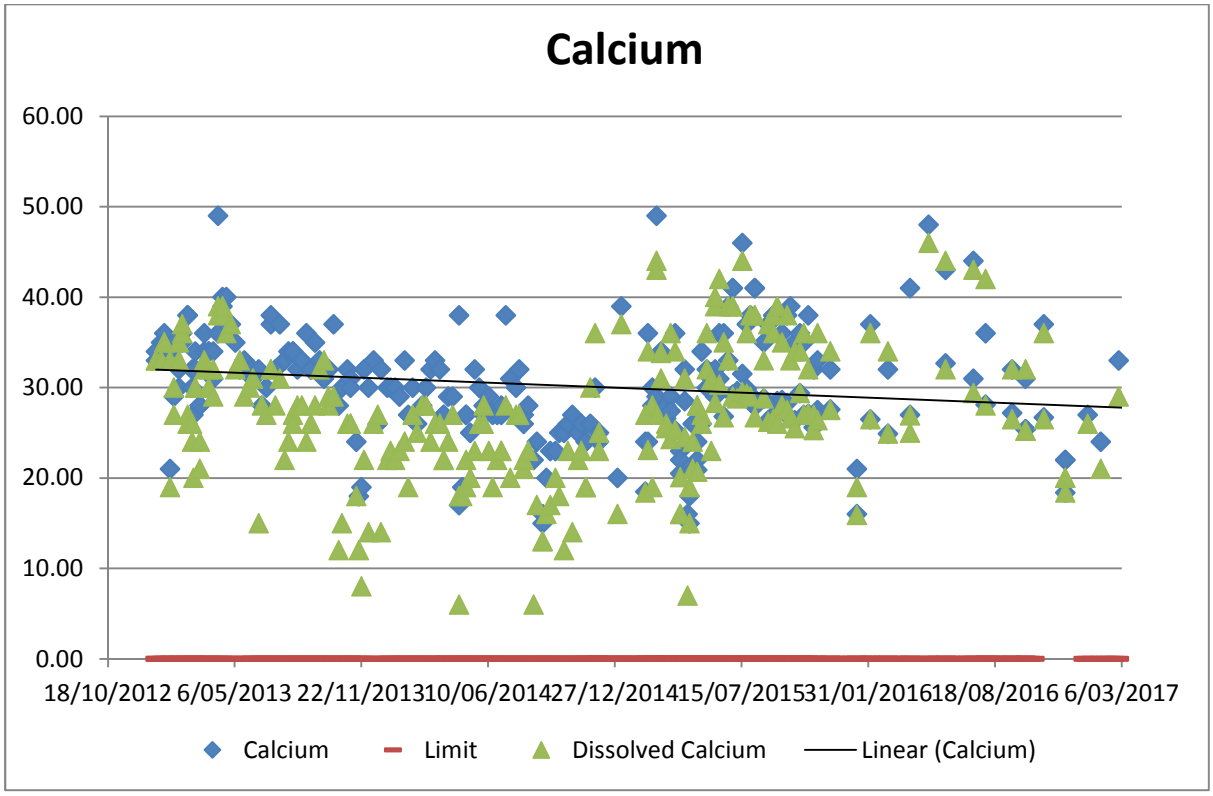

Barium
1.20
1.00
0.80
0.60
0.40
0.20
0.00
18/10/2012
5/07/2013
22/03/2014
7/12/2014
24/08/2015
10/05/2016
25/01/2017
Barium
Limit
Barium (Dissolved)
Linear (Barium)

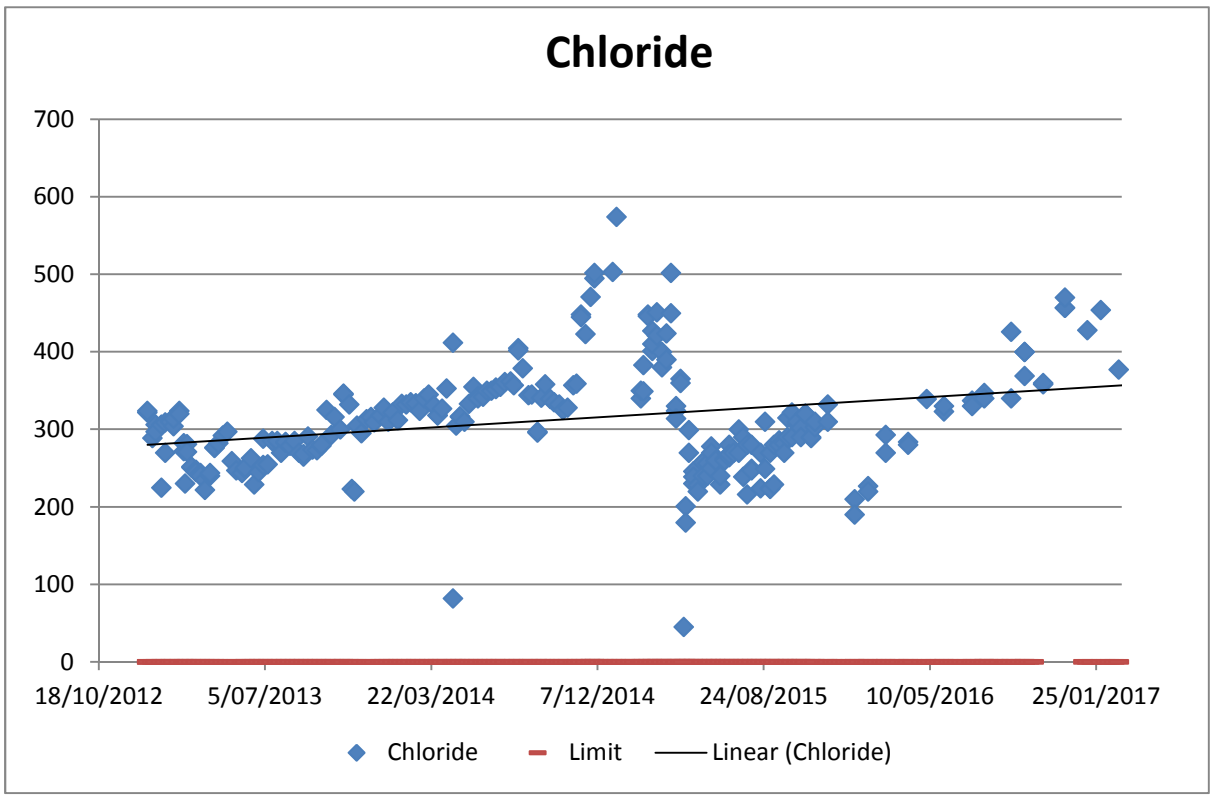

Beryllium
0.0012
0.0010
0.0008
0.0006
0.0004
0.0002
0.0000
18/10/2012
5/07/2013
22/03/2014
7/12/2014
24/08/2015
10/05/2016
25/01/2017
Beryllium (Dissolved)
Limit
Beryllium (Total)
Linear (Beryllium (Dissolved))

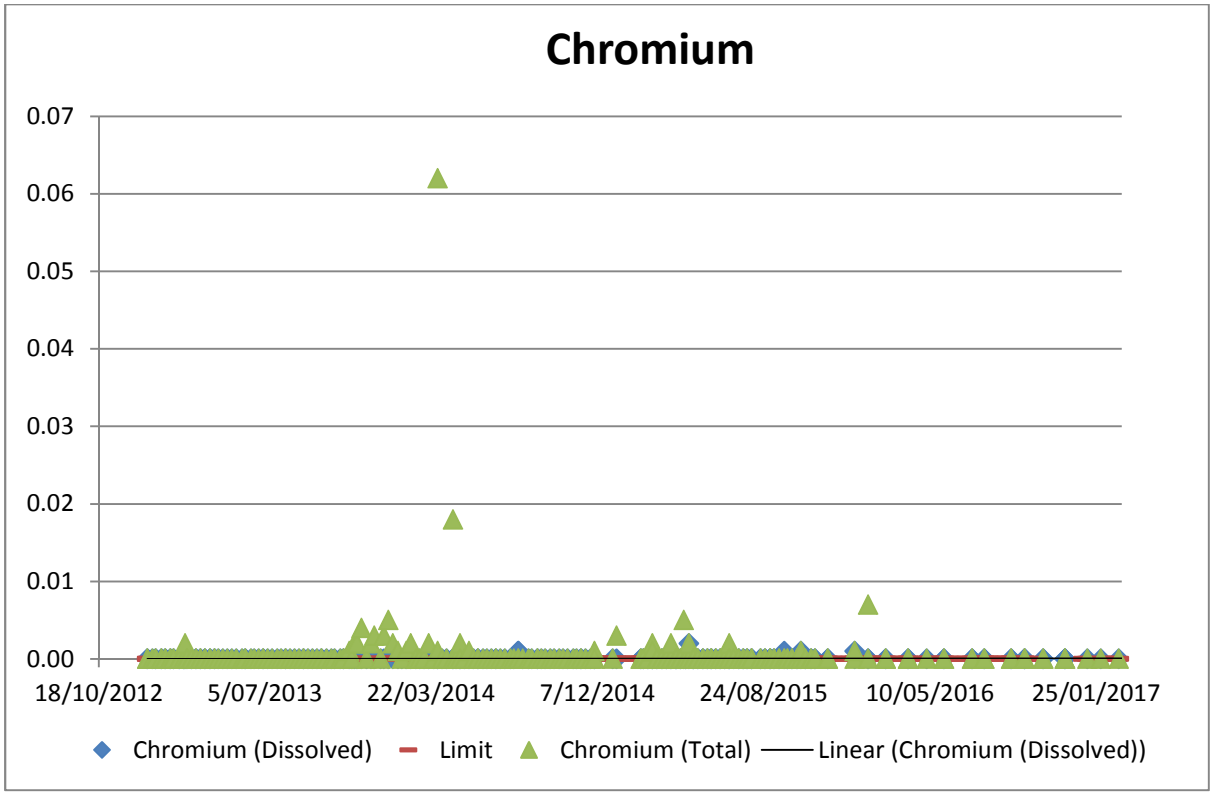

Bicarbonate
800.00
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
18/10/2012
5/07/2013
22/03/2014
7/12/2014
24/08/2015
10/05/2016
25/01/2017
Bicarbonate Alkalinity as CaCO3
Limit
Linear (Bicarbonate Alkalinity as CaCO3)

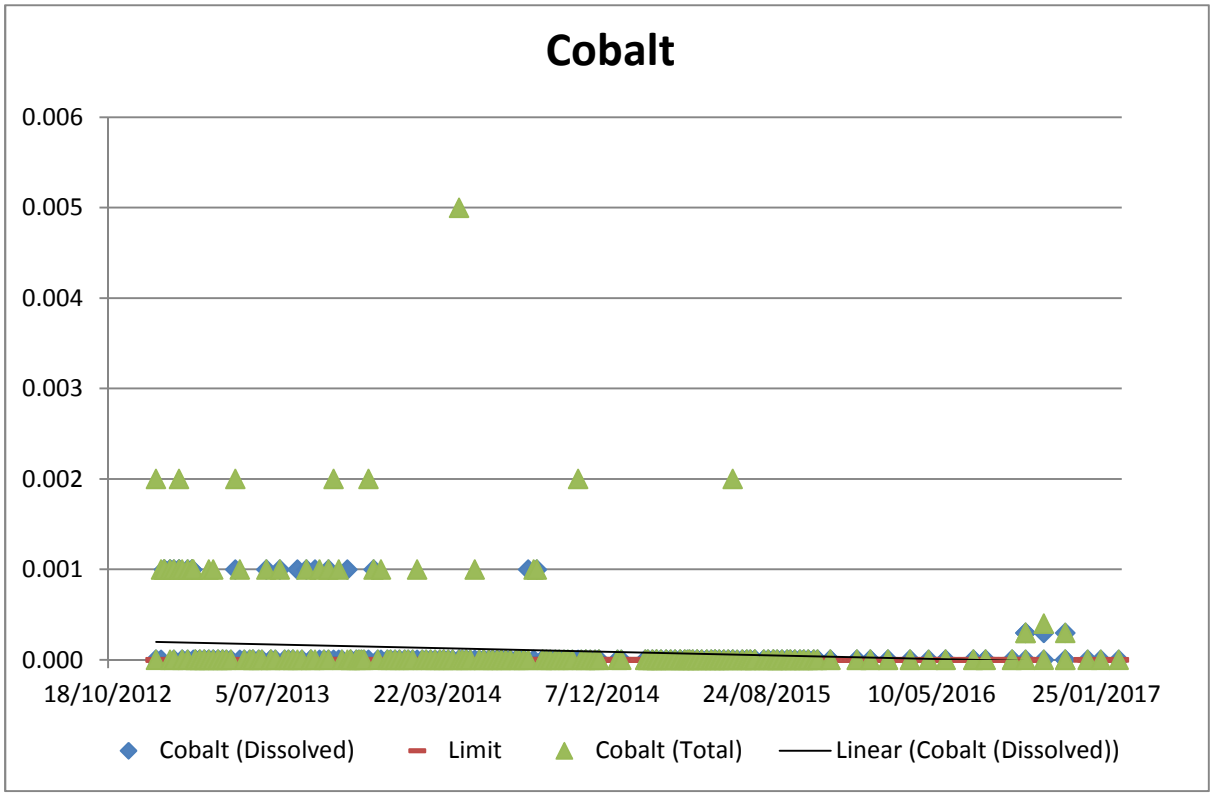

Boron
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
18/10/2012
5/07/2013
22/03/2014
7/12/2014
24/08/2015
10/05/2016
25/01/2017
Boron
Limit
Boron (Dissolved)
Linear (Boron)

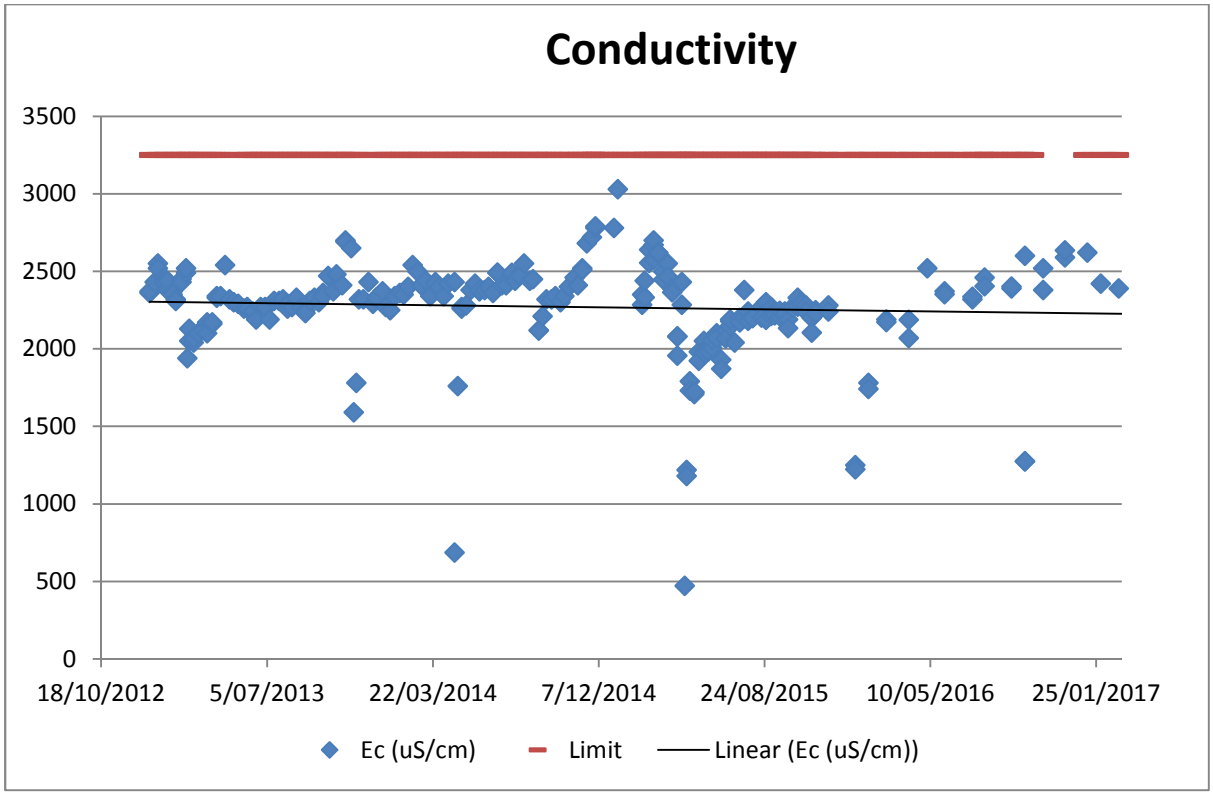

Cadmium
0.0012
0.0010
0.0008
0.0006
0.0004
0.0002
0.0000
18/10/2012
5/07/2013
22/03/2014
7/12/2014
24/08/2015
10/05/2016
25/01/2017
Cadmium (Dissolved)
Limit
Cadmium (Total)
Linear (Cadmium (Dissolved))

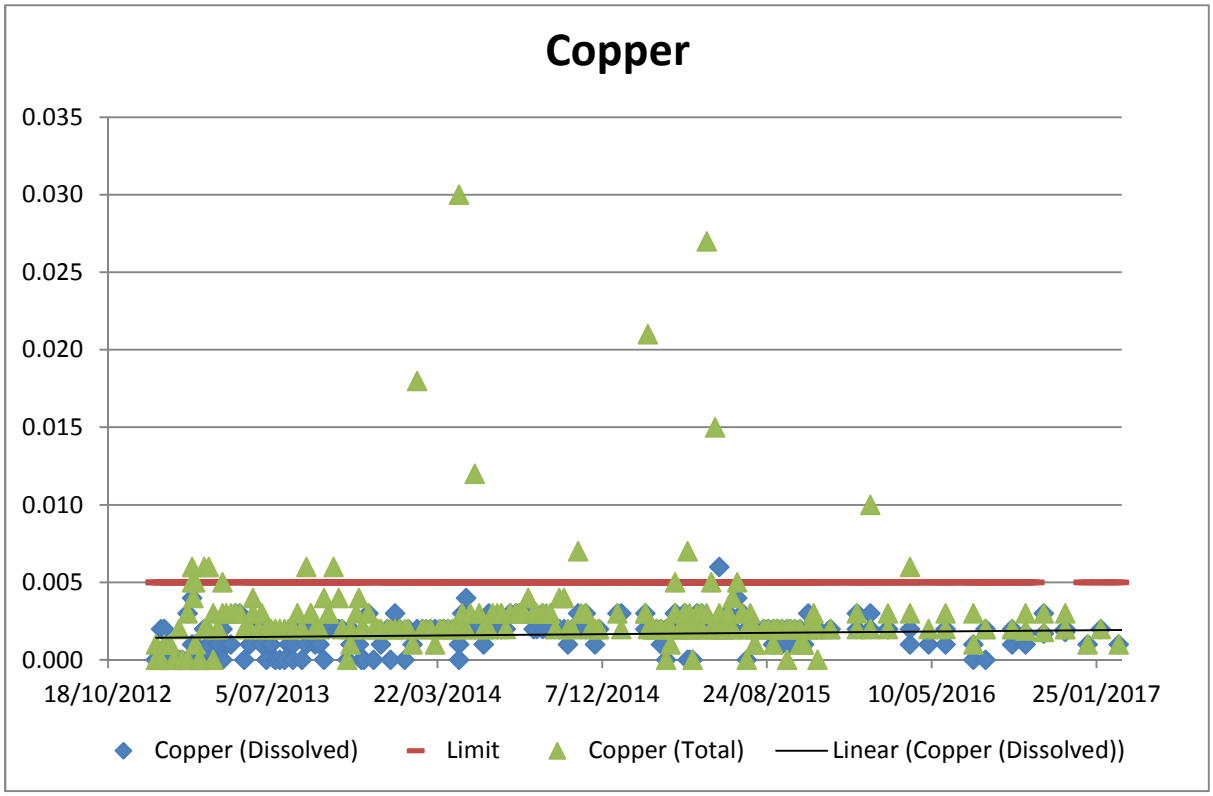

Calcium
60.00
50.00
40.00
30.00
20.00
10.00
0.00
18/10/2012 6/05/2013 22/11/2013 10/06/2014 27/12/2014 15/07/2015 31/01/2016 18/08/2016 6/03/2017
Calcium
Limit
Dissolved Calcium
Linear (Calcium)

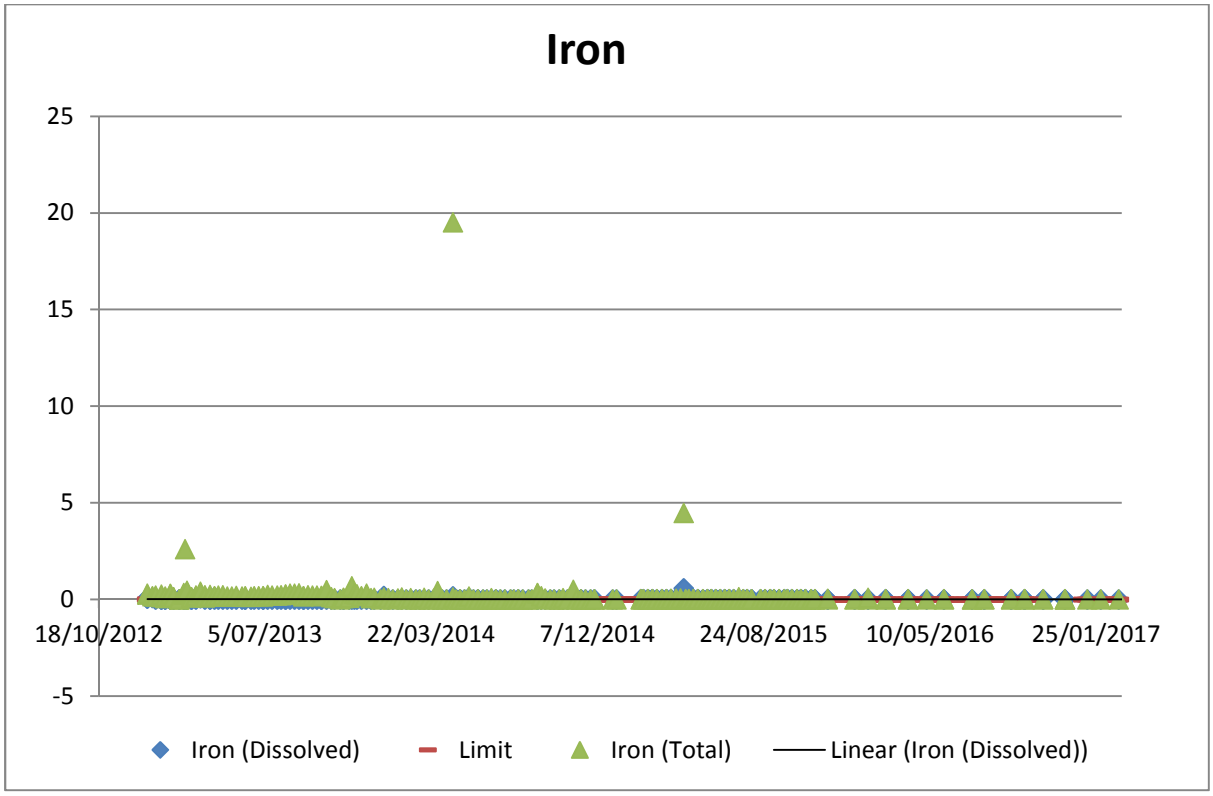

Chloride
700
600
500
400
300
200
100
0
18/10/2012 5/07/2013 22/03/2014 7/12/2014 24/08/2015 10/05/2016 25/01/2017
Chloride
Limit
Linear (Chloride)

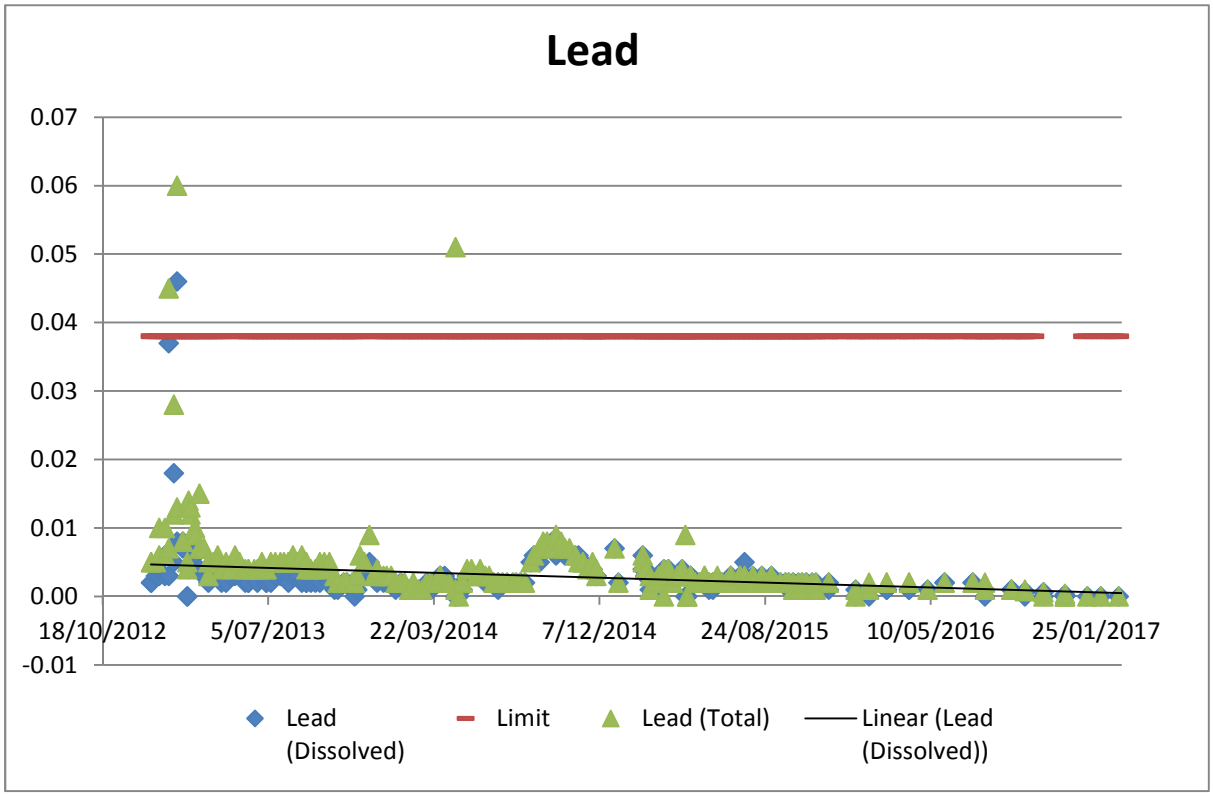

Chromium
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
18/10/2012
5/07/2013
22/03/2014
7/12/2014
24/08/2015
10/05/2016
25/01/2017
Chromium (Dissolved)
Limit
Chromium (Total)
Linear (Chromium (Dissolved))

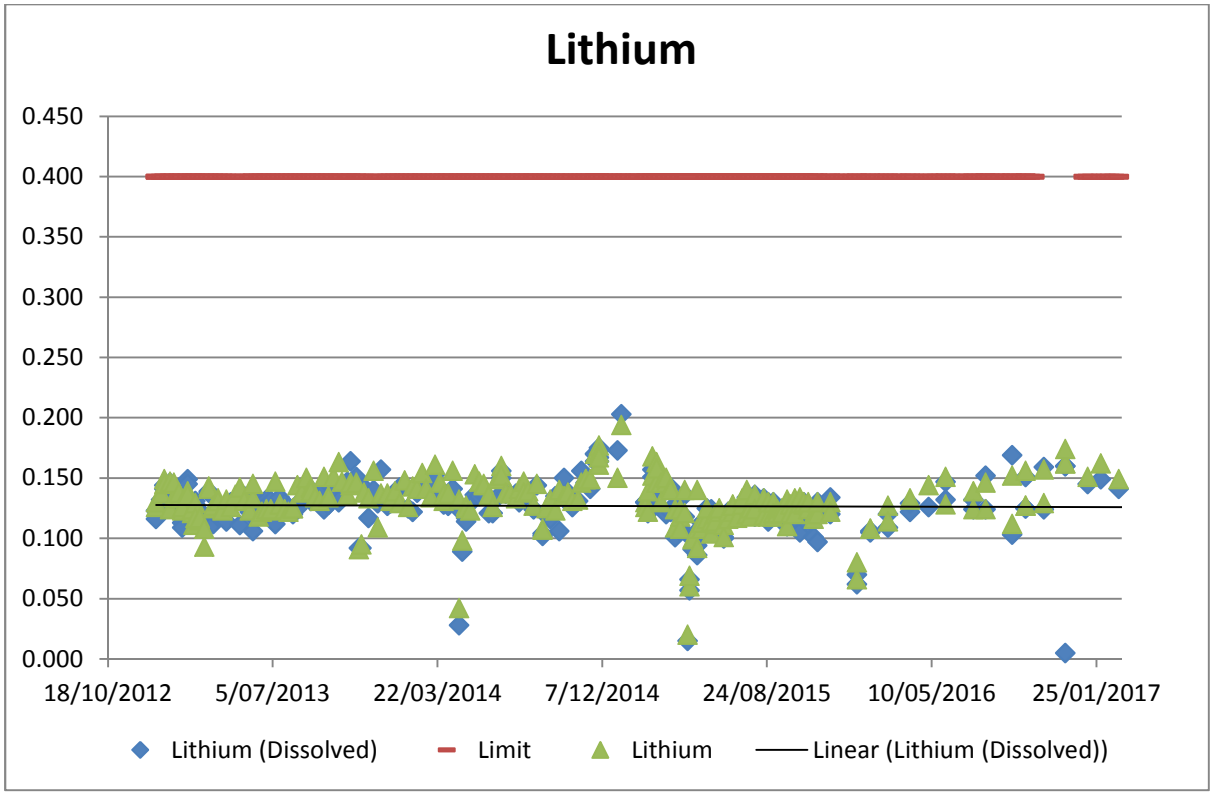

Cobalt
0.006
0.005
0.004
0.003
0.002
0.001
0.000
18/10/2012
5/07/2013
22/03/2014
7/12/2014
24/08/2015
10/05/2016
25/01/2017
Cobalt (Dissolved)
Limit
Cobalt (Total)
Linear (Cobalt (Dissolved))

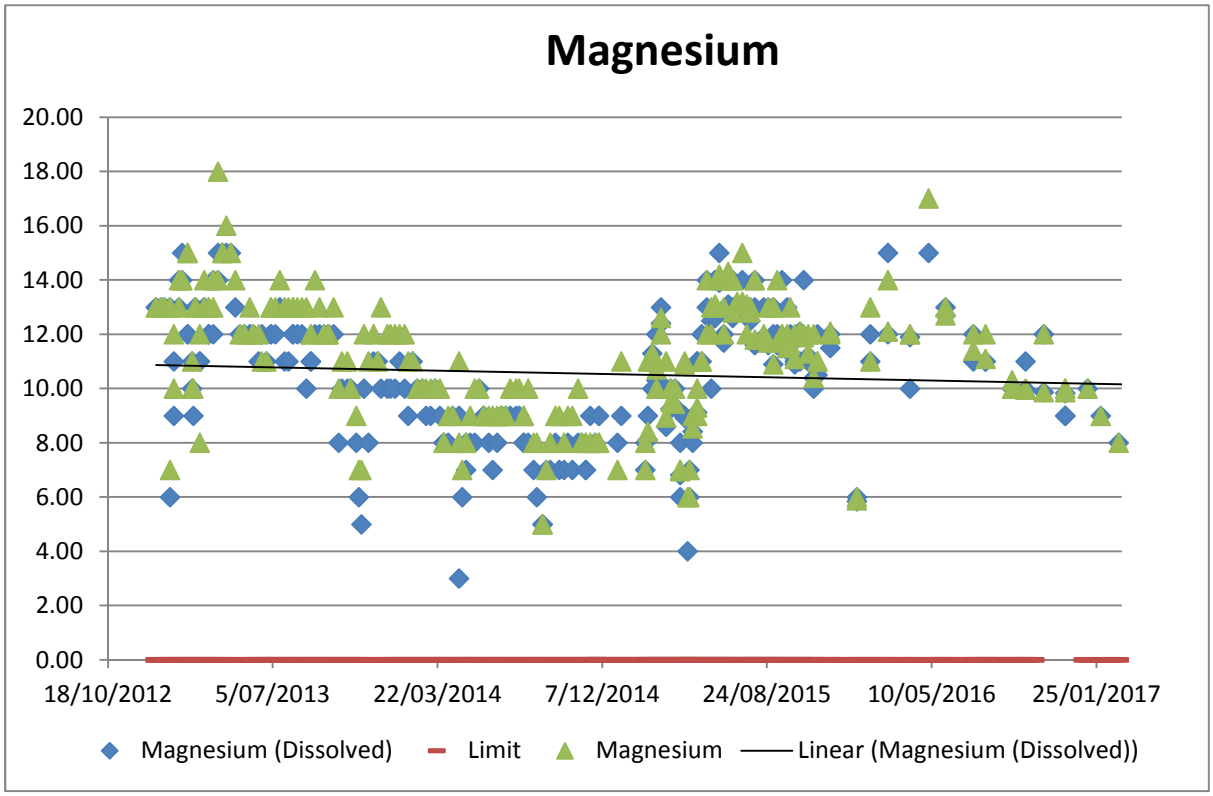

Conductivity
3500
3000
2500
2000
1500
1000
500
0
18/10/2012
5/07/2013
22/03/2014
7/12/2014
24/08/2015
10/05/2016
25/01/2017
Ec (uS/cm)
Limit
Linear (Ec (uS/cm))

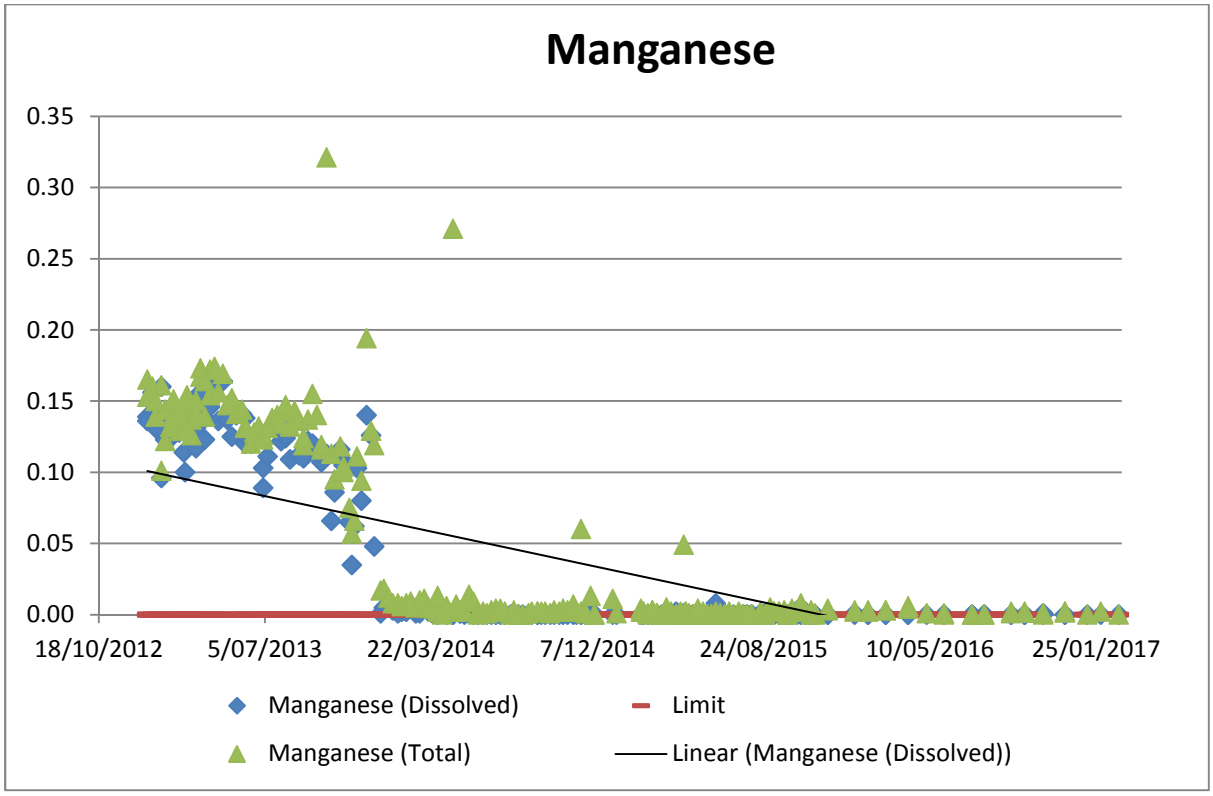

Copper
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
18/10/2012
5/07/2013
22/03/2014
7/12/2014
24/08/2015
10/05/2016
25/01/2017
Copper (Dissolved)
Limit
Copper (Total)
Linear (Copper (Dissolved))

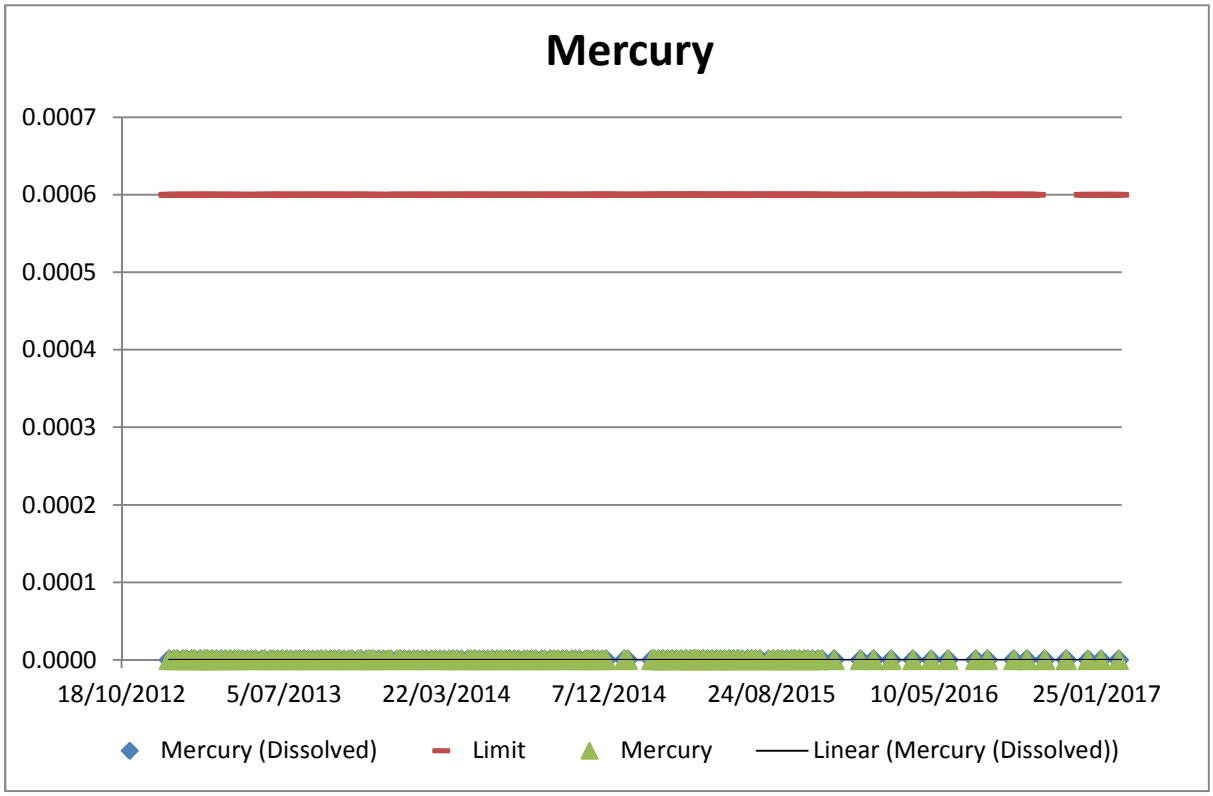

Iron
25
20
15
10
5
0
-5
18/10/2012
5/07/2013
22/03/2014
7/12/2014
24/08/2015
10/05/2016
25/01/2017
Iron (Dissolved)
Limit
Iron (Total)
Linear (Iron (Dissolved))

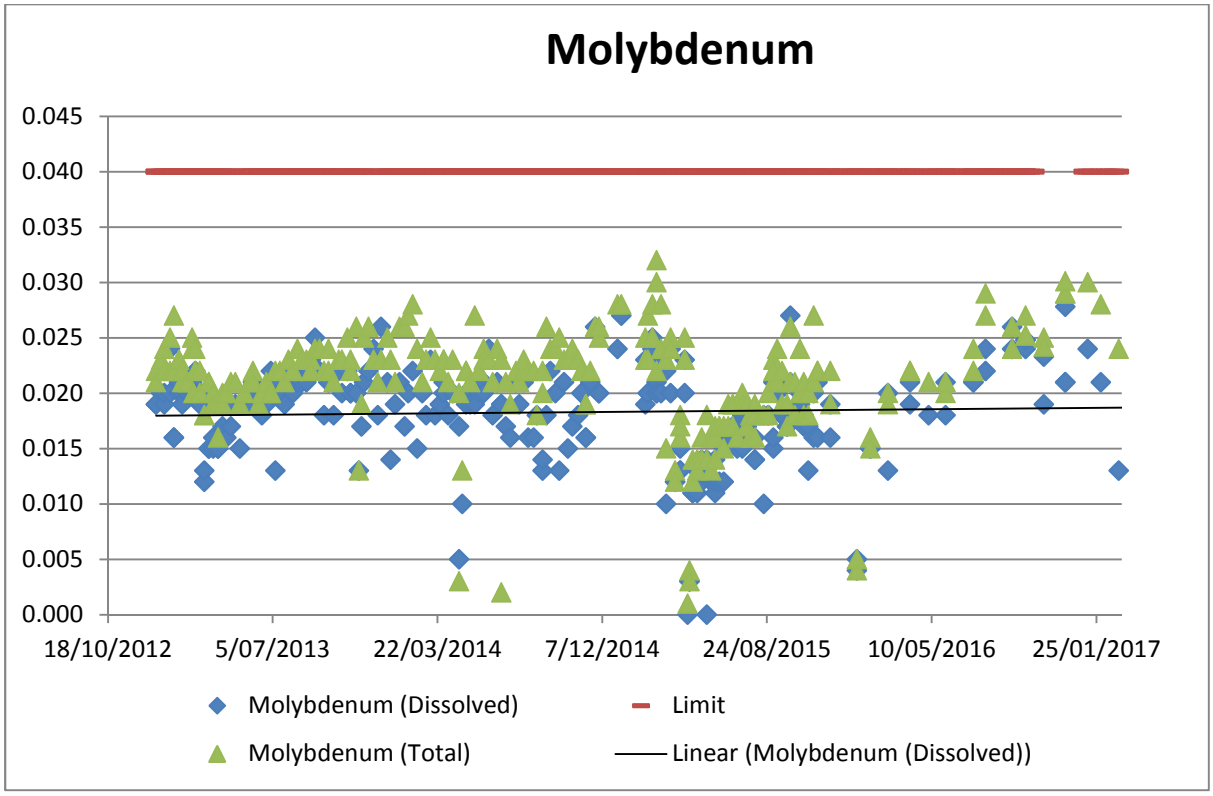

Lead
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
-0.01
18/10/2012
5/07/2013
22/03/2014
7/12/2014
24/08/2015
10/05/2016
25/01/2017
Lead (Dissolved)
Limit
Lead (Total)
Linear (Lead (Dissolved))

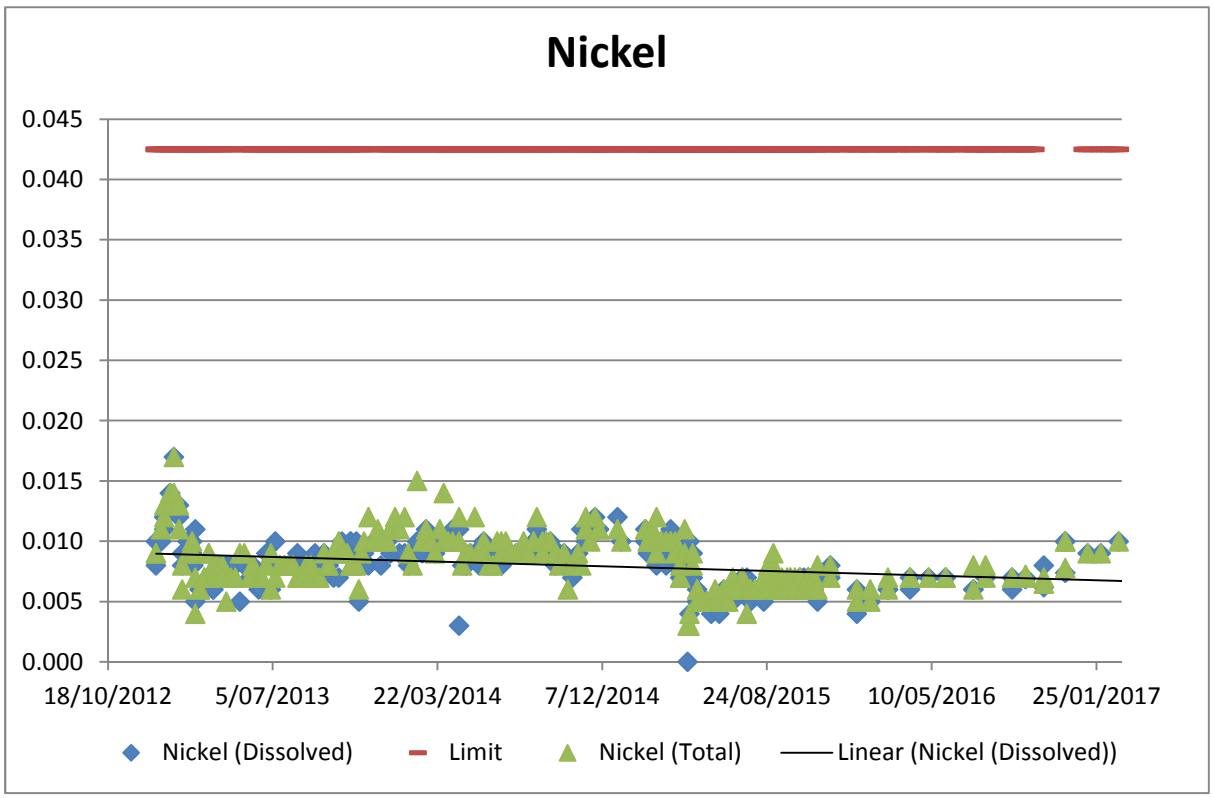

Lithium
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
18/10/2012
5/07/2013
22/03/2014
7/12/2014
24/08/2015
10/05/2016
25/01/2017
Lithium (Dissolved)
Limit
Lithium
Linear (Lithium (Dissolved))

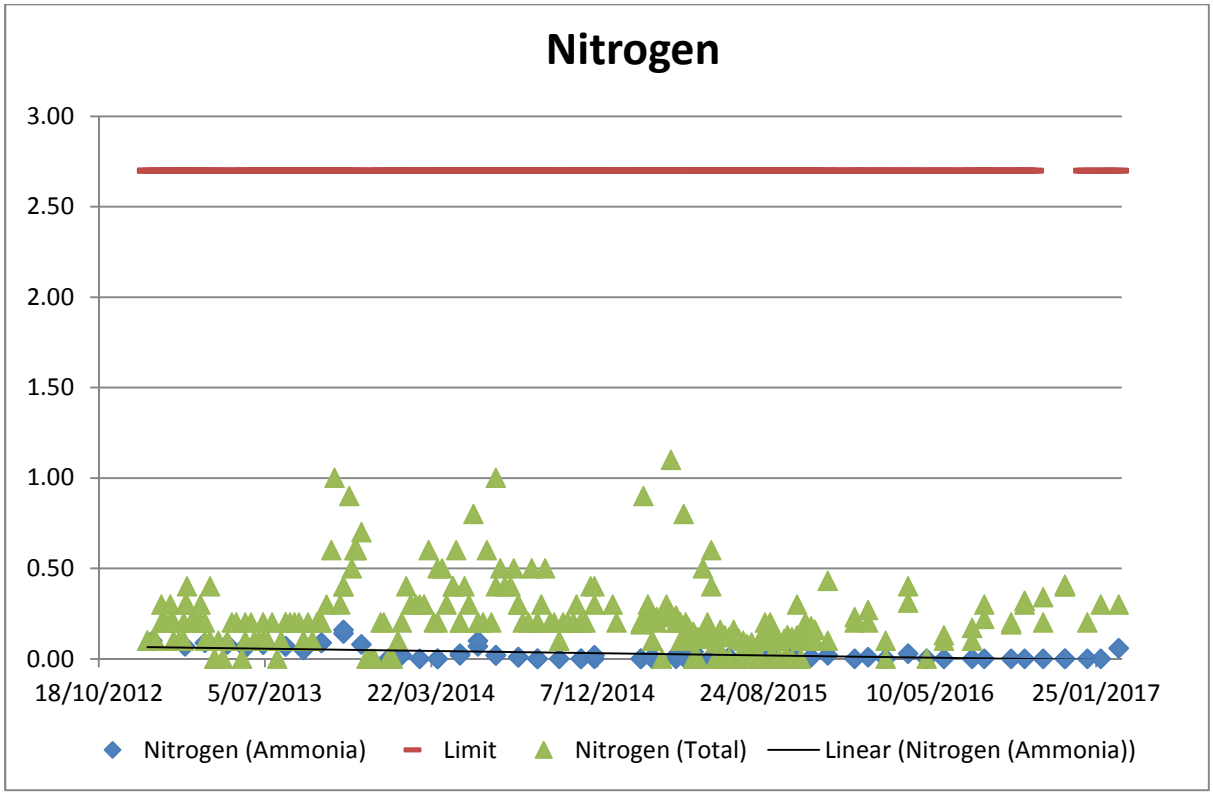

Magnesium
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
18/10/2012
5/07/2013
22/03/2014
7/12/2014
24/08/2015
10/05/2016
25/01/2017
Magnesium (Dissolved)
Limit
Magnesium
Linear (Magnesium (Dissolved))

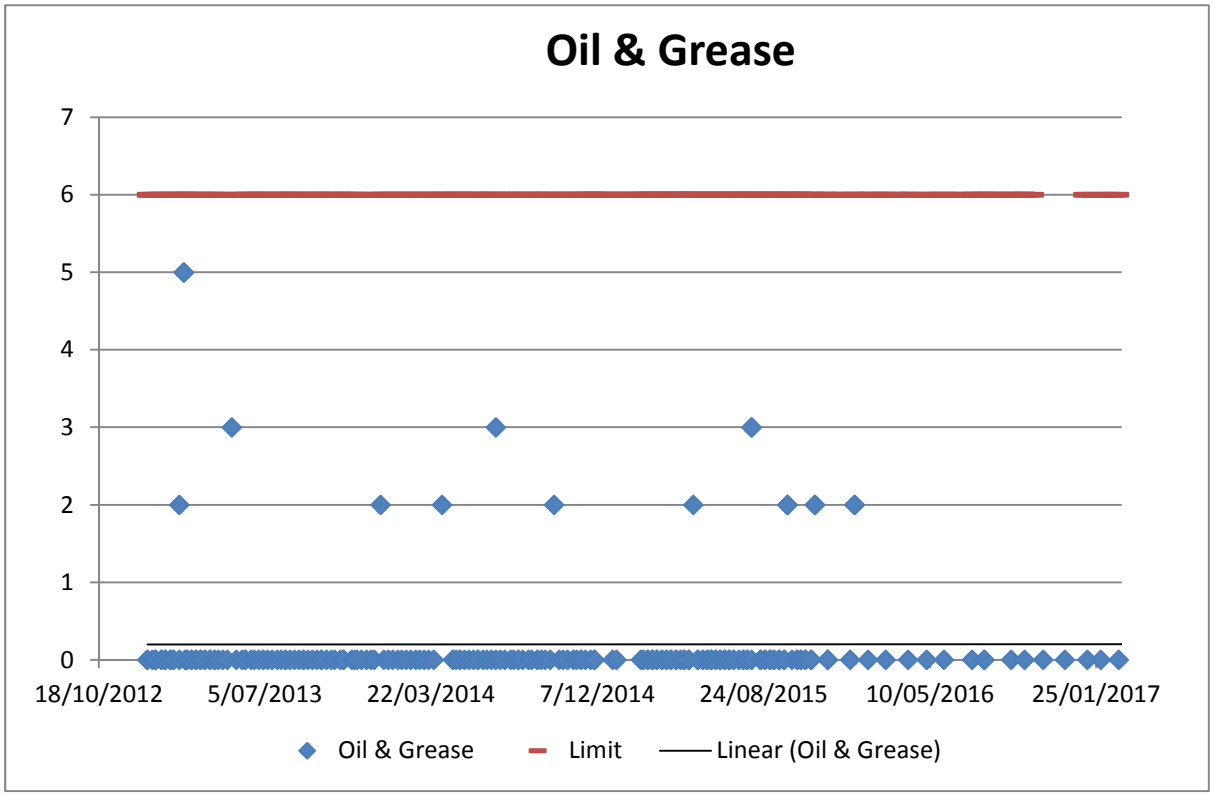

Manganese
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
18/10/2012
5/07/2013
22/03/2014
7/12/2014
24/08/2015
10/05/2016
25/01/2017
Manganese (Dissolved)
Limit
Manganese (Total)
Linear (Manganese (Dissolved))

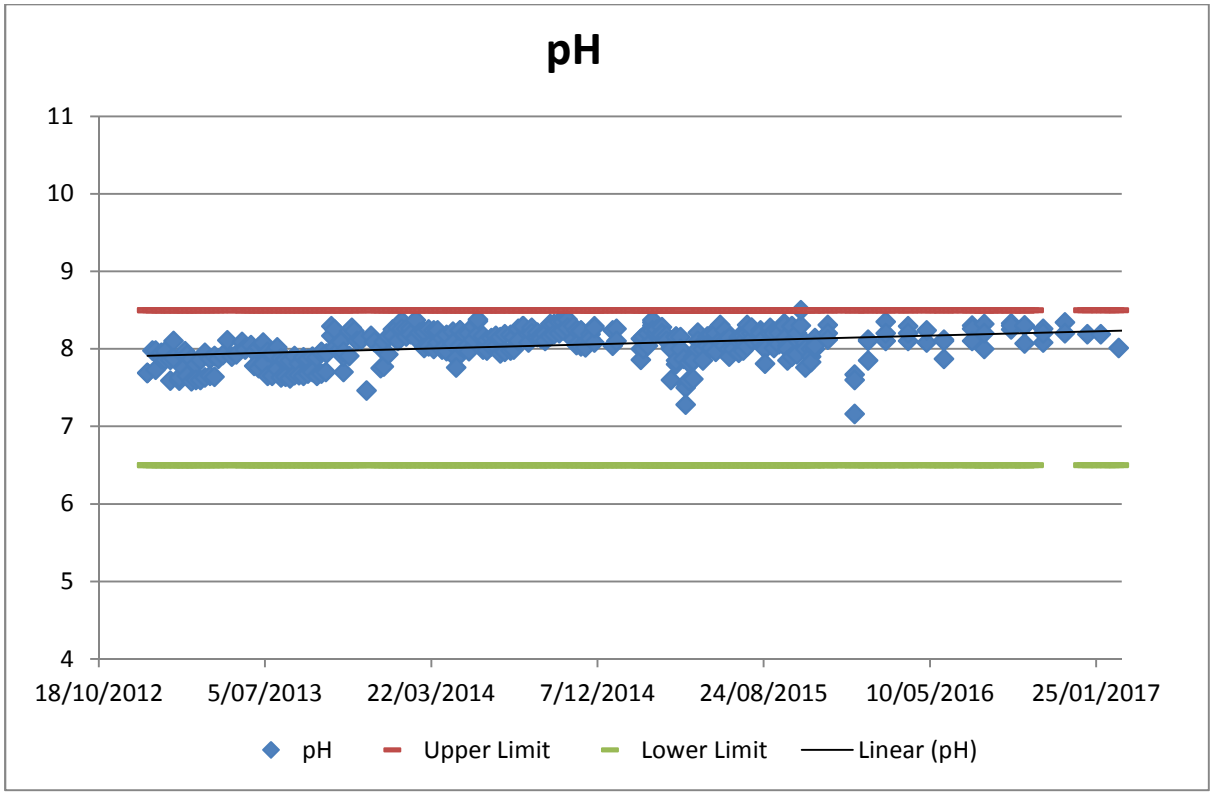

Mercury
0.0007
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0.0000
18/10/2012
5/07/2013
22/03/2014
7/12/2014
24/08/2015
10/05/2016
25/01/2017
Mercury (Dissolved)
Limit
Mercury
Linear (Mercury (Dissolved))

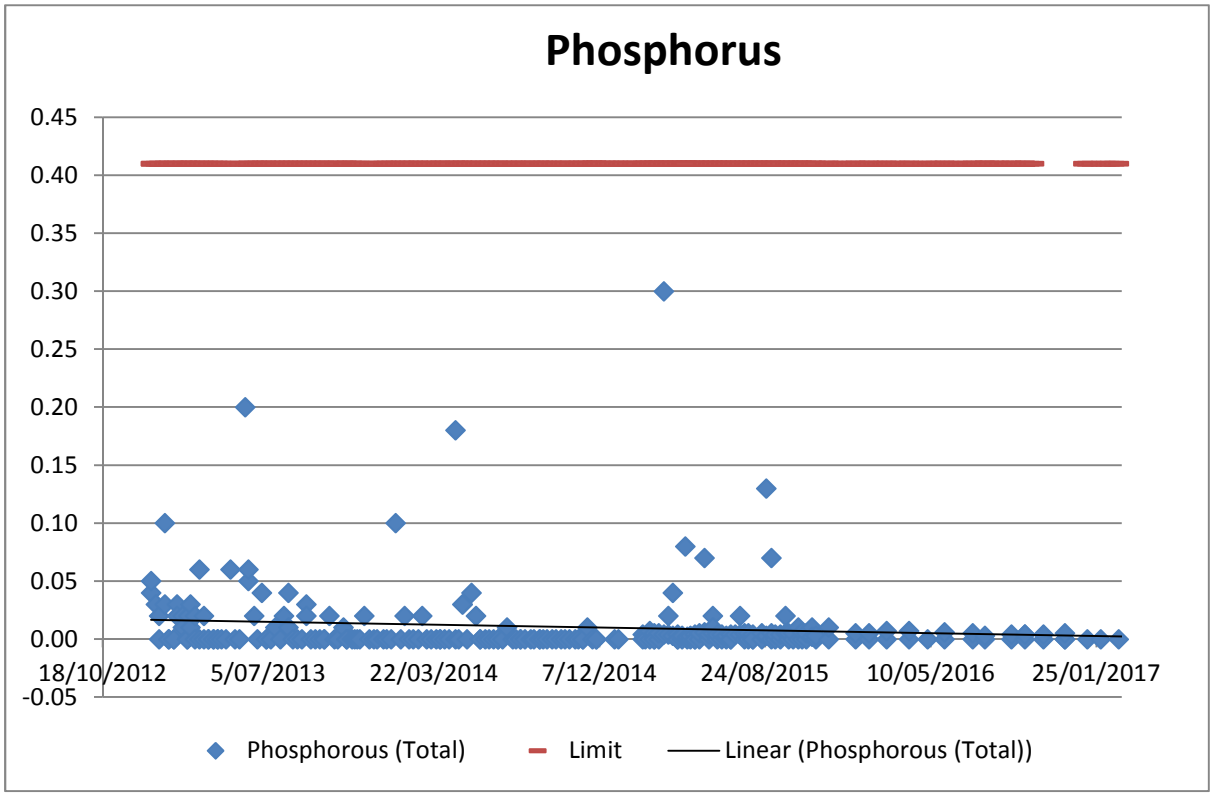

Molybdenum
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
18/10/2012
5/07/2013
22/03/2014
7/12/2014
24/08/2015
10/05/2016
25/01/2017
Molybdenum (Dissolved)
Limit
Molybdenum (Total)
Linear (Molybdenum (Dissolved))


Nickel
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
18/10/2012
5/07/2013
22/03/2014
7/12/2014
24/08/2015
10/05/2016
25/01/2017
Nickel (Dissolved)
Limit
Nickel (Total)
Linear (Nickel (Dissolved))


Nitrogen
3.00
2.50
2.00
1.50
1.00
0.50
0.00
18/10/2012
5/07/2013
22/03/2014
7/12/2014
24/08/2015
10/05/2016
25/01/2017
Nitrogen (Ammonia)
Limit
Nitrogen (Total)
Linear (Nitrogen (Ammonia))


Oil & Grease
7
6
5
4
3
2
1
0
18/10/2012
5/07/2013
22/03/2014
7/12/2014
24/08/2015
10/05/2016
25/01/2017
Oil & Grease
Limit
Linear (Oil & Grease)


pH
11
10
9
8
7
6
5
4
18/10/2012
5/07/2013
22/03/2014
7/12/2014
24/08/2015
10/05/2016
25/01/2017
pH
Upper Limit
Lower Limit
Linear (pH)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0.40
0.35
0.30
0.25
0.20
0.15
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0.05
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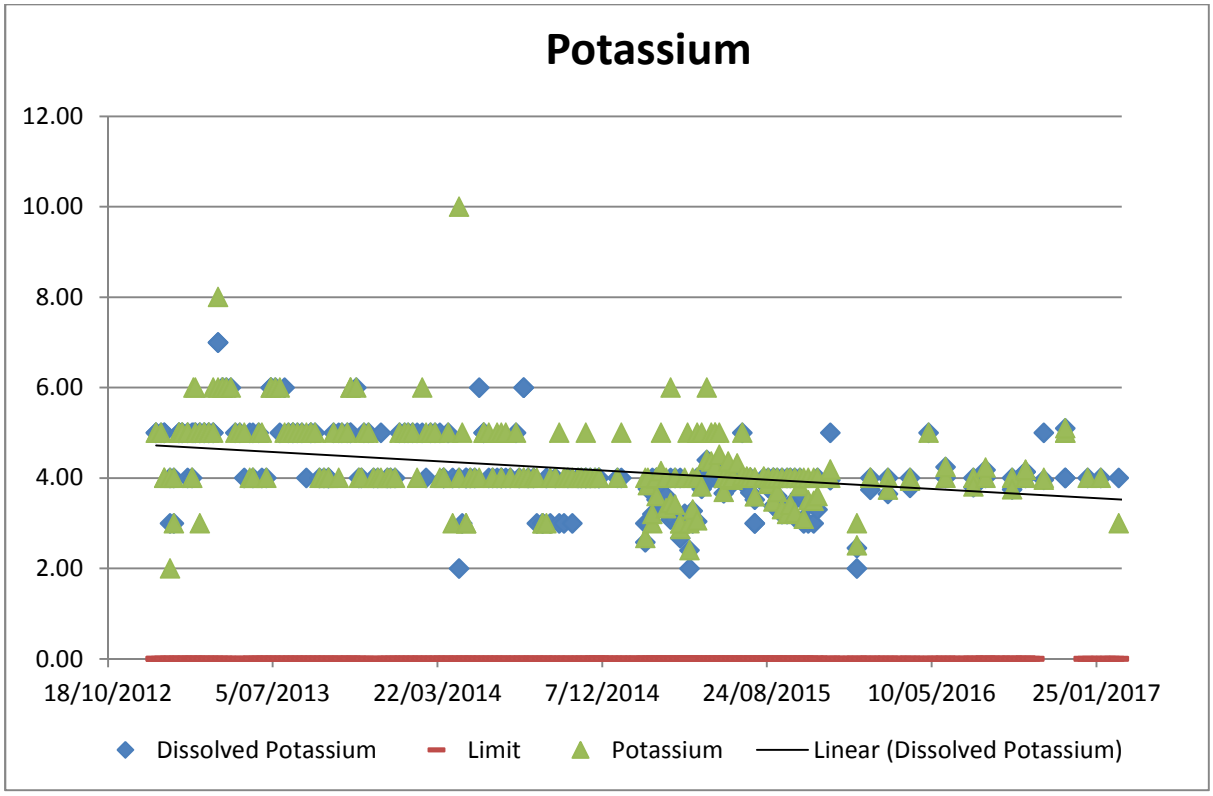
18/10/2012
5/07/2013
22/03/2014
7/12/2014
24/08/2015
10/05/2016
25/01/2017
Phosphorous (Total)
Limit
Linear (Phosphorous (Total))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10.00
8.00
6.00
4.00
2.00
0.00
18/10/2012
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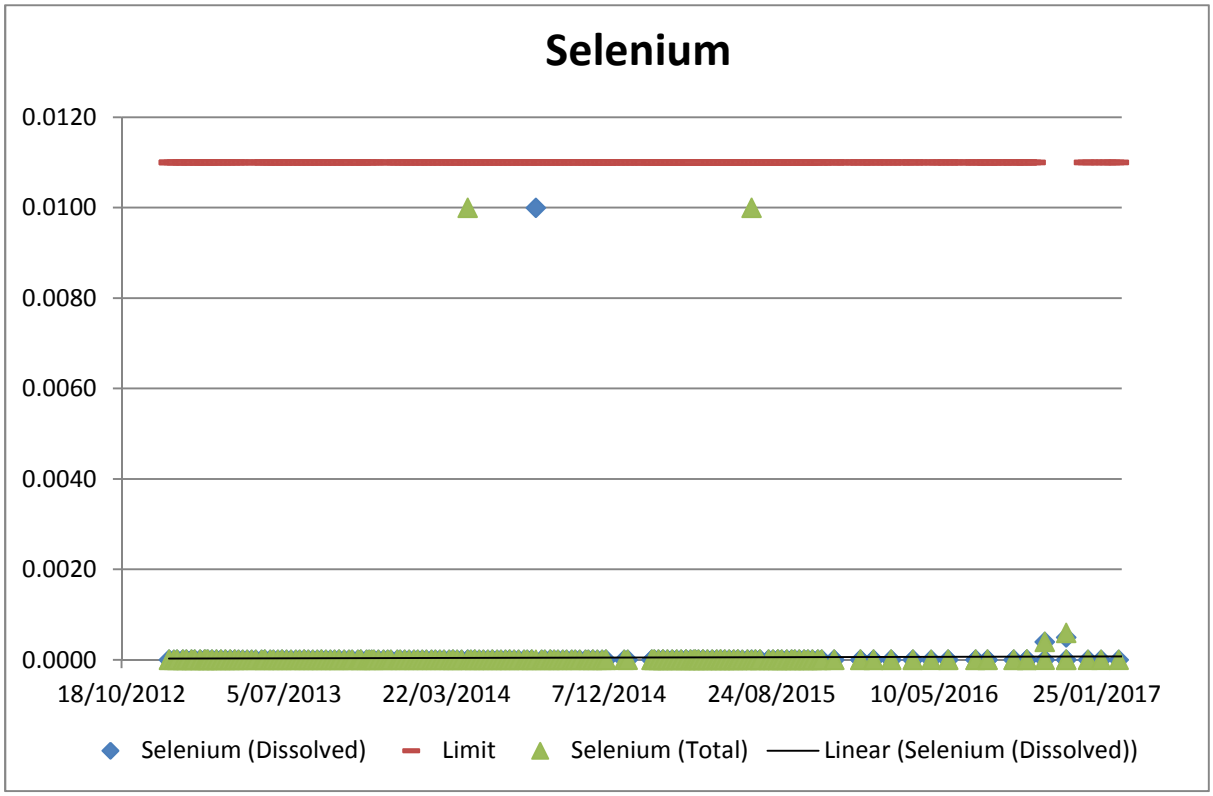
24/08/2015
10/05/2016
25/01/2017
Dissolved Potassium
Limit
Potassium
Linear (Dissolved Potassium)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0.0100
0.0080
0.0060
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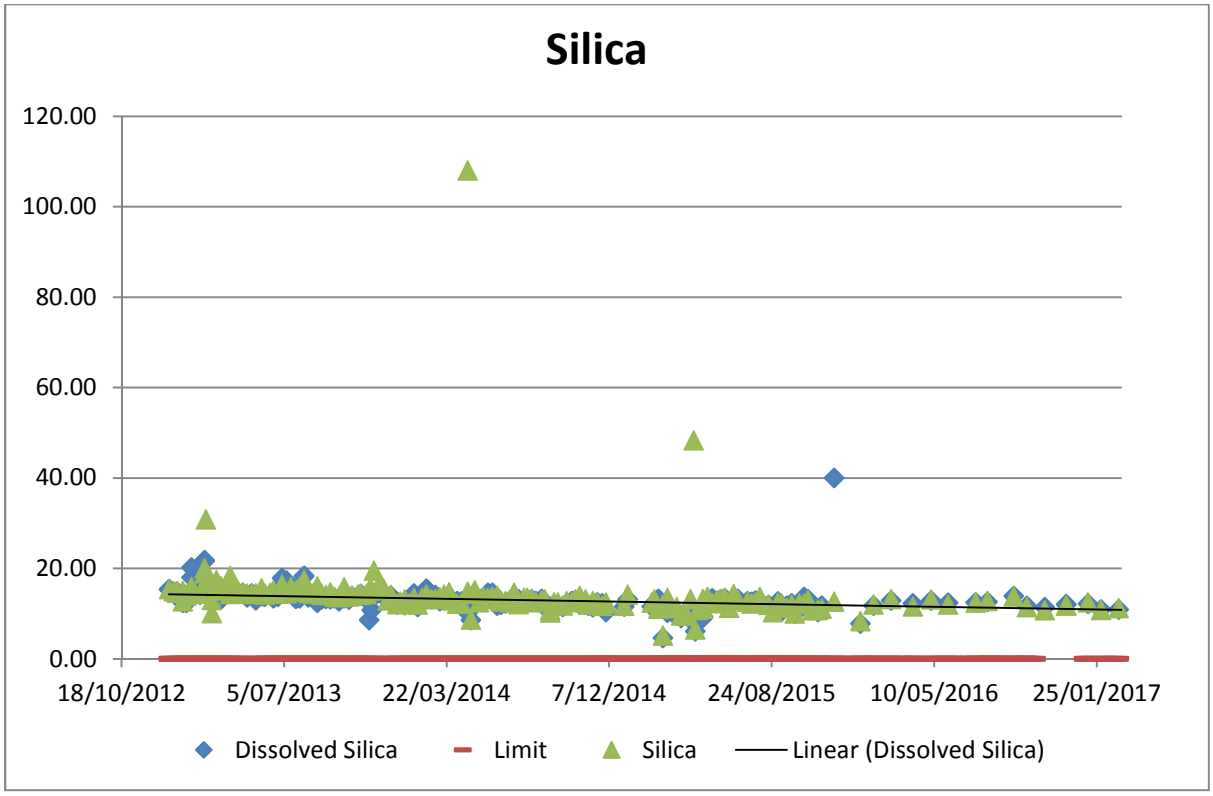
0.0020
0.0000
18/10/2012
5/07/2013
22/03/2014
7/12/2014
24/08/2015
10/05/2016
25/01/2017
Selenium (Dissolved)
Limit
Selenium (Total)
Linear (Selenium (Dissolved))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80.00
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40.00
20.00
0.00
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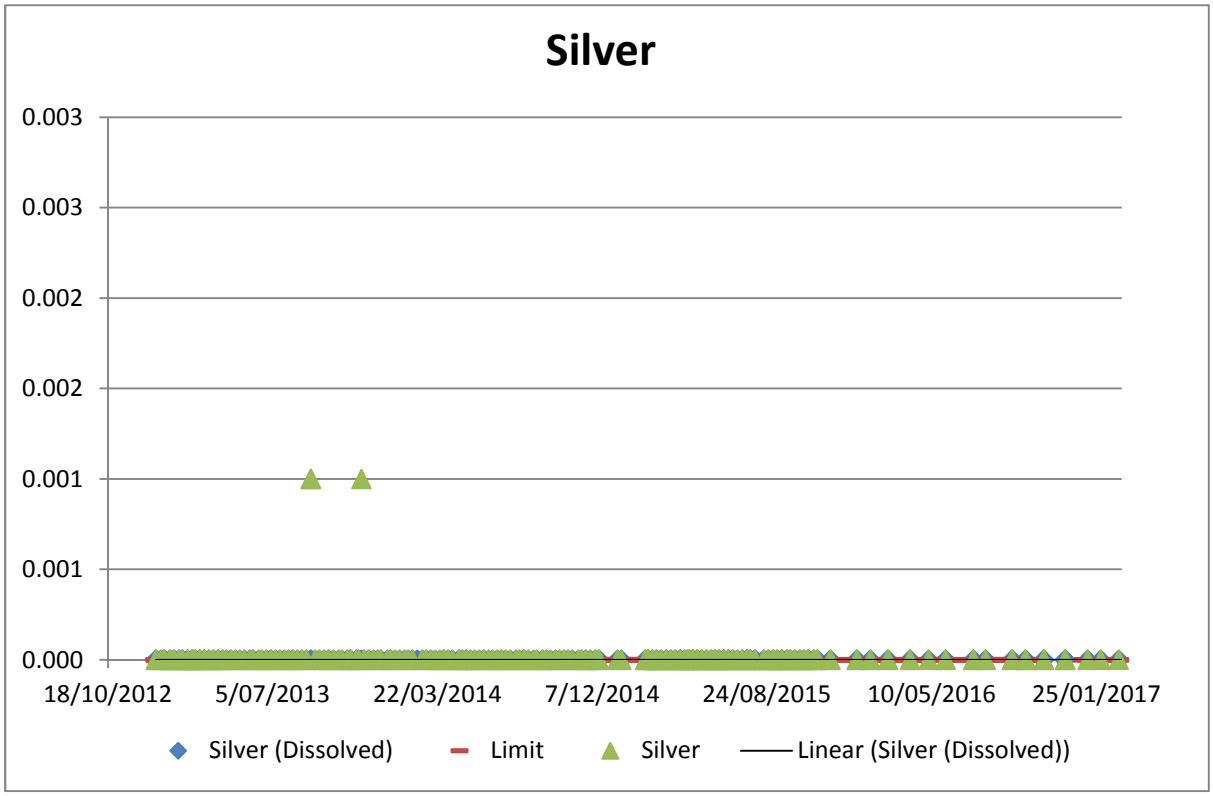
24/08/2015
10/05/2016
25/01/2017
Dissolved Silica
Limit
Silica
Linear (Dissolved Silica)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0.002
0.002
0.001
0.001
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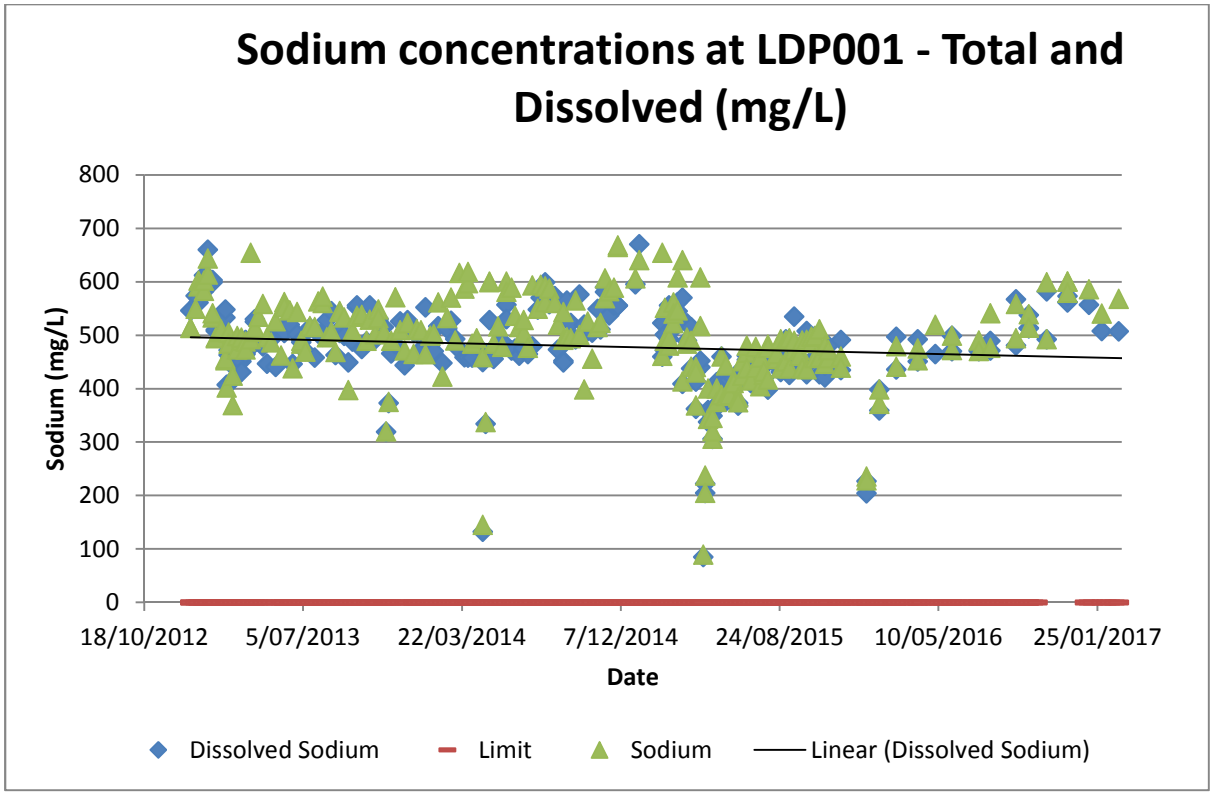
Silver (Dissolved)
Limit
Silver
Linear (Silver (Dissolved))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Sodium (mg/L)
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700
600
500
400
300
200
100
0
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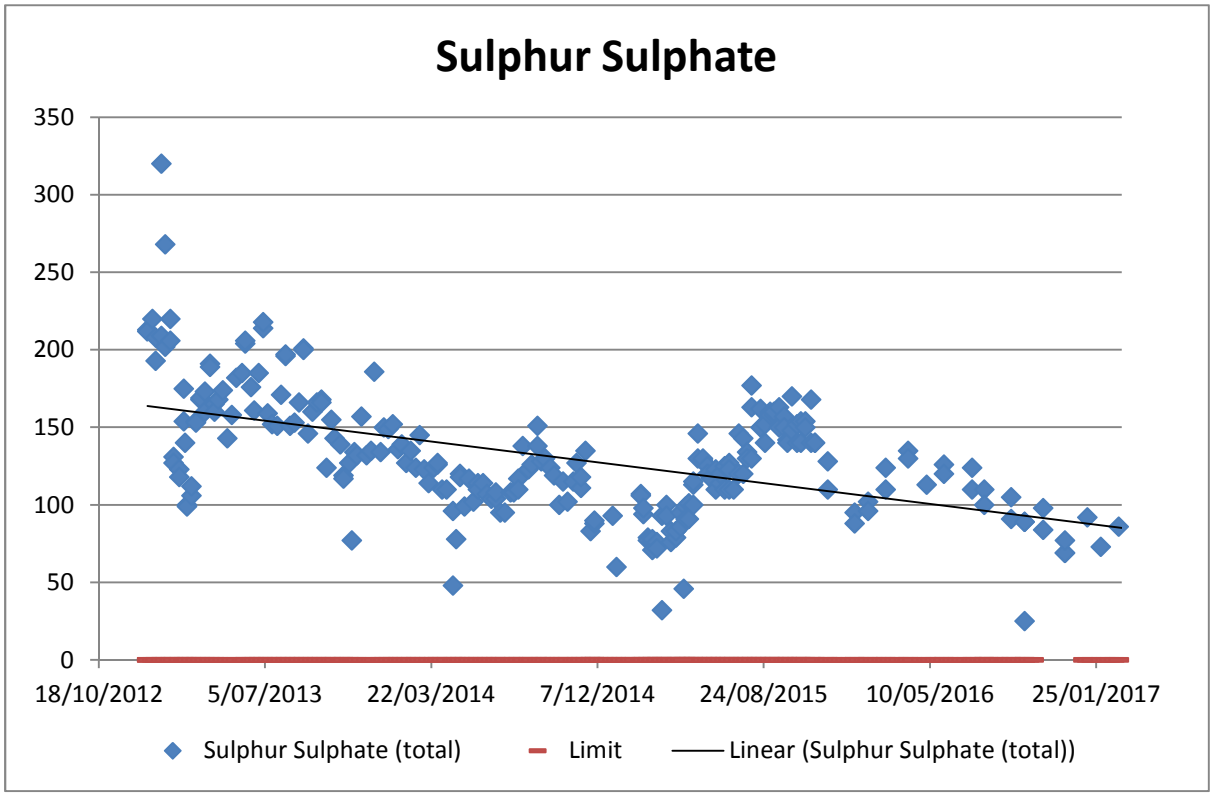
5/07/2013
22/03/2014
7/12/2014
24/08/2015
10/05/2016
25/01/2017
Date
Dissolved Sodium
Limit
Sodium
Linear (Dissolved Sodium)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250
200
150
100
50
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22/03/2014
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24/08/2015
10/05/2016
25/01/2017
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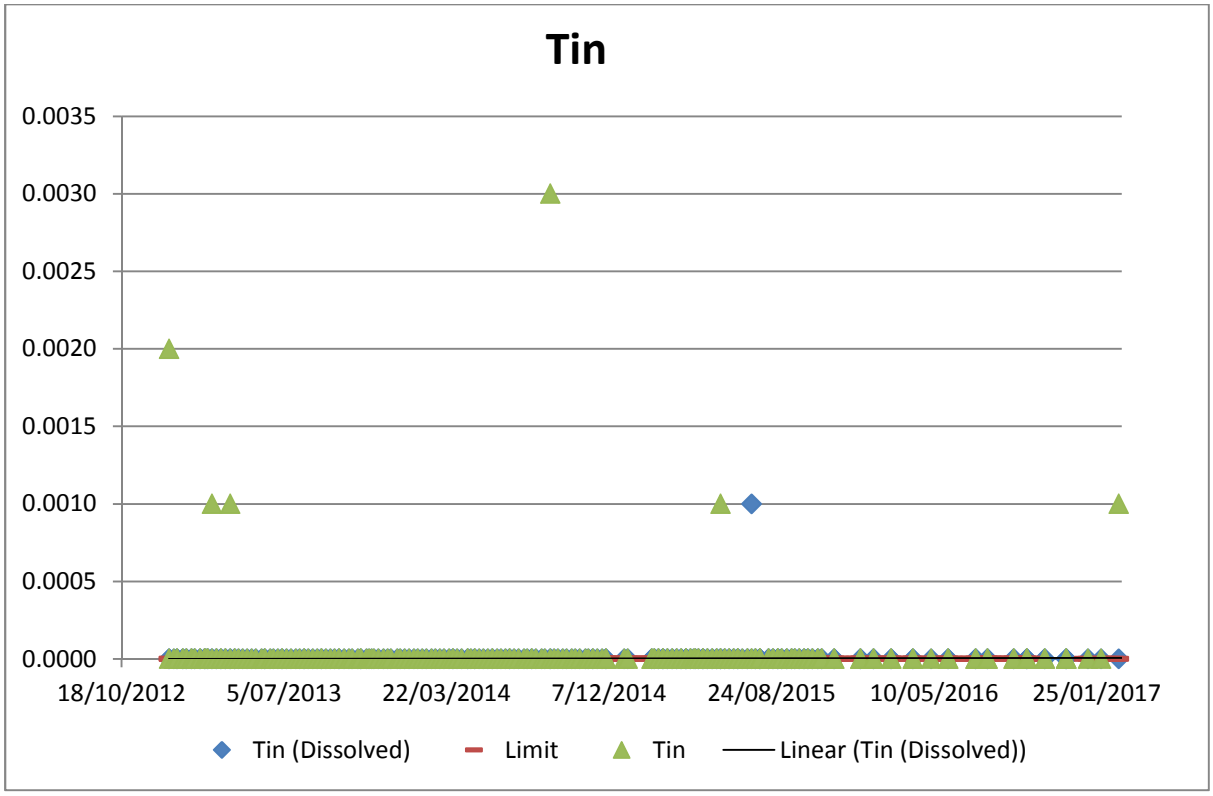
Limit
Linear (Sulphur Sulphate (total))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0.0030
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0.0020
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0.0010
0.0005
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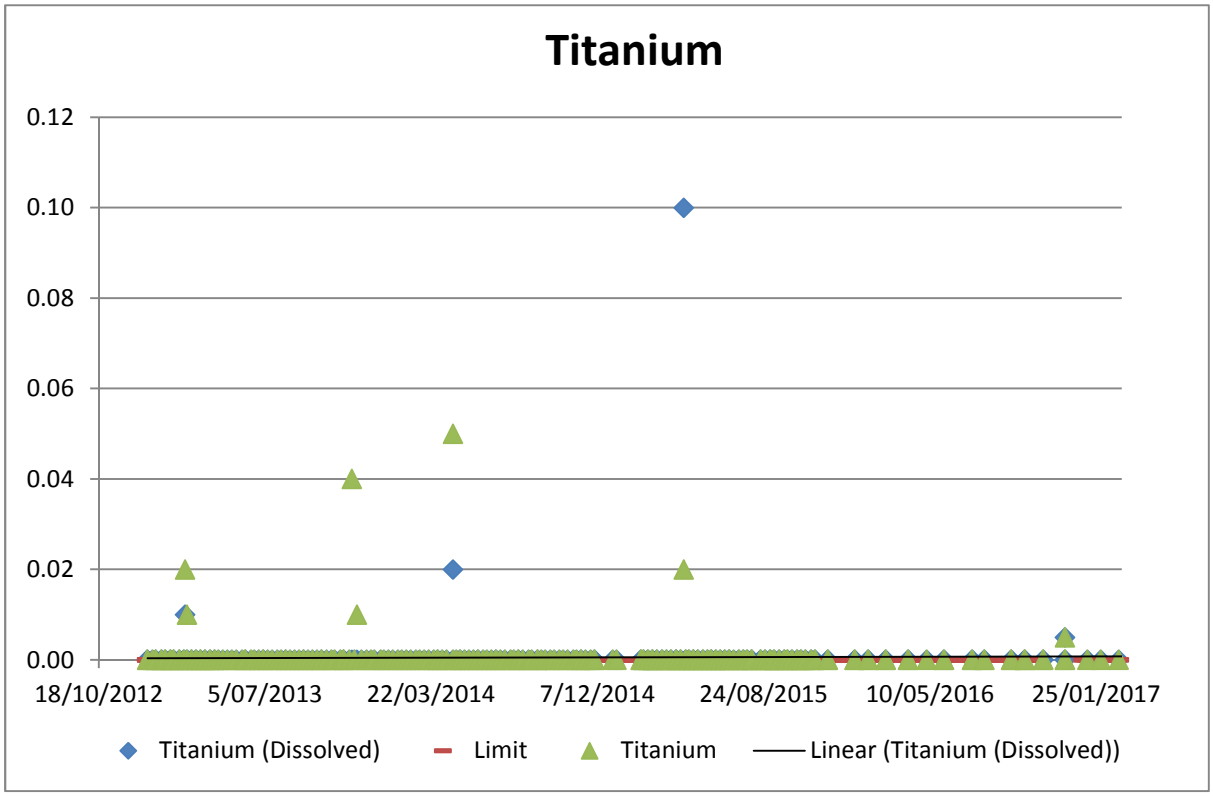
24/08/2015
10/05/2016
25/01/2017
Tin (Dissolved)
Limit
Tin
Linear (Tin (Dissolved))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0.00
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22/03/2014
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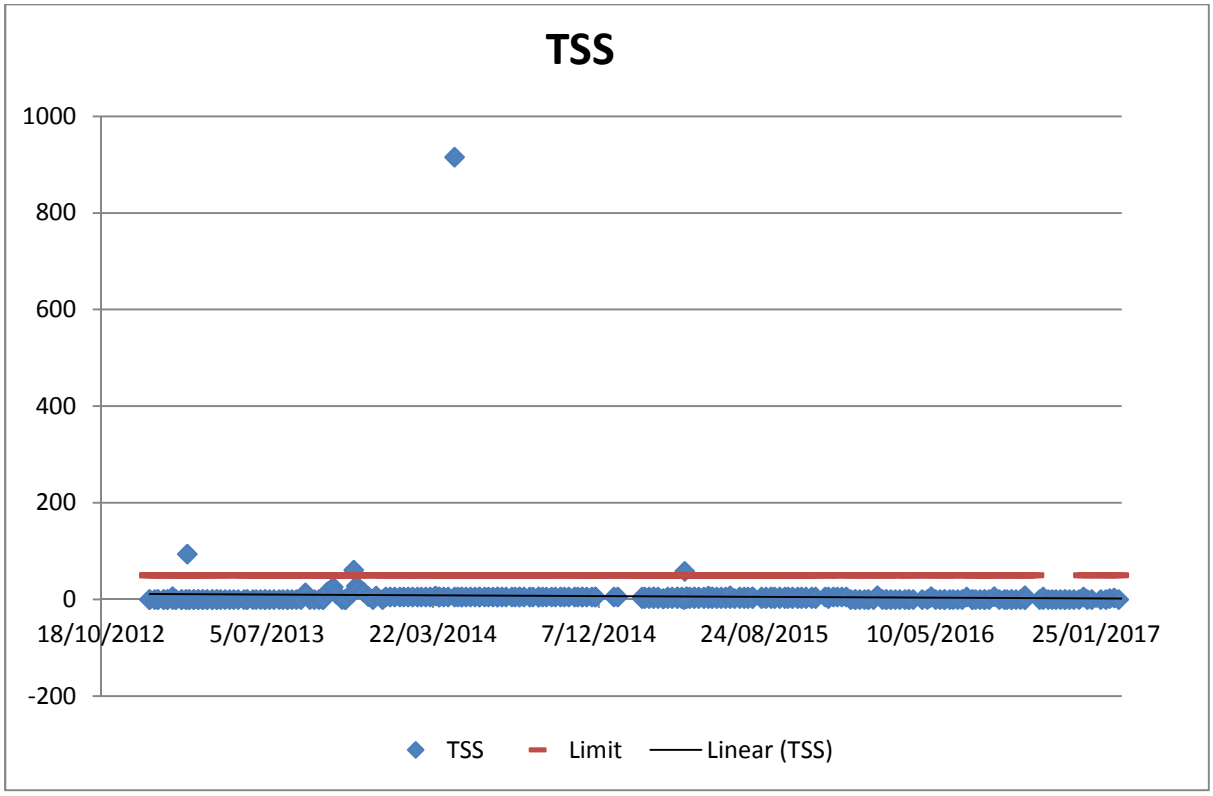
24/08/2015
10/05/2016
25/01/2017
Titanium (Dissolved)
Limit
Titanium
Linear (Titanium (Dissolved))


TSS
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600
400
200
0
-200
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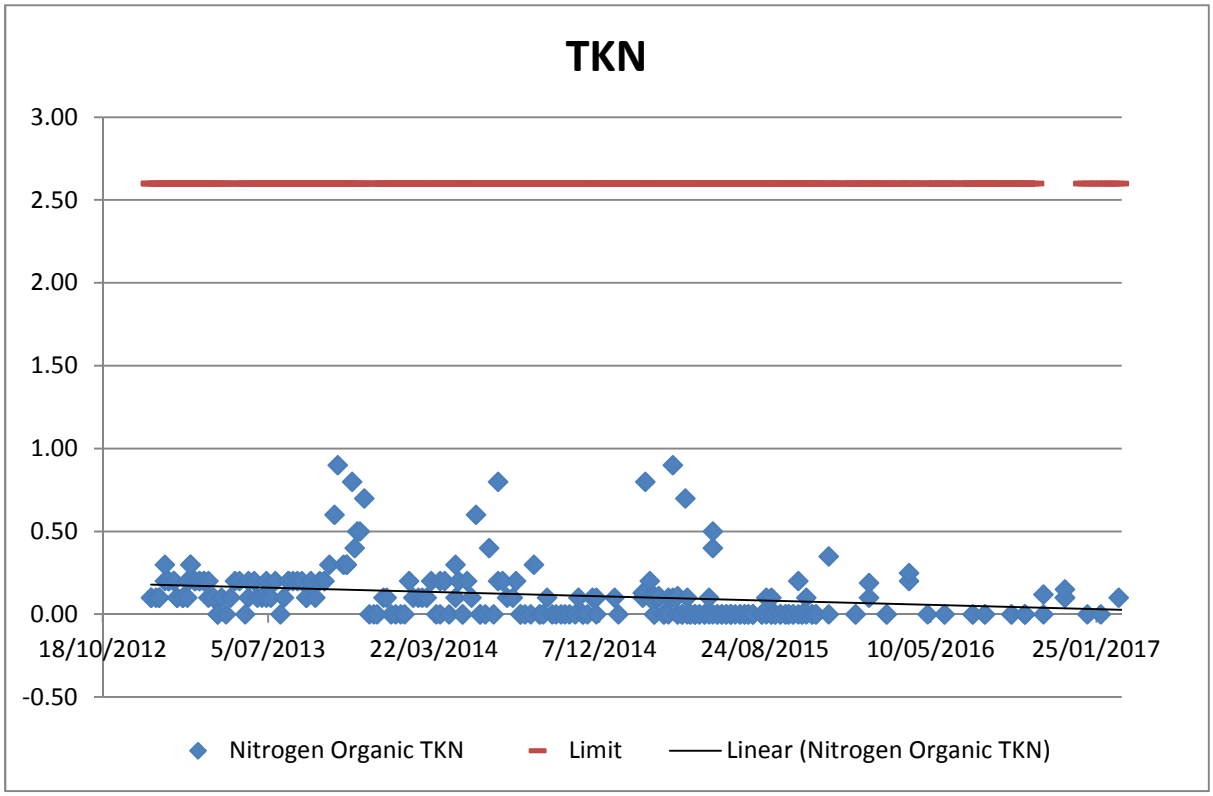
22/03/2014
7/12/2014
24/08/2015
10/05/2016
25/01/2017
TSS
Limit
Linear (TSS)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7/12/2014
24/08/2015
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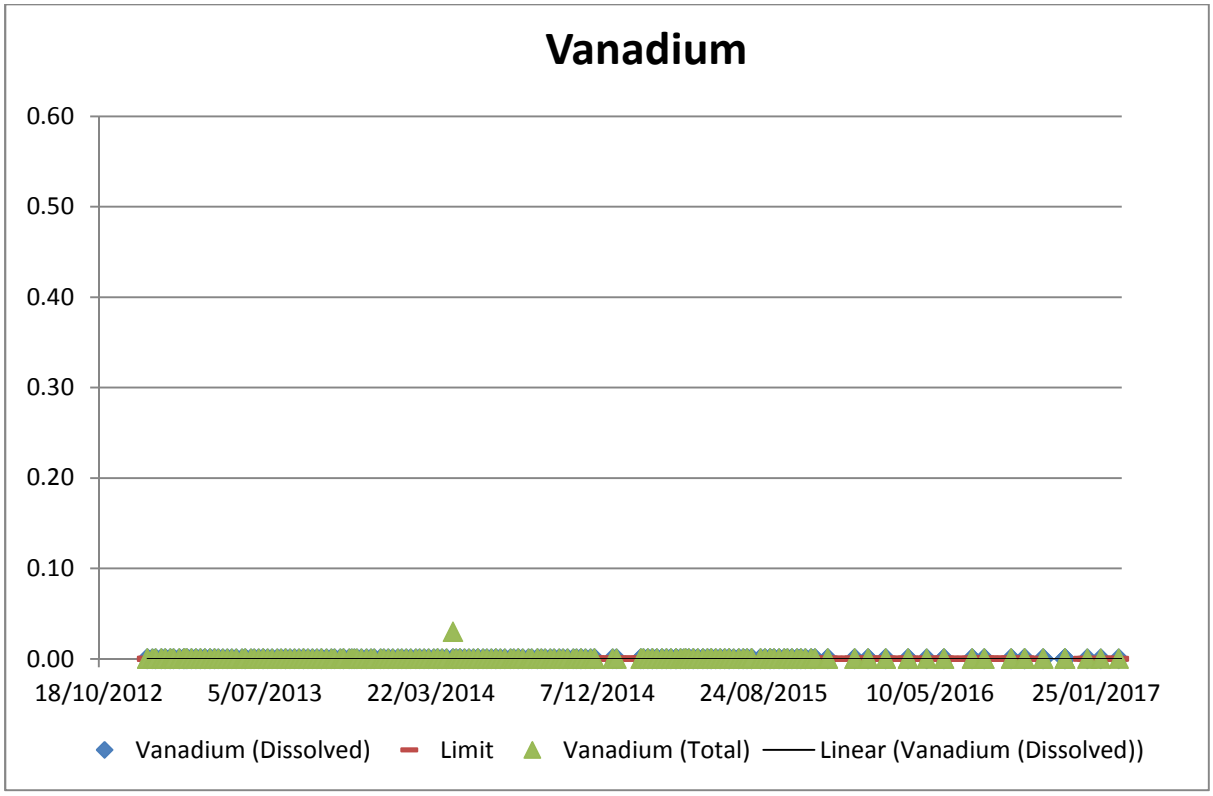
Nitrogen Organic TKN
Limit
Linear (Nitrogen Organic TKN)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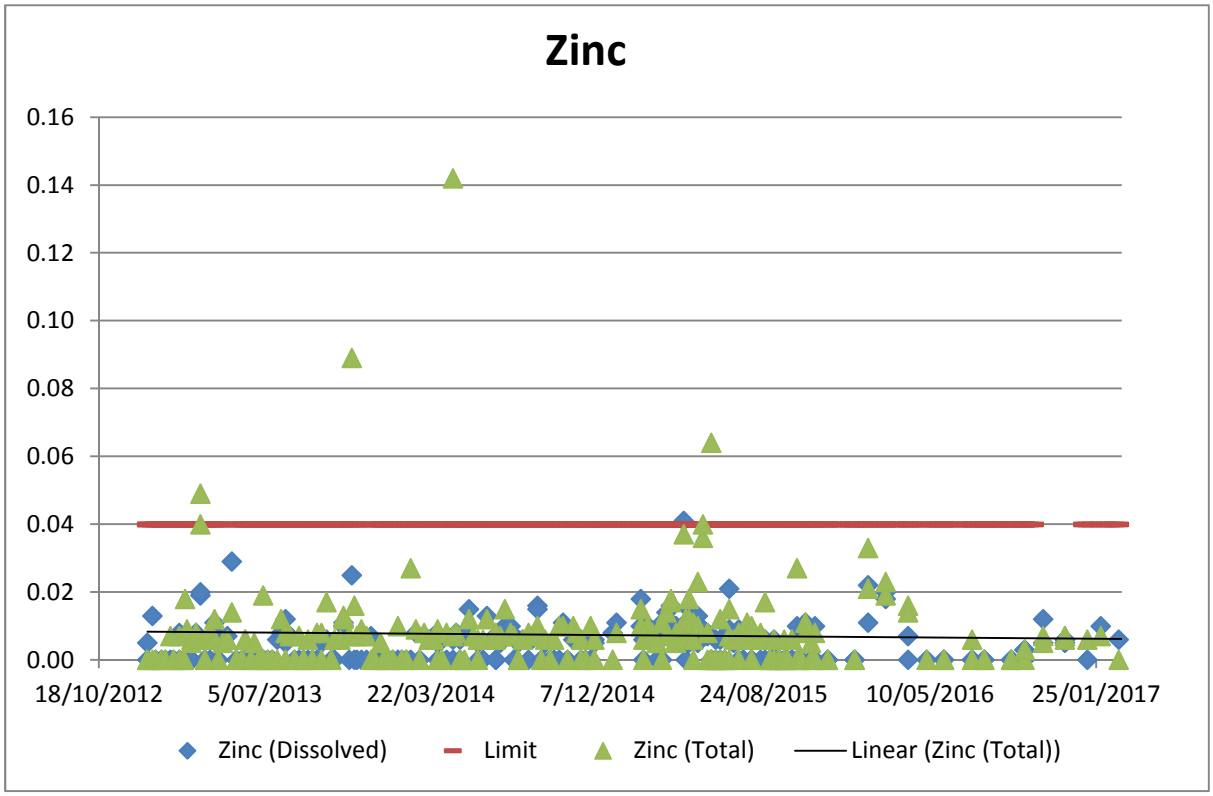
18/10/2012
5/07/2013
22/03/2014
7/12/2014
24/08/2015
10/05/2016
25/01/2017
Vanadium (Dissolved)
Limit
Vanadium (Total)
Linear (Vanadium (Dissolved))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22/03/2014
7/12/2014
24/08/2015
10/05/2016
25/01/2017
Zinc (Dissolved)
Limit
Zinc (Total)
Linear (Zinc (Total))

2017 ANNUAL FAUNA MONITORING REPORT
Newstan Colliery

Prepared for ***Centennial Coal Newstan***

23 MARCH 2018

Prepared by:

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Report Number: PR135734
Version / Date: Final V2 | 23/03/2018

Prepared for:

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Environment and Community Coordinator

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Document Status

Version	Purpose of Document	Orig	Review	Review Date
1	DRAFT	DSL/SD	LE	19/12/2017
2	FINAL	LE	MA	23/03/2018

Approval for Issue

Name	Signature	Date
Mark Aitkens		23/03/2018

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Summary

RPS Australia East Pty Ltd (RPS) was commissioned by Centennial Coal Pty Ltd to undertake the annual ecological monitoring program for the Newstan Colliery complex is hereafter referred to as the "project area". This Annual Monitoring Report (AMR) details the methods and results for the surveys of habitat, flora, diurnal birds, microchiropteran bats (microbats) and invertebrates for the 2017 monitoring period.

Aims

This monitoring program aims to confirm whether there have been any discernible impacts on the surrounding terrestrial habitats (outside of approved disturbance areas) as a result of mining operations and to monitor the efficacy of rehabilitation areas. In addition, specific recommendations have been provided with the management objective of enhancing the species richness and structural diversity of each site and the project area as a whole.

Flora and Habitat

Habitat and flora assessments showed expected results, with reference sites having a higher inferred ecological condition than rehabilitation sites. Reference sites presented a higher availability of resources including mature trees, foraging resources, ground habitat features, hollows and flora diversity. Low weed presence was observed at reference sites, while a high degree of weed establishment was evident at all rehabilitation sites.

Diurnal Birds

The 2017 diurnal bird surveys recorded 51 different bird species across 10 sites, as well as opportunistically across Centennial Newstan, during the monitoring events. No threatened species listed as 'Vulnerable' under the BC Act were recorded.

Microchiropteran Bats

A total of eight microbat species were confidently detected including three listed as Vulnerable under the *Biodiversity Conservation Act* 2016 (BC Act) (i.e. Eastern Bentwing Bat (*Miniopterus orianae oceanensis*) Little Bentwing Bat (*Miniopterus australis*), Eastern Freetail Bat (*Mormopterus norfolkensis*)).

Invertebrates

A total of 86 invertebrate morphospecies were detected during the 2017 surveys. Due to the level of identification, it is not possible to be determined whether these species are native or exotic.

The highest diversity recorded was at Rehab C and the highest abundance occurred at Rehab A. This year's results are similar to last years in terms of emerging patterns and suggest the rehabilitation sites require more time and monitoring to determine if the sites will trend towards control site assemblages.

Conclusions

Evidence of continued ecological succession is apparent in the rehabilitation areas; although some differences in the rate of improvement were detected. It is recommended that the future management focus be on the transformation of the groundcover stratum from predominantly exotic species coverage to more native. A list of native tussock forming grasses is proposed in combination with standard weed management practices. Placement of logs on the ground surface is also considered a positive management action that would assist in this objective. Installation of nest boxes is also suggested to hasten other vertebrate activity within the rehabilitation area. With management and habitat enhancement, it is anticipated that further ecological benefit at a rate similar to that experience in past years will become apparent in the rehabilitation areas in subsequent monitoring years.

1.0 Introduction

RPS has been engaged by Centennial Coal Pty Ltd to undertake the 2017 Annual Ecological Monitoring Program at Newstan Colliery in Fassifern, NSW, approximately 19km southwest of Newcastle (see **Figure 1**). This is the third survey of the monitoring program, which is to continue on an annual basis until determined by the Director-General. Detailed in the Annual Monitoring Report (AMR) are the survey methods and results as well as providing an evaluation of the rehabilitation works against nominated success criteria.

1.1 Regulatory Context

As per the conditions of consent for DA73-11-98, this monitoring program has been undertaken in accordance with the Flora and Fauna Management Plan, Newstan Colliery (RPS 2014), to satisfy Conditions 3.4 and 8.5. The monitoring content includes habitat assessments, avifauna, microbat and invertebrate surveys and flora quadrats at rehabilitation sites and control sites with additional use of infrared cameras to detect any local fauna.

1.2 Objectives and Scope of Works

The objective of this monitoring program is to confirm if there have been any discernible impacts on the surrounding terrestrial habitats as a result of mining operations and to monitor the efficacy of rehabilitation areas through indicator species. In addition, specific recommendations have been provided with the management objective of enhancing species richness and structural diversity. The scope of works for the annual monitoring involves collecting and analysing data for diurnal birds, micro-bats and invertebrates, as well as specific habitat attributes and flora quadrats over 13 sites. However, not all the above mentioned methodologies are prescribed for each of the 13 sites.

1.3 Qualifications and Licensing

1.3.1 Qualifications

The principal authors of this report are Daniel Watts B. Sc. (Hons) (Field Ecologist) and Duncan Scott-Lawson B. Env. Sc. (Ecologist) of RPS. The report was reviewed by Lauren Eather B. Sc (Ecologist) of RPS.

1.3.2 Licensing

Research was conducted under the following licences:

- NSW National Parks and Wildlife Service Scientific Investigation Licence S100536 (Valid 31 December 2017);
- Animal Research Authority (Trim File No: 16/361) issued by NSW Department of Primary Industries (Valid 21 March 2018);
- Animal Care and Ethics Committee Certificate of Approval (Trim File No: 16/361) issued by NSW Department of Primary Industries (Valid 21 March 2019); and
- Certificate of Accreditation of a Corporation as an Animal Research Establishment (Trim File No: 01/1522 & Ref No: AW2001/014) issued by NSW Agriculture (Valid 22 May 2020).

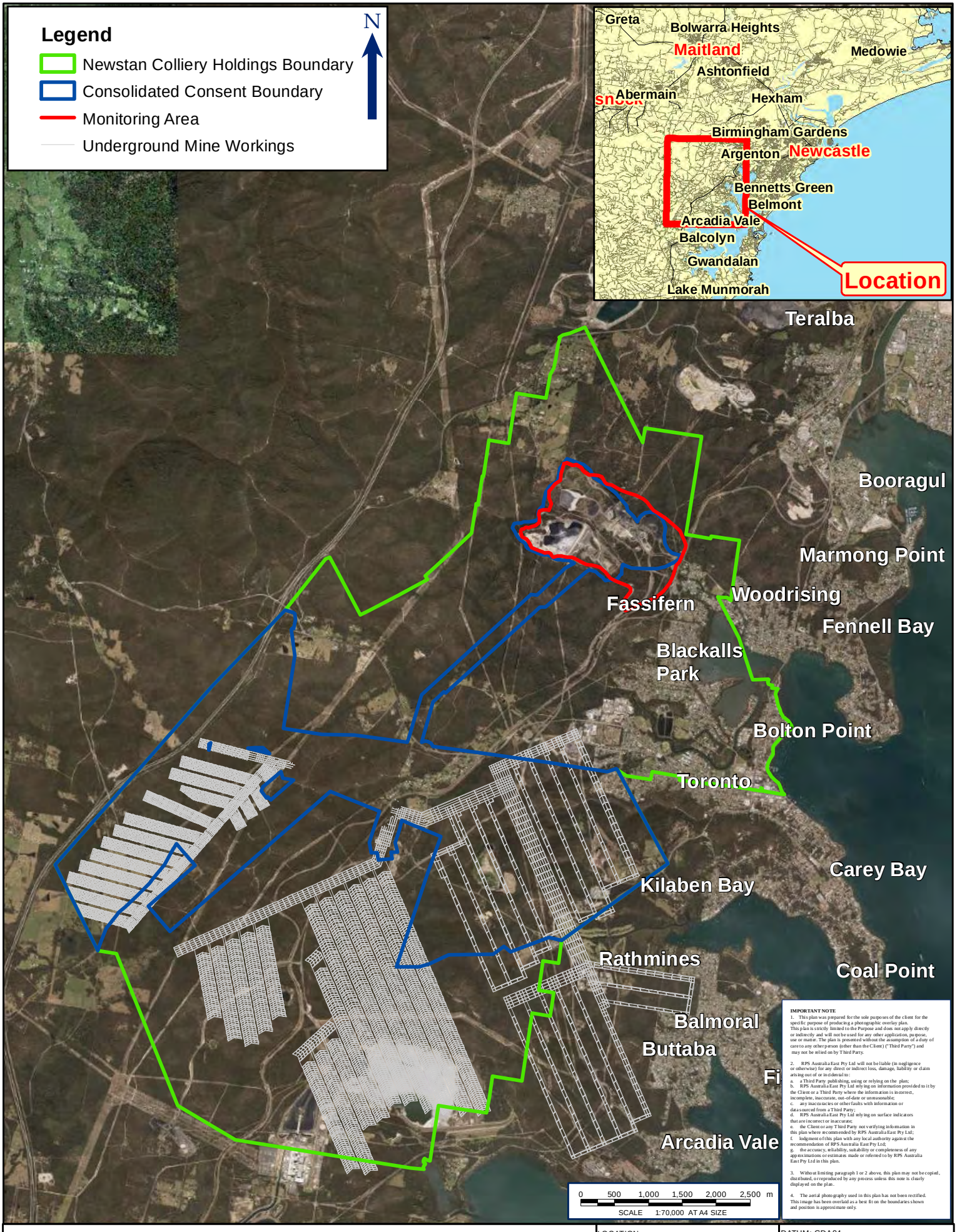


FIGURE 1: NEWSTAN COLLIERY LOCATION

LOCATION: NEWSTAN	DATUM: GDA94 PROJECTION: MGA Zone 56
JOB NO.: **PR 135734** PURPOSE: ECOLOGY Technician: Natalie.Wood Date: 18/12/2017	Data Sources: RPS Land and Property 2015

CLIENT: CENTENIAL COAL

RPS AUSTRALIA EAST PTY LTD (ABN 44 140 292 762)
241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303
T: 02 4940 4200 F: 02 4961 6794 www.rpsgroup.com.au

RPS

Path: S:\Centennial\All Jobs\135734 Newstan Annual Monitoring\10 - Drafting\Arcgis Map Documents\Eco\135734 Figure 1 Project Area A4 20171031.mxd

2.0 Methodology

2.1 Overview

Monitoring performed within the project area include targeted surveys for birds, microbats and invertebrates. Birds and bats are considered to be one of the best bio-indicators of a habitat's health. They are known to respond to environmental changes over many spatial scales (Temple and Weins, 1989; Gaisler et al. 2006) and can yield results that are data rich and efficient to collect (Carignan and Villard 2002). They are also highly suited to monitoring as they can be monitored efficiently over large spatial scales; are easy to accurately identify; have stable taxonomy and relatively well known ecology and behaviour; are reasonably long-lived; and hold a high position in some food chains where they may integrate the effects of environmental stresses over time (Furness et al. 1993; Read et al. 2000; Lantz and Martinez-Espineira 2008). These surveys were also conducted in conjunction with habitat and/or flora assessments in order to ascertain whether there are any correlations with species diversity and habitat complexity both between sites and across years.

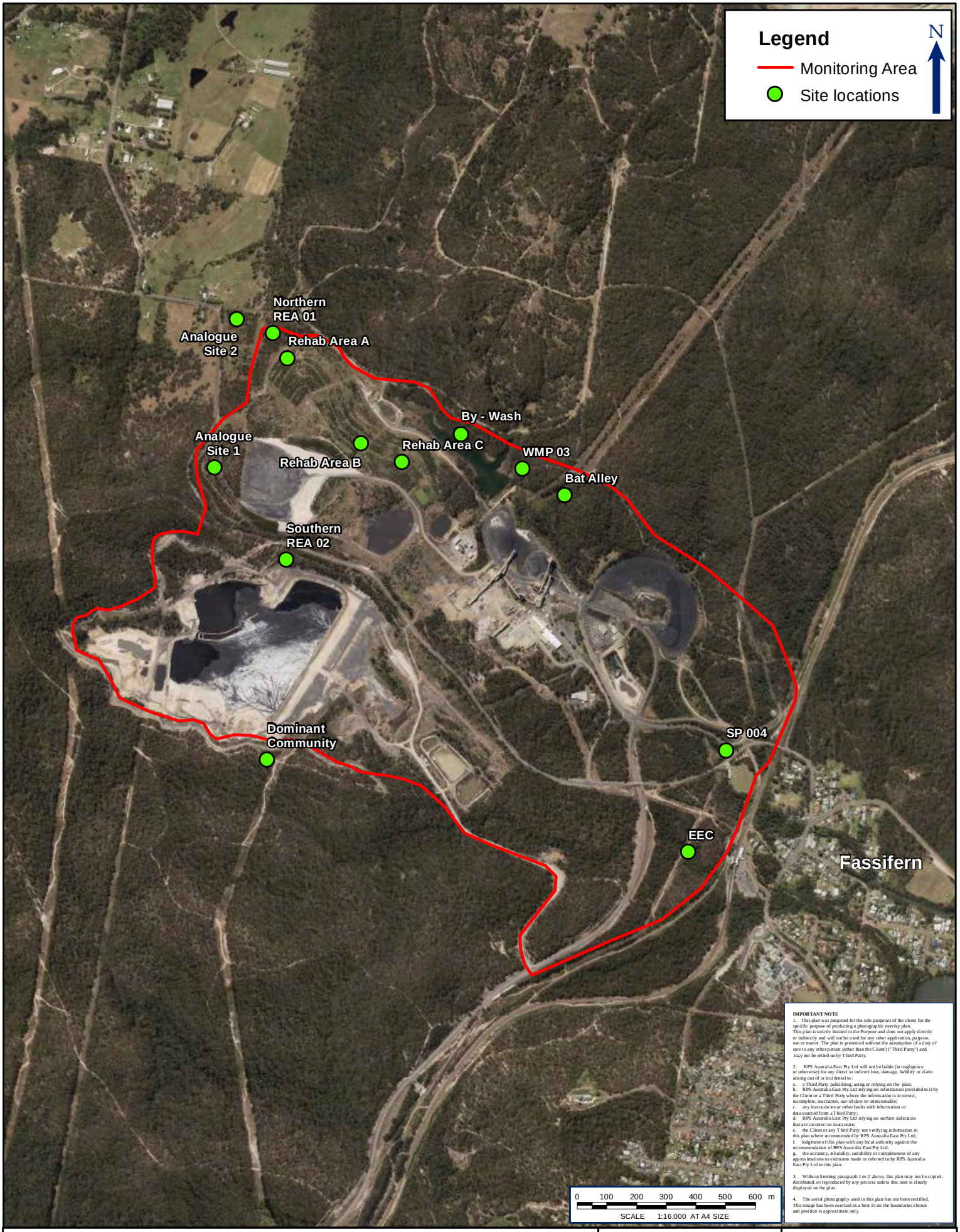
A total of 13 sites were originally chosen by Centennial Newstan in collaboration with RPS, consisting of a combination of rehabilitation and reference sites. **Table 1** below shows a breakdown of the survey effort between the sites including bird surveys, Anabat (echo location recording devices), invertebrate surveys, infrared cameras, flora quadrats and habitat assessments. The field-work for the Annual Ecological Monitoring Program was undertaken during 23 to 27 October 2017. The locations of the monitoring sites are shown in **Figure 2**.

Table 1 Survey Method Type per Monitoring Site

Survey Site	Flora Quadrat	Bird Census	Invertebrate Survey	Infrared Camera	Anabat	Habitat Assessment
Rehabilitation Site A	X	X	X		X	X
Rehabilitation Site B	X	X	X		X	X
Rehabilitation Site C	X	X	X		X	X
Analogue Site 1	X	X	X		X	X
Analogue Site 2	X	X	X		X	X
Bat Alley					X	
EEC (Endangered Ecological Community)	X	X		X	X	X
Dominant Community	X		X	X	X	X
By-Wash		X		X		
WMP03		X		X		
SP004		X		X		
REA Site 1				X	X	
REA Site 2				X	X	

2.2 Weather Conditions

The closest Bureau of Meteorology weather station that provided daily rainfall was from Toronto, approximately 2km to the south-east, and temperature data was collected from Cooranbong approximately 10km to the south of the site. Daily temperatures (maximum and minimum) and rainfall experienced during the survey period are provided in Error! Reference source not found. below.



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4. The aerial photography used in this plan has not been rectified. This image has been overlaid as a best fit on the boundaries shown and position is approximate only.

FIGURE 2: MONITORING LOCATIONS

LOCATION: NEWSTAN

DATUM: GDA94

PROJECTION: MGA Zone 56

JOB NO.: **PR 135734**

PURPOSE: ECOLOGY

Technician: Natalie.Wood Date: 18/12/2017

Data Sources:
RPS
Land and Property 2015

CLIENT: CENTENIAL COAL

RPS AUSTRALIA EAST PTY LTD (ABN 44 140 292 762)
241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303
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RPS

Path: S:\Centennial\All Jobs\135734 Newstan Annual Monitoring\10 - Drafting\Arcgis Map Documents\Eco\135734 Figure 2 Monitoring Locations A A4 20171031.mxd

Table 2 Daily Weather Observations During the Monitoring Period

Date	Minimum temperature (°C)	Maximum temperature (°C)	Total Rainfall (mm)
23 October 2017	11.97	20.3	15
24 October 2017	9.95	28.09	0.0
25 October 2017	16.74	31.77	0.0
26 October 2017	18.07	25.08	30.5
27 October 2017	13.94	24.11	27.5

2.3 Habitat Descriptions

Detailed habitat assessments for the 2017 monitoring period were undertaken at Rehabilitation Sites A, B and C, Analogue Sites 1 and 2, EEC (Endangered Ecological Community) and Dominant Community. The below data was chosen and collected by RPS, with consideration of the habitat analysis techniques described in Bayley and Brouwer (2004). Recorded habitat attributes include:

Physical features including:

- Topographic position;
  - Slope;
  - Aspect;
  - Structure;
  - Patch size;
  - Patch shape;
  - Width if linear;
  - Connectivity;
  - Linear type;
  - Geology;
  - Soil colour and texture; and
  - Surface water bodies within 100 m.
- Plant diversity and health including:
  - Exposed soil;
  - Lichen;
  - Litter;
  - Herbs/ forbs;
  - Grasses;
  - Grassland condition;
  - Grassland height;
  - Grassland species diversity;
  - Dieback;
  - Mistletoe;

- Litter tree base;
- DBH ranges and percentage cover;
- Shrub species;
- Shrub layer species diversity;
- Canopy species;
- Canopy layer species diversity;
- Canopy layer structural diversity;
- Patch health;
- Canopy description;
- Understory description; and
- Tree species percentage (%) of cover.

- Habitat value including:
  - Rock on rock;
  - Overhangs/caves;
  - Mistletoe;
  - Terrestrial and Arboreal termite mounds;
  - Hollow; structure, size classes, number, status and relative abundance;
  - Number of habitat trees;
  - Scratches on smooth tree trunks; and
  - Loose tree bark.
- Level of disturbance including:
  - Fire;
  - Number of cut stumps;
  - Presence of grazing and, if so, by what animal species;
  - Presence of erosion and, if so, what type;
  - Dumping;
  - Weed cover abundance; and
  - Dominant weed species.

The above variables have been analysed by using a habitat typology assessment developed by RPS.

Specimens of plant species that could not be identified in the field were collected and identified according to nomenclature in Harden (1992, 1993, 2000 and 2002).

2.4 Diurnal Bird Census

Birds were surveyed for 20 minutes at each designated site. Surveys were restricted to mornings or late afternoons in order to record birds during peak activity periods. All birds observed or heard within or flying over the site were recorded. Birds that were detected outside the search area of a site were recorded separately as opportunistic. Where threatened bird species were detected, a hand-held *Trimble* differential

global positioning system (D-GPS) with accuracy to less than one metre (m), was used to record the locations.

2.5 Invertebrate Survey

Invertebrate populations were sampled over the survey period from 23 to 27 October 2017. Weather conditions ranged from maximum daily temperatures of 21°C max to 32.2°C and daily rainfall from zero to 33mm.

There are a number of methods that can be employed to capture invertebrates; however, the chosen method was selected due to the wider coverage of insect diversity collection. The chosen method was the Yellow Pan Trap method outlined by the Oliver et al. (1999).

Flying invertebrates are attracted to the colour of yellow and as such were sampled using yellow pans (plastic plates with a diameter of 230 mm and a depth of 25 mm) containing a soap solution (Oliver et al., 1999; Dahms, 1997) (refer to **Plate 1**). Each pan was pegged to the ground using two skewers, as to prevent disturbance by other mobile fauna in the area.

Each site had a transect consisting of three yellow pans set 5 m apart, which were sampled on Tuesday and Friday mornings. A sieve was used to collect all insects, and as a result, invertebrates <0.5 mm were not included in the sampling process. The filtered material was placed in sampling jars containing methylated spirits and labelled appropriately. All pans and sieves were inspected thoroughly after each filtering process and washed out to ensure all invertebrates were removed.

Plate 1 Yellow Invertebrate Tray

2.5.1 Invertebrate Sorting and Identification

Invertebrates were sorted and identified to morphospecies or Recognisable Taxonomic Units (RTUs). This is a recognised methodology that has been utilised as a time and cost-efficient technique to sort and identify

invertebrates for biological surveys (Beattie and Oliver, 1994). No classification reference material or technical training is required, and invertebrates are separated based on differentiating characteristics. Morphospecies can be used as surrogates for species provided that the correspondence between morphospecies and species is approximately one to one and that each morphospecies is unique (Beattie & Oliver, 1994).

Each sampling jar was individually sorted in a shallow tray containing a small amount of methylated spirits. Invertebrates were sorted into morphospecies using easily identifiable features that distinguished them from other sampled invertebrates. A photo record of each morphospecies and corresponding label was taken. **Plate 2** shows two examples of identified morphospecies.

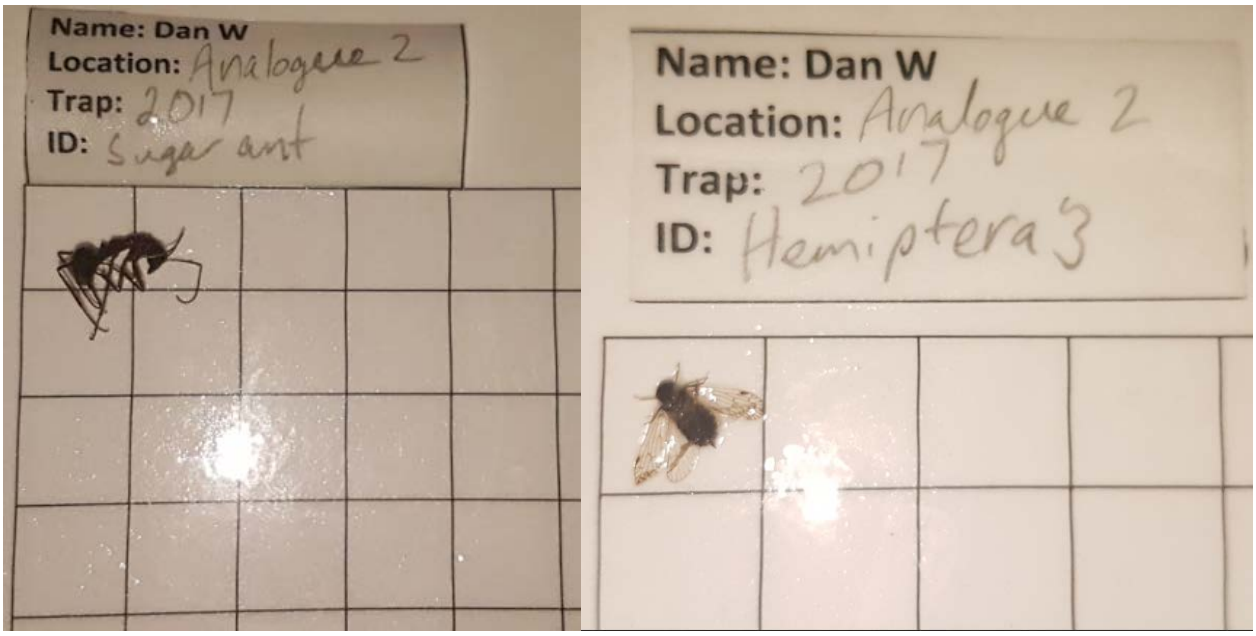


Plate 2 Examples of invertebrate morphospecies analysis

2.5.2 Analysis

Raw data from invertebrate sorting and identification was tabulated in an excel spreadsheet and the following was calculated for each site;

- Total number of the type of invertebrate (diversity);
- Total number of individual invertebrates (abundance); and
- Species unique to a specific site.

2.6 Microbat Monitoring

Microbat species were monitored using in situ echolocation call recorders (Anabats). Recorders were set to record calls from 6pm to 6am each day. Microbat calls were recorded using the Anabat SD11 system (Titley Scientific) and recorded calls were analysed by a recognised expert in the field (Dr Anna McConville of Echo Ecology). No trapping of microbats was performed as part of the annual monitoring.

Anabats were placed at selected sites, as displayed in **Table 1**. The units were positioned to maximise calls recorded along potential microbat flyways. A Trimble hand held D-GPS accurate to less than one metre was used at each site to record the position of each Anabat device for each survey.

2.7 Infrared Cameras

Remote sensor infrared cameras were used across seven of the sites to detect nocturnal and diurnal fauna. Each camera was tied to a tree at approximately 0.5 m from the ground and angled towards the ground. Tinned mackerel was used as bait and placed within the camera's centre focal point on the ground to attract fauna. A total of 13 camera trap nights were undertaken over the survey period.

2.8 Flora Quadrat

A total of seven floristic 20 x 20 m quadrats were undertaken across the Project Area. Each quadrat was undertaken with reference to current NSW mapping standards (Sivertsen, 2009) whereby floristic data was collected using a six-point Braun-Blanquet cover abundance scale. The applied Braun-Blanquet cover abundance scale assigns each species to one of these six cover abundance classes which are considered indicative of the dominance of these species within the quadrat. Where relevant, vegetation communities were described in accordance with the Lower Hunter and Central Coast Regional Environment Management Strategy (LHCCREMS) (NPWS 2000) vegetation map units (MU). Additionally, structural features of the vegetation within the quadrat and other relevant habitat features (e.g. soil type; presence of rock; slope) were also recorded.

2.9 Limitations

Not all flora species are detectable throughout all times of any given year and it is unlikely that all species would be detected during surveys undertaken once a year. For example, cryptic orchids flower within specific seasons and cannot be detected at other times of the year. Also, vegetation structure and cover abundance was estimated visually and, as a result, there is likely to be an element of observer bias. Where possible, this observer bias has been limited by using guides and charts for measurements (National Committee on Soil and Terrain, 2009).

The flowering and fruiting plant species that attract some nomadic or migratory threatened species, often fruit or flower in cycles spanning a number of years. Furthermore, these resources might only be accessed in some areas during years when resources more accessible to threatened fauna species fail. Consequently, threatened species may be absent from some areas where potential habitat exists for extended periods.

Bird surveys were limited to a single sample for each site. Differences between sites could be reflection of a number of confounding factors (e.g. time of day, weather conditions), which could only be reduced through multiple / repeat subsampling to better understand variance.

Limitations on tools used during field work are also present, where malfunctions can occur with any mechanical device. If this occurs, data can be lost, and results cannot be recollected in this instance. All measures have been undertaken to ensure all tools used are in the best working condition for the surveys.

3.0 Results

A total of 51 bird species, four mammals and eight microbat species were observed within Centennial Newstan during the 2017 survey period. Three species listed as vulnerable under the BC Act were recorded as detailed below:

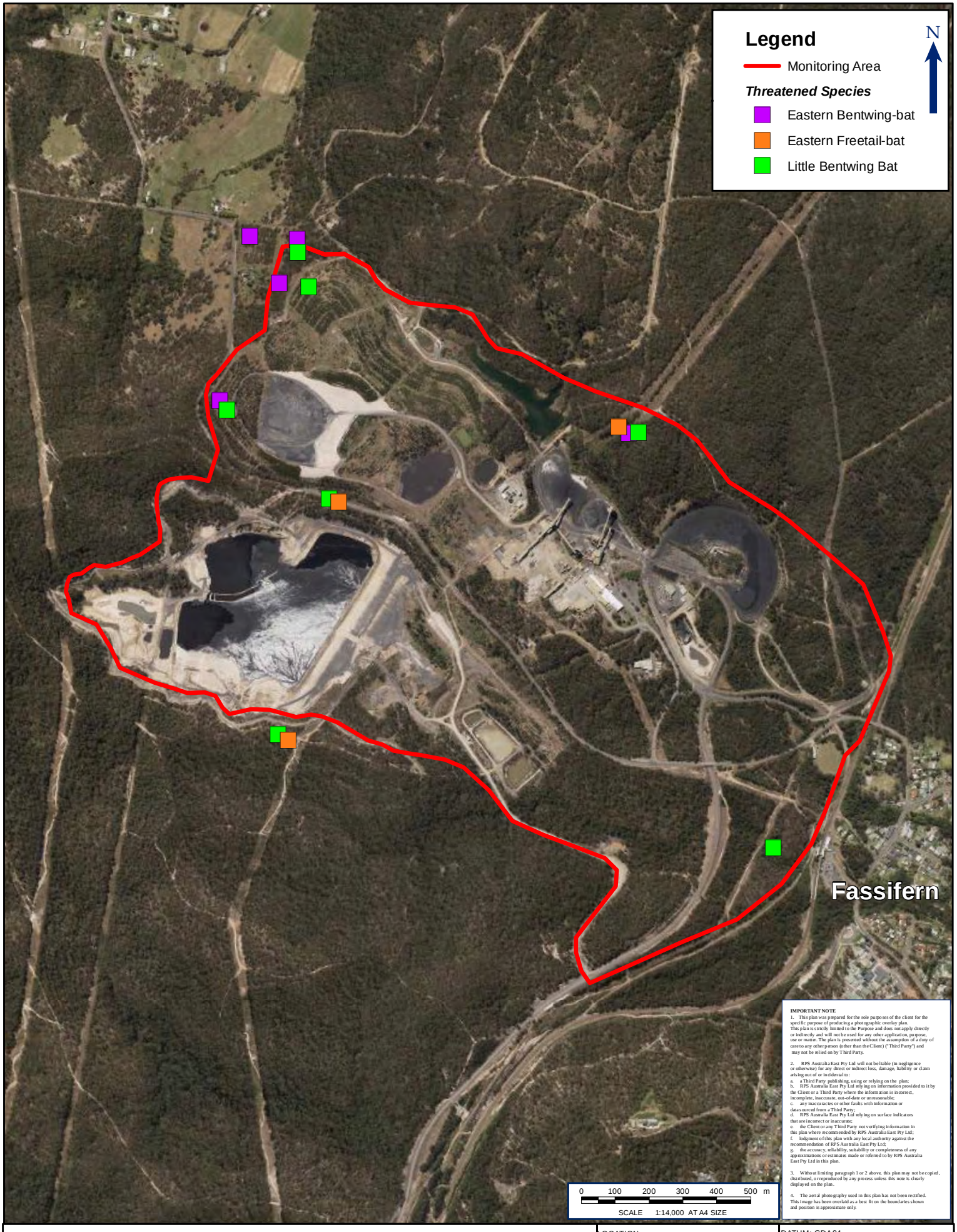
- Little Bentwing Bat (*Miniopterus australis*);
- Eastern bentwing Bat (*Miniopterus orianae oceanensis*); and
- Eastern Freetail-bat (*Mormopterus norfolkensis*).

3.1 Mine Rehabilitation Sites

3.1.1 Rehabilitation Site A

Rehabilitation Site A is situated in the mine rehabilitation area that has been subject to vegetation rehabilitation through direct seeding. It is the most western site of the three rehabilitation sites. Rehabilitation Site A is displayed in **Plate 3**.

Plate 3 Regenerating Acacias and non-native grasses at Rehabilitation A



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4. The aerial photography used in this plan has not been rectified. This image has been overlaid as a best fit on the boundaries shown and position is approximate only.

FIGURE 3: THREATENED SPECIES LOCATIONS

LOCATION: NEWSTAN

DATUM: GDA94

PROJECTION: MGA Zone 56

JOB NO.: **PR 135734**

PURPOSE: ECOLOGY

Technician: Natalie.Wood Date: 19/12/2017

Data Sources:
RPS
Land and Property 2015

CLIENT: CENTENIAL COAL

RPS AUSTRALIA EAST PTY LTD (ABN 44 140 292 762)
241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303
T: 02 4940 4200 F: 02 4961 6794 www.rpsgroup.com.au

RPS

Path: S:\Centennial\All Jobs\135734 Newstan Annual Monitoring\10 - Drafting\Arcgis Map Documents\Eco\135734 Figure 3 Threatened Species B A4 20171218.mxd

3.1.1.1 Flora Quadrat

A total of 21 flora species were recorded at Rehabilitation Site A including 12 native and nine exotic flora, compared with 29 in 2016 and 24 species in 2015. Vegetation within the site does not correspond to any MU within LHCCREMS vegetation mapping (NPWS 2000) as the species selected for rehabilitation were primarily chosen for quick re-establishment. No threatened flora species listed under the BC Act or *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) were identified within the quadrat.

3.1.1.2 Diurnal Bird Surveys

The 2017 surveys within Rehabilitation Site A recorded nine bird species, which is consistent with nine in 2016 but varied by one species in 2015 which had recorded 10. All recorded species are locally common species including the Grey Fantail (*Rhipidura albiscapa*) and Yellow-faced Honeyeater (*Lichenostomus chrysops*). No threatened species listed under the BC Act or EPBC Act were recorded at this site during surveys. A list of all recorded bird species is provided in **Appendix 1**.

3.1.1.3 Microbat Monitoring

The Anabat results for Rehabilitation Site A are provided in **Appendix 2** (Express 3 23/10/2017 and 24/10/2017). Four microbat species were confidently identified at Rehabilitation Site A including:

- White-striped Freetail Bat (*Austronomous australis*);
- Little Bentwing Bat (*Miniopterus australis*);
- Horseshoe Bat (*Rhinolophus megaphyllus*); and
- *Mormopterus ridei*.

The Eastern Bentwing Bat (*Miniopterus orianae oceanensis*) was also recorded as a probable call at this site. Of these species, the Little Bentwing Bat and Eastern Bentwing Bat are listed as vulnerable under the BC Act.

3.1.1.4 Invertebrate Surveys

A total of 12 morphospecies were detected at Rehabilitation Site A, compared with 35 in 2016 and 10 found at the same site in 2015. A list of all morphospecies per site is outlined in **Appendix 3**.

3.1.1.5 Habitat Assessment

3.1.1.5.1 Physical Features

Rehabilitation Site A is a north facing site on a hill top falling into the mid-slope. The site was characterised as regenerating shrubland.

3.1.1.5.2 Plant Diversity

Given the site is a rehabilitation area, the vegetation does not represent an existing vegetation community and the selected flora species are a combination of native and exotic. The dominant species within the site was a combination of Acacia species. A canopy layer is absent. The shrub layer largely consisted of regenerating acacia trees (100–200 mm DBH) and saplings, with no mature trees occurring across the site. The ground cover was dominated by dense coverage of exotic grasses.

3.1.1.5.3 Level of Disturbance

The site displayed a high level of historical disturbance due to the lack of canopy species, high weed presence, regenerating shrub species, low quality soil type (imported virgin excavated natural material

(VEMN)) and existing largely as a monoculture of Acacia species. Grazing pressure is light and vegetation ground cover is dense and approaching 100%.

3.1.1.5.4 Potential Habitat

At present, foraging resources are largely limited to the flowering of Acacia species and weed species. As a result, fewer local bird species would utilise the site. Exotic grass species dominate the ground cover, restricting the presence of native grasses, herbs and forbs. It also limits the presence of small ground dwelling mammals and skinks that are unable to penetrate the thick grass. The site is accessible by macropods that would utilise the grassy areas to rest and forage. No logs, hollows, termite mounds or areas of rock were present within this site.

3.1.1.5.5 Overall Value

The habitat resources within Rehabilitation Site A were considered to be poor, due to the lack of structural diversity and native species richness. As the site is regenerating, improvement in habitat condition is a possibility over time, particularly with the continued growth of juvenile eucalypt species and formation of a canopy moving towards a woodland ecosystem.

3.1.2 Rehabilitation Site B

Rehabilitation Site B is situated in the mining rehabilitation area that has been subject to vegetation rehabilitation through direct seeding. It is situated between Rehabilitation Site A and Rehabilitation Site C. **Plate 4** displays Rehabilitation Site B.

Plate 4 Regenerating Acacias and non-native grasses at Rehabilitation B

3.1.2.1 Flora Quadrat

A total of 22 flora species were recorded at Rehabilitation Site B including 11 native and 11 exotic flora species. Vegetation within the site does not correspond to any MU within LHCCREMS vegetation mapping (NPWS 2000) as the species selected for rehabilitation were primarily chosen for quick reestablishment. No threatened flora species listed under the BC Act or EPBC Act were identified within the quadrat.

3.1.2.2 Diurnal Bird Surveys

The 2016 surveys within Rehabilitation Site B recorded 17 bird species compared with nine in 2016 and four in 2015. All species were locally common including the Eastern Yellow Robin (*Eopsaltria australis*) and Sacred Kingfisher (*Todiramphus sanctus*). No threatened species listed under the BC Act or EPBC Act were recorded at this site during surveys. A list of all recorded bird species is provided in **Appendix 1**.

3.1.2.3 Microbat Monitoring

No bat calls were identified at Rehabilitation Site B.

3.1.2.4 Invertebrate Surveys

A total of 22 invertebrate morphospecies were detected at Rehabilitation Site B, compared with 37 in 2016 and 25 at the same site in 2015. A list of all morphospecies per site is outlined in **Appendix 3**.

3.1.2.5 Habitat Assessment

3.1.2.5.1 Physical Features

Rehabilitation Site B is a north-east facing site on a hill top and side. The site was characterised as regenerating shrubland.

3.1.2.5.2 Plant Diversity

Given the site is a rehabilitation area, the vegetation does not represent an existing vegetation community and the selected flora species are a combination of native and exotic. The dominant species within the site was a combination of Acacia species, with lesser dominant eucalypt species occurring. The canopy layer was absent. The shrub layer largely consisted of regenerating trees (100–200 mm DBH) and saplings, with no mature trees occurring across the site. The ground cover was dominated by exotic grasses however some native ground covers were observed. The regenerating shrub layer is dominated by *Acacia decurrens*, which is approaching maturity. It would be expected that this species will commence die-back within the next few years providing opportunity for the canopy species to emerge.

3.1.2.5.3 Level of Disturbance

The site displayed a high level of historical disturbance as a result of abundant weed presence and exists largely as a monoculture of Acacia species. A thick layer of crushed rock was also layered above the soils and acts as a prevention to soil erosion.

3.1.2.5.4 Potential Habitat

At present, foraging resources are largely limited to the flowering of Acacia species and weed species. As a result, fewer local bird species would utilise the site. Exotic grass species dominate the ground cover, restricting the presence of native grasses, herbs and forbes. It also limits the presence of small ground dwelling mammals and skinks that are unable to penetrate the thick grass. The site is accessible by macropods that would utilise the grassy areas to rest and forage. No logs, hollows, termite mounds or areas of rock were present within this site.

3.1.2.5.5 Overall Value

Habitat resources within Rehabilitation Site B were considered to be poor, due to the lack of structural diversity and native species richness. As the site is regenerating, improvement in habitat condition will occur, particularly with the continued growth of juvenile eucalypt species.

3.1.3 Rehabilitation Site C

Rehabilitation Site C is situated in the mining rehabilitation area that has been subject to vegetation rehabilitation through direct seeding. It is situated to the east of Rehabilitation Site B. **Plate 5** displays Rehabilitation Site C.

Plate 5 Regenerating Acacias and non-native grasses at Rehabilitation C

3.1.3.1 Flora Quadrat

A total of 26 flora species were recorded at Rehabilitation Site C in comparison to 28 species identified in 2016 and 31 in 2015. Vegetation within the site does not correspond to any MU within LHCCREMS vegetation mapping (NPWS 2000), as the species selected for rehabilitation were primarily chosen for quick reestablishment. No threatened flora species listed under the BC Act or EPBC Act were identified within the quadrat.

3.1.3.2 Diurnal Bird Surveys

The 2017 surveys at Rehabilitation C recorded 18 bird species, compared with 12 in 2017 and six in 2015. No threatened species listed under the BC Act or EPBC Act were recorded at this site during surveys. A list of all recorded bird species is provided in **Appendix 1**.

3.1.3.3 Microbat Monitoring

No microbat calls were identified at Rehabilitation Site C.

3.1.3.4 Invertebrate Surveys

A total of 37 invertebrate morphospecies were detected at Rehabilitation Site C, compared with 45 in 2016 and 19 in 2015. A list of all morphospecies per site is outlined in **Appendix 3**.

3.1.3.5 Habitat Assessment

3.1.3.5.1 Physical Features

Rehabilitation Site C is a north east facing site on a hill top and side. The site was characterised as regenerating shrubland.

3.1.3.5.2 Plant Diversity

Given the site is a rehabilitation area, the vegetation does not represent an existing vegetation community and the selected flora species are a combination of native and exotic. The dominant species within the site was a combination of Acacia species. The canopy layer was absent. The shrub layer largely consisted of regenerating trees (100–200 mm DBH) and saplings, with no mature trees occurring across the site. The ground cover was dominated by exotic grasses however areas of leaf litter and bare ground gave rise to the establishment of native ground cover.

3.1.3.5.3 Level of Disturbance

The site displayed a high level of historical disturbance as a result of high weed presence and exists largely as a monoculture of Acacia species.

3.1.3.5.4 Potential Habitat

At present, foraging resources are largely limited to the flowering of Acacia species and weed species. As a result, few local bird species are likely to utilise the site. Exotic grass species dominate the ground cover, however some native ground covers were observed. Small mammals and reptiles may utilise the site for foraging. The site is accessible by macropods that would utilise the grassy areas to rest and forage. No logs, hollows, termite mounds or areas of rock were present within this site.

3.1.3.5.5 Overall Value

Habitat resources within Rehabilitation Site C were considered to be poor, due to the lack of structural diversity and native species richness. As the site is regenerating, improvement in habitat condition is a possibility over time, particularly with the continued growth of juvenile eucalypt species.

3.1.4 Analogue Site 1

Analogue Site 1 illustrates greater diversity and abundance in comparison to the other rehabilitation areas within the Newstan Colliery project area. It is situated within the western corner of the project application area boundary in close proximity to Miller Road. **Plate 6** displays Analogue Site 1.

Plate 6 Analogue Site 1 Vegetation

3.1.4.1 Flora Quadrat

A total of 27 flora species were recorded at Analogue Site 1 in comparison to 22 in 2016 and 19 in 2015. Vegetation within the Analogue Site 1 appears to be approaching MU 30 Coastal Plains Smooth-barked Apple Woodland (NPWS 2000), which is consistent with the most dominant community in the Newstan Colliery project area. No threatened flora species listed under the BC Act or EPBC Act were identified within the quadrat.

3.1.4.2 Diurnal Bird Surveys

The 2017 surveys at Analogue Site 1 recorded 18 bird species, compared to none in 2016 and 10 in 2015. No threatened species listed under the BC Act or EPBC Act was recorded at this site during surveys. A list of all recorded bird species is provided in **Appendix 1**.

3.1.4.3 Microbat Monitoring

The Anabat results for Analogue Site 1 are provided in **Appendix 2** (Express 4 25/10/2017, 26/10/2017 and 27/10/2017). Six microbat species were confidently identified at Analogue Site 1, including:

- White-striped Freetail-bat (*Austronomous australis*);

- Chocolate Wattled Bat (*Chalinolobus morio*);
- Gould's Wattled Bat (*Chalinolobus gouldii*);
- Little Bentwing Bat (*Miniopterus australis*);
- *Mormopterus ridei*; and
- Horseshoe Bat (*Rhinolophus megaphyllus*).

Of these species, the Little Bentwing Bat and Eastern Bentwing Bat are listed as vulnerable under the BC Act. The Eastern Bentwing Bat (*Miniopterus orianae oceanensis*) was also recorded as a probable call at this site. This species is also listed as vulnerable under the BC Act.

3.1.4.4 Invertebrate Surveys

A total of 32 invertebrate morphospecies were detected at Analogue Site 1, compared with 26 in 2016 and 18 at the same site in 2015. A list of all morphospecies per site is outlined in **Appendix 3**.

3.1.4.5 Habitat Assessment

3.1.4.5.1 Physical Features

Analogue Site 1 occurred on a mid slope south-westerly aspect. The site was characterised as open forest (30-70% foliage cover (PFC)), with canopy species starting to emerge.

3.1.4.5.2 Plant Diversity

The vegetation within the site comprised a dry, open forest dominated by *Corymbia maculata* (Spotted Gum). The canopy largely consisted of regenerating eucalypt trees (100–200 mm DBH) and saplings, with mature trees only occurring sporadically across the site. There shrub layer was primarily exotic species such as *Verbena bonariensis* (Purpletop) as well as various Acacia species. The ground cover was dominated by exotic grasses, particularly *Chloris gayana* (Umbrella Grass).

3.1.4.5.3 Level of Disturbance

Given that the site is an existing rehabilitation area, signs of historical disturbance are apparent through the dense weed presence and lack of habitat resources. A track runs parallel to the site that encourages the continued spread of weeds, and easy access by exotic fauna species.

3.1.4.5.4 Potential Habitat

No tree hollows were observed within Analogue Site 1. Fallen logs were present within the site in 2017 which will provide further diversity of habitat moving into the future. Other characteristics of potential habitat such as loose tree bark or termite mounds were also absent from the site.

3.1.4.5.5 Overall Value

The patch is considered to be 'low' in regard to its health as the vegetation lacks diversity within canopy layer species and displays low structural diversity within all strata. However, this is expected to improve over time as the habitat matures.

3.1.5 Analogue Site 2

Analogue Site 2 is located outside the Newstan Colliery pit top to the north eastern corner. It is largely a regenerating area aimed at representing MU 30, however, due to its' regenerating nature, it consists primarily of juvenile eucalypts and a dense layer of Acacia species.

Plate 7 Analogue Site 2 Vegetation

3.1.5.1 Flora Quadrat

A total of 30 flora species were recorded at Analogue Site 2 including 14 native and 16 exotic flora species, which is the same data recorded in 2016. Vegetation within the site does not correspond to any MU within LHCCREMS vegetation mapping (NPWS 2000), as the species selected for rehabilitation were primarily chosen for quick reestablishment. No threatened flora species listed under the BC Act or EPBC Act were identified within the quadrat.

3.1.5.2 Diurnal Bird Surveys

The 2017 surveys at Analogue Site 2 recorded six bird species compared to 16 species in 2016 and 14 species in 2015. All recorded species are locally common species including the Yellow-faced honeyeater (*Lichenostomus chrysops*), and Rufous Whistler (*Pachycephala rufiventris*). No threatened species listed under the BC Act or EPBC Act was recorded at this site during surveys. A list of all recorded bird species is provided in **Appendix 1**.

3.1.5.3 Microbat Monitoring

The Anabat results for Analogue Site 2 are provided in **Appendix 2** (Express 3 25/10/2017 and 26/10/2017). Five microbat species were confidently identified at Analogue site 2 including:

- White-striped Freetail-bat (*Austronomous australis*);
- Gould's Wattled Bat (*Chalinolobus gouldii*);
- Little Bentwing Bat (*Miniopterus australis*);
- *Mormopterus ridei*; and
- Horseshoe Bat (*Rhinolophus megaphyllus*).

Of these species, the Little Bentwing Bat and Eastern Bentwing Bat are listed as vulnerable under the BC Act. The Eastern Bentwing Bat (*Miniopterus orianae oceanensis*) was also recorded as a probable call at this site. This species is also listed as vulnerable under the BC Act.

3.1.5.4 Invertebrate Surveys

A total of 34 invertebrate morphospecies were detected at Analogue Site 2, compared with 42 in 2016 and 25 in 2015. A list of all morphospecies per site is outlined in **Appendix 3**.

3.1.5.5 Habitat Assessment

3.1.5.5.1 Physical Features

Analogue Site 2 is a north-west facing upper-slop. The site was characterised as regenerating shrubland with canopy species starting to emerge.

3.1.5.5.2 Plant Diversity

The site was determined to be relatively young in its development, with the canopy predominantly comprised of dense stands of *Melaleuca armillaris* to 4-5 m in height, and individual *Corymbia maculata* at similar height. No mature trees were identified. The shrub layer was mostly dominated by exotic species such as *Sporobolus fertilis* (Parramatta Grass) as well as multiple Acacia species. The grassy ground cover was predominately exotic, but included small areas of leaf litter and bare soil.

3.1.5.5.3 Level of Disturbance

Given that the site is an existing rehabilitation area, signs of historical disturbance are apparent through the dense weed presence and lack of habitat resources. The site had high weed dispersal and no sign of erosion or dumping.

3.1.5.5.4 Potential Habitat

The site was limited in its resource availability. No mature trees were observed, thus no hollows were available. Exotic grass species dominate the ground cover, however some native ground covers were observed. Small mammals and reptiles may utilise the site for foraging. The site is accessible by macropods that would utilise the grassy areas to rest and forage. No logs, hollows, termite mounds or areas of rock were present within this site.

3.1.5.5.5 Overall Value

The patch is considered to be 'low' in regards to its health as the vegetation lacks diversity within canopy layer species and displays low structural diversity within all strata. However, this is expected to improve over time as the habitat matures.

3.2 Reference Sites

3.2.1 Bat Alley

Bat Alley is a disused mine shaft to the north east of Newstan Colliery that hosts known populations of threatened bat species. The area has been conserved for conservation purposes and has been afforded a 50m buffer for protection and site preservation. Of the survey methodologies conducted under this program, only microbat species monitoring was conducted at this site.

3.2.1.1 Microbat Monitoring

The Anabat results for Bat Alley are provided in **Appendix 2** (Express 2 25/10/2017, 26/10/2017, 27/10/2017 and 28/10/2017). Anabat surveys positively identified six species, including:

- White-striped Free-tailed Bat (*Austronomus australis*),
- Gould's Wattled Bat (*Chalinolobus gouldii*);
- Little Bentwing-bat (*Miniopterus australis*),
- Eastern Freetail-bat (*Mormopterus norfolkensis*);
- *Mormopterus ridei*; and
- Eastern Horseshoe Bat (*Rhinolophus megaphyllus*).

The Eastern Bentwing Bat (*Miniopterus orianae oceanensis*) was also recorded as a probable call at this site. Of these species, the Little Bentwing Bat and Eastern Bentwing Bat are listed as vulnerable under the BC Act.

3.2.2 EEC

The EEC site is located to the southeast of the mining area and contains riparian vegetation surrounding a permanent inundated area and creek. The site is dissected by multiple tracks and an electrical easement. **Plate 8** displays vegetation within the EEC site.

Plate 8 Looking south into the EEC Site

3.2.2.1 Flora Quadrat

A total of 39 flora species were recorded at the EEC site with only one exotic flora species. This is compared to 29 species recorded in 2016 and 30 recorded in 2015. Based on the floristic structure and diversity of vegetation within the EEC site, the vegetation community is delineated as MU 43 Wyong Paperbark Swamp Forest under LHCCREMS (NPWS 2000) which corresponds to the BC Act listed EEC Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions.

3.2.2.2 Diurnal Bird Surveys

During the 2017 surveys a total of 10 bird species were recorded compared to 21 in 2016 and 19 in 2015. Recorded species were limited to locally common bird species including the Eastern rosella (*Platycercus eximius*) and Superb Fairy-wren (*Malurus cyaneus*). No threatened species listed under the BC Act or EPBC Act were recorded during surveys. A list of all recorded bird species is provided in **Appendix 1**.

3.2.2.3 Microbat Monitoring

The Anabat results for the EEC site are provided in **Appendix 2** (Express 4 28/10/2017 and 29/10/2017). Four microbats were positively identified at the EEC site including:

- White-striped Free-tailed Bat (*Austronomus australis*),
- Gould's Wattled Bat (*Chalinolobus gouldii*);
- Little Bentwing-bat (*Miniopterus australis*); and
- *Mormopterus ridei*.

Of the above listed species, the Little Bentwing Bat is listed as Vulnerable under the BC Act.

3.2.2.4 Infrared Camera Surveys

A Red-necked Wallaby (*Macropus rufogriseus*) was recorded at the site.

3.2.2.5 Habitat Assessment

3.2.2.5.1 Physical Features

The EEC site occurred within a creek line. The site was characterised as closed forest (>70% foliage cover (PFC)).

3.2.2.5.2 Plant Diversity

The vegetation within the site comprised a wet, closed forest dominated by *Melaleuca linariifolia* (Flax-leaved Paperbark). The canopy consisted of random middle aged trees (200-400 mm DBH) and saplings, with few mature trees occurring across the site. The shrub layer was dominated by *Gahnia sieberiana* (Red-fruited Saw-sedge) while the ground cover was dominated by various ferns, sedges and grasses. Leaf litter was dense in parts with moderate amount accumulating at the base of canopy trees.

3.2.2.5.3 Level of Disturbance

The vegetation observed within this site exhibited signs of disturbance due to fire. This was evident by the presence of a scorched understory, a rejuvenating understory and fire scars on trees. Healthy regeneration was observed.

Exempting fire damage, the level of disturbance to the site was considered to be low. Only one exotic flora species (*Lantana camara*) was detected within the quadrat. Two access tracks and an easement dissect the surrounding vegetation which makes the site more accessible to exotic fauna species and weed encroachment.

3.2.2.5.4 Potential Habitat

A variety of canopy trees including Melaleuca, Angophora and Corymbia species offer flowers, nectar and pollen at different times of year for bird and arboreal mammal species, including migratory species. Only one small hollow was identified within the assessed area, however, logs of differing sizes were prevalent offering denning habitat for small mammals and reptiles. No termite mounds were observed.

3.2.2.5.5 Overall Value

The site is considered to be in good health as it offers various ecological resources, demonstrates structural and species diversity and displays low levels of disturbances.

3.2.3 Dominant Community

This site was situated outside the mining disturbance footprint to the south west, in relatively undisturbed vegetation. Vegetation within the site represents the most dominant vegetation community within the Newstan Colliery project area, which is MU 30 Coastal Plains Smooth-barked Apple Woodland. **Plate 9** depicts this site.

Plate 9 Dominant Community site with MU 30 vegetation

3.2.3.1 Flora Quadrat

A total of 26 flora species were recorded at site Dominant Community, all of which were native flora species. Based on the floristics determined during the flora quadrat the vegetation on site is considered to be MU 30 Coastal Plains Smooth-barked Apple Woodland, which is not commensurate with any BC Act or EPBC Act.

3.2.3.2 Diurnal Bird Survey

During the 2017 surveys a total of five bird species were recorded compared to 10 in 2016 and 11 in 2015. Recorded species were limited to locally common bird species including the Rufous Whistler (*Pachycephala rufiventris)* and Restless Flycatcher (*Myiagra inquieta*). No threatened species listed under the BC Act or EPBC Act were recorded during surveys. A list of all recorded bird species is provided in **Appendix 1**.

3.2.3.3 Microbat Monitoring

The Anabat results for Dominant Community site are provided in **Appendix 2** (Express 4 23/10/2017 and 24/10/2017). Six microbat species were positively identified at the Dominant Community site including:

- White-striped Free-tailed Bat (*Austronomus australis*),
- Gould's Wattled Bat (*Chalinolobus gouldii*);
- Little Bentwing-bat (*Miniopterus australis*);
- Eastern Freetail-bat (*Mormopterus norfolkensis*);
- *Mormopterus ridei*; and

- Eastern Horseshoe Bat (*Rhinolophus megaphyllus*).

Of the above listed species, the Little Bentwing Bat is listed as Vulnerable under the BC Act.

3.2.3.4 Infrared Camera Surveys

Infrared cameras detected fox (*vulpes vulpes*) at this site as shown in **Plate 10.**

Plate 10 Red Fox at Dominant Community site

3.2.3.5 Invertebrate Surveys

A total of 17 morphospecies of invertebrates were recorded at the Dominant Community Site, compared with 26 in 2016 and 14 at the same site in 2015. A list of all morphospecies per site is outlined in **Appendix 3**.

3.2.3.6 Habitat Assessment

3.2.3.6.1 Physical Features

The Dominant Community site occurred on an upper ridge with a south-westerly aspect. The site was characterised as open forest (30-70% foliage cover (PFC)) and was located approximately 150 metres south of the reject emplacement area for Newstan Colliery.

3.2.3.6.2 Plant Diversity

The vegetation within the site comprised a dry, open forest dominated by *Angophora costata* (Smooth-barked Apple). The shrub layer and ground cover consisted of native flora species with both moderate structural and high species diversity.

3.2.3.6.3 Level of Disturbance

The level of disturbance within the site was considered to be low. No exotic flora species were detected within the quadrat, no erosion was observed and only minor evidence of fire was observed.

3.2.3.6.4 Potential Habitat

Angophora costata trees are known for producing hollows, and the vegetation type at this site is dominated by *A. costata*. Various sized hollows were observed within the assessed area and based on the vegetation type, many hollows are expected to exist within the remaining areas of this MU.

This MU is also known habitat for the threatened *Tetratheca juncea* (Black-eyed Susan). No individuals were detected at the site during surveys. However, this species is known to occur within the immediate area and has potential to occur.

3.2.3.6.5 Overall Value

The site is considered to be in good health as it offers various ecological resources, demonstrates structural and species diversity and displays low levels of disturbances.

3.2.4 By-Wash

By-Wash, WMP03 and SP004 sites were existing aquatic monitoring sites and were selected due to their close proximity to riparian zones.

The By-Wash site was approximately 5m from the edge of the most northern dam within Newstan Colliery. Flora species diversity and habitat resources were low with a monoculture of *Dodonaea triquetra* (Large-leaf Hop-bush) within the shrub layer at the site.

3.2.4.1 Diurnal Bird Survey

A total of 15 species were recorded at the By-wash site during the 2017 surveys compared to 13 in 2015. No threatened species listed under the BC Act or EPBC Act was recorded at this site during surveys. A list of all recorded bird species is provided in **Appendix 1.**

3.2.4.2 Infrared Camera Surveys

No animals were recorded at By-wash site.

3.2.5 WMP03

WMP03 was in close proximity to a dam weir at the northern portion of the Newstan Colliery project area. Two tracks were adjacent to the site, however the vegetation within the site was in relatively good condition.

3.2.5.1 Diurnal Bird Surveys

A total of 16 species were recorded at WMP03 during the 2017 surveys, compared with nine in 2016 and nine in 2015. No threatened species listed under the BC Act or EPBC Act was recorded at this site during surveys. A list of all recorded bird species is provided in **Appendix 1**.

3.2.5.2 Infrared Camera Surveys

No animals were recorded at WMP03 site.

3.2.6 SP004

SP004 is situated adjacent to a riparian zone which contains a permanent creek, to the far west of Newstan Colliery. Vegetation within the site contains a variety of ground cover, shrub and canopy species offering resources for a wide range of local bird species.

3.2.6.1 Infrared Camera Survey

A Northern Brown Bandicoot (*Isoodon macrourus*) and exotic Rats (*Rattus rattus*) were identified on remote cameras at this site.

3.2.6.2 Diurnal Bird Surveys

A total of 19 species were recorded at WMP03 during the 2017 surveys, compared with 20 in 2016 and 17 in 2015. No threatened species listed under the BC Act or EPBC Act were recorded at this site during surveys. A list of all recorded bird species is provided in **Appendix 1**.

3.2.7 REA Site 1

REA Site 1 is located within a relatively undisturbed area of MU30, situated in the north-eastern corner of Newstan Colliery.

3.2.7.1 Microbat Monitoring

The Anabat results for REA Site 1 are provided in **Appendix 2** (Express 2 23/10/2017 and 24/10/2017). Five microbat species were positively identified at REA Site 1 including:

- White-striped Free-tailed Bat (*Austronomus australis*);
- Gould's Wattled Bat (*Chalinolobus gouldii*);
- Chocolate Wattled Bat (*Chalinolobus morio*);
- Little Bentwing-bat (*Miniopterus australis*);
- Eastern Horseshoe Bat (*Rhinolophus megaphyllus*).

The Eastern Bentwing Bat (*Miniopterus orianae oceanensis*) was also recorded as a probable call at this site. Of these species, the Little Bentwing Bat and Eastern Bentwing Bat are listed as vulnerable under the BC Act.

3.2.7.2 Infrared Camera Surveys

No animals were recorded at REA Site 1.

3.2.8 REA Site 2

REA Site 2 was situated to the north of the Newstan Reject Emplacement Area, to the south of Miller Road. The area was adjacent to a track and showed signs of disturbance such as weeds and visible rubbish

3.2.8.1 Microbat Monitoring

The Anabat results for REA Site 2 are provided in **Appendix 2** (Express 2 29/10/2017). Five microbat species were positively identified at REA Site 2 including:

- White-striped Free-tailed Bat (*Austronomus australis*),
- Little Bentwing-bat (*Miniopterus australis*);
- Eastern Freetail-bat (*Mormopterus norfolkensis*);
- *Mormopterus ridei*; and
- Eastern Horseshoe Bat (*Rhinolophus megaphyllus*).

Of the above listed species, the Little Bentwing Bat and the Eastern Freetail-bat are listed as Vulnerable under the BC Act.

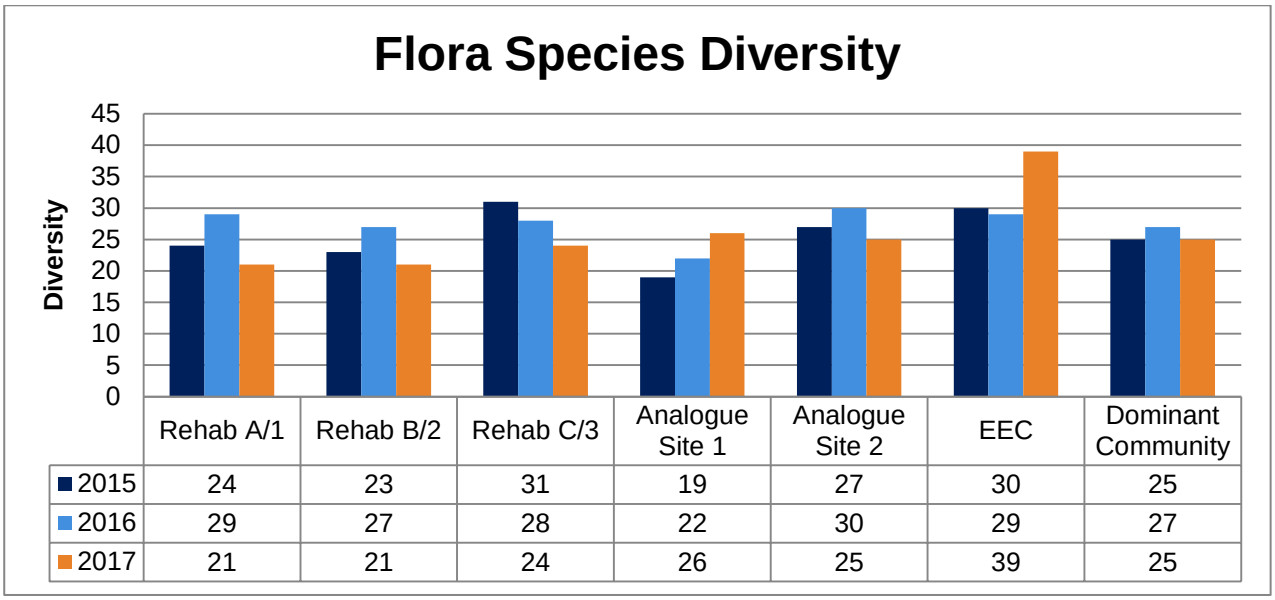
3.2.8.2 Infrared Camera Surveys

No animals were recorded on camera at REA Site 2.

4.0 Discussion and Assessment of Rehabilitation

4.1 Flora Species Assemblages

A total of 112 flora species were detected from those sites that were selected for flora quadrats. A comparison between flora diversity in 2016 and 2017 is provided in **Figure 4**.



	Rehab A/1	Rehab B/2	Rehab C/3	Analogue Site 1	Analogue Site 2	EEC	Dominant Community
2015	24	23	31	19	27	30	25
2016	29	27	28	22	30	29	27
2017	21	21	24	26	25	39	25

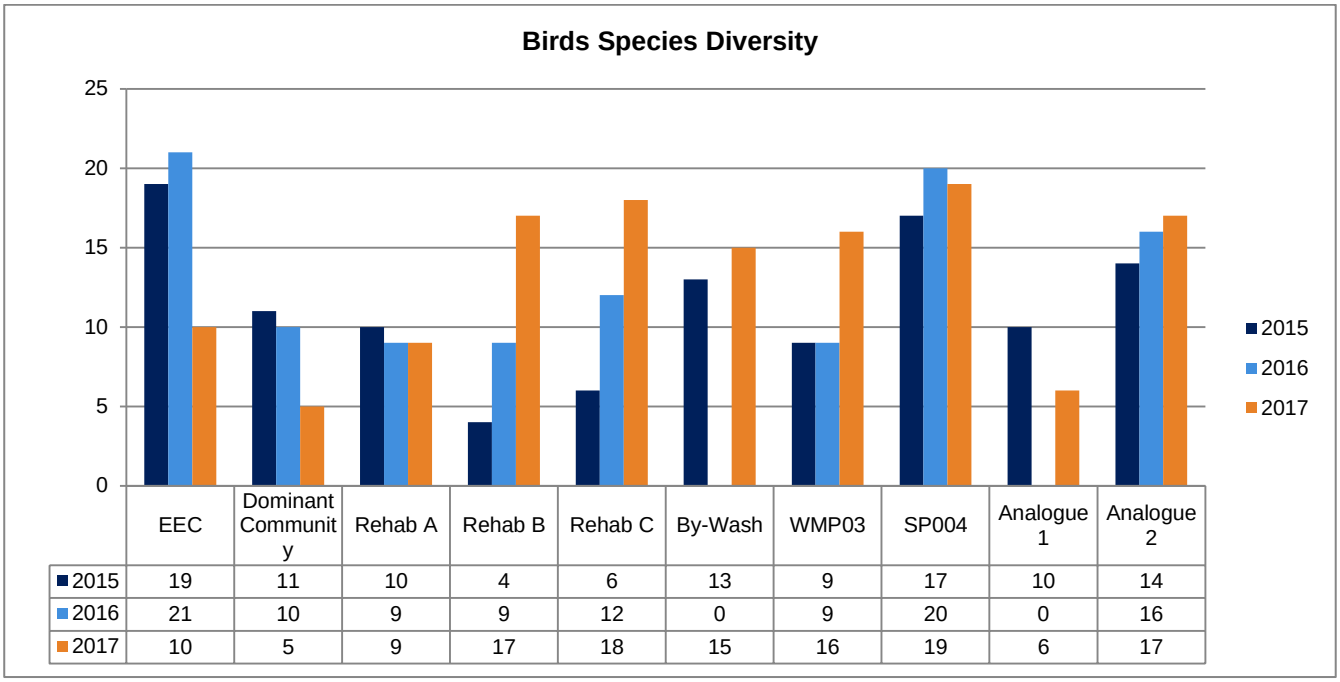
Figure 4 Comparison of Flora Species Diversity in 2015, 2016 and 2017 comparison

Diversity at the sites has been fairly consistent since 2015. The 2017 results at the EEC site are slightly higher than 2015 and 2016. It is too early in the program to prescribe a distinct reason for this increase; however, it could be due to a range of factors including climatic variation, surveyor bias, influence from the adjacent remnant and generalised increase in vertebrate fauna activity as rehabilitation areas mature.

No threatened flora were detected during surveys. The EEC site contained the Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions, which is listed as an Endangered Ecological Community under the BC Act. A tabulated record of results for each site is provided in **Appendix 4**.

4.2 Bird Species Assemblages

In total, 51 bird species were detected during the 2017 survey, with 36 species in the reference sites and 35 in the rehabilitation sites. **Figure 5** demonstrates the differences in bird species diversity between all monitoring sites over 2015, 2016 and 2017.



	EEC	Dominant Community	Rehab A	Rehab B	Rehab C	By-Wash	WMP03	SP004	Analogue 1	Analogue 2
2015	19	11	10	4	6	13	9	17	10	14
2016	21	10	9	9	12	0	9	20	0	16
2017	10	5	9	17	18	15	16	19	6	17

Figure 5 Bird Species Diversity in 2015, 2016 and 2017 comparison

4.3 Bird Species Response to Rehabilitation

Species diversity has increased slightly over the last three years of monitoring with rehabilitation areas showing signs of increased use by different species. Further increases in diversity are expected throughout the rehabilitation sites as resource establishment/ availability become increasingly attractive to bird populations occurring in adjoining remnant vegetation.

The Yellow-faced Honeyeater was ubiquitous across all monitoring sites with the next most frequently observed species being the Grey Fantail (n=8), Rufous Whistler (n=7), Fan-tailed Cuckoo (n=5) and Sacred Kingfisher (n=5). These species were well represented in both rehabilitation and remnant vegetation, are commonly found in forest vegetation types and are expected results as they are regionally common. In contrast, three species rarely observed in the monitoring period that are sensitive to logging (Kavanagh et al 2004), thus suitable for inclusion in monitoring programs to examine the effects of change in vegetation structure, included the White-threated Treecreeper (n=1), Wonga Pigeon (n=1) and Olive-backed Oriole (n=1). These species were observed at the sites By-Wash, SP004, Rehabilitation Site A and EEC.

Rehabilitation Site A has exhibited consistent species diversity (i.e. 9 to 10 species) over the past three years when compared to a ~30% year on year increase at Rehabilitation Sites B and C. The apparent differences in bird species diversity may potentially be indicative of a divergence in habitat suitability between these sites. In this respect a review of satellite imagery for the entire rehabilitation area appears to show a rapid transformation in vegetation structure at Rehabilitation Sites B and C with comparatively little change evident in Rehabilitation Site A over the past three years. Vegetation structure/ complexity is a known important habitat feature positively correlated with species diversity.

From a resource perspective, distance to water is likely to represent another important factor in analysing species diversity. A permanent water body located nearby Rehabilitation Sites B and C is likely to increase patch attractiveness relative to Rehabilitation site A, where the distance to water is greater. For similar reasons, proximity to large remnant native vegetation (Kavanagh et al 2007) is also likely to increase the attractiveness Rehabilitation sites B and C over Rehabilitation site A. For these reasons alone it is considered that Rehabilitation Sites B and C are more likely to be visited by bird species than Rehabilitation Site A.

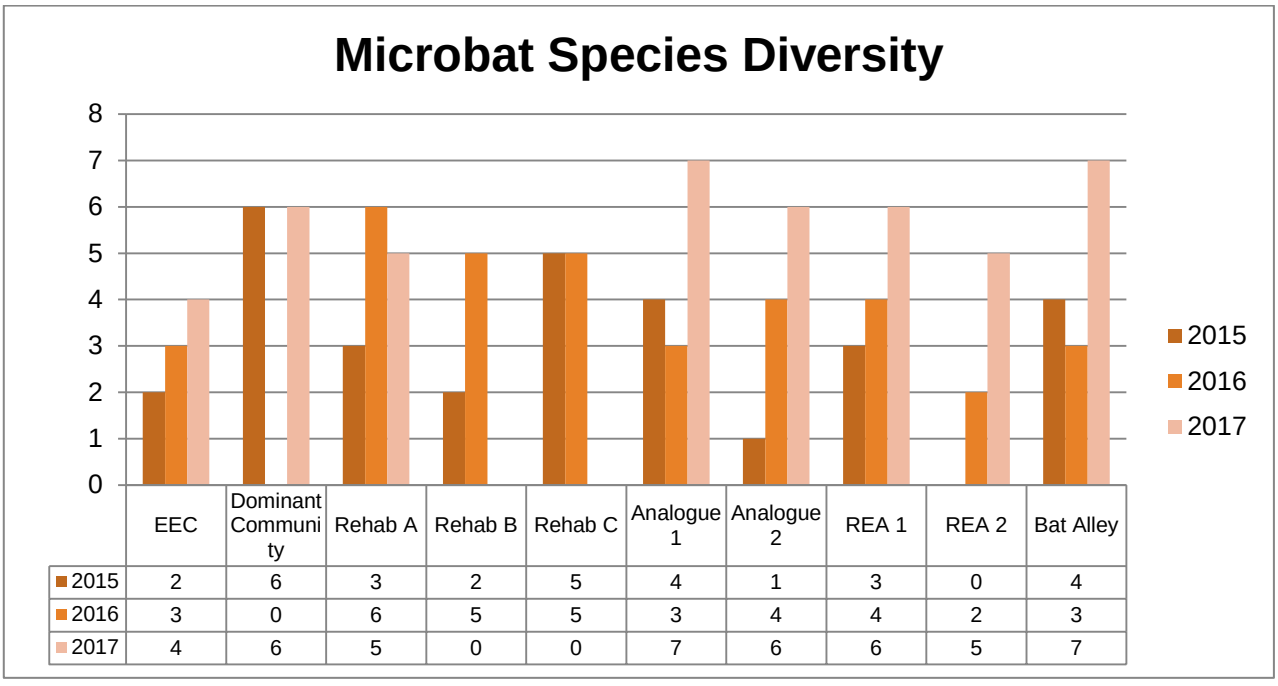
One unexpected result is the substantial decrease in bird species at the EEC and Dominant Community sites, where numbers were expected to be the same if not higher given the relatively higher habitat quality of these sites. While reasons for this result are unclear, it is considered that greater clarity may have been be obtained through repeat sampling that would otherwise overcome limitations in the interpretation of single sample data (i.e. better appreciation for the variance of species diversity in these sites).

The continued high number of species detections within site SP004 is likely explained by a few factors including, but not limited to, the sites adjacency to a permanent creek line and riparian vegetation (i.e. distance to water). This water body is likely to be important for a number of locally common bird species, particularly in dry periods (i.e. acts as a refuge). The stand age (i.e. older more mature vegetation) and proximity to large remnant native vegetation are also likely to be important determinants in the relatively high observed species diversity (Kavanagh et al 2007).

4.4 Microbat Species Assemblages

During the 2017 surveys, a total of eight species were confidently detected through definite and probable calls. The Little Bentwing Bat (*Miniopterus australis*), Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) and Eastern Freetail Bat (*Mormopterus norfolkensis*), which are listed under the BC Act as Vulnerable, were confidently detected.

Figure 6 illustrates bat species richness between all sites from 2015, 2016 and 2017. A list of all recorded microbat species is provided in **Appendix 2**.



	EEC	Dominant Community	Rehab A	Rehab B	Rehab C	Analogue 1	Analogue 2	REA 1	REA 2	Bat Alley
2015	2	6	3	2	5	4	1	3	0	4
2016	3	0	6	5	5	3	4	4	2	3
2017	4	6	5	0	0	7	6	6	5	7

Figure 6 Microbat Species Richness between sites in 2015, 2016 and 2017

4.5 Microbat Response to Rehabilitation

Originally, the 2015 results from microbat surveys showed a varying level of presence between sites, despite their overall close proximity. However, over time, this varying level has begun to even out with higher numbers of species occurring across the survey sites. Aside from Rehabilitation Sites B and C, where Anabats failed to record data, the 2017 results have yielded the highest number of species at all sites except Rehabilitation Site A.

Analogue 1 and Bat Alley have all revealed the highest microbat diversity of all sites (n=7) which has been a change over time. It was to be expected that Bat Alley would have higher species of bats based on the high-quality habitats which were relatively undisturbed which provide hollows for roosting and a diversity of foraging resources. However, it could be suggested that the Analogue Site 1 provides suitable foraging resources for numerous microbat species that was not previously available. An increase in invertebrate species diversity was evident at Analogue Site 1 (refer to **Figure 7**), which could have attracted new species of microbats that forage on those different invertebrate species.

Rehabilitation Site A has had a slight decrease in the presence of microbat species during 2017. There was also a notable decrease in the diversity of invertebrates available at Rehabilitation Site A, which could have contributed to this decline. The decline is a minor decline and is likely to fluctuate over time with respect to other environmental factors.

Bat Alley, which has been known to host two threatened species, namely the Little Bentwing Bat (*Miniopterus australis*) and Large-eared Pied Bat (*Chalinolobus dwyeri*) (RPS 2014), revealed an increased abundance of Little Bentwing Bat calls compared to 2016, but a decrease compared to 2015 (2015 n= 56 and 2016 n=1). A total of 20 Little Bentwing Bat calls were confidently analysed at Bat Alley, however, no calls of the Large-eared Pied Bats were recorded during the 2017 surveys. Current surveys are the first time to detect the Eastern Freetail-bat (*Mormopterus norfolkensis*), a threatened species, at Bat Alley, with one call being positively identified. Given this one-off call, it is likely that it was passing through or foraging briefly at Bat Alley. A high amount of White-striped Freetail-bat (*Austronomous australis*) (n=322) calls were also detected at Bat Alley, suggesting possible co-inhabitation by numerous species.

Consistently with 2015, the threatened Little Bentwing Bat (*M. australis*) was detected at every site that received a working Anabat (eight sites). Although the number of calls cannot be divided into number of individuals, this result is nonetheless promising for this threatened species in the local area. This result is potentially related to the close proximity of all sites to Bat Alley (a known roosting site).

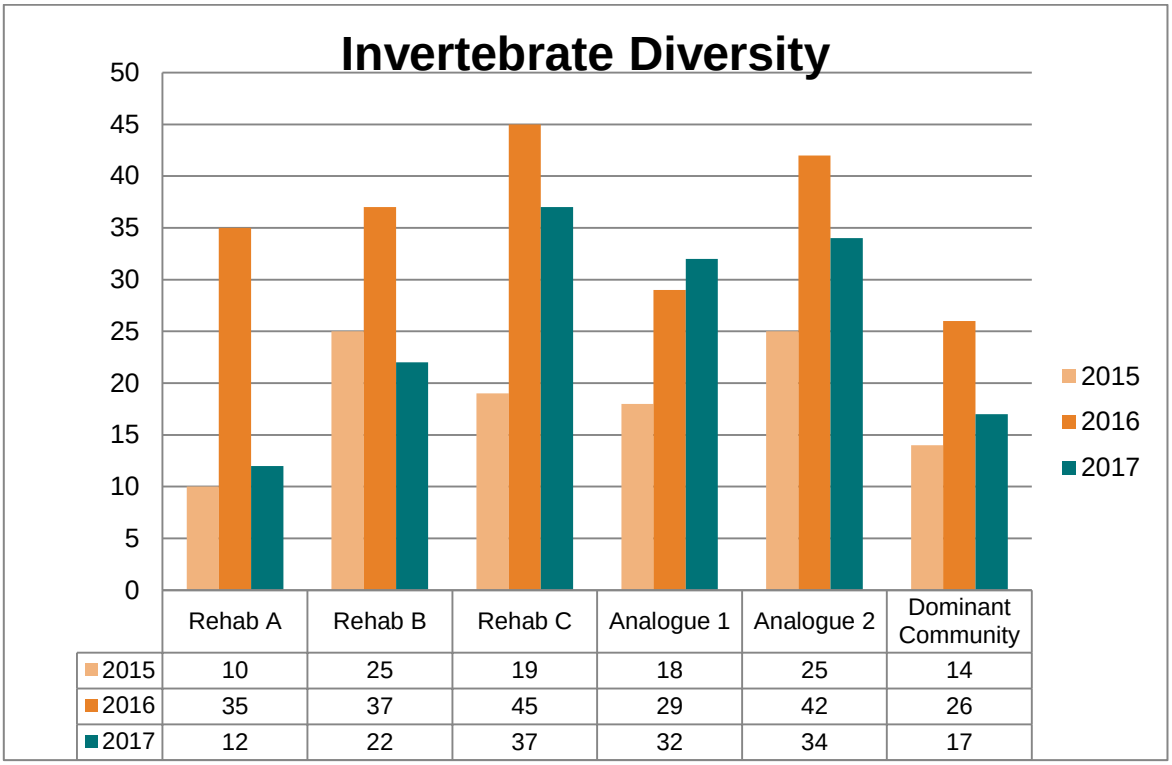
With data missing from Rehabilitation Sites B and C, it is difficult to ascertain if these sites would result in expected lower numbers, or display an increase in species diversity due to factors such as invertebrate species diversity increases such as that at Analogue Site 1. Rehabilitation Site A, which experienced a substantial reduction invertebrate species diversity, displayed a minor reduction in microbat species diversity.

The continued presence of the eight species of Microbats is promising, with further species expected to be recorded in the following years. Over time, the results have shown that the microbats are utilising the rehabilitation sites as much as the reference sites. Whilst the provision of roosting habitat is not available in these sites, it is evident that foraging habitat is. Future results will help provide information on trends at each of the sites at Newstan Colliery.

4.6 Invertebrate Species Assemblages

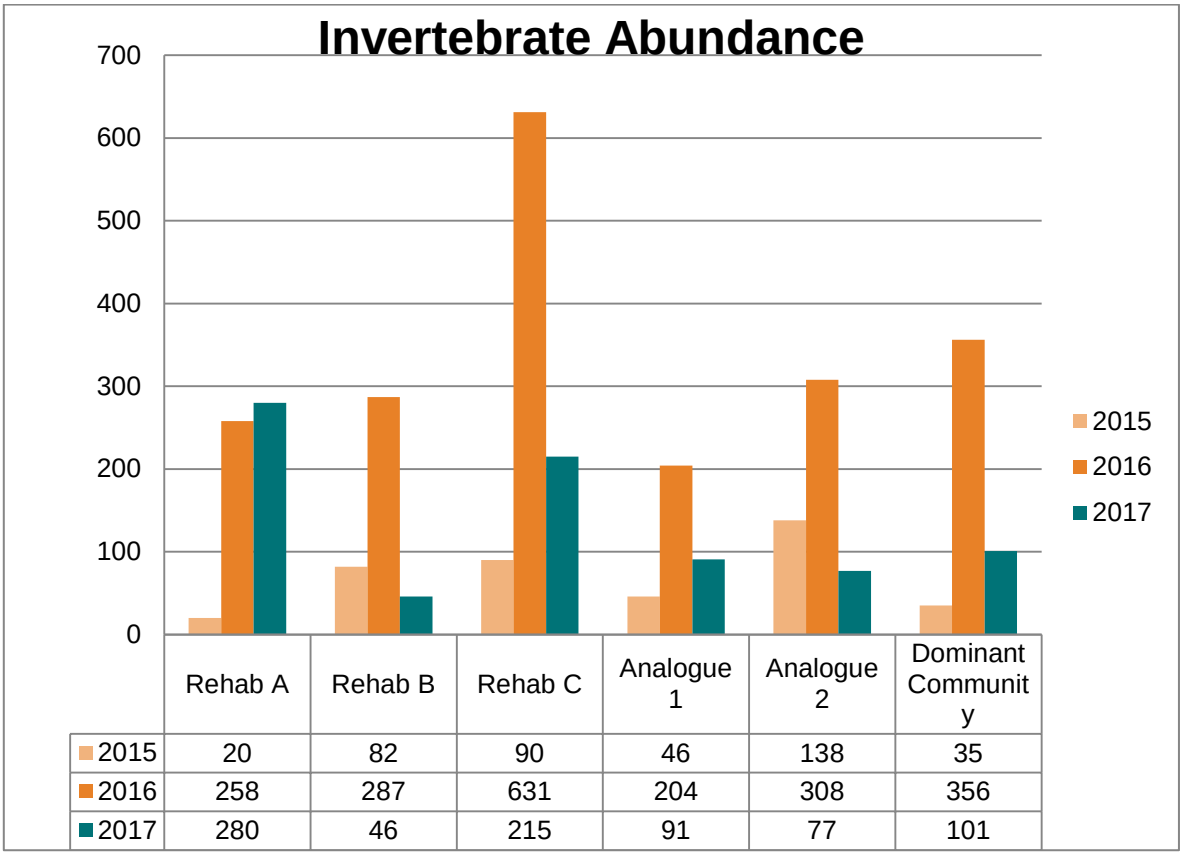
Morphospecies abundance and diversity was reduced in the 2017 surveys in comparison to the 2016 surveys data in all sites except for Analogue site 1. The 2017 data closely reflect diversity and abundance obtained in 2015 with higher abundance and diversity recorded in 2016. The limited data set does not provide adequate sample size to provide conclusive outcomes, however climatic variables are likely to have contributed to this variation. Continued monitoring will allow for further understanding of differences (if they exist) between rehabilitation and reference sites.

Figure 7 compares morphospecies diversity between sites whilst **Figure 8** compares the abundance of morphospecies between sites. **Appendix 3** contains a full invertebrate species list for each site.



	Rehab A	Rehab B	Rehab C	Analogue 1	Analogue 2	Dominant Community
2015	10	25	19	18	25	14
2016	35	37	45	29	42	26
2017	12	22	37	32	34	17

Figure 7 Invertebrate Species Diversity comparing 2015, 2016 and 2017



	Rehab A	Rehab B	Rehab C	Analogue 1	Analogue 2	Dominant Community
2015	20	82	90	46	138	35
2016	258	287	631	204	308	356
2017	280	46	215	91	77	101

Figure 8 Invertebrate Species Abundance comparing 2015, 2016 and 2017

4.7 Invertebrate Response to Rehabilitation

Most sites demonstrated relatively high species richness levels (**Figure 7**) despite having low abundances (**Figure 8**). Rehabilitation Site A is the exception as it had low richness with the highest abundance of all sites for the 2017 monitoring event. At this site the dominant species was an *Iridiomyrmex* (probably *Iridiomyrmex purpureus*) a meat ant. Ants from the genus *Iridiomyrmex* are among the most commonly encountered in Australia and can be very bold and aggressively defend territory (Australian Museum, 2010).

The second most abundant species, which was the most abundant species in Rehabilitation Site C, was also an *Iridiomyrmex* species.

Species in the genus *Iridiomyrmex* typically exploit transient resources effectively and may be competitively excluding other species from these areas. The meat ant at Rehabilitation Site A was almost entirely restricted to this site, suggesting the species is highly localised or the conditions at this site are ideal for the species to thrive. Alternatively, the small black ant that drove abundances at Rehabilitation Site C occurred in all sites at low abundances, suggesting a wider distribution with favourable conditions at this site. The above mentioned behavioural traits may explain the large discrepancy between richness and abundance for Rehabilitation Site A and the higher abundance for Rehabilitation Site C relative to other sites.

Other factors that may be contributing to the absence and presence of invertebrates at the different rehabilitation sites may also include; soil condition, microclimate and plant biomass, which have also been identified in other scientific studies (Kruess & Tscaharntke, 2002; Bergstrom, 2004).

Both species richness (**Figure 7**) and abundances (**Figure 8**) were lower in 2017 compared to 2016 survey results. The differences observed between years may be a result of rainfall which could have decreased the activity of invertebrates or reduced the effectiveness of the traps. Despite the decrease between years, between sites species richness sites followed a very similar trend to the previous year, with sites varying similarly to previous displaying variation similar to previous results. Abundances formed no clear pattern except where an individual *Iridiomyrmex* spp. occurred.

The consistency in the pattern of species richness noted across all sites between years suggests little change has occurred between monitoring events. Furthermore, the lower richness and abundance across most sites compared to 2016 results are likely due to differing weather conditions. Rainfall may inhibit the activity of larger insects that were collected previously but were absent in 2017 monitoring results. Little change between years in patterns is to be expected as the species assemblages and population structures can take many years to establish. We should expect to see the rehabilitation and analogue sites slowly shift towards the control site as the rehabilitation progresses.

4.8 Limitations to Habitat Potential

4.8.1 Structural Diversity and Foraging Resources

Limiting factors to habitat potential were common throughout all rehabilitated sites surveyed in 2017, but varied in their intensity. The majority of sites consisted of varying amounts of regrowth, and canopy layer density at sites has been compromised to some degree. This has limited the structural diversity and complexity of the sites, and limited the availability of foraging resources for a variety of fauna species. These factors are known to be crucial for establishing and maintaining woodland bird diversity in small remnant woodland patches (Watson et al., 2001). The influence of an active canopy layer on bird diversity is likely to be an underlying factor in the relatively high species diversity observed at the EEC site where stands of flowering Angophora and Corymbia were present, and the low diversity at Rehab A, B and C where a canopy layer is absent.

4.8.2 Refuge for Ground Fauna

Although the monitoring sites do not require specific surveys for ground fauna, opportunistic observations are always noted, and cameras are used to capture any fauna occupying the ground level. There is a

notable difference in ground refuge such as rocks, logs and tree roots for ground dwelling fauna between sites, with the undisturbed sites displaying a higher amount of these resources. The rehabilitated sites (particularly Rehabilitation Sites A, B and C) could benefit from an increase in ground debris such as logs and rocks.

4.8.3 Hollow-bearing Trees

Populations of hollow dependent fauna such as gliders, possums, forest owls, parrots and some species of microbats are limited by an absence of sufficient densities of hollow-bearing trees at all rehabilitation sites. Arboreal mammals are particularly susceptible to a lack of hollows for roosting purposes. A paucity of roosting habitat in the form of tree hollows, combined with a lack of foraging resources within the canopy or shrub layer, severely restricts the potential for arboreal mammals (particularly gliders) to utilise the site. Growth and progress of the rehabilitation sites will eventually provide hollows; however, this is a lengthy process. To date, there has been no evident increase in the availability of hollow-bearing trees at rehabilitation sites.

4.8.4 Connectivity

The project area is located within a fragmented mosaic of remnant and/or regrowth vegetation interspersed with areas of mine infrastructure, powerline easements and road networks. The sites vary dramatically in their connectivity with surrounding vegetation, from the isolated REA 2 to those with links to large surrounding patches of bush at EEC, Dominant Community and WMP03.

4.8.5 Weed Species

The infestation of weed species continues to be a concern for many sites, with the presence of *Lantana camara*, *Verbena bonariensis* and various exotic grasses occurring at multiple sites. All rehabilitated sites display a very high presence of weed species, particularly in the understorey where exotic grasses dominate and restrict the establishment of native groundcovers. *Verbena bonariensis* is particularly bad for the Analogue sites.

5.0 Conclusion & Recommendations

The rehabilitation strategy for Newstan Colliery includes a monitoring program that is to assess the progress of rehabilitated areas towards achieving the overall objectives of the strategy. A number of elements are required to be monitored as part of the program including both vertebrate and invertebrate fauna species. An invertebrate, bird and microbat survey was conducted at multiple reference and rehabilitation sites throughout the project area. This is the third survey using this monitoring design for the annual monitoring program, which is to continue on an annual basis until a nominated end date is prescribed by the Director General.

Bird diversity, which totalled 51 species for 2017, was lower than 2016 (n=53) and higher than 2015 (n=46). Substantial increases in bird diversity were evident at the rehabilitation sites during this year's survey. No threatened birds were detected during 2017 surveys.

Of the eight species of microbats detected throughout various sites, three are listed as Vulnerable under the BC Act. Of these threatened species, the Little Bentwing Bat (*Miniopterus australis*) was recorded at all sites successfully surveyed for microbats. It was expected that reference sites would display a higher diversity of microbat presence, however, Bat Alley and Analogue 1 had the highest number of species (n=7).

Results of the survey indicate that the invertebrate communities at the rehabilitation sites appear to be continuing the initial stages of recovery. Whilst the invertebrate community has not yet returned to control levels, it has re-established and only Rehabilitation Site A appears to have a single dominant species taking advantage of the different conditions. A mixture of ground-dwelling and aerial insects is present within all rehabilitation sites and it does appear that some functional indicator groups are present. The rehabilitation sites are progressing towards achieving the success criteria and the overall objective of returning the areas to resemble an un-disturbed environment.

Recommendations for the ongoing management of monitoring sites have been developed to address those factors that limit the habitat potential at each site (as detailed in Section 4.8 above). The majority of sites are showing signs of disturbances primarily by dense weed infestations. Natural regeneration is generally slow and active management practices are encouraged to significantly improve the quality of potential habitat located at each site.

The following recommendations have been made to supplement the natural regeneration of habitat at each monitoring site:

- Installation of nest boxes at Analogue Site 1 is encouraged to supplement roosting and nesting habitat for arboreal mammals, microchiropteran bats, owls and parrots;
- Enhancement of ground resources such as logs, and rock is recommended for all rehabilitation sites; and
- A weed control program should be employed at Rehabilitation Sites A, B, C and Analogue Sites 1 and 2 to contain the spread of weeds and aim to re-establish a native understorey at each site.

Continued monitoring of the sites as described within Section 2 of this report will complement the current data sets. Monitoring will also provide valuable information regarding the effectiveness of any management actions implemented as a result of the recommendations provided within this report.

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7.0 Acronyms and Units

AMR	Annual Monitoring Report
BC Act	*Biodiversity Conservation Act* 2016
DBH	Diameter at Breast Height
EEC	Endangered Ecological Community
EPBC Act	*Environment Protection and Biodiversity Conservation Act* 1999
LHCCREMS	Lower Hunter and Central Coast Regional Environmental Mapping System
NPWS	National Parks and Wildlife Service

Appendix 1

Fauna Species List

Common Name	Scientific Name
Avifauna	
Australian Magpie	*Cracticus tibicen*
Australian Raven	*Corvus coronoides*
Australian Reed-Warbler	*Acrocephalus australis*
Australian Wood Duck	*Chenonetta jubata*
Bell Miner	*Manorina melanophrys*
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*
Brown Thornbill	*Acanthiza pusilla*
Brown Quail	*Coturnix ypsilophora*
Buff-rumped thornbill	*Acanthiza reguloides*
Channel-billed Cuckoo	*Scythrops novaehollandiae*
Dollar bird	*Eurystomus orientalis*
Domestic chicken	*Gallus gallus domesticus*
Eastern Koel	*Eudynamys orientalis*
Eastern Rosella	*Platycercus eximius*
Eastern Spinebill	*Acanthorhynchus tenuirostris*
Eastern Whipbird	*Psophodes olivaceus*
Eastern Yellow Robin	*Eopsaltria australis*
Fan-tailed Cuckoo	*Cacomantis flabelliformis*
Galah	*Eolophus roseicapillus*
Golden Whistler	*Pachycephala pectoralis*
Grey Fantail	*Rhipidura albiscapa*
Grey Shrike-thrush	*Colluricincla harmonica*
Laughing Kookaburra	*Dacelo novaeguineae*
Lewin's Honeyeater	*Meliphaga lewinii*
Little Lorikeet	*Glossopsitta pusilla*
Magpie-lark	*Grallina cyanoleuca*
Noisy Miner	*Manorina melanocephala*
Olive-backed oriole	*Oriolus sagittatus*
Pallid cuckoo	*Cacomantis pallidus*
Pied Butcherbird	*Cracticus nigrogularis*
Pied Currawong	*Strepera graculina*
Purple Swamphen	*Porphyrio porphyrio*

Common Name	Scientific Name
Rainbow bee-eater	*Rainbow Bee-eater*
Red-browed Finch	*Neochmia temporalis*
Restless Flycatcher	*Myiagra inquieta*
Rufous Whistler	*Pachycephala rufiventris*
Sacred Kingfisher	*Todiramphus sanctus*
Silvereye	*Zosterops lateralis*
Spotted Pardalote	*Pardalotus punctatus*
Striated thornbill	*Acanthiza lineata*
Superb Fairy-wren	*Malurus cyaneus*
Variegated Fairy-wren	*Malurus lamberti*
Weebill	*Smicrornis brevirostris*
Welcome Swallow	*Hirundo neoxena*
Whistling kite	*Haliastur sphenurus*
White-cheeked Honeyeater	*Phylidonyris niger*
White-throated Gerygone	*Gerygone olivacea*
White-throated tree creeper	*Cormobates leucophaea*
Willie Wagtail	*Rhipidura leucophrys*
Wonga pigeon	*Leucosarcia picata*
Yellow-faced Honeyeater	*Lichenostomus chrysops*
Mammals	
Red Fox	*Vulpes vulpes*
Red-necked Wallaby	*Macropus rufogriseus*
Black Rat	*Rattus rattus*
Northern Brown Bandicoot	*Isoodon macrourus*
White-striped Freetail-bat	*Austronomus australis*
Gould's Wattled Bat	*Chalinolobus gouldii*
Chocolate Wattled Bat	*Chalinolobus morio*
Little Bentwing Bat	*Miniopterus australis*
Eastern Bentwing Bat	*Miniopterus orianae oceanensis*
Eastern Freetail bat	*Mormopterus norfolkensis*
Freetail Bat	*Mormopterus ridei*
Horseshoe Bat	*Rhinolophus megaphyllus*

Appendix 2

Anabat Results

Appendix 3

Invertebrate Results

Morphospecies	Rehab A/1	Rehab B/2	Rehab C/3	Analogue Site 1	Analogue Site 2	Dominant Community
Apis mellifera					4	
Mites			1			
Midges		3		7		2
Tiny wasp	2	7	8	5	6	4
Wasp						
Wasp 2				1	3	
Wasp 3			1	1	3	
Wasp 4					4	
Wasp 5					1	
Wasp 6				1	1	
Wasp 7				1	1	
Wasp 8	1		1			
Wasp 9			5			
Wasp 10				1		
Wasp 11				1		
Wasp 12				1		
Wasp 13						1
Small black wasp				1		
Small black wasp 2			1			
Small black wasp 3			7	9		5
Small blk/org wasp				1		
Medium black wasp		1	1			
Medium black wasp 2				1	1	
Tiny grasshopper					1	
Tiny lepidoptera	1		1			
Amphipod 1		1	3			
Coleoptera 1	10					
Tiny mosquito					1	
Springtail			2	7		1
Thysanoptera sp			1			
Wolf spider			1		1	
Arachnids	2		5	2		
Arachnid 2					1	
Arachnid 3					1	
Tiny black beetle	1				3	1
Proboscid beetle		1				
Nematocera 1			1	2		
Nematocera 2				3		

Morphospecies	Rehab A/1	Rehab B/2	Rehab C/3	Analogue Site 1	Analogue Site 2	Dominant Community
Jumping spider			1			
Collembola		1				1
Collembola 2						2
Coleoptera						
Coleoptera 2			4			
Coleoptera 3		1			3	
Coleoptera 4						
Coleoptera 5						
Coleoptera 6		1				
Coleoptera 7			1			
Coleoptera 8	10	11	12	1		
Coleoptera 9	10	11	12	1		
Gryllidae 1		1				
Tiny brown beetle			1			
Reduvidae 2	1			1		
Gnaphosid sp	1	1	21	2		1
Hymenoptera 1					1	
Hymenoptera 2	1					
Slater	1	7	3	1		
Fly 2					1	
Fly 3		1	2			
Hemiptera			1		2	1
Hemiptera 2			2		2	
Hemiptera 3		1				
Hemiptera 4					1	
Hemiptera 5					1	
Hemiptera 6		1				
Hemiptera 7		1				
Hemiptera 8				1		
Black hemiptera			2			
Wingless hemiptera					2	
Bush Fly		1				
Large Fly 3		1	1	14	11	
Fruit Fly				2	2	
Tiny Fly					3	1
Tiny striped fly			3	4	1	
Tiny stout fly		1	5	1		1
Tiny stout fly 2			2	2	1	

Morphospecies	Rehab A/1	Rehab B/2	Rehab C/3	Analogue Site 1	Analogue Site 2	Dominant Community
Stripped Fly		1				
Stripped wing Fly			1			
Metallic fly					3	
Metallic robber fly					1	
Tiny Metallic fly	1		1			
Long ovi fly					1	
Bull Ant				1		
Flying Ant			1			
Meat ant 1	267					1
Sugar Ant 1			1	1		
Green Ant 1		5	13	5		
Spiny Ant			2			
Small Brown Ant		1	3			1
Small Black Ant	1	7	103	8	7	74
Small mosquito						1

Appendix 4

Flora Results

Scientific Name	Common Name	NSW Status	Comm Status	Rehab A	Analogue 1	Analogue 2	Rehab B	Rehab C	EEC	Dom Com
Acacia decurrens	Black Wattle			1	1	1	1	1		
Acacia falciformis	Broad-leaved Hickory			1			1			
Acacia implexa	Hickory Wattle			1		1				
Acacia irrorata	Green Wattle								1	
Acacia linifolia	White Wattle			1						
Acacia longifolia					1		1	1		
Acacia mearnsii	Black Wattle				1			1		
Acacia parramattensis	Sydney Green Wattle				1					
Acacia salicina	Cooba							1		
*Acacia saligna**	Orange Wattle							1		
Adiantum aethiopicum	Common Maidenhair								1	
*Ageratina adenophora**	Crofton Weed			1	1					
Allocasuarina spp.								1		
Allocasuarina torulosa	Forest Oak					1				1
*Ambrosia artemisifolia**	Annual Ragweed			1						
*Andropogon virginicus**	Whisky Grass				1	1				
Angophora costata	Smooth-barked Apple				1				1	
Banksia spinulosa	Hairpin Banksia									1
*Bidens pilosa**	Cobbler's Pegs			1	1	1	1	1		
Billardiera scandens	Hairy Appleberry								1	

Scientific Name	Common Name	NSW Status	Comm Status	Rehab A	Analogue 1	Analogue 2	Rehab B	Rehab C	EEC	Dom Com
Boronia parviflora	Swamp Boronia									1
*Briza maxima**	Quaking Grass					1				
*Briza subaristata**	-				1	1	1			
Callistemon salignus	Willow Bottlebrush								1	
Cassytha glabella									1	
Centella asiatica	Swamp Pennywort								1	
*Chloris gayana**	Rhodes Grass				1		1	1		
*Cirsium vulgare**	Spear Thistle			1	1					
*Conyza sumatrensis**	Tall Fleabane				1		1	1	1	
Corymbia gummifera	Red Bloodwood									1
Corymbia maculata	Spotted Gum			1	1	1	1	1	1	1
Cotula australis	Common Cotula			1						
Cynodon dactylon	Common Couch			1	1	1	1	1		
Daviesia ulicifolia	Gorse Bitter Pea							1		
Desmodium varians	Slender Tick-trefoil								1	
Dianella caerulea	Blue Flax-lily								1	1
Dichondra repens	Kidney Weed					1	1		1	
Dillwynia retorta	Eggs and Bacon									1
Dioscorea transversa	Native Yam								1	
Dodonaea triquetra	Hop-bush						1	1	1	

Scientific Name	Common Name	NSW Status	Comm Status	Rehab A	Analogue 1	Analogue 2	Rehab B	Rehab C	EEC	Dom Com
Doryanthes excelsa	Gymea Lily								1	
Echinopogon caespitosus	Bushy Hedgehog grass									1
Entolasia marginata	Bordered Panic								1	
Entolasia stricta	Wiry Panic								1	1
Epacris pulchella	Wallum Heath									1
Eragrostis brownii	Brown's Lovegrass					1				
Eragrostis leptostachya	Paddock Lovegrass					1				
Eucalyptus capitellata	Brown Stringybark									1
Eucalyptus elata	River Peppermint				1					
Eucalyptus resinifera	Red Mahogany								1	
Eucalyptus siderophloia	Northern Grey Ironbark				1					
Gahnia clarkei	Tall Saw-sedge								1	
Geitonoplesium cymosum	Scrambling Lily								1	
Glochidion ferdinandi var. ferdinandi	Cheese Tree								1	
Glycine clandestina	Twining Glycine								1	
Goodenia heterophylla								1		1
Hakea propinqua	Warty Needlebush					1				
Hardenbergia violacea	False Sarsparilla				1					
*Hydrocotyle bonariensis**	Kurnell Curse / Pennywort			1						

Scientific Name	Common Name	NSW Status	Comm Status	Rehab A	Analogue 1	Analogue 2	Rehab B	Rehab C	EEC	Dom Com
*Ipomoea cairica**	Coastal Morning Glory			1						
Joycea pallida	Silvertop Wallaby Grass									1
*Juncus cognatus**	-					1				
Kennedia rubicunda	Dusky Coral Pea				1			1		
Lambertia formosa	Mountain Devil									1
*Lantana camara**	Lantana			1				1	1	
Lepidosperma laterale	Variable Sword-sedge									1
Leptospermum juniperinum	Prickly Tea-tree					1				
Leptospermum polygalifolium	Tantoon							1	1	
Leptospermum trinervium	Slender Tea-tree									1
Leucopogon appressus	-									1
Lomandra longifolia	Spiky-headed Mat-rush			1					1	1
Lomandra obliqua	Twisted Mat-rush									1
*Lonicera japonica**	Japanese Honeysuckle								1	
*Megathyrsus maximus**	Guinea Grass			1	1		1	1		
Melaleuca armillaris subsp. armillaris	Bracelet Honey Myrtle					1				
Melaleuca linariifolia	Snow in Summer								1	
Melaleuca stypheloides	Prickly-leaved Tea Tree								1	
Microlaena stipoides	Weeping Grass								1	

Scientific Name	Common Name	NSW Status	Comm Status	Rehab A	Analogue 1	Analogue 2	Rehab B	Rehab C	EEC	Dom Com
*Nephrolepis cordifolia**	Fish-bone Fern					1				
Oplismenus imbecillis	-								1	
Oxalis perrenans	Yellow-flowered Wood Sorrel			1					1	
Pandorea pandorana	Wonga Vine								1	
Panicum simile	Two Colour Panic							1		
Parsonsia straminea	Common Silkpod						1			
*Pennisetum clandestinum**	Kikuyu, Kikuyu Grass			1		1		1		
Persoonia levis	Broad-leaved Geebung									1
Phyllanthus hirtellus	Thyme Spurge								1	
Pimelea linifolia	Slender Rice Flower									1
*Plantago lanceolata**	Ribwort				1	1	1	1		
Podolobium ilicifolium	Prickly Shaggy Pea									1
Polymeria calycina	Bindweed								1	
Pseuderanthemum variabile	Pastel Flower								1	
Ptilothrix deusta	-									1
Ranunculus lappaceus	Glossy Buttercup			1						
Ranunculus spp.					1					
*Ricinus communis**	Castor Oil Plant			1						
*Senecio madagascariensis**	Fireweed				1	1				
*Senecio pterophorus**	African Daisy							1		

Scientific Name	Common Name	NSW Status	Comm Status	Rehab A	Analogue 1	Analogue 2	Rehab B	Rehab C	EEC	Dom Com
Senna pendula var. *glabrata**	-				1				1	
*Setaria pumila**	Pale Pigeon Grass					1	1			
*Sida rhombifolia**	Paddy's Lucerne				1	1	1			
*Solanum mauritianum**	Wild Tobacco								1	
*Sorghum spp.**								1		
*Sporobolus africanus**	Parramatta Grass					1				
Stephania japonica	Snake vine								1	
*Tephrosia grandiflora**	-						1	1		
Themeda triandra	Kangaroo Grass						1			1
Trachymene spp.	Trachymene					1			1	1
*Verbena bonariensis**	Purpletop			1	1	1	1			
Veronica plebeia	Creeping Speedwell				1					
*Vicia sativa**	Common vetch						1			
*Vicia villosa**	Russian Vetch						1			