YANCOAL
兖煤澳大利亚有限公司

Duralie Coal Mine
Annual Review

2020

DURALIECOAL
Part of the Yancoal Australia Group

DURALIE COAL MINE

ANNUAL REVIEW

Reporting Period: 1st July 2019 to 30th June 2020

Table 1 – Annual Review Title Block

Name of operation	*Duralie Coal Mine*
Name of operator	*Yancoal Australia Ltd*
Development consent/ project approval #	*PA (08_0203) (Duralie Extension Project)*
Name of holder of Development consent/ project approval #	*Duralie Coal Pty Limited*
Mining lease #	*ML1427, ML1646*
Name of holding of mining lease	*CIM Duralie Pty Ltd*
Water licence #	*20BL168404, 20WA202053, various monitoring bore licences.*
Name of holder of water licence	*CIM Duralie Pty Ltd & Duralie Coal Pty Ltd*
MOP/ RMP start date	*1st January 2020*
MOP/ RMP end date	*31st December 2021*
Annual Review start date	*1st July 2019*
Annual Review end date	*30th June 2020*
I, John Cullen, certify this audit report is true and accurate record of the compliance status of Duralie Coal Mine for the period of 1st July 2019 to 30th June 2020 and that I am authorised to make this statement on behalf of Yancoal. *Note.* *a) The Annual Review is an 'environmental audit' for the purpose of section 9.39 of the Environmental Planning and Assessment Act 1979. Section 9.42 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 the 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	*Mr John Cullen*
Title of authorised reporting officer	*Operations Manager – Duralie Coal*
Signature of authorised reporting officer	
Date	*30 September 2020*

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1 STATEMENT OF COMPLIANCE

This Annual Review has been prepared in accordance with NSW Project Approval 08_0203 Schedule 5, Condition 3 for the Duralie Coal Mine (DCM) for the period 1 July 2019 to 30 June 2020. This report is also prepared in accordance with the annual reporting requirements for ML 1427 Condition 3 and ML 1646 Condition 4.

Table 2 provides a statement of compliance against DCPL's relevant approvals. A summary of the non-compliances with Project Approval 08_0203, ML 1427 and ML 1646 during the reporting period are included in Table 3. During the reporting period there were no identified non-compliances or reportable incidents at the DCM.

Table 2- Statement of Compliance

Were all conditions of the relevant approval(s) complied with?	
Project Approval No. 08_0203	No
ML1427, ML1646	Yes

Table 3 – Summary of Non-compliances

Condition #	**Condition Description/Non-Compliance**	**Compliance Status/Risk**	**Comment**	**Section addressed**
Project Approval 08_0203				
Schedule 3, Condition 32	Duralie Coal Mine Groundwater Management Plan Section 6 Monitoring Program. Quarterly groundwater monitoring during February 2020 partially not completed, i.e. 8 of 17 sites not sampled.	Non-compliant	Groundwater monitoring scheduled for February 2020 was partially not completed due to limited access resulting from wet weather. Follow-up monitoring was attempted in March 2020, however ground conditions were still unsuitable to allow safe access to the monitoring sites. No adverse effects would be anticipated resulting from the non-compliance. No groundwater impacts have been observed. The next round of quarterly groundwater monitoring was completed in May 2020.	Section 7.3.2
Schedule 3 Condition 7	Duralie Coal Mine Noise Management Plan Section 7.5 Sound Power Level Monitoring – Annual mobile plant sound power monitoring not undertaken.		No mobile plant sound power monitoring has been undertaken during the reporting period due to the reduced fleet, reduced operating periods and no evening or night-time operations. Notwithstanding, an administrative non-compliance has been recorded in accordance with the NMP monitoring requirements. No adverse effects would be anticipated resulting from the non-compliance and no noise complaints have been received. The NMP will be revised in the next reporting period to reflect monitoring requirements during periods of reduced operations.	Section 6.8.5

Schedule 3 Condition 29(b)	Duralie Coal Mine Surface Water Management Plan Section 8.7 Ecotoxicity Testing Program – ecotoxicity monitoring not completed in reporting period.		Ecotoxicity monitoring was not undertaken during the reporting period as required. The application of mine water via irrigation ceased in 2018. A review of ecotoxicity monitoring results between 2013 and 2019 was undertaken in April 2019. There was no evidence of any significant toxicity and no connection with any effects from mining. The review recommended that the Ecotoxicity Testing Program is no longer required in the absence of irrigation. Notwithstanding, an administrative non-compliance has been recorded against the current requirements of the WMP. A review of the WMP will be prepared in the next reporting period to update the ecotoxicity monitoring requirements as per the recommendations in CMLR, 2019.	Section 7.2.5
ML 1427 & ML 1646				
	Nil			

Table 4 – Compliance Status Categories

Risk Level	Colour Code	Description
High	Non-Compliant	Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence
Medium	Non-Compliant	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-Compliant	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 non-compliance	Non-Compliant	Non-compliance which does not result in any risk of environmental harm

2. INTRODUCTION

The Duralie Coal Mine (DCM) is located in the Gloucester Basin approximately 80km north of Newcastle in New South Wales, between the villages of Stroud Road and Wards River. Refer **Figure 1** (**Appendix 1**).

Duralie Coal Pty Ltd (DCPL), a wholly owned subsidiary of Yancoal Australia Limited (YAL), is the owner and operator of the DCM.

Development Consent for the mine was granted by the NSW Minister for Urban Affairs and Planning on 21 August 1997 and Mining Lease Number 1427 was issued by the NSW Minister for Mineral Resources on 6 April 1998.

In October 1998, a Statement of Environmental Effects (SEE) was produced to consider proposed alterations to the Duralie Coal Mine. These proposed alterations were approved by the NSW Minister for Urban Affairs and Planning on 5 February 1999.

Construction commenced in June 2002 with mining production commencing in March 2003 and the first coal railed to the Stratford Mining Complex (SMC) for processing in the same month.

DCPL received Project Approval for the Duralie Extension Project (PA 08_0203) in November 2010 for mining activities to extend until 31 December 2021 and Mining Lease 1646 was issued on 4 January 2011. The Project Approval has since been modified on two occasions on 1 November 2012 and 5 December 2014.

DCM consists of an open-cut, truck and excavator mine producing run of mine (ROM) coal, which is railed to the Stratford Mining Complex (SMC) and processed at the SMC Coal Handling and Processing Plant (CHPP).

This Annual Review (AR) has been prepared in accordance with the conditions of the Project Approval and Mining Leases, and in accordance with the Department of Planning and Environment (DPE) Annual Review Guidelines (October 2015).

The AR describes the environmental protection, pollution control and rehabilitation activities at the DCM for the period 1 July 2019 to 30 June 2020. As required by the Project Approval, comparisons of environmental monitoring results have been made against relevant statutory requirements, monitoring results of previous years and relevant predictions of Environmental Assessments. Environmental management activities planned for the next 12 months are also discussed.

2.1 MINE CONTACTS

The DCM is an owner operated mine site by DCPL Site personnel responsible for mining, rehabilitation and environmental issues at the end of the reporting period were:

Position	Name	Contact
Operations Manager, Stratford & Duralie Operations	Mr John Cullen	02 6538 4210
Environment & Community Superintendent	Mr Michael Plain	02 6538 4203

3. APPROVALS

3.1.1 Status of Leases, Licences, Permits and Approvals

The DCM operates in accordance with the approvals provided in Table 5.

Table 5 – Duralie Coal Mine - Leases, Licences and Approvals

Description	Date of Grant	Duration of Approval	Comment
NSW Project Approvals			
Duralie Extension Project – Project Approval (08_0203)	5/12/2014 (As Modified)	The Applicant may carry out mining operations on site until the end of 2021.	• Granted 26/10/2010. • MOD 1 (Rail Hours) 1/11/2012. • MOD 2 (Open Cut variations) 5/12/2014.
Mining Leases and Exploration Licences			
ML1427	06/04/1998	21 years. (06/04/2019)	Renewal lodged in April 2018.
ML1646	04/01/2011	21 years. (04/01/2032)	Variation of Conditions dated 20/06/2018
AUTH 315	14/10/2013	28 November 2017.	Renewal lodged 27/11/2017.
Environment Protection Licences			
Environment Protection Licence (EPL) 11701	4/9/2002	Until the licence is surrendered, or revoked.	As modified by subsequent variations (refer to EPA website).
Commonwealth Approvals			
Commonwealth Approval (EPBC 2010/5396)	22/10/2010	22/10/2020	Commencement of Action 14/01/2011.
Water Licences			
Water Supply Works Approval 20WA202053	1/7/2004	1 October 2028.	Coal Shaft Creek diversion and various on-site water management structures. Renewed 17/10/2018.
WAL 41518 (previously 20BL168404)	22/09/2002	Perpetuity	Groundwater Licence for the Duralie Open Cut extraction. Converted to WAL 41518 under WM Act 2000 on 14/12/2017.
Groundwater licences – various monitoring bores.	Various	Perpetuity	Monitoring purposes only.

Environmental Management Plans

Environmental Management Plans (EMPs) have been prepared and approved for the DCM. The current versions approved by DPIE are available on the Duralie Coal website.

- Environmental Management Strategy (revised). Approved 24 October 2017.
- Air Quality and Greenhouse Gas Management Plan (revised). Approved 23 June 2015.
- Biodiversity Management Plan (revised). Approved by DP&E 25 January 2019, DoEE 27 November 2018.
- Blast Management Plan (revised). Approved 24 October 2017.
- Giant Barred Frog Study. Approved 6 March 2012.
- Giant Barred Frog Management Plan (revised). Approved 5 September 2017.
- Heritage Management Plan (revised). Approved 23 June 2015.
- Noise Management Plan (revised). Approved 9 May 2018.
- Waste Management Plan. Approved 23 June 2015.
- Water Management Plan (revised). Approved 5 September 2017.
- Mining Operations Plan & Rehabilitation Management Plan (MOP) (revised). Resources Regulator approved 27 February 2020.
- Duralie Extension Project Study of Dust Emissions from Rail Transport under condition 21A of the Project Approval, approved 2012.
- Consultation Plan – Additional Rail Noise Mitigation Measures, approved December 2012.
- Pollution Incident Response Management Plan (revised), January 2019.

3.1.2 Amendments to Approvals/Licences during the Reporting Period

Table 6 lists approvals and amendments that were granted during the reporting period.

Table 6 – Amendments to Approvals/Licences

Licence/Approval	Amendment type	Date of amendment
Mining Operations Plan and Rehabilitation Management Plan (MOP)	New MOP prepared for period 1 January 2020 to 31 December 2021.	27 February 2020

4. OPERATIONS SUMMARY

A summary of operations (Production), during the preceding and current reporting period as well as a forward forecast for the next reporting period is provided below in **Table 7**.

Table 7 - Production Summary

Material	Approved limit (specify source)	Previous reporting period (tonnes)	This reporting period (tonnes)	Next reporting period (tonnes)
Waste Rock/ Overburden (BCM) (DCM only) [2]	N/A	225,969	0	695,000
ROM Coal (DCM only)	3 million tonnes per annum	172,170	0	327,000
PAF Rehandle (LCM) [1]	N/A	98,070	264,463	1.084,000
Codisposal Reject (Includes Stratford Consent)	Approx. 12.3 million tonnes over life of project.	308,111	535,056	563,000
Saleable product (Includes Stratford Consent)	N/A (Process limit of 5.6 million tonnes per annum)	415,690	763,749	1,065,000

Note 1: Rehandled PAF overburden material reported separately in LCM.
Note 2: Waste rock measured in BCM.

No ROM coal or overburden was mined at the DCM during the reporting period. Product coal utilising Duralie ROM coal is produced at the SMC. No Duralie ROM coal was processed at the CHPP to produce a saleable product coal during the reporting period. Saleable coal production, incorporating both SMC and DCM (nil contribution), for the period July 2019 to June 2020 was 763,749 tonnes comprising 193,168 tonnes of coking coal and 570,581 tonnes of thermal coal.

Duralie ROM production for the reporting period is listed in **Table 8** below by month.

Table 8: Monthly ROM Coal Production from the DCM

MONTH	ROM PRODUCTION (tonnes)
July 2019	0
August 2019	0
September 2019	0
October 2019	0
November 2019	0
December 2019	0
January 2020	0
February 2020	0
March 2020	0
April 2020	0
May 2020	0
June 2020	0
Total	**0**

Product coal production to date by month is shown in **Table 9**.

Table 9: Product Coal Produced by Month from SMC

MONTH	Coking Coal	Thermal Coal	Total Product Coal
July 2019	32,364	49,225	81,589
August 2019	31,038	82,192	113,230
September 2019	16,287	83,993	100,280
October 2019	11,471	92,215	103,686
November 2019	21,053	88,425	109,478
December 2019	16,380	49,711	66,091
January 2020	10,076	31,091	41,167
February 2020	11,852	23,672	35,524
March 2020	7,463	13,225	20,688
April 2020	9,023	10,178	19,201
May 2020	12,723	20,005	32,728
June 2020	13,438	26,649	40,087
Total Annual	**193,168**	**570,581**	**763,749**

4.1 EXPLORATION

No exploration activities were undertaken during the 2019-2020 reporting period. No exploration activities are proposed for Authorisation 315 (A315) during the 2020-2021 reporting period. Work within the exploration lease areas will focus predominately on data management, review and interpretation.

During the reporting period Assessment Lease Application (ALA74) was lodged covering areas incorporating A315. A revised renewal application for A315 will be lodged with DRG Titles Services, excluding the ALA74 area.

4.2 ESTIMATE MINE LIFE

In accordance with PA 08_0203, mining operations are permissible until 31 December 2021.

Mining operations including rehabilitation activities at the DCM are expected to continue during this period. ROM coal production at the DCM ceased in October 2018. Approximately 300kt of ROM coal is remaining in the Weismantel pit and this remaining coal is intended to be extracted between 2020 to 2021. The MOP includes the production schedule for the next two years.

A new MOP will be prepared for the next term following 31 December 2021. This MOP will include the ongoing compliance requirements in accordance with PA 08_0203, ML 1427 and ML 1646 including rehabilitation obligations.

4.3 MINING

The DCM is an open cut truck and shovel operation located approximately 20km south of the Stratford Mine facilities, producing ROM coal, which is railed to the SMC and processed at the SMC Coal Handling and Processing Plant (CHPP). Product coal is transported via train on the North Coast Railway to the Port of Newcastle

The operations extract ROM coal from the Weismantel and Clareval seams at the base of the Gloucester Coal Measures. The deposit forms a synclinal structure with the open cut area located at the southernmost crop line within the main axis of the Gloucester Basin. The operation is now situated on the west limb of the syncline with seams dipping at about 50 degrees east. Mining is undertaken within ML1427 and of ML1646 and includes the extension of the Weismantel pit to the north west and the inclusion of the Clareval seam parallel and to the west of the Weismantel seam.

Dips within the deposit vary from a shallow 5 degrees to an almost vertical profile. Consequently, a method of horizontal 3m to 4m benches is used as the primary extraction method. An average of 5m of free dig material is generally experienced at Duralie after which all waste material generally requires blasting.

No mining activities were conducted in the 2019/2020 reporting period. Mining in the Clareval pit was completed during September 2017. Mining of ROM coal within the Weismantel pit ceased in October 2018. Clearing in advance of mining has now been completed up to the approved disturbance limit in both Weismantel and Clareval. Approximately 400kt of ROM coal is remaining in the Weismantel pit and is intended to be extracted between 2020 to 2021.

During the reporting period DCPL complied with the approved operating hours. Mining operations are permitted 7 days per week, however no mining was undertaken during 2019/20. During the reporting period PAF rehandle and rehabilitation works were undertaken on day shift during Monday to Friday with no weekend work. Rehabilitation activities occurred during Q4 2019 and Q1 2020. PAF rehandle operations occurred during May and June 2020.

Surface facilities at the mine and current mine development and rehabilitation as at 30 June 2020 are indicated within **Figure 4**, provided in **Appendix 1**.

4.3.1 Mining Equipment and Method

The mining and rehabilitation equipment currently in use at DCM up until 30 June 2020 is listed in **Table 10** provided below.

Table 10: Current Mining and Rehabilitation Fleet*

Plant Item	Number
Excavators	2 – 1 x Cat 336 and 1 x 6015
Haul Trucks	8 – 5 x Cat 775's and 3 x Volvo 45's
Drills	0
Dozers	2 - D8 and D10
Water Carts	0 2 – 1 x Cat 773 and 1 x 40t
Graders	1 x Cat 14M
Loader (ROM feed)	0

*Total fleet not all used concurrently.

The mobile plant fleet at the DCM has significantly reduced during the reporting period. Table 10, includes the mining fleet undertaking PAF rehandle works and the rehabilitation fleet. The rehabilitation fleet are generally mobilised for individual campaigns of a few months at a time. Rehabilitation activities occurred during Q4 2019 and Q1 2020. PAF rehandle operations occurred during May and June 2020.

The mining sequence is summarised below and is conducted in accordance with the approved MOP and supporting approvals including relevant EMPs (refer Section 1.1) as required. The mining sequence generally occurs in the following manner:

- A vegetation clearance and ground disturbance plan is prepared. This included fauna/flora assessments and cultural heritage surveys.
- A sedimentation control plan is prepared for the area to be disturbed.
- Delineation of the proposed disturbance area is undertaken.
- Water infrastructure and sedimentation controls are implemented.
- Tree clearing is limited to the minimum required for ongoing operations and undertaken ahead of the advancing workings.
- Topsoil is removed in accordance with a topsoil stripping plan.
- Overburden removal is undertaken by a hydraulic excavator. Generally, the first one to five metres of subsoil/overburden is ripped and/or free-dug. Deeper overburden requires blasting prior to excavation.
- Overburden waste material is deposited either in out-of-pit waste emplacements or backfilled into

mining voids.
- Following waste emplacement, shaping to the approved final landform in undertaken in preparation for rehabilitation works.

4.4 COAL HANDLING AND BENEFICATION

4.4.1 Duralie CHP Throughput & Rejects Management

ROM coal is initially handled at the Duralie Coal Handling Plant (CHP). Rock greater than 140 mm is removed from ROM coal using a rotary breaker at the CHP. The separated rock is conveyed to a rejects bin from which it is loaded out and trucked to be buried on site as potentially acid forming (PAF) waste. The ROM coal is then transferred via conveyor to a train loadout bin and railed to the SMC via a shuttle train.

Reject fractions from the ROM coal are generated at the SMC and deposited along with processing waste fractions produced from the washing of SMC coals. The Stratford Mine utilises a co-disposal method that combines the coarse rejects with the intermediate sized materials and tailings. The co-disposal area is managed in accordance with the SMC Life of Mine Reject Disposal Plan. Refer to the SMC Annual Reviews for further details.

4.4.2 ROM Coal Processing On Site

ROM coal is processed through a rotary breaker at the Duralie CHP to produce a coal fraction less than 140 mm. The essential elements of the coal processing plant on site and their design capacities are as follows:

ROM conveyor handling rate	1400 tph
Train load out rate	2400 tph

4.4.3 Coal Stockpile Capacity (ROM)

The ROM pad stockpile with a capacity of 20,000t is utilised for temporary ROM coal storage which is transported by loader directly to the ROM hopper.

4.4.4 Product Transport

All ROM coal is transported from site to the SMC by rail. The approved hours of operation of the Duralie shuttle train are between 6 am and midnight. In exceptional circumstances, the Duralie shuttle train may operate on the North Coast Railway between midnight and 1am in accordance with Condition 8, Schedule 2 of the Project Approval. No ROM coal was railed during the reporting period. DCPL complied with the operating hours and this condition was not utilised during the reporting period.

The last coal transported from the DCM to the SMC occurred in October 2018.

A summary of Product Coal transported during the reporting period is included in the SMC Annual Review as no product is transported directly from Duralie.

4.5 WASTE MANAGEMENT AND RECYCLING

A fully accredited waste contractor was engaged during the reporting period to manage all waste streams from the DCM. This contract includes general waste and recycling, scrap metal, hydrocarbons including waste grease and oil and hazardous waste.

The waste management contractor provides monthly reporting on all waste streams disposed from the DCM. The monthly reports also provide details of recycling achieved and hazardous substances. The waste management contractor undertakes routine inspections of waste disposal facilities to identify any management actions required.

4.5.1 Sewerage Treatment and Disposal

Sewage treatment at the mine site involves multiple septic systems at the offices and crib rooms that manage all generated sewage. Sewage is processed using Garden Master 7100 Elite Aerated Waste Water Treatment Systems. The systems works on the combined principles of primary settlement and aerobic treatment. Treated effluent is discharged via a spray system into a grassed area located to the southwest of the Main Office.

The sewage treatment facility is registered with MidCoast Council and serviced on a quarterly basis by an approved contractor.

4.5.2 Fuel, Oil and Grease Management and Disposal

Fuel (diesel) storage at the mine site consisted of a single 70,000 litre capacity above ground double-skinned storage tank (Transtanks). An "Acknowledgement of Notification of Hazardous Chemicals on Premises" (Acknowledgement Number NDG 036328 was held for this facility during the reporting period. Potential hydrocarbon contaminated runoff from fuel fill points is captured on concrete pads and directed through an oil water separator. Dirty water runoff from the fuel pad is captured and directed to the main water dam.

Bulk oil is stored onsite within a bunded area and double-skinned tanks near the workshop. Used engine oils (lubricating oils), hydraulic oils and grease are recovered during plant and vehicle servicing in the workshop and in the field. Waste oil is stored in designated Transtanks and waste grease is stored in drums on bunded pallets.

Within the workshop area, separate bunded areas hold a 28,000 litre waste oil tank and bulk storage of oils, greases and lubricants (tanks and drums). A washpad is utilised to clean vehicles and plant either prior to leaving site or for general servicing/repair. Off the washpad is a concrete sump which serves to trap silt and from which oil is removed using an oil water separator. Waste oil collected is removed from site by a commercial contractor for subsequent recycling off-site.

4.5.3 Rubbish Disposal

All domestic rubbish (e.g. food scraps, paper etc.) are deposited in industrial rubbish bins which are periodically emptied by a waste contractor for subsequent disposal.

Scrap metal produced by the workshop is collected and transferred off site by a scrap metal merchant. The merchant collects the scrap metal following inspections by the waste contractor.

Paper, cardboard, aluminium drink cans and other recyclables are collected for recycling as part of site waste segregation. Waste is transported to licenced facilities and waste tracking sheets recorded.

4.6 HAZARDOUS AND EXPLOSIVE MATERIALS MANAGEMENT

Hazardous materials are stored and used in accordance with relevant safety data sheets (SDS). SDS's are kept in a file inside the First Aid Room and are available from an online database on the company intranet.

Bulk explosives are approved for storage within an explosives compound at site. During the reporting period blasting activities were completed at the DCM. All blasting products have been removed from site.

All hazardous waste is appropriately disposed of by a fully accredited waste contractor and waste tracking certificates are supplied to DCPL.

4.6.1 Status of Hazardous Chemicals Notification

An "Acknowledgement of Notification of Hazardous Chemicals on Premises" (Acknowledgement Number NDG 036328) issued by SafeWork NSW is held by Duralie Coal Pty Ltd. This Acknowledgement addresses:

- Above-ground tanks (diesel)
- External magazine (detonators and boosters)
- Above-ground tank (oxidising liquid)
- Roofless bulk storage (ammonium nitrate)

4.7 OTHER INFRASTRUCTURE MANAGEMENT

4.7.1 Prescribed Dams - Dams Safety Committee

The Main Water Dam, Auxiliary Dam 1 and Auxiliary Dam 2 are all prescribed under the Dams Safety Act 1978.

Management plans for the prescribed dams are combined into single documents. The DCM Prescribed Dams Operation and Maintenance Manual was updated and approved by the DSC during 2018. The Prescribed Dams Safety Emergency Plan (DSEP) was updated in consultation with the SES and approved by the DSC during 2017.

Routine visual inspections of the prescribed dams are undertaken three (3) times per week. Monthly monitoring of piezometers terminating beneath the dam's clay core and within the clay core is also undertaken and water levels interpreted. Monuments located along the crests of the dams were surveyed for any indication of movement during the reporting period. No significant movement has been identified in any of the dam walls during the reporting period. Routine maintenance of vegetation on the dam walls has been undertaken.

The 5-yearly prescribed dam surveillance reports were scheduled and completed during November 2017. The surveillance reports didn't identify any significant issues with the management and maintenance of the structures. The surveillance reports have been endorsed by the Dam Safety Committee in their letter dated 14 December 2017.

During the reporting period, no water was transferred from the open cuts to the prescribed dams. DCPL has prepared plans for the decommissioning of the prescribed dams. The plans were submitted to NSW Dam Safety who have requested an independent peer review. Following the independent review the plans will be resubmitted to NSW Dam Safety for approval. AD1 was dewatered during February 2018 and decommissioned during the reporting period with the structure completely removed. AD2 is planned to be dewatered during the next reporting period. Further detail regarding the decommissioning of the prescribed dams is included in the mine closure planning program in Section 8.5.

5. ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

DPIE provided notification on 4 November 2019 that the DCM Annual Review 2018/2019 was generally in accordance with the Project Approval requirements and the Department's Annual Review Guidelines, with no further amendments or actions were required.

The Resources Regulator provided confirmation of receipt of the DCM Annual Review 2018/2019 on 29 October 2019, with no further amendments or actions required.

No inspections were undertaken by the Regulators following the submission of the DCM Annual Review 2018/2019.

A site visit was undertaken the Resources Regulator in January 2020 during the preparation of the new Mining Operations Plan for the Duralie Coal Mine.

6. ENVIRONMENTAL PERFORMANCE

6.1 REVIEW OF ENVIRONMENTAL PERFORMANCE

A brief review of environmental performance in relation to EPL 11701, together with Project Approval 08_0203 conditions, is provided below. This performance is further discussed in the sections on environmental management activities and environmental monitoring.

6.1.1 Development Consent or Approval Conditions

DCPL continues to operate in accordance with the existing PA 08_0203.

Development Consent conditions which were met during this reporting period are described in the following sections. These include administrative and reporting conditions, environmental management and monitoring conditions, community engagement and rehabilitation. Environmental monitoring data was regularly reported as required by the development consent and associated EMPs.

EMPs required in accordance with the conditions of PA 08_0203 have been prepared and continued to be implemented during the reporting period. A MOP has been prepared for the DCM and approved by the Resources Regulator on 27 February 2020.

An Independent Environmental Audit of the DCM was not required during the reporting period. The last IEA of the DCM was conducted during December 2017. Further detail is included on Section 10.

6.1.2 EPA Environment Protection Licence 11701

DCPL continues to operate in accordance with the conditions of EPL 11701. During the reporting period there were one identified non-compliance at the DCM relating to Condition M2.3 for surface water monitoring. Refer to EPL 11701 Annual Return 2019 for further details.

- All monitoring has been carried out in accordance with licence conditions.
- Records of environmental monitoring activities have been kept.
- A record of environmental and pollution complaints has been maintained.
- Dust suppression measures are in place. Dust monitoring to date (dust deposition gauges, high volume (PM10) air samplers and a TEOM monitor) shows that current dust suppression systems have been effective and dust levels were below limits set by EPA (upon exclusion of non-dust contamination of dust deposition gauges).
- Noise compliance monitoring was undertaken in November 2019 and May 2020. The surveys

determined that mine noise emissions at the time of the surveys complied with EPA noise level criteria at all monitored locations.
- No sediment dam spills occurred during the reporting period.
- A Pollution Incident Response Management Plan (PIRMP) was maintained and is available on the Duralie Coal website.
- An Annual Return for EPL 11701 was prepared.
- No reportable environmental incidents occurred at the DCM during the reporting period.

During the reporting period nil complaints were received via the EPA hotline. Responses to complaints are provided to the EPA and details are included in the Complaints Register in **Appendix 5** (if applicable).

6.2 METEOROLOGICAL MONITORING

A meteorological station (i.e. weather station) is operated at the mine site as required by the Project Approval conditions. The location of the meteorological station and the two inversion monitoring towers is shown on **Figure 3** (**Appendix 1**).

6.2.1 Rainfall

Table 11 provided below summarises the rainfall record obtained from the site Weather Station rain gauge. Graphical representation of the historical average and monthly recorded rainfall during the reporting period is provided in **Appendix 2**.

Table 11: Duralie Mine - Monthly Rainfall Records

MONTH	YEAR				STROUD DISTRICT
	2020 (to end reporting period)		2019		AVERAGE[2]
	Monthly Total (mm)	No. of Rain Days/Month[1]	Monthly Total (mm)	No. of Rain Days/Month[1]	1889-2010
January	135.6	52	30.4	8	115.3
February	262.6	16	45.2	7	125.0
March	91.0	15	173.6	15	147.3
April	22.0	9	36.2	11	100.9
May	59.4	7	37.6	5	91.5
June	69.0	7	69.4	12	101.1
July			24.2	8	75.1
August			12.2	5	65.3
September			27.0	7	63.1
October			30.8	7	78.3
November			25.2	7	83.3
December			33.4	9	100.8
TOTAL	**639.6**	**106**	**545.2**	**101**	**1147.0**

Notes: 1. No. of Rain Days/Month - the number of days in the month on which rain fell.
(When tipping bucket rain gauge data used, a "rain day" by definition requires a minimum recording of >0.25mm comprising dew, heavy fog or light rain (or a combination thereof).
2. Average based on Stroud Post Office records until mine site weather station commissioned in 2002.

The 2019 calendar year rainfall total was significantly lower than the long-term district average. Two of the twelve months in this period exceeded their respective long term average.

The rainfall total for the reporting period (July 2019 to June 2020) was 792.4 mm, significantly lower than the historical average.

6.2.2 Evaporation

Table 12 shows minimum, average and maximum evaporation rates for the reporting period. The graphical representation of the daily minimum, average and maximum evaporation rates recorded for each month during this review period is provided in **Appendix 2**.

Table 12: Monthly Minimum, Average and Maximum Evaporation Rates

MONTH	MINIMUM EVAPORATION RATE (mm/day)	AVERAGE EVAPORATION RATE (mm/day)	MAXIMUM EVAPORATION RATE (mm/day)
July 2019	0.4	3.0	1.5
August 2019	0.7	3.0	2.3
September 2019	0.7	5.9	3.0
October 2019	0.7	7.8	3.9
November 2019	1.4	8.0	4.8
December 2019	1.0	8.6	5.0
January 2020	0.7	7.8	3.8
February 2020	0.5	6.7	2.7
March 2020	0.6	4.4	1.9
April 2020	0.6	4.7	2.1
May 2020	0.4	3.5	1.4
June 2020	0.3	2.6	1.1

6.2.3 Wind Speed and Direction

Table 13 below indicates the monthly average and maximum wind speeds and dominant wind directions for the period July 2019 to June 2020, inclusive. The graphical representation of the daily average and maximum wind speeds recorded and monthly wind roses for each month during this period are provided in **Appendix 2.**

Table 13: Monthly Average and Maximum Wind Speeds and Dominant Wind Directions by Month

MONTH	AVERAGE WIND SPEED (k/hr)	MAXIMUM WIND SPEED RECORDED (k/hr)	DOMINANT WIND DIRECTIONS
July 2019	6.3	51.6	W
August 2019	8.9	58.1	W
September 2019	9.5	69.7	W-SW
October 2019	9.1	60.5	SSW
November 2019	11.2	46.7	NE & WSW-SSW
December 2019	11.0	58.3	NE
January 2020	9.1	53.2	SSW
February 2020	7.9	53.6	S
March 2020	6.8	37.4	SSW
April 2020	6.5	49.8	W-WSW
May 2020	7.6	46.0	WSW
June 2020	6.2	44.7	W & SSE

6.2.4 Temperature

Table 14 summarises monthly air temperatures. The graphical representation of the daily minimum, average and maximum atmospheric temperatures recorded for each month is provided in **Appendix 2**.

Table 14: Monthly Minimum, Average and Maximum Air Temperatures

MONTH	MINIMUM AIR TEMP RECORDED (deg C)	AVERAGE AIR TEMP (deg C)	MAXIMUM AIR TEMP RECORDED (deg C)
July 2019	0.5	12.0	24.2
August 2019	0.8	12.7	25.0
September 2019	5.4	16.1	32.5
October 2019	7.3	19.2	33.6
November 2019	8.3	22.0	37.8
December 2019	14.0	24.3	43.7
January 2020	17.0	25.2	43.2
February 2020	15.1	22.8	41.5
March 2020	12.0	20.0	35.4
April 2020	7.9	18.4	28.4
May 2020	2.2	13.7	24.5
June 2020	4.1	12.5	23.0

6.3 AIR QUALITY

6.3.1 Dust Control Procedures

DCM has an approved Air Quality and Greenhouse Gas Management Plan (AQMP) that establishes a dust management strategy which:

- Identifies air quality criteria;
- Outlines proactive and responsive dust management and control measures;
- Establishes dust management protocols;
- Formulates an air quality monitoring programme;
- Establishes stakeholder consultation protocols; and
- Details reporting and review requirements.

The following dust control procedures are used during mining operations to control dust emissions from wind erosion on exposed areas and dust generated from mining, handling and processing activities:

- Minimising topsoil stripping operations ahead of the pre-strip to minimise the area of exposed ground;
- Progressive rehabilitation including prompt reshaping, topsoiling and revegetation;
- Watering of haul roads and other trafficked areas;
- Watering dig faces prior to and during digging;
- Fitting drills with dust suppression equipment including aprons and sprays;
- Water sprays on the ROM dump hopper and transfer point between the ROM and train loading bins;
- Water sprays during train coal loading;
- Real-time monitoring with alarm triggers set to enable implementation of reactive dust control management measures; and
- Modifying operations during adverse weather conditions.

6.3.2 Dust Monitoring and Criteria

DCPL monitors air quality (dust) surrounding the mine site by means of a network of nine (9) static dust fallout gauges, four (4) high volume PM_{10} air samplers, one real-time dust monitor (TEOM) and a meteorological monitoring station (i.e. weather station). The locations of these monitoring sites are shown on **Figure 3** (**Appendix 1**).

Monthly dust fallout levels are measured so that dust deposition rates in g/m^2/month can be determined at each monitoring site. The EPA annual average limit for dust deposition is 4.0g/m^2/month.

The high volume air samplers (HVAS) (PM_{10}) are located at locations representative of surrounding sensitive receivers, along Johnsons Creek Road ("Hattam" – located to the northeast of the mine, "Twin Houses" – located to the east of the mine and "High Noon" – located to the south of the mine). A HVAS unit is also located on private land along the Bucketts Way ("Edwards" – located west of the mine).

HVAS sampling occurs for a 24 hour period every 6 days in accordance with AS 2724.3. The EPA goal for air quality is an annual average limit of 30*u*g/m^3/day and a National Environmental Protection Measure (NEPM) 24-hour average limit of 50*u*g/m^3/day.

A Tapered Element Oscillating Microbalance (TEOM) analyser measuring PM_{10} and $PM_{2.5}$ is used to continuously measure particulate matter. Real-time air quality monitoring data is used to identify when ambient PM_{10} levels in the surrounding environment are elevated and require contingency action. Real-time response triggers have been established and are designed to provide a system to warn operation personnel (via SMS) when particulate emissions are approaching a relevant criterion and to implement a hierarchy of management/control actions to mitigate potential impacts.

6.3.3 Review of Dust Monitoring Results

6.3.3.1 Dust Deposition Gauges

Table 15 shows the dust deposition results for nine (9) dust deposition gauges. Gauge D7 is located within the Village of Wards River. **Table 16** shows the annual average dust deposition results at the end of the reporting period (June 2020).

Table 15: Dust Deposition Gauge Results

	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20
D3	5.1[I,V,B,S]	3.2	5.5I[B,V,S]	7.1[I,V,B,S]	5.9[I,V,B,S]	4.3[I,B,S]	5.1[I,V,B]	1.6	0.9	0.4	1.0	7.1[I,V,S]
D4	0.5	0.5	0.4	1.0	2.2	2.7	1.1	2.1	2.9	0.7	0.4	0.1
D5	1.6	1.0	0.7	1.2	3.4	2.4	2.6	0.6	1.3	0.2	2.2	0.5
D7	0.5	0.7	1.3	0.9	1.9	2.7	2.1	1.8	0.8	0.4	0.8	0.3
D8	7.9[O]	0.5	0.6	0.8	1.7	2.5	1.8	1.4	0.6	0.8	1.1	0.7
D9	1.8	0.9	0.9	1.2	2.8	2.0	1.6	1.4	0.7	0.5	0.7	0.2
D10	0.7	0.6	1.4	0.9	2.5	2.5	1.7	2.9	0.9	0.9	0.5	0.5
D12	0.7	0.7	1.0	1.1	1.8	1.5	1.5	3.0	0.5	0.3	0.5	0.1
D13	21.4[I,V,S,O]	0.7	1.1	1.1	6.3[I,V,S]	1.8	1.3	1.5	0.6	4.0[I]	2.4	1.6

Notes/excluded results, Visual Description Guide:
D=Dirt: Subhedral to euhedral crystalline grains including fine sand, clay and other fine mineral particulates.
C=Coal: Black sharp angled grains with glossy conchoidal fractures or dull with cellular feature.
I=Insects: Whole insects e.g. spiders, ants, moths or outer parts of insects including wings, legs and exoskeletons.
S=Polysaccharide Slime: Slimy gelatinous material including decomposed soft body parts of insects and vegetation.
V=Vegetation: Plant debris and algae including trichomes, decomposed organic matter and particulates showing characteristic cellular structures.
B=Bird droppings: The most common contamination.
O=Other contaminants not included above.

Dust levels recorded had an average value of 1.3 g/m^2/month (contaminated results not counted). Elevated values were at times affected by various degrees of contamination from insects, bird droppings, vegetation (seeds/grasses) and algae.

Table 16: Annual Average Dust Deposition Gauge Results

D3	D4	D5	D7	D8	D9	D10	D12	D13	EPA Limit
1.4	1.2	1.5	1.2	1.1	1.2	1.3	1.1	1.3	4.0

Results compared with the EPA annual average upper limit of 4 g/m^2/month indicate no exceedances against criteria at the end of the reporting period. Graphical representation of dust gauge results and annual rolling averages are provided in **Appendix 3**.

Results of depositional dust monitoring were generally similar to previous reporting periods and are in concurrence with the DCM Environmental Assessment (EA) (2010) which predicts the annual average criteria of 4 g/m^2/month will not be exceeded at any receiver and that project only incremental increases in annual average dust deposition will not exceed the applicable 2 g/m^2/month EPA criterion at any receiver.

6.3.3.2 High Volume (PM10) Air Samplers

Table 17 shows the PM_{10} HVAS monitoring results for the four HVAS in ug/m^3/day (24 hours) for the monitoring sites during the reporting period.

Results show that all monitoring locations (in terms of monitored days) did not exceed the National Environmental Protection Measure (NEPM) of 50ug/m^3/day, listed under Condition 19, Schedule 3 of the Project Approval, with the exception during late October to early December 2020 when the region was experiencing catastrophic bushfires. The HVAS 24 hour criteria is to be assessed on an incremental impact (i.e. increase in concentrations due to the development alone, excluding background concentrations from other sources).

On all exceedance events the TEOM monitor also recorded multiple alarms. It is noted that over this period, widespread bushfires were occurring throughout the Northern & Mid Coasts of NSW which were causing very poor regional air quality.

Table 17: High Volume Air Sampler (PM_{10}) Results

Date	High Noon	Twin Houses	Hattam	Edwards
1-Jul-19	6	12	11	10
7-Jul-19	1	3	1	2
13-Jul-19	4	4	6	5
19-Jul-19	2	9	5	3
25-Jul-19	6	14	7	8
31-Jul-19	2	4	4	5
6-Aug-19	4	10	9	4
12-Aug-19	2	5	7	2
18-Aug-19	15	30	11	11
24-Aug-19	13	26	21	12
30-Aug-19	1	1	2	1
5-Sep-19	8	14	20	12
11-Sep-19	3	4	4	3
17-Sep-19	4	4	4	5
23-Sep-19	7	9	10	12
29-Sep-19	6	10	8	10
5-Oct-19	3	13	11	12
11-Oct-19	2	4	4	2
17-Oct-19	20	25	21	21
23-Oct-19	11	16	15	9
29-Oct-19	71	94	77	81
4-Nov-19	4	90	5	5
10-Nov-19	8	14	18	9

Date	High Noon	Twin Houses	Hattam	Edwards
16-Nov-19	44	100	172	30
22-Nov-19	128	135	126	127
28-Nov-19	65	66	66	65
4-Dec-19	16	18	17	16
10-Dec-19	89	91	96	90
16-Dec-19	31	37	34	37
22-Dec-19	28	31	33	33
28-Dec-19	25	25	24	27
3-Jan-20	20	18	22	22
9-Jan-20	34	26	33	32
15-Jan-20	13	24	11	10
21-Jan-20	33	39	38	45
27-Jan-20	24	21	22	22
2-Feb-20	23	24	24	23
8-Feb-20	5	4	4	4
14-Feb-20	11	12	12	12
20-Feb-20	17	20	17	16
26-Feb-20	10	12	15	12
3-Mar-20	18	18	19	18
9-Mar-20	8	8	8	8
15-Mar-20	8	10	9	11
21-Mar-20	17	24	21	21
27-Mar-20	7	9	8	7
2-Apr-20	9	10	7	8
8-Apr-20	5	4	3	4
14-Apr-20	10	11	11	9
20-Apr-20	6	14	11	8
26-Apr-20	8	12	10	11
2-May-20	1	1	2	2
8-May-20	4	10	6	4
14-May-20	4	5	5	4
20-May-20	2	4	3	3
26-May-20	6	5	6	7
1-Jun-20	3	3	3	3
7-Jun-20	10	10	11	14
13-Jun-20	1	1	1	1
19-Jun-20	2	4	3	3
25-Jun-20	1	3	2	1
Annual Rolling Average	**15.6**	**21.0**	**19.6**	**16.6**

Annual averages for all sampling locations were below the 30 µg/m^3/day criterion set under the Project Approval. Graphical representation of the annual rolling average for the four HVAS including PM10 and TSP during the reporting period is provided in **Appendix 3**. The HVAS rolling averages increased over the 12 month period, primarily due to the poor air quality during late 2019 resulting from the widespread bushfires. The rolling average at the end of the reporting period for "High Noon" was 15.6, "Twin Houses" was 21.0, "Hattam" was 19.6 and Edwards was 16.6 ug/m^3/day. Thus, annual averages for all sampling locations were well below the 30 ug/m^3/day criterion.

Results of HVAS monitoring are in concurrence with the DCM EA (2010) which predicts the annual average PM_{10} criterion of 30 µg/m^3 will not be exceeded at any receiver and that project only 24 hour PM_{10} concentrations will not be above the 50 µg/m^3 criterion at any privately owned receiver with the exception of "Hattam" which is now mine owned and in close proximity to the mining operations. Other than exceedances resulting from extraordinary circumstances (extreme bushfires) all results at all sites were below the 50 µg/m^3 24 hour criterion during the reporting period. The HVAS annual rolling averages

remained low and fluctuations generally reflect changes in meteorological conditions throughout the year, i.e. rainfall and wind.

6.3.3.3 High Volume (TSP) Air Calculation

Concentrations of TSP are calculated, based on the results of the PM_{10} HVAS and the assumption that 40% of TSP is PM_{10}, as per the relationship obtained from co-located TSP and PM_{10} monitors operated in the Hunter Valley (NSW Minerals Council, 2000) as per the approved AGMP.

The derived TSP annual rolling averages for the four HVAS are shown in **Appendix 3**. The TSP rolling average at the end of the reporting period for "High Noon" was 38.9, "Twin Houses" was 52.6, "Hattam" was 49.0 and Edwards was 41.6 ug/m^3/day. Thus, annual averages for all sampling locations were below the 90 ug/m^3/day criterion.

6.3.3.4 TEOM (PM_{10}) Monitoring

A TEOM which measures PM_{10} and $PM_{2.5}$ on a real-time continuous basis is utilised as a management tool for operations to guide proactive and reactive mitigation measures. Real-time air quality monitoring data is used to identify when ambient PM_{10} levels in the surrounding environment are elevated and require contingency action. Real-time response triggers have been established and are designed to provide a system to warn operation personnel (via SMS) when dust levels are approaching a relevant criterion and to require management/control actions to mitigate potential impacts.

24 hour average results for the reporting period and graphical representation of the running/cumulative average of PM_{10} results are provided in **Appendix 3.** The annual average from 1 July 2019 to 30 June 2020 is 18.9 ug/m^3 for $PM_{10.}$ The TEOM results are generally consistent with those measured by the HVAS units.

A register was maintained recording any trigger alarms from the TEOM system and the response implemented by DCPL. All alarms during the reporting period resulted from either external events such as bushfires during October to December 2019, strong winds and regional dust storms or system calibration and maintenance. A real-time dust monitoring response register for the reporting period is provided in **Appendix 3.**

6.3.4 Complaints

No complaints related to air quality were received during the reporting period. A full detailed complaints list is provided in **Appendix 5**.

6.4 BIOREMEDIATION

Operations at the DCM are conducted with the aim of minimising the potential for land contamination. The management of hydrocarbon contaminated soils is detailed in the Duralie Coal PIRMP. DCM has previously operated an onsite bioremediation area for hydrocarbon contaminated soil where biological degradation of hydrocarbons is used to reduce the hydrocarbon concentration in the soil to an acceptable level.

The bioremediation area at the DCM was decommissioned during the 2017/18 reporting period, following the ceasing of operations and maintenance activities at the DCM. Any hydrocarbon contaminated material is now recovered and stored for disposal offsite by the licenced waste contractor engaged at DCPL.

6.5 BIODIVERSITY

In accordance with Condition 33, Schedule 3 of the Project Approval, DCM is required to implement the Offset strategy and achieve the broad completion criteria to the satisfaction of the Secretary of the DPIE. The management of biodiversity at the DCM in both the Mining Lease areas and the Biodiversity Offset Area is undertaken in accordance with the approved Biodiversity Management Plan (BMP).

The *DCM Annual Biodiversity Report 2020* (**Appendix 6**) provides a review of the effectiveness of measures in the Biodiversity Management Plan (BMP) for the annual period ending 30 June 2020 in accordance with Section 7.2 of the BMP. The scope of this report covers biodiversity management activities across both the Mining Lease areas and the Biodiversity Offset Areas.

Following the DCM Independent Environmental Audit undertaken in December 2017 a revision of the BMP was prepared for the three year period between August 2018 and July 2021 and includes broader concepts for the longer term (6+ years) management since commencement of the BMP in 2012. The key changes to the BMP include relevant updates to the performance and completion criteria tables with consideration to the works which have been completed to date.

In accordance with the BMP, the *DCM Annual Biodiversity Report 2020* is included in **Appendix 6**. A brief summary of main findings and conclusions are provided in the subsections below.

6.5.1 Vegetation Clearance Report

Vegetation clearance is undertaken in accordance with the BMP Section 5.4 Vegetation Clearance Plan. Prior to any clearance operations a Clearing Plan is prepared, and vegetation pre-clearance surveys are undertaken.

Vegetation clearance for the Duralie Extension Project was finalised in 2017. During the 2019/2020 reporting period, no vegetation clearance was undertaken.

The area of disturbance at the end of June 2020 is shown in the DCM Annual Review 2020 **Figure 4 (Appendix 1)**.

Information obtained during vegetation clearance activities (i.e. habitat features, hollows cleared and fauna observed) has been used to determine the requirements for nest box replacement in the Biodiversity Offset Areas.

6.5.2 Nest Box Program

Nest box management is undertaken in accordance with the BMP Section 6.4. Nest boxes have been installed to provide habitat opportunities in the short to medium-term for a number of arboreal fauna species including the Squirrel Glider.

AMBS Ecology & Heritage (AMBS) was commissioned to implement the Nest Box Program as described in the BMP Section 5.4.2 and Section 6.4.

The nest box program currently involves:

- 18 nest boxes targeting the Squirrel Glider (*Petaurus norfolcensis*), installed during February 2013;
- 106 nest boxes targeting a variety of hollow-dependent species, installed during August 2013;
- 45 nest boxes targeting a variety of hollow-dependent species, installed during September 2014;
- 42 nest boxes targeting a variety of hollow-dependent species, installed during September 2016.

- 26 nest boxes targeting a variety of hollow-dependent species that were installed in the Rehabilitation Area between 16 October 2019 and 18 October 2019; and
- 9 nest boxes targeting the Feathertail Glider (*Acrobates pygmaeus*) that were installed during September and October 2019.

An annual nest box monitoring report was completed by AMBS in September 2019. Results of the *2018 - 2019 Nest Box Programme for the Duralie Offset Area Report (AMBS, June 2019)* are included in the *DCM Annual Biodiversity Report 2020* is included in **Appendix 6.**

6.5.3 Weed Control and Monitoring

The weed control program aims to manage weeds to minimise their impact on native flora and fauna.

Weed spraying activities are generally undertaken between the months of September and April each year. Physical management measures such as mechanical removal, slashing and/or back-burning can be undertaken at other times of the year as required.

A contractor is engaged at the DCM to undertake weed management activities on an ongoing basis. Follow-up weed treatment of all remnant enhancement and regrowth management VMUs recommenced in October 2019 and continued through to April 2020. The key species targeted included blackberry, lantana, privet, wild tobacco and Giant Parramatta grass.

Weeds monitoring to evaluate the effectiveness of control measures is undertaken in conjunction with the annual vegetation monitoring and is documented in the Duralie Coal Mine Biodiversity Offsets Monitoring Report 2020 (Appendix F).

The 2020 monitoring report indicates that:

> *Woody weeds were observed and recorded throughout the offset area. Non-fire affected VMUs recorded large brambles of blackberry, and in the alluvial flat VMUs (VMU AD, F, S and Y), privet and wild tobacco were also observed. In the fire affected VMUs, blackberry was observed to be re-growing from rootstock, while the dense lantana thickets that were encountered in previous surveys were burned away and were not observed to be re-growing. However, blackberry, lantana and wild tobacco were still common in the gullies.*
>
> *Recommendation:*
>
> - *Targeted weed control in the remnant patches to prevent damage to the re-establishing native vegetation, with more widespread control works elsewhere.*

6.5.4 Feral Animal Control and Monitoring

The objective of feral animal control program is to manage feral animals to minimise their impact on native flora and fauna in the Biodiversity Offset Areas or the impact on agricultural production in other surrounding areas.

MDP Vertebrate Pest Management has been engaged by DCPL since 2016 to implement feral animal control programs across property owned by DCPL including both the Stratford & Duralie Mining Leases and the Stratford & Duralie Biodiversity Offset Areas. During the reporting period wild dog and fox control was undertaken between October 2019 to November 2019 and March 2020 to April 2020. The program involved a combination of trapping and shooting. The programs were productive with a total of 15 wild dogs and 7 foxes trapped and shot over the control programs.

In accordance with the BMP Section 5.10 a follow-up feral animal survey was undertaken by AMBS Ecology & Heritage (AMBS) during April 2017 to monitor the success of control programs and determine priorities for ongoing control measures. A summary of the survey results is included in the Annual Biodiversity Report 2019 (**Appendix 6**).

A feral animal survey of the Duralie Mining Lease and Duralie Biodiversity Offset Area will be undertaken

again during the next reporting period. Feral animal monitoring will guide the ongoing management efforts for controlling feral animals.

6.5.5 Controlling Access and Managing Grazing

The BMP requires works to be undertaken to exclude livestock and control access to the Biodiversity Offset Areas.

During the reporting period contractors were engaged to undertake maintenance activities on access tracks, culverts, gates and fences. The works included slashing of tracks, firebreaks and repairs to damaged gates and culverts. Additional signage was also installed on the key access points to the Biodiversity Offset Areas.

The *Duralie Coal Mine Biodiversity Offsets Monitoring Report 2020* found some internal fencing was damaged at several locations in the fire affected VMUs, either directly or by falling trees and branches. In the non-fire affected VMUS, fencing was generally in good condition. There were no signs of livestock at the time of the survey, however there was some evidence of previous access by cattle in several areas.

Livestock continue to be excluded from the Biodiversity Offset areas with the exception of 'crash grazing' programs in preparation for revegetation activities following a field assessment by a qualified consultant. However, during inspections of the Biodiversity Offset area, cattle were identified to have entered through damaged fencing on the eastern and northern boundaries. The cattle were removed and maintenance work was undertaken to repair the fencing.

6.5.6 Bushfire Management

The objective of bushfire management in the Biodiversity Areas is to prevent impacts from unplanned bushfire and to use fire to promote biodiversity.

To assist with bushfire management, access tracks and firebreaks have been constructed and maintained as shown in the BMP Figure 9.

Hazard reduction burning has been undertaken in consultation with the RFS. Continued discussions have been held with the RFS to conduct fire management activities and any such activities will be assessed and implemented to ensure the most appropriate period for ecological burn activities whilst also giving due consideration to personnel and asset safety. Following the revegetation works, the aim is to exclude fire from the offsets areas for at least 5 years to allow for tubestock and seedlings to establish.

Monitoring of fuel loads to evaluate bushfire risk and guide bushfire hazard reduction activities is undertaken in conjunction with the annual vegetation monitoring. Bushfire risk will continue to be mitigated through the maintenance of access tracks and fire breaks.

The DCM Offset Area was affected by an unplanned bushfire in November 2019 named the Buckley's Range Fire by the NSW RFS. A report has been prepared by Kleinfelder to document the bush fire event and the effect(s) on the Offset Area in compliance with the BMP monitoring and assessment requirements (Kleinfelder, 2020) (**Appendix 6**). An extracted summary of the survey results from the *Duralie Coal Buckley's Range Bushfire Impact Report 2020* is provided in **Appendix 6**.

6.5.7 Seed Collection and Propagation

Revegetation in the BMP Revegetation Areas has occurred via seed and tubestock. Local endemic species are preferentially used where a seed supply is available, however consideration will be given to the use of a high quality seed sourced further from the site as required.

Where possible, seed required for revegetation activities has been collected from within the Biodiversity Offset area and surrounds. Specific tree and shrub species which have not been available for collection have been sourced through external third-party suppliers. Further seed collection may be undertaken if found necessary to meet the completion criteria of the BMP offset revegetation and mine site rehabilitation.

Kleinfelder along with several nurseries have been engaged to assist in the propagation of native plant species with tube-stock grown under controlled nursery conditions and delivered to site as required for revegetation works.

6.5.8 Revegetation and Regeneration Management

The aim of revegetation is to establish a range of habitat niches including native canopy, and understorey, with the goal of achieving self-sustaining vegetation communities as well as increasing the resilience to identified risks such as fire, herbivory and future weed invasion.

Revegetation works in the Duralie biodiversity offset have been undertaken progressively since the implementation of the BMP.

Revegetation trials were undertaken during 2016 and included seed collection, inoculation, growing of tube-stock, ground preparations including weed spraying and direct seeding of approximately 80 hectares. Due to the inability to undertake controlled burning, slashing was undertaken as an alternative option prior to direct and broadcast seeding.

Tubestock was propagated during Summer 2016/2017 in preparation for Autumn planting in 2017. VMUs Y, AD and S, (approximately 40 hectares), located on alluvial flats near Mammy Johnsons River were prepared for planting by slashing, spraying for weeds and ripping. This was followed by the planting of approximately 7,200 tube-stock in April 2017. The results of the re-vegetation activities are reported in the *DCM Biodiversity Offsets Revegetation Program Report Spring 2016 - Autumn 2017*.

Following the hazard reduction burning in August 2017, revegetation works in VMUs Z, AB and AC were undertaken. In September 2017, direct seeding of approximately 52 hectares was completed, followed by harrowing.

Tube-stock planting of VMUs F, V, W and X was proposed for Autumn 2018 including approximately 16,000 plants over 61 hectares. The native tree seed was propagated over the Summer of 2017/2018 by Cumberland Plain Seeds. However, due to the slower than expected establishment of the tubestock, planting was postponed during winter and completed in September 2018. The results of the 2018 re-vegetation activities are reported in the *DCM Biodiversity Offsets Results of Spring 2018 Planting Report*.

During Spring 2019 tubestock was propagated in preparation for further revegetation works in Autumn 2020 to reach the required woodland density and species diversity in VMUs F, V, W, X, AA and AH. Plans showing the area proposed for revegetation in the Biodiversity Areas in 2020 are included in **Appendix 6**. The results of the 2020 re-vegetation activities are reported in the *DCM Biodiversity Offsets Planting Program Report Autumn 2020*.

The 2020 Duralie Offsets planting involved in-fill planting and new planting areas totaling 55.8ha in three vegetation communities. VMUs F and W were planted with species characteristic of the Rough-barked Apple – Red Gum grassy woodland on floodplain (Cabbage Gum variant). A total of 2,370 tubestock were installed into VMU F and W. VMU AH was planted with species characteristic of the Forest Red Gum – Grey Ironbark – Thick-leaved Mahogany Forest community. In total 5, 810 tubestock were installed into this VMU AH. Species characteristic of the Spotted Gum – Grey Ironbark Forest (Spotted Gum Variant) were installed into a total of 18.3h in VMUs – VMU AA, VMU V and VMU X). In total 6, 621 tubestock were installed in these areas. Overall, this year's planting program was deemed to be very successful. Survival is expected to very good with excellent rainfall experienced before and during planting.

A revegetation program for 2021 is being prepared to continue to progress towards the biodiversity offset completion criteria.

6.5.9 Biodiversity Offset Monitoring and Reporting

The BMP monitoring program aims to monitor and report on the effectiveness of the BMP management measures and progress against the detailed performance and completion criteria. As described in the Section 7 of the BMP an annual report reviewing DCPL's environmental performance and progress against the requirements of the BMP including monitoring and reporting is prepared annually and appended to this *Duralie Coal Mine Annual Review*.

The *DCM Annual Biodiversity Report 2020* for the annual period ending 30 June 2020 is included in **Appendix 6** and reports on monitoring for:

- Effectiveness of revegetation in the offset area;
- Usage of the offset by fauna;
- Effectiveness of weed control;
- Effectiveness of feral animal control;
- Nest box monitoring program.

Habitat and vegetation condition monitoring is undertaken to quantitatively measure the change in habitat and vegetation condition over time. The visual monitoring and photo monitoring programs are undertaken concurrently with the vegetation monitoring to provide additional information on the change of the Biodiversity Areas over time and inform maintenance requirements.

Initial vegetation surveys were undertaken in 2013 and 2014. The annual vegetation and landscape function monitoring continues to be undertaken and was repeated in February 2019. The results are provided in the *DCM Biodiversity Offset Monitoring Report 2020.* A summary of the survey results is included in the *Annual Biodiversity Report 2020* (**Appendix 6**). The next round of monitoring is scheduled for early 2021.

Monitoring of fauna usage within the Biodiversity Areas is conducted every three years to document the fauna species response to improvement in vegetation and habitat in the Biodiversity Areas and assess the performance in providing habitat for a range of vertebrate fauna. The surveys include an assessment of habitat complexity, species richness and abundance.

AMBS was engaged to undertake fauna monitoring within the Biodiversity Offset areas and mine rehabilitation areas during February 2018. The results are provided in the *DCM Fauna Surveys of the Offset and Mine Rehabilitation Areas, February 2018*. A summary of the survey results is included in the Annual Biodiversity Report 2020 (**Appendix 6**).

6.5.10 Long Term Security and Conservation Bond

Long-term Security

In accordance with Condition 42, Schedule 3 of the Project Approval, DCPL is required to make suitable arrangements for the long-term security of the Duralie Extension Project Biodiversity Offset Area. DCPL used the mechanisms available under section 88E(3) of the NSW Conveyancing Act, 1919, namely:

- Registration of a Positive Covenant under section 88E(3) of the NSW Conveyancing Act, 1919; and
- Registration of a Restriction on the Use of Land by a Prescribed Authority under section 88E(3) of the NSW Conveyancing Act, 1919.

Public Positive Covenants and Restrictions on the Use of Land for the Biodiversity Offsets have been registered on title with NSW Land and Property Information (LPI) in May 2015.

Conservation Bond

In accordance with Condition 44, Schedule 3 of the Project Approval, DCPL is required to lodge a Conservation Bond with the DP&E which covers the cost of implementing the Biodiversity Offset Strategy

detailed in the BMP.

The conservation bond for the Biodiversity Offset areas was calculated by Greening Australia and verified by Rider Levett Bucknell in December 2013. The terms of the conservation bond in the form of a Bank Guarantee were approved by then DP&E on 12 December 2013. The Bank Guarantee has been subsequently provided to DP&E.

In December 2017, an Independent Environmental Audit of the DCM was undertaken in accordance with PA 08_0203. A revision of the BMP was approved in January 2019 in accordance with PA 08_0203 Schedule 5 Condition 4. Following this, a revision of the conservation bond will be prepared and lodged with DP&E in accordance with Schedule 3 Condition 45. The revised conservation bond will be lodged in the next reporting period.

6.5.11 Complaints

No complaints related to the management of biodiversity were received during the reporting period. A full detailed complaints list is provided in **Appendix 5**.

6.6 GIANT BARRED FROG MANAGEMENT

Management and monitoring of the Giant Barred Frog population is conducted in accordance with the approved Duralie Coal Mine Giant Barred Frog Management Plan (GBFMP). The GBF monitoring has been undertaken to establish baseline data of the frog population and monitor whether a greater than negligible impact on the Giant Barred Frog population has occurred as a result of rainfall runoff from the mine's irrigation areas. Monitoring results are used to assess the DCM against performance measures detailed in the GBFMP.

Annual monitoring and reporting on the implementation of the Giant Barred Frog Management Plan was undertaken between 2011 and 2016.

During a previous reporting period (2015/2016), the GBFMP was revised with proposed changes to the GBF monitoring program. The GBFMP was approved by DP&E on 17 December 2015 and by the Commonwealth Department of the Environment (DotE), on 4 January 2016 and is available on the Duralie Coal website.

As stated in Section 7 of the GBFMP the timing and frequency of monitoring will be triggered upon commencement of irrigation within the Duralie Extension Project irrigation areas. DCM does not propose to undertake the irrigation activities associated with the Duralie Extension Project and as such, the Project has not presented a potential impact on the Giant Barred Frog population.

No further monitoring of the Giant Barred Frog has been required since 2016 in accordance with the GBFMP.

In accordance with Condition 31A, Schedule 3 of the Project Approval and the GBFMP, DCPL is required to prepare a long-term study on the life-cycle and population of the GBF. This study will be prepared in the next rereporting period.

6.7 BLASTING

6.7.1 Blast Criteria and Control Procedures

Blasting at the DCM is conducted in accordance with Conditions 8-15, Schedule 3 of the Project Approval and respective EPL conditions and the approved Blast Management Plan (BLMP).

The BLMP establishes a blast management strategy which:

- Identifies blasting criteria;
- Outlines blast management and control measures;
- Establishes blast management protocols;
- Formulates a blast monitoring programme;
- Details reporting and review requirements.

EPL condition L5 and Condition 8 of the Project Approval state that overpressure caused by blasting at monitored locations may exceed 115 dB(L) for no more than 5% of blasts during the reporting period and must not exceed 120 dB(L) at any time. Similarly, ground vibration at monitored locations caused by blasting may exceed a peak particle velocity of 5 mm/s for no more than 5% of blasts during the reporting period and not exceed 10 mm/s. Additionally, blasting must not exceed 5mm/s at Mammy Johnson's grave or 10mm/s at Former Weismantel's Inn.

In accordance with Condition 13(b) of the Project Approval, a dedicated blasting hotline is available to provide current scheduled blasting times for the DCM. Persons living within two (2) kilometres of an active or approved operational area may also request advice of scheduled blasting activities.

The permitted blasting hours and frequency are prescribed in the Project Approval. Blasting is permitted between 9am and 5pm on Monday to Saturday only. Additionally, a maximum of 1 blast per day is permitted on site and an annual average of 3 blasts per week.

No blasting was undertaken on site during the 2019/20 reporting period. Blasting activities at the DCM ceased in August 2018.

Blasting activities are designed and managed in accordance with the BLMP.

6.7.2 Review of Blast Monitoring Results

The locations of blast monitoring units are shown on **Figure 3 (Appendix 1)**. Blast monitors are located on the following residences:

- Schultz Property (Bucketts Way, south west of mine);
- Moylan Property (West);
- Fisher-Webster Property (North); and
- Former Weismantels Inn (West).

No blasting was undertaken on site during the 2019/20 reporting period. Blast monitoring equipment has been removed whilst no blasting is being undertaken at the DCM.

6.7.3 Property Inspections & Investigations

Building condition surveys of several privately owned dwellings located in the vicinity (within 2kms) of the mine have previously been undertaken by an independent structural engineer. In addition, surveys may be commissioned following a request by a landowner concerned about dwelling damage which they consider may be related to blasting activity (Condition 11, Schedule 3).

During the reporting period, no building inspections of private residences were undertaken. No requests were received from any landowners to undertake a building inspection or to update a previous inspection report.

No blasting activities at the DCM occurred during the reporting period.

Former Weismantel's Inn is a heritage listed building owned by DCPL. An inspection of the Former Weismantel's Inn was undertaken in July 2020 and reported there is no evidence that the former Weismantel Inn building has been affected by blast-induced ground vibrations.

6.7.4 Complaints

No blast related complaints were received during the reporting period. A full detailed complaints list is provided in **Appendix 5** (when required).

6.8 NOISE

6.8.1 Noise Criteria and Control Procedures

DCM has an approved Noise Management Plan (NMP) that establishes a noise management strategy which:

- Identifies noise criteria;
- Outlines proactive and responsive noise management and control measures;
- Formulates a noise monitoring program;
- Establishes data assessment protocols; and
- Details reporting and review requirements.

Noise emissions from the DCM are managed in accordance with the criteria and procedures described in the NMP. The noise criteria are specified in PA 08_0203 and EPL 11701. The NMP was revised and updated during the 2018 reporting period to reflect the ongoing monitoring requirements at times when no operations are occurring at the Duralie mine.

DCPL implements measures to ensure noise from the DCM is managed to approved levels, through a combination of the following:

- ensuring best management practices are implemented and reviewed;
- implementing noise controls to reduce noise from the source and attenuate noise transmission; and
- if necessary, implementing measures to control noise at receivers following a review of monitoring data.

Mining operations are permitted 24 hours per day and 7 days per week in accordance with the EA 2010. During the reporting period DCPL complied with the approved operating hours.

During the reporting period no mining activities were undertaken. During the reporting period PAF rehandle and rehabilitation works were undertaken during Monday to Friday with no weekend work. Additionally, nightshift operations ceased in July 2018 and only day shift operations have been undertaken since this time.

The noise monitoring program has included both attended noise surveys and real-time noise monitoring. The results of compliance attended monitoring are used to assess compliance with relevant noise impact assessment criteria in the NMP. Real-time noise monitoring results are used for ongoing performance assessment and will assist in the implementation of pre-emptive management actions to avoid potential non-compliances.

DCPL undertakes quarterly attended noise monitoring surveys in accordance with the NMP in order to determine the status of compliance with noise limits. Attended noise surveys were conducted during the reporting period. These surveys were conducted during November 2019 and May 2020. Attended noise monitoring is only undertaken during periods when mining or rehabilitation activities are occurring in accordance with the NMP.

A Sentinex real-time noise (RTN) monitor provides a management tool for operations to measure mine contribution noise emissions and implement management controls as outlined under the approved NMP. The real-time noise system is only required during periods of night-time operations; hence this did not occur during the reporting period.

The noise monitoring program also includes rail noise monitoring and mobile plant monitoring. The locations of noise monitoring sites are shown on **Figure 3 (Appendix 1)**.

6.8.2 Review of Attended Noise Monitoring Results

The summary results of the attended noise surveys undertaken during the reporting period are provided in **Tables 18 and 19**. Noise monitoring locations are shown on **Figure 3** (**Appendix 1**). The full Noise Survey Reports are available at the Duralie Coal website (www.duraliecoal.com.au).

Note that the noise criteria do not apply on sites which are DCPL owned or if there is a written agreement between DCPL and the landowner (refer to footnotes).

Operator-attended operational noise monitoring was conducted at four locations on Friday 29 November 2019 and Friday 29 May 2020. Results are presented in **Tables 18 and 19.**

November 2019 Survey

Table 18: Noise Performance Assessment – Operations – November 2019 Survey

Location	Estimated DCM LAeq(15minute) Contribution dBA	Noise Criteria LAeq(15minute) dBA	Compliance
NM1 Woodley[1]	I/A	35	Yes
NM4 Fisher-Webster	I/A	35	Yes
NM5 Moylan	I/A	35	Yes
NM6 Oleksiuk and Carmody	I/A	35	Yes

[1]Woodley property has changed ownership but will retain the title of 'Woodley' until licence revision.
I/A = Inaudible

The November 2019 assessment of daytime operational noise emissions found DCM to be compliant with the relevant criteria, contained within the DCM PA and EPL, at all attended monitoring locations.

May 2020 Survey

Table 19: Performance Assessment – Operations – May 2020 Survey

Location	Estimated DCM LAeq(15minute) Contribution dBA	Noise Criteria LAeq(15minute) dBA	Compliance
NM1 Woodley[1]	I/A	35	Yes
NM4 Fisher-Webster	I/A	35	Yes
NM5 Moylan	30	35	Yes
NM6 Oleksiuk and Carmody	<30	35	Yes

[1]Woodley property has changed ownership but will retain the title of 'Woodley' until licence revision.
I/A = Inaudible

The May 2020 assessment of daytime operational noise emissions found DCM to be compliant with the relevant criteria, contained within the DCM PA and EPL, at all attended monitoring locations.

The 2010 EA and 2014 EA provide predictions on mine contributed noise emissions for various operational years. Year 5 (2015) was predicted as the maximum operational noise levels for the Modification Project with reduced operational noise from 2016 to 2019. In terms of the four monitoring locations ("Woodley", "Fisher-Webster", "Moylan" and "Oleksiuk & Carmody") predicted mine contributed noise emissions were consistent with measured values for all locations, factoring in the current reduced fleet and reduced operating hours at the DCM.

6.8.3 Real Time Noise Monitoring System

A real-time noise monitoring response protocol is described in the NMP Section 7.3.5. Real-time monitoring is used as a management tool to assist DCPL to take proactive management actions and implement additional noise mitigation measures to avoid potential non-compliances. Noise investigation triggers have been established which send alarms when noise emissions are approaching levels which may exceed the noise criteria at privately-owned receivers. Details of any RTN alarms and the operational responses implemented by DCPL are recorded in the RTN Response Register.

The RTN monitor located to the north of the DCM was decommissioned during the 2018/19 reporting period in accordance with the NMP following the cessation of evening and night-time mining operations.

6.8.4 Rail Noise Monitoring

The NMP requires that rail noise monitoring is undertaken on a quarterly basis at the existing Wards River and Craven locations during shuttle train operations. Rail noise monitoring is reported against rail noise criteria described in Section 4 of the NMP and is undertaken for general information purposes only (i.e. they are not DCM compliance requirements).

Rail operations aim to progressively reduce noise levels to the goals of 65dB(A)Leq, (daytime from 7am – 10pm), 60dB(A)Leq (night-time from 10pm –7am) and 85dB(A) (24hr) max pass-by noise, at one metre from the façade of affected residential properties. Additionally, Condition 4(e), Schedule 3 of the Project Approval includes a notification requirement for affected residents were the maximum rail pass-by noise exceeds 85dB(A).

The transport of ROM coal from the DCM via shuttle train ceased during October 2018 with the last train railed on 4 October 2018. Therefore, rail noise monitoring was not conducted during the current reporting period.

6.8.5 Mobile Plant Noise Assessments

The DCM fleet of mobile plant including haul trucks, excavators, dozers, graders and other items are required to be assessed annually for sound power levels (SWL) in accordance with the NMP. SWL's are compared to the target SWL's referred to in the 2010 EA and 2014 EA and are also compared to historical results to track performance over time. Availability of mobile plant for noise testing is subject to production requirements and servicing/maintenance/breakdowns.

The current mining fleet is shown in Section 4.3.1 of this report.

Mining operations ceased in October 2018 and much of the mobile plant fleet has been relocated to the nearby Stratford Mining Complex. A reduced fleet has been maintained to undertake ongoing PAF rehandling and rehabilitation works. These activities are undertaken during Monday to Friday on day shift only (i.e. no evening or night-time operations). These changes have significantly reduced the overall sound power level of the mobile plant operations compared to the predicted levels in the 2014 EA.

During the reporting period rehabilitation activities occurred during Q4 2019 and Q1 2020. PAF rehandle operations occurred during May and June 2020.

No mobile plant sound power monitoring has been undertaken during the reporting period due to the reduced fleet, reduced operating periods and no evening or night-time operations. Notwithstanding, an administrative non-compliance has been recorded in accordance with the NMP monitoring requirements. No adverse effects would be anticipated resulting from the non-compliance and no noise complaints have been received. The NMP will be revised to reflect monitoring requirements during periods of reduced operations.

6.8.6 Complaints

No noise related complaints were received during the reporting period. The complaints list is provided in **Appendix 5** (when required).

6.9 LANDSCAPING AND VISUAL SCREENING

The overall visual impacts of the DCM are described in the EA 2010 are generally considered low. However, some local impacts will occur and undertakings such as the following have been, and will continue to be, adopted to lessen these impacts:

- Minimising (where possible) disturbance to native vegetation, especially where such vegetation is providing visual screening;
- Retention specifically of ridge Open Forest and regrowth forest (where possible);
- Retention of all riparian vegetation along Mammy Johnsons River and those out of pit sections of Coal Shaft Creek;
- Ensuring out of pit emplacement design produces a landform which integrates with the adjoining natural landform;
- Painting of substantial fabricated infrastructure with a colour ("Rivergum") that assists it to blend in with the adjoining landscape;
- Maintenance of infrastructure to retain the ability of such infrastructure to blend into the surrounding landscape over the life of the project; and
- Placement, configuration and direction of lighting to reduce offsite nuisance effects of stray light;
- Prioritising rehabilitation of exposed and outer batters of waste emplacements;
- Vegetation would be established around the perimeter of the open pit voids to provide visual screening.

In accordance with Condition 51, Schedule 3 of the Project Approval, a visual screen has been constructed and maintained along a section of the Bucketts Way to the north-west of the mine in consultation with DPE, RMS, Great Lakes Council and DCM CCC. As predicted some additional vantage points of the mine have been exposed through the clearing of the northern extent of the Weismantel pit and landscaping works and progressive rehabilitation will continue to reduce the visual impact.

The rehabilitation principles and objectives at the DCM are included in the Project Approval and described in the DCM MOP. This includes requirements for landscaping and visual screening to ensure the final landforms are visually consistent with the surrounding environment and meet community and regulatory expectations. The rehabilitation will be generally consistent with the proposed rehabilitation strategy described in the EA.

6.9.1 Complaints

No visual amenity related complaints were received during the reporting period. The complaints list is included in **Appendix 5** (when applicable).

6.10 CULTURAL AND NATURAL HERITAGE CONSERVATION

Cultural and natural heritage at the DCM are managed in accordance with the approved Heritage Management Plan (HMP). The purpose of the HMP is to address the requirements of Condition 46, Schedule 3 of the Project Approval. The aim of the HMP is to ensure that the development does not cause any direct or indirect impact on identified Aboriginal or Non-Aboriginal heritage sites located outside the approved disturbance area of the development on the site. The HMP has also been prepared to manage potential impacts on items of heritage significance at the DCM in the vicinity of the surface development.

Archaeological surveys conducted at the Duralie Mine site in the 1980's and 1990's did not identify any Aboriginal sites or items with the exception of one site. A tree, to be subsequently referred to as the "honey tree" was the subject of a site inspection involving various parties including representatives of NPWS in November 1998. The consensus at the time of inspection was that the "honey tree", an old ironbark, had had timber pieces inserted into the trunk in a spiral pattern to allow someone to scale the tree and access the crown – possibly to collect honey. It was not clear whether such timber insertion would have been performed by an Aboriginal person or early European settler. The "honey tree" was subsequently listed on the NPWS Aboriginal Heritage Information Management System (AHIMS) database.

The EA 2010 identified 9 sites of Aboriginal heritage significance (DM2, DM3, DM4, DM5, DM6, DM9, DM10, DM11 and the "Honey Tree") on the Mining Lease. The heritage sites outside the approved disturbance area have been protected by way of signpost and fencing where required. In addition, 4 sites (DM1, DM7, DM8 and Mammy Johnson's Grave) were identified outside of the Mining Lease.

In accordance with the HMP, topsoil disturbance during earthworks, construction and operation of the mine has been monitored utilising officers of the Karuah Local Aboriginal Land Council (KLALC). During the reporting period no topsoil disturbance was undertaken.

In accordance with the HMP, monitoring of the Aboriginal heritage sites at the DCM has been undertaken.

Table 20: Aboriginal Heritage Sites within EA Study Area

Site Code (refer EA documentation)	Site Type	Status
DM2	Isolated Artefact	Salvaged by KLALC
DM3	Scarred Tree	Existing, no disturbance.
DM4	Scarred Tree	Existing, no disturbance
DM5	Scarred Tree	Salvaged by KLALC
DM6	Isolated Artefact	Existing, not located by KLALC
DM9	Open Artefact Scatter	Existing, no disturbance
DM10	Scarred Tree	Existing, no disturbance
DM11	Isolated Artefact	Disturbed, not located by KLALC.
38-1-0033	Scarred Tree – Honey Tree	Existing. No disturbance

Former Weismantels Inn is a heritage listed building owned by DCPL. A building inspection of the Weismantels Inn is conducted every two years.

An inspection of the Former Weismantels Inn was undertaken in July 2020 and reported there is no evidence that the former Weismantel Inn building has been affected by blast-induced ground vibrations.

6.11 SPONTANEOUS COMBUSTION

Any incidences of spontaneous combustion at the DCM are managed in accordance with a Spontaneous Combustion PMHMP. This plan provides a comprehensive overview of processes implemented at the DCM to manage identified hazards associated with spontaneous combustion. Management and mitigation practices generally involve reducing the interaction of potentially reactive materials with water and oxygen by appropriate dumping practices, profiling and capping any materials likely to heat and reducing the time coal faces are exposed prior to mining.

During the previous reporting period no events of spontaneous combustion were identified at the DCM.

DCPL had previously identified areas of self-heating on the Potentially Acid Forming (PAF) waste emplacements and continue to undertake remedial works to these areas. PAF rehandle activities is ongoing to place all identified PAF material in pit below the predicted post-mining groundwater table level.

No air quality complaints related to odour were received during the reporting period. A detailed complaints list is provided in **Appendix 5**.

6.12 AGRICULTURAL REPORT

An assessment of the Agricultural and Rural Suitability of the land surrounding the DCM was undertaken in the EA 2010. The Project is located in a rural area characterised by cattle grazing on native and improved pastures. Areas managed for forestry, conservation, poultry farming and other types of agricultural production also occur in the wider area.

The Agricultural Land Use Rehabilitation Objective for the DCM is to establish the land capability classification for the relevant nominated agricultural pursuit.

Rural Land Capability
The Rural Land Capability classification system is used to determine the various classes of rural land on the basis of the capability of the land to remain stable under particular uses. Land is allocated to one of eight classes, with emphasis on the erosion hazards in the use of the land. The majority of land within the existing DCM and Project area is classified as Class IV using the rural land capability classification with the major factors in determining the classes being slope and soil stability in water.

Agricultural Suitability
The Agricultural Suitability system is used to classify land in terms of its suitability for general agricultural use. Agricultural land is classified by evaluating biophysical, social and economic factors that may constrain the use of land for agriculture. The agricultural land classification mapping classifies the majority of lower slopes of the DCM area as Class 3 land, and the upper slopes as Class 4. The land in the far south of ML is classified as Class 5 agricultural suitability.

The rehabilitated areas on the Duralie Waste Emplacement are proposed for Class 4 agricultural suitability. Class 4 Agricultural Suitability is defined as (NSW Agriculture, 2002):
Land suitable for grazing but not for cultivation. Agriculture is based on native pastures and improved pastures established using minimum tillage techniques. Production may be seasonally high but the overall production level is low as a result of major environmental constraints.

Agricultural lands on and surrounding the DCM including DCPL owned land continues to be managed for agricultural production. DCPL implements a property management strategy which includes grazing & pasture management and weed and pest control measures. The majority of agricultural lands are grazed under agistment/lease contracts.

There have been no changes to the agricultural land suitability during the reporting period. Further information on agricultural rehabilitation areas is included in Section 8.

7. WATER MANAGEMENT

Water management is undertaken in accordance with the approved Water Management Plan (WMP) and sub-components of the plan including surface water, ground water and site water balance required under Condition 29, Schedule 3 the Project Approval.

The main objectives of the water management system on-site are:

- protect the integrity of local and regional water resources;
- operate such that there is no uncontrolled overflow of contained water storages;
- maintain separation between runoff from areas undisturbed by mining and water generated within active mining areas; and
- provide a reliable source of water to meet the requirements of the DCM.

The main principles of the water management system on-site are to:

- Minimise the generation of mine related water and divert clean water around disturbed areas;
- Minimise storage requirements by maximising re-use of mine related water;
- Remove potential impacts on downstream water resources by provision of secure containment on site and disposal by irrigation re-use;
- Implement a fail-safe system, whereby under extreme events in excess of design capacity, mine related waters would spill to the mine pit and not to the clean water catchments; and
- Not allow sediment laden water having an elevated suspended solids concentration to be discharged off site.

7.1.1 Water Supply and Demand

The DCM water management system operates under a surplus water balance, with a trend for increasing water storage on-site over time. The main water supply storage on-site for use in irrigation and dust suppression is the Main Water Dam (MWD) (monitoring point SW3) located to the northwest of the Industrial Area. The MWD, Auxiliary Dam 1 (AD1) and Auxiliary Dam 2 (AD2) are the principal permanent mine water storages on-site. Water from these dams comprises pit produced water (runoff to/rainfall/seepage to), water from specific sediment dams and surface water runoff from the Industrial area.

The principal water losses in the water system are:

- Water applied to land by means of irrigation.
- Water used for dust suppression.
- Evaporation from the Main Water Dam, Auxiliary Dam 1 and Auxiliary Dam 2.
- Water retained in ROM coal and railed to Stratford.

The Main Water Dam's current storage capacity is approximately 1405 ML whilst Auxiliary Dam 1 can contain approximately 460 ML and Auxiliary Dam 2 has an estimated storage capacity of approximately 2720 ML.

At the completion of the reporting period the Mine Water Dam contained 966 ML (74.7%), and Auxiliary Dam 2 contained 1770 ML (68.2%). No mine water was disposed of to watercourses during the reporting period.

Auxiliary Dam 1 was dewatered to the Main Water Dam followed by decommissioning in 2019/20.

7.1.2 Site Water Balance Review

A water balance model of the Duralie Extension Project mine operations was developed by HEC based on an operational model of the DCM water management system. The site water balance model of the DCM water management system has been developed to simulate the behaviour of the water management system to the end of the approved mine life.

A site water balance review is undertaken annually and captures all inflows and outflows from the water management system. The water which accumulates in the open pits through rainfall or groundwater seepage is measured at the point of dewatering. An independent Annual Water Balance Review (Hydro Engineering & Consulting, 2019) for the DCM was conducted for the 2019 calendar year and a summary is provided below.

Contained Water Storages

A water balance analysis review of the Main Water Dam, AD1 and AD2 water balance 2019 is as follows: Figures are based on Duralie Mine Site Water Balance Review for the 2019 calendar year.

Inflows (mL/pa)

Rainfall runoff	412
Pumped from open cut pits	0
Pumped from other storages	0
MWD diversion seepage	37
First flush capture	65*
Total Inflow	**514**

*Excluding 64 days' missing data

Outflows (mL/pa)

Evaporation	687
Haul Road dust suppression	10
Irrigation loss	0
Total Outflow	**697**
INFLOW - OUTFLOW	**-183**

Start of 2019 year total storage volume	2,981
End of 2018 year total storage volume	2,721
Change in Storage	**-260**

The above indicates a reduction in stored water volume in these storages during 2019. Note that this does not include any increase in stored water volume in the Clareval pit, the Weismantel pit and the adjacent waste rock emplacements. The estimated volume of water contained in the pits increased during 2019.

Open Cut Pits

No dewatering from the open cut pits to the mine water dams was undertaken during the reporting period. A mine pit water balance analysis was undertaken for the open cut pits using data recorded during 2019. The volume of 'groundwater' (inflow other than rainfall runoff) estimated reporting to the pits (Clareval pit only) in 2019 is estimated to be 66 ML. This contrasts with a volume of 126 ML volume estimated from the groundwater model developed as part of the Duralie Extension Project (GCL, 2010).

Groundwater Licencing

DCPL holds an existing Water Access Licence (WAL 41518) granted under the North Coast Fractured and Porous Rock Water Sharing Plan, that allows for up to 300 ML of groundwater to be extracted from "works" in any 12 month period.

Table 21: Water Take

Water Licence #	Water sharing plan, source and management zone (as applicable)	Entitlement	Estimated Take Previous Period – 2018 (ML)Total	Estimated Take Current Period - 2019 (ML)Total
WAL 41518 (NOW ref: 20AL213502) - Duralie Pit (Weismantel and Clareval)	Gloucester Basin Groundwater Source - North Coast Fractured and Porous Rock Groundwater Source 2016	300ML extraction.	0ML	66ML

7.2 SURFACE WATER

7.2.1 Surface Water Management

Surface water management is managed in accordance with WMP: Appendix 2 Surface Water Management Plan (SWMP) under Condition 29, Schedule 3 of the DEP Approval and is divided into the management of clean water and mine water as outlined below. Mine water comprises both mine related water and sediment laden/turbid water.

7.2.1.1 Erosion and Sediment Control

The primary objectives of the erosion and sediment control at the DCM are to:

- minimise and control soil erosion and sediment generation in areas disturbed by ongoing mining and associated activities at the DCM; and
- minimise the potential for sediment generated from site activities to adversely affect the water quality of the Mammy Johnsons River or the Karuah River.

Sediment generation and erosion is primarily controlled by:

- Maximum separation of runoff from disturbed and undisturbed areas;
- Timely progressive rehabilitation and vegetation establishment on disturbed areas (e.g. completed sections of the overburden dump) to minimise the area exposed to erosion;
- Construction of surface drains to facilitate the efficient transport of surface runoff;
- The direction of runoff from disturbed areas into sediment dams for settlement of suspended solids; and
- The placement of silt fences down slope of other disturbed areas (e.g. down slope of topsoil stockpiles before a grass cover has been established).

DCM had the following dedicated erosion and sediment control structures in use during the reporting period:

- Two (2) rail siding sediment dams – designated as RS1 and RS6
- One (1) waste emplacement (rehabilitation) sediment dam – designated as VC1
- Temporary Sediment Dams in advance of mining operations (none active at the end of the reporting period).

Sediment dam sizing is described in the SWMP Section 7.1 Erosion and Sediment Control Plan. Erosion and sediment control structures are designed and constructed in consideration of the recommendations for site drainage works presented in "*Managing urban storm water – Soils and Construction Volume 1*" (Landcom, 2004) and "*Managing urban storm water – Soils and Construction Volume 2e*" (DECC, 2008).

Runoff in excess of the design capacity will result in a dam spilling in accordance with the design criteria. It should be noted that pumping (where possible) of sediment dams in order to prevent or limit the amount of spilling water was undertaken. Prioritisation of pumping operations also took into account the likely quality of spilling water when a dam was considered vulnerable to spilling. The quality of water collecting within sediment dam is managed (where practicable) to minimise suspended sediment load.

Sediment dams are inspected following receipt of sufficient rain whereby such dams have the potential to spill. Diversion structures and drains are also maintained, including vegetation management, to ensure integrity of the structures and capacity for flow.

During the reporting period there were no spills from sediment dams at the DCM.

In addition to dedicated sediment dams, clean water is directed around disturbed areas (where practicable) using diversion drains/bunds or in the case of Coal Shaft Creek, a creek diversion (refer discussion under *Water Management*) in order to minimise sediment laden water.

All elements of sediment control are regularly monitored and maintained. Sediment dams are cleaned out when the storage volume is substantially reduced by sediment deposition (i.e. when 30% of storage

volume is lost to sediment build up) and inspected after major rainfall events.

Inspection of diversion structures and sediment control dams occurred during and following heavy rainfall events. The site contained all mine water on site within its water management system and control structures remained effective.

A photographic surveillance record of key structures along the existing Coal Shaft Creek diversion is undertaken annually and was conducted during February 2020. Regular inspections of the CSC diversion are also undertaken and in general the diversion is stable and no signs of erosion or sedimentation have been identified. Maintenance activities including weed spraying and vegetation control was undertaken on the clean water diversion drains and around the prescribed dams during the reporting period.

7.2.1.2 Clean Water Management

The main objective of clean water management is the segregation of clean water from mine related water by the construction of diversion drains around disturbed areas, thereby minimising the quantity of water that is impacted by the operation '.

Surface water controls aim to prevent clean runoff water from entering the open mining pit and overburden dumping areas where practical. The main structures are:

- Diversion of Coal Shaft Creek. The diversion channel (built in stages) is required until the creek can be re-established at the conclusion of mining;
- Main Water Dam (MWD) diversion drain. This drain intercepts runoff from the catchment above the MWD and delivers that water to Coal Shaft Creek;
- Auxiliary Dam 1 (AD1) and Auxiliary Dam 2 (AD2) diversion drains;
- Clareval western diversion drain;
- Flood control embankments to prevent inundation of mining areas;
- A culvert under the Main Coal Haul Road which allows Coal Shaft Creek to flow through the site; and
- Various runoff control drains/bunds about disturbed areas, designed to divert clean water runoff around those areas.

The main elements of the clean water diversion system are shown in **Figure 3** (**Appendix 1**).

Inspections of diversion structures were undertaken during and after rainfall. Remedial and maintenance works were completed as required within the diversion drains and dams during the reporting period.

7.2.1.3 Mine Related Water Management

Mine related water management refers to the control, collection and re-use of water which may have become contaminated by mining operations and associated activities. This water comprises mine water and sediment laden/turbid water. Mine water is water that has come into contact with mining activities. Sediment laden/turbid water has come into contact with disturbed areas but predominantly not core mining areas. Mine waters are typically characterised by higher salinity and on occasion lower pH. Sediment laden waters are characterised by elevated suspended solids and elevated turbidity.

During the reporting period all mine water was contained on site and no spills occurred from mine water storage dams.

The main objectives of the mine related water control facilities are:

- Segregation of clean water from mine related water, to minimise the quantities of mine related water to be managed;
- On site storage to prevent escape to Coal Shaft Creek and Mammy Johnsons River; and
- Management of the stored quantity of dirty water by irrigation.

The principal sources of mine related water are:

(a) Mine Water
- Incident rainfall
- Groundwater seeping into mining pits;
- Rainfall induced runoff and seepage from active sections of the overburden dump; and
- Rainfall induced runoff from the Industrial Area.

(b) Sediment Laden Water
- Rainfall induced runoff from roads;
- Rainfall induced runoff from areas stripped of topsoil (typically exposing clays); and
- Rainfall induced runoff from areas yet to adequately vegetate within sediment dam catchments.

Mine related water uses and losses are:
- Evaporation and seepage losses from water storages;
- Haul road dust suppression;
- Railed coal dust suppression;
- Water retained in ROM coal railed to the Stratford Mine; and
- Stored water applied to land via irrigation (evapotranspiration) including evaporative sprays.

The mine related water storages on site are:
- Main Water Dam (MWD)
- Auxiliary Dam 1 (AD1) (decommissioned during reporting period)
- Auxiliary Dam 2 (AD2)
- Sediment Dam VC1 (rehabilitated waste dump)
- Sediment Dams RS1 and RS6 (rail siding dams)

The locations of mine and sediment laden water storage areas are shown in **Figure 3** (**Appendix 1**).

7.2.2 Surface Water Monitoring

DCPL monitors surface water quality on and surrounding the mine site by sampling from a series of selected locations. These locations comprise both streams and water storage structures. A meteorological monitoring station (i.e. weather station) provides site rainfall data. The locations of these monitoring sites are shown on **Figure 3 (Appendix 1).**

Surface water monitoring is conducted in accordance with the approved SWMP and EPL 11701.

Surface water is sampled and analysed on a weekly, monthly, event basis or following a sediment dam spill.

Water sampling is not undertaken in no-flow conditions. Collected waters are analysed for a suite of physical and chemical parameters. Results are compared with water quality triggers for the DCM developed in accordance with the methodology in ANZECC/ARMCANZ (2000). "Gilberts & Associates 2011 - Development of Water Quality Trigger Levels for the Duralie Extension Project" and EPA requirements (DCM Surface Water Management Plan Appendix B).

7.2.2.1 Review of Local Streams Monitoring Results

Reference should be made to accompanying data tables provided in **Appendix 4**. The routine surface water monitoring sites at the DCM are:

- *SW2 – Coal Shaft Creek (CSC)*
- *SW2 Rail Culvert – Coal Shaft Creek Downstream*
- *SW6 – Former RS3/4 Culvert*
- *SW9 – Un-named Tributary (UNT)*
- *SW10 – Coal Shaft Creek Upstream*
- *GB1 – Mammy Johnsons River (MJR)*

- *Highnoon – Mammy Johnsons River (MJR)*
- *Site 9 – Karuah River (KR)*
- *Site 11 – Mammy Johnsons River (MJR)*
- *Site 12 – Mammy Johnsons River (MJR)*
- *Site 15 - Mammy Johnsons River (MJR)*
- *Site 19 – Karuah River* (KR)
- *North Drain*
- South Drain

Assessment of Performance Indicators

The surface water monitoring results are used to assess the DCM against the performance indicators and performance measures as detailed in Table 7 of the SWMP. If data analysis indicates a performance indicator has been exceeded or is likely to be exceeded, an assessment will be made against the performance measure. If a performance measure is considered to have been exceeded, the Contingency Plan will be implemented (WMP Section 10). If data analysis indicates that the performance measure has not been exceeded, DCPL will continue to undertake monitoring.

Table 22 and **23** provide a summary of the surface water analysis of the monitoring data during the reporting period. The summarised data is used to assess against the surface water performance indicators and measures outlined in Table 7 of the SWMP.

Table 22: Summary of Surface Water Monitoring Results and Trigger Levels – pH, EC and TSS

Site	**pH**			**EC**		**TSS**	
MJR	20th%ile	80th%ile	Trigger	80th%ile	Trigger	80th%ile	Trigger
Site 11	6.9	7.3	**7.1-7.6**	421	**370**	8	**15**
GB1	6.8	7.3		333		19	
Site 12	6.8	7.1		335		52	
CSC							
SW2 (RC)	7.0	7.4	**7.1-7.9**	642	**544**	16	**80**
SW10	6.9	7.2		136		101	
UT							
SW9	6.6	6.6	**6.4-7.1**	143	**461**	286	**57**
SW10	6.9	7.2		136		101	

Note: SW9 & SW10 two samples only

Table 23: Summary of Surface Water Monitoring Results and Trigger Levels – Copper, Turbidity, Zinc and Aluminium

Site	**Copper**		**Turbidity**		**Zinc**		**Aluminium**	
MJR	80th%ile	Trigger	80th%ile	Trigger	80th%ile	Trigger	80th%ile	Trigger
Site 11	0.004	**0.002**	19	**24**	0.007	**0.011**	0.52	**1.24**
GB1	0.003		19		0.008		0.26	
Site 12	0.003		30		0.008		0.68	
CSC								
SW2 (RC)	0.003	**0.003**	20	**119**	0.064	**0.064**	0.44	**3.02**
SW10	0.008		144		0.014		4.93	
UT								
SW9	0.003	**0.004**	134	**94**	0.018	**0.024**	2.15	**2.96**
SW10	0.008		144		0.014		4.93	

Note: SW9 & SW10 two samples only

Assessment of the Performance Indicators and Performance outcomes are presented in **Table 24.**

Table 24: Surface Water Monitoring Performance Outcomes – 2019-20 Reporting Period

Performance Measure	Monitoring of Environmental Consequences			Data Analysis to Assess against Performance Indicators	Performance Indicators	Assessment of Performance Indicators	Assessment of Performance Measure	Relevant Management and Contingency Measures
	Sites	Parameters	Frequency					
No more than a negligible impact on water quality in Mammy Johnsons River as a result of the Duralie Extension Project	• Site 11 • GB1 Site 12	• EC, pH, turbidity, Copper (total), Zinc (total), Aluminium (total). Hardness, TSS, BOD and DO.	• Monthly / Event	The 80th percentile concentration calculations for EC, pH, total copper, turbidity, total zinc, total aluminium, and TSS in addition to The 20th percentile value of pH at Site 11, GB1 and Site 12 are presented in Tables 25 & 26	Water quality at Site 11 is not worse than the pre-irrigation water quality at Site 11 whilst water quality is better at GB1 and Site 12 compared to the pre-irrigation water quality at these sites.	Data analysis indicates Site 11 exceeded the performance indicator for pH, EC and Copper. Analysis of the monitoring data shows EC to be elevated on three occasions during period. EC was also elevated at upstream sites GB1 and Site 12 on these occasions. Whilst EC at Site 11 slightly exceeded the 80th%ile trigger it was found to not be significantly higher than EC concentrations at GB1 and Site 12. Hence similar trends observed upstream and downstream. Analysis of the monitoring data also shows similar trends observed upstream and downstream for pH and Copper. Whilst pH at Site 11 was outside the 20th%ile trigger it was found not to be significantly different to the average pH at the upstream sites GB1 and Site 12. The performance indicator for DO was not exceeded except for three reading at site 12 in February, March and May 2020. DO is consistently below 85% at Site 11 and GB1.	No further requirement for assessment of Performance Measure.	Continue monitoring.

Table 24 (Continued): Surface Water Monitoring Performance Outcomes – 2019-20 Reporting Period

Performance Measure	Monitoring of Environmental Consequences			Data Analysis to Assess against Performance Indicators	Performance Indicators	Assessment of Performance Indicators	Assessment of Performance Measure	Relevant Management and Contingency Measures
	Sites	Parameters	Frequency					
No more than a negligible impact on water quality in Coal Shaft Creek as a result of the Duralie Extension Project	• SW2 (RC) • SW10	• EC, pH, turbidity, Copper (total), Zinc (total), Aluminium (total). Hardness, TSS, BOD and DO.	• Monthly / Event	The 80th percentile concentration calculations for EC, pH, total copper, turbidity, total zinc, total aluminium, and TSS in addition to the 20th percentile value of pH at SW2 (RC) and SW10 are presented in Tables 25 & 26	Water quality at Site SW2 (RC) is not worse than the pre-irrigation water quality at Site SW2 (RC) whilst water quality is better at SW10 compared to the pre-irrigation water quality at that site.	Data analysis indicates Site SW2 (RC) exceeded the performance indicator for EC and was slightly below the 20th%ile lower trigger for pH. Analysis of the monitoring data shows EC to be elevated on occasion under low flow conditions. pH was low on one occasion under fast flow conditions at SW2 (RC). Whilst EC exceeded the 80th%ile trigger at SW2 (RC) and was slightly below the 20th%ile lower pH trigger it is difficult to compare to SW10 EC and pH results as SW10 was dry for all but two sampling events in the reporting period. The performance indicator for DO was exceeded on two occasions. The performance indicator for DO was similar upstream at SW10 on these sampling events.	No further requirement for assessment of Performance Measure.	Continue monitoring.

Table 24 (Continued): Surface Water Monitoring Performance Outcomes – 2019-20 Reporting Period

Performance Measure	Monitoring of Environmental Consequences			Data Analysis to Assess against Performance Indicators	Performance Indicators	Assessment of Performance Indicators	Assessment of Performance Measure	Relevant Management and Contingency Measures
	Sites	Parameters	Frequency					
No more than a negligible impact on water quality in Unnamed Tributary as a result of the Duralie Extension Project	• SW9 • SW10	• EC, pH, turbidity, Copper (total), Zinc (total), Aluminium (total). Hardness, TSS, BOD and DO.	• Monthly/ Event	The 80th percentile concentration calculations for EC, pH, total copper, turbidity, total zinc, total aluminium, and TSS in addition to the 20th percentile value of pH at SW9 and SW10 are presented in Tables 25 & 26	Water quality at Site SW9 is not worse than the pre-irrigation water quality at SW9 whilst water quality is better at SW10 compared to the pre-irrigation water quality at that site.	Data analysis indicates SW9 exceeded the performance indicator for TSS and Turbidity. Analysis of the monitoring data shows TSS to be elevated on the one of the two occasions where sampling was undertaken. SW9 and SW10 were dry for all sampling events except two in the reporting period. The performance indicator for DO was exceeded once at Site SW9 and elevated upstream at SW10 on the same sampling event.	No further requirement for assessment of Performance Measure.	Continue monitoring.

The above results were consistent with previous year's monitoring results and the predictions made in the EA 2010. The EA 2010 indicated that water quality in Mammy Johnsons River was variable, but was generally good. It was also found that the salinity of the stream was higher during periods of low flow and generally showed a relative reduction in EC during higher flow periods (Gilbert, 2010). The current monitoring results are consistent with these observations. During the reporting period the Gloucester region experienced severe drought conditions resulting in "no flow" conditions at most monitoring sites for an extended period. This is reflected in the monitoring results.

Table 27 indicates some occurrences of exceedances of the performance indicators. If data analysis indicates a performance indicator has been exceeded or is likely to be exceeded, an assessment will be made against the performance measure. The data analysis shows monitoring data also shows similar trends observed upstream and downstream, i.e. exceedances were not due to DCM. Accordingly, no further assessment of the performance measure is required.

Historical monitoring data presented in the DCM Environmental Assessment, Surface Water Assessment (Gilbert, 2010) show that Coal Shaft Creek is generally more saline than Mammy Johnsons River and the Karuah River. Results during the reporting period generally concur with these observations. It is considered that Coal Shaft Creek is generally more saline due to its ephemeral nature and the outcropping/sub-cropping of coal seams within the catchment.

7.2.2.2 Review of Mine Water Monitoring Results

The management of mine related water is described in Section 7.2.1.3 of this report. Mine water comprises water that is generated within the mine workings, waste rock emplacements (prior to reshaping and topsoiling), storage areas for such water and runoff from areas where coal is handled. Mine water is generally characterised by elevated EC, elevated sulphate concentrations and low turbidity/TSS.

The three principal mine water storage areas are the Main Water Dam (sampling location SW3 major), Auxiliary Dam 1 (AD1) and Auxiliary Dam 2 (AD2). Monitoring of mine water quality is also conducted within the Weismantel pit (sampling location SW4) and the Clareval pit (sampling location Clareval).

No overflows or discharges of mine water occurred during the 2019/20 reporting period.

Monitoring for SW3 (major) during the reporting period indicated, on average, a moderate EC (3120 uS/cm), slightly alkaline pH (8.3) and low miscellaneous metals concentration. Reference should be made to **Table 25** and the water monitoring results in **Appendix 4**. AD1 was dewatered prior to the previous reporting period and no samples were required.

Table 25: Summary of Mine Water Monitoring Results – pH, EC and TSS

	pH		EC (µS/cm)		TSS (mg/L)	
Site	**Range**	**Average**	**Range**	**Average**	**Range**	**Average**
MWD (SW3)	8.0-8.7	8.3	2452-3770	3120	<5-13	7
AD2	7.7-8.8	8.3	2388-3850	3348	*	*
Clareval	**	**	**	**	**	**
Weismantel (SW4)	6.9-7.7	7.3	3160-6840	5609	<5-98	22

Notes * = TSS not monitored at AD2
** = No safe access to Clareval Pit during the reporting period
*** = AD1 dewatered during the 2018 reporting period.

The simulated water quality for the Main Water Dam was prepared for the EA 2010 including a salinity balance and an assessment of the suitability for irrigation water (Gilberts, 2010). Mine water pH has remained generally near neutral or slightly alkaline for the life of the project. The Mine Water Dam EC trend has been generally consistent with the simulated EC showing a slightly increasing trend up to 2015 and then staying relatively stable through to 2020, however the average EC (3120 uS/cm) in 2020 has remained higher than the predicted EC of 2140 uS/cm. This is predominantly due to the higher EC water from the Clareval pit. No pumping from the open cut pits occurred during the reporting period. Clareval

Pit was not monitored during the reporting period due to no safe access into the pit during backfilling since operations were completed in September 2017.

The electrical conductivity (EC) performance indicator in Table 7 of the Surface Water Management Plan (SWMP) was exceeded during the reporting period in the MWD. As a requirement of the SWMP, the increasing salinity triggered an assessment of performance measure.

An assessment of the irrigation water quality was undertaken in the *2019 Irrigation Area Monitoring Report* (Horizon Environmental, 2019) and is included in Section 7.4.1. Irrigation and soil monitoring in 2019 concluded that there has been no significant detrimental effect on soil properties, or suitability of soil in irrigated areas for current or future agricultural use. Additionally, the monitoring found no detectable adverse impact from irrigation management on pasture cover or composition.

No irrigation of mine water occurred during the reporting period and no additional assessment were required.

7.2.3 Biological Monitoring

As part of Duralie Coal's environmental monitoring program, Invertebrate Identification Australasia was commissioned to conduct biological (aquatic ecology – macroinvertebrates) monitoring of the streams near the DCM. Biological monitoring has been conducted each year since the start of mining operations.

Monitoring during this reporting period was conducted in October 2019 and February 2020 and involved sampling from seven sites. The October survey identified a total of 34 families of aquatic macroinvertebrates. This represents a small decrease in total numbers of families across all sites compared with the previous spring survey. However, the results are comparable with those recorded for the autumn 2018 surveys, at least in the lower sites of the Mammy Johnsons River and the Karuah River. The upper sites of the Mammy Johnsons River were significantly reduced as a result of lower water levels. Site M5 on the Karuah River recorded a small increase in numbers of families. For the February survey a total of 28 families of aquatic macroinvertebrates were recorded. This represents a significant decrease in total numbers of families across all sites except for Site M6 compared with the previous autumn survey. However, the results are comparable with those recorded for the two 2019 surveys, at least in the lower sites of the Mammy Johnsons River and the Karuah River. The upper sites of the Mammy Johnsons River were significantly reduced as a result of lower water levels. Site M5 on the Karuah River also recorded a small decrease in numbers of families. During the reporting period the Gloucester region experienced severe drought conditions resulting in "no flow" conditions at most monitoring sites for an extended period. This is reflected in the monitoring results. The report summaries are provided below.

The October 2019 report concluded that;

> *"the results of the current survey confirm what has previously been demonstrated, i.e. that the aquatic biodiversity is continuing to show similar trends to that recorded in previous years and under similar environmental conditions. The low numbers of EPT taxa recorded at most river sites above and below the mining operations indicates that while both river systems have been impacted by the low to no flow conditions the biodiversity is being maintained, particularly in the Karuah and the lower sections of the Mammy Johnsons River. The other off-river sites recorded lower values than the river sites, however, as they are much smaller systems, they do not have the same scale of resources, permanence of water levels and variety of niches to support more complex biodiversity. They are also more impacted by decreases in flow or changes in environmental conditions. In conclusion, the results from the current survey suggest that while the overall biodiversity and river environmental conditions has declined, there are no apparent adverse effects on the aquatic macroinvertebrate fauna in the Mammy Johnsons River as a result of any activities arising from the operations of the Duralie Mine." (Invertebrate Identification Australasia 2019).*

The February 2020 report concluded that;

"the results of the current survey confirm what has previously been demonstrated, i.e. that the aquatic biodiversity is continuing to show similar trends to that recorded in previous years and under similar environmental conditions. The low numbers of EPT taxa recorded at most river sites above and below the mining operations indicates that while both river systems have been impacted by the low to no flow conditions the biodiversity is being maintained, particularly in the Karuah and the lower sections of the Mammy Johnsons River. The other off-river sites recorded lower values than the river sites, however, as they are much smaller systems, they do not have the same scale of resources, permanence of water levels and variety of niches to support more complex biodiversity. They are also more impacted by decreases in flow or changes in environmental conditions. In conclusion, the results from the current survey suggest that while the overall biodiversity and river environmental conditions has declined, there are no apparent adverse effects on the aquatic macroinvertebrate fauna in the Mammy Johnsons River as a result of any activities arising from the operations of the Duralie Mine." (Invertebrate Identification Australasia 2020).

Biodiversity values have been generally similar to those noted from prior reporting periods. Biological monitoring reports to date have not indicated any significant adverse effects on the aquatic ecosystem as a result of the mine's operations as per predictions made in the environmental assessments.

7.2.4 Riparian Vegetation Monitoring

The Riparian Vegetation "Health" Monitoring program is conducted in accordance with the SWMP. Visual monitoring and photography is conducted in order to detect any potential change in the quality and quantity of riparian vegetation. The unnamed Tributary, Coal Shaft Creek and Mammy Johnsons River are monitored on an annual basis in conjunction with the biological monitoring for signs of leaf scorching, desiccation and dieback. Riparian health monitoring includes the development of a photographic database of riparian vegetation at fixed photo points.

Riparian vegetation health monitoring is undertaken in conjunction with the biological macroinvertebrates monitoring (Section 7.2.3).

Irrigation activities at the DCM ceased in 2018, hence the potential impact pathways identified in the EA 2014 have ceased. Assessed monitoring results as part of the irrigation monitoring program showed no identified impact due to irrigation or mining activities. A review of the WMP will be undertaken to reflect the current stage of operations and update the ongoing monitoring requirements based on the potential impact pathways.

7.2.5 Ecotoxicity Testing Program

In accordance with the Surface Water Management Plan and Condition 29(b) of Project Approval (08_0203), DCM have undertaken ecotoxicity testing of samples taken from selected water monitoring sites in Mammy Johnsons River, Coal Shaft Creek and DCM Main Water Dam since 2013. The ecotoxicity testing programme was initially required to be undertaken quarterly and then revised following analysis of the monitoring results. The ecotoxicity tests were undertaken by Ecotox Services Australasia during 2013 to 2019. A review of the ecotoxicity monitoring data was undertaken by the University of Queensland Centre for Mined Land Rehabilitation in May 2014 and again in October 2015. The ecotoxicity program was refined based on recommendations contained in the reviews of the monitoring data.

The application of mine water via irrigation ceased in 2018. This irrigation of mine water was identified in the EA 2010 to potentially have an impact on the water quality and ecology of Mammy Johnsons River and was the basis for the requirement for undertaking ecotoxicity monitoring.

In April 2019, a further review and summary interpretation of the DCM ecotoxicity monitoring program results was undertaken by University of Queensland Centre for Mined Land Rehabilitation (CMLR). The

review was undertaken to assess any identified impacts over the life of the project and provide recommendations on the ongoing monitoring efforts.

The *Summary Interpretation of Duralie Coal Mine Ecotoxicity Testing Results, Apr 2019* (CMLR, 2019) concluded the following;

> *The results for ecotoxicity testing with five aquatic species of Coal Shaft Creek, Mammy Johnsons River at two additional sampling times during 2016 – 2018 show that there was no evidence for any significant toxicity and no connection with any effects from mining. The Main Water Dam at Duralie Coal Mine showed that sporadic effects to some test species occurred, but not all. This is considered to indicate the potential for minor effects to occur on an on-going basis but does not show affects from the offsite natural waters.*
>
> *Based on the consistent evidence from 2013-2018 for aquatic testing in the Main Water Dam it is recommended that the Ecotoxicity Testing Program is no longer required. If any irrigation activity were to be undertaken from the Main Water Dam at Duralie Mine site, the mine site and downstream waters would require ecotoxicity testing before and after application.*

In accordance with the recommendation above ecotoxicity monitoring is no longer required as potential impact pathways have ceased. Assessed monitoring results as part of the irrigation monitoring report and ecotoxicity monitoring reports showed no identified impact. Notwithstanding, an administrative non-compliance has been recorded against the current requirements of the WMP as no ecotoxicity monitoring was undertaken during the reporting period. A review of the WMP will be prepared during the next reporting period to update the ecotoxicity monitoring requirements as per the recommendations in CMLR, 2019.

7.3 GROUNDWATER

7.3.1 Groundwater Management

A Groundwater Management Plan (GWMP) (WMP Appendix 3) has been prepared to control potential impacts on local and regional groundwater resources and includes a monitoring program to validate and review the groundwater model predictions.

The groundwater systems within which the DCM lies, specifically relate to:

- Gloucester Basin Water Source (i.e. porous rock aquifer) under the Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016.
- Karuah River Water Source (i.e. alluvial aquifers) under the Water Sharing Plan for the Lower North Coast Unregulated and Alluvial Water Sources 2009.

Groundwater characteristics of the DCM have been studied prior to and over the life of the DCM and most recently for the EA 2014. A hydrogeological characterisation of the Gloucester Basin is included in the GWMP.

7.3.2 Groundwater Monitoring Results

Groundwater monitoring is conducted in accordance with the DCM Water Management Plan (WMP) Appendix 3 Groundwater Management Plan (GWMP).

DCM monitors groundwater quality on and surrounding the mine site by sampling from a series of selected monitoring bore locations. The location of these bores is shown in **Figure 3 (Appendix 1).**

Collected waters are analysed for a suite of physical and chemical parameters. Results are evaluated for observable trending and compared to the predicted results from the EA 2010.

A summary of groundwater monitoring results for the reporting period can be found in **Table 26** and **Appendix 4**. Groundwater monitoring scheduled for February 2020 was partially not completed due to limited access resulting from wet weather. Eight of the seventeen (17) monitoring sites were not able to be sampled. Follow-up monitoring was attempted in March 2020, however ground conditions were still unsuitable to allow safe access to the monitoring sites. No adverse effects would be anticipated resulting from the non-compliance. No groundwater impacts have been observed. The next round of quarterly groundwater monitoring was completed in May 2020.

Comments on analysed parameters for monitoring conducted during the reporting period are as follows:

- Depth to groundwater was comparable with recent historical data for most monitored wells and consistent with predicted levels.
- pH is comparable with historical data with minor fluctuations apparent. pH in the reporting period varied from a slightly acidic 5.1 (DB10W in Nov 2019) to a neutral 7.4 (SI2W in May 2020);
- Electrical conductivity generally showed a high degree of variability across many of the wells as has historically been the case. This would appear to reflect the cycle of dry and wet conditions. Shallow wells intercept generally low conductivity alluvial aquifers, whilst deep wells associated with coal measures generally have higher conductivity;
- Calcium and magnesium concentrations across all wells tended to fluctuate within reasonably tight ranges which has historically been the case;
- Small fluctuations were also observed for Sulphate concentrations across all wells;
- Aluminium concentrations are quite low (often being close to the limit of analytical detection) in all the deeper wells but comparatively higher in the shallower wells. The highest concentration recorded was 44.7 mg/l (DB1W in August 2019);
- Iron concentrations showed no common trend with rises and falls across wells generally. Concentrations showed a wide range from a low of <0.05 mg/l (SI2W) to a high of 50.2 mg/l (DB1W in August 2019);

- Manganese concentrations across all wells were not high with the highest being 2.65 mg/l within WR2 in May 2020; and
- Zinc concentrations were essentially low and consistent with available historical data.

Table 26: Summary of Groundwater Monitoring Results – Average depth, pH and EC.

Site	Depth (m)	pH	EC (µS/cm)
DB1W	16.1	5.9	4233
DB2W	14.1	6.1	1552
DB3W	4.4	6.2	166
DB4W	6.9	6.8	3723
DB5W	12.5	5.6	2191
DB6W	21.3	6.6	5938
DB7W	11.2	6.8	2804
DB8W	18.4	*	*
DB9W	20.9	7.2	3525
DB10W	15.1	5.3	3808
DB11W	10.9	6.7	3997
BH4BW	5.4	6.0	241
SI1W	10.0	7.1	2953
SI2W	19.8	7.2	3245
SI3W	28.2	6.9	7553
WR1	10.6	6.3	2678
WR2	71.1	6.8	6138

Note * = Depth only monitored at DB8W

It should be noted that the EA (2010) described groundwater in the Project area as being characterised by the following parameters/ranges:

- pH – 6.0 to 8.0
- Electrical conductivity – 100 to 7600 uS/cm

Results for the reporting period are provided in **Appendix 4**. In summary, hydrographic plots (Graph 1, Graph 2 and Graph 3), indicate that groundwater monitoring results for the period are generally consistent with predicted outcomes as assessed in the EA (2010). Further review occurred in line with the GWMP where inflows to pits and water levels within bores were consistent with modelled predictions and indicators as per the GWMP. No trigger levels or exceedance of performance measures were identified during the reporting period. No complaints related to groundwater were received during the reporting period.

Depth to water information from piezometer monitoring indicates that bore water levels are generally consistent between bores and are generally consistent with EA (2010) predictions.

The four bores to the west of the open cut pit (SI1W, SI2W, SI3W & DB6W) are all above or close to maximum predicted levels.

No depressurisation has been observed to date at Bore DB11W, located north of operations.

Groundwater quality results for the reporting period indicate results consistent with EA predictions and historical groundwater data trends. For this reporting period, the groundwater pH range for bores likely to be influenced by the coal measures was between 5.1 and 7.4. This is a generally similar range to that noted in the EA. Similarly, the electrical conductivity range for the bores was 155 to 7880 uS/cm. These results are generally similar to and within the range noted in the EA.

Irrigation bores (SI Series) indicate no obvious signs of deep drainage generated from irrigation activities. Irrigation activities ceased during 2018 and no impacts from deep drainage would be expected.

No indication of an increase in connectivity between alluvial bores (DB3W and BH4BW) and the deeper groundwater system has been observed based on monitoring results for water quality and groundwater

table level.

The waste emplacements bores (WR Series) indicate signs of recharging of the backfilled void, particularly at WR1. This is consistent with the numerical modelling of the post-mining groundwater levels (EA 2010) which shows slow but complete recovery of the groundwater system over many decades and that the Clareval void, once filled with water, would act as a sink, while the Weismantel void lake would act as a flow-through lake system. Additional detail is available within the EA for the DEP Modification 2 approved in December 2014.

Assessment of Performance Indicators

Groundwater monitoring results are assessed against Performance Indicators and Measures as described Section 7.1 and Table 6 of the GWMP. Monitoring data for the reporting period was in accordance with the performance measures which indicate:

- No more than a negligible impact on stream baseflow as a result of the Duralie Project;
- No more than a negligible impact on water levels in groundwater production bores on private land.

Refer **Table 27** below.

Table 27: Groundwater Monitoring Performance Outcomes – 2019-20 Reporting Period

Performance Measure	Performance Indicators	Assessment of Performance Indicators	Assessment of Performance Measure
No more than negligible impact on stream baseflow and/or natural river leakage of Mammy Johnsons River to the deeper groundwater system as a result of the Duralie Extension Project (incorporating the Open Pit Modification).	Groundwater inflows to open pits are consistent with Duralie Open Pit Modification Environmental Assessment (EA) predictions.	Data analysis indicates groundwater inflows to open pits have been less than the Duralie Open Pit Modification Environmental Assessment (EA) predictions. Refer to the site water balance review for 2019 (HEC, 2019). .	No further requirement for assessment of Performance Measure.
	Groundwater levels in alluvium bores are consistent with Duralie Open Pit Modification EA predictions (accounting for temporal changes in rainfall recharge).	Data analysis of daily alluvium bore pressure sensors indicates groundwater levels in alluvium bores are consistent with Duralie Open Pit Modification EA predictions (accounting for temporal changes in rainfall recharge). Refer to groundwater monitoring data.	No further requirement for assessment of Performance Measure.
No more than negligible impact on water levels in groundwater production bores on privately-owned land as a result of the Duralie Extension Project (incorporating the Open Pit Modification).	No groundwater related complaints received	No groundwater related complaints were received during the reporting period.	No further requirement for assessment of Performance Measure.

7.3.3 Groundwater Inflows to Open Cut Mining Operations

Groundwater seepage inflows to mining voids is directed and collected in pit sumps along with rainfall and surface water runoff and seepage through backfilled pit areas. Water level and water quality analysis of the pit sumps is undertaken on a monthly basis. The volumes of water extracted from the pit sumps is recorded where practicable.

The water quality monitoring results for the open cut pits during the reporting period is included in Section 7.2.2.2 of this report.

A site water balance review is undertaken on an annual basis to monitor the status of inflows (including groundwater inflows to open pits), storage and consumption. A summary of the 2019 site water balance review (HEC, 2019) is included in Section 7.1.2 of this report.

No dewatering from the open cut pits was undertaken during the reporting period. Mining activities have currently ceased in both Weismantel and Clareval pits. Data analysis indicates groundwater inflows to open pits have been less than the EA 2014 predictions.

7.4 IRRIGATION

The Duralie Coal Mine operates under a continual stored water surplus. The Project Approval conditions precludes the disposal of mine water from the approved project approval boundary and Duralie is managed as a zero discharge site.

Irrigation at the DCM is managed in accordance with the WMP, specifically Appendix 2 Surface Water Management Plan Attachment 1 Irrigation Management Plan (IMP). Irrigation has previously consisted of a network of fixed sprays in the Type I, II and IV irrigation areas supported by evaporative fans in the Type I and Type V irrigation areas (waste rock emplacement) only.

During the 2017 reporting period the fixed spray system was removed from the Type IV area (rehabilitated waste emplacement). The evaporative sprays were also removed from the Type I and Type V (waste rock emplacement area) during the 2017 reporting. The remainder of the irrigation network was removed in 2018. No irrigation has occurred within Type III irrigation areas located in the catchment of Coal Shaft Creek above Dam 3. Furthermore, the additional irrigation areas proposed in the EA 2014 have not be commissioned during the life of the project.

During 2018 all irrigation activities at the DCM were ceased. ROM coal mining in the Clareval Pit was finalised in September 2017 and the void space has now become available for water storage and waste rock backfill. Since this time open cut dewatering to the Main Water Dam has also ceased with water preferentially transferred to the Clareval void. As such, the demand for irrigation to reduce the total site water storage has reduced and all irrigation activities on site have now ceased. Mine water will be progressively transferred from the mine water dams to the voids as discussed in the mine closure planning section.

The irrigation system management controls were maintained until the cessation of irrigation activities in 2018. An overview of the site irrigation system is outlined in the WMP.

7.4.1 Irrigation Area Soil and Vegetation Monitoring

Irrigation area monitoring has been conducted in accordance with the WMP which incorporates the Irrigation Management Plan (IMP) as an attachment of the Surface Water Management Plan (SWMP). The annual irrigation area monitoring includes an assessment of soil characteristics and vegetation condition with consideration to the irrigation water quality applied.

The irrigation area performance measures and indicators are included in Table 6 of SWMP Section 9. The irrigation performance measure states that irrigation activities would have no significant impact on soil properties or suitability of soil in irrigated areas for future agricultural use (i.e. grazing on native pasture). The irrigation performance indicators relate to pH in the **MWD** being maintained between 6.0 and 8.5; SAR less than 6 and EC less than 2500µS/cm (2.5dS/m). If a performance indicator is exceeded an assessment of the performance measure is also included in the irrigation monitoring report.

Irrigation monitoring in accordance with the IMP was undertaken again in June 2019. The 2019 monitoring included an assessment of any impacts from irrigation over the life of the DCM and recommendations for ongoing monitoring following the cessation of irrigation. A summary from the *Irrigation Area Monitoring Report* (*Horizon Environmental, 2019*) is provided below:

*"Irrigated water disposal ceased in 2018. The present condition of soils and pastures in the irrigation areas has been investigated to identify whether soil fertility has declined and if so, whether remediation is needed. Specifically, impact of cumulative electrolyte loadings from salts, trace metals and metalloids in irrigated mine water on future grazing land use of irrigated areas at Duralie Coal Mine (**DCM**) was investigated in 2018-19 and reviewed over the life of the monitoring program since 2013 across two reference sites representative of the different soils and geologies; and five mine water irrigation sites. Contamination assessment referred to ANZECC & ARMCANZ guidelines for water quality monitoring and published Australian guidance for soil fertility assessment. The implications of identified soil impacts for longer-term agricultural land use are discussed.*

Irrigation water salinity, sodicity and pH have historically exceeded the irrigation management trigger levels. Metal and metalloid concentrations in the MWD have been below short-term guidelines (irrigation periods up to 20 years). Consequently, cumulative contaminant loadings in the irrigation management system are not considered to be an issue for future land management. However, there has been an upward trend over time in soil sodicity from the annual soil monitoring results. The increase in sodicity has not been accompanied by declines in soil organic carbon that would indicate soil structural degradation. Consequently, soil sodicity is not considered to be detrimental to pasture production in the irrigated areas. Generally, major nutrients (total nitrogen, extractable phosphorus and potassium) and micronutrients (Cu and Zn) in surface soils are limiting to pasture quality and productivity. A fertiliser management program would improve pasture productivity.

We found no detectable adverse impact from irrigation management on pasture cover or composition. Complete ground cover is being maintained on the irrigated pasture. Introducing grazing in the irrigation areas compared with low grazing pressure on reference sites, appears to be changing pasture composition to dominance of paspalum (Paspalum dilatatum) in the irrigated pastures. Observed year to year variation in pasture biomass are likely to be associated with seasonal conditions and applied grazing pressure. There may be a general lack of soil porosity to depth that could promote waterlogging. Low soil porosity at depth may be due to over-clearing for pasture. Deep ripping combined with revegetation or pasture improvement may improve pasture productivity. There does not appear to be a detrimental effect on ground cover or pasture composition in the irrigated pastures compared with the dryland, reference sites.

Recommendation:

> *The former irrigation areas can be decommissioned without detriment to pastureland use. A fertilizer management program for major nutrients and trace metals would improve pasture production generally, inside and outside of former irrigation areas."*

8. REHABILITATION

Rehabilitation of disturbed land at DCM is undertaken in accordance with the Mining Operations Plan and Rehabilitation Management Plan (MOP 2019). The MOP term covers mining operations and rehabilitation activities up to the end of 2021. The MOP is available on the Duralie Coal website.

A new MOP was prepared for the DCM during 2019 and was approved by the Resources Regulator on 27 February 2020. The new MOP reflects the proposed mining and rehabilitation activities for the next 2 year period and also include a detailed Mine Closure Plan.

Condition 55, Schedule 3 of the Project Approval specifies the DCM post mining land use and rehabilitation objectives which are reproduced in **Table 28** below.

Table 28: Rehabilitation Objectives

Feature	Objective
Mine site (as a whole of the disturbed land and water)	Safe, stable and non-polluting, fit for the purpose of the intended post-mining land use(s).
Surface infrastructure	To be decommissioned and removed, unless the Secretary agrees otherwise.
Coal Shaft Creek Diversion	Hydraulically and geomorphologically stable, with riparian vegetation that is the same or better than prior to mining.
Landforms	Final landforms sustain the intended land use for the post-mining domain(s). Final landforms are consistent with and compliment the topography of the surrounding region to minimise the visual prominence of the final landforms in the post-mining landscape. Final landforms incorporate design relief patterns and principles consistent with natural drainage.
Other land affected by the project	Restore ecosystem function, including maintaining or establishing self-sustaining ecosystems comprising: • local native plant species; and • a landform consistent with the surrounding environment
Water Quality	Water retained on site is fit for the intended land use(s) for the post-mining domain(s). Water discharged from site is consistent with the baseline ecological, hydrological and geomorphic conditions of the creeks prior to mining disturbance. Water management is consistent with the regional catchment management strategy.
Native flora and fauna habitat and corridors	Size, locations and species of native tree lots and corridors are established to sustain biodiversity habitats. Species are selected that re-establishes and complements regional and local biodiversity.
Final void	Safe, stable and non-polluting.
Post-mining agricultural pursuits	The land capability classification for the relevant nominated agricultural pursuit for each domain is established and self-sustaining within 5 years of land use establishment (first planting of vegetation).
Community	Minimise the adverse socio-economic effects associated with mine closure.

A summary of the rehabilitation objectives, performance indicators and completion criteria relevant to the DCM rehabilitation domains is provided in the MOP. Plan 4 in the MOP shows the conceptual final landform, relevant primary domains and secondary rehabilitation domains.

8.1 BUILDINGS & INFRASTRUCTURE

Buildings and infrastructure at the DCM have been utilised during the life of the operations. Following the cessation of mining activities in October 2018, some infrastructure has been decommissioned and an assessment has been undertaken for the infrastructure which will still be required. During the 2018 reporting period the following infrastructure was decommissioned and relocated to the SMC:

- Muster area and bathhouse
- Field crib hut

- Fuel storage tanks
- Oil and grease storage tanks

The remaining infrastructure will be required at the DCM for future activities including completion of mining, PAF rehandle and rehabilitation work. No other buildings or infrastructure were constructed, demolished or renovated during the reporting period. No decommissioning of infrastructure is scheduled during the next reporting period. Building and infrastructure decommissioning is further addressed in the Section 8.6 Mine Closure.

8.2 REHABILITATION OF DISTURBED LAND

Rehabilitation of disturbed areas is undertaken progressively and concurrently with ongoing mining operations. Rehabilitation planning, management and implementation is described in the MOP. The overburden emplacement is rehabilitated in progressive increments to the final landform so the area of disturbed land is minimised and disturbed water catchment areas are reduced. Stage plans for the Duralie disturbance and rehabilitation areas are provided in the MOP.

Mining and rehabilitation activities follow the general progression below:

- Vegetation is cleared ahead of mine progression. Details are included in the Annual Biodiversity Report included in **Appendix 6**;
- Topsoil is removed ahead of the advancing pit or overburden dump and recovered for rehabilitation;
- Overburden and ROM coal extraction is undertaken:
- Bulk shaping of waste emplacements, drainage works, ground preparation and topsoil placement; and
- Planting of rehabilitation areas following all preparation works. The areas to be rehabilitated will comprise a combination of native forest/woodland and pasture with scattered trees as described in the MOP.

The DCM rehabilitation progress is generally in accordance with the planned activities described in the MOP 2019 Plan 3A - Mining and Rehabilitation 2020. The MOP makes provision for 406 hectares of total disturbance area and 206 hectares of rehabilitated area by the end of 2020. These areas were recalculated in the new MOP 2019 based on updated survey data, which reduced the total areas by 20 hectares.

The current (June 2020) total disturbance area is 400 hectares and the completed rehabilitation area is 170 hectares (including 11 hectares of landform establishment). The difference between proposed and completed rehabilitation is due to 22 hectares of waste emplacement due for landform establishment prior to the end of 2020 and 14 hectares of waste emplacement not yet completed.

During the reporting period, approximately 20 hectares of the Weismantel waste emplacement area was rehabilitated, incorporating ground preparation, spreading with topsoil and planting with native vegetation species in March 2020. Additionally, AD1 was decommissioned during the reporting period with rehabilitation of 10 hectares of land to pasture in March 2020.

Prior to the end of 2020, a further 22 hectares of bulk shaping (landform establishment) is scheduled to be finalised on the Clareval waste emplacement.

Table 29 presents a summary of the rehabilitation undertaken at the Duralie mine site up to the current reporting period. The current mining areas and rehabilitation as of 30 June 2020 are shown in **Figure 4,** provided in **Appendix 1.**

Table 29 – Rehabilitation status

Mine area type	Previous RP (actual hectares)	Current RP (actual hectares)	Next RP (forecast hectares)
Total Mining Lease	942.8	942.8	942.8
Total mine footprint	406	400	400
Total active disturbance	248	230	208
Land being prepared for rehab (Landform Establishment)	7	11	0
Land under active rehabilitation (Growth Medium Development)	0	0	0
Completed rehabilitation (Ecosystem Establishment & Sustainability)	151	159	192

Note: Areas recalculated in the new MOP 2019 based on updated survey data.

Rehabilitation Resources

Topsoil resources are managed in accordance with the MOP Section 3.3.4. No vegetation clearance or topsoil stripping was undertaken during the reporting period. No further disturbance is proposed for mining activities at the DCM.

The site topsoil balance is updated annually to track the recovery and usage of topsoil and ensure adequate resources are available for rehabilitation of disturbed areas at the DCM. The latest topsoil balance was updated in July 2020. At the end of the reporting period an estimated 112,000 cubic metres of topsoil was held in various stockpiles. This would provide for rehabilitation of 112 hectares to the nominal topsoil depth of 100mm. The current area of disturbance which will require topsoil (i.e. not including final void of 53ha or water management area of 63ha) is 115 hectares, therefore sufficient topsoil resources are available to complete rehabilitation of the operation.

Topsoil stripping has now been completed up to the northern extent of both the Clareval pit and the Weismantel pit. The DCM topsoil balance will be updated again during the next reporting period.

Rehabilitation Maintenance

Recommendations for maintenance activities on rehabilitated land have been included in the rehabilitation monitoring reports, refer to Section 8.3.

During the reporting period maintenance activities focussed on the improvement of pasture rehabilitation at the DCM. Maintenance works included slashing, aerating and fertiliser application. Maintenance activities also included slashing and clearing of access tracks and weeds spraying. Weed control has been undertaken across the rehabilitation areas targeting lantana, blackberry, wild tobacco and giant parramatta grass.

During the next reporting period maintenance work will focus on weeds control and improving biodiversity and stem density in the native vegetation rehabilitation areas.

8.3 REHABILITATION MONITORING

Monitoring of the DCM rehabilitation areas is described in Section 9 of the MOP. Rehabilitation is monitored on a regular basis to ensure vegetation is establishing in the rehabilitation areas and to determine the need for any maintenance and/or contingency measures (e.g. supplementary plantings, weed or erosion control). The monitoring also aims to demonstrate the effectiveness of the rehabilitation techniques and track the progression towards achieving the performance and completion criteria.

The annual rehabilitation monitoring program includes the areas designated for the post-mining land uses (Secondary Domains) of Native Vegetation (Woodland/Open Forest) and Agricultural Pursuits

(Pasture/Scattered Trees).

Visual Monitoring

Rehabilitation monitoring includes a visual assessment:

- monitoring of soil erosion status and the effectiveness of erosion control methods;
- assessing germination success and vegetation establishment (diversity and abundance);
- usage of habitat enhancement features;
- the presence of weeds or feral animals; and
- mine landform runoff water quality.

The visual monitoring provides an early identification of areas requiring remedial planting or other maintenance works to maintain rehabilitation progress. The rehabilitation reports provide a list of maintenance recommendations predominantly relating to erosion control, weeds control and vegetation management and enhancement.

Ecosystem Function Analysis

The assessment of rehabilitation quality and ecosystem value is conducted via the use of Ecosystem Function analysis (EFA). EFA aims to measure the progression of rehabilitation towards self-sustaining ecosystems. EFA has been incorporated into the overall DCM rehabilitation monitoring program to provide an assessment of landscape functionality.

EFA Analogue Transects have been established in proximal areas to represent the varying landscapes (i.e. slopes and aspects) and target communities planned for each rehabilitation area.

In December 2013, a fixed transect-based Landscape Function Analysis (LFA), Vegetation Dynamics and Habitat Complexity monitoring program was established across the DCM Rehabilitation areas. As rehabilitation progresses, additional EFA Revegetation Transects will be established at the DCM in each of the rehabilitation domain areas.

The rehabilitation transects were assessed again in June 2020 as part of the seventh annual round of monitoring in accordance with Section 9 of the MOP. A summary of the findings from the *2020 Duralie Coal Mine Rehabilitation Monitoring Report* (Kleinfelder, 2020) (**Appendix 7**) follows;

Overall, the rehabilitation of the Duralie Spoil Emplacement continues to progress satisfactorily and is on a trajectory towards meeting the performance and completion criteria detailed in the MOP. LFA indices are continuing to achieve or approach the analogue site apart from the pasture rehabilitation area.

By index:

- *Stability Index – all rehabilitation greater than four years old has achieved Analogue index scores. Younger rehabilitation – 2016 – has improved. This is the second survey of the 2018 rehabilitation area and it recorded a decrease from the last survey but is relatively stable due to good vegetation cover and flat slope. Overall, the soil surface is intact with no active erosion observed.*
- *Infiltration Index – the transects surveyed in 2020 remain below the Analogue benchmark score and require further time for development. The 2008 rehabilitation achieved the highest average index score as expected, with the younger rehabilitation achieving progressively lower scores. The 2018 pasture rehabilitation recorded a reduction for this index, and,*
- *Nutrient Cycling Index – the transects surveyed in 2020 were below the analogue value, with the remaining rehabilitation ages recording mixed results, largely dependent on the area surveyed and the stage of life cycle for the vegetation i.e. Acacia die-off reducing the litter production.*

The vegetation structure on the spoil emplacement is still at a relatively early stage of development when compared to remnant vegetation found on the analogue sites. Stem density is variable across the spoil emplacement, but almost without exception the rehabilitated areas have lower overall numbers of plants than the average analogue values. Stem densities are also variable within each rehabilitation area and reflects both transects surveyed and natural processes at work. Area of 2008 and 2012 rehabilitation are

experiencing die-off of Acacia species resulting in more open areas dominated by exotic grasses. One rehabilitation area, the 2011 rehabilitation recorded an increase in average stem densities, although the individual areas showed increases highlighting the variability of vegetation coverage across the spoil emplacement.

The distribution of the vegetation by strata is considerably different in the rehabilitated areas when compared to analogue sites, with distribution of stem densities reversed. In the rehabilitation areas, Eucalypt densities – i.e. canopy – are generally the bulk of the stems, and much higher than the analogue density regardless of age rehabilitation. The only exception to this is the 2013 rehabilitation where canopy numbers are still quite low or non-existent. The shrub stratum on the other hand is largely composed of juvenile Eucalypts and Acacias, whereas analogue sites, the shrub stratum composed of "true" shrub species (i.e. those that will not grow above 1.5 to 2.0 in height) is dominant in terms of numbers. 2010 and some areas of the 2008 rehabilitation have recorded an increase in new native species – particularly in the shrub and forb layers that appear to have established naturally.

Average canopy volumes have recorded a mix of increases (2010 and 2011 rehabilitation) and decreases (remaining areas) across the spoil emplacement which has resulted as an artefact of the transects surveyed and the previously mentioned Acacia die-off as these species reach the end of their life-cycle.

Weed species, dominated by Lantana camara, Solanum mauritianum and Ligustrum sinense were noted in the older rehabilitation areas with the rehabilitation in the vicinity of Transect 3443 assessed as being adversely impacted by the presence of L. sinense.

It was concluded that the rehabilitation of the spoil emplacement is progressing satisfactorily, with the following recommendations/management actions made:

- *The area represented by Transects 3502 and 3450 require seeding or planting with canopy species, but the area near Transect 3450 would require groundcover biomass reduction.*
- *Older areas of the rehabilitation where Acacia die-off has occurred and opened-up the area to sunlight (becoming dominated by exotic grasses) could be seeded with shrub species not included in the original seed mix to increase diversity.*
- *More generally further introduction of a wider variety of shrub species, especially those that do not spread by avian fauna could be facilitated with a modest seeding and/or planting program.*
- *Leucopogon juniperinus (Prickly Beard-heath) is a common species through the analogue sites but is not available commercially. It would be beneficial to attempt to collect seed from on site to use in the rehabilitation introducing it to younger rehabilitation areas or where it has not yet colonised.*
- *Woody weed control works should be undertaken in the areas identified above where L. camara, L. sinense and S. mauritianum have become established and pose a threat to successful revegetation.*
- *As part of the above the drains could be mulched (as opposed to slashed) to provide access for weed control works, any revegetation program and fire breaks.*
- *Use of hazard reduction burns should be investigated for feasibility. The continuing build-up of litter (including the die-off of Acacias) combined with the either dense and tall grassy groundcover or high stem density of woody vegetation poses a risk if an uncontrolled fire were to occur (e.g. lightning strike). A controlled burn would have the added advantages of:*
    - *Reducing the biomass of the groundcovers and allowing ease of movement off tracks and drains*
    - *Promote the germination of the seed bank from the species on the spoil emplacement – although this can lead to a large increase in the density of the Acacias.*
    - *Help with control of the woody weeds – L. camara in particular.*

Fauna Monitoring

Fauna usage of the native woodland/forest rehabilitation areas is monitored and documented over time. Fauna surveys are conducted to assess the success of the rehabilitation and revegetation activities in providing habitat for a range of vertebrate fauna. The surveys include an assessment of habitat complexity, species richness and abundance. Fauna monitoring is undertaken every three years and was last undertaken during February 2018.

During 2018 AMBS Ecology & Heritage (AMBS) was engaged to undertake a fauna survey within the DCM native rehabilitation areas to assess the success of the rehabilitation areas in providing habitat for a range of vertebrate fauna. The fauna survey undertaken in February 2018 also extended to the Duralie Biodiversity Offset Areas.

The results are provided in the *DCM Fauna Surveys of the Offset and Mine Rehabilitation Areas, February 2018* (AMBS, 2018). An extracted summary is provided below.

"Targeted fauna surveys were undertaken at five sites within the Duralie Offset Area and two sites in the Duralie Mine Rehabilitation Area during February 2018. At most sites survey techniques included pitfall traps, funnel traps, Elliott A traps, harp traps, ultrasonic call recording, spotlighting, diurnal bird surveys and reptile searches. Opportunistic observations of signs of fauna were noted throughout the field survey period, including during transit between surveys sites".

"A total of 124 species of vertebrate were recorded, comprising 8 frogs, 10 reptiles, 56 birds and 30 mammals…, most of which were native. With the exception of reptiles, a similar number of frog, mammal and bird species were recorded at Mine Rehabilitation Area sites compared with Offset Area sites. Five introduced species were recorded during the surveys, including Cattle (Bos taurus), House Mouse (Mus musculus), European Rabbit (Oryctolagus cuniculus), Black Rat (Rattus rattus) and Red Fox (Vulpes vulpes). Fifteen of the species detected are listed as threatened or migratory on the schedules of the Biodiversity Conservation Act 2016 (NSW) and/or the Environment Protection Biodiversity Conservation Act 1999 (Cth)."

Four of these species have been recorded for the first time during dedicated fauna surveys for the DCM, including the Little Lorikeet, Masked Owl, Long-nosed Potoroo and New Holland Mouse.

The fauna surveys suggest the DCM offset and rehabilitation areas provide habitat for a range of native vertebrate fauna, including birds, mammals, reptiles and frogs. The number of species recorded utilising the rehabilitation area is encouraging, particularly given the relatively young age of the vegetation."

Habitat Enhancement

A nest box programme for the Duralie Extension Project, is being implemented by AMBS Ecology & Heritage for the DCM, in accordance with the Biodiversity Management Plan (BMP). During 2019 the nest box programme was extended to the native vegetation rehabilitation areas and involved the installation of 26 nest boxes targeting a variety of hollow-dependent species that were installed in October 2019.

Quarterly monitoring of the rehabilitation area nest boxes has been undertaken during the first year after installation The nest box programme progress reports present the monitoring results:

> *Nineteen nest boxes in the Rehabilitation Area were occupied by vertebrates or contained signs of previous occupancy. This represents an occupancy rate of approximately 73%.*
>
> *At the time of the survey, occupancy by vertebrates included the Brush-tailed Phascogale (Phascogale tapaotafa), Sugar Glider (Petaurus breviceps), Mountain Brushtail Possum (Trichosurus cunninghami), Diamond Python (Morelia spilota) and Common Ringtail Possum (Pseudocheirus peregrinus). Signs of the Bush Rat (Rattus fuscipes) and Brown Antechinus (Antechinus stuartii) were also recorded. Unidentified rodent scats were recorded in two nest boxes.*
>
> *Other signs of previous occupancy by vertebrates within nest boxes included leaves (eucalypt), bark, fur, scats, insect material, and indentation in nest box substrate.*

Further details are included in the DCM Annual Biodiversity Report.

8.3.1 Threats to Rehabilitation Completion

The Duralie MOP Section 10 includes a description of intervention and adaptive management for threats to rehabilitation. DCPL has successfully undertaken rehabilitation activities at the DCM since 2008. The Environmental Risk Assessments (SP Solutions, 2009) (HMS, 2017) identified potential issues and risks associated with rehabilitation at the DCM. These potential risks are identified and risk assessed which leads to improvement of rehabilitation practices and remediation as required.

A trigger, action, response plan (TARP) (MOP Table 15) has been developed based on identified threats to rehabilitation at the DCM.

During the reporting period the 2020 rehabilitation monitoring program identified a list of recommendations regarding the existing rehabilitation and future rehabilitation works (**Section 8.3**) (**Appendix 7**). The recommendations mostly related to increasing native tree and shrub structure and biodiversity in the native rehabilitation areas, and secondly continuing to manage weeds in both the native and pasture rehabilitation areas.

A review of the threats identified in the rehabilitation TARP (MOP Table 15) indicates the following issues may present a risk to the success of the DCM rehabilitation achieving the relevant rehabilitation completion criteria:

- Species diversity and/or density in rehabilitation areas does not correspond with reference site(s).
- Inadequate weed and pest animal control results in failure of rehabilitation area.

The recommendations in the rehabilitation monitoring report (**Section 8.3)** provide recommended maintenance and management measures to address these specific issues.

8.4 REHABILITATION TRIALS AND RESEARCH

DCPL has extensive experience in both native woodland/forest revegetation and agricultural pasture rehabilitation, with successful rehabilitation areas completed over the past 20 years at both the Duralie and Stratford mine sites. Learnings from the rehabilitation works undertaken onsite to date along with industry best practice guidelines are employed in the methodology for new rehabilitation areas.

Revegetation trials continue to be implemented in the biodiversity offset area in accordance with the Biodiversity Management Plan. The program has trialled several methods for ground preparation, seeding and planting to determine the most suitable and cost effective methods for completing the remaining offset revegetation and mine site rehabilitation. Refer to Section 6.5 of this report and the Duralie Coal Mine Annual Biodiversity Report (DCPL, 2020) for a summary of works undertaken during the reporting period.

8.5 REHABILITATION TARGETS

The DCM MOP Plan 3A - Mining and Rehabilitation 2020 rehabilitation target for end of 2020 calendar year is a cumulative total of 206 hectares of rehabilitation. To date 170 hectares of rehabilitation has been completed comprising Landform Establishment, Ecosystem Establishment and Ecosystem Sustainability.

Prior to the end of 2020, a further 22 hectares of bulk shaping (landform establishment) is scheduled to be finalised on the Clareval waste emplacement.

The DCM MOP Plan 3B - Mining and Rehabilitation 2021 rehabilitation target for end of 2021 calendar year is a cumulative total of 206 hectares of rehabilitation.

DCPL proposes to undertake rehabilitation of approximately 33 hectares to Ecosystem Establishment phase during the next reporting period.

8.6 DEVELOPMENT OF THE FINAL REHABILITATION PLAN

8.6.1 Mine Closure Planning

A new MOP was prepared for the DCM during 2019 and was approved by the Resources Regulator on 27 February 2020. The new MOP reflects the proposed mining and rehabilitation activities for the next 2-year period and also includes a detailed Mine Closure Plan.

The mine closure planning program developed for the DCM includes a schedule of all technical and/or environmental assessments that will be required to undertake final rehabilitation following the cessation of open-cut mining at the DCM. The technical assessments identified in the Mine Closure Planning Program have been informed by the key risks and risk reduction strategies associated with rehabilitation and mine closure of the DCM, identified in the 2017 ERA (MOP Section 3.1).

The majority of the assessments/studies required by the Mine Closure Planning Program have been completed progressively during the previous MOP term. The remaining components of the program will continue to be developed over the next MOP term.

The Mine Closure Planning Program components and completion status/schedule for each component is provided in the MOP Table 15. The subsections below provide progressive updates on the key mine closure planning requirements for the DCM and the actions completed during the reporting period.

8.6.2 Final Landform designs

The rehabilitation objectives for the final landforms requires final landform designs which sustain the intended land use for the post-mining domain(s). Final landforms are to be consistent with and complement the topography of the surrounding region to minimize the visual prominence of the final landforms in the postmining landscape. Final landforms are to incorporate design relief patterns and principles consistent with natural drainage.

The conceptual DCM final landform design (prepared as part of the 2014 Modification EA) has been refined to reflect the status of the DCM upon completion of mining operations. As mining of the Clareval and Weismantel open pits will not be undertaken to the depths modelled in the conceptual final landform design, the changes to the conceptual final landform design are therefore primarily limited to the final voids and immediate surrounds. The only other change to the conceptual final landform is the removal of Auxiliary Dam No. 1, with Auxiliary Dam No. 2 and the MWD being retained, however reduced in size.

As required by the Mine Closure Planning Program, numerous technical assessments have commenced based on the refined final landform design, including a Stability Assessment, a Geotechnical Assessment of the final voids, final void water balance and final void water quality review, and a revised site water balance.

8.6.3 Final Void Management

Under the Project Approval, at the cessation of mining, the northern extents of the currently approved DEP include final voids in the Clareval pit and Weismantel pit. A final void water balance and groundwater model was prepared for the DEP EA 2010 and was revised for the Open Pit Modification EA 2014.

The mine closure planning schedule includes several components relating to water management and final voids.

Final Void Design

DCPL is required to rehabilitate the final void to ensure the landform is safe, stable and non-polluting. During the previous reporting period DCPL engaged an independent consultant to provide advice on the development of a detailed final void design including geotechnical stability and provide recommendations for the reshaping of final highwalls and endwalls. The report provides advice on rehabilitated wall stability and slope design.

The final void design has been revised during the reporting period to minimise the overall extent of the final void as much as is reasonably feasible and within the Project Approval constraints. The final void design will continue to be included in the MOP.

Final Void Water Balance

The final void water balance conducted by Gilbert & Associates (2014) for the DCM indicates the final voids would slowly fill over time and the final water levels in the Clareval open pit and Weismantel open pit would stabilise below the spill levels,

A review of the final void water balance is being prepared to ensure the water balance incorporates the final landform design and surface water inflows and outflows to/from the final void. HEC were engage during the reporting period to revise the site water balance and provide advice on the predicted post-mining final void equilibrium level.

Final Void Water Quality

A review of the medium to long term water quality predictions of the final void against available monitoring data is being prepared by HEC to determine the requirement for additional/alternate management measures other than that currently proposed.

Groundwater model

The groundwater model for the post-mining groundwater system is intrinsically related to the final void water balance. In conjunction with the final void water balance review, SLR has also been engaged the undertake a verification of the site groundwater model in relation to the final landform designs and inform the groundwater seepage rates to the final void. This report will be included in the MOP.

8.6.4 Water Management

The rehabilitation and post-mining water management strategy is described in the DEP EA 2014.

Site Water Balance

A review of the post-mining site water balance is being prepared by HEC to ensure the water balance incorporates the refined final landform design. The site water balance will be included in a revision of the DCM Water Management Plan.

Water Infrastructure

Consistent with the approved DCM, rehabilitation of water management infrastructure would occur in

consultation with regulatory authorities and the community, and considering future local and regional water infrastructure needs. Site water dams (e.g. MWD, Auxiliary Dams) and accompanying upstream diversion structures may be retained for future use. Sediment dams would remain pending long-term acceptable water quality and may be kept for stockwater if suitable. Irrigation infrastructure owned by DCPL would be decommissioned, unless used for post-mining agricultural use.

Further detail regarding the management of the Coal Shaft Creek reconstruction and the Mine Water Dams are included in the sub-sections below.

8.6.5 Coal Shaft Creek Reconstruction Plan

Re-construction of the lower reaches of Coal Shaft Creek is required following the completion of mining activities. The Coal Shaft Creek Reconstruction Plan was prepared in December 2012 and provides a conceptual design for the creek reconstruction. The plan is included as an attachment to the DCM Water Management Plan. The final Coal Shaft Creek design will be included in the mine closure planning process as described in the MOP Section 8.4.2

The MOP requires an analysis to be conducted into the geotechnical, hydrological and hydraulic design of the final alignment focussing on long-term stability, seepage management and the creation of habitat. The outcomes of these analyses will inform the final detailed design of the post-mining alignment and reconstruction of Coal Shaft Creek.

During the previous reporting period HEC was commissioned to prepare a detailed final design of the Coal Shaft Creek re-alignment and reconstruction. The Coal Shaft Creek Reconstruction Plan will be prepared in consultation with the relevant authorities and stakeholders. The Coal Shaft Creek Reconstruction Plan will be described in the MOP and included as an attached to the Water Management Plan.

8.6.6 Rehabilitation Resources

Topsoil resources are managed in accordance with the MOP Section 3.3.4. To ensure suitable and adequate topsoil resources are available for final rehabilitation, a site topsoil balance is undertaken annually and the volume compared to the total remaining disturbed area requiring rehabilitation. Annual reporting of the site soil balance and rehabilitation performance is provided in Section 8.2 of this report.

Topsoil stripping has now been completed up to the northern extent of both the Clareval pit and the Weismantel pit.

Clay resources will be required for the construction of clay cut-off walls along the southern end of the toe of the waste rock emplacement to reduce direct seepage out of the waste rock emplacement to negligible levels. Clay resources would also be required for lining of the reconstructed Coal Shaft Creek. Details are included in the CSC Reconstruction Plan

8.6.7 Infrastructure Decommissioning

The mine closure planning program includes consideration for infrastructure decommissioning including:

- Identify and remove/demolish all non-active infrastructure which is not required for the remainder of processing activities.
- Undertake consultation to confirm any alternative use for retained infrastructure (i.e. rail loop, haul roads, access tracks and dams) post-mining.

A list of the site assets/infrastructure designated for decommissioning and rehabilitation is included in the MOP. Additionally, a removal strategy and decommissioning schedule is included in the MOP.

Further details regarding decommissioning activities during the reporting period is included in Section

8.1 of his report. During the 2018 reporting period the following infrastructure was decommissioned and relocated to the SMC:

- Muster area and bathhouse
- Field crib hut
- Fuel storage tanks
- Oil and grease storage tanks

No further decommissioning of infrastructure is proposed during the next reporting period.

8.6.8 Mine Water Dams Decommissioning

The Main Water Dam, Auxiliary Dam 1 and Auxiliary Dam 2 are all prescribed under the Dams Safety Act 1978. DCPL is required to prepare a strategy for decommissioning of the mine water dams or for integration with the final land use. Additionally, DCPL is required to prepare a strategy for transferring mine water from the prescribed dams back to the final voids following the completion of mining activities.

A Conceptual Decommissioning Strategy for the DCM's prescribed mine water dams has been prepared by ATC Williams Pty Ltd (ATC Williams) (2019). The strategy has been prepared in consideration of relevant NSW Dams Safety's guidance sheets and Australian National Committee on Large Dams (ANCOLD) guidelines. The Conceptual Decommissioning Strategy was submitted to Dam Safety NSW in December 2019 and is currently undergoing and independent peer review. The final Conceptual Decommissioning Strategy will be resubmitted to Dam Safety NSW for approval in the next reporting period.

The decommissioning strategy proposes that Auxiliary Dam 1 will be decommissioned and will not form part of the DCM final landform, while Auxiliary Dam 2 and the MWD will be reduced in size and retained for beneficial use by a future landholder. The approach for Auxiliary Dam 2 and the MWD is to reduce the capacity of the dams such that under a dam break scenario, the consequence category would be considered Low, thereby having no ongoing regulated status (ATC Williams, 2019).

During the 2018, AD1 was dewatered to MWD. No water has been pumped from the open cuts and adequate storage is currently available in MWD and AD2. Since the completion of mining in the Clareval Open Cut, the void has become available for water storage. No water has been transferred from the Mine Water Dams as of the end of the reporting period, however water has been transferred from the Weismantel Pit to the Clareval void.

Decommissioning and rehabilitation of AD1 was completed during the first half of 2020. AD2 is planned to be dewatered during the next reporting period following by decommissioning.

9. COMMUNITY RELATIONS

9.1 COMMUNITY ENGAGMENT ACTIVITIES

Yancoal Australia Ltd is committed to making a positive contribution in the areas in which it operates. To help facilitate this commitment Stratford Coal Pty Ltd have established the Community Support Program to provide assistance to local initiatives within the local area in which they operate. The aim of the Community Support Program is to help benefit a diverse range of community needs such as education, environment, health, infrastructure projects, arts, leisure and cultural heritage.

The Stratford Coal Community Support Program has granted over $683,000 since commencing in 2010 and during 2020 a total of $84,900 in grants was approved. Unfortunately, due to restrictions imposed following the outbreak of Covid-19, many of the local events were unable to run in 2020. SCPL in consultation with the individual community organisations, provided a reduced sum of funding for these events to cover any administrative costs, planning costs and any other out-of-pocket expenses. A reduced total sum of $48,400 was distributed between 24 community organisations for a diverse range of community projects and initiatives. The community groups to receive grants in 2020 were:

Community Support Program 2020 Recipients	Project Description
Aussie Helpers	Massive Murray River Paddle - Aussie Helpers - Drought Relief
Stroud Neighbourhood Children's Cooperative	Installation of Playground Equipment
Gloucester Agricultural, Horticultural & Pastoral Assoc.	Gloucester Show 2020 - Educational & Interactive Activities for the Younger Show Audience
Worimi First People Aboriginal Corp	Weaving Workshops
Gloucester Country Club	Stratford Coal Super Sevens Golf Competition 2020
MidCoast Science & Engineering Challenge	MidCoast Science & Engineering Challenge and Discovery Days 2020
Gloucester Pre-School	Sunshade for Playground
Barrington Public School	Sandpit Upgrade
Gloucester Public School P & C Assoc	Initialit - 1 for improved literacy
Stroud Community Lodge Inc	Life Support - Portable Defibrillators
Stroud Rodeo Association	2020 Stroud Rodeo and Campdraft - Major Sponsor
Stroud & District Men's Shed Inc	Equipment Upgrade & Improved OH&S
Booral Rural Fire Brigade	IT Upgrade for Community Education & Firefighter Training
Stroud Show Association	2020 Stroud Show - Major Sponsor
Gloucester Chamber of Commerce and Industry	Chill Out Festival 2020
Stroud Raiders Rugby League Club	Stroud Rugby League Scoreboard - Stroud Showground
Stratford Public School P & C	School Kitchen Upgrade - Replace Refrigerator
Stratford Public School	Infants Classroom Interactive Touchscreen
Stroud Road Community Hall & Progress Assoc	Stroud Road Spring "Bash 'n Bang" 2020

Gloucester Mountain Man Tri-Challenge	2020 Gloucester Mountain Man Tri Challenge
Cancer Council	Shit Box Rally 2020 - Cancer Council
Stroud Rural Fire Brigade	Storage for Firefighters PPE
Stroud Public School P&C Association	HeartStart Defibrillator Purchase
Gloucester District Tennis Association	2020 Gloucester Open AMT & JT

Stratford Coal Pty Ltd have also continued their commitment to education and training in the Gloucester region through Stratford Coal's Education Support Program, providing much needed funding for the next generation of young students. The Education Support Program is managed by an independent committee and the funds distributed by MidCoast Council. In 2020, $47,500 has been allocated in funding to help support local students and businesses in university degrees, TAFE courses and apprenticeships.

Since the commencement of mining in 1995, Stratford Coal has contributed more than $775,000 to locally based community and training initiatives via the Education Support Program. During that time, the funding has support over 160 tertiary students, 100 apprentices and 50 businesses.

Yancoal and Stratford Coal have continued their partnerships with:

- The Clontarf Foundation -Chatham Academy
- QLD University of Technology
- Westpac Rescue Helicopter.

During 2020 SCPL engaged in several activities with the Chatham Academy students including a site visit to the Stratford Coal mine site. The site visit provided an example of an operational mine site and what goes into running a mine including the rehabilitation of mine land. Following the site visit, Clontarf students spent the afternoon learning how to plant tubestock trees in the Stratford Biodiversity Offset Area.

During the reporting period Stratford Coal have given presentations to Advance Gloucester.

9.2 COMMUNITY CONSULTATIVE COMMITTEE

The Duralie Community Consultative Committee (CCC) was established in 2003 and operates under the guidance of the NSW DPIE. Meetings are held 6-monthly and provide a forum for open discussion between the community, Council, the Company and other stakeholders on issues relating to the mine's operations, environmental performance and community engagement.

The Community Consultative Committee (CCC) for the DCM is currently comprised of:

- An independent Chairperson;
- Three (3) local community representatives;
- Two (2) local government representatives (MidCoast Council); and
- Two (2) DCPL representatives.

The CCC was formed in accordance with Schedule 5, Condition 5 of the Project Approval for the Duralie Extension Project. The Committee operates in such a manner as to generally satisfy the *Community Consultative Committees Guidelines for State Significant Projects* (Department of Planning, 2016) and to the satisfaction of the Secretary of the DPIE.

Two CCC meetings were held during the reporting period in August 2019 and February 2020.

Items raised and/or discussed during the two (2) CCC meetings held during the reporting period include but are not limited to:

- General environmental management & monitoring, including air quality, noise, surface water and groundwater
- Duralie Nest Box program
- Water management
- Community complaints
- Broader community engagement and the CCC's print media articles
- Duralie community enhancement contributions to Council and allocation thereof
- Karuah River Catchment Management
- Biodiversity Offset area
- Yancoal land management
- Yancoal internal environmental assurance audit
- Yancoal community support program
- Agricultural rehabilitation possibilities
- Stratford Extension Project updates and transition from Duralie Mine.

The committee has regularly invited guests to present on a variety of subjects that the members express an interest in. Speakers for the reporting period MidCoast Council's Director of Community Spaces and Services, MidCoast Council's Catchment Officer and Yancoal's Business Optimisation Manager on the Duralie Community Enhancement Funding, Karuah Catchment and Landcare Projects and Stratford and Duralie operations,

Regular site inspections have been undertaken during the CCC meeting including viewing of the rehabilitation area and biodiversity offset area. The CCC meeting agendas, presentations and minutes are available on the Duralie Coal website (www.duraliecoal.com.au).

An Annual Report for the Duralie Coal CCC was prepared by the Chair and submitted to DPIE on 6 March 2020 (**Appendix 5**).

9.3 ENVIRONMENTAL COMPLAINTS

Complaints (by category) received by Duralie Coal Pty Ltd over the last 5 reporting years are shown in Table 30:

Table 30 – Community Complaints Summary

Complaint Category	2015/16	2016/17	2017/18	2018/19	2019/20
Noise	10	3	0	0	0
Blasting	3	0	0	0	0
Air Quality	1	14	1	4	0
Water	0	0	0	0	0
Lighting	0	0	0	0	0
Visual	0	0	0	0	0
Train	0	0	0	0	0
Other	0	0	0	0	0
Total Complaints	**14**	**17**	**1**	**4**	**0**

No complaints were received during the 2019/20 reporting period relating to the DCM operations.

9.3.1 Liaison and Complaint Resolution

DCPL aims to inform the community of its activities and consult with the community in an open and honest manner and address complaints/conflicts and consult to achieve mutually acceptable outcomes.

In accordance with the Project Approval Conditions, DCPL is required to establish and maintain a complaint handling and response procedure. DCPL operates a system to receive, handle, respond to and record complaints or information requests relating to operation of the DCM which is described in the Environmental Management Strategy.

DCPL operates a dedicated community information hotline (1300 658 239) 24 hours per day. The number is advertised within the Sensis *White Pages Directory (Newcastle)*, a local telephone directory (*Pink Pages*) and in the local newspapers *(Gloucester Advocate and Dungog Chronicle)* on a six-monthly basis.

Designated DCPL staff, when notified of a complaint, determine an appropriate response on the basis of the nature of the complaint during business hours. This may involve a site visit/inspection, liaison with personnel on site or other appropriate action. After business hours, all complaints and operations are reviewed as soon as practicable by the open cut examiner and responded to by DCPL staff during business hours.

All complaints received and responses taken in relation to each complaint are recorded in a Complaints Register. The Complaints Register is tabled at each Community Consultative Committee meeting for the period covered since the last Committee meeting and is included in **Appendix 5**. The complaints register is also made available on the Duralie Coal website.

9.4 EMPLOYMENT STATUS AND DEMOGRAPHY

At the end of the reporting period (i.e. June 2020), the total number of staff and FTE's employed at the Duralie Coal Mine was 21, including 10 SCPL employees (shared with SMC) and 11 contractors. During the reporting period 2 environment & community representatives were employed and shared with the nearby Stratford Mining Complex.

During 2018 DCPL transitioned the workforce from DCM to the SMC to align with the completion of coal mining at the DCM and the recommencement of operations at the SMC. The total FTE numbers above assumes all DCPL operators are now based at Stratford. Ongoing rehabilitation works at the DCM have been undertaken by Ditchfield contractors.

In addition to direct permanent employment at the mine, on the basis of a conservative employment multiplier of one mine site job generating one job within the general community, up to 21 (full time equivalent) jobs are expected to have been provided in supporting services. On the basis of a review of employees' living location, 52% of mine employees resided within the greater local area (defined as being bounded by Stroud, Gloucester and Dungog).

9.5 EMPLOYEE ENVIRONMENTAL AWARENESS TRAINING

DCPL recognises the importance of establishing, developing and maintaining a risk-aware, trained, and competent workforce at its operations to ensure a high standard of environment and community management.

DCPL environmental & community management objectives include:

- ensuring employees and contractors are informed about DCPL's policies and are made aware of their environmental and community responsibilities in relation to DCPL's activities;
- providing all employees/contractors with the knowledge, skills and equipment necessary to meet their environmental obligations; and

- promoting an awareness and concern for good environmental management amongst all employees/contractors.

New employees and contractors working at site are provided with information on environmental and community issues as part of Stratford Coal induction training which is updated periodically. This includes elements such as the Pollution Incident Response Management Plan and reporting obligations of personnel and the management of environmental incidents. Ongoing environmental awareness training is also undertaken with staff and employees periodically.

During the reporting period employee and contractor training included presentations on:

- General environmental management and awareness – Training was undertaken during 2019 with all employees and contractors at the Stratford & Duralie operations. This included information on the DCM Pollution Incident Response Management Plan and incident reporting.
- 2019 Internal Environmental Assurance Audit - A presentation was provided to the site managers and supervisors on the findings presented as opportunities for improvement.

10. INDEPENDENT ENVIRONMENTAL AUDIT

An Independent Environmental Audit (IEA) of the DCM was not required during the reporting period. The next IEA is scheduled to be undertaken prior to 31 December 2020.

The outcomes and recommendations form the 2020 IEA will be included in the next DCM Annual Review.

The previous IEA reports for the DCM along with the responses to the recommendations are available on the Duralie Coal website at http://www.duraliecoal.com.au. The next Independent Environmental Audit of the DCM is scheduled to be undertaken prior to the end of 2020.

11. INCIDENTS AND NON-COMPLIANCE

Activities at the DCM continue to be carried out in accordance with the conditions of Project Approval 08_0203, ML 1427, ML 1646 and EPL 11701.

A protocol for managing incidents and non-compliances is included in the DCM Environmental Management Strategy. A statement of compliance is included in **Section 1** of this report.

During the reporting period, there were no identified reportable incidents at the DCM in accordance with the Project Approval 08_0203 or Mining Leases. There were three identified non-compliance at the DCM in accordance with the Project Approval 08_0203. These non-compliances related to groundwater monitoring, sound power monitoring and ecotoxicity monitoring. Refer to **Section 1 Table 3** for further details regarding non-compliances and response by DCM.

During the reporting period there was one identified non-compliance at the DCM relating to EPL 11701 Condition M2.3 for surface water monitoring. Refer to EPL 11701 Annual Return 2019 for further details.

No additional actions have been requested by either DPIE, Resource Regulator or the EPA in relation to these non-compliances.

12. ACTIVITIES PROPOSED IN THE NEXT AR PERIOD

DCPL will continue mining operations in accordance with Project Approval 08_0203 and the relevant Environmental Management Plans for DCM.

A new MOP will be prepared for the ongoing mine closure phase of operations prior to the end of 2021 and build on the mine closure planning program in the current MOP. The new MOP will reflect the proposed rehabilitation and mine closure activities for the 3-year term following 2021.

The following environmental targets have been set for the next 12 months:

- Mining and rehabilitation activities will be implemented in accordance with the timing in stage plans in the DCM MOP.
- Continue developing the detailed Mine Closure Plans in accordance with the mine closure planning schedule in the MOP for the DCM.
- Progress rehabilitation works to satisfy DEP EA and MOP nominated rehabilitation targets;
- Continue to meet the environmental management, monitoring and reporting requirements in accordance with the Project Approval conditions.
- Progress biodiversity offset works in accordance with the BMP including full implementation of the revegetation works.
- Maintain low level of complaints and non-compliances.

13. REFERENCES

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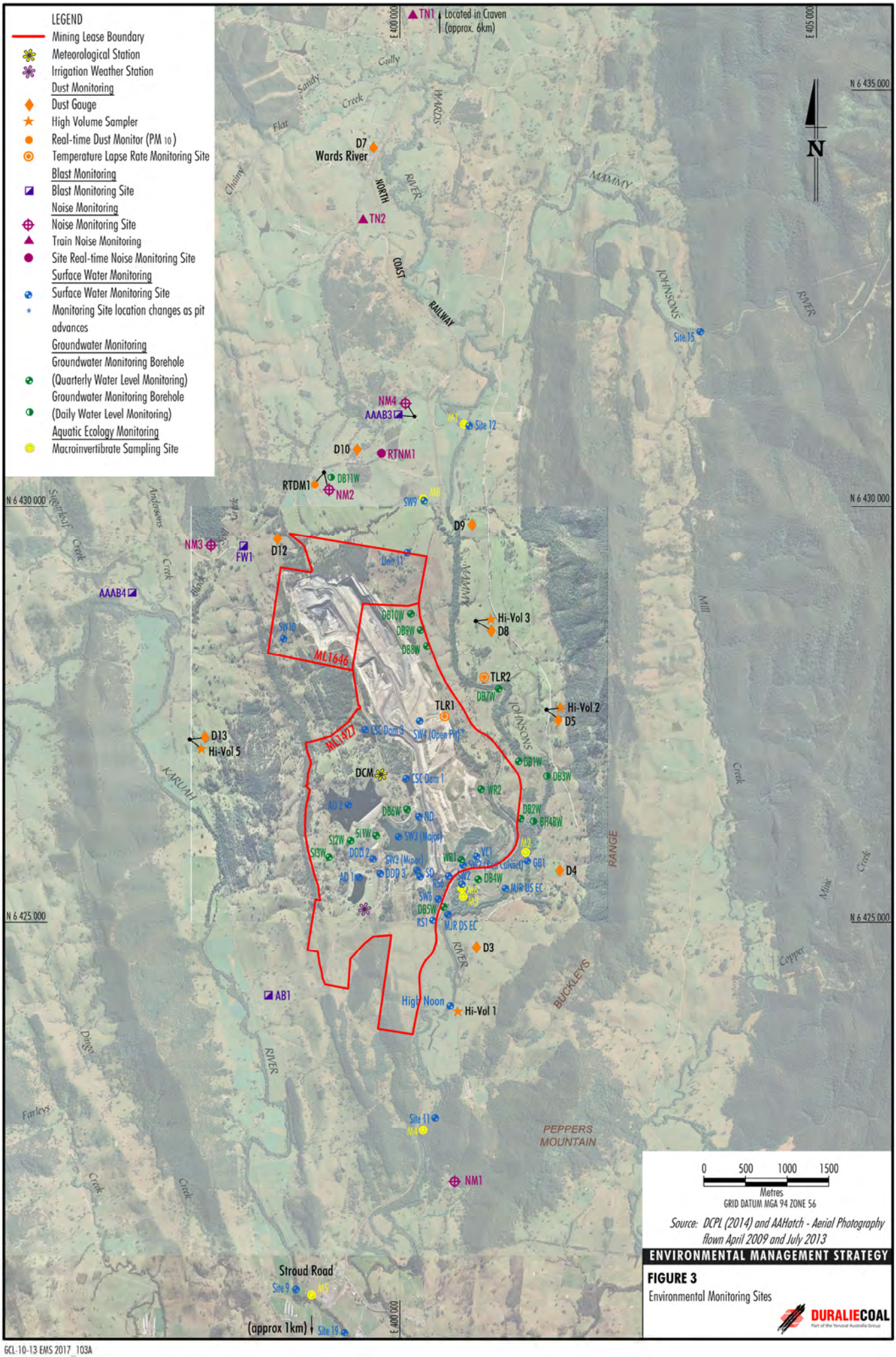
- NSW Trade and Investment, Resources and Energy (2013) *Guidelines to the Mining, Rehabilitation and Environmental Management Process.*
- NSW Government (2015) *Annual Review Guideline*.

Appendix 1:

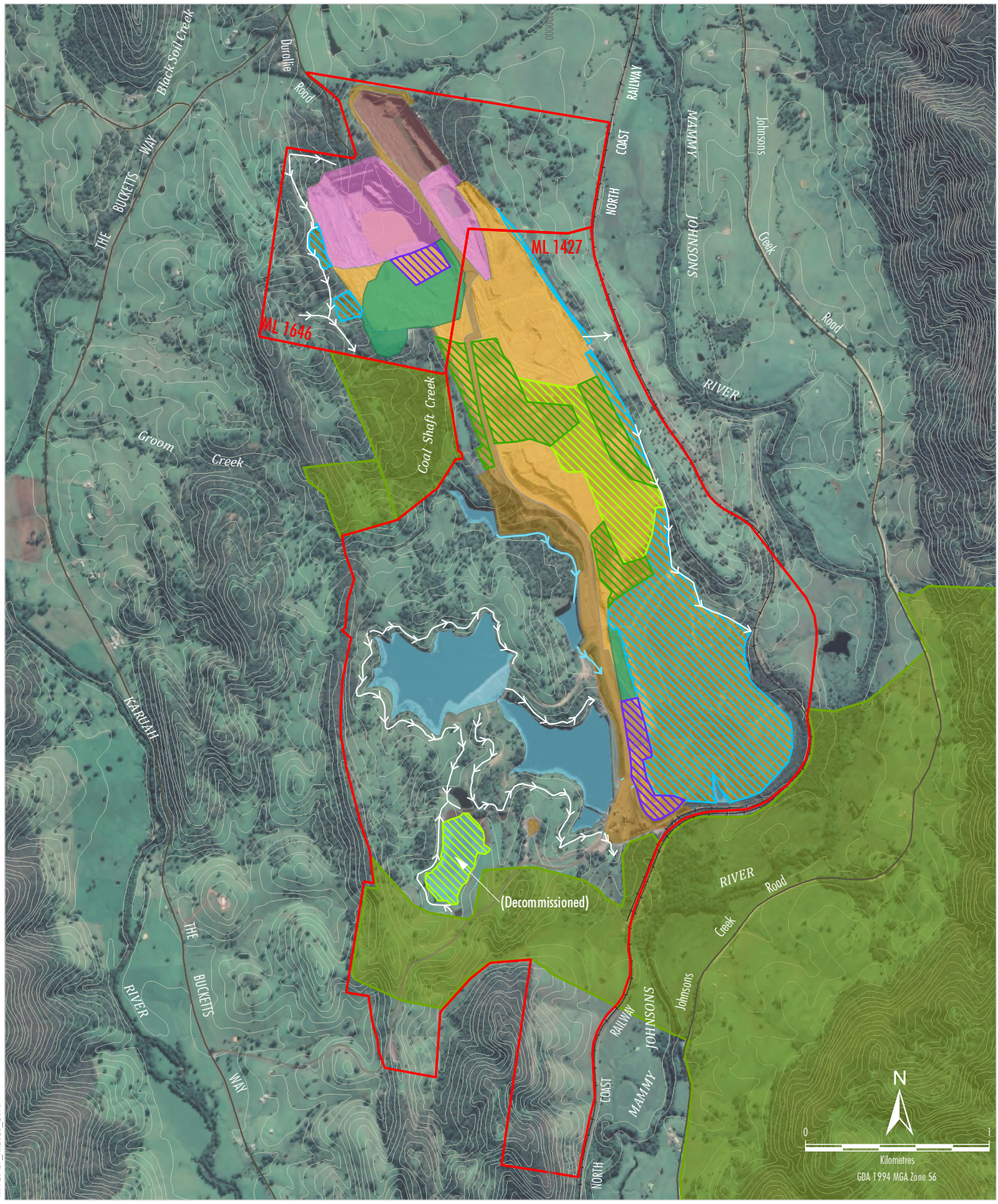
- **Site Locality Plan**
- **Project General Arrangement**
- **Monitoring Locations**
- **Disturbed and Rehabilitated Land Plan.**

GCL-10-13 EMS 2017_101A


LEGEND
Mining Lease Boundary
Approximate Extent of Existing/Approved Surface Development
Existing/Approved Up-catchment Diversion System
Existing/Approved First Flush Protocol Pump Back System
N
N 6 430 000
N 6 425 000
E 400 000
Martins Crossing
Duralie Road
BUCKETTS WAY
Monkerai Road
THE Wall Black
Weismantel Open Pit
Soil Stockpile
NORTH COAST RAILWAY
SWAMPY SWAMP
Johnsons Creek
Road
RIVER
ML1427
ML1496
Clareval Open Pit
Soil Stockpile
Coal Shaft Creek
Groom Creek
Eastern Diversion Drain
Coal Shaft Creek Diversion
Auxiliary Dam No.2
Main Water Dam
Auxiliary Dam No.3
Waste Rock Emplacement
PEACH TREE MOUNTAIN
BUCKLEY'S RANGE
Coal Loadout Bin
Rotary Breaker
Rail Siding
Main Infrastructure Area
Explosives Storage
Auxiliary Dam No.1
Quarry
Access
KARUAH
0 200 1000
Metres
GRID DATUM: MGA 94 ZONE 56
Source: DCPL (2014); AAHatch - Aerial Photography flown April 2009 and June 2014
ENVIRONMENTAL MANAGEMENT STRATEGY
FIGURE 2
Project General Arrangement
DURALIECOAL



GCL-10-13 EMS 2017_103A



YAN-20-29_AR2020_2016

LEGEND

- Mining Lease Boundary
- Up-catachment Diversion
- Culvert
- Indicative Coal Shaft Creek Diversion
- Proposed Rehabilitation for 2021
- Expected Mining Area

Primary Domains

- Infrastructure (1)
- Water Management Area (2)
- Waste Emplacement Area (3)
- Final Void/Open Pit (4)
- Offset Area (5)

Rehabilitation Phase

- Landform Establishment
- Ecosystem and Land Use Establishment – Pasture/Scattered Trees
- Ecosystem and Land Use Establishment – Woodland/Open Forest
- Ecosystem and Land Use Sustainability

Source: © NSW Spatial Services (2019)
Orthophoto: Google Imagery (April 2020)

DURALIECOAL
Part of the Yancoal Australia Group

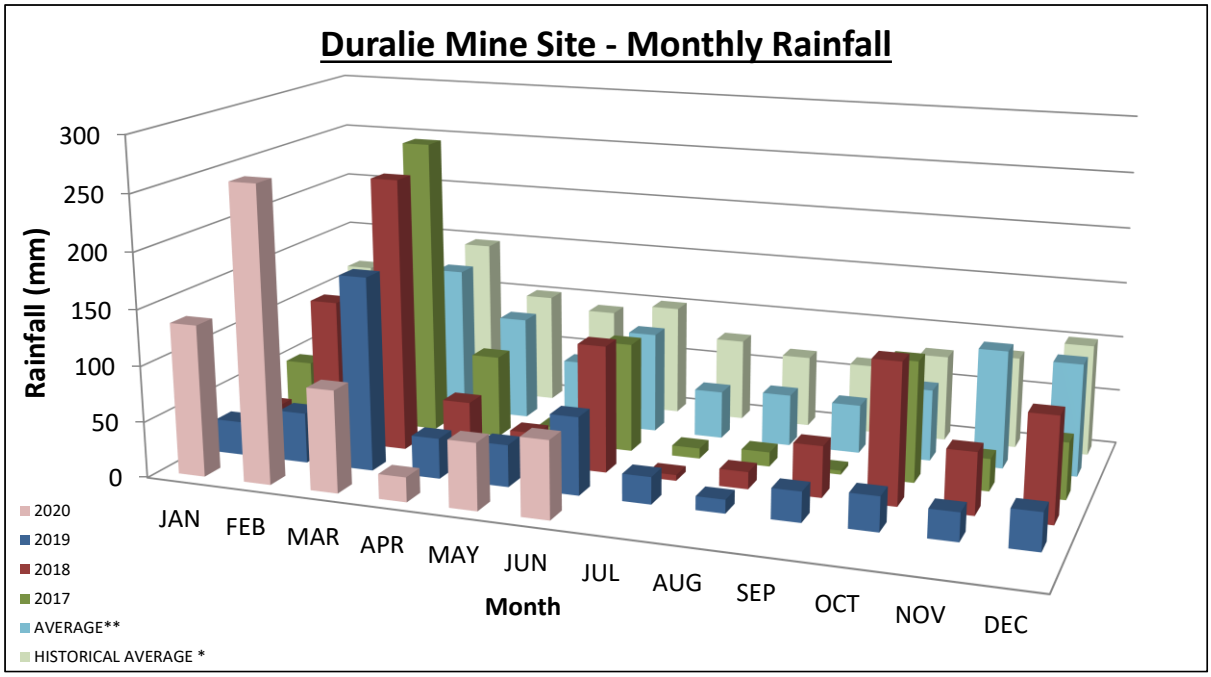
DURALIE COAL MINE 2020 ANNUAL REVIEW

Mining and Rehabilitation Areas

Figure 4

Appendix 2:

Meteorological Monitoring



*Stroud + Duralie 1889 to 2010 (inclusive)

**Duralie Mine 2002 – 2020 (inclusive)

Figure 2-1: Monthly Rainfall for 2017 to 2020 and Historical Averages

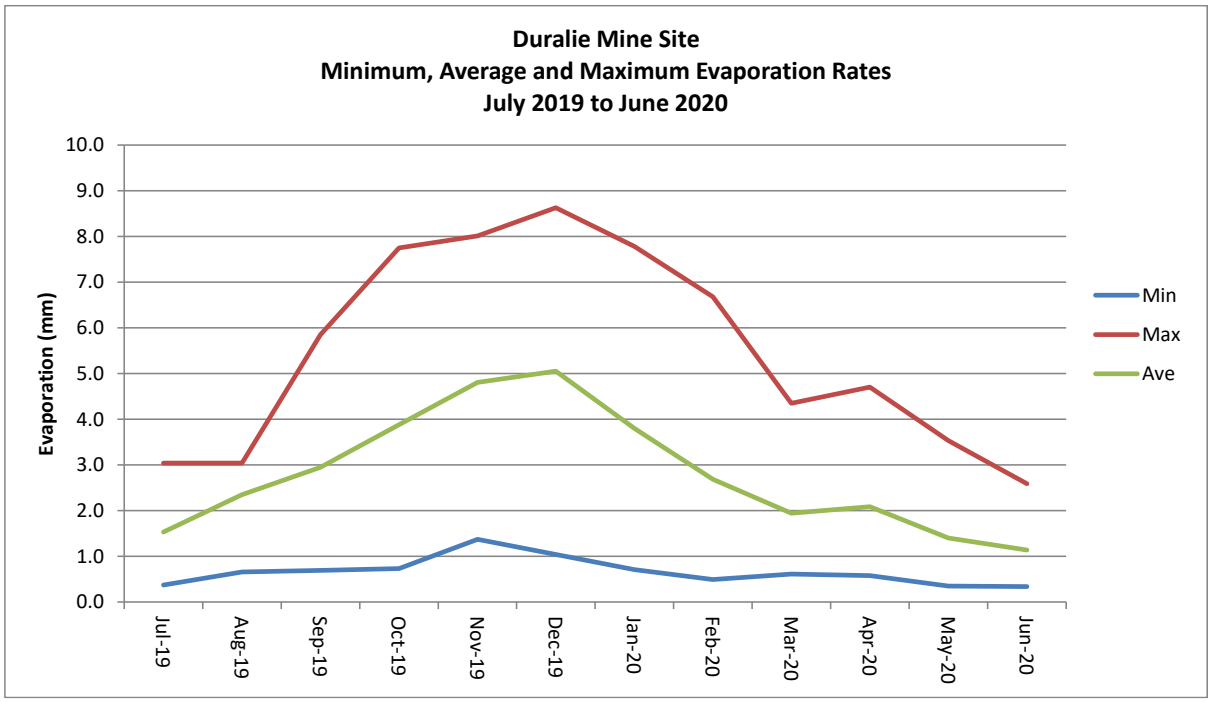


Figure 2-2: Minimum, Maximum and Average Evaporation Rates During the Reporting Period

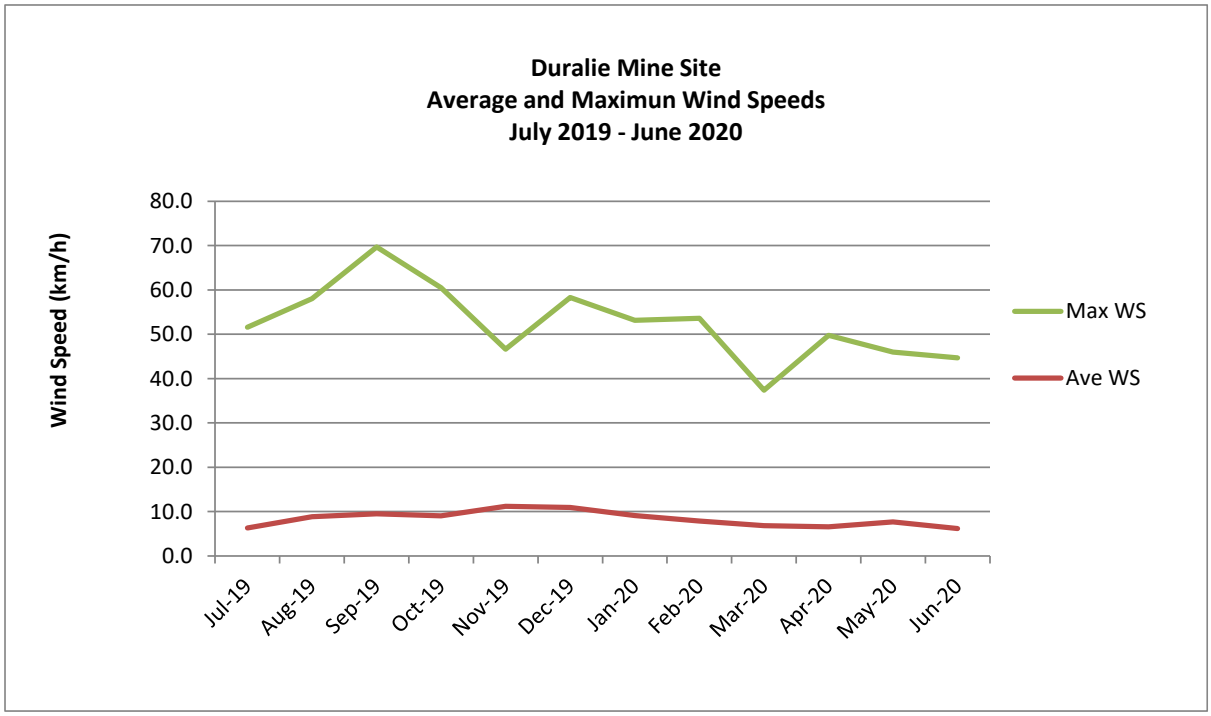


Figure 2-3: Maximum and Average Wind Speeds During the Reporting Period

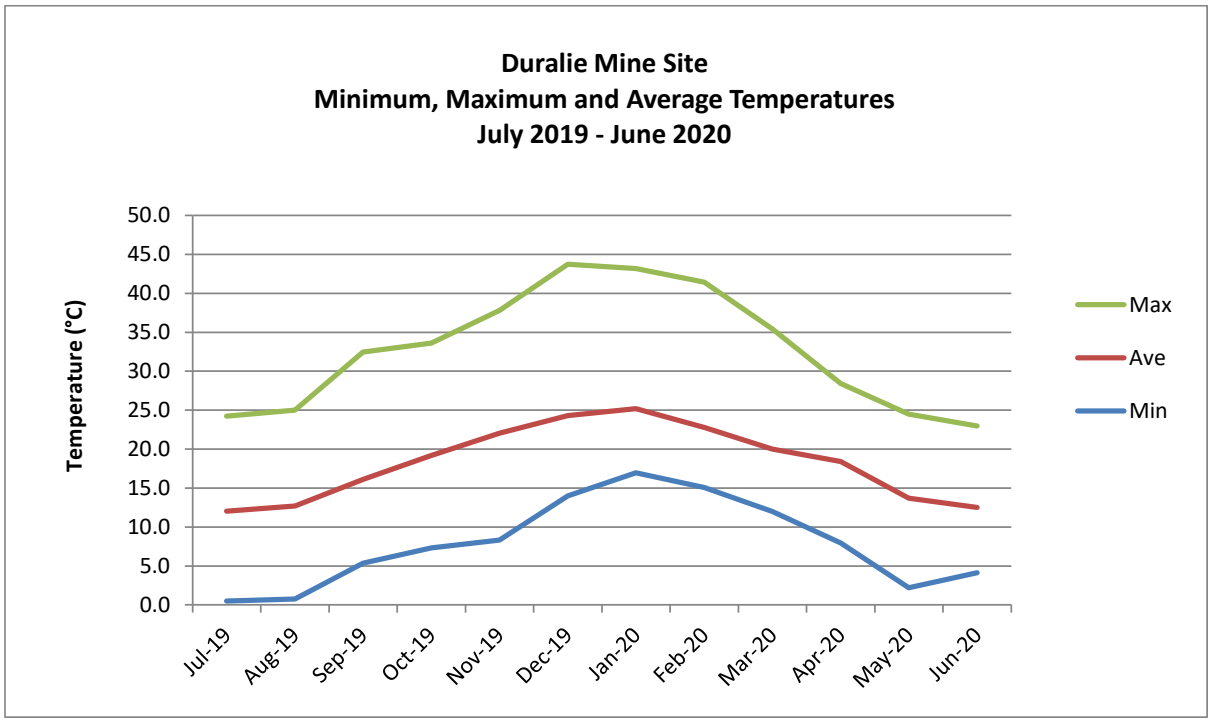


Figure 2-4: Minimum, Maximum and Average Temperatures During the Reporting Period

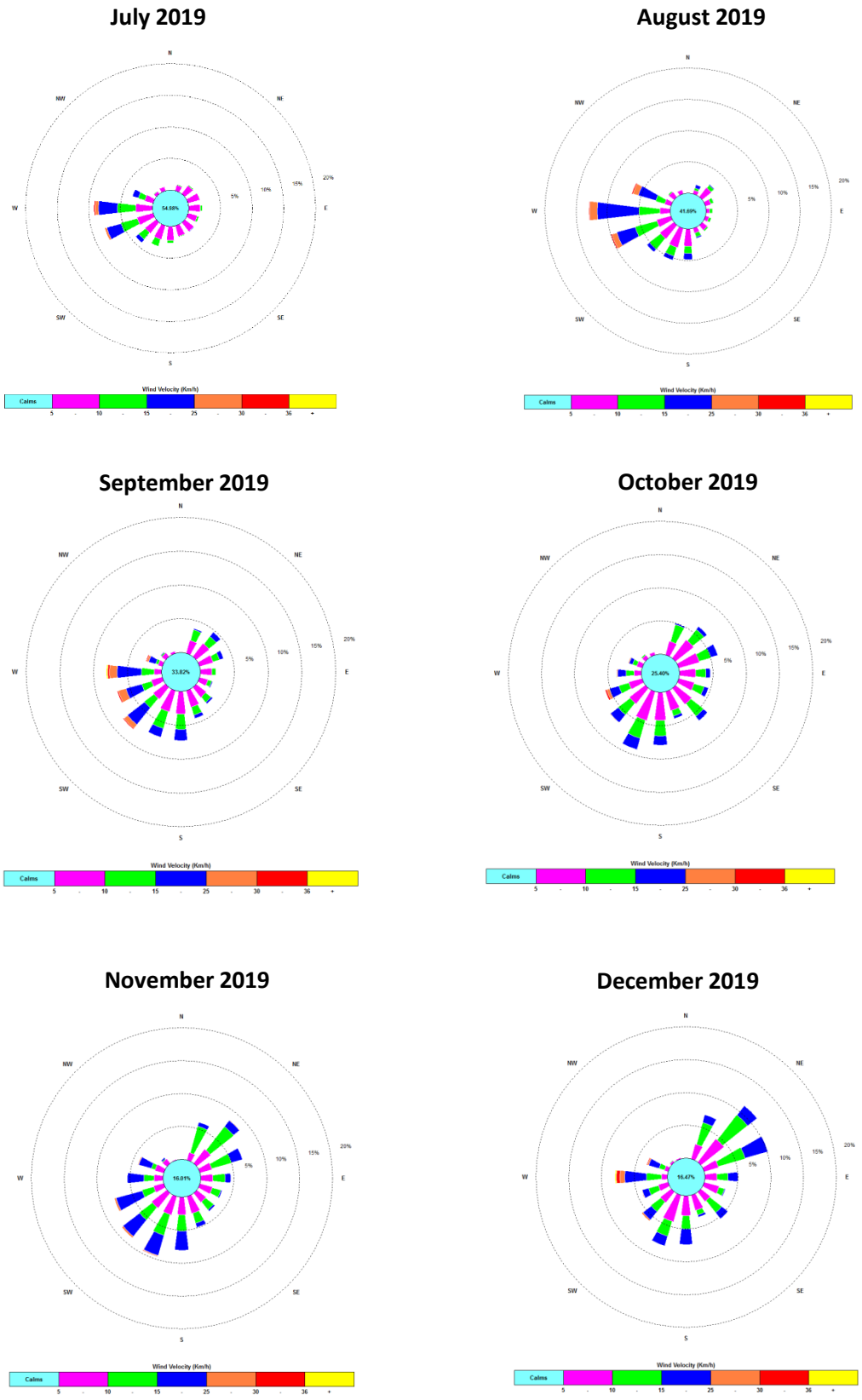
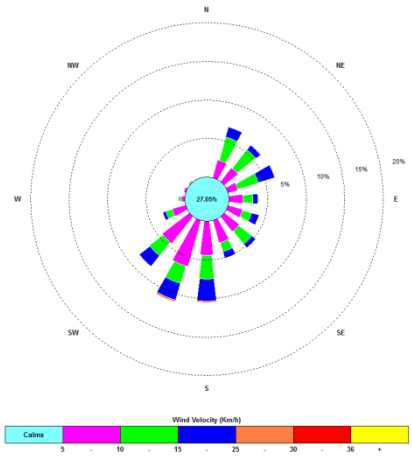
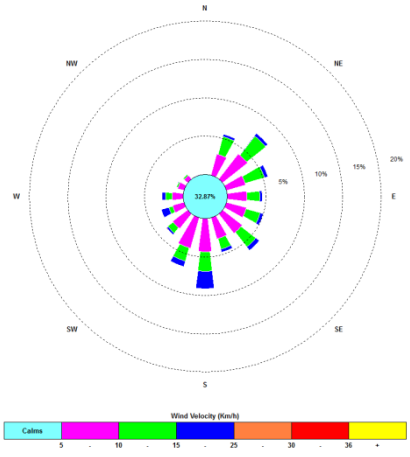


Figure 2-5: Monthly Windroses showing wind direction, speed and frequencies

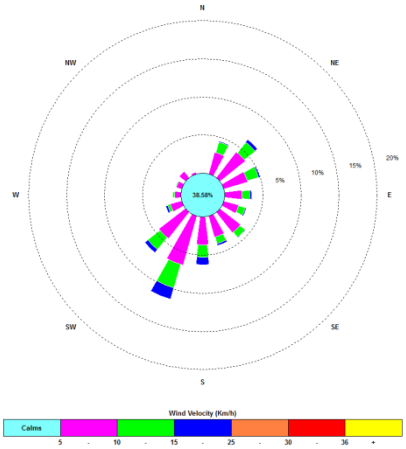
January 2020



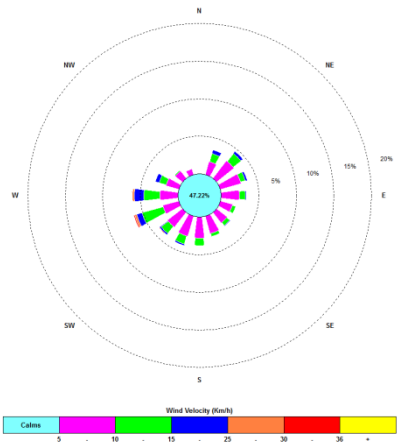
February 2020



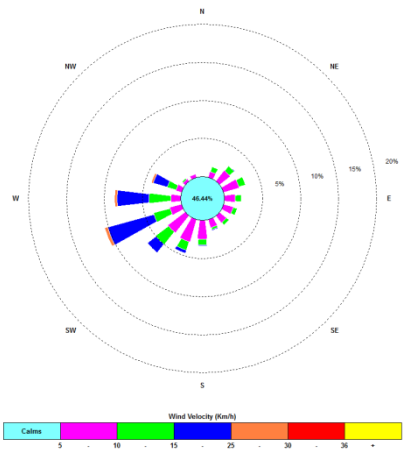
March 2020



April 2020



May 2020



June 2020

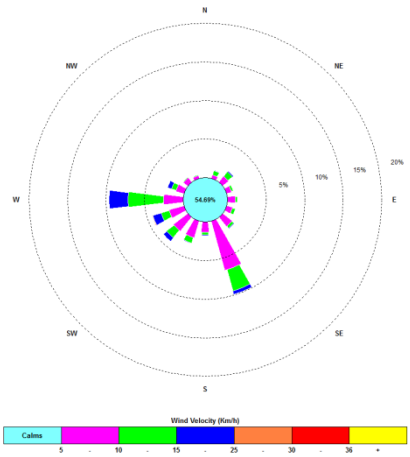


Figure 2-5 (continued): Monthly Windroses showing wind direction, speed and frequencies

Appendix 3:

Air Quality Monitoring Results

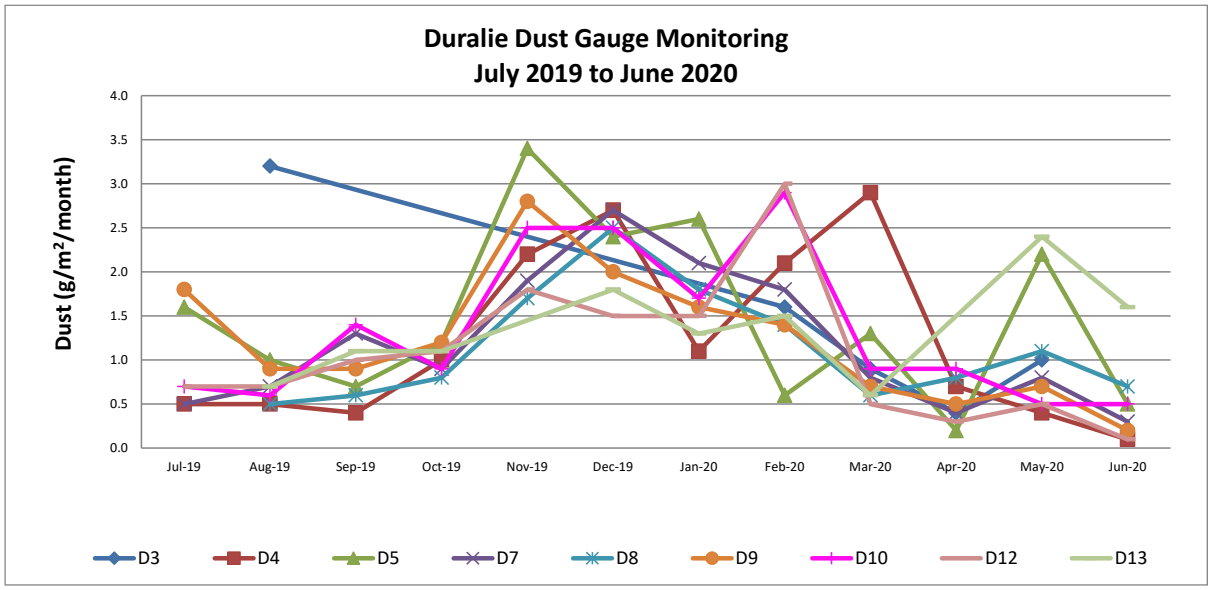


Figure 3-1: Monthly Depositional Dust Monitoring Results (minus contaminated results) during the Reporting Period

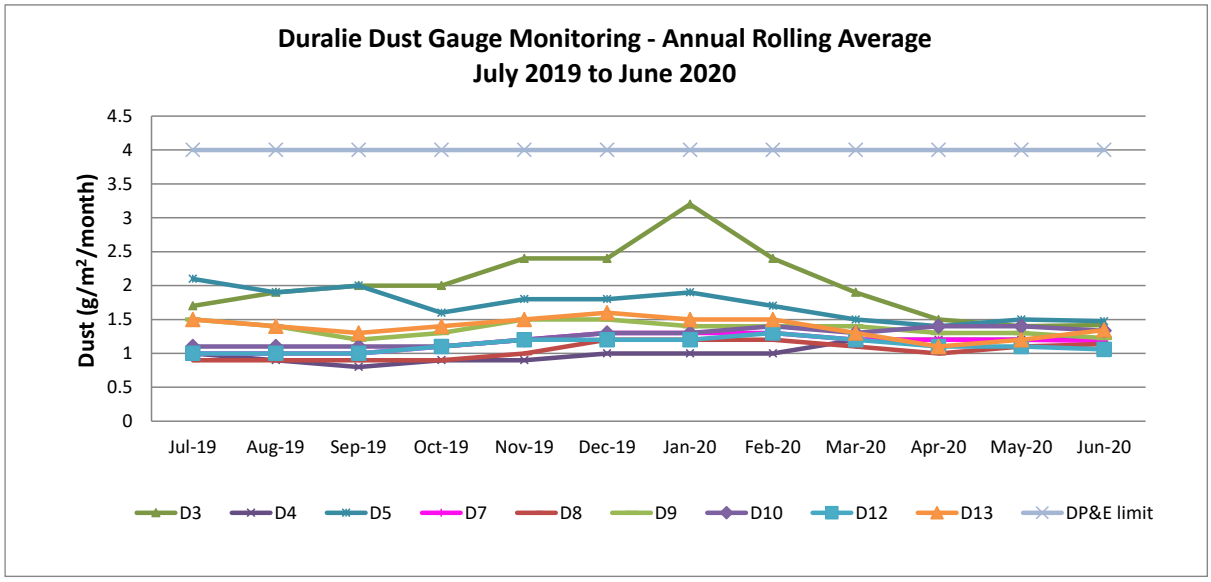


Figure 3-2: Rolling Annual Average Depositional Dust Monitoring Results (minus contaminated results) during the Reporting Period

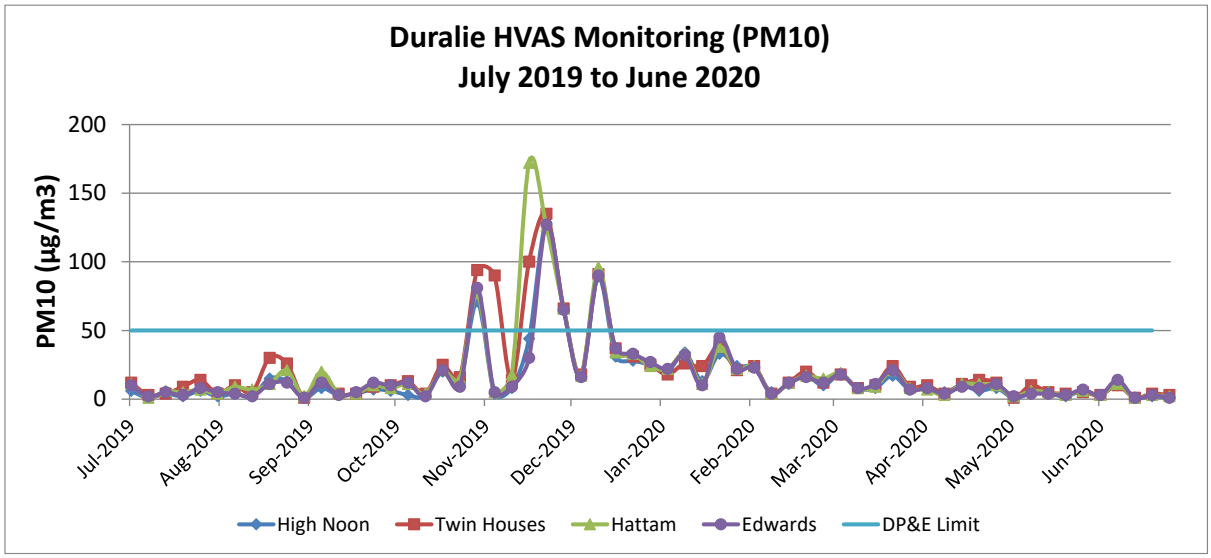


Figure 3-3: High Volume Air Sampling (PM_{10}) Results during the Reporting Period

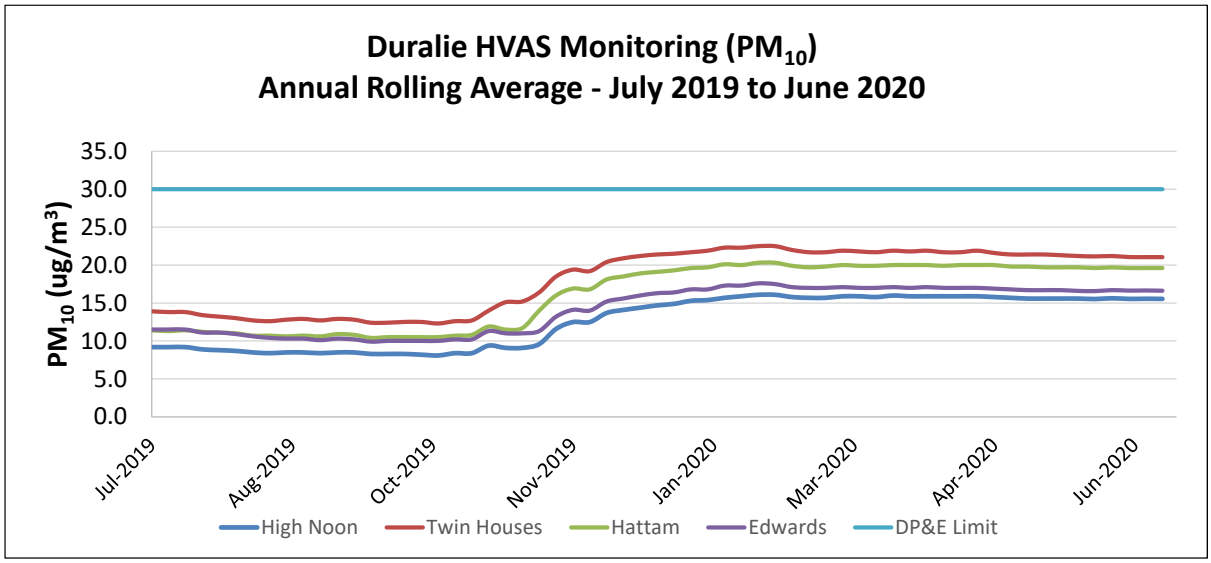


Figure 3-4: Rolling Annual Average HVAS (PM_{10}) Results during the Reporting Period

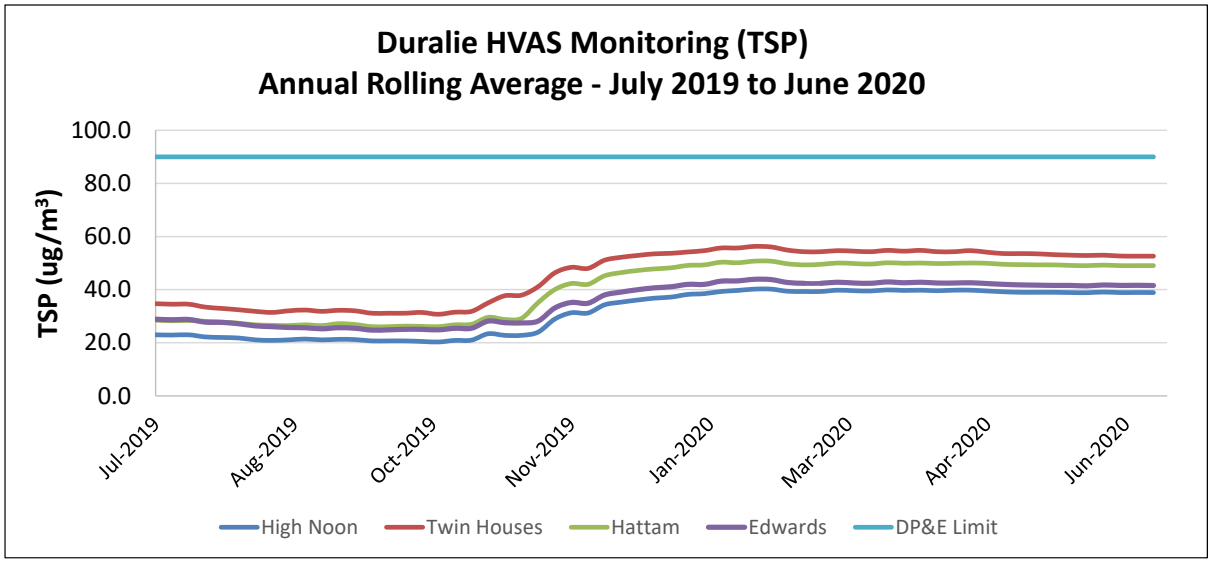


Figure 3-5: Rolling Annual Average HVAS (TSP) Results during the Reporting Period

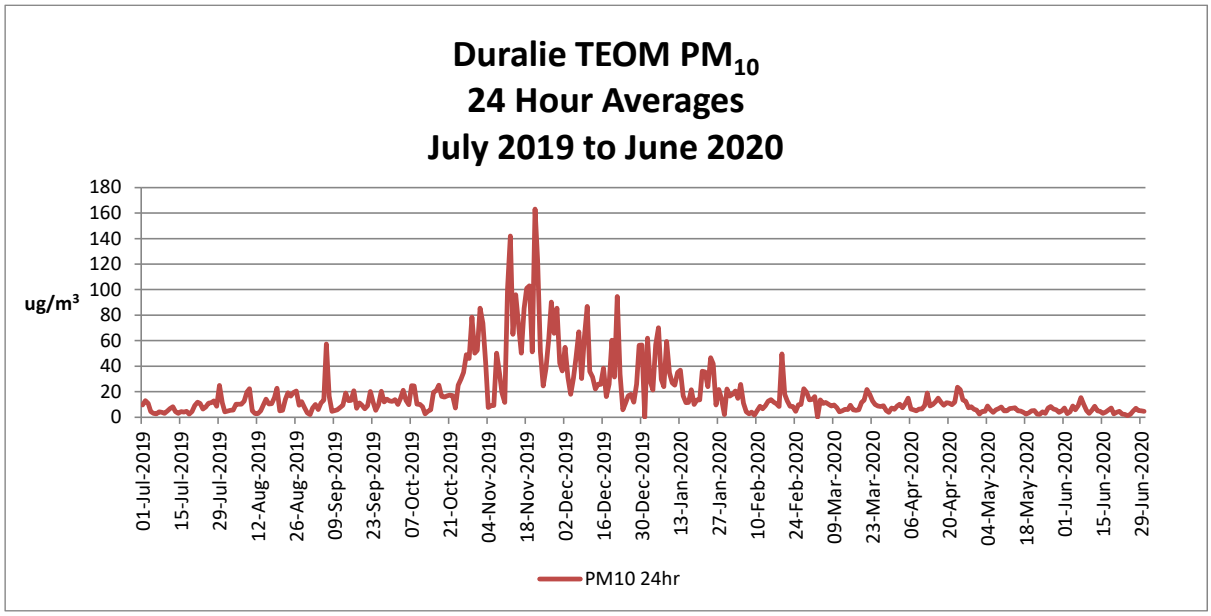


Figure 3-6: Real Time Dust Monitoring (PM_{10}) Results during the Reporting Period

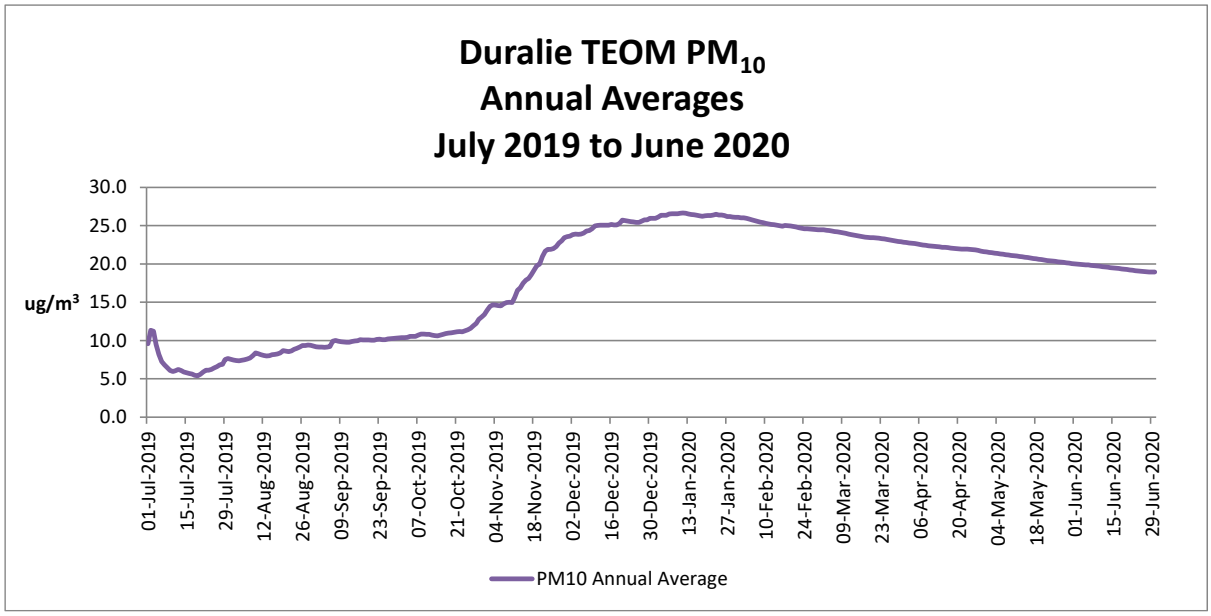


Figure 3-7: Rolling Annual Average TEOM (PM_{10}) Results during the Reporting Period

Real Time Dust Monitoring (PM_{10}) Results during the Reporting Period

	PM10 24hr	PM10 Annual Average		PM10 24hr	PM10 Annual Average		PM10 24hr	PM10 Annual Average		PM10 24hr	PM10 Annual Average		PM10 24hr	PM10 Annual Average		PM10 24hr	PM10 Annual Average
1/07/2019	9.6	9.6	1/09/2019	7.2	9.1	1/11/2019	85.4	14.0	1/01/2020	61.9	25.9	1/03/2020	14.0	24.5	1/05/2020	2.4	21.5
2/07/2019	13.1	11.3	2/09/2019	10.1	9.2	2/11/2019	73.8	14.5	2/01/2020	28.6	26.1	2/03/2020	16.2	24.5	2/05/2020	4.7	21.5
3/07/2019	10.9	11.2	3/09/2019	6.1	9.1	3/11/2019	42.5	14.7	3/01/2020	21.4	26.3	3/03/2020	no data	24.4	3/05/2020	4.7	21.4
4/07/2019	4.4	9.5	4/09/2019	11.2	9.1	4/11/2019	7.6	14.6	4/01/2020	56.8	26.4	4/03/2020	13.6	24.4	4/05/2020	8.8	21.4
5/07/2019	3.0	8.2	5/09/2019	13.4	9.2	5/11/2019	9.0	14.6	5/01/2020	70.1	26.4	5/03/2020	10.8	24.3	5/05/2020	5.9	21.3
6/07/2019	2.6	7.3	6/09/2019	57.3	9.9	6/11/2019	9.2	14.5	6/01/2020	29.7	26.5	6/03/2020	11.7	24.2	6/05/2020	4.0	21.3
7/07/2019	4.3	6.8	7/09/2019	16.6	10.0	7/11/2019	50.2	14.8	7/01/2020	23.9	26.6	7/03/2020	10.3	24.2	7/05/2020	5.8	21.2
8/07/2019	3.9	6.5	8/09/2019	4.6	9.9	8/11/2019	35.0	15.0	8/01/2020	59.4	26.6	8/03/2020	8.8	24.1	8/05/2020	6.9	21.2
9/07/2019	3.1	6.1	9/09/2019	5.2	9.9	9/11/2019	19.2	15.0	9/01/2020	35.0	26.6	9/03/2020	9.6	24.1	9/05/2020	8.0	21.1
10/07/2019	4.8	6.0	10/09/2019	5.9	9.8	10/11/2019	11.6	15.0	10/01/2020	27.0	26.6	10/03/2020	7.4	24.0	10/05/2020	5.0	21.1
11/07/2019	6.9	6.1	11/09/2019	7.6	9.8	11/11/2019	101.0	15.6	11/01/2020	25.2	26.7	11/03/2020	4.3	23.9	11/05/2020	5.1	21.0
12/07/2019	8.3	6.2	12/09/2019	9.4	9.8	12/11/2019	142.0	16.5	12/01/2020	35.1	26.6	12/03/2020	5.1	23.8	12/05/2020	6.9	21.0
13/07/2019	4.5	6.1	13/09/2019	18.9	9.9	13/11/2019	64.9	16.9	13/01/2020	36.8	26.5	13/03/2020	6.2	23.8	13/05/2020	7.0	20.9
14/07/2019	3.1	5.9	14/09/2019	13.0	9.9	14/11/2019	96.1	17.5	14/01/2020	16.7	26.5	14/03/2020	6.0	23.7	14/05/2020	7.5	20.9
15/07/2019	4.5	5.8	15/09/2019	13.3	10.0	15/11/2019	72.7	17.9	15/01/2020	11.5	26.4	15/03/2020	9.5	23.6	15/05/2020	5.0	20.8
16/07/2019	4.1	5.7	16/09/2019	20.8	10.1	16/11/2019	50.3	18.1	16/01/2020	11.6	26.4	16/03/2020	5.8	23.6	16/05/2020	4.8	20.8
17/07/2019	4.7	5.6	17/09/2019	7.1	10.1	17/11/2019	85.2	18.6	17/01/2020	21.5	26.3	17/03/2020	5.5	23.5	17/05/2020	3.8	20.7
18/07/2019	2.5	5.5	18/09/2019	11.2	10.1	18/11/2019	101.0	19.2	18/01/2020	10.1	26.2	18/03/2020	5.8	23.5	18/05/2020	2.4	20.7
19/07/2019	4.5	5.4	19/09/2019	9.3	10.1	19/11/2019	103.0	19.8	19/01/2020	13.7	26.3	19/03/2020	11.7	23.4	19/05/2020	3.5	20.6
20/07/2019	9.3	5.6	20/09/2019	6.7	10.0	20/11/2019	51.3	20.0	20/01/2020	13.7	26.3	20/03/2020	13.5	23.4	20/05/2020	5.0	20.6
21/07/2019	11.8	5.9	21/09/2019	9.1	10.0	21/11/2019	163.0	21.0	21/01/2020	36.1	26.3	21/03/2020	21.8	23.4	21/05/2020	5.2	20.5
22/07/2019	10.9	6.1	22/09/2019	20.1	10.2	22/11/2019	123.0	21.7	22/01/2020	35.5	26.4	22/03/2020	17.9	23.4	22/05/2020	2.4	20.5
23/07/2019	6.4	6.1	23/09/2019	11.6	10.2	23/11/2019	51.3	21.9	23/01/2020	23.9	26.5	23/03/2020	12.8	23.3	23/05/2020	2.4	20.4
24/07/2019	8.1	6.2	24/09/2019	5.4	10.1	24/11/2019	24.6	21.9	24/01/2020	46.6	26.4	24/03/2020	10.0	23.3	24/05/2020	4.2	20.4
25/07/2019	11.1	6.4	25/09/2019	9.8	10.1	25/11/2019	38.3	22.0	25/01/2020	41.9	26.4	25/03/2020	8.9	23.2	25/05/2020	3.0	20.3
26/07/2019	11.5	6.6	26/09/2019	20.3	10.2	26/11/2019	61.7	22.3	26/01/2020	9.6	26.3	26/03/2020	8.4	23.1	26/05/2020	7.3	20.3
27/07/2019	12.9	6.8	27/09/2019	12.0	10.2	27/11/2019	90.2	22.7	27/01/2020	21.7	26.2	27/03/2020	9.1	23.1	27/05/2020	8.3	20.2
28/07/2019	8.5	6.9	28/09/2019	14.3	10.3	28/11/2019	65.8	23.0	28/01/2020	14.2	26.2	28/03/2020	5.2	23.0	28/05/2020	6.5	20.2
29/07/2019	24.9	7.5	29/09/2019	12.8	10.3	29/11/2019	85.4	23.4	29/01/2020	2.0	26.1	29/03/2020	3.9	22.9	29/05/2020	5.9	20.2
30/07/2019	11.5	7.7	30/09/2019	12.5	10.3	30/11/2019	42.4	23.6	30/01/2020	22.1	26.1	30/03/2020	7.2	22.9	30/05/2020	3.9	20.1
31/07/2019	4.3	7.5	1/10/2019	13.8	10.4	1/12/2019	36.2	23.6	31/01/2020	16.5	26.1	31/03/2020	6.3	22.8	31/05/2020	5.0	20.1
1/08/2019	4.8	7.5	2/10/2019	9.9	10.4	2/12/2019	54.9	23.8	1/02/2020	17.9	26.0	1/04/2020	8.9	22.8	1/06/2020	7.2	20.0
2/08/2019	5.4	7.4	3/10/2019	14.7	10.4	3/12/2019	31.5	23.9	2/02/2020	20.5	26.0	2/04/2020	10.2	22.7	2/06/2020	2.9	20.0
3/08/2019	5.6	7.3	4/10/2019	21.2	10.5	4/12/2019	18.0	23.9	3/02/2020	14.8	26.0	3/04/2020	7.5	22.7	3/06/2020	4.2	19.9
4/08/2019	10.2	7.4	5/10/2019	13.3	10.6	5/12/2019	30.7	23.9	4/02/2020	25.7	25.9	4/04/2020	10.9	22.7	4/06/2020	8.8	19.9
5/08/2019	10.3	7.5	6/10/2019	9.8	10.6	6/12/2019	46.8	24.0	5/02/2020	11.1	25.8	5/04/2020	14.9	22.6	5/06/2020	5.9	19.9
6/08/2019	10.3	7.6	7/10/2019	24.8	10.7	7/12/2019	67.0	24.3	6/02/2020	4.3	25.7	6/04/2020	6.4	22.5	6/06/2020	9.1	19.9
7/08/2019	12.6	7.7	8/10/2019	24.5	10.8	8/12/2019	30.3	24.3	7/02/2020	2.6	25.5	7/04/2020	5.8	22.5	7/06/2020	15.3	19.8
8/08/2019	19.7	8.0	9/10/2019	10.2	10.8	9/12/2019	63.1	24.6	8/02/2020	4.1	25.5	8/04/2020	5.1	22.4	8/06/2020	10.0	19.8
9/08/2019	22.4	8.4	10/10/2019	10.3	10.8	10/12/2019	86.9	25.0	9/02/2020	1.7	25.4	9/04/2020	6.4	22.4	9/06/2020	5.2	19.7
10/08/2019	5.1	8.3	11/10/2019	8.2	10.8	11/12/2019	35.9	25.0	10/02/2020	5.2	25.3	10/04/2020	6.5	22.3	10/06/2020	3.0	19.7
11/08/2019	2.8	8.2	12/10/2019	2.7	10.7	12/12/2019	31.6	25.1	11/02/2020	8.6	25.2	11/04/2020	9.2	22.3	11/06/2020	5.5	19.7
12/08/2019	2.8	8.0	13/10/2019	4.6	10.7	13/12/2019	22.2	25.1	12/02/2020	6.7	25.2	12/04/2020	18.9	22.3	12/06/2020	8.7	19.6
13/08/2019	5.1	8.0	14/10/2019	5.9	10.6	14/12/2019	25.9	25.1	13/02/2020	9.0	25.1	13/04/2020	8.9	22.2	13/06/2020	5.1	19.6
14/08/2019	9.4	8.0	15/10/2019	19.5	10.7	15/12/2019	25.7	25.1	14/02/2020	12.6	25.1	14/04/2020	10.1	22.2	14/06/2020	4.7	19.5
15/08/2019	14.2	8.1	16/10/2019	21.0	10.8	16/12/2019	38.4	25.1	15/02/2020	13.9	25.0	15/04/2020	12.3	22.2	15/06/2020	3.1	19.5
16/08/2019	10.5	8.2	17/10/2019	25.2	10.9	17/12/2019	16.2	25.1	16/02/2020	11.9	24.9	16/04/2020	14.9	22.1	16/06/2020	4.1	19.4
17/08/2019	10.7	8.2	18/10/2019	16.4	11.0	18/12/2019	25.9	25.1	17/02/2020	10.6	25.0	17/04/2020	11.9	22.1	17/06/2020	5.7	19.4
18/08/2019	15.3	8.4	19/10/2019	15.8	11.0	19/12/2019	60.5	25.3	18/02/2020	8.5	25.0	18/04/2020	9.4	22.0	18/06/2020	7.1	19.4
19/08/2019	22.8	8.7	20/10/2019	16.7	11.1	20/12/2019	31.5	25.7	19/02/2020	49.7	25.0	19/04/2020	11.5	22.0	19/06/2020	2.6	19.3
20/08/2019	5.0	8.6	21/10/2019	17.4	11.1	21/12/2019	94.6	25.7	20/02/2020	18.0	24.9	20/04/2020	11.0	22.0	20/06/2020	3.8	19.3
21/08/2019	5.5	8.5	22/10/2019	16.9	11.2	22/12/2019	33.8	25.6	21/02/2020	12.8	24.8	21/04/2020	9.9	21.9	21/06/2020	4.7	19.2
22/08/2019	14.0	8.6	23/10/2019	7.3	11.1	23/12/2019	5.8	25.5	22/02/2020	8.6	24.7	22/04/2020	11.8	21.9	22/06/2020	2.5	19.2
23/08/2019	19.1	8.8	24/10/2019	25.1	11.3	24/12/2019	10.8	25.5	23/02/2020	8.5	24.7	23/04/2020	23.6	21.9	23/06/2020	2.3	19.1
24/08/2019	16.5	9.0	25/10/2019	29.9	11.4	25/12/2019	16.7	25.4	24/02/2020	4.6	24.6	24/04/2020	21.6	21.9	24/06/2020	1.2	19.1
25/08/2019	19.3	9.2	26/10/2019	35.1	11.6	26/12/2019	18.0	25.4	25/02/2020	9.8	24.6	25/04/2020	13.7	21.9	25/06/2020	2.4	19.1
26/08/2019	20.6	9.4	27/10/2019	49.1	11.9	27/12/2019	11.9	25.6	26/02/2020	10.0	24.6	26/04/2020	12.6	21.8	26/06/2020	4.9	19.0
27/08/2019	9.4	9.4	28/10/2019	46.0	12.2	28/12/2019	25.9	25.8	27/02/2020	22.3	24.5	27/04/2020	7.4	21.8	27/06/2020	7.0	19.0
28/08/2019	12.3	9.4	29/10/2019	78.4	12.8	29/12/2019	56.4	25.8	28/02/2020	19.5	24.5	28/04/2020	8.2	21.7	28/06/2020	5.2	18.9
29/08/2019	7.6	9.4	30/10/2019	50.1	13.1	30/12/2019	56.7	26.0	1/03/2020	13.6	24.5	29/04/2020	6.2	21.6	29/06/2020	5.1	18.9
30/08/2019	3.4	9.3	31/10/2019	52.3	13.4	31/12/2019	no data	26.0				30/04/2020	5.6	21.6	30/06/2020	4.6	18.9
31/08/2019	2.1	9.2															

Appendix 4:

Surface Water and Groundwater Monitoring

Surface Water

SW2 - Coal Shaft Creek **EPL 11701 Point 30**

Date	Category	Comment	ph	EC uS/cm	Turbidity NTU	DO %	TSS mg/l	Alkalinity (as $CaCO_3$) mg/l	Acidity (as $CaCO_3$) mg/l	SO4 mg/l	Cl mg/l	Ca mg/l	Mg mg/l	Al mg/l	Mn mg/l	Zn mg/l	Fe mg/l	Cu mg/l
30-Jul-19	Monthly	No flow																
29-Aug-19	Monthly	No flow																
30-Sep-19	Monthly	No flow																
31-Oct-19	Monthly	No flow																
28-Nov-19	Monthly	No flow																
27-Dec-19	Monthly	No flow																
30-Jan-20	Monthly	No flow																
9-Feb-20	Monthly	Slow, clear, brown	**6.7**	193	100.0	82	48	12	6	67	27	12	8	**3.24**	0.227	**0.076**	3.55	0.003
10-Feb-20	Discharge	Fast flow, light brown	**6.7**	133	41.7		38											
11-Feb-20	Discharge	Slow flow, flooded above banks	**7.0**	473	33.2		15											
12-Feb-20	Discharge	Slow flow, slightly turbid, light brown	7.3	454	28.0		11											
13-Feb-20	Discharge	Slow flow, slightly turbid, light brown	7.3	417	28.7		11											
14-Feb-20	Discharge	Slow flow, slightly turbid, light brown	7.1	413	29.5		9											
15-Feb-20	Discharge	Slow flow, slightly turbid, light brown	7.1	444	22.1		6											
16-Feb-20	Discharge	Slow flow, slightly turbid, light brown	7.1	444	17.5		5											
17-Feb-20	Discharge	Slow flow, light brown	7.4	437	14.5		8											
18-Feb-20	Discharge	Slow flow, slightly turbid, light brown	7.3	442	40.5		11											
19-Feb-20	Discharge	Slow flow, light brown	7.2	349	19.3		10											
20-Feb-20	Discharge	Fast Flow, Brown	**6.7**	255	11.3		9											
21-Feb-20	Discharge	Steady flow, light brown	7.1	453	9.8		6											
22-Feb-20	Discharge	Steady flow, light brown	7.9	271	3.9		5											
27-Mar-20	Discharge	Slow flow, light brown	**6.8**	461	29.7	60	6	75	7	34	44	18	14	0.29	0.443	0.008	3.53	<0.001
28-Mar-20	Discharge	Slow flow, slightly turbid and brown	**7.0**	298	9.7		<5											
29-Mar-20	Discharge	Slow flow, light brown	**6.8**	395	23.0		<5											
30-Mar-20	Discharge	Slow flow, slightly turbid, light brown	**6.7**	434	25.0		<5											
30-Apr-20	Monthly	Trickle, turbid, brown	**8.9**	**578**	59.6	23	18	128	11	67	60	25	20	0.04	1.050	<0.005	8.44	0.002
28-May-20	Monthly	Trickle, clear, colourless	**6.7**	501	37.8	46	<5	47	7	96	43	20	16	0.38	0.431	0.014	3.85	<0.001
29-Jun-20	Monthly	Trickle, slightly turbid, Light brown	**6.9**	**634**	38.6	56	5	54	17	125	65	24	19	0.04	0.428	<0.005	3.64	<0.001
Min			6.7	133	4	23	5	12	6	34	27	12	8	0.04	0.227	0.005	3.53	0.001
Avg			7.1	404	30	53	11	63	10	78	48	20	15	0.80	0.516	0.022	4.60	0.002
Max			8.9	634	100	82	48	128	17	125	65	25	20	3.24	1.050	0.076	8.44	0.003
Var			0.3	14222	434	462	125	1827	21	1178	229	27	23	1.89	0.097	0.001	4.62	0.000
SD			0.5	119	21	21	11	43	5	34	15	5	5	1.37	0.312	0.031	2.15	0.001
*Water Quality Trigger			7.1 - 7.9	544	119	85 - 110%	80							3.02		0.064		0.003

Water quality triggers for the Duralie Coal Mine developed in accordance with the methodology in ANZECC/ARMCANZ (2000).** ***"Gilberts & Asscocistes 2011 - **Development of Water Quality Trigger Levels for the Duralie Extension Project".**

SW2 RC - Coal Shaft Creek at Rail Siding Culvert (Entrance)

Date	Category	Comment	ph	EC uS/cm	Turbidity NTU	DO %	TDS mg/l	TSS mg/l	Hardness mg/l	Alkalinity $CaCO_3$ mg/l	Acidity $CaCO_3$ mg/l	SO4 mg/l	Cl mg/l	Ca mg/l	Mg mg/l	Al mg/l	Mn mg/l	Zn mg/l	Fe mg/l	CO_3 $CaCO_3$ mg/l	Bicarb (as $CaCO_3$) mg/l	BOD mg/l	Na mg/l
30-Jul-19	Monthly	Nil flow																					
29-Aug-19	Monthly	Nil flow																					
30-Sep-19	Monthly	Nil flow																					
31-Oct-19	Monthly	Nil flow																					
28-Nov-19	Monthly	Nil flow																					
27-Dec-19	Monthly	Nil flow																					
30-Jan-20	Monthly	Nil flow																					
9-Feb-20	Monthly	Fast flow	**6.9**	228	57.7	97.8	146	18	72	11	3	103	24	14	9	1.53	0.043	**0.089**	1.63	<1	11	2	36
27-Mar-20	Discharge Event	Steady flow, clear	7.3	537.6	10.94	88.6	344	7	129	70	2	120	47	22	18	0.17	0.021	0.014	0.36	<1	70	2	56
30-Apr-20	Monthly	Trickle flow, clear, light brown	**7.0**	**601.2**	8.24	**34.4**	385	12	145	126	6	63	65	25	20	0.11	0.376	0.028	1.78	<1	126	<2	62
28-May-20	Monthly	Trickle, clear	7.2	**805.2**	5.18	**61.4**	515	**<5**	184	56	5	170	75	31	26	0.14	0.048	0.022	0.54	<1	56	4	77
29-Jun-20	Monthly	Slow flow, clear	7.6	**593**	2.61	**76.4**	379.52	**<5**	136	62	6	130	67	23	19	0.06	0.014	0.012	0.26	<1	62	2	65
Min			6.9	228	3	34.4	146	5	72	11	2	63	24	14	9	0.06	0.014	0.012	0.26	1	11	2	36
Avg			7.2	553	17	71.7	354	9	133	65	4	117	56	23	18	0.40	0.100	0.033	0.91	1	65	2	59
Max			7.6	805	58	97.8	515	18	184	126	6	170	75	31	26	1.53	0.376	0.089	1.78	1	126	4	77
Var			0.1	43348	529	621.6	17724	31	1623	1688	3	1525	417	38	37	0.40	0.024	0.001	0.53	0	1688	1	227
SD			0.3	208	23	24.9	133	6	40	41	2	39	20	6	6	0.63	0.155	0.032	0.73	0	41	1	15
*Water Quality Trigger			7.1 - 7.9	544	119	85 - 110%		80								3.02		0.064					

Water quality triggers for the Duralie Coal Mine developed in accordance with the methodology in ANZECC/ARMCANZ (2000). ***"Gilberts & Asscocistes 2011 - Development of Water Quality Trigger Levels for the Duralie Extension Project".***

SW2 RC - Coal Shaft Creek at Rail Siding Culvert (Entrance)

Date	As mg/l	Ba mg/l	Cd mg/l	Cr mg/l	Cu mg/l	Pb mg/l	Mo mg/l	Ni mg/l	Se mg/l	Ag mg/l	U mg/l	B mg/l	Hg mg/l	F mg/l	NH3 (as N) mg/l	NO2 (as N) mg/l	NO3 (as N) mg/l	N mg/l	P mg/l
30-Jul-19																			
29-Aug-19																			
30-Sep-19																			
31-Oct-19																			
28-Nov-19																			
27-Dec-19																			
30-Jan-20																			
9-Feb-20	<0.001	0.025	<0.0001	0.002	0.002	<0.001	<0.001	0.002	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	<0.01	0.01	2.2	**2.5**	0.03
27-Mar-20	<0.001	0.02	<0.0001	<0.001	<0.001	<0.001	<0.001	0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	0.02	<0.01	0.12	0.4	<0.01
30-Apr-20	<0.001	0.029	<0.0001	<0.001	0.003	<0.001	<0.001	0.002	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	<0.01	<0.01	<0.01	0.5	0.01
28-May-20	<0.001	0.032	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	0.2	<0.01	<0.01	0.07	0.4	<0.01
29-Jun-20	<0.001	0.021	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	0.1	<0.01	<0.01	0.01	0.3	0.07
Min		0.020		0.001	0.001			0.001						0.100	0.010	0.010	0.010	0.3	0.010
Avg		0.025		0.001	0.002			0.001						0.120	0.012	0.010	0.482	0.8	0.026
Max		0.032		0.002	0.003			0.002						0.200	0.020	0.010	2.200	2.5	0.070
Var		0.000		0.000	0.000			0.000						0.002	0.000	0.000	0.924	0.9	0.001
SD		0.005		0.000	0.001			0.001						0.045	0.004	0.000	0.961	0.9	0.026
*Water Quality Trigger					0.003										0.05			1.2	0.08

***Water quality triggers for the Duralie Coal Mine developed in accordance with the methodology in ANZECC/ARMCANZ (2000).**
"Gilberts & Asscocistes 2011 - Development of Water Quality Trigger Levels for the Duralie Extension Project".

SW6

Date	Category	Comment	ph	EC	Turbidity	DO	TSS	Alkalinity (as $CaCO_3$)	Acidity (as $CaCO_3$)	SO4	Cl	Ca	Mg	Al	Mn	Zn	Fe	Cu
				uS/cm	NTU	%	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
30-Jul-19	Monthly	Nil flow																
29-Aug-19	Monthly	Nil flow																
30-Sep-19	Monthly	Nil flow																
31-Oct-19	Monthly	Nil flow																
28-Nov-19	Monthly	Nil flow																
27-Dec-19	Monthly	Nil flow																
30-Jan-20	Monthly	Nil flow																
9-Feb-20	Monthly	Steady flow	7.2	**545**	18	87	8	51	4	285	76	45	37	0.54	0.014	<0.005	0.5	0.001
27-Mar-20	Discharge Event	Slow flow, light brown	**6.8**	**730**	8	**48**	**<5**	59	7	216	47	32	26	0.21	0.013	<0.005	0.56	<0.001
30-Apr-20	Monthly	Nil flow																
28-May-20	Monthly	Nil flow																
29-Jun-20	Monthly	Nil flow																
Min			6.8	545	8	48	5	51	4	216	47	32	26	0.21	0.013	0.005	0.50	0.001
Avg			7.0	638	13	68	7	55	6	251	62	39	32	0.38	0.014	0.005	0.53	0.001
Max			7.2	730	18	87	8	59	7	285	76	45	37	0.54	0.014	0.005	0.56	0.001
Var			0.1	17113	50	761	5	32	5	2381	421	85	61	0.05	0.000	0.000	0.00	0.000
SD			0.3	131	7	28	2	6	2	49	21	9	8	0.23	0.001	0.000	0.04	0.000
*Water Quality Trigger			7.1 - 7.9	544	119	85 - 110%	80							3.02		0.064		0.003

***Water quality triggers for the Duralie Coal Mine developed in accordance with the methodology in ANZECC/ARMCANZ (2000).**
"Gilberts & Asscocistes 2011 - Development of Water Quality Trigger Levels for the Duralie Extension Project".

SW9 - Un-named Tributary (Fisher-Webster)

Date	Category	Comment	ph	EC	Turbidity	DO	TDS	TSS	Hardness	Alkalinity (as $CaCO_3$)	Acidity (as $CaCO_3$)	SO4	Cl	Ca	Mg	Al	Mn	Zn	Fe	CO3 (as $CaCO_3$)	Bicarb (as $CaCO_3$)	BOD	Na
				uS/cm	NTU	%	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
30-Jul-19	Monthly	Nil flow																					
29-Aug-19	Monthly	Nil flow																					
30-Sep-19	Monthly	Nil flow																					
31-Oct-19	Monthly	Nil flow																					27
28-Nov-19	Monthly	Nil flow																					
27-Dec-19	Monthly	Nil flow																					
30-Jan-20	Monthly	Nil flow																					
9-Feb-20	Monthly	Steady / Fast Flow	6.6	113.1	**157**	90.2	72.38	**353**	25	7	6	<1	14	5	3	2.47	0.084	0.018	2	<1	7	<2	
27-Mar-20	Discharge Event	Still, brown	6.6	150.5	41.5	**53.3**	96.32	16	29	36	6	<10	27	5	4	0.88	0.084	0.018	4.02	<1	36	2	
30-Apr-20	Monthly	Nil flow																					
28-May-20	Monthly	Nil flow																					
29-Jun-20	Monthly	Nil flow																					
Min			6.6	113.1	42	53.3	72.38	16	25	7	6	1	14	5	3	1.00	0.084	0.018	2.00	1	7	2	
Avg			6.6	131.8	99	71.8	84.35	185	27	22	6	6	21	5	4	2.00	0.084	0.018	3.01	1	22	2	
Max			6.6	150.5	157	90.2	96.32	353	29	36	6	10	27	5	4	2.00	0.084	0.018	4.02	1	36	2	
Var			0.0	699.4	6670	680.8	286.56	56785	8	421	0	41	85	0	1	1.00	0.000	0.000	2.00	0	421	0	
SD			0.0	26.4	82	26.1	16.93	238	3	21	0	6	9	0	1	1.00	0.000	0.000	1.00	0	21	0	
*Water Quality Trigger			6.4 - 7.1	461	94	85 - 110%		57								2.96		0.024					

***Water quality triggers for the Duralie Coal Mine developed in accordance with the methodology in ANZECC/ARMCANZ (2000).**
"Gilberts & Asscocistes 2011 - Development of Water Quality Trigger Levels for the Duralie Extension Project".

SW9 - Un-named Tributary (Fisher-Webster)

Date	As	Ba	Cd	Cr	Cu	Pb	Mo	Ni	Se	Ag	U	B	Hg	F	NH3 (as N)	NO2 (as N)	NO3 (as N)	N	P
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
9-Feb-20	<0.001	0.058	<0.0001	0.001	0.003	0.003	<0.001	0.002	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	**0.09**	0.02	1.78	**2.7**	0.44
27-Mar-20	0.004	0.065	<0.0001	<0.001	0.003	0.003	<0.001	0.003	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	0.38	<0.10	0.18	3.8	1.32
Min	0.001	0.058	0.0001	0.001	0.003	0.003	0.001	0.002	0.01	0.001	0.001	0.05	0.0001	0.1	0.09	0.02	0.18	2.7	0.44
Avg	0.003	0.062	0.0001	0.001	0.003	0.003	0.001	0.003	0.01	0.001	0.001	0.05	0.0001	0.1	0.24	0.06	0.98	3.3	0.88
Max	0.004	0.065	0.0001	0.001	0.003	0.003	0.001	0.003	0.01	0.001	0.001	0.05	0.0001	0.1	0.38	0.10	1.78	3.8	1.32
Var	0.000	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.00	0.000	0.000	0.00	0.0000	0.0	0.04	0.00	1.28	0.6	0.39
SD	0.002	0.005	0.0000	0.000	0.000	0.000	0.000	0.001	0.00	0.000	0.000	0.00	0.0000	0.0	0.21	0.06	1.13	0.8	0.62
*Water Quality Trigger				0.002	0.0040										0.13			2.6	0.68

***Water quality triggers for the Duralie Coal Mine developed in accordance with the methodology in ANZECC/ARMCANZ (2000).**
"Gilberts & Asscocistes 2011 - Development of Water Quality Trigger Levels for the Duralie Extension Project".

SW10 - Coal Shaft Creek (Holmes Upstream)

Date	Category	Comment	ph	EC uS/cm	Turbidity NTU	DO %	TDS mg/l	TSS mg/l	Hardness mg/l	Alkalinity (as $CaCO_3$) mg/l	Acidity (as $CaCO_3$) mg/l	SO4 mg/l	Cl mg/l	Ca mg/l	Mg mg/l	Al mg/l	Mn mg/l	Zn mg/l	Fe mg/l	CO3 (as $CaCO_3$)	Bicarb (as $CaCO_3$)	Na mg/l	BOD mg/l
30-Jul-19	Monthly	No flow																					
29-Aug-19	Monthly	No flow																					
30-Sep-19	Monthly	Nil flow																					
31-Oct-19	Monthly	Nil flow																					
28-Nov-19	Monthly	Nil flow																					
27-Dec-19	Monthly	Nil flow																					
30-Jan-20	Monthly	Nil flow																					
9-Feb-20	Monthly	Fast flow	7.2	77	14	90	49	<5	31	9	5	<1	19	6	4	0.72	0.01	<0.005	0.73	<1	9	<2	12
27-Mar-20	Discharge Event	Trickle	**6.9**	151	**177**	**70**	97	125	59	64	6	<10	12	12	7	**5.98**	0.269	0.016	5.62	<1	64	<2	20
30-Apr-20	Monthly	Nil flow																					
28-May-20	Monthly	Nil flow																					
29-Jun-20	Monthly	Nil flow																					
Min			6.9	77.0	14	70	49	5	31	9	5	1	12	6	4	0.72	0.010	0.005	0.73	1	9	2	12
Avg			7.0	114.0	96	80	73	65	45	37	6	6	16	9	6	3.35	0.140	0.011	3.18	1	37	2	16
Max			7.2	151.0	177	90	97	125	59	64	6	10	19	12	7	5.98	0.269	0.016	5.62	1	64	2	20
Var			0.1	2738.0	13285	200	1152	7200	392	1513	1	41	25	18	5	13.83	0.034	0.000	11.96	0	1513	0	32
SD			0.2	52.3	115	14	34	85	20	39	1	6	5	4	2	3.72	0.183	0.008	3.46	0	39	0	6
*Water Quality Trigger			7.1 - 7.9	544	119	85 - 110%		80								3.02		0.064					

Water quality triggers for the Duralie Coal Mine developed in accordance with the methodology in ANZECC/ARMCANZ (2000). *Gilberts & Asscocistes 2011 - Development of Water Quality Trigger Levels for the Duralie Extension

SW10 - Coal Shaft Creek (Holmes Upstream)

Date	As mg/l	Ba mg/l	Cd mg/l	Cr mg/l	Cu mg/l	Pb mg/l	Mo mg/l	Ni mg/l	Se mg/l	Ag mg/l	U mg/l	B mg/l	Hg mg/l	F mg/l	NH3 (as N) mg/l	NO2 (as N) mg/l	NO3 (as N) mg/l	N mg/l	P mg/l
30-Jul-19																			
29-Aug-19																			
30-Sep-19																			
31-Oct-19																			
28-Nov-19																			
27-Dec-19																			
30-Jan-20																			
9-Feb-20	<0.001	0.009	<0.0001	0.001	0.003	<0.001	<0.001	0.002	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	0.06	<0.01	2.61	3.7	<0.01
27-Mar-20	<0.001	0.045	<0.0001	0.005	0.009	0.001	<0.001	0.006	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	0.02	<0.01	0.39	3	0.21
30-Apr-20																			
28-May-20																			
29-Jun-20																			
	0.001	0.009	0.0001	0.001	0.003	0.001	0.001	0.002	0.01	0.001	0.001	0.05	0.0001	0.1	0.02	0.01	0.39	3.0	0.01
	0.001	0.027	0.0001	0.003	0.006	0.001	0.001	0.004	0.01	0.001	0.001	0.05	0.0001	0.1	0.04	0.01	1.50	3.4	0.11
	0.001	0.045	0.0001	0.005	0.009	0.001	0.001	0.006	0.01	0.001	0.001	0.05	0.0001	0.1	0.06	0.01	2.61	3.7	0.21
	0.000	0.001	0.0000	0.000	0.000	0.000	0.000	0.000	0.00	0.000	0.000	0.00	0.0000	0.0	0.00	0.00	2.46	0.2	0.02
	0.000	0.025	0.0000	0.003	0.004	0.000	0.000	0.003	0.00	0.000	0.000	0.00	0.0000	0.0	0.03	0.00	1.57	0.5	0.14
*Water Quality Trigger					0.003										0.05			1.2	0.08

***Water quality triggers for the Duralie Coal Mine developed in accordance with the methodology in ANZECC/ARMCANZ (2000).**
"Gilberts & Asscocistes 2011 - Development of Water Quality Trigger Levels for the Duralie Extension Project".

GB1 - Mammy Johnsons River EPL 11701 Point 31

Date	Category	Comment	ph	EC uS/cm	Turbidity NTU	DO %	TDS mg/l	TSS mg/l	Hardness mg/l	Alkalinity (as $CaCO_3$) mg/l	Acidity (as $CaCO_3$) mg/l	SO4 mg/l	Cl mg/l	Ca mg/l	Mg mg/l	Al mg/l	Mn mg/l	Zn mg/l	Fe mg/l	CO3 (as $CaCO_3$) mg/l	Bicarb (as $CaCO_3$) mg/l	BOD mg/l	Na mg/l
30-Jul-19	Monthly	low, light brown in	7.15	**376**	3	**47**	241	**<5**	77	69	5	9	58	16	9	0.02	0.036	**<0.005**	0.53	<1	69	3	38
29-Aug-19	Monthly	Nil flow																					
30-Sep-19	Monthly	Nil flow																					
31-Oct-19	Monthly	Nil flow																					
28-Nov-19	Monthly	Nil flow																					
27-Dec-19	Monthly	Nil flow																					
30-Jan-20	Monthly	Nil flow																					
9-Feb-20	Monthly	Fast flow	**6.77**	102	**208**	**83**	65	**245**	31	8	5	21	26	6	4	**4.11**	0.204	**0.016**	4.32	<1	8	3	16
10-Feb-20	Discharge	ast flow, light brow	7.41	136	**59**			**47**															
11-Feb-20	Discharge	ast flow, light brow	**6.63**	244	19			**20**															
12-Feb-20	Discharge	ast flow, light brow	**6.84**	298	12			12															
13-Feb-20	Discharge	eady flow, light brov	**6.77**	249	**34**			13															
14-Feb-20	Discharge	ast flow, light brow	**6.93**	261	15			9															
15-Feb-20	Discharge	eady flow, light brov	**6.75**	301	7			6															
16-Feb-20	Discharge	Steady flow, clear	**6.97**	309	5			**<5**															
17-Feb-20	Discharge	Steady flow, clear	**6.87**	307	4			**<5**															
18-Feb-20	Discharge	Steady flow, clear	**6.9**	361	4			**<5**															
19-Feb-20	Discharge	eady flow, light brov	**6.95**	272	21			**26**															
20-Feb-20	Discharge	Fast flow, brown	**6.9**	259	12			5															
21-Feb-20	Discharge	eady flow, light brov	**6.94**	275	6			6															
22-Feb-20	Discharge	eady flow, light brov	7.45	268	4			**<5**															
27-Mar-20	Discharge	eady flow, light brov	7.14	264	12	**74**	169	7	55	30	2	<10	50	12	6	0.26	0.070	**<0.005**	1.42	<1	30	2	33
28-Mar-20	Discharge	eady flow, light brov	**6.92**	339				**<5**															
29-Mar-20	Discharge	eady flow, light brov	7.36	260				**24**															
30-Mar-20	Discharge	eady flow, light brov	**6.78**	191	15			**<5**															
30-Apr-20	Monthly	eady flow, light brov	**10.92**	**377**	5	**52**	241	5	86	46	4	31	61	18	10	0.06	0.122	**<0.005**	1.63	<1	46	2	39
28-May-20	Monthly	Steady flow, clear	7.28	**377**	6	**82**	241	**<5**	77	48	5	25	57	16	9	0.09	0.032	**<0.005**	0.73	<1	48	2	34
29-Jun-20	Monthly	Slow flow, clear	7.48	281	5	85	180	**<5**	50	26	8	23	51	10	6	0.12	0.018	0.008	0.79	<1	26	<2	28
Min			6.6	102.0	3	47	65	5	31	8	2	9	26	6	4	0.02	0.018	0.005	0.53	1	8	2	16
Avg			7.2	277.6	23	71	189	21	63	38	5	20	51	13	7	0.78	0.080	0.007	1.57	1	38	2	31
Max			10.9	377.0	208	85	241	245	86	69	8	31	61	18	10	4.11	0.204	0.016	4.32	1	69	3	39
Var			0.8	4979.7	2076	283	4794	2602	435	447	4	75	162	20	5	2.67	0.005	0.000	2.00	0	447	0	72
SD			0.9	70.6	46	17	69	51	21	21	2	9	13	5	2	1.64	0.071	0.004	1.41	0	21	1	8
*Water Quality Trigger			7.1 - 7.6	370	24	85 - 110%		15								1.24		0.011					

***Water quality triggers for the Duralie Coal Mine developed in accordance with the methodology in ANZECC/ARMCANZ (2000).**
"Gilberts & Asscocistes 2011 - Development of Water Quality Trigger Levels for the Duralie Extension Project".

GB1 - Mammy Johnsons River

Date	As mg/l	Ba mg/l	Cd mg/l	Cr mg/l	Cu mg/l	Pb mg/l	Mo mg/l	Ni mg/l	Se mg/l	Ag mg/l	U mg/l	B mg/l	Hg mg/l	F mg/l	NH3 (as N) mg/l	NO2 (as N) mg/l	NO3 (as N) mg/l	N mg/l	P mg/l
30-Jul-19	<0.001	0.04	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	**<0.01**	<0.01	0.07	0.4	0.02
29-Aug-19																			
30-Sep-19																			
31-Oct-19																			
28-Nov-19																			
27-Dec-19																			
30-Jan-20																			
9-Feb-20	0.002	0.10	<0.0001	0.002	0.003	0.004	<0.001	0.002	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	**0.12**	0.02	2.04	4.4	0.15
10-Feb-20																			
11-Feb-20																			
12-Feb-20																			
13-Feb-20																			
14-Feb-20																			
15-Feb-20																			
16-Feb-20																			
17-Feb-20																			
18-Feb-20																			
19-Feb-20																			
20-Feb-20																			
21-Feb-20																			
22-Feb-20																			
27-Mar-20	<0.001	0.04	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	0.02	<0.01	0.13	0.5	0.04
28-Mar-20																			
29-Mar-20																			
30-Mar-20																			
30-Apr-20	<0.001	0.05	<0.0001	0.002	0.003	<0.001	<0.001	0.002	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	<0.01	<0.01	0.10	0.4	0.03
28-May-20	<0.001	0.04	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	0.02	<0.01	0.04	0.5	<0.01
29-Jun-20	<0.001	0.03	<0.0001	<0.001	0.012	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	<0.01	<0.01	0.05	0.2	0.03
Min	0.001	0.032	0.0001	0.001	0.001	0.001	0.001	0.001	0.01	0.001	0.001	0.05	0.0001	0.1	0.01	0.01	0.04	0.2	0.01
Avg	0.001	0.050	0.0001	0.001	0.004	0.002	0.001	0.001	0.01	0.001	0.001	0.05	0.0001	0.1	0.03	0.01	0.41	1.1	0.05
Max	0.002	0.096	0.0001	0.002	0.012	0.004	0.001	0.002	0.01	0.001	0.001	0.05	0.0001	0.1	0.12	0.02	2.04	4.4	0.15
Var	0.000	0.001	0.0000	0.000	0.000	0.000	0.000	0.000	0.00	0.000	0.000	0.00	0.0000	0.0	0.00	0.00	0.64	2.7	0.00
SD	0.000	0.023	0.0000	0.001	0.004	0.001	0.000	0.001	0.00	0.000	0.000	0.00	0.0000	0.0	0.04	0.00	0.80	1.6	0.05
*Water Quality Trigger				0.001	0.0020										0.06			0.8	0.15

***Water quality triggers for the Duralie Coal Mine developed in accordance with the methodology in ANZECC/ARMCANZ (2000).**
"Gilberts & Asscocistes 2011 - Development of Water Quality Trigger Levels for the Duralie Extension Project".

Highnoon - Mammy Johnsons River EPL 11701 Point 35

Date	Category	Comment	ph	EC uS/cm	Turbidity NTU	DO %	TDS mg/l	TSS mg/l	Hardness mg/l	Alkalinity (as $CaCO_3$) mg/l	Acidity (as $CaCO_3$) mg/l	SO4 mg/l	Cl mg/l	Ca mg/l	Mg mg/l	Al mg/l	Mn mg/l	Zn mg/l	Fe mg/l	CO3 (as $CaCO_3$) mg/l	Bicarb (as $CaCO_3$) mg/l	BOD mg/l	Na mg/l
30-Jul-19	Monthly	Slow flow, light brown	**7.03**	**438**	3	**37**	280	8	85	59	5	21	70	16	11	0.03	0.075	**<0.005**	0.65	<1	59	4	46
29-Aug-19	Monthly	Nil flow																					
30-Sep-19	Monthly	Nil flow																					
31-Oct-19	Monthly	Nil flow																					
28-Nov-19	Monthly	Nil flow																					
27-Dec-19	Monthly	Nil flow																					
30-Jan-20	Monthly	Nil flow																					
9-Feb-20	Monthly	Fast flow	**6.92**	130	**289**	**81**	83	**407**	40	22	5	24	30	8	5	**7.14**	0.328	**0.026**	7.72	<1	22	5	21
10-Feb-20	Discharge	Fast flow, light brown	**7.95**	145	**52**			**50**															
11-Feb-20	Discharge	Fast flow, light brown	**6.51**	240	24			**22**															
12-Feb-20	Discharge	Steady flow, light brown	**6.57**	289	12			13															
13-Feb-20	Discharge	Steady flow, light brown	**6.82**	257	**33**			13															
14-Feb-20	Discharge	Steady flow, light brown	**6.68**	260	21			**18**															
15-Feb-20	Discharge	Steady flow, clear	**6.78**	298	6			**<5**															
16-Feb-20	Discharge	Slow flow, clear	**6.74**	311	5			**<5**															
17-Feb-20	Discharge	Slow flow, light brown	**6.93**	317	5			**<5**															
18-Feb-20	Discharge	Steady flow, light brown	**6.79**	342	8			**<5**															
19-Feb-20	Discharge	Steady flow, clear	**6.75**	319	14			14															
20-Feb-20	Discharge	Fast flow, brown	**6.77**	259	11			6															
21-Feb-20	Discharge	Steady flow, light brown	**6.96**	270	7			**<5**															
22-Feb-20	Discharge	Steady flow, light brown	7.26	265	5			**<5**															
27-Mar-20	Discharge	Steady flow, light brown	7.21	269	17	**79**	172	8	59	39	3	<10	47	12	7	0.57	0.060	**<0.005**	1.50	<1	39	2	34
28-Mar-20	Discharge	Steady flow, light brown	**6.78**	319	7			**<5**															
29-Mar-20	Discharge	Steady flow, light brown	**7.62**	271				**24**															
30-Mar-20	Discharge	Steady flow, light brown	**6.8**	194	17			7															
30-Apr-20	Monthly	Slow flow, light brown	**6.83**	341	5	**53**	218	6	77	46	5	28	58	16	9	0.05	0.148	0.007	1.65	<1	46	<2	37
28-May-20	Monthly	Steady flow, clear	7.23	**426**	13	85	273	**<5**	77	42	5	32	66	16	9	0.25	0.061	**<0.005**	1.42	<1	42	<2	38
29-Jun-20	Monthly	Slow flow, clear	7.56	291	6	**84**	186	**<5**	52	27	7	23	50	11	6	0.15	0.024	**<0.005**	0.83	<1	27	<2	28
Min			6.8	194	5	53	172	5	52	27	3	10	47	11	6	0.05	0.024	0.005	0.83	1.0	27	2	28
Avg			7.0	297	10	75	212	8	66	39	5	23	55	14	8	0.26	0.073	0.006	1.35	1.0	39	2	34
Max			7.6	426	17	85	273	24	77	46	7	32	66	16	9	0.57	0.148	0.007	1.65	1.0	46	2	38
Var			0.1	3353	22	224	2012	32	162	67	3	92	73	7	2	0.05	0.003	0.000	0.13	0.0	67	0	20
SD			0.3	58	5	15	45	6	13	8	2	10	9	3	2	0.23	0.053	0.001	0.36	0.0	8	0	5
*Water Quality Trigger			7.1 - 7.6	370	24	85 - 110%		15								1.24		0.011					

***Water quality triggers for the Duralie Coal Mine developed in accordance with the methodology in ANZECC/ARMCANZ (2000).**
"Gilberts & Asscocistes 2011 - Development of Water Quality Trigger Levels for the Duralie Extension Project".

Highnoon - Mammy Johnsons River

Date	As	Ba	Cd	Cr	Cu	Pb	Mo	Ni	Se	Ag	U	B	Hg	F	NH3 (as N)	NO2 (as N)	NO3 (as N)	N	P
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
30-Jul-19	<0.001	0.05	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	<0.01	<0.01	0.01	0.6	0.03
29-Aug-19																			
30-Sep-19																			
31-Oct-19																			
28-Nov-19																			
27-Dec-19																			
30-Jan-20																			
9-Feb-20	0.003	0.14	<0.0001	0.004	0.005	0.007	<0.001	0.004	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	0.18	0.02	2.04	4.7	0.38
10-Feb-20																			
11-Feb-20																			
12-Feb-20																			
13-Feb-20																			
14-Feb-20																			
15-Feb-20																			
16-Feb-20																			
17-Feb-20																			
18-Feb-20																			
19-Feb-20																			
20-Feb-20																			
21-Feb-20																			
22-Feb-20																			
27-Mar-20	<0.001	0.04	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	0.06	<0.01	0.32	0.9	0.04
28-Mar-20																			
29-Mar-20																			
30-Mar-20																			
30-Apr-20	<0.001	0.04	<0.0001	<0.001	0.002	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	0.02	<0.01	0.07	0.5	0.04
28-May-20	<0.001	0.05	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	<0.01	<0.01	0.08	0.5	0.02
29-Jun-20	<0.001	0.03	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	<0.01	<0.01	0.05	0.2	0.04
Min	0.001	0.031	0.0001	0.001	0.001	0.001	0.001	0.001	0.01	0.001	0.001	0.05	0.0001	0.1	0.01	0.01	0.05	0.2	0.02
Avg	0.001	0.039	0.0001	0.001	0.001	0.001	0.001	0.001	0.01	0.001	0.001	0.05	0.0001	0.1	0.03	0.01	0.13	0.5	0.04
Max	0.001	0.046	0.0001	0.001	0.002	0.001	0.001	0.001	0.01	0.001	0.001	0.05	0.0001	0.1	0.06	0.01	0.32	0.9	0.04
Var	0.000	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.00	0.000	0.000	0.00	0.0000	0.0	0.00	0.00	0.02	0.1	0.00
SD	0.000	0.007	0.0000	0.000	0.001	0.000	0.000	0.000	0.00	0.000	0.000	0.00	0.0000	0.0	0.02	0.00	0.13	0.3	0.01
*Water Quality Trigger				0.001	0.0020										0.06			0.8	0.15

***Water quality triggers for the Duralie Coal Mine developed in accordance with the methodology in ANZECC/ARMCANZ (2000). "Gilberts & Asscocistes 2011 - Development of Water Quality Trigger Levels for the Duralie Extension Project".**

Site 9 - Karuah River (Near Stroud Road Village)

Date	Category	Comment	ph	EC uS/cm	Turbidity NTU	DO %	TDS mg/l	TSS mg/l	Hardness mg/l	Alkalinity (as $CaCO_3$) mg/l	Acidity (as $CaCO_3$)	SO4 mg/l	Cl mg/l	Ca mg/l	Mg mg/l	Al mg/l	Mn mg/l	Zn mg/l	Fe mg/l	CO3 (as $CaCO_3$)	Bicarb (as $CaCO_3$)	BOD mg/l	Na mg/l
30-Jul-19	Monthly	Steady flow, clear	7.3	202	1	85	129	6	50	40	2	5	32	10	6	0.08	0.006	<0.005	0.16	<1	40	4	19
29-Aug-19	Monthly	Slow flow, clear	7.3	291	2	66	186	6	68	53	2	6	37	14	8	0.02	0.037	<0.005	0.15	<1	53	<2	24
30-Sep-19	Monthly	, light brown in col	7.2	201	2	69	129	12	50	41	2	6	35	10	6	0.05	0.024	<0.005	0.27	<1	41	<2	19
31-Oct-19	Monthly	, light brown in co	7.5	280	2	29	179	10	65	67	8	3	40	13	8	0.06	0.128	<0.005	0.45	<1	67	2	25
28-Nov-19	Monthly	Nil Flow																					
27-Dec-19	Monthly	Nil Flow																					
30-Jan-20	Monthly	Steady flow	7.5	267	4	39	174	<5	81	43	7	42	40	16	10	0.15	0.044	<0.005	0.41	<1	43	7	24
9-Feb-20	Monthly	st flow, grey in colo	6.9	85	117	90	54.2	165	27	14	4	1	20	6	3	3.01	0.126	0.011	3.14	<1	14	2	14
27-Mar-20	Discharge Event	ow, light brown in	7.7	100	33	91	63.8	35	18	17	7	<10	19	4	2	0.87	0.049	<0.005	1.02	<1	17	<2	14
30-Apr-20	Monthly	flow, light brown in	7.2	184	2	84	118	<5	43	38	3	8	26	9	5	0.05	0.012	<0.005	0.54	<1	38	2	17
28-May-20	Monthly	Fast flow, clear	7.6	125	3	99	80	<5	27	24	4	6	18	6	3	0.06	0.004	<0.005	0.31	<1	24	3	12
29-Jun-20	Monthly	Fast flow, clear	7.4	172	2	98	110	<5	34	34	5	10	26	7	4	0.07	0.004	<0.005	0.29	<1	34	<2	16
Min			6.9	85	1	29	54	5	18	14	2	1	18	4	2	0.02	0.004	0.005	0.15	1.0	14	2	12
Avg			7.4	191	17	75	122	25	46	37	4	10	29	10	6	0.44	0.043	0.006	0.67	1.0	37	3	18
Max			7.7	291	117	99	186	165	81	67	8	42	40	16	10	3.01	0.128	0.011	3.14	1.0	67	7	25
Var			0.1	5355	1333	591	2228	2490	418	258	5	137	74	15	7	0.88	0.002	0.000	0.81	0.0	258	3	22
SD			0.2	73	37	24	47	50	20	16	2	12	9	4	3	0.94	0.047	0.002	0.90	0.0	16	2	5
*Water Quality Trigger			N/A	N/A	N/A											N/A		N/A					

***Water quality triggers for the Duralie Coal Mine developed in accordance with the methodology in ANZECC/ARMCANZ (2000). "Gilberts & Asscocistes 2011 - Development of Water Quality Trigger Levels for the Duralie Extension Project".**

Site 9 - Karuah River (Near Stroud Road Village)

Date	As mg/l	Ba mg/l	Cd mg/l	Cr mg/l	Cu mg/l	Pb mg/l	Mo mg/l	Ni mg/l	Se mg/l	Ag mg/l	U mg/l	B mg/l	Hg mg/l	F mg/l	NH3 (as N) mg/l	NO2 (as N) mg/l	NO3 (as N) mg/l	N mg/l	P mg/l
30-Jul-19	<0.001	0.016	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	0.02	<0.01	0.10	0.3	0.02
29-Aug-19	<0.001	0.017	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	0.01	<0.01	0.03	0.3	0.02
30-Sep-19	<0.001	0.02	<0.0001	0.001	<0.001	0.002	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	0.03	<0.01	0.02	0.5	0.06
31-Oct-19	0.001	0.027	<0.0001	0.001	<0.001	0.003	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	0.1	0.03	<0.01	<0.01	0.6	0.07
28-Nov-19																			
27-Dec-19																			
30-Jan-20	0.002	0.039	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	0.1	0.39	0.04	0.19	1.2	0.22
9-Feb-20	0.001	0.044	<0.0001	0.003	0.004	0.002	<0.001	0.002	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	0.02	0.02	2.80	5.5	0.27
27-Mar-20	<0.001	0.02	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	0.07	<0.01	0.31	0.9	0.04
30-Apr-20	<0.001	0.016	<0.0001	<0.001	0.008	<0.001	<0.001	0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	<0.01	<0.01	0.08	0.2	0.08
28-May-20	<0.001	0.011	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	0.02	<0.01	<0.01	0.1	<0.01
29-Jun-20	<0.001	0.014	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	<0.01	<0.01	0.01	<0.1	0.02
Min	0.001	0.011	0.0001	0.001	0.001	0.001	0.001	0.001	0.01	0.001	0.001	0.05	0.0001	0.1	0.01	0.01	0.01	0.1	0.01
Avg	0.001	0.022	0.0001	0.001	0.002	0.001	0.001	0.001	0.01	0.001	0.001	0.05	0.0001	0.1	0.06	0.01	0.36	1.0	0.08
Max	0.002	0.044	0.0001	0.003	0.008	0.003	0.001	0.002	0.01	0.001	0.001	0.05	0.0001	0.1	0.39	0.04	2.80	5.5	0.27
Var	0.000	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.00	0.000	0.000	0.00	0.0000	0.0	0.01	0.00	0.75	2.7	0.01
SD	0.000	0.011	0.0000	0.001	0.002	0.001	0.000	0.000	0.00	0.000	0.000	0.00	0.0000	0.0	0.12	0.01	0.86	1.6	0.09

***Water quality triggers for the Duralie Coal Mine developed in accordance with the methodology in ANZECC/ARMCANZ (2000). "Gilberts & Asscocistes 2011 - Development of Water Quality Trigger Levels for the Duralie Extension Project".**

Site 11 - Mammy Johnsons - Downstream of High Noon

Date	Category	Comment	ph	EC uS/cm	Turbidity NTU	DO %	TDS mg/l	TSS mg/l	Hardness mg/l	Alkalinity $CaCO_3$ mg/l	Acidity $CaCO_3$ mg/l	SO4 mg/l	Cl mg/l	Ca mg/l	Mg mg/l	Al mg/l	Mn mg/l	Zn mg/l	Fe mg/l	CO3 $CaCO_3$ mg/l	Bicarb (as $CaCO_3$) mg/l	BOD mg/l	Na mg/l
30-Jul-19	Monthly	Slow flow, light brown	7.19	**460**	2	**49**	294	5	94	63	3	20	79	18	12	0.05	0.026	<0.005	0.34	<1	63	2	49
29-Aug-19	Monthly	Nil flow																					
30-Sep-19	Monthly	Nil flow																					
31-Oct-19	Monthly	Nil flow																					
28-Nov-19	Monthly	Nil flow																					
27-Dec-19	Monthly	Nil flow																					
30-Jan-20	Monthly	Nil flow																					
09-Feb-20	Monthly	Fast flow	**6.8**	114	**280**	**75**	73	**360**	31	10	6	25	27	6	4	**6.93**	0.288	**0.023**	6.99	<1	10	5	19
27-Mar-20	Discharge Event	Fast flow, light brown	7.16	266	19	**76**	170	7	59	38	3	<10	47	12	7	0.52	0.059	<0.005	1.53	<1	38	2	34
30-Apr-20	Monthly	Steady flow, light brown	**6.91**	**386**	4	**59**	247	8	84	48	4	29	60	17	10	0.06	0.111	0.007	1.65	<1	48	2	37
28-May-20	Monthly	Fast flow, clear	7.28	**421**	12	**84**	269	**<5**	84	40	5	32	65	17	10	0.2	0.050	<0.005	1.29	<1	40	4	40
29-Jun-20	Monthly	Steady flow, clear	**8.34**	298	5	**85**	191	**<5**	50	29	6	24	51	10	6	0.14	0.021	<0.005	0.79	<1	29	<2	28
Min			6.8	114	2.0	49	73	5	31	10	3	10	27	6	4	0.05	0.021	0.005	0.34	1	10	2	19
Avg			7.3	324	53.7	71	207	65	67	38	5	23	55	13	8	1.32	0.093	0.009	2.10	1	38	3	35
Max			8.3	460	280.0	85	294	360	94	63	6	32	79	18	12	6.93	0.288	0.023	6.99	1	63	5	49
Var			0.3	15974	12332.1	209	6519	20888	591	319	2	60	313	23	9	7.59	0.010	0.000	5.98	0	319	2	106
SD			0.6	126	111.1	14	81	145	24	18	1	8	18	5	3	2.76	0.101	0.008	2.45	0	18	1	10
*Water Quality Trigger			7.1 - 7.6	370	24	85 - 110%		15								1.24		0.011					

***Water quality triggers for the Duralie Coal Mine developed in accordance with the methodology in ANZECC/ARMCANZ (2000). "Gilberts & Asscocistes 2011 - Development of Water Quality Trigger Levels for the Duralie Extension Project".**

Site 11 - Mammy Johnsons - Downstream of High Noon

Date	As mg/l	Ba mg/l	Cd mg/l	Cr mg/l	Cu mg/l	Pb mg/l	Mo mg/l	Ni mg/l	Se mg/l	Ag mg/l	U mg/l	B mg/l	Hg mg/l	F mg/l	NH3 (as N) mg/l	NO2 (as N) mg/l	NO3 (as N) mg/l	N mg/l	P mg/l
30-Jul-19	<0.001	0.042	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	<0.01	<0.01	0.05	0.4	0.07
29-Aug-19																			
30-Sep-19																			
31-Oct-19																			
28-Nov-19																			
27-Dec-19																			
30-Jan-20																			
9-Feb-20	0.003	0.121	<0.0001	0.004	0.004	0.006	<0.001	0.003	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	0.18	0.02	1.61	4	0.22
27-Mar-20	<0.001	0.037	<0.0001	**0.011**	0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	0.05	<0.01	0.34	1	0.05
30-Apr-20	<0.001	0.043	<0.0001	**<0.001**	0.005	<0.001	<0.001	0.002	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	0.01	<0.01	0.08	0.5	0.04
28-May-20	<0.001	0.044	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	<0.01	<0.01	0.07	0.5	0.02
29-Jun-20	<0.001	0.031	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	**<0.01**	<0.01	0.04	0.2	0.04
Min	0.001	0.031	0.0001	0.001	0.001	0.001	0.001	0.001	0.010	0.001	0.001	0.050	0.0001	0.1	0.01	0.01	0.04	0.2	0.02
Avg	0.001	0.053	0.0001	0.003	0.002	0.002	0.001	0.002	0.010	0.001	0.001	0.050	0.0001	0.1	0.05	0.01	0.37	1.1	0.07
Max	0.003	0.121	0.0001	0.011	0.005	0.006	0.001	0.003	0.010	0.001	0.001	0.050	0.0001	0.1	0.18	0.02	1.61	4.0	0.22
Var	0.000	0.001	0.0000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000	0.0	0.00	0.00	0.38	2.1	0.01
SD	0.001	0.034	0.0000	0.004	0.002	0.002	0.000	0.001	0.000	0.000	0.000	0.000	0.0000	0.0	0.07	0.00	0.62	1.4	0.07
*Water Quality Trigger				0.001	0.0020										0.06			0.8	0.15

***Water quality triggers for the Duralie Coal Mine developed in accordance with the methodology in ANZECC/ARMCANZ (2000). "Gilberts & Asscocistes 2011 - Development of Water Quality Trigger Levels for the Duralie Extension Project".**

Site 12 - Mammy Johnsons - Relton Property

Date	Category	Comment	ph	EC	Turbidity	DO	TDS	TSS	Hardness	Alkalinity (as $CaCO_3$)	Acidity (as $CaCO_3$)	SO4	Cl	Ca	Mg	Al	Mn	Zn	Fe	CO3 (as $CaCO_3$)	Bicarb (as $CaCO_3$)	BOD	Na
				uS/cm	NTU	%	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
30-Jul-19	Monthly	ow flow, light brov	6.88	274	1.6	**65**	175	<5	59	52	4	5	48	12	7	0.04	0.032	<0.005	0.47	<1	52	3	28
29-Aug-19	Monthly	Nil flow																					
30-Sep-19	Monthly	Nil flow																					
31-Oct-19	Monthly	Nil flow																					
28-Nov-19	Monthly	Nil flow																					
27-Dec-19	Monthly	Nil flow																					
30-Jan-20	Monthly	Nil flow																					
9-Feb-20	Monthly	Fast flow, grey	6.64	97	**93.6**	**91**	62	**120**	31	6	5	16	27	6	4	**2.66**	0.122	0.013	2.45	<1	6	3	17
27-Mar-20	Discharge Event	adv flow, light bro	7.22	289	6.9	**88**	185	<5	61	30	2	<10	54	13	7	0.15	0.067	<0.005	1.83	<1	30	2	36
30-Apr-20	Monthly	adv flow, light bro	6.96	388	6.7	63	248	7	86	44	4	33	60	18	10	0.06	0.082	<0.005	1.72	<1	44	3	38
28-May-20	Monthly	Steady flow, clear	7.04	322	10.3	**87**	206	<5	68	26	4	32	52	14	8	0.19	0.026	<0.005	0.82	<1	26	2	29
29-Jun-20	Monthly	s as advised by T.Kirkwood																					
Min			6.6	97	2	63	62	5	31	6	2	5	27	6	4	0.04	0.026	0.005	0.47	1	6	2	17
Avg			6.9	274	24	79	175	28	61	32	4	19	48	13	7	0.62	0.066	0.007	1.46	1	32	3	30
Max			7.2	388	94	91	248	120	86	52	5	33	60	18	10	2.66	0.122	0.013	2.45	1	52	3	38
Var			0.0	11714	1531	185	4790	2623	395	315	1	163	159	19	5	1.30	0.002	0.000	0.64	0	315	0	68
SD			0.2	108	39	14	69	51	20	18	1	13	13	4	2	1.14	0.039	0.004	0.80	0	18	1	8
*Water Quality Trigger			7.1 - 7.6	370	24	85 - 110%		15								1.24		0.011					

***Water quality triggers for the Duralie Coal Mine developed in accordance with the methodology in ANZECC/ARMCANZ (2000).**
"Gilberts & Asscocistes 2011 - Development of Water Quality Trigger Levels for the Duralie Extension Project".

Site 12 - Mammy Johnsons - Relton Property

Date	As	Ba	Cd	Cr	Cu	Pb	Mo	Ni	Se	Ag	U	B	Hg	F	NH3 (as N)	NO2 (as N)	NO3 (as N)	N	P
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
30-Jul-19	<0.001	0.036	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	**<0.01**	<0.01	0.09	0.4	<0.01
29-Aug-19																			
30-Sep-19																			
31-Oct-19																			
28-Nov-19																			
27-Dec-19																			
30-Jan-20																			
9-Feb-20	0.001	0.067	<0.0001	0.001	0.002	0.002	<0.001	0.002	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	0.08	0.01	2.00	3.1	0.06
27-Mar-20	<0.001	0.046	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	0.02	<0.01	0.09	0.5	0.02
30-Apr-20	<0.001	0.048	<0.0001	<0.001	0.004	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	0.01	<0.01	0.26	0.6	0.03
28-May-20	<0.001	0.040	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	<0.01	<0.01	0.04	0.3	<0.01
29-Jun-20																			
Min	0.001	0.036	0.0001	0.001	0.001	0.001	0.001	0.001	0.01	0.001	0.001	0.05	0.0001	0.1	0.01	0.01	0.04	0.3	0.01
Avg	0.001	0.047	0.0001	0.001	0.002	0.001	0.001	0.001	0.01	0.001	0.001	0.05	0.0001	0.1	0.03	0.01	0.50	1.0	0.03
Max	0.001	0.067	0.0001	0.001	0.004	0.002	0.001	0.002	0.01	0.001	0.001	0.05	0.0001	0.1	0.08	0.01	2.00	3.1	0.06
Var	0.000	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.00	0.000	0.000	0.00	0.0000	0.0	0.00	0.00	0.71	1.4	0.00
SD	0.000	0.012	0.0000	0.000	0.001	0.000	0.000	0.000	0.00	0.000	0.000	0.00	0.0000	0.0	0.03	0.00	0.84	1.2	0.02
*Water Quality Trigger				0.001	0.0020										0.06			0.8	0.15

***Water quality triggers for the Duralie Coal Mine developed in accordance with the methodology in ANZECC/ARMCANZ (2000).**
"Gilberts & Asscocistes 2011 - Development of Water Quality Trigger Levels for the Duralie Extension Project".

Site 15 - Mammy Johnsons - Tereel

Date	Category	Comment	ph	EC	Turbidity	DO	TDS	TSS	Hardness	Alkalinity (as $CaCO_3$)	Acidity (as $CaCO_3$)	SO4	Cl	Ca	Mg	Al	Mn	Zn	Fe	CO3 (as $CaCO_3$)	Bicarb (as $CaCO_3$)	BOD	Na
				uS/cm	NTU	%	mg/l	mg/l	mg/l	mg/l		mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
30-Jul-19	Monthly	Slow flow, light brown	**7.0**	164	2	**68**	105	8	31	24	3	4	33	6	4	0.07	0.016	<0.005	0.42	<1	24	2	22
29-Aug-19	Monthly	Nil flow																					
30-Sep-19	Monthly	Nil flow																					
31-Oct-19	Monthly	Nil flow																					
28-Nov-19	Monthly	Nil flow																					
27-Dec-19	Monthly	Nil flow																					
30-Jan-20	Monthly	Nil flow																					
9-Feb-20	Monthly	t flowing. Flowing over r	**6.6**	174	34	97	112	42	31	6	5	13	29	6	4	1.03	0.069	0.01	0.79	<1	6	2	17
27-Mar-20	Discharge Event	Steady flow	6.9	236	9	**84**	151	18	52	22	2	<10	49	11	6	0.16	0.081	0.006	0.85	<1	22	<2	30
30-Apr-20	Monthly	Steady flow, light brown	7.0	308	1	**78**	197	5	68	27	3	26	52	14	8	0.04	0.060	0.006	0.81	<1	27	2	30
28-May-20	Monthly	Fast flow, clear	6.8	280	4	**98**	179	<5	50	13	4	22	47	10	6	0.11	0.018	<0.005	0.56	<1	13	3	26
29-Jun-20	Monthly	Steady flow, clear	**7.2**	202	**3**	**95**	129	**<5**	47	17	6	20	49	9	6	**0.13**	0.010	<0.005	0.52	<1	17	<2	26
Min			6.6	164	1	68	105	5	31	6	2	4	29	6	4	0.04	0.010	0.005	0.42	1.0	6	2	17
Avg			6.9	227	9	87	146	14	47	18	4	16	43	9	6	0.26	0.042	0.006	0.66	1.0	18	2	25
Max			7.2	308	34	98	197	42	68	27	6	26	52	14	8	1.03	0.081	0.010	0.85	1.0	27	3	30
Var			0.1	3369	160	145	1365	216	197	61	2	68	93	9	2	0.15	0.001	0.000	0.03	0.0	61	0	25
SD			0.2	58	13	12	37	15	14	8	1	8	10	3	2	0.38	0.031	0.002	0.18	0.0	8	0	5
*Water Quality Trigger			7.1 - 7.6	370	24	85 - 110%		15								1.24		0.011					

***Water quality triggers for the Duralie Coal Mine developed in accordance with the methodology in ANZECC/ARMCANZ (2000).**
Gilberts & Asscocistes 2011 - Development of Water Quality Trigger Levels for the Duralie Extension Project.

Site 15 - Mammy Johnsons - Tereel

Date	As	Ba	Cd	Cr	Cu	Pb	Mo	Ni	Se	Ag	U	B	Hg	F	NH3 (as N)	NO2 (as N)	NO3 (as N)	N	P
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
30-Jul-19	<0.001	0.022	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	0.05	<0.01	0.02	0.2	<0.01
29-Aug-19																			
30-Sep-19																			
31-Oct-19																			
28-Nov-19																			
27-Dec-19																			
30-Jan-20																			
9-Feb-20	<0.001	0.044	<0.0001	<0.001	0.004	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	0.06	0.01	2.11	2.8	<0.01
27-Mar-20	<0.001	0.045	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	0.04	<0.01	0.06	0.4	<0.01
30-Apr-20	<0.001	0.042	<0.0001	<0.001	0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	<0.01	<0.01	0.06	0.3	0.01
28-May-20	<0.001	0.038	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	<0.01	<0.01	0.28	0.5	<0.01
29-Jun-20	<0.001	0.034	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	0.03	<0.01	0.06	0.2	0.02
Min	0.001	0.022	0.0001	0.001	0.001	0.001	0.001	0.001	0.01	0.001	0.001	0.05	0.0001	0.1	0.01	0.01	0.02	0.2	0.01
Avg	0.001	0.038	0.0001	0.001	0.002	0.001	0.001	0.001	0.01	0.001	0.001	0.05	0.0001	0.1	0.03	0.01	0.43	0.7	0.01
Max	0.001	0.045	0.0001	0.001	0.004	0.001	0.001	0.001	0.01	0.001	0.001	0.05	0.0001	0.1	0.06	0.01	2.11	2.8	0.02
Var	0.000	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.00	0.000	0.000	0.00	0.0000	0.0	0.00	0.00	0.68	1.0	0.00
SD	0.000	0.009	0.0000	0.000	0.001	0.000	0.000	0.000	0.00	0.000	0.000	0.00	0.0000	0.0	0.02	0.00	0.83	1.0	0.00
*Water Quality Trigger				0.001	0.0020										0.06			0.8	0.15

***Water quality triggers for the Duralie Coal Mine developed in accordance with the methodology in ANZECC/ARMCANZ (2000).**
Gilberts & Asscocistes 2011 - Development of Water Quality Trigger Levels for the Duralie Extension Project.

Site 19 - Karuah River (Washpool Turnoff)

Date	Category	Comment	ph	EC	Turbidity	DO	TDS	TSS	Hardness	Alkalinity (as $CaCO_3$)	Acidity (as $CaCO_3$)	SO4	Cl	Ca	Mg	Al	Mn	Zn	Fe	CO3 (as $CaCO_3$)	Bicarb (as $CaCO_3$)	BOD	Na
				uS/cm	NTU	%	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
30-Jul-19	Monthly	Steady flow, clear	7.69	223	2	**101**	143	6	50	43	3	6	35	10	6	0.02	0.015	<0.005	0.21	<1	43	2	22
29-Aug-19	Monthly	Slow flow, clear	**7.57**	292	**3**	**83**	187	**6**	68	56	<1	8	39	14	8	**0.04**	0.030	**<0.005**	0.16	<1	56	<2	28
30-Sep-19	Monthly	Slow flow, clear	**7.28**	**221**	**2**	**87**	141	**5**	52	45	2	6	38	11	6	**0.06**	0.025	**<0.005**	0.28	<1	45	<2	21
31-Oct-19	Monthly	Trickle flow, clear	**7.91**	269	0	**91**	172	<5	65	60	2	6	45	13	8	0.02	0.038	<0.005	0.25	<1	60	<2	27
28-Nov-19	Monthly	Nil flow																					
27-Dec-19	Monthly	Nil flow																					
30-Jan-20	Monthly	t flow. Brown in col	**7.15**	313	**5**	**28**	203	**8**	99	82	7	23	50	20	12	**0.03**	2.910	0.018	2.03	<1	82	3	33
9-Feb-20	Monthly	st flow. Grey in colo	**6.85**	103	63	**88**	66	68	31	13	5	2	29	6	4	2.57	0.075	**0.007**	2.43	<1	13	3	18
27-Mar-20	Discharge Event	ast flow, light brow	**7.5**	149	27	10	95	39	34	29	2	<10	31	7	4	0.81	0.054	0.006	1.25	<1	29	2	21
30-Apr-20	Monthly	eady flow, light brow	6.95	221	2	83	141	<5	50	43	4	10	31	10	6	0.05	0.023	<0.005	0.66	<1	43	2	20
28-May-20	Monthly	Fast flow, clear	**7.53**	253	9	93	162	<5	50	34	4	15	39	10	6	0.32	0.017	<0.005	0.73	<1	34	4	24
29-Jun-20	Monthly	Fast flow, clear	**7.47**	220	**3**	**103**	141	**<5**	43	34	10	16	38	9	5	**0.10**	0.009	**<0.005**	0.48	<1	34	<2	22
Min			6.9	103	0	10	66	5	31	13	1	2	29	6	4	0.02	0.009	0.005	0.16	1	13	2	18
Avg			7.4	226	12	77	145	15	54	44	4	10	38	11	7	0.40	0.320	0.007	0.85	1	44	2	24
Max			7.9	313	63	103	203	68	99	82	10	23	50	20	12	2.57	2.910	0.018	2.43	1	82	4	33
Var			0.1	3962	387	986	1660	455	383	359	8	38	42	16	6	0.64	0.829	0.000	0.65	0	359	0	20
SD			0.3	63	20	31	41	21	20	19	3	6	7	4	2	0.80	0.910	0.004	0.80	0	19	1	5
*Water Quality Trigger			7.1 - 7.6	370	24	85 - 110%		15								1.24		0.011					

***Water quality triggers for the Duralie Coal Mine developed in accordance with the methodology in ANZECC/ARMCANZ (2000).**
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Site 19 - Karuah River (Washpool Turnoff)

Date	As	Ba	Cd	Cr	Cu	Pb	Mo	Ni	Se	Ag	U	B	Hg	F	NH3 (as N)	NO2 (as N)	NO3 (as N)	N	P
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
30-Jul-19	<0.001	0.016	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	<0.01	<0.01	0.01	0.3	0.01
29-Aug-19	<0.001	0.017	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	<0.01	<0.01	0.10	**0.4**	**0.04**
30-Sep-19	<0.001	0.020	<0.0001	0.001	<0.001	0.003	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	<0.01	<0.01	<0.01	**0.3**	**0.27**
31-Oct-19	<0.001	0.021	<0.0001	0.001	<0.001	0.003	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	0.1	<0.01	<0.01	<0.01	0.6	<0.01
28-Nov-19																			
27-Dec-19																			
30-Jan-20	<0.001	0.017	<0.0001	<0.001	<0.001	<0.001	0.001	0.013	<0.01	<0.001	0.001	0.33	<0.0001	0.1	0.15	<0.01	0.06	1.2	0.16
9-Feb-20	0.001	0.038	<0.0001	0.002	0.003	0.001	<0.001	0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	0.03	0.02	1.82	2.7	0.09
27-Mar-20	<0.001	0.025	<0.0001	<0.001	0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	0.08	<0.01	0.22	0.8	0.05
30-Apr-20	<0.001	0.019	<0.0001	<0.001	0.003	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	0.02	<0.01	0.07	0.3	0.03
28-May-20	<0.001	0.029	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	<0.01	<0.01	0.08	0.5	<0.01
29-Jun-20	<0.001	0.019	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.0001	<0.1	<0.01	<0.01	0.02	**0.1**	**<0.01**
Min	0.001	0.016	0.0001	0.001	0.001	0.001	0.001	0.001	0.010	0.001	0.001	0.05	0.0001	0.1	0.01	0.01	0.01	0.1	0.01
Avg	0.001	0.022	0.0001	0.001	0.001	0.001	0.001	0.002	0.010	0.001	0.001	0.08	0.0001	0.1	0.03	0.01	0.24	0.7	0.07
Max	0.001	0.038	0.0001	0.002	0.003	0.003	0.001	0.013	0.010	0.001	0.001	0.33	0.0001	0.1	0.15	0.02	1.82	2.7	0.27
Var	0.000	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.01	0.0000	0.0	0.00	0.00	0.31	0.6	0.01
SD	0.000	0.007	0.0000	0.000	0.001	0.001	0.000	0.004	0.000	0.000	0.000	0.09	0.0000	0.0	0.05	0.00	0.56	0.8	0.09
*Water Quality Trigger				0.001	0.0020										0.06			0.8	0.15

***Water quality triggers for the Duralie Coal Mine developed in accordance with the methodology in ANZECC/ARMCANZ (2000).**
"Gilberts & Asscocistes 2011 - Development of Water Quality Trigger Levels for the Duralie Extension Project".

SW3 - Main Water Dam (Major) EPL11701 Point 3

Date	Category	Storage RL	pH	EC	Turbidity	TDS	TSS	Hardness	Alkalinity (as $CaCO_3$)	Acidity (as $CaCO_3$)	SO4	Cl	Ca	Mg	Al	Mn	Zn	Fe	CO3 (as $CaCO_3$)	Bicarb (as $CaCO_3$)	BOD	Na
				uS/cm	NTU	mg/l	mg/l	mg/l			mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
4-Jul-19	Weekly	RL 71.029	8.2	3340	0.6																	
11-Jul-19	Weekly	RL 70.977	8.2	3340	1.0																	
18-Jul-19	Weekly	RL 70.959	8.3	3380	0.8																	
24-Jul-19	Weekly	RL 71.024	8.2	3400	1.0																	
30-Jul-19	Monthly	RL 71.003	8.3	3040	0.6	1946	6	1010	124	6	1270	266	169	143	<0.01	0.06	<0.005	<0.05	<1	124	3	342
8-Aug-19	Weekly	RL 71.008	8.3	3140	20.5																	
14-Aug-19	Weekly	RL 71.061	8.3	3140	1.0																	
20-Aug-19	Weekly	RL 71.015	8.3	3130	0.9																	
29-Aug-19	Monthly	Citec not working	8.4	3080	0.6	1971	<5	1040	130	11	1170	260	183	141	<0.01	0.14	<0.005	<0.05	<1	130	<2	322
5-Sep-19	Weekly	RL 71.040	8.4	3170	0.7																	
12-Sep-19	Weekly	RL 71.036	8.3	3100	1.5																	
19-Sep-19	Weekly	RL 71.085	8.6	3340	0.9																	
26-Sep-19	Weekly	RL 71.000	8.5	3050	1.8																	
30-Sep-19	Monthly	RL 71.000	8.5	3040	4.8	1946	7	994	131	4	893	332	169	139	<0.01	0.20	<0.005	<0.05	<1	131	<2	323
10-Oct-19	Weekly	RL 70.989	8.5	3100	0.6																	
17-Oct-19	Weekly	RL 71.018	8.6	3080	1.2																	
24-Oct-19	Weekly	RL 71.007	8.5	3030	1.6																	
31-Oct-19	Monthly	RL 70.976	8.5	2810	5.4	1798	13	1030	134	<1	1210	326	168	149	0.04	0.18	<0.005	<0.05	2	131	<2	333
8-Nov-19	Weekly	RL 70.968	8.4	2980	1.6																	
14-Nov-19	Weekly	RL 70.934	8.4	3060	1.3																	
22-Nov-19	Weekly	RL 70.934	8.2	3000	1.9																	
28-Nov-19	Monthly	RL 70.895	8.7	3000	1	1950	<5	1130	130	4	1500	299	189	160	0.01	0.21	<0.005	<0.05	<1	130	<2	358
5-Dec-19	Weekly	RL 70.867	8.2	3170	1																	
12-Dec-19	Weekly	RL 70.887	8.4	2780	7																	
19-Dec-19	Weekly	RL 70.861	8.4	3150	4																	
27-Dec-19	Monthly	unable to obtain	8.5	3180	2	2035	7	959	138	3	952	314	158	137	0.01	0.10	<0.005	<0.05	<1	138	4	321
2-Jan-20	Weekly	unable to obtain	8.6	3200	1																	
8-Jan-20	Weekly	RL 70.849	8.6	3770	2																	
15-Jan-20	Weekly	RL 70.852	8.2	3180	3																	
24-Jan-20	Weekly	RL 70.866	8.4	3300	2																	
30-Jan-20	Monthly	not working -	8.6	2452	2	1594	<5	1040	129	<1	1160	306	163	154	0.01	0.05	<0.005	<0.05	7	122	<2	350
6-Feb-20	Weekly	RL not recorded	8.3	3200	1																	
9-Feb-20	Monthly	unable to obtain	8.3	2970	3	1901	<5	1010	115	4	1220	312	162	148	0.06	0.09	<0.005	0.06	<1	115	2	338
13-Feb-20	Weekly	RL 71.150	8.4	3090	3																	
20-Feb-20	Weekly	RL 71.000	8.2	2920	2																	
24-Feb-20	Weekly	RL 71.014	8.5	3010	1																	
5-Mar-20	Weekly	RL 71.012	8.4	3110	13																	
9-Mar-20	Weekly	RL 71.039	8.3	3070	2																	
18-Mar-20	Weekly	RL 71.004	8.0	2875	2																	
26-Mar-20	Weekly	RL 71.040	8.1	3200	1																	
27-Mar-20	Discharge Event	RL not recorded	8.0	3100	1	1984	5	1000	137	3	928	304	160	146	0.01	0.11	0.01	<0.05	<1	137	2	330
9-Apr-20	Weekly	RL 71.670	8.1	3240	2																	
16-Apr-20	Weekly	RL 71.172	8.3	3190	2																	
23-Apr-20	Weekly	RL 71.017	8.1	3220	1																	
30-Apr-20	Monthly	RL 70.997	8.3	3230	2	2067	12	1050	156	4	1180	303	176	149	0.02	0.18	0.01	<0.05	<1	156	2	335
7-May-20	Weekly	RL 70.989	8.4	3260	1																	
14-May-20	Weekly	RL 71.000	8.1	3248	4																	
21-May-20	Weekly	RL 71.019	8.1	3111	2																	
28-May-20	Monthly	RL 71.052	8.2	3432	2	2196	<5	954	145	4	994	288	153	139	<0.01	0.19	<0.005	<0.05	<1	145	<2	312
4-Jun-20	Weekly	RL 71.007	8.1	3500	1																	
11-Jun-20	Weekly	RL 71.073	8.3	3240	1																	
18-Jun-20	Weekly	RL 71.092	8.3	2728	2																	
25-Jun-20	Weekly	RL not recorded	8.5	2793	1																	
29-Jun-20	Monthly	RL 70.961	8.3	2819	2	1804.2	6	933	154	6	985	298	146	138	<0.01	0.10	<0.005	<0.05	<1	154	<2	306
Min			*8.0*	2452	1	1594	5	933	115	1	893	260	146	137	0.01	0.05	0.005	0.05	1	115	2	306
Avg			*8.3*	3120	2	1933	7	1013	135	4	1122	301	166	145	0.02	0.13	0.005	0.05	2	134	2	331
Max			*8.7*	3770	21	2196	13	1130	156	11	1500	332	189	160	0.06	0.21	0.007	0.06	7	156	4	358
Var			*0.0*	44195	10	22997	8	2741	140	7	31216	455	148	50	0.00	0.00	0.000	0.00	3	153	0	228
SD			*0.2*	210	3	152	3	52	12	3	177	21	12	7	0.02	0.06	0.001	0.00	2	12	1	15
*Water Quality Trigger			N/A	N/A	N/A	N/A	N/A								N/A		N/A					

***Water quality triggers for the Duralie Coal Mine developed in accordance with the methodology in ANZECC/ARMCANZ (2000).**
Gilberts & Asscocistes 2011 - Development of Water Quality Trigger Levels for the Duralie Extension Project.

SW3 - Main Water Dam (Major)

Date	As	Ba	Cd	Cr	Cu	Pb	Mo	Ni	Se	Ag	U	B	Hg	F	NH3 (as N)	NO2 (as N)	NO3 (as N)	N	P
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
30-Jul-19	<0.001	0.031	<0.0001	<0.001	<0.001	<0.001	0.002	0.003	<0.01	<0.001	<0.001	<0.05	<0.0001	0.2	<0.01	<0.01	<0.01	0.3	<0.01
29-Aug-19	<0.001	0.029	<0.0001	<0.001	<0.001	<0.001	0.003	0.004	<0.01	<0.001	<0.001	<0.05	<0.0001	0.3	<0.01	<0.01	<0.01	0.3	<0.01
30-Sep-19	<0.001	0.032	0.0001	0.001	<0.001	0.0020	0.003	0.004	<0.01	<0.001	<0.001	<0.05	<0.0001	0.2	<0.01	<0.01	<0.01	0.3	<0.01
31-Oct-19	<0.001	0.033	<0.0001	0.001	<0.001	0.0030	0.002	0.003	<0.01	<0.001	<0.001	<0.05	<0.0001	0.3	<0.01	<0.01	<0.01	0.5	<0.01
28-Nov-19	<0.001	0.033	<0.0001	<0.001	<0.001	<0.001	0.002	0.003	<0.01	<0.001	<0.001	<0.05	<0.0001	0.2	0.02	<0.01	<0.01	0.3	<0.01
27-Dec-19	<0.001	0.035	<0.0001	0.001	<0.001	0.0020	0.003	0.004	<0.01	<0.001	<0.001	<0.05	<0.0001	0.4	0.06	<0.01	<0.01	0.3	0.06
30-Jan-20	<0.001	0.034	<0.0001	<0.001	<0.001	<0.001	0.002	0.003	<0.01	<0.001	<0.001	<0.05	<0.0001	0.3	<0.01	<0.01	0.03	0.2	<0.01
9-Feb-20	<0.001	0.035	<0.0001	<0.001	<0.001	<0.001	0.002	0.004	<0.01	<0.001	<0.001	<0.05	<0.0001	0.2	0.02	<0.01	0.56	0.8	<0.01
27-Mar-20	<0.001	0.032	<0.0001	0.001	<0.001	<0.001	0.002	0.003	<0.01	<0.001	<0.001	<0.05	<0.0001	0.1	0.09	<0.01	<0.01	0.3	<0.01
30-Apr-20	<0.001	0.031	<0.0001	<0.001	0.004	<0.001	0.002	0.003	<0.01	<0.001	<0.001	<0.05	<0.0001	0.2	0.05	<0.01	0.02	0.3	0.04
28-May-20	<0.001	0.032	<0.0001	<0.001	<0.001	<0.001	0.002	0.003	<0.01	<0.001	<0.001	<0.05	<0.0001	0.4	0.07	<0.01	0.05	0.8	<0.01
29-Jun-20	<0.001	0.03	<0.0001	<0.001	<0.001	<0.001	0.002	0.004	<0.01	<0.001	<0.001	<0.05	<0.0001	0.3	<0.01	<0.01	0.02	0.3	0.02
Min	0.001	0.029	0.0001	0.001	0.001	0.001	0.002	0.003	0.01	0.00	0.001	0.05	0.0001	0.1	0.01	0.01	0.01	0.2	0.01
Avg	0.001	0.032	0.0001	0.001	0.001	0.001	0.002	0.003	0.01	0.00	0.001	0.05	0.0001	0.3	0.03	0.01	0.06	0.4	0.02
Max	0.001	0.035	0.0001	0.001	0.004	0.003	0.003	0.004	0.01	0.00	0.001	0.05	0.0001	0.4	0.09	0.01	0.56	0.8	0.06
Var	0.000	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.000	0.00	0.0000	0.0	0.00	0.00	0.02	0.0	0.00
SD	0.000	0.002	0.0000	0.000	0.001	0.001	0.000	0.001	0.00	0.00	0.000	0.00	0.0000	0.1	0.03	0.00	0.16	0.2	0.02

***Water quality triggers for the Duralie Coal Mine developed in accordance with the methodology in ANZECC/ARMCANZ (2000).**
Gilberts & Asscocistes 2011 - Development of Water Quality Trigger Levels for the Duralie Extension Project.

Site - Southern Arm of MWD Diversion Drain

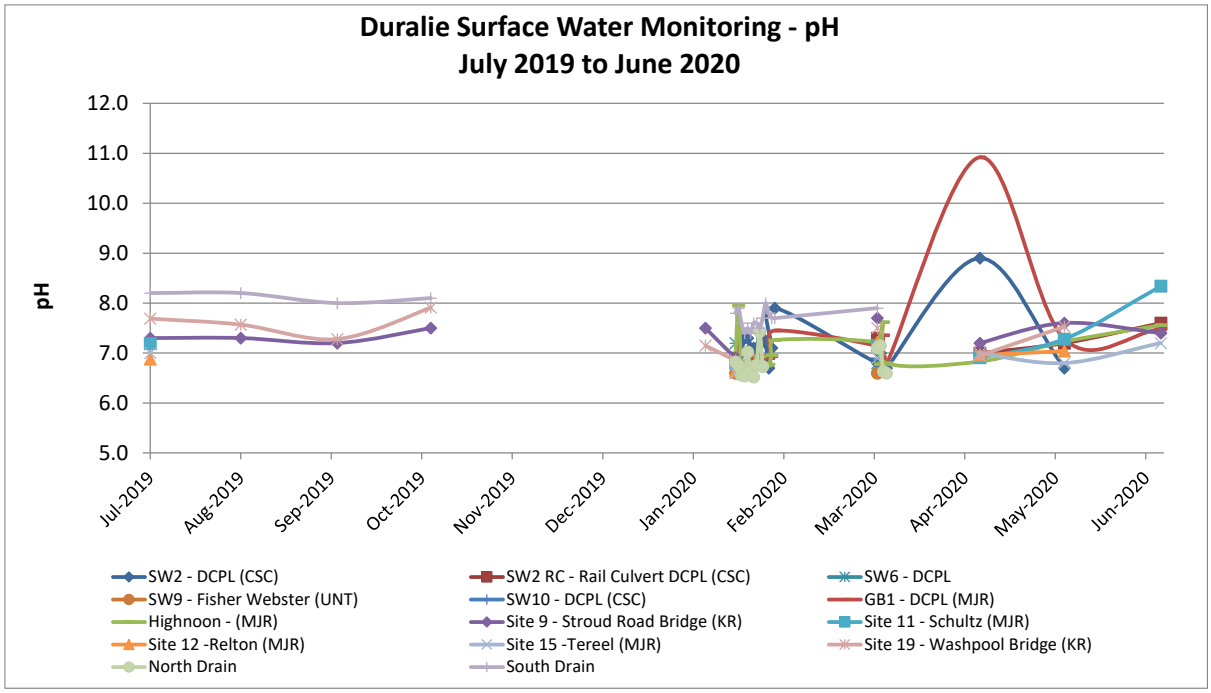
Date	Category	Comment	ph	EC uS/cm	Turbidity NTU	TSS mg/l
30-Jul-19	Monthly	Steady flow, clear. Sampled from Drain	8.2	**3050**	0.38	6
29-Aug-19	Monthly	Slow flow. Sampled from Drain.	8.2	**3200**	0.43	<5
30-Sep-19	Monthly	Slow flow. Sampled from Drain.	8.0	**3200**	0.84	5
31-Oct-19	Monthly	Trickle flow. Sampled from Drain flowing into Dam	8.1	**2890**	1.01	7
28-Nov-19	Monthly	No flow				
27-Dec-19	Monthly	No flow				
30-Jan-20	Monthly	No flow				
9-Feb-20	Monthly	Steady flow, light brown. Sampled from both Drain and Dam	7.8	**1492**	30.8	14
10-Feb-20	Discharge	Fast flow, brown, flow to drain	7.9	**949**	55.3	22
11-Feb-20	Discharge	Fast flow, light brown, flow to drain	7.6	**809**	48.2	18
12-Feb-20	Discharge	Fast flow, slightly turbid, light brown, flow to drain	7.4	**688**	74.6	27
13-Feb-20	Discharge	Fast flow, slightly turbid, light brown, flow to drain	7.5	**615**	38.3	24
14-Feb-20	Discharge	Fast flow, light brown, flow to drain	7.4	**632**	55.6	17
15-Feb-20	Discharge	Fast flow, light brown, flow to drain	7.6	**841**	20.5	5
16-Feb-20	Discharge	Slow flow, light brown, flow to drain	7.6	**1049**	9.09	<5
17-Feb-20	Discharge	Steady clear flow to drain	7.5	**1122**	8.03	5
18-Feb-20	Discharge	Steady clear flow to drain	7.7	**1186**	16.55	13
19-Feb-20	Discharge	Fast clear flow to drain	8.0	**1253**	18.16	10
20-Feb-20	Discharge	Fast, light brown flow to drain	**7.8**	**1153**	13.21	7
21-Feb-20	Discharge	Flow to dam	**7.7**	**1263**	28.1	30
22-Feb-20	Discharge	Steady flow to dam	7.7	**1303**	6.14	<5
27-Mar-20	Discharge	Steady flow, light brown. Sampled from Dam	7.9	**194.4**	12.14	10
28-Mar-20	Discharge	No flow				
29-Mar-20	Discharge	No flow				
30-Mar-20	Discharge	No flow				
30-Apr-20	Monthly	No flow				
28-May-20	Monthly	No flow				
29-Jun-20	Monthly	No flow				
Min			7.4	194	0.38	5
Avg			7.8	1415	23.02	12
Max			8.2	3200	74.60	30
Var			0.1	878631	483.73	69
SD			0.3	937	21.99	8
*Water Quality Trigger			7.1 - 7.9	544	119	80

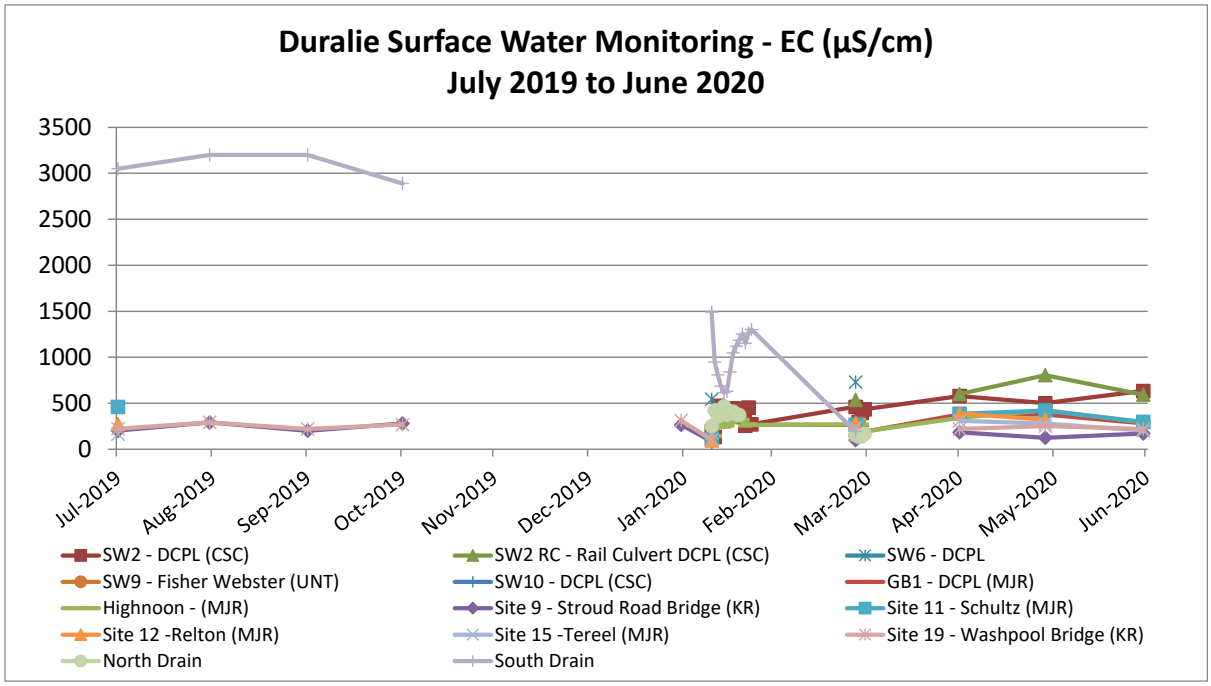
***Water quality triggers for the Duralie Coal Mine developed in accordance with the methodology in ANZECC/ARMCANZ (2000).**

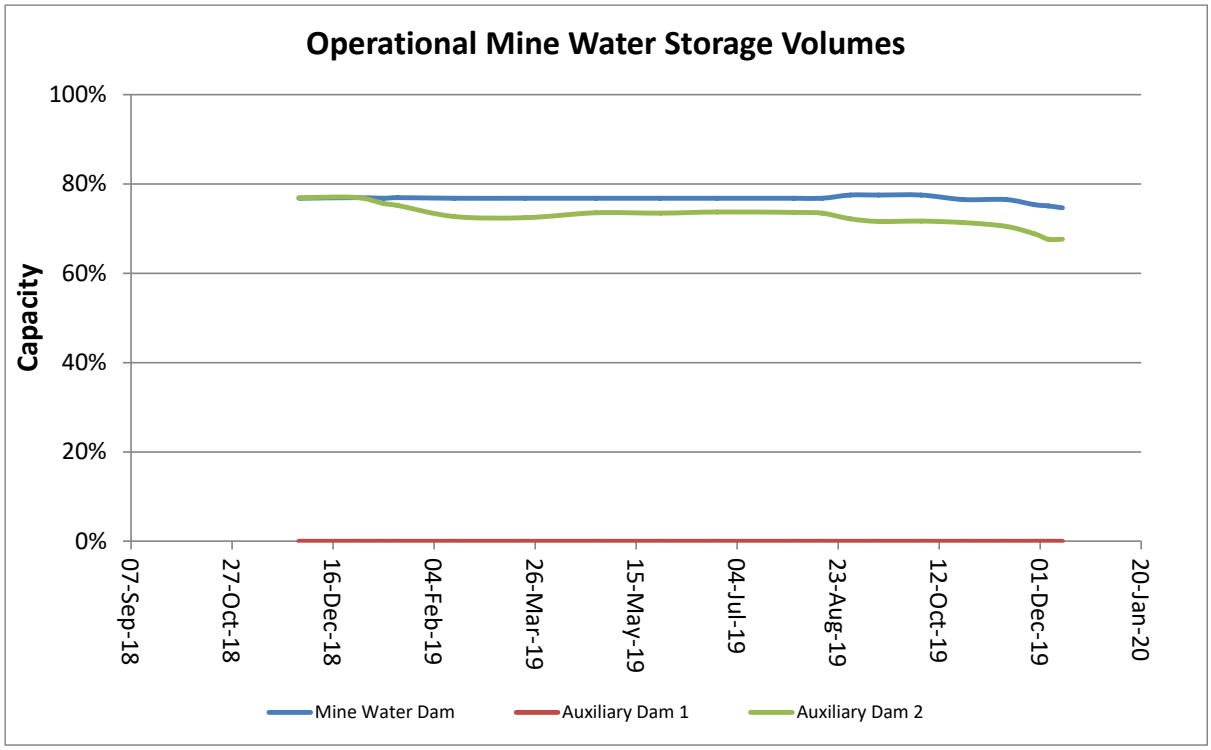
Site - Northern Arm of MWD Diversion Drain

Date	Category	Comment	ph	EC uS/cm	Turbidity NTU	TSS mg/l
30-Jul-19	Monthly	No flow				
29-Aug-19	Monthly	No flow				
30-Sep-19	Monthly	No flow				
31-Oct-19	Monthly	No flow				
28-Nov-19	Monthly	No flow				
27-Dec-19	Monthly	No flow				
30-Jan-20	Monthly	No flow				
9-Feb-20	Monthly	Steady flow, brown and slightly turbid	**6.8**	251	37.1	14
10-Feb-20	Discharge	Steady flow, light brown	**6.8**	424	11.61	10
11-Feb-20	Discharge	Steady flow, slightly turbid, light brown	**6.6**	357	76.5	27
12-Feb-20	Discharge	Steady flow,turbid, light brown	**6.5**	392	61	23
13-Feb-20	Discharge	Steady flow, light brown	**7.0**	468	15.71	<5
14-Feb-20	Discharge	Steady flow, light brown	**6.6**	378	6.95	41
15-Feb-20	Discharge	Slow flow, light brown	**6.5**	412	8.49	30
16-Feb-20	Discharge	Trickle flow, light brown	**6.8**	408	7.52	<5
17-Feb-20	Discharge	Trickle flow, clear	**7.4**	381	3.27	<5
18-Feb-20	Discharge	Slow flow, light brown	**6.7**	373	2.92	<5
19-Feb-20	Discharge	No flow				
20-Feb-20	Discharge	No flow				
21-Feb-20	Discharge	No flow				
22-Feb-20	Discharge	No flow				
27-Mar-20	Discharge	Steady flow, light brown in colour. Flowing over 'V' notch	7.1	155.6	31	23
28-Mar-20	Discharge	Trickle, brown	7.2	138.2		9
29-Mar-20	Discharge	Steady flow, brown and turbid	**6.6**	**143.2**	87.1	34
30-Mar-20	Discharge	Slow flow, light brown	6.6	**166.1**	50.5	16
30-Apr-20	Monthly	No flow				
28-May-20	Monthly	No flow				
29-Jun-20	Monthly	No flow				
Min			6.5	138	3	5
Avg			6.8	318	31	18
Max			7.4	468	87	41
Var			0.1	14237	861	146
SD			0.3	119	29	12
*Water Quality Trigger			7.1 - 7.9	544	119	80

***Water quality triggers for the Duralie Coal Mine developed in accordance with the methodology in ANZECC/ARMCANZ (2000).**


Duralie Surface Water Monitoring - pH
July 2019 to June 2020
pH
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
Jul-2019
Aug-2019
Sep-2019
Oct-2019
Nov-2019
Dec-2019
Jan-2020
Feb-2020
Mar-2020
Apr-2020
May-2020
Jun-2020
SW2 - DCPL (CSC)
SW2 RC - Rail Culvert DCPL (CSC)
SW6 - DCPL
SW9 - Fisher Webster (UNT)
SW10 - DCPL (CSC)
GB1 - DCPL (MJR)
Highnoon - (MJR)
Site 9 - Stroud Road Bridge (KR)
Site 11 - Schultz (MJR)
Site 12 -Relton (MJR)
Site 15 -Tereel (MJR)
Site 19 - Washpool Bridge (KR)
North Drain
South Drain


Duralie Surface Water Monitoring - EC (µS/cm)
July 2019 to June 2020
3500
3000
2500
2000
1500
1000
500
0
Jul-2019
Aug-2019
Sep-2019
Oct-2019
Nov-2019
Dec-2019
Jan-2020
Feb-2020
Mar-2020
Apr-2020
May-2020
Jun-2020
SW2 - DCPL (CSC)
SW2 RC - Rail Culvert DCPL (CSC)
SW6 - DCPL
SW9 - Fisher Webster (UNT)
SW10 - DCPL (CSC)
GB1 - DCPL (MJR)
Highnoon - (MJR)
Site 9 - Stroud Road Bridge (KR)
Site 11 - Schultz (MJR)
Site 12 -Relton (MJR)
Site 15 -Tereel (MJR)
Site 19 - Washpool Bridge (KR)
North Drain
South Drain


Operational Mine Water Storage Volumes
Capacity
100%
80%
60%
40%
20%
0%
07-Sep-18
27-Oct-18
16-Dec-18
04-Feb-19
26-Mar-19
15-May-19
04-Jul-19
23-Aug-19
12-Oct-19
01-Dec-19
20-Jan-20
Mine Water Dam
Auxiliary Dam 1
Auxiliary Dam 2

Groundwater

DB1W

Parameter	Units	23-Aug-19	20-Nov-19	Feb-20	8-May-20	Min	Avg	Max	Variance	Std Dev
Depth to standing WL	(m)	16.12	16.37		15.95	16.0	16.15	16.37	0.04	0.21
pH		6.1	5.7		5.9	5.7	5.9	6.1	0.05	0.22
Conductivity @ 25^{0}C	(µS/cm)	4970	3290		4440	3290	4233	4970	737633	859
ORP	(mV)	116	71		-58	-58	43	116	8157	90
Dissolved Oxygen	(%)	26	32		14	14	24	32	87	9
TDS	(mg/L)	3170	2240		3100	2240	2837	3170	268233	518
Alkalinity as CaCO3	(mg/L)	123	99		136	99	119	136	352	19
Acidity as CaCO3	(mg/L)	50	178		108	50	112	178	4108	64
Sulphate	(mg/L)	387	374		372	372	378	387	66	8
Chloride	(mg/L)	1400	1150		1130	1130	1227	1400	22633	150
Calcium	(mg/L)	320	210		272	210	267	320	3041	55
Magnesium	(mg/L)	71	58		64	58	64	71	42	7
Sodium	(mg/L)	657	476		490	476	541	657	10141	101
Aluminium	(mg/L)	44.70	3.71		1.30	1.30	16.57	44.70	594.92	24.39
Manganese	(mg/L)	1.2	1.0		0.9	0.9	1.0	1.2	0.02	0.16
Zinc	(mg/L)	1.56	0.21		0.08	0.08	0.62	1.56	0.67	0.82
Iron	(mg/L)	50.2	43.5		29.0	29.0	40.9	50.2	117.43	10.84

No access in February 2020 due to flooding and boggy conditions

DB2W

Parameter	Units	22-Aug-19	20-Nov-19	Feb-20	8-May-20	Min	Avg	Max	Variance	Std Dev
Depth to standing WL	(m)	13.94	14.19		14.09	13.94	14.07	14.19	0.02	0.13
pH		6.18	6.07		6.09	6.1	6.1	6.2	0.00	0.06
Conductivity @ 25^{0}C	(µS/cm)	1577	1418		1662	1418	1552	1662	15340	124
ORP	(mV)	137	1		-46	-46	31	137	9032	95
Dissolved Oxygen	(%)	19	18		16	16	18	19	3.05	1.75
TDS	(mg/L)	904	806		964	806	891	964	6361	80
Alkalinity as CaCO3	(mg/L)	169	188		196	169	184	196	192	14
Acidity as CaCO3	(mg/L)	28	89		92	28	70	92	1304	36
Sulphate	(mg/L)	160	151		171	151	161	171	100	10
Chloride	(mg/L)	340	365		308	308	338	365	816	29
Calcium	(mg/L)	106	107		103	103	105	107	4	2
Magnesium	(mg/L)	27	27		25	25	26	27	1.33	1.15
Sodium	(mg/L)	196	176		156	156	176	196	400	20
Aluminium	(mg/L)	<0.01	0.06		<0.01	0.06	0.06	0.06		
Manganese	(mg/L)	0.81	0.79		0.73	0.73	0.78	0.81	0.00	0.04
Zinc	(mg/L)	0.01	0.02		0.03	0.01	0.02	0.03	0.00	0.01
Iron	(mg/L)	12.6	12.5		12.8	12.5	12.6	12.8	0.02	0.15

No access in February 2020 due to flooding and boggy conditions

DB3W

Parameter	Units	23-Aug-19	20-Nov-19	Feb-20	8-May-20	Min	Avg	Max	Variance	Std Dev
Depth to standing WL	(m)	4.12	4.42		4.55	4.12	4.36	4.55	0.05	0.22
pH		6.3	6.3		6.1	6.1	6.2	6.3	0.01	0.12
Conductivity @ 25^{0}C	(µS/cm)	171	172		155	155	166	172	91	10
ORP	(mV)	177	163		5	5	115	177	9124	96
Dissolved Oxygen	(%)	67	75		28	28	57	75	625	25
TDS	(mg/L)	165	210		146	146	174	210	1080	33
Alkalinity as CaCO3	(mg/L)	36	42		50	36	43	50	49	7
Acidity as CaCO3	(mg/L)	11	23		19	11	18	23	37	6
Sulphate	(mg/L)	6	4		4	4	5	6	1	1
Chloride	(mg/L)	14	17		12	12	14	17	6	3
Calcium	(mg/L)	4	4		2	4	4	4	0	0
Magnesium	(mg/L)	2	2		2	2	2	2	0	0
Sodium	(mg/L)	23	24		20	20	22	24	4	2
Aluminium	(mg/L)	1	1		25	1	9	25	186	14
Manganese	(mg/L)	0.05	0.08		0.20	0.05	0.11	0.20	0.01	0.08
Zinc	(mg/L)	0.02	0.01		0.11	0.01	0.05	0.11	0.00	0.05
Iron	(mg/L)	2.4	3.8		34.9	2.4	13.7	34.9	337.47	18.37

No access in February 2020 due to flooding and boggy conditions

DB4W

Parameter	Units	22-Aug-19	20-Nov-19	Feb-20	8-May-20	Min	Avg	Max	Variance	Std Dev
Depth to standing WL	(m)	6.70	7.01		6.89	6.70	6.87	7.01	0.02	0.16
pH		6.7	6.8		6.8	6.7	6.8	6.8	0.01	0.10
Conductivity @ 25^{0}C	(µS/cm)	3910	3320		3940	3320	3723	3940	122233	350
ORP	(mV)	-148	-213		-6	-213	-122	-6	11206	106
Dissolved Oxygen	(%)	16	12		9	9	12	16	10	3
TDS	(mg/L)	2440	2130		2230	2130	2267	2440	25033	158
Alkalinity as CaCO3	(mg/L)	277	333		356	277	322	356	1651	41
Acidity as CaCO3	(mg/L)	15	43		22	15	27	43	212	15
Sulphate	(mg/L)	128	55		53	53	79	128	1826	43
Chloride	(mg/L)	1210	1050		950	950	1070	1210	17200	131
Calcium	(mg/L)	174	144		143	143	154	174	310	18
Magnesium	(mg/L)	84	56		57	56	66	84	252	16
Sodium	(mg/L)	628	501		489	489	539	628	5932	77
Aluminium	(mg/L)	0.28	0.04		<0.01	0.04	0.16	0.28	0.03	0.17
Manganese	(mg/L)	1.5	1.1		1.0	1.0	1.2	1.5	0.07	0.27
Zinc	(mg/L)	0.01	<0.005		<0.005	0.01	0.01	0.01		
Iron	(mg/L)	0.9	0.2		0.1	0.1	0.4	0.9	0.20	0.44

No access in February 2020 due to flooding and boggy conditions

DB5W

Parameter	Units	22-Aug-19	20-Nov-19	Feb-20	8-May-20	Min	Avg	Max	Variance	Std Dev
Depth to standing WL	(m)	12.33	12.65		12.37	12.33	12.45	12.65	0.03	0.17
pH		5.7	5.6		5.6	5.6	5.6	5.7	0.00	0.04
Conductivity @ 25^{0}C	(µS/cm)	2235	2062		2277	2062	2191	2277	12986	114
ORP	(mV)	30	77		-2	-2	35	77	1579	40
Dissolved Oxygen	(%)	18	27		13	13	20	27	52	7
TDS	(mg/L)	1250	1220		1350	1220	1273	1350	4633	68
Alkalinity as CaCO3	(mg/L)	37	51		60	37	49	60	134	12
Acidity as CaCO3	(mg/L)	99	175		113	99	129	175	1636	40
Sulphate	(mg/L)	187	198		166	166	184	198	264	16
Chloride	(mg/L)	665	678		552	552	632	678	4802	69
Calcium	(mg/L)	32	36		30	30	33	36	9	3
Magnesium	(mg/L)	37	37		34	34	36	37	3	2
Sodium	(mg/L)	404	323		287	287	338	404	3591	60
Aluminium	(mg/L)	0.04	0.05		0.07	0.04	0.05	0.05	0.00	0.02
Manganese	(mg/L)	1.2	1.2		1.0	1.00	1.12	1.18	0.01	0.11
Zinc	(mg/L)	0.058	0.059		0.056	0.06	0.06	0.06	0.00	0.00
Iron	(mg/L)	46.7	45.5		43.8	43.8	45.3	46.7	2.12	1.46

No access in February 2020 due to flooding and boggy conditions

DB6W

Parameter	Units	22-Aug-19	18-Nov-19	27-Feb-20	13-May-20	Min	Avg	Max	Variance	Std Dev
Depth to standing WL	(m)	21.18	21.18	21.33	21.36	21.18	21.26	21.36	0.01	0.10
pH		6.6	6.5	6.7	6.7	6.5	6.6	6.7	0.01	0.12
Conductivity @ 25^{0}C	(µS/cm)	6110	5730	5700	6210	5700	5938	6210	67825	260
ORP	(mV)	146	164	124	150	124	146	164	275	17
Dissolved Oxygen	(%)	20	17	20	26	17	21	26	14	4
TDS	(mg/L)	3590	3620	5250	3860	3590	4080	5250	623000	789
Alkalinity as CaCO3	(mg/L)	542	617	648	668	542	619	668	3058	55
Acidity as CaCO3	(mg/L)	31	116	27	46	27	55	116	1721	41
Sulphate	(mg/L)	102	101	86	101	86	98	102	59	8
Chloride	(mg/L)	1840	1630	1570	1600	1570	1660	1840	15000	122
Calcium	(mg/L)	323	297	270	290	270	295	323	479	22
Magnesium	(mg/L)	204	190	204	190	190	197	204	65	8
Sodium	(mg/L)	718	614	655	610	610	649	718	2514	50
Aluminium	(mg/L)	0.12	0.25	0.07	0.29	0.07	0.18	0.29	0.01	0.10
Manganese	(mg/L)	0.336	0.340	0.315	0.319	0.315	0.328	0.340	0.000	0.012
Zinc	(mg/L)	0.017	0.021	0.048	0.016	0.016	0.026	0.048	0.000	0.015
Iron	(mg/L)	4.4	4.8	4.6	4.6	4.4	4.6	4.8	0.03	0.17

DB7W

Parameter	Units	22-Aug-19	21-Nov-19	Feb-20	8-May-20	Min	Avg	Max	Variance	Std Dev
Depth to standing WL	(m)	11.26	11.36		10.96	10.96	11.19	11.36	0.04	0.21
pH		7.0	6.6		6.9	6.6	6.8	7.0	0.05	0.22
Conductivity @ 25^{0}C	(µS/cm)	2980	2516		2915	2516	2804	2980	63120	251
ORP	(mV)	-113	127		-128	-128	-38	127	20475	143
Dissolved Oxygen	(%)	23	26		11	11	20	26	63	8
TDS	(mg/L)	1500	1460		1620	1460	1527	1620	6933	83
Alkalinity as CaCO3	(mg/L)	374	423		440	374	412	440	1174	34
Acidity as CaCO3	(mg/L)	11	40		25	11	25	40	210	15
Sulphate	(mg/L)	57	53		42	42	51	57	60	8
Chloride	(mg/L)	755	741		658	658	718	755	2749	52
Calcium	(mg/L)	148	143		137	137	143	148	30	6
Magnesium	(mg/L)	56	56		52	52	55	56	5	2
Sodium	(mg/L)	424	356		329	329	370	424	2396	49
Aluminium	(mg/L)	0.2	1.5		0.1	0.1	0.6	1.5	0.59	0.77
Manganese	(mg/L)	0.658	0.648		0.558	0.558	0.621	0.658	0.003	0.06
Zinc	(mg/L)	<0.005	0.033		<0.005	0.033	0.033	0.033		
Iron	(mg/L)	0.18	2.48		0.12	0.12	0.93	2.48	1.81	1.35

No access in February 2020 due to flooding and boggy conditions

DB8W

Parameter	Units	20-Aug-19	18-Nov-19	25-Feb-20	13-May-20	Min	Avg	Max	Variance	Std Dev
Depth to standing WL	(m)	19.19	19.09	18.98	16.38	18.98	18.41	19.19	1.84	1.36

DB9W

Parameter	Units	20-Aug-19	18-Nov-19	28-Feb-20	13-May-20	Min	Avg	Max	Variance	Std Dev
Depth to standing WL	(m)	20.8	20.94	21.02	20.97	20.80	20.93	21.02	0.01	0.09
pH		7.25	7.07	7.31	7.22	7.1	7.2	7.3	0.01	0.10
Conductivity @ 25^{0}C	(µS/cm)	3590	3380	3420	3710	3380	3525	3710	23500	153
ORP	(mV)	74	183	107	110	74	119	183	2115	46
Dissolved Oxygen	(%)	25	26	24	44	24	30	44	94	10
TDS	(mg/L)	1810	1830	2140	1980	1810	1940	2140	23533	153
Alkalinity as CaCO3	(mg/L)	101	136	119	135	101	123	136	271	16
Acidity as CaCO3	(mg/L)	5	10	2	6	2	6	10	11	3
Sulphate	(mg/L)	236	256	252	258	236	251	258	100	10
Chloride	(mg/L)	956	957	897	927	897	934	957	810	28
Calcium	(mg/L)	158	154	144	164	144	155	164	71	8
Magnesium	(mg/L)	12	16	10	16	10	14	16	9	3
Sodium	(mg/L)	602	489	543	521	489	539	602	2270	48
Aluminium	(mg/L)	0.04	0.05	0.02	0.04	0.0	0.0	0.1	0.00	0.01
Manganese	(mg/L)	0.182	0.189	0.139	0.163	0.139	0.168	0.189	0.00	0.02
Zinc	(mg/L)	0.013	0.019	0.014	0.012	0.012	0.015	0.019	0.00	0.00
Iron	(mg/L)	0.64	0.56	0.4	0.39	0.39	0.50	0.64	0.02	0.12

DB10W

Parameter	Units	20-Aug-19	18-Nov-19	28-Feb-20	13-May-20	Min	Avg	Max	Variance	Std Dev
Depth to standing WL	(m)	14.38	15.13	15.6	15.35	14.38	15.12	15.60	0.28	0.53
pH		5.16	5.06	5.69	5.4	5.1	5.3	5.7	0.08	0.28
Conductivity @ 25^{0}C	(µS/cm)	4210	3990	2580	4450	2580	3808	4450	704958	840
ORP	(mV)	129	186	105	86	86	127	186	1883	43
Dissolved Oxygen	(%)	29	32	23	50	23	34	50	138	12
TDS	(mg/L)	2470	2410	18600	2440	2410	6480	18600	65287000	8080
Alkalinity as CaCO3	(mg/L)	12	23	66	23	12	31	66	571	24
Acidity as CaCO3	(mg/L)	27	66	2	44	2	35	66	732	27
Sulphate	(mg/L)	400	452	450	468	400	443	468	868	29
Chloride	(mg/L)	1100	1120	1130	1100	1100	1113	1130	225	15
Calcium	(mg/L)	59	76	99	85	59	80	99	281	17
Magnesium	(mg/L)	75	74	91	83	74	81	91	63	8
Sodium	(mg/L)	598	602	679	648	598	632	679	1507	39
Aluminium	(mg/L)	0.38	0.17	0.61	0.19	0.2	0.3	0.6	0	0
Manganese	(mg/L)	0.794	0.813	1.08	0.829	0.794	0.879	1.080	0.02	0.13
Zinc	(mg/L)	0.233	0.287	0.183	0.22	0.183	0.231	0.287	0.00	0.04
Iron	(mg/L)	9.76	6.92	12.7	7.66	6.92	9.26	12.70	6.71	2.59

DB11W

Parameter	Units	22-Aug-19	21-Nov-19	Feb-20	8-May-20	Min	Avg	Max	Variance	Std Dev
Depth to standing WL	(m)	10.76	11.06		10.80	10.8	10.87	11.06	0.03	0.16
pH		6.43	6.79		6.85	6.4	6.69	6.85	0.05	0.23
Conductivity @ 25^{0}C	(µS/cm)	5530	2880		3580	2880	3997	5530	1885833	1373
ORP	(mV)	50	131		-88	-88	31	131	12261	111
Dissolved Oxygen	(%)	23	27		12	12	21	27	58	8
TDS	(mg/L)	3640	1690		2280	1690	2537	3640	1000033	1000
Alkalinity as CaCO3	(mg/L)	190	291		318	190	266	318	4552	67
Acidity as CaCO3	(mg/L)	21	36		22	21	26	36	70	8
Sulphate	(mg/L)	300	200		184	184	228	300	3952	63
Chloride	(mg/L)	1600	851		832	832	1094	1600	191864	438
Calcium	(mg/L)	433	203		235	203	290	433	15521	125
Magnesium	(mg/L)	101	36		43	36	60	101	1273	36
Sodium	(mg/L)	602	367		375	367	448	602	17803	133
Aluminium	(mg/L)	0.19	0.33		0.15	0.2	0.22	0.33	0.01	0.09
Manganese	(mg/L)	2.240	0.905		0.950	0.9	1.37	2.24	0.57	0.76
Zinc	(mg/L)	0.025	0.007		<0.005	0.0	0.02	0.03	0.00	0.01
Iron	(mg/L)	9.13	2.93		3.68	2.9	5.25	9.13	11.45	3.38

No access in February 2020 due to flooding and boggy conditions

BH4BW

Parameter	Units	22-Aug-19	21-Nov-19	Feb-20	8-May-20	Min	Avg	Max	Variance	Std Dev
Depth to standing WL	(m)	5.32	5.50		5.24	5.2	5.35	5.50	0.02	0.13
pH		6.0	5.7		6.2	5.7	5.97	6.21	0.07	0.27
Conductivity @ 25^{0}C	(µS/cm)	266	184		274	184	241	274	2481	50
ORP	(mV)	148	86		-32	-32	67	148	8361	91
Dissolved Oxygen	(%)	37	31		41	31	36	41	24	5
TDS	(mg/L)	201	115		141	115	152	201	1945	44
Alkalinity as CaCO3	(mg/L)	82	84		108	82	91	108	209	14
Acidity as CaCO3	(mg/L)	36	54		46	36	45	54	81	9
Sulphate	(mg/L)	6	2		2	2	3	6	5	2
Chloride	(mg/L)	19	15		12	12	15	19	12	4
Calcium	(mg/L)	10	14		10	10	11	14	5	2
Magnesium	(mg/L)	7	7		7	7	7	7	0	0
Sodium	(mg/L)	22	26		20	20	23	26	9	3
Aluminium	(mg/L)	11	1		1	1	4	11	38.45	6.20
Manganese	(mg/L)	0.6	0.4		0.7	0.4	0.56	0.72	0.02	0.16
Zinc	(mg/L)	0.1	0.01		0.1	0.0	0.05	0.08	0.00	0.03
Iron	(mg/L)	34.1	7.0		17.1	7.0	19.40	34.10	187.57	13.70

No access in February 2020 due to flooding and boggy conditions

SI1W

Parameter	Units	20-Aug-19	18-Nov-19	24-Feb-20	13-May-20	Min	Avg	Max	Variance	Std Dev
Depth to standing WL	(m)	9.97	10.07	9.84	9.92	9.84	9.95	10.07	0.01	0.10
pH		6.9	7.0	7.2	7.2	6.9	7.1	7.2	0.01	0.11
Conductivity @ 25^{0}C	(µS/cm)	2950	2840	2850	3170	2840	2953	3170	23492	153
ORP	(mV)	146	246	153	101	101	162	246	3704	61
Dissolved Oxygen	(%)	34	34	56	47	34	43	56	115	11
TDS	(mg/L)	2040	1980	2890	2010	1980	2230	2890	194200	441
Alkalinity as CaCO3	(mg/L)	420	475	504	448	420	462	504	1298	36
Acidity as CaCO3	(mg/L)	12	41	20	21	12	24	41	152	12
Sulphate	(mg/L)	928	770	748	767	748	803	928	7012	84
Chloride	(mg/L)	324	333	303	298	298	315	333	279	17
Calcium	(mg/L)	192	181	155	193	155	180	193	313	18
Magnesium	(mg/L)	164	149	152	162	149	157	164	54	7
Sodium	(mg/L)	311	254	246	274	246	271	311	841	29
Aluminium	(mg/L)	0.03	0.28	0.17	0.09	0.03	0.14	0.28	0.01	0.11
Manganese	(mg/L)	0.004	0.023	0.029	0.003	0.0	0.01	0.03	0.00	0.01
Zinc	(mg/L)	<0.005	0.014	0.011	<0.005	0.0	0.01	0.01		
Iron	(mg/L)	0.12	0.41	0.38	0.12	0.12	0.26	0.41	0.03	0.16

SI2W

Parameter	Units	22-Aug-19	22-Nov-19	24-Feb-20	13-May-20	Min	Avg	Max	Variance	Std Dev
Depth to standing WL	(m)	19.71	19.88	19.85	19.94	19.7	19.85	19.94	0.01	0.10
pH		7.2	7.0	7.1	7.4	7.0	7.17	7.41	0.03	0.18
Conductivity @ 25^{0}C	(µS/cm)	3360	3090	3120	3410	3090	3245	3410	26700	163
ORP	(mV)	226	281	123	72	72	176	281	9050	95
Dissolved Oxygen	(%)	19	27	26	19	19	23	27	17	4
TDS	(mg/L)	2320	1700	2140	2470	1700	2158	2470	111225	334
Alkalinity as CaCO3	(mg/L)	268	309	292	317	268	297	317	470	22
Acidity as CaCO3	(mg/L)	8	22	7	10	7	12	22	48	7
Sulphate	(mg/L)	1180	978	1110	1220	978	1122	1220	11283	106
Chloride	(mg/L)	307	322	296	302	296	307	322	124	11
Calcium	(mg/L)	161	156	133	156	133	152	161	158	13
Magnesium	(mg/L)	179	166	159	170	159	169	179	70	8
Sodium	(mg/L)	439	352	330	356	330	369	439	2293	48
Aluminium	(mg/L)	0.04	0.02	0.01	0.02	0.01	0.02	0.04	0.00	0.01
Manganese	(mg/L)	0.016	0.014	0.022	0.015	0.014	0.017	0.022	0.000	0.004
Zinc	(mg/L)	0.014	0.014	0.023	0.021	0.014	0.018	0.023	0.000	0.005
Iron	(mg/L)	0.14	0.07	<0.05	0.07	0.07	0.09	0.14	0.00	0.04

SI3W

Parameter	Units	20-Aug-19	22-Nov-19	24-Feb-20	13-May-20	Min	Avg	Max	Variance	Std Dev
Depth to standing WL	(m)	28.16	28.19	28.21		28.16	28.19	28.21	0.00	0.03
pH		6.8	6.8	7.0		6.8	6.9	7.0	0.02	0.13
Conductivity @ 25^{0}C	(µS/cm)	7880	7410	7370		7370	7553	7880	80433	284
ORP	(mV)	186	285	180		180	217	285	3477	59
Dissolved Oxygen	(%)	60	65	71		60	65	71	30	5
TDS	(mg/L)	5230	5010	6290		5010	5510	6290	468400	684
Alkalinity as CaCO3	(mg/L)	291	288	332		288	304	332	604	25
Acidity as CaCO3	(mg/L)	16	29	15		15	20	29	61	8
Sulphate	(mg/L)	968	764	715		715	816	968	18004	134
Chloride	(mg/L)	2280	2390	2340		2280	2337	2390	3033	55
Calcium	(mg/L)	643	608	523		523	591	643	3808	62
Magnesium	(mg/L)	181	177	173		173	177	181	16	4
Sodium	(mg/L)	939	822	802		802	854	939	5476	74
Aluminium	(mg/L)	0.36	0.66	0.06		0.06	0.36	0.66	0.09	0.30
Manganese	(mg/L)	0.390	0.075	0.032		0.032	0.166	0.390	0.04	0.20
Zinc	(mg/L)	0.055	0.029	0.027		0.027	0.037	0.055	0.00	0.02
Iron	(mg/L)	1.04	0.73	0.18		0.18	0.65	1.04	0.19	0.44

Too low to sample in May 2020

WR1

Note: Installed 3-Sep-13. E - 400776, N - 6425804

Waste Emplacement - South

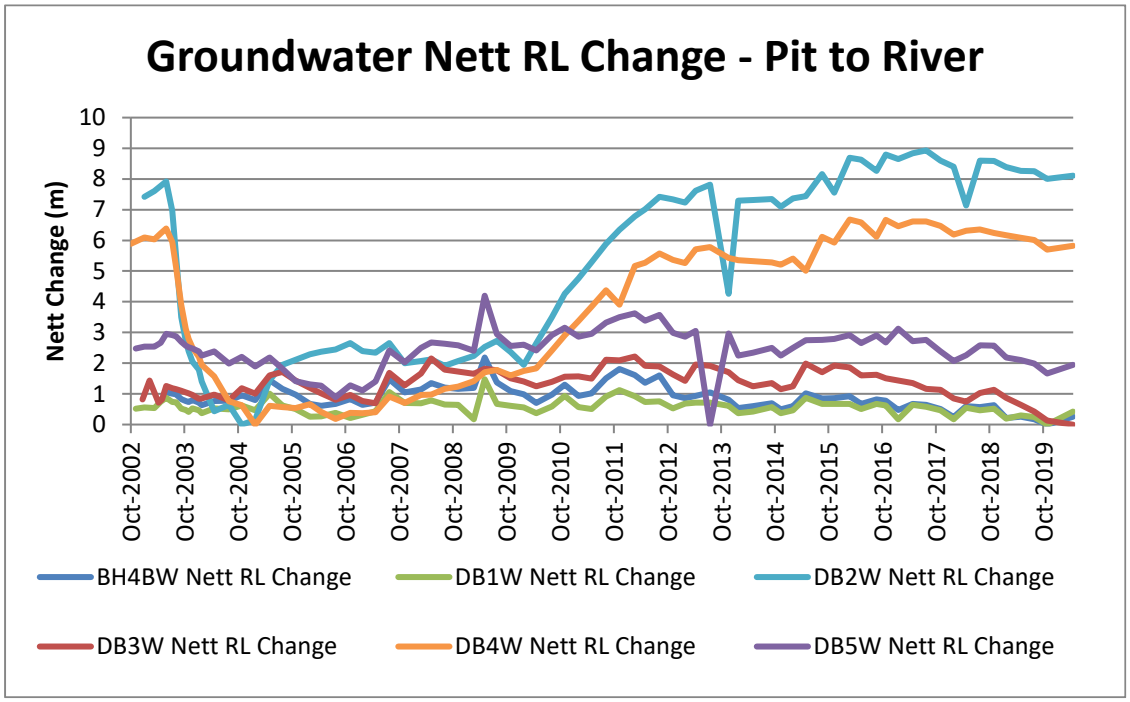
Parameter	Units	20-Aug-19	22-Nov-19	24-Feb-20	13-May-20	Min	Avg	Max	Variance	Std Dev
Depth to standing WL	(m)	10.23	11.59	10.42	10.2	10.20	10.61	11.59	0.44	0.66
pH		6.33	5.99	6.36	6.41	6.0	6.3	6.4	0.04	0.19
Conductivity @ 25^{0}C	(µS/cm)	2550	2422	2750	2988	2422	2678	2988	61068	247
ORP	(mV)	191	301	114	86	86	173	301	9253	96
Dissolved Oxygen	(%)	33	31	33	30	30	32	33	2	1
TDS	(mg/L)	1600	1680	1760	1860	1600	1725	1860	12367	111
Alkalinity as CaCO3	(mg/L)	257	294	306	286	257	286	306	435	21
Acidity as CaCO3	(mg/L)	18	78	6	42	6	36	78	1008	32
Sulphate	(mg/L)	433	552	535	593	433	528	593	4625	68
Chloride	(mg/L)	429	463	441	467	429	450	467	327	18
Calcium	(mg/L)	184	201	180	218	180	196	218	303	17
Magnesium	(mg/L)	36	40	39	42	36	39	42	6	3
Sodium	(mg/L)	379	323	305	334	305	335	379	994	32
Aluminium	(mg/L)	0.14	1.42	0.31	1.7	0.1	0.9	1.7	0.61	0.78
Manganese	(mg/L)	0.766	0.844	0.896	0.939	0.766	0.861	0.939	0.01	0.07
Zinc	(mg/L)	<0.005	0.01	<0.005	0.006	0.006	0.008	0.010	0.00	0.00
Iron	(mg/L)	1.55	2.25	1.88	2.78	1.55	2.12	2.78	0.28	0.53

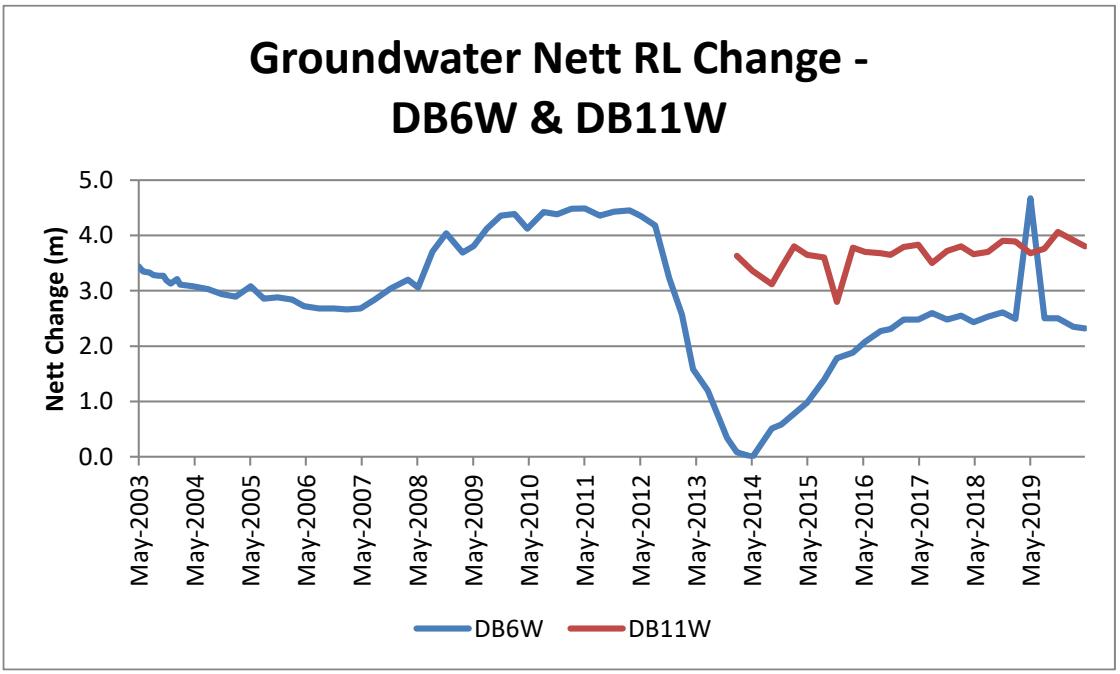
WR2

Note: Installed 3-Sep-13. E - 400990, N - 6426582

Waste Emplacement - East

Parameter	Units	20-Aug-19	22-Nov-19	28-Feb-20	13-May-20	Min	Avg	Max	Variance	Std Dev
Depth to standing WL	(m)	70.81	70.36	71.63	71.62	70.36	71.11	71.63	0.39	0.63
pH		6.81	6.64	6.87	6.98	6.6	6.83	6.98	0.02	0.14
Conductivity @ 25^{o}C	(µS/cm)	6240	5830	5960	6520	5830	6138	6520	94292	307
ORP	(mV)	124	283	281	125	124	203	283	8270	91
Dissolved Oxygen	(%)	20	29	29	22	20	25	29	20	4
TDS	(mg/L)	4420	4660	7110	5580	4420	5443	7110	1485758	1219
Alkalinity as CaCO3	(mg/L)	170	205	219	213	170	202	219	481	22
Acidity as CaCO3	(mg/L)	22	35	12	21	12	23	35	90	9
Sulphate	(mg/L)	1220	979	1130	1260	979	1147	1260	15537	125
Chloride	(mg/L)	1540	1470	1420	1450	1420	1470	1540	2600	51
Calcium	(mg/L)	1000	981	1020	1030	981	1008	1030	474	22
Magnesium	(mg/L)	32	31	31	33	31	32	33	1	1
Sodium	(mg/L)	385	338	366	356	338	361	385	385	20
Aluminium	(mg/L)	0.82	2.57	0.96	10	0.82	3.59	10.00	18.91	4.35
Manganese	(mg/L)	2.57	2.61	2.63	2.65	2.57	2.62	2.65	0.00	0.03
Zinc	(mg/L)	0.066	0.208	0.091	0.181	0.066	0.137	0.208	0.00	0.07
Iron	(mg/L)	4.01	7.61	6.34	21.9	4.01	9.97	21.90	65.53	8.10


Groundwater Nett RL Change - Pit to River
Nett Change (m)
10
9
8
7
6
5
4
3
2
1
0
Oct-2002
Oct-2003
Oct-2004
Oct-2005
Oct-2006
Oct-2007
Oct-2008
Oct-2009
Oct-2010
Oct-2011
Oct-2012
Oct-2013
Oct-2014
Oct-2015
Oct-2016
Oct-2017
Oct-2018
Oct-2019
BH4BW Nett RL Change
DB1W Nett RL Change
DB2W Nett RL Change
DB3W Nett RL Change
DB4W Nett RL Change
DB5W Nett RL Change


Groundwater Nett RL Change -
DB6W & DB11W
Nett Change (m)
5.0
4.0
3.0
2.0
1.0
0.0
May-2003
May-2004
May-2005
May-2006
May-2007
May-2008
May-2009
May-2010
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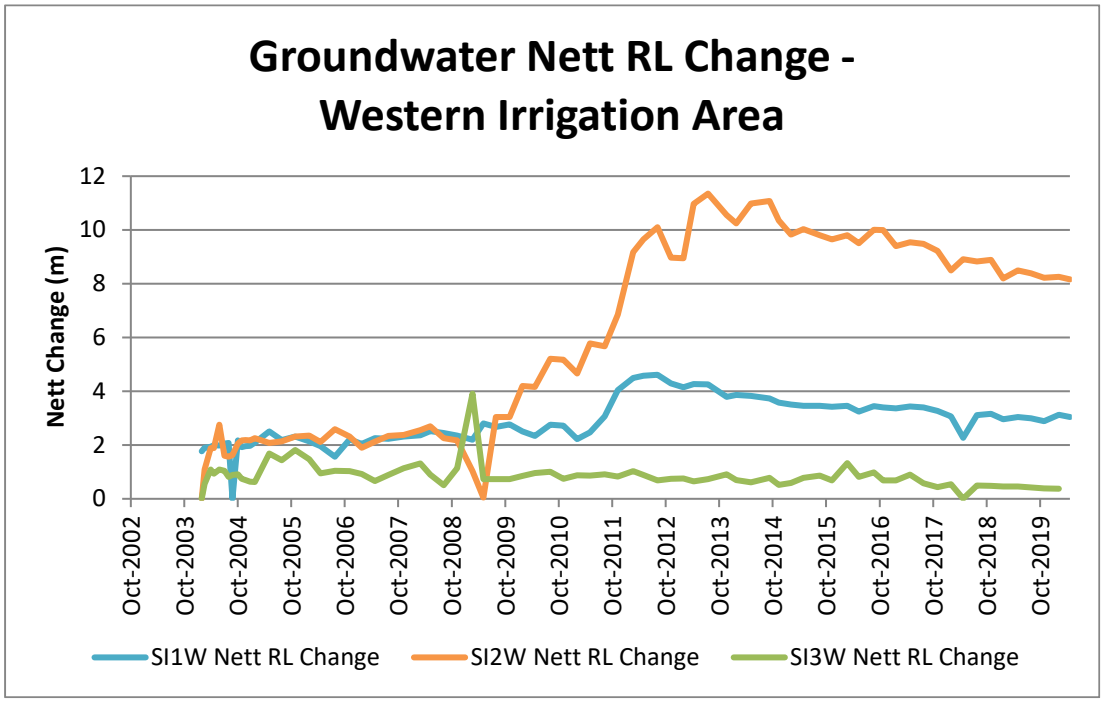
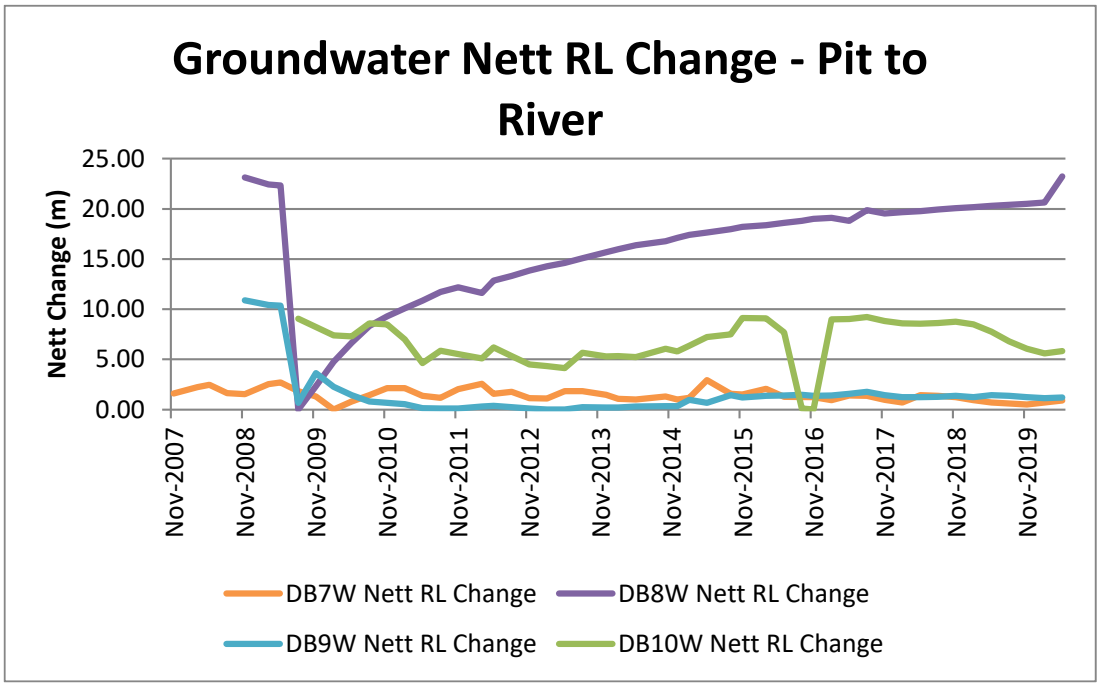
May-2013
May-2014
May-2015
May-2016
May-2017
May-2018
May-2019
DB6W
DB11W


Groundwater Nett RL Change - Western Irrigation Area
Nett Change (m)
12
10
8
6
4
2
0
Oct-2002
Oct-2003
Oct-2004
Oct-2005
Oct-2006
Oct-2007
Oct-2008
Oct-2009
Oct-2010
Oct-2011
Oct-2012
Oct-2013
Oct-2014
Oct-2015
Oct-2016
Oct-2017
Oct-2018
Oct-2019
SI1W Nett RL Change
SI2W Nett RL Change
SI3W Nett RL Change


Groundwater Nett RL Change - Pit to River
Nett Change (m)
25.00
20.00
15.00
10.00
5.00
0.00
Nov-2007
Nov-2008
Nov-2009
Nov-2010
Nov-2011
Nov-2012
Nov-2013
Nov-2014
Nov-2015
Nov-2016
Nov-2017
Nov-2018
Nov-2019
DB7W Nett RL Change
DB8W Nett RL Change
DB9W Nett RL Change
DB10W Nett RL Change

Appendix 5:

Complaints & CCC Annual Report

Duralie Complaint Summary

Period: 12 Months to July 2020

Total No. of Complaints: 0 (0 noise, 0 blasting, 0 air quality (inc. odour), 0 other)

Total No. of Complainants: 0

Date/Time of Complaint	Complainant Location	Method of Complaint	Nature of Complaint	Investigation/Outcome

Duralie Coal Community Consultative Committee Annual Report for Year 2019

Community Consultative Committee Details

CCC / Project Name:	Duralie Coal Mine	**Reporting Period:**	January - December 2019
Independent Chairperson:	**Margaret MacDonald-Hill**	**Proponent Contact:**	**Alarna Bristow**

1 Executive Summary

The Duralie Community Consultative Committee (CCC) was established in 2003 as part of the Duralie Coal Mine Development Consent approval and operates in accordance with the Department of Planning and Environment's 2019 Community Consultative Committee Guidelines for State Significant Projects. The Committee is currently comprised of:

- four local community representatives;
- two - three MidCoast Council representatives (elected and staff);
- two Duralie Coal representatives, with attendance from other personnel as required;
- one independent Chairperson.

As mining operations are now complete at Duralie, in February 2019, the CCC decided to reduce the frequency of its meetings to biannual. Site tours of the mine site and surrounding places of interest still occur each year and at the behest of the committee. Attendance numbers at meetings remain consistent, with occasional apologies because of other commitments. The CCC members share a very strong community interest and their insights and ongoing dialogue to building partnerships and social capital within the local community is a valuable ingredient to a competent committee.

The committee has maintained a specific focus on mine closure planning, land rehabilitation and management and future land use, all off which remain regular agenda items at each meeting. Biodiversity offsets has been raised at meetings during the past year, the mechanisms to provide long term security in accordance with the project's approval and the biodiversity legislation, past and present practices.

Invited speakers for the period included MidCoast Council's Director of Community Spaces and Services, MidCoast Council's Catchment Officer and Yancoal's Business Optimisation Manager on the Duralie Community Enhancement Funding, Karuah Catchment and Landcare Projects and Stratford and Duralie operations, respectively.

Other topics of discussion for the reporting period also included:

- general environmental management & monitoring, including air quality, noise, surface water and groundwater
- Duralie Nest Box program
- water management
- community complaints
- broader community engagement and the CCC's print media articles

- Duralie community enhancement contributions to Council and allocation thereof
- Karuah River Catchment Management
- Biodiversity Offset area
- Yancoal land management
- Yancoal internal environmental assurance audit
- Yancoal community support program
- Agricultural rehabilitation possibilities
- Stratford Extension Project updates and transition from Duralie Mine.

As stated in previous reporting, the committee members are an integral part of the local community and as such, the CCC forum is a good example of an effective committee working together to improve community engagement within the mine's area of operation, between the villages of Stroud Road and Wards River and to achieve beneficial outcomes in the MidCoast Council Local Government Area. Staff of Duralie Coal Pty Ltd provide a high level of information regarding the mine, in advance of each meeting and in response to committee requests.

All members of the committee fulfil their roles with due diligence and the rapport between all stakeholders is self evident and ongoing between and during meetings.

1. CCC activities over last 12 months

- Committee meetings were held in the months of February and August 2019 with the view that this will remain whilst mining operations are scaled down.
- Attendance at meetings is static with mostly a full contingent, excepting apologies due to ill health or unforseen work commitments. Absences are rare as the committee sets its meeting dates at the end of each calendar year for the ensuing year.
- A site visit of the rehabilitation areas was undertaken at the August meeting.
- No joint Committee meetings were held, although the Duralie Committee maintains an interest in Yancoal's sister operation at Stratford. Stratford updates are included on the agenda for each meeting.
- Through aligned networks, the committee is kept informed by Duralie Coal and Midcoast Council of other events occurring in the region throughout the year such as Karuah Catchment Landcare group and Land Service field days.
- Two representatives of the Duralie CCC are members on the Duralie Community Fund Panel under the auspice of MidCoast Council established May 2018.

2. Key issues

The Duralie CCC maintains its interest in the process and distribution of the community enhancement contributions paid to Council each year. MidCoast Council staff address the committee on an annual basis and continue to provide financial reports and updates throughout the year.

During August and as a result of ongoing drought conditions, a request was received from Advance Gloucester, a local grassroots association formed in 2014 to promote and

support activities for the betterment of the Gloucester area and the benefit of the general population. The request was for a controlled release of water from the Stratford East Dam for drought relief to the downstream landholders. This matter was taken up by the Stratford CCC as the dam is located within its jurisdiction. It was subsequently referred to the Government agencies for determination. It prompted a discussion on the need for retaining water management infrastructure such as dams in mine closure planning, the benefits such assets may provide to the region's future use and Duralie Coal's obligations to meet statutory requirements such as dam decommissioning.

Issue	Actions Taken	Next Steps
Stratford Coal Education Program	Actively support ongoing success of Stratford Coal Education Program through CCC networks and media	Ongoing
Yancoal Community Support Programs	Disseminate information through CCC networks and media	Ongoing
Post mining requirements	Planning for post mining landforms	Ongoing interaction through CCC and workshops as required
Request for controlled release of dam water	Noted by CCC. Taken up by Stratford CCC.	Referred to EPA and DPIE with request that holistic strategic planning be given to future water harvesting and potential security of water resources
Duralie Nest Box Program	CCC viewed video on success of the program and dissemination to wider community	Circulated in local newspaper
Request for options on biodiversity security mechanisms	Discussion on Biodiversity Conservation Trust Agreements and Public Positive Covenants (PPC) during CCC meetings	Information supplied to CCC on restrictions on land titles. Confirmed with DPIE PPC are in perpetuity

3. Focus for next 12 months

The planned activities for 2020 will be guided by the contributions of the CCC members. These activities are likely to include:

- continue to investigate potential opportunities to increase agricultural land capability whilst meeting rehabilitation requirements.
- Engage with Yancoal and the broader community on post mining options, including landscape and potential uses of infrastructure and maintaining the committee's presence through local media releases
- further discussion on biodiversity conservation area.

To the best of my knowledge, there are no outstanding or emerging issues that have not been addressed or are in the process of being so, to the committee's satisfaction.

Committee Meeting minutes and presentations are available on the website within two weeks of each meeting.

Signature of Chair:	
Date:	March 6 2020

Appendix 6:

Duralie Coal Mine Annual Biodiversity Report 2020

Duralie Coal Mine Annual Biodiversity Report 2020

FOR THE YEAR ENDING 30 JUNE 2020

CONTENTS

List of Appendices

1 INTRODUCTION

The Duralie Coal Mine (**DCM**), located in the Southern part of the Gloucester Basin NSW, is approximately 30 kilometres south of Gloucester and is owned and operated by Duralie Coal Pty Ltd (**DCPL**), a fully owned subsidiary of Yancoal Australia Limited (**YAL**).

1.1 Scope

In accordance with the Duralie Extension Project, Project Approval 08_0203 (as modified December 2014), the proponent (DCPL) is required in accordance with *Schedule 3, condition 43* to prepare and implement a Biodiversity Management Plan (BMP). This Plan must include a:

> *"a program to monitor and report on the effectiveness of the measures in the Biodiversity Management Plan and conditions 33-43 of this approval, and the performance of the Offset Strategy, with summary reporting to be carried out annually and comprehensive reporting every three years following the independent environmental audit".*

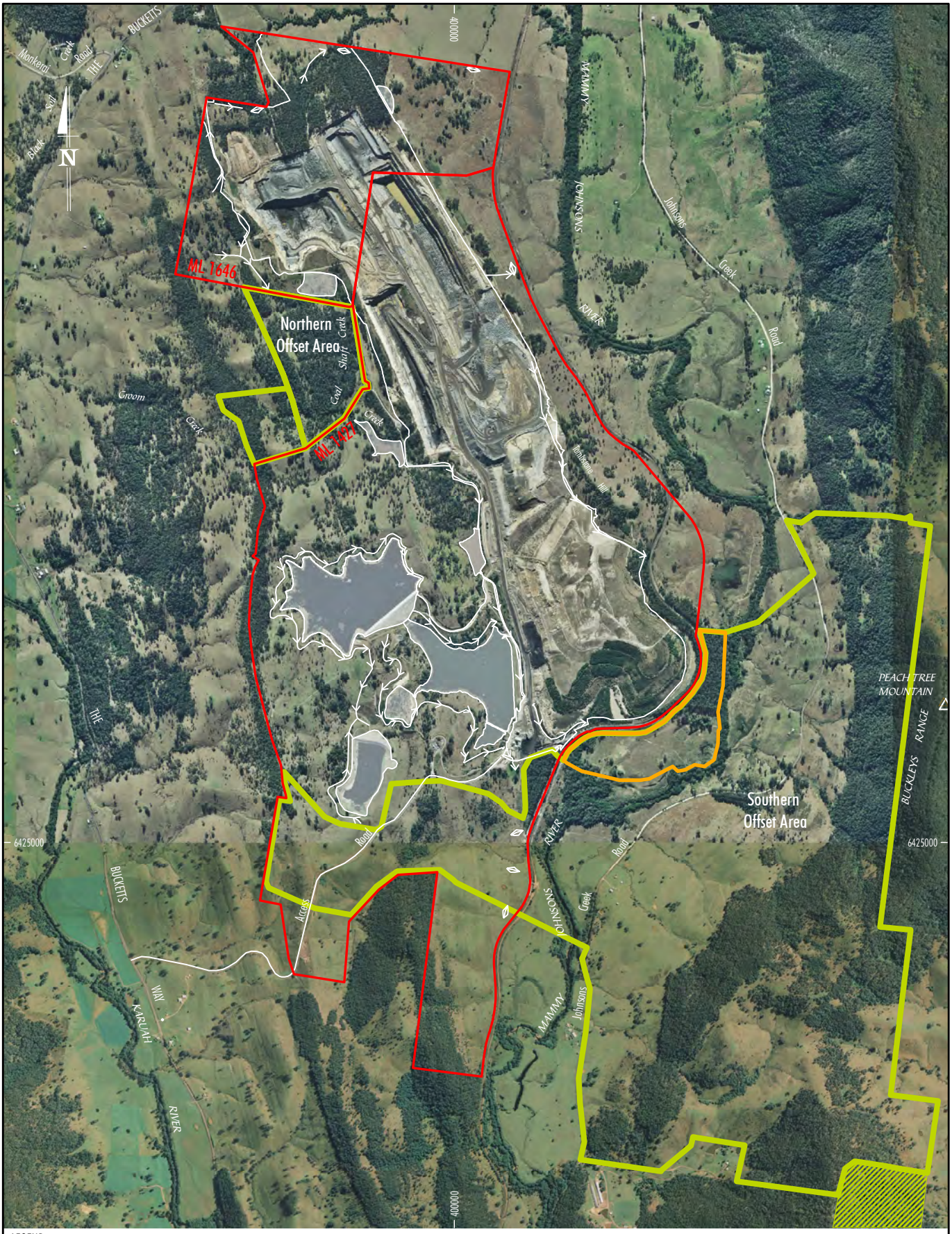
This DCM Annual Biodiversity Report provides a review of the effectiveness of measures in the BMP for the annual year ending 30 June 2020 in accordance with Section 7.2 of the BMP. The scope of the review includes the Mining Lease area ML1427 and ML1646 and Biodiversity Offset areas as indicated on Plan A.

This report (and associated Appendices) is included as an Appendix of the DCM Annual Review which is available on the Duralie Coal website www.duraliecoal.com.au.

During the previous reporting period a revised BMP was submitted to the NSW Department of Planning and Environment (DP&E) and approved on **25 January 2019 (Appendix A).** Following the DCM Independent Environmental Audit undertaken in **December 2017** a revision of the BMP was prepared for the three-year period between August 2018 and July 2021 and includes broader concepts for the longer term (6+ years) management since commencement of the BMP in 2012. The key changes to the BMP include relevant updates to the performance and completion criteria tables with consideration to the works which have been completed to date.

2 STATUS OF BMP PERFORMANCE CRITERIA

Performance criteria as prescribed in the BMP is presented in **Tables 1 to 10**. The performance criteria have been developed to meet the specific objectives for the areas described in Section 2 of the BMP. All performance criteria are linked to the management specifications listed in the BMP Section 5 and Section 6, and monitoring/reporting specifications in the BMP Section 7. The status of BMP performance criteria is provided in the subsequent sections of this report.



LEGEND

- Mining Lease Boundary
- Approximate Extent of Project Major Surface
- Private Land Under Conservation Agreement
- Offset Area
- Bowens Road North Offset Area

0 1000

Metres

GRID DATUM MGA 94 ZONE 56

Source: DCPL (2014); AAHatch - Aerial Photography flown April 2009 and July 2013

BIODIVERSITY MANAGEMENT PLAN

FIGURE 3

Location of the Offset Areas

DURALIECOAL

GCL-10-13 Bio MP 2018_204A

3 VEGETATION CLEARANCE PROTOCOL

3.1 Vegetation Clearance Report

Vegetation clearance is undertaken in accordance with the BMP Section 5.4 Vegetation Clearance Plan. Prior to any clearance operations a Clearing Plan is prepared, and vegetation pre-clearance surveys are undertaken.

Vegetation clearance for the Duralie Extension Project was finalised in 2017. During the 2019/2020 reporting period, no vegetation clearance was undertaken.

The area of disturbance at the end of June 2020 is shown in the DCM Annual Review 2020 Figure 4 (Appendix B).

Information obtained during vegetation clearance activities (i.e. habitat features, hollows cleared and fauna observed) has been used to determine the requirements for nest box replacement in the biodiversity offset areas (refer Section 4).

3.2 Salvaged and Reused Material for Habitat Enhancement

Section 5.8 of the BMP requires salvaged material from vegetation clearance activities to be used for habitat enhancement within the revegetation or rehabilitation areas. Habitat features such as trunks, logs, large rocks, branches, stumps and roots are salvaged and relocated where practicable. As there was no vegetation clearance undertaken during the reporting period, no further habitat materials were salvaged.

During previous reporting periods cleared vegetation was managed as follows:

- Suitable trees and stumps salvaged and stockpiled for reuse.
- Mulched vegetation stored in stockpiles and used on the rehabilitation and incorporated into topsoil.

4 NEST BOX PROGRAM

Nest box management is undertaken in accordance with the BMP Section 6.4. Nest boxes will be installed to provide habitat opportunities in the short to medium-term for a number of arboreal fauna species including the Squirrel Glider.

Table 1: Nest Box Program Performance Criteria (PC) and Completion Criteria (CC)

Management Action	Completed Activities to June 2018	Annually from June 2018 onwards PC Maintenance Phase	Completion Criteria
Nest box strategy including target species, habitat trees/feature, nest box designs maintenance and monitoring	Nest box plan developed following habitat assessment and pre-clearance surveys (Section 5.4).		
Nest box installation Includes installation of 18 Squirrel Glider boxes, however may be expanded as required.	Hollow bearing habitat features (nest boxes) installed (Section 6.4).		Nest boxes installed.

Maintenance and monitoring of installed nest boxes. Including monitoring for European bee invasion and repair/replacement	Monitoring in autumn and spring completed. Maintenance undertaken where required (Sections 6.4 and 7.1).	Annual nest box monitoring and maintenance (Sections 6.4 and 7.1).	Nest boxes monitored and maintained, being replaced where required.

Legend	Not commenced	In progress	Completed

AMBS Ecology & Heritage (AMBS) was commissioned to implement the Nest Box Program as described in the BMP Section 5.4.2 and Section 6.4. The Nest Box Program consists of two main components:

- Replacing 18 boxes specifically targeting the Squirrel Glider; and
- Replacing boxes on a like for like basis for any hollow bearing trees cleared during vegetation clearance operations (refer to Section 3).

The installation of nest boxes has occurred over five periods with the most recent installation in **October 2019**. No further nest box installations were required resulting from vegetation clearance activities. During the reporting period 26 nest boxes were installed in the rehabilitation areas for additional habitat enhancement. A further 9 Feathertail Glider boxes were installed in the offset area to replace the existing unoccupied Feathertail Glider nest boxes with a design that is likely to be more successful within the study area for occupation by fauna. The next monitoring is scheduled for September 2020.

The current program involves:

- 18 nest boxes targeting the Squirrel Glider (*Petaurus norfolcensis*), installed during February 2013;
- 106 nest boxes targeting a variety of hollow-dependent species, installed during August 2013;
- 45 nest boxes targeting a variety of hollow-dependent species, installed during September 2014;
- 42 nest boxes targeting a variety of hollow-dependent species, installed during September 2016.
- 26 nest boxes targeting a variety of hollow-dependent species that were installed in the Rehabilitation Area between 16 October 2019 and 18 October 2019; and
- 9 nest boxes targeting the Feathertail Glider (*Acrobates pygmaeus*) that were installed during September and October 2019.

An annual nest box monitoring report was completed by AMBS in **September 2019** (Appendix C).

The 2018 - 2019 Nest Box Programme for the Duralie Offset Area Report (AMBS June 2019) summarises the work undertaken in relation to the Nest Box Programme for the Duralie Offset Area between October 2018 and September 2019, in accordance with the Duralie Coal Mine Biodiversity Management Plan (BMP). Works undertaken and other milestones that took place during this period included yearly monitoring of 210 nest boxes that have been installed between February 2013 and September 2016. One new Feathertail Glider (hardwood) nest box design was installed in September 2019.

A summary of results from the 2019-2020 report is provided below.

> *"Fifteen species were recorded or shown signs of previous occupation during the current reporting period, including the Squirrel Glider, Sugar Glider, Feathertail Glider, Brush-tailed Phascogale, Brown Antechinus, Common Brushtail Possum, Common Ringtail Possum, Gould's Wattled Bat, Chocolate Wattled Bat, Gould's Long-eared Bat, Australian Wood Duck, Masked Owl, White-throated Treecreeper, Lace Monitor, and an unidentified snake (scat). The record of the Chocolate Wattled Bat is the first for the Nest Box Programme. Species recorded previously but not during the current reporting period include the Bush Rat [probable], Mountain Brushtail Possum, Lesser Long-eared Bat, a Free-tailed Bat, Australian King-Parrot, Australian Owlet Nightjar, Eastern Rosella, Peron's Tree Frog, Common Tree Snake*

and Diamond/Carpet Python). Twenty-four vertebrate species have now been recorded within nest boxes during the Nest Box Programme.

Three of the species recorded utilising the nest boxes are listed as vulnerable under the NSW Biodiversity Conservation Act 2016 (BC Act), the Squirrel Glider, Brush-tailed Phascogale and Masked Owl.

The majority of nest boxes were in good condition, although one nest box required replacing during September 2019, the Rosella nest box at B7. Minor degradation was noted on several other nest boxes, such as peeling or splitting of the plywood, slight warping of the lid, disintegration of the brace plate, chewing of entrance holes, small cracks on the outside of the nest box, and moisture appearing inside the nest box. Eight nest boxes are likely to require replacing during the next monitoring survey.

Signs of the European Honey Bee were recorded at five nest boxes, but no bees were present at the time of the survey. Termite activity was observed at one nest box.

Overall, a total of 186 out of 210 nest boxes, or approximately 88%, have been occupied or shown signs of occupancy since their installation. This includes 100% of the Squirrel Glider nest boxes installed in February 2013, 86% of the additional nest boxes installed in August 2013, 93% of the additional nest boxes installed in September 2014, and 85% of the additional nest boxes installed in September 2016.

Occupancy of nest boxes has generally increased over time until the previous few years when occupation rates have remained relatively constant. However, for some nest boxes there has been a noticeably decrease in occupation during September 2019, which is likely due to record low rainfall and extreme drought conditions. The record low rainfall experienced in the study area would negatively affect local animal populations, in particular reducing abundance and reproductive success, which is likely why we observed fewer signs of animals within nest boxes in September 2019.

There are at least ten microbat nest boxes which have been installed for approximately six years and have not been occupied or shown signs of occupancy. Given other nest boxes with the same design have been occupied in other locations in the offset areas, we recommend relocating these nest boxes in an attempt to increase occupation rates."

Plate 1 - Sugar Gliders (***Petaurus norfolcensis)***

Plate 2 – Masked Owl at B18 nestbox (***Tyto novaehollandiae***)

5 WEED CONTROL AND MONITORING

Weed control is undertaken in accordance with the BMP Section 5.9 and Section 6.5. The weed control program aims to manage weeds to minimise their impact on native flora and fauna.

Table 2: Weed Control Performance Criteria (PC) and Completion Criteria (CC)

Management Action	Completed Activities to June 2018	Annually from June 2018 onwards PC Maintenance Phase	Completion Criteria
Weed Control/treatment program in remnant enhancement and regrowth management VMUs	Primary woody weed control (Sections 5.9 and 6.5). Primary control of priority target weeds described in Sections 5.9 and 6.5 commenced. Follow-up woody and priority weed control undertaken as per Sections 5.9 and 6.5.	Follow-up woody and priority weed control undertaken as per Sections 5.9 and 6.5.	Target/priority weed coverage within offset VMUs reduced by 90%.
Weed control/ management in Installation (revegetation) VMUs	Pre-cultivation spraying in all installation VMUs undertaken including control of exotic Sporobolus and fireweed (Figure 7 and Section 6.11). Second cultivation spray in all installation VMUs undertaken including control of exotic Sporobolus and fireweed where necessary (Section 6.11). Additional pre-planting weed treatment in all installation VMUs undertaken if required (Section 6.11). Control of competitive plants within revegetation areas as detailed in Section 6.11.	Additional pre-planting weed treatment in all installation VMUs undertaken if required (Section 6.11). Control of competitive plants within revegetation areas as detailed in Section 6.11.	Control of competitive plants within revegetation areas until maintenance phase (detailed in Section 6.11) is complete i.e. 90% of canopy and shrub species have survived 12 months after planting including replanting of lost species.
Monitoring and reporting	Monitoring and documentation of weed species, occurrence and densities a per Section 7.1.	Monitoring and documentation of weed species, occurrence and densities as per Section 7.1.	Monitoring and reporting undertaken.

The general procedure for controlling weed involves:

- Monitoring to identify locations and densities of priority weed;
- Identification of suitable control measures;
- Implementation of the selected control measure by a suitable qualified person; and
- Follow-up inspections to evaluate effective of weed control.

Weed spraying activities are generally undertaken between the months of September and April each year. Physical management measures such as mechanical removal, slashing and/or back-burning can be undertaken at other times of the year as required.

Greening Australia were contracted to undertake an initial weed assessment of the offset area in August 2013. The aim of the weed assessment was to assist in setting priorities and developing on-ground actions for weed control and is presented in the form of a mapping survey. The mapping survey provides reference to individual weed infestations within each Vegetation Management Unit (**VMU**) for the biodiversity offset area. Each weed occurrence was allocated a priority ranking based on the species status i.e. noxious or agricultural, and the size and density of the infestation. The survey information contributed to the development of a strategic approach to the control of priority weeds and allow contractors to locate

infestations using the mapping files. Additionally, it will continue to assist in tracking weeds to gauge the effectiveness of control measures and the potential spread and future distribution.

A contractor is engaged at the DCM to undertake weed management activities on an ongoing basis. Follow-up weed treatment of all remnant enhancement and regrowth management VMUs recommenced in **October 2019** and continued through to **April 2020**. The key species targeted included blackberry, lantana, privet, wild tobacco and Giant Parramatta grass.

Weeds monitoring to evaluate the effectiveness of control measures is undertaken in conjunction with the annual vegetation monitoring and is documented in the *Duralie Coal Mine Biodiversity Offsets Monitoring Report 2020* (Appendix F).

The 2020 monitoring report indicates that:

> *Woody weeds were observed and recorded throughout the offset area. Non-fire affected VMUs recorded large brambles of blackberry, and in the alluvial flat VMUs (VMU AD, F, S and Y), privet and wild tobacco were also observed. In the fire affected VMUs, blackberry was observed to be re-growing from rootstock, while the dense lantana thickets that were encountered in previous surveys were burned away and were not observed to be re-growing. However, blackberry, lantana and wild tobacco were still common in the gullies.*
>
> *Recommendation:*
> - *Targeted weed control in the remnant patches to prevent damage to the re-establishing native vegetation, with more widespread control works elsewhere.*

6 FERAL ANIMAL CONTROL AND MONITORING

Feral animal control is undertaken in accordance with the BMP Section 5.10 and Section 6.5. The objective of feral animal control program is to manage feral animals to minimise their impact on native flora and fauna in the Biodiversity Offset Areas or the impact on agricultural production in other surrounding areas.

Table 3: Feral Animal Management Performance Criteria (PC) and Completion Criteria (CC)

Management Action	Completed Activities to June 2018	Annually from June 2018 onwards PC Maintenance Phase	Completion Criteria
Feral animal control program	Initial study undertaken.	Feral animal control as required.	Feral animal numbers within offset areas minimised as evidenced through monitoring data.
Monitoring and reporting	Monitoring and documentation of feral animal species undertaken.	Monitoring undertaken.	-

AMBS was commissioned to undertake the initial invasive animal survey, in accordance with Section 5.10 of the BMP in 2013. The objective of the study was to determine the range of invasive animals that occur or are likely to occur within the DCM and offset areas and provide recommendations for invasive animal control.

MDP Vertebrate Pest Management has been engaged by DCPL since 2016 to implement feral animal control programs across property owned by DCPL including both the Stratford & Duralie Mining Leases and the Stratford & Duralie Biodiversity Offset Areas. During the reporting period wild dog and fox control was undertaken between **October 2019** to

November 2019 and **March 2020** to **April 2020**. The program involved a combination of trapping and shooting. The programs were productive with a total of 15 wild dogs and 7 foxes trapped and shot over the control programs.

Plate 3 – Wild Dog

Plate 4 – Wild Dog

In accordance with the BMP Section 5.10 a follow-up feral animal monitoring survey was undertaken by AMBS Ecology & Heritage during **April 2017** to monitor the success of control programs and determine priorities for ongoing control measures. The feral animal survey covered the Duralie Mining Lease and Duralie Biodiversity Offset Area.

An extracted summary of the survey results from the *Invasive animal study of the Duralie Coal Mining Lease and Offset areas, Gloucester Valley* (September 2017) is provided below (Appendix D).

> *The results of the current invasive animal survey were similar to those from the initial invasive animal survey in 2013. A total of 14 invasive species have been recorded in the study area in the past or during recent surveys or are considered to have potential to occur. Eleven of these species were either not recorded or were recorded in very low numbers during the current surveys and are of little concern at the current time. These include the Common Starling, House Sparrow, Mallard, Rock Dove, Spotted Turtle-Dove, House Mouse, Black Rat, Brown Hare and Deer. In accordance with the BMP the abundance of these species should be monitored every two years to determine if future controls are necessary.*
>
> *Four species of invasive animal were repeatedly recorded in the study area and are a potential threat to native biodiversity. These are the Fox, Feral Cat, Rabbit and the Common Myna. Wild Dogs were also recorded in the study area. Wild Dogs are mostly seen as an agricultural threat, preying on sheep, calves and other livestock (Fleming et al. 2001). They are not generally considered to have severe negative impacts on biodiversity, although this topic has not been well studied.*
>
> *In summary:*
> *• Foxes and Feral Cats may represent a threat to biodiversity within the study area;*
> *• Wild Dogs are present in the study area, and while they may or may not be a threat to biodiversity, are currently a declared pest species;*
> *• The European Rabbit is present at low densities, but its abundance can increase rapidly, particularly if dog, fox and cat numbers decrease, and it is also a declared pest species;*
> *• The abundances of all of the above species within the study area are likely to be inter-related.*

It is therefore recommended that if control measures for Wild Dogs and/or European Rabbits are implemented in order to comply with the Pest Control Order, that any such control measures should be implemented together with control measures for Foxes and Feral Cats, in a co-ordinated manner, and the impacts monitored. Pest control in the study area should be considered in the context that the study area represents a small part of a much broader region. Pest control in the study area alone is likely to be of only temporary and limited benefit, unless carried out in a broader area in conjunction with other landholders, and carried out over the medium to long term.

A feral animal survey of the Duralie Mining Lease and Duralie Biodiversity Offset Area will be undertaken again during the next reporting period. Feral animal monitoring will guide the ongoing management efforts for controlling feral animals.

7 CONTROLLING ACCESS AND MANAGING GRAZING

Controlling access and managing grazing is undertaken in accordance with the BMP Section 5.11, 6.6 and 6.7.

Table 4: Managing Grazing and Agriculture Performance Criteria (PC) and Completion Criteria (CC)

Management Action	Completed Activities to June 2018	Annually from June 2018 onwards PC Maintenance Phase	Completion Criteria
Managing grazing and agriculture	Livestock excluded from the Offset through installation of gates and fencing illustrated in Figure 9 (Section 6.7).		Livestock excluded from the offset.
Monitoring and maintenance of fencing and gate infrastructure	Monitoring of gates and fencing to exclude livestock. Where required, maintenance undertaken and documented (Section 7.1).	Monitoring of gates and fencing to exclude livestock. Where required, maintenance undertaken and documented (Section 7.1).	Gates and fencing monitored and maintained.

Table 5: Controlling Access Performance Criteria (PC) and Completion Criteria (CC)

Management Action	Completed Activities to June 2018	Annually from June 2018 onwards PC Maintenance Phase	CC
Operational Review to facilitate site access for offset management activities including installation, inspection and bushfire management	Operational Review developed. Review includes road, fire trail and culvert construction and requirements for fencing and revegetation cultivation/site preparation[2]. Maintenance activities, particularly track maintenance and slashing have been considered (Section 6.7, plus related Sections 6.9 and 6.5).		Operational Review undertaken and outcomes implemented.
Community and stakeholder engagement	Assessment of surrounding landholders and the local community to evaluate opportunities for participation in implementation of this Biodiversity Management Plan undertaken. Local council consultation has commenced regarding placement of signage on the Johnson's Creek Road bisect area of the Offset (see Figure 9 for location) (Section 6.7). Signage has been installed on the Johnson's Creek Road bisect area of the Offset to alert drivers of potential fauna on the roads.		Opportunities for landholder and community participation in the BMP identified. Local council consulting regarding signage. Signage installed on Johnsons Creek Road.
Infrastructure including access tracks, fencing, fire trails and culverts	Access tracks, fire trails, firebreaks, fencing and culverts have been completed as per Figure 9 and the Operational Review[2] (Section 6.7).		Access related infrastructure identified in the Operational Review and completed.

Management Action	Completed Activities to June 2018	Annually from June 2018 onwards PC Maintenance Phase	CC
Monitoring and maintenance of infrastructure including tracks, fire trails, signs, culverts and fences.	Monitoring and maintenance of all access tracks and fire trails has been undertaken[2] (Sections 6.7, 6.9 and 7.1).	Monitoring and maintenance of all access tracks, fire trails and warning signs has been undertaken[2] (Sections 6.7, 6.9 and 7.1).	Regular monitoring and maintenance program for roads, tracks, fire trails, signs, fences and culverts.

The implementation of the BMP management measures commenced in 2013. The BMP requires works to be undertaken to exclude livestock and control access to the Biodiversity Offset Areas.

Installation works to control access and manage grazing in the offset areas was completed in 2014. During the reporting period contractors were engaged to undertake maintenance activities on access tracks, culverts, gates and fences. The works included slashing of tracks, firebreaks and repairs to damaged gates and culverts. Additional signage was also installed on the key access points to the Biodiversity Offset Areas.

The *Duralie Coal Mine Biodiversity Offsets Monitoring Report 2020* (Appendix F) found some internal fencing was damaged at several locations in the fire affected VMUs, either directly or by falling trees and branches. In the non-fire affected VMUS, fencing was generally in good condition. There were no signs of livestock at the time of the survey, however there was some evidence of previous access by cattle in several areas.

Livestock continue to be excluded from the Biodiversity Offset areas with the exception of 'crash grazing' programs in preparation for revegetation activities following a field assessment by a qualified consultant. However, during inspections of the Biodiversity Offset area, cattle were identified to have entered through damaged fencing on the eastern and northern boundaries. The cattle were removed and maintenance work was undertaken to repair the fencing.

Roadside Flora and Fauna signage has been installed in accordance with advice from Great Lakes Council and with regard to Australian Standard AS1742.2. Further correspondence was held with GLC Ecologist in 2015 regarding future requirements for traffic controls within the offset areas.

Plate 5 – Biodiversity Offset fencing and signage

8 BUSHFIRE MANAGEMENT

Bushfire management is undertaken in accordance with the BMP Section 5.12 and Section 6.9. The objective of bushfire management in the Biodiversity Areas is to prevent impacts from unplanned bushfire and to use fire to promote biodiversity.

Table 6: Bushfire Management Performance Criteria (PC) and Completion Criteria (CC)

Management Action	Completed Activities to June 2018	Annually from June 2018 onwards PC Maintenance Phase	Completion Criteria
Operational Review to facilitate site access for offset management activities including installation, inspection and bushfire management.	Operational Review completed[2]. Areas addressed within the review include road, fire trail and culvert construction along with maintenance activities, particularly track slashing (Sections 5.12 and 6.7).		
Fire excluded from the offset for initial 3 years.	Fire excluded from offset prior to 2015 (Section 6.9).		Fire excluded from offset prior to 2015.
Bushfire management activities through hazard reduction actions installation and maintenance of relevant access infrastructure.	Access tracks, fire trails, firebreaks, fencing and culverts have been completed as per Figure 9 and the Operational Review 2 (Sections 6.7 and 6.9Fire management activities have been undertaken as required, including yearly access trail inspection, maintenance and repair of inaccessible tracks within one month of identification2, hazard reduction burning (Sections 5.12, 6.7 and 6.9).	Fire management activities have been undertaken as required, including yearly access trail inspection, maintenance and repair of inaccessible tracks within one month of identification2, hazard reduction burning (Sections 5.12, 6.7 and 6.9).	Regular bushfire management measures in place.
Monitoring and maintenance	Fuel loads monitored and documented (Sections 6.9 and 7.1). Identified issues incorporated into future management planning	Fuel loads monitored and documented (Sections 6.9 and 7.1). Identified issues incorporated into future management planning.	Fuel loads monitored and maintained. Risks identified and managed as part of part of hazard reduction actions.

Where possible, fire was excluded from the Biodiversity Offset area during the first three years (up to 2015) to assist with native regeneration. To assist with bushfire management, access tracks and firebreaks have been constructed and maintained as shown in the BMP Figure 9.

Hazard reduction burning has been undertaken in consultation with the RFS. Continued discussions have been held with the RFS to conduct fire management activities and any such activities will be assessed and implemented to ensure the most appropriate period for ecological burn activities whilst also giving due consideration to personnel and asset safety. Following the revegetation works, the aim is to exclude fire from the offsets areas for at least 5 years to allow for tubestock and seedlings to establish.

Monitoring of fuel loads to evaluate bushfire risk and guide bushfire hazard reduction activities is undertaken in conjunction with the annual vegetation monitoring. Further detail is included in Section 10 and Appendix F. Bushfire risk will continue to be mitigated through the maintenance of access tracks and fire breaks.

The DCM Offset Area was affected by an unplanned bushfire in November 2019 named the Buckley's Range Fire by the NSW RFS. A report has been prepared by Kleinfelder to document the bush fire event and the effect(s) on the Offset Area in compliance with the BMP monitoring and assessment requirements (Kleinfelder, 2020) (Appendix G).

An extracted summary of the survey results from the *Duralie Coal Buckley's Range Bushfire Impact Report 2020* is provided below (Appendix G).

> *Evidence of the effect of the fire on the conservation and ecological value of the Offsets Areas and any management actions to mitigate these were assessed as part of the survey.*
>
> *Fire intensity varied during the Buckley's Range Fire due to several factors including topography, weather conditions over the duration of the fire (10 days total), differences in fuel load and vegetation type and backburning operations. The most intense areas of the fire were generally along the north-south ridgeline and adjacent slopes.*
>
> *Fire interval is a key determinant of the ecological damage/change that fire imposes on vegetation communities. Comparison of the recommended fire intervals for the vegetation communities to the fire history of the Offsets Areas showed that with only eight years since the previous fire, the fire interval is just within the lower frequency for the drier woodland communities but too frequent for the wetter communities.*
>
> *The overall ecological impact assessment of the fire anticipates that areas of low intensity burn will regenerate adequately, while the high intensity burn areas may have been adversely affected with a possible loss of biodiversity. Although it is too early to determine this, certainly the loss of litter, groundcover and the hypothesised loss of soil seed bank may at the very least slow recovery in these areas. The loss of larger trees in the wooded and the grassland areas may result in a longer-term impacts as they provide seed sources (especially in the grassland areas) and habitat for arboreal fauna.*
>
> *Damage to infrastructure from the fires was fortunately limited. Fences were the main casualty with boundary fences destroyed, requiring repair and replacement to prevent unauthorised access. As a result of these fence losses, cattle have encroached into the Offsets Areas and will prove difficult to remove. Internal fences were extensively damaged and present a hazard to personnel and fauna and require removal.*
>
> *Recommendations include future fire suppression in the offset area, fence removal and repair, clearing tracks, follow-up weeds control and ongoing monitoring.*

Plate 6 –Photograph showing the intensity of the fire at the southern offset (15th November)

Plate 7 – looking upslope showing Blady Grass regrowth

9 REVEGETATION MANAGEMENT

9.1 Seed Collection and Propagation

Seed collection and propagation is undertaken in accordance with the BMP Section 5.7 and 6.10.

Table 7: Seed Collection and Tubestock Supply Performance Criteria (PC) and Completion Criteria (CC)

Management Action	Completed Activities to June 2018	Annually from June 2018 onwards PC Maintenance Phase	CC
Collecting and propagating seed	Seed collection (of required species as specified in Section 6.10 and Appendix D) has commenced during vegetation clearance or an alternate seed source has been obtained. (Sections 5.7 and 6.10). Seed collection from cleared vegetation finalised (Section 5.7). Seed collection to obtain required quantities and species for future revegetation continued (Section 6.10, Appendix D).		Seed collection necessary to obtain required quantities and species for future revegetation completed.
Plant propagation/ tubestock supply	Propagation of species required for revegetation work in Offsets commenced. Species and quantity as per guidelines in Section 5.7, 6.10 and Appendix D or adjusted based on additional literature/field trial results.	Propagation of species required for revegetation/supplementary infill planting work in Offsets undertaken as per guidelines in Sections 5.7 and 6.10 and Appendix D.	Plant propagation necessary to obtain quantities and species required for revegetation completed.

Revegetation in the BMP Revegetation Areas has occurred via seed and tubestock. Local endemic species are preferentially used where a seed supply is available, however consideration will be given to the use of a high quality seed sourced further from the site as required.

Where possible, seed required for revegetation activities has been collected from within the Biodiversity Offset area and surrounds. Specific tree and shrub species which have not been available for collection have been sourced through external third-party suppliers. Further seed collection may be undertaken if found necessary to meet the completion criteria of the BMP offset revegetation and mine site rehabilitation.

Kleinfelder along with several nurseries have been engaged to assist in the propagation of native plant species with tube-stock grown under controlled nursery conditions and delivered to site as required for revegetation works.

9.2 Revegetation and Regeneration

Revegetation management is undertaken in accordance with the BMP Section 6.11 and 6.12. The aim of revegetation is to establish a range of habitat niches including native canopy, and understorey, with the goal of achieving self-sustaining vegetation communities as well as increasing the resilience to identified risks such as fire, herbivory and future weed invasion. The Revegetation VMUs in the Biodiversity Areas will be revegetated to substantially increase the area of native vegetation and maximise habitat diversity and a range of successional stages.

Table 8: Revegetation Performance Criteria (PC) and Completion Criteria (CC)

Management Action	Completed Activities to June 2018	Annually from June 2018 onwards PC Maintenance Phase	Completion Criteria
Operational Review	Operational review including access, tracks and cultivation requirements for implementing revegetation completed (Section 6.7).		Operational Review completed and implemented.
Implementing Revegetation - Weed management and maintenance	Pre-cultivation spraying in all installation VMUs including control of exotic Sporobolus and fireweed undertaken (Sections 6.5 and 6.11). Pre-plant weed treatment in all installation VMUs as per Figure 7 undertaken as required (Sections 6.5 and 6.11). Control of competitive plants within revegetation areas as detailed in Section 6.11. Maintenance including watering and herbivory controls, undertaken as required (Section 6.11).	Pre-plant weed treatment in all installation VMUs as per Figure 7 undertaken as required (Sections 6.5 and 6.11). Control of competitive plants within revegetation areas as detailed in Section 6.11. Maintenance including watering and herbivory controls, undertaken as required (Section 6.11).	Pre-planting weed control undertaken, including control of threatening weeds Sporobolus and Fireweed. Competitive plants controlled during revegetation establishment.
Implementing revegetation	Initial cultivation of all proposed trial installation VMUs commenced (Vegetation Management Units I, S, U and AB.) according to guidelines in Section 6.11. Trial revegetation for VMUs I, S, U and AB completed. Plant palettes adjusted where field trails or research demonstrate alternative species/density (Section 6.10). Propagation of species required for revegetation work in Offsets commenced. Species and quantity as per guidelines in Sections 5.7 and 6.10 and Appendix D.	Revegetation planting finalised. All plants prescribed in Appendix D have been installed. (Section 6.11). Based on learnings from the revegetation trials, planting of tubestock/direct seeding in installation VMUs according to species palette and quantity guidelines in Appendix D and Section 6.1 has been completed	Species type and quantities planted according to threshold guidelines in the species palette or as guided by on site trials. 90% survival of canopy and shrub-layer plants 12 months after installation, including replacement of lost plants to above threshold levels. Revegetation areas have met Assessment Criteria and Completion criteria described in Table 24, Section 8 (e.g. 90% of all initial canopy species rates are present within VMUs).
Monitoring and reporting	Monitoring and reporting of trial revegetation results, changes to plant palette, plant health, establishment success and maintenance activities. (Section 7.1).	Monitoring and reporting of trial revegetation results, changes to plant palette, plant health, establishment success and maintenance activities. (Section 7.1).	Annual Monitoring and reporting completed.

Revegetation Preparation & Trials

Pre-cultivation weed spraying was undertaken in Summer to Autumn 2016 in preparation for the trial revegetation works. Initial revegetation works for VMUs I, S and U commenced in Autumn of 2016. Preparation works were completed including seed collection, inoculation, growing of tube-stock and ground preparations including weed spraying. The trial revegetation program included methods involving both tube-stocking, and direct seeding. Ground preparation was site specific and included weed spraying, crash grazing and back burning as required.

Revegetation works in VMUs AF, AE, AA and Z were undertaken during **December 2016** and included ground preparation and direct seeding of approximately 80 hectares. Due to the inability to undertake controlled burning, slashing was undertaken as an alternative option prior to direct and broadcast seeding.

Plate 8 - Loading seed for revegetation works.

Plate 9 - Spreading native tree and shrub seed.

Revegetation Implementation

Tubestock was propagated during Summer 2016/2017 in preparation for Autumn planting in 2017. VMUs Y, AD and S, (approximately 40 hectares), located on alluvial flats near Mammy Johnsons River were prepared for planting by slashing, spraying for weeds and ripping. This was followed by the planting of approximately 7,200 tube-stock in **April 2017**. The results of the 2017 re-vegetation activities are reported in the *DCM Biodiversity Offsets Revegetation Program Report Spring 2016 - Autumn 2017*.

Following the hazard reduction burning in **August 2017**, revegetation works in VMUs Z, AB and AC were undertaken. In **September 2017**, direct seeding of approximately 52 hectares was completed, followed by harrowing.

Plate 10: Tube-stock being prepared for the biodiversity offset.

Plate 11: Planted tube-stock.

Tube-stock planting of VMUs F, V, W and X was proposed for Autumn 2018 including approximately 16,000 plants over 61 hectares. The native tree seed was propagated over the Summer of 2017/2018 by Cumberland Plain Seeds. However, due to the slower than expected establishment of the tubestock, planting was postponed during winter and completed in **September 2018**. The results of the 2018 re-vegetation activities are reported in the *DCM Biodiversity Offsets Results of Spring 2018 Planting Report*.

Plate 12: ***Tubestock planted in September 2018.***

Plate 13: ***Tubestock planted in September 2018.***

During Spring 2019 tubestock was propagated in preparation for further revegetation works in Autumn 2020 to reach the required woodland density and species diversity in VMUs F, V, W, X, AA and AH. Plans showing the area proposed for revegetation in the Biodiversity Areas in 2020 are included in Appendix E. The results of the 2020 re-vegetation activities are reported in the *DCM Biodiversity Offsets Planting Program Report Autumn 2020*.

The Duralie Offsets planting involved in-fill planting and new planting areas totaling 55.8ha in three vegetation communities. VMUs F and W were planted with species characteristic of the Rough-barked Apple – Red Gum grassy woodland on floodplain (Cabbage Gum variant). A total of 2,370 tubestock were installed into VMU F and W. VMU AH was planted with species characteristic of the Forest Red Gum – Grey Ironbark – Thick-leaved Mahogany Forest community. In total 5, 810 tubestock were installed into this VMU AH. Species characteristic of the Spotted Gum – Grey Ironbark Forest (Spotted Gum Variant) were installed into a total of 18.3h in VMUs – VMU AA, VMU V and VMU X). In total 6, 621 tubestock were installed in these areas. Overall, this year's planting program was deemed to be very successful. Survival is expected to very good with excellent rainfall experienced before and during planting.

Plate 14: ***Tubestock planting in VMU V in Mar 2020.***

Plate 15: ***Tubestock preparation in 2020.***

A revegetation program for 2021 is being prepared to continue to progress towards the biodiversity offset completion criteria.

Monitoring

Following the initial re-vegetation works in 2015, annual vegetation monitoring (including LFA and vegetation dynamics) was undertaken in **January 2017** and continues to be undertaken annually. The results from the biodiversity offset monitoring are shown in Section 10. Results from the annual monitoring will be used to measure revegetation against the performance criteria and completion criteria and to determine future works requirements and maintenance activities.

10 BIODIVERSITY OFFSET MONITORING AND REPORTING

The Biodiversity Offset monitoring and reporting program is prescribed in the BMP Section 7. The program aims to monitor and report on the effectiveness of the BMP management measures and progress against the detailed performance and completion criteria.

Table 9: Monitoring and Reporting Performance Criteria (PC) and Completion Criteria (CC)

Management Action	Completed Activities to June 2018	Annually from June 2018 onwards PC Maintenance Phase	CC
Monitoring and reporting	Monitoring and reporting has been undertaken[3] as per requirements in Sections 7.1 and 7.2. Independent Environmental Audit has been supplied to the NSW Secretary of the DP&E for review.	Monitoring and reporting has been undertaken[3] as per requirements in Sections 7.1 and 7.2.	Monitoring requirements completed when all completion criteria are achieved in accordance with Section 8 (e.g. 357.5 ha of revegetated woodland/open woodland habitat areas and 36 ha of revegetated forest habitat areas are a self-sustaining ecosystem).

As described in the Section 7 of the BMP an annual report reviewing DCPL's environmental performance and progress against the requirements of the BMP including monitoring and reporting is prepared annually and appended to the *Duralie Coal Mine Annual Review*. The Annual Biodiversity Report, reports on monitoring for:

- Effectiveness of revegetation in the offset area;
- Usage of the offset areas by fauna;
- Effectiveness of weed control;
- Effectiveness of feral animal control;
- Nest box monitoring program.

10.1 Habitat and Vegetation Condition Monitoring

Habitat and vegetation condition monitoring is undertaken to quantitatively measure the change in habitat and vegetation condition over time. The visual monitoring and photo monitoring programs are undertaken concurrently with the vegetation monitoring to provide additional information on the change of the Biodiversity Offset Areas over time and inform maintenance requirements.

To monitor the effectiveness of revegetation in the Biodiversity Offset Areas, Greening Australia was commissioned to undertake the baseline monitoring of LFA and vegetation structure within the Biodiversity Offset areas in **February 2013**. The baseline monitoring provides information to track the progression towards meeting the completion criteria of the BMP.

The annual vegetation and landscape function monitoring continues to be undertaken and was repeated in **February 2019.** The results are provided in the *DCM Biodiversity Offset Monitoring Report 2020* (Appendix F). An extracted summary is reproduced below. The next round of monitoring is scheduled for 2021.

> *In accordance with Section 7 of the Duralie Coal Mine – Biodiversity Management Plan (2018), monitoring and assessment of the effectiveness of the Offset Area revegetation is required. This assessment will be conducted using the stipulated methodologies (Section 7.1 of the BMP) which includes both components of Ecosystem Functional Analysis (EFA), Landscape Functional Analysis (LFA) and Vegetation Dynamics to measure the progression of the*

rehabilitation towards a self-sustaining ecosystem, floristic surveys and walkover surveys to assess the effectiveness of the revegetation efforts and weed control.

This report presents the results of the monitoring undertaken in February 2020. A subset of Vegetation Management Unit (VMU) transects were selected, which were established in the 2013 baseline survey. A total of 15 VMUs were monitored in the Offset Areas – 14 Installation VMUs (where active planting and seeding is required) and one regrowth management VMU (weed and erosion control only)(Table 1). These 14 VMUs had been the subject of active management where biomass reduction through slashing, grazing or ecological burns followed by planting and/or seeding had occurred, whereas the remaining VMU has been the subject of weed control works.

A significant bushfire event affected the Duralie Biodiversity Offset area during November 2019. The Buckley's Range Bushfire in November 2019 divides the survey result into eight fire affected VMUs (all were located east of Johnson's Creek Rd) six of which were installation VMUs and VMU P (regrowth management). The remaining seven VMUs were not affected by the fire.

LFA results for the fire affected VMUs show that for all but two of the VMUs, indices were lower than the previous survey in 2019 and in most cases were below the 2013 and 2014 survey results. The exceptions were VMUs AB and Z which had been subjected to ecological burns instigated by Duralie Coal and supervised by the Rural Fire Service (RFS) in 2017. The major effect of the bushfire was attributed to the loss of litter, which is a key component of all indices. Of the non-fire affected VMUs, all but one recorded increase in the LFA indices with all indices at or above the previous survey results. VMU W was an exception with decreases in all indices attributed to transect location with the combined effects of vehicular traffic and cattle incursion serving to increase compaction and decrease litter build up.

The previous survey resulted in vegetation dynamics being surveyed on nine of the VMUs. This year vegetation dynamics could only be conducted on seven VMUs (six installation VMUs plus VMU P). Cattle incursion on VMU F had resulted in loss of planted tubestock, while VMU I had suffered loss of woody vegetation due to the fire. Vegetation structure in the installation VMUs shows further planting is required with results showing that the while canopy species have survived, there were few planted midstorey and almost no shrub species recorded. Only VMU U has nearly achieved the required canopy density (80 stems per hectare), achieving a calculated 75 stems per hectare. The remaining installation VMUs where tubestock planting had been undertaken recorded between 34 stems/ha (VMU Y) and a low of 6 stems/ha (VMU AD). It is suggested that these numbers are below actual numbers given that during walkover surveys smaller individuals were often observed to be below the prevalent exotic shrubby vegetation and with further time, will be able to located and measured during the surveys. VMU P recorded a small decrease in stem density with a loss of some shrubs due to the fire, although this is seen as a temporary result.

Installation VMUs where slashing and seeding had been the method of revegetation were also the main fire affected VMUs. In these VMUs, the fire provided mixed results. Remnant vegetation was adversely affected in places with some paddock trees lost and many saplings and shrubs destroyed, especially in the southern sections of the offset areas where the fire was most intense e.g. VMU AF. However, in other areas of the offset areas the fire has stimulated the germination of seedlings e.g. VMU AE, Z and I. Natural regeneration was recorded in those VMUs where remnant vegetation remains as isolated stands (e.g. VMU U), in gullies (e.g. VMU AB) or is located adjacent to the VMU (e.g. VMU Y).

Woody weeds were observed and recorded throughout the offset area. Non-fire affected VMUs recorded large brambles of blackberry, and in the alluvial flat VMUs (VMU AD, F, S and Y), privet and wild tobacco were also observed. In the fire affected VMUs, blackberry was observed to be re-growing from rootstock, while the dense lantana thickets that were encountered in previous surveys were burned away and were not observed to be re-growing. However, blackberry, lantana and wild tobacco were still common in the gullies.

Other observations were limited to damage to internal fencing in the fire affected VMUs, either directly by the fire itself or through fallen trees. Erosion was limited to some notching in the ephemeral gully lines considered to be natural features that will stabilise, with a potentially more serious observation of tunnelling in VMU U.

Recommendations made included:

- *In-fill planting to increase biodiversity, designed to complement the survival in that VMU – e.g. more shrubs in VMU U and more canopy in VMU Z.*
- *But where the VMU requires biomass reduction to enable this to occur e.g. VMUs AD, S and Y, allow another season or two for smaller canopy to grow above the surrounding woody exotic vegetation.*
- *Cool season ecological burns in the non-fire affected VMUs around the remnant vegetation patches to stimulate the germination of native species' seeds in the soil seed bank and facilitate outward colonisation. Manual control of biomass around existing shrubs and saplings may be require facilitating their survival.*
- *Targeted weed control in the remnant patches to prevent damage to the re-establishing native vegetation, with more widespread control works elsewhere.*
- *Relocation of the transect in VMU U, W and Y to locations more representative of the revegetation effort.*

10.2 Fauna Monitoring

Monitoring of fauna usage within the Biodiversity Areas is conducted every three years to document the fauna species response to improvement in vegetation and habitat in the Biodiversity Areas and assess the performance in providing habitat for a range of vertebrate fauna. The surveys include an assessment of habitat complexity, species richness and abundance.

AMBS was engaged to undertake fauna monitoring within the Biodiversity Offset areas and native mine rehabilitation areas during February 2018. The results are provided in the *DCM Fauna Surveys of the Offset and Mine Rehabilitation Areas, February 2018* (Appendix H). An extracted summary is provided below.

"Targeted fauna surveys were undertaken at five sites within the Duralie Offset Area and two sites in the Duralie Mine Rehabilitation Area during February 2018. At most sites survey techniques included pitfall traps, funnel traps, Elliott A traps, harp traps, ultrasonic call recording, spotlighting, diurnal bird surveys and reptile searches. Opportunistic observations of signs of fauna were noted throughout the field survey period, including during transit between surveys sites".

"A total of 124 species of vertebrate were recorded, comprising 8 frogs, 10 reptiles, 56 birds and 30 mammals…, most of which were native. With the exception of reptiles, a similar number of frog, mammal and bird species were recorded at Mine Rehabilitation Area sites compared with Offset Area sites. Five introduced species were recorded during the surveys, including Cattle (Bos taurus), House Mouse (Mus musculus), European Rabbit (Oryctolagus cuniculus), Black Rat (Rattus rattus) and Red Fox (Vulpes vulpes). Fifteen of the species detected are listed as threatened or migratory on the schedules of the Biodiversity Conservation Act 2016 (NSW) and/or the Environment Protection Biodiversity Conservation Act 1999 (Cth).

Plate 16: Koala (***Phascolarctos cinereus***)

Plate 17: Long-nosed Potoroo (***Potorous tridactylus***)

11 MAMMY JOHNSONS RIVER STABILISATION

In accordance with Section 6.8 of the BMP a detailed design for the in-stream rehabilitation of a severely eroded section of Mammy Johnsons River (MJR) has been prepared by Alluvium (2013) (Appendix I). No works on the MJR bank stabilisation have commenced during the reporting period. Further planning is required.

Table 10: MJR Bank Stabilisation Performance Criteria (PC) and Completion Criteria (CC)

Management Action	Completed Activities to June 2018	Annually from June 2018 onwards PC Maintenance Phase	Completion Criteria
River bank stabilisation design	Design for the in-stream rehabilitation of a severely eroded section of Mammy Johnsons River has been prepared. Office of Water engaged regarding plan approval[1] (Section 6.8).		Design of stabilisation plan completed and approved by the Office of Water
River bank in-stream rehabilitation		In-stream rehabilitation works undertaken[1] (Section 6.8).	Rehabilitation of severely eroded section of Mammy Johnsons River completed.

12 LONG TERM SECURITY AND CONSERVATION BOND

12.1 Long Term Security

In accordance with Condition 42, Schedule 3 of Project Approval 08_0203, DCPL is required to make suitable arrangements for the long-term security of the Duralie Extension Project Biodiversity Offset Area. DCPL used the mechanisms available under section 88E(3) of the NSW Conveyancing Act, 1919, namely:

- Registration of a Positive Covenant under section 88E(3) of the NSW Conveyancing Act, 1919; and
- Registration of a Restriction on the Use of Land by a Prescribed Authority under section 88E(3) of the NSW Conveyancing Act, 1919.

Public Positive Covenants and Restrictions on the Use of Land for the Biodiversity Offsets have been registered on title with NSW Land and Property Information (LPI) in **May 2015**.

12.2 Conservation Bond

In accordance with Condition 44, Schedule 3 of Project Approval 08_0203, DCPL is required to lodge a Conservation Bond with the DP&E which covers the cost of implementing the Biodiversity Offset Strategy detailed in the BMP.

The conservation bond for the Biodiversity Offset areas was calculated by Greening Australia and verified by Rider Levett Bucknell in December 2013. The terms of the conservation bond in the form of a Bank Guarantee were approved by NSW Department of Planning & Environment (DP&E) on **12 December 2013**. The Bank Guarantee has been subsequently provided to DP&E.

In December 2017, an Independent Environmental Audit of the DCM was undertaken in accordance with PA 08_0203. A revision of the BMP was approved in January 2019 in accordance with PA 08_0203 Schedule 5 Condition 4. Following this, a revision of the conservation bond will be prepared and lodged with DP&E in accordance with Schedule 3 Condition 45. The revised conservation bond will be lodged in the next reporting period.

13 COMMONWEALTH EPBC APPROVAL COMPLIANCE REPORTS

In accordance with the Commonwealth Approval [**EPBC 2010/5396**], during the reporting period DCPL submitted to the Department of Environment and Energy (DoEE) the following compliance report:

- *Duralie Coal Extension Project Annual Compliance Report 2020,* submitted on **16 April 2020** (Condition 20).

Additionally, the following reports were submitted annually for the first five years following the commencement of the operation:

- *DCM Implementation of the Giant Barred Frog Management Plan Annual Reports (Condition 10);*
- *DCM Implementation of the Biodiversity Management Plan Annual Reports (Condition 14(i)).*

These reports are now required to be submitted every **fifth** (5) year before the anniversary of the commencement of the operations.

14 APPENDICES

Appendix A: DP&E approval of the BMP.

Appendix B: DCM Annual Review 2020 – Figure 4 Mining & Rehabilitation Areas

Appendix C: AMBS Ecology & Heritage - Nest Box Programme for the Duralie Offset Area, Annual Report for 2019.

Appendix D: AMBS Ecology & Heritage - Invasive Animal Study, Duralie Coal Mining Lease and Offset areas, 2017.

Appendix E: Biodiversity Offset Area – Areas proposed for revegetation in 2020.

Appendix F: Kleinfelder - Duralie Coal Mine Biodiversity Offsets Monitoring Report 2020.

Appendix G: Kleinfelder – Duralie Coal Buckley's Range Bushfire Impact Report 2020.

Appendix H: AMBS Ecology & Heritage - DCM Fauna Surveys of the Offset and Mine Rehabilitation Areas, 2018.

Appendix I: Alluvium - Mammy Johnson's River – Bank Stabilisation Detailed Design, 2013.

(Appendices available on request)

Appendix 7:

Rehabilitation Monitoring Report 2020

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2020 Duralie Coal Mine Rehabilitation Monitoring Report

Yancoal Pty Ltd

Duralie Coal Pty Ltd

1164 Buckett's Way via Stroud Road
NSW, 2422

2020 Duralie Coal Mine

Rehabilitation Monitoring Report

Duralie Coal Pty Ltd
1164 Buckett's Way via Stroud Road
NSW, 2422

Kleinfelder Document Number: NCA20R113967
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Prepared for:

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EXECUTIVE SUMMARY

The survey of the Duralie Coal Mine Rehabilitation areas conducted in June 2020 was the seventh survey in accordance with the Duralie Coal Mine – Mining Operations Plan & Rehabilitation Management Plan (MOP) (2017) to assess the rehabilitation progress against the project specific performance and completion criteria. Using Landscape Functional Analysis (LFA) and vegetation dynamics the survey provides indicators of rehabilitation success and assessment of landscape processes obtained from measurements at twelve 25m transects representing the various ages of rehabilitation summarised below.

Table 1: Summary of transects surveyed in 2020

Year Rehabilitated	No. Transects Surveyed	Transect Designation
2008	2 (Native Woodland)	3042, 3443, 3450
2010	1 (Native Woodland)	3046
2011	1 (Native Woodland)	3043
2012	3 (Native Woodland)	3044, 3049, 3055
2013	1 (Native Woodland)	3503
2016	2 (Native Woodland)	3501, 3502
2018	1 (Pasture)	3504
2020	2 established but not surveyed this year 1 (Pasture) 1 (Native Woodland)	 3505 3506

Processes associated with the soil surface are reported as three main indices:

- *Stability Index - measures the ability of the soil to resist erosion and to reform after disturbances.*
- *Infiltration Index - measures how the soil partitions rainfall into soil-water that is plant available and runoff that is lost from the local system and may also remove nutrients and other materials, and,*
- *Nutrient Cycling Index - how efficiently organic matter is cycled back into the soil.*

The development of the woody vegetation is tracked by measuring the number of plants per hectare and calculating the volume of canopy for each distinct layer of vegetation. This is presented as Vegetation Structure. Observations of weeds and desirable native species are recorded.

The results for the above indices from this year's survey were compared to the average index scores from a subset of six analogue transects established in remnant woodland vegetation communities of the Duralie Biodiversity Offset area and surveyed in January 2017.

Overall, the rehabilitation of the Duralie Spoil Emplacement continues to progress satisfactorily and is on a trajectory towards meeting the performance and completion criteria detailed in the MOP. LFA indices are continuing to achieve or approach the analogue site apart from the pasture rehabilitation area.

By index:

- *Stability Index – all rehabilitation greater than four years old has achieved Analogue index scores. Younger rehabilitation – 2016 – has improved. This is the second survey of the 2018 rehabilitation area and it recorded a decrease from the last survey but is relatively stable due to good vegetation cover and flat slope. Overall, the soil surface is intact with no active erosion observed.*
- *Infiltration Index – the transects surveyed in 2020 remain below the Analogue benchmark score and require further time for development. The 2008 rehabilitation achieved the highest average index score as expected, with the younger rehabilitation achieving progressively lower scores. The 2018 pasture rehabilitation recorded a reduction for this index, and,*
- *Nutrient Cycling Index – the transects surveyed in 2020 were below the analogue value, with the remaining rehabilitation ages recording mixed results, largely dependent on the area surveyed and the stage of life cycle for the vegetation i.e. Acacia die-off reducing the litter production.*

The vegetation structure on the spoil emplacement is still at a relatively early stage of development when compared to remnant vegetation found on the analogue sites.

Stem density is variable across the spoil emplacement, but almost without exception the rehabilitated areas have lower overall numbers of plants than the average analogue values. Stem densities are also variable within each rehabilitation area and reflects both transects surveyed and natural processes at work. Area of 2008 and 2012 rehabilitation are experiencing die-off of Acacia_species resulting in more open areas dominated by exotic grasses. One rehabilitation area, the 2011 rehabilitation recorded an increase in average stem densities, although the individual areas showed increases highlighting the variability of vegetation coverage across the spoil emplacement.

The distribution of the vegetation by strata is considerably different in the rehabilitated areas when compared to analogue sites, with distribution of stem densities reversed. In the rehabilitation areas, Eucalypt densities – i.e. canopy – are generally the bulk of the stems, and much higher than the analogue density regardless of age rehabilitation. The only exception to this is the 2013 rehabilitation where canopy numbers are still quite low or non-existent. The shrub stratum on the other hand is largely composed of juvenile Eucalypts and Acacias, whereas analogue sites, the shrub stratum composed of "true" shrub species (i.e. those that will not grow above 1.5 to 2.0 in height) is dominant in terms of numbers. 2010 and some areas of the 2008 rehabilitation have recorded an increase in new native species – particularly in the shrub and forb layers that appear to have established naturally.

Average canopy volumes have recorded a mix of increases (2010 and 2011 rehabilitation) and decreases (remaining areas) across the spoil emplacement which has resulted as an artefact of the transects surveyed and the previously mentioned Acacia die-off as these species reach the end of their life-cycle.

Weed species, dominated by Lantana camara, Solanum mauritianum and Ligustrum sinense were noted in the older rehabilitation areas with the rehabilitation in the vicinity of Transect 3443 assessed as being adversely impacted by the presence of L. sinense.

It was concluded that the rehabilitation of the spoil emplacement is progressing satisfactorily, with the following recommendations/management actions made:

- *The area represented by Transects 3502 and 3450 require seeding or planting with canopy species, but the area near Transect 3450 would require groundcover biomass reduction.*
- *Older areas of the rehabilitation where Acacia die-off has occurred and opened-up the area to sunlight (becoming dominated by exotic grasses) could be seeded with shrub species not included in the original seed mix to increase diversity.*
- *More generally further introduction of a wider variety of shrub species, especially those that do not spread by avian fauna could be facilitated with a modest seeding and/or planting program.*
- *Leucopogon juniperinus (Prickly Beard-heath) is a common species through the analogue sites but is not available commercially. It would be beneficial to attempt to collect seed from on site to use in the rehabilitation introducing it to younger rehabilitation areas or where it has not yet colonised.*
- *Woody weed control works should be undertaken in the areas identified above where L. camara, L. sinense and S. mauritianum have become established and pose a threat to successful revegetation.*

- *As part of the above the drains could be mulched (as opposed to slashed) to provide access for weed control works, any revegetation program and fire breaks.*
- *Use of hazard reduction burns should be investigated for feasibility. The continuing build-up of litter (including the die-off of Acacias) combined with the either dense and tall grassy groundcover or high stem density of woody vegetation poses a risk if an uncontrolled fire were to occur (e.g. lightning strike). A controlled burn would have the added advantages of:*
    - *Reducing the biomass of the groundcovers and allowing ease of movement off tracks and drains*
    - *Promote the germination of the seed bank from the species on the spoil emplacement – although this can lead to a large increase in the density of the Acacias.*
    - *Help with control of the woody weeds – L. camara in particular.*

Contents

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1. INTRODUCTION

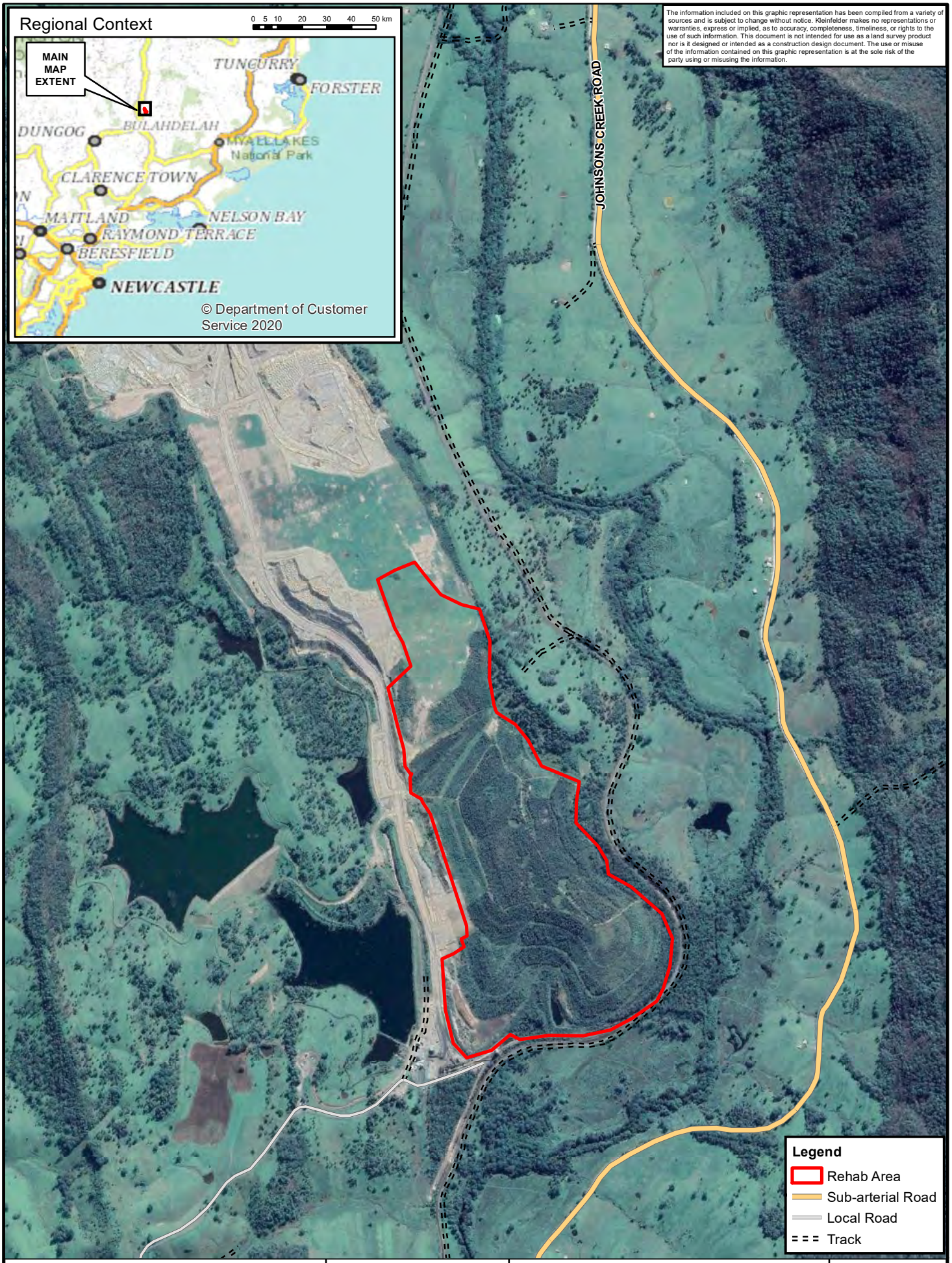
Duralie Coal Pty Ltd (DCPL) is a wholly owned subsidiary of Yancoal Australia Ltd and operates the Duralie Coal Mine (DCM). The DCM is located between the small towns of Stroud Road and Wards River, approximately 80km north of Newcastle in New South Wales (**Figure 1**). Approval for mining was granted in 1997 and coal production commenced in 2003.

The DCM operates under two key approvals, NSW Project Approval (08_0203) and the Commonwealth Approval (EPBC 2010/5396). Both may be viewed at http://www.duraliecoal.com.au.

In accordance with Section 8.1 of the Duralie Coal Mine – Mining Operations Plan & Rehabilitation Management Plan (2017) monitoring and assessment of the quality and ecological value of the woodland rehabilitation will be required. This assessment will be conducted using EFA (Ecosystem Functional Analysis) to measure the progression of the rehabilitation towards a self-sustaining ecosystem. This report is submitted to fulfil this requirement.

1.1 SCOPE AND RATIONALE

Kleinfelder Australia was commissioned by DCPL to conduct LFA and EFA monitoring to ensure compliance with the above stated objectives. As part of the monitoring program, Kleinfelder undertook to conduct LFA and EFA monitoring at transects situated to provide representative data of rehabilitation age, slope and aspect. This, the seventh annual survey (the fifth conducted by Kleinfelder Australia staff) was conducted on the 11th, 17th – 19th of June 2020.



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DATA SOURCE:
NSW DFSI - 2018
Google Earth - 2020

Locality

Duralie Coal Pty Ltd
2020 Duralie Coal Mine Rehabilitation Monitoring Report
1164 Buckett's Way via Stroud Road NSW

FIGURE:

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2. METHODS

2.1 TRANSECTS SURVEYED

The 2020 survey utilised a combination of a subset of the original 20 Greening Australia transects on the DCM spoil emplacement which were surveyed in 2013 and 2014, and new transects established to monitor more recent rehabilitation. **Table 2** details the transects by age of rehabilitation surveyed in 2020. **Figure 2** shows the location of the transects on the Duralie Spoil Emplacement and the age of rehabilitation monitored.

Table 2: Year of rehabilitation and designation of the transects selected for monitoring in 2020

Age of Rehabilitation	Designation	Rehabilitation Type	Aspect	Transect Bearing
2008	3042	Native Woodland	South	196
	3443	Native Woodland	South	160
	3450	Native Woodland	East	080
2010	3046	Native Woodland	North East	051
2011	3043	Native Woodland	North East	063
2012	3044	Native Woodland	South West	229
	3049	Native Woodland	West	250
	3055	Native Woodland	North West	310
2013	3503	Native Woodland	East	080
2016	3501	Native Woodland	West	260
	3502	Native Woodland	South	170
2018	3504	Pasture	North (flat)	350

The 2016 survey (the first undertaken by Kleinfelder) utilised 10 of these previously established transects, having ascertained in conjunction with Yancoal staff that this number satisfied reporting requirements (**Table 3**). The 2017 survey utilised a different set of six established transects with an additional four new transects – two transects in areas of the spoil emplacement rehabilitated in 2016, one transect in 2013 rehabilitation and one transect in an area of 2008 rehabilitation that had not been previously surveyed. While data collected from this survey was not from the same transects as surveyed in 2018, all ages of rehabilitation are represented in all surveys. **Table 3** compares the transects used for the 2016 – 2019 surveys to the 2020 survey and includes two transects that were established on newly rehabilitated areas but not surveyed this year.

Monitoring photographs were taken looking along transects from the starting peg with the tape measure visible if possible, as well as representative photographs of the query zones of each transect.

Table 3: Comparison of transects surveyed from 2016 – 2020

Year Rehabilitated	2016 Survey	2017 Survey	2018 Survey	2019 Survey	2020 Survey
2008	3045			3045	
	3443	3444 (new)	3443	3444	3443
	3474	3042			3042
	3450		3450		3450
2010	3046	3454	3046	3454	3046
2011	3043	3048	3043	3048	3043
2012	3041	3044	3047	3041	3044
	3049	3052	3055	3054	3049
	3055	3466	3056	3466	3055
2013		3503	3503	3503	3503
2016		3501	3501	3501	3501
		3502	3502	3502	3502
2018				3504	3504 (Pasture)
2020	**(New - established but not surveyed)**				3505 (Pasture)
					3506 (Woodland)

2.2 LANDSCAPE FUNCTIONAL ANALYSIS

Landscape Functional Analysis is a monitoring technique that uses eleven soil surface characteristics to determine the functional status of a landscape and is fully described in Tongway and Hindley (2011). These soil surface characteristics correspond to a range of physical, chemical and biological processes that control movement of water, topsoil and organic matter in a landscape. The landscape is divided into a patch and interpatch system along transects where water and nutrients are accumulated or shed respectively. Full data for each transect is provided in **Appendix 1**.

2.3 VEGETATION STRUCTURE

The second component of the monitoring consisted of assessing the vegetation structure at each transect. The “point-centre-quadrat” method as outlined in Tongway and Hindley (2011) was employed to collect density and canopy size of vegetation present at each transect. At 5 x 5m points along transects, the distance to the nearest stem or other important species or structural component (i.e. largest canopy) was measured and the plant height, canopy density, and dimensions (breadth and width) were recorded. Tallest trees had dimension estimated, whereas smaller stems (<4m) were measured.

2.4 DATA ANALYSIS

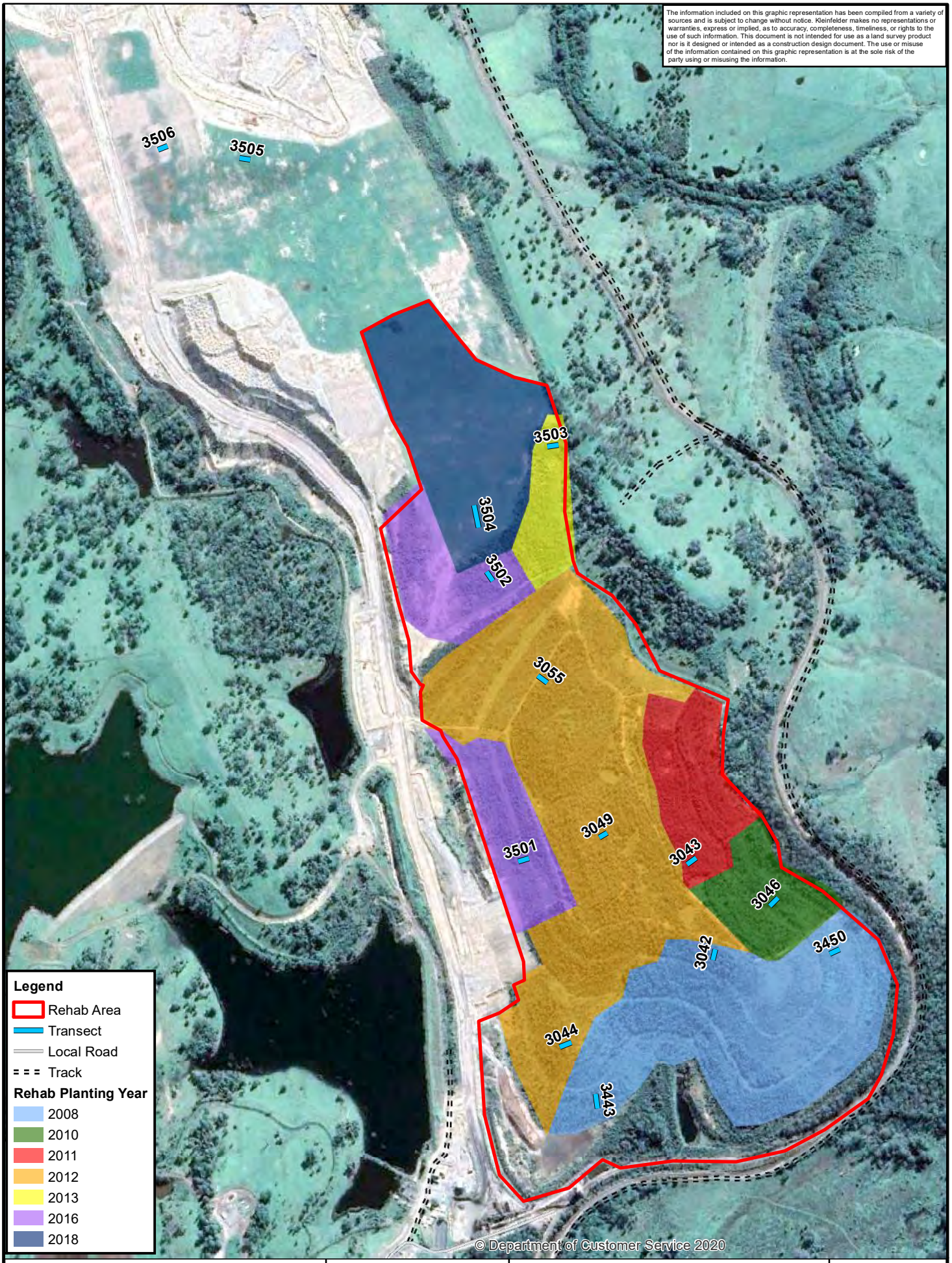
The collected data is input into a software system purpose designed for LFA where a series of tables are generated providing data on both a hillside and a patch basis. This data can then be used to provide insight into the functional status of the landscape.

Vegetation Structure data is also input into purpose-designed software where woody plant density and vegetative volume on a per hectare basis is calculated. These surveys were conducted in conjunction with the LFA monitoring using the same transects for data collection from the six ages of rehabilitation (**Table 2**). Raw data for each transect is presented in **Appendix 1**.

Analogue data for comparison of monitoring on the spoil emplacement was undertaken in 2017 (Kleinfelder, 2017). Surveys were undertaken in six vegetation management units (VMUs) representing the most common woodland and vegetation communities in the Biodiversity Offset areas. This data is included for comparison to the monitoring results from the 2013 and 2014 surveys for LFA in the Duralie Biodiversity Offset area (**Table 4**).

Table 4: LFA Index results from the six analogue sites (Woodland Remnant Offsets) surveyed in the 2017 Biodiversity Offsets Monitoring Report

Index	Stability Index			Infiltration Index			Nutrient Cycling Index		
Survey Year	2013	2014	2017	2013	2014	2017	2013	2014	2017
Index Score	71.5	69.6	76.9	47.3	51.0	68.9	44.6	44.1	61.7
Standard Error	4.2	7.7	1.9	3.9	5.5	5.5	4.8	5.0	5.1



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2020 Transects

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3. 2020 SURVEY RESULTS

3.1 SOIL SURFACE INDICATORS

3.1.1 Stability Index

Results from the 2020 survey show that the stability index is at or exceeding analogue average values (76.9 ± 1.9) for all rehabilitation older than four years. There were no major surface erosion issues observed during the 2020 survey.

The oldest rehabilitation areas – 2008 to 2012 – all recorded average stability index scores at or above the analogue average, with individual transects also recording index scores at or above analogue average score. Younger rehabilitation – 2013 and 2016 - areas were either equivalent or close to the analogue average. The exception was the 2018 rehabilitation – transect 3504 – which was below the average, but also lower than last year's survey

3.1.2 Infiltration Index

A benchmark value of 68.9 ± 5.5 was recorded for this index from the analogue sites in 2017. Results from this year's survey shows that none of the rehabilitation areas have achieved this benchmark. Overall the trend is for the oldest rehabilitation to have recorded the highest Infiltration Index scores, decreasing to the most recent rehabilitation (**Figure 4**). The average 2008 rehabilitation index score is approaching analogue average with an index score of 59.8 ± 2.3. Transect 3450 with an index score of 63.1 ± 1.6 has achieved this score (**Table 5**). The rehabilitation areas from 2012 to 2018 have index scores that are roughly equivalent, and generally lower than the Infiltration Index scores for the 2008 to 2011 rehabilitation. These ages of rehabilitation recorded index scores of between 41.1 ± 0.8 (Transects 3049 – 2012 rehabilitation) and 51.1 ± 3.3 for Transect 3055 – also 2012 rehabilitation (**Table 5**).

3.1.3 Nutrient Cycling Index

The average analogue nutrient cycling index score recorded in 2017 was 61.7 ± 5.1. As with the previous index, the general trend for this index follows the age of the rehabilitation (**Table**

5). The 2008 rehabilitation has approached this index score again this survey (54.2 ± 3.1), with two of the three transects surveyed recording scores over 57. This trend continues to the 2018 rehabilitation with the lowest Nutrient Cycling Index score of 31.9 ± 7.4 (**Figure 3**).

3.1.4 Other Soil Surface Indicators

Landscape Organisational Index (LOI) (**Table 5**) scores for the transects in the different rehabilitation areas are uniform, with all rehabilitation areas being assessed entirely as “patch”, i.e. areas of nutrient accumulation, thus they have LOI’s of 1.00.

The number of patches per 10m of transect is an indicator of the heterogeneity of the ground surface and given that the ground surface of all the transects was judged to be all patch, this indicate the that patch types also vary. For instance, transects with numbers less than one are a single patch type, whether that is grassy sward or litter, whereas transects with higher numbers will have numerous smaller patch types.

Average Patch Width measures the cross slope spread of the patches. The Analogue sites recorded an average patch width of 6.63m, with most of the rehabilitation areas recording a width of 10m – the maximum that the LFA system can record. This indicates that the patch system identified in the surveys is very uniform with a minimum of variation as expected for areas seeded with grasses. This survey only Transect 3055 recorded an average patch width of under 10 m.

Table 5: **Results of the 2020 Landscape Functional Analysis survey at Duralie Coal Mine spoil emplacement by transect and age of rehabilitation compared to average results from the Analogue sites in the Biodiversity Offsets areas (surveyed 2017).**

Year Rehab	Transect	Stability Index	SE	Infiltration Index	SE	Nutrients Cycling Index	SE	LOI	No Patches /10m	Ave Patch Width (m)
2017 Analogue Average		76.9	1.9	68.9	5.5	61.7	5.1	1	1.9	6.63
2008	3042	78.9	1.1	61.0	1.7	57.4	1.7	1	0.8	10
	3443	76.1	1.3	55.2	0.9	47.8	1.8	1	2.4	10
	3450	78.1	0.0	63.1	1.6	57.3	2.3	1	0.4	10
2010	3046	79.4	1.7	56.2	6.0	53.2	4.2	1	0.4	10
2011	3043	77.0	2.5	58.7	2.6	50.5	4.4	1	0.4	10
2012	3044	77.0	3.0	44.2	3.1	40.7	4.6	1	2.8	10
	3049	77.1	1.3	41.1	0.8	37.4	0.8	1	6	10
	3055	79.0	1.5	51.1	3.3	48.3	4.0	1	2	7.4
2013	3503	73.3	3.5	49.8	4.0	40.7	5.8	1	0.4	10
2016	3501	77.7	1.0	43.9	1.9	43.0	1.7	1	7.2	10
	3502	73.1	1.4	46.7	2.2	37.9	3.0	1	7.6	10
2018	3504	63.2	2.1	42.4	4.2	31.9	7.4	1	3.2	10

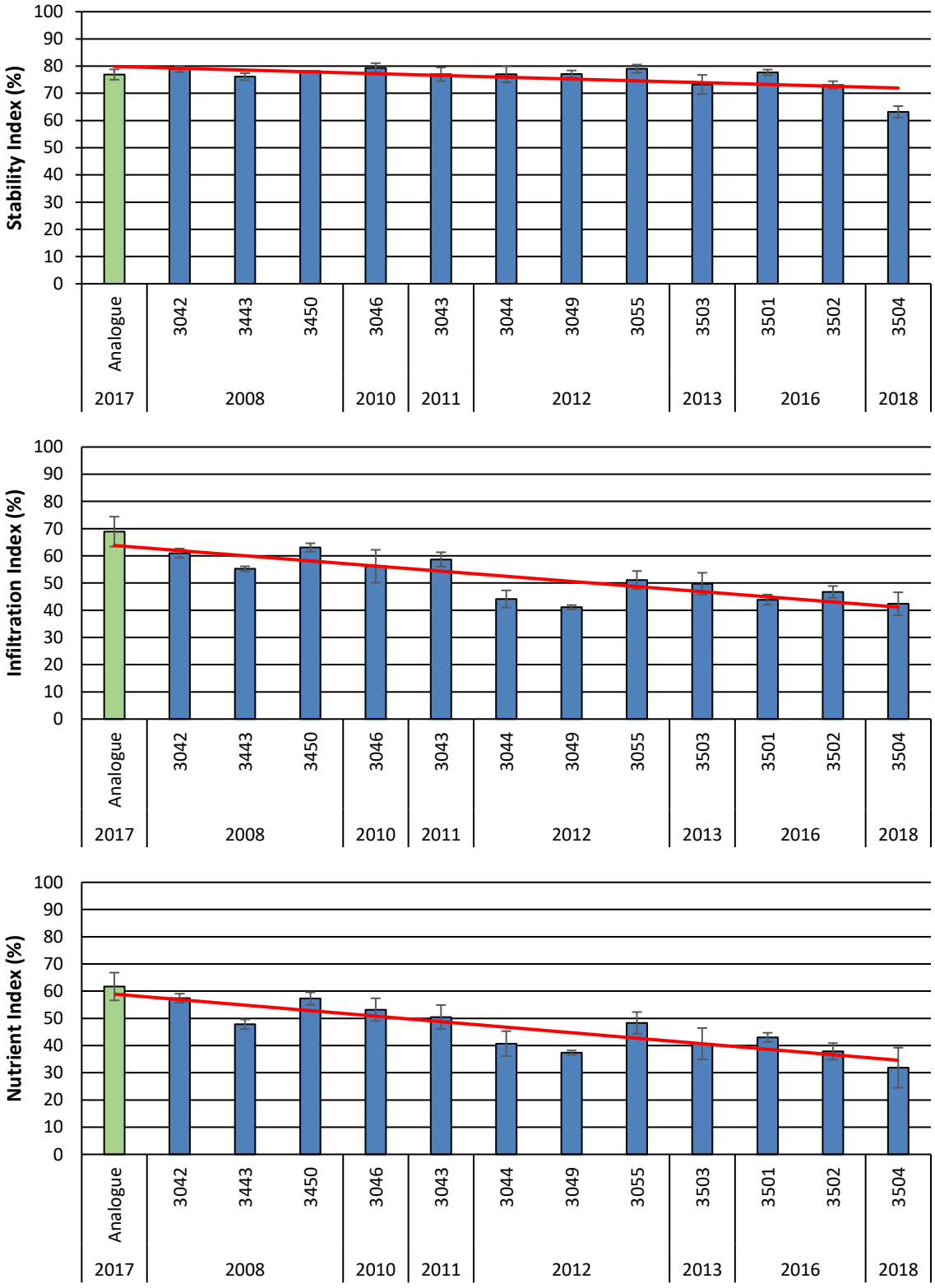

Figure 3: **Landscape Functional Analysis results by Index for the 2020 survey of the Duralie Rehabilitation. Transects are grouped by year of rehabilitation. Error bars are Standard Errors of Mean. Red line is linear trendline.**

3.1.5 Soil Surface Indicators - Historical

A comparison of the 2020 survey results is made to the previous surveys conducted and are shown in **Figure 4** and **Figure 5**.

3.1.5.1 Stability Index

The older rehabilitation areas (2008 to 2011) have generally achieved average analogue values (76.9 ± 1.9) for this index and have done so since 2017 (**Figure 4**). The exception was the 2008 rehabilitation in the 2018 survey where the index score was 68.9, but as was noted in the 2018 Rehabilitation Report (Kleinfelder, 2018) the average index score for this survey was dragged down by a single transect, Transect 3443 (63.5 ± 1.7). This transect was included in this year's survey and has recovered considerably in the two years since last surveyed to record a score of 76.1 ± 1.3. The following two surveys show that this aged rehabilitation has achieved consistent scores.

The 2010 and 2011 rehabilitation areas have been more consistent since achieving the index analogue value - although it should be acknowledged that these two areas are smaller, and each has only two transects with similar aspect.

The 2012 rehabilitation has achieved analogue index scores in this and the previous survey which is an excellent indication of the success of the rehabilitation as there are no repeated transects surveyed.

More recently rehabilitated areas of the spoil emplacement show more variable results but generally there is a trend for this index score to increase to be at or near analogue values. The 2012 rehabilitation has recorded very consistent index scores for the past five surveys and remains essentially unchanged over this period (**Figure 5**). As with the 2008 rehabilitation this is a good result, with different transects surveyed each year showing that this area of the spoil emplacement as a whole is progressing well (**Table 3**).

3.1.5.2 Infiltration and Nutrient Cycling Indices

While the absolute values differ between these two indices, they largely follow the same trajectory and can be discussed as one in broad terms. With these indices influenced by plant cover and litter production, time is a key factor in their progression towards analogue values and both indices show a general trend of increase with age. At this stage of the rehabilitation,

only twice in the 2008 rehabilitation (2017 and 2019) have analogue values been achieved (**Figure 4**). This may in part be attributed to the areas surveyed – Transect 3444 located at the far southern end of the spoil emplacement with a dense multi-generational canopy cover of Eucalypts and sparser mid-storey and shrub species. The 2013 rehabilitation has recorded lower values this year which may in part be due to the die-off of the *Acacias* and the opening up of the transect area with more grass production.

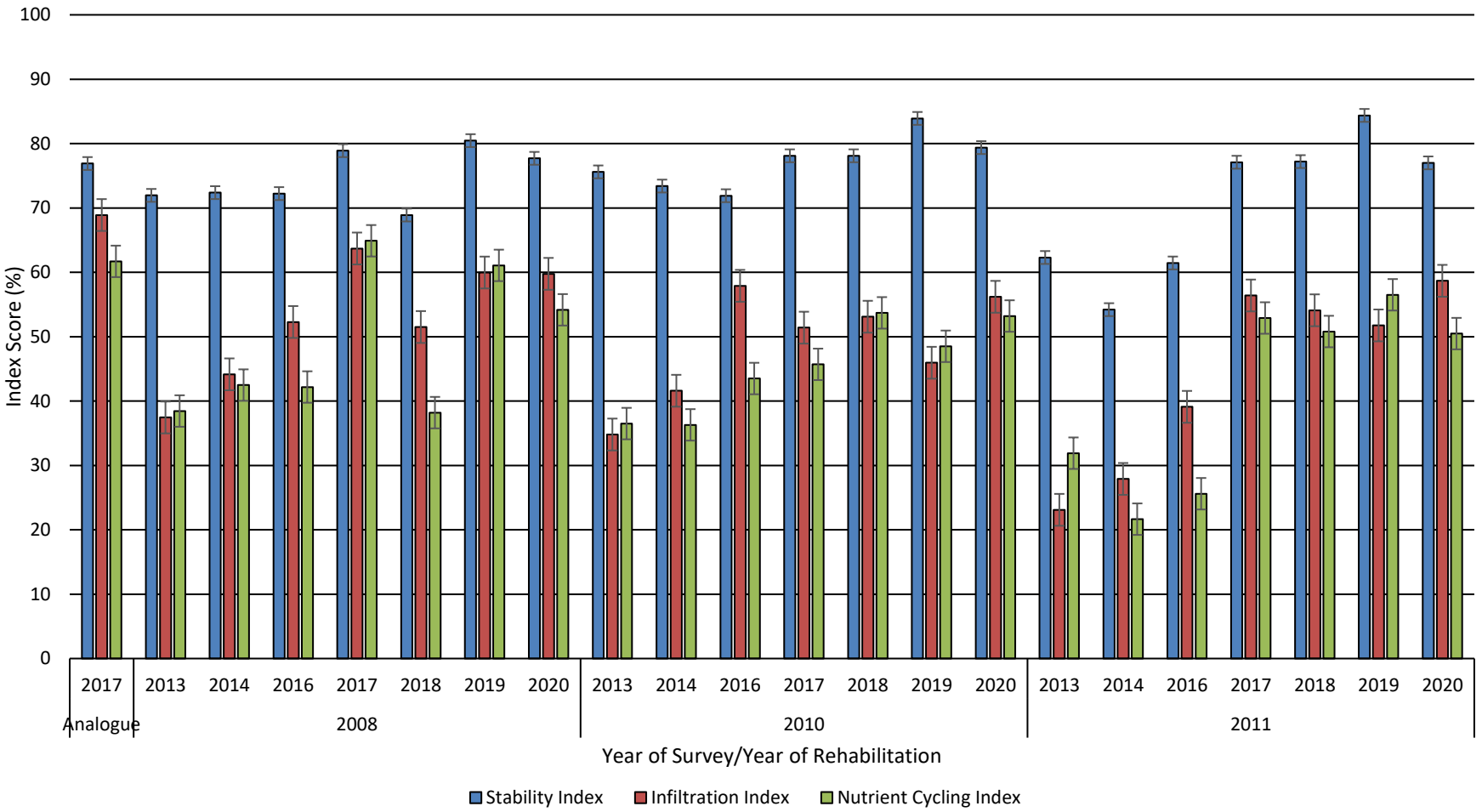

Figure 4: **Landscape Functional Analysis results for the surveys of the 2008 to 2011 rehabilitation areas on the Duralie Coal Mine spoil emplacement and comparison to the 2017 average analogue sites derived from the Biodiversity Offsets Areas. Standard Error bars are shown where statistically valid, i.e. three or more transects in that age cohort for the 2020 survey**

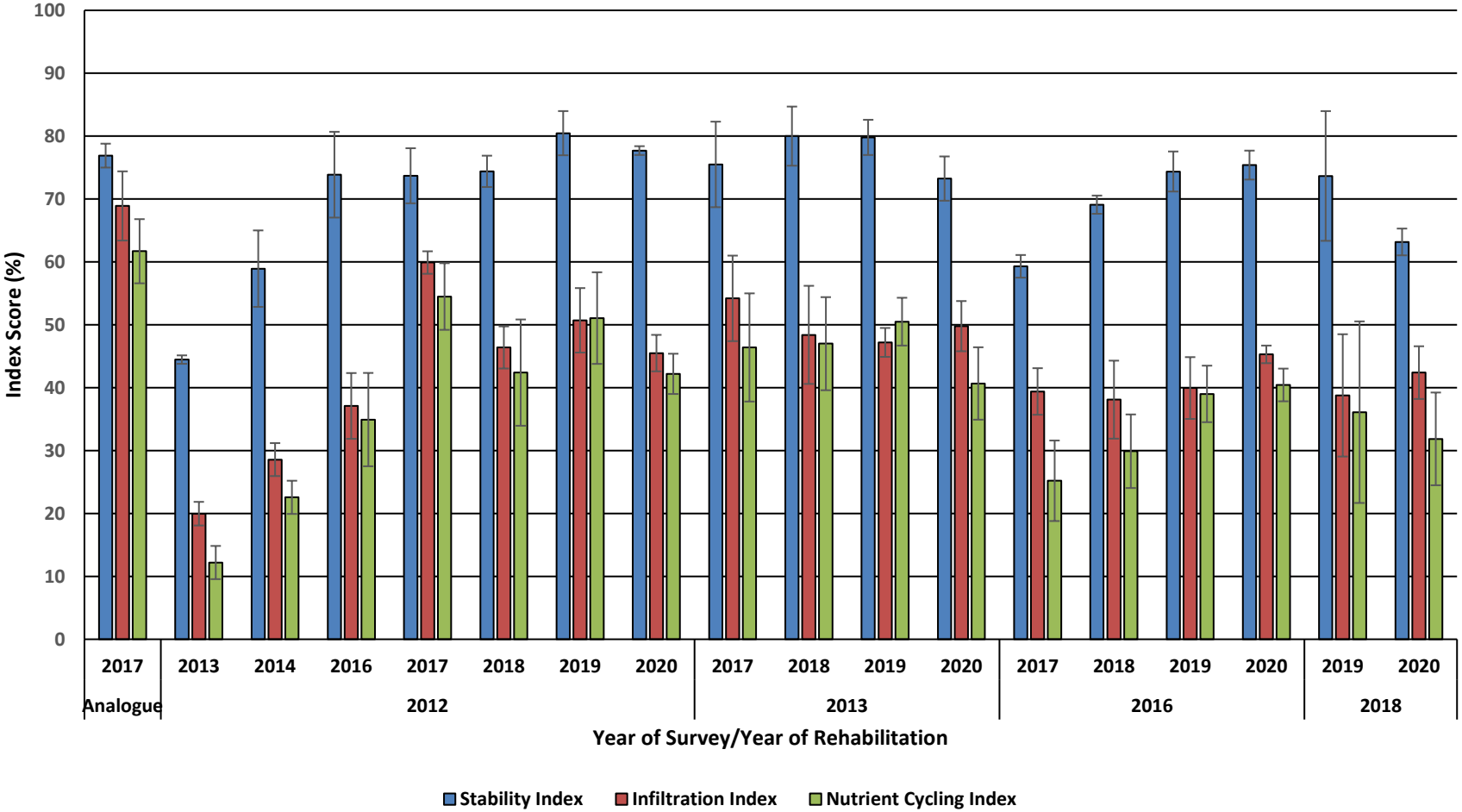

Figure 5: **Landscape Functional Analysis results for the surveys of the 2012 to 2018 rehabilitation areas on the Duralie Coal Mine spoil emplacement and comparison to the 2017 average analogue sites derived from the Biodiversity Offsets Areas. Standard Error bars are shown where statistically valid, i.e. three or more transects in that age cohort for the 2020 survey**

3.2 VEGETATION DENSITY AND STRUCTURE

Vegetation density and structure numerical data from the 2020 survey are presented in **Table 6** with graphical representation of this data in **Figure 6** and **Figure 7.**

3.2.1 2008 Rehabilitation

This survey of the 2008 transects recorded average stem densities at 4,015 stems/ha, and woody vegetation volume was 17,266 m^3/ha. Examination of the individual transects (see below) shows that this area of rehabilitation is variable in terms of native species density and diversity.

Transect 3042 (**Plate 3**) recorded a total of 10,188 stems/ha and a total woody vegetation volume of 40,343 m^3/ha. *Corymbia maculata* and *Eucalyptus punctata* formed the canopy stratum (688 stems/ha at 3.81m stem spacing) that were estimated to be between 10m to 17m in height. The midstorey was slightly more diverse and much denser at 8171 plant/ha (1.1m plant spacing), dominated by the above two species but also recording the ironbark *Eucalyptus crebra* and another unidentified *Eucalyptus* species (no fruit available). This stratum ranged in height from 2.1m to 8.0m. The "shrub" stratum consisted of stems <2m in height and a density of 1,328 stems/ha (2.74m stem spacing). It was again dominated by young canopy species but with examples of the true shrub species *Leucopogon juniperinus* and *Ozothamnus diosmifolius*. With such a dense canopy the groundcover was sparse and was assessed as sparse grasses and forbs or entirely litter. The original seeding included a large component of *Acacias* species which have senesced and died off with a few seedlings observed to have germinated. Where individual stems had fallen over creating gaps and along the edges the rehabilitation (access tracks and drains), more light was available and further shrub species such as *Acacia decurrens, A. longifolia, A. irrorata, A. mearnsii, A. ulicifolia* as well as *Daviesia ulicifolia* and *Pulteneae villosa* were observed. Weed species recorded were *Solanum mauritianum* and *Ligustrum sinense*.

Transect 3443 (**Plate 7**) recorded a total of 669 stems/ha and a total woody vegetation volume of 8,990 m^3/ha. The canopy stratum was composed of sparse *C. maculata* and *E. punctata* (33 stems/ha at 17.35m spacing) between 12m and 15m in height. The midstorey stratum was made up of a few smaller *C. maculata* and *E. punctata,* but was more diverse with *Acacia falcata, A. irrorata, A. mearnsii, A. ulicifolia* and *Trema tomentosa* between 2.2m and 9m in

height (398 stems/ha at 5.01m spacing). The shrub layer included all native stems <2m in height and consisted of 238 stems/ha at a spacing if 6.48m between stems. Species recorded included only a few Eucalypt saplings and was dominated by the *Acacia* species listed above. Other species observed in the area included *E. crebra* and the shrub *Cassinia arcuata.* Die-off of the first germinated *Acacias* was also apparent in this area of the rehabilitation, although the presence of *Acacias* in the midstorey and shrub strata along with small numbers of seedlings indicates self-sustaining regeneration. *Eucalyptus* species were also identified in all three strata indicating at least three recruitment events, again pointing to self-sustaining regeneration. This area of the rehabilitation was much more open, and the groundcover was more developed with a combination of native grasses (e.g. *Themeda triandra*), forbs (*Cheilanthes sieberi, Dichondra repens* and *Lobelia purpurascens*) and a twiner *Desmodium varians.* What these statistics do not reveal is the extent of the weed coverage in this area. *L. sinense* has started to form thickets, and in combination with *S. mauritianum* require substantial control works.

Transect 3450 recorded a total of 1,189 stems/ha at 2.9m between stems and total woody vegetation volume of 2,556 m^3/ha, the lowest density and volume of the 2008 rehabilitation areas surveyed this year. This was composed only of midstorey and shrub species with no canopy species recorded along the transect or within the vicinity on this bench level of the spoil emplacement – there were Eucalypts visible on the slope above. Species recorded here include *Breynia oblongifolia, A. irrorata, L. juniperinus*, *O. diosmifolius* and *T. tomentosa.* Die-off of the previously dominant *Acacias* was very evident. The numerous *Acacia* seedlings observed to be germinating together with fruit on several of the native species indicates that the species present are self-sustaining. The major feature of this area are the woody weeds *Lantana camara*, *L. sinense* and *S. mauritianum* that appear to be thriving. The groundcover is a dense sward of exotic and native grasses and forbs.

3.2.2 2010 Rehabilitation

The 2010 rehabilitation area (Transect 3046) (**Plate 9**) recorded an overall stem density of 1,608 stems/ha and woody vegetation volume of 29,621 m^3/ha. The canopy stratum was dominated by *C. maculata* with a few *E. punctata* which were between 10m and 13m in height, recorded 605 stems/ha at an average spacing of 3.94m. The midstorey stratum consisted of the next generation of Eucalypt species and a good mix of midstorey and tall shrub species between 2.0m and 6.0m in height at a density of 550 stems/ha and 4.26m between stems. Species in this stratum included *C. maculata, E. punctata* (representing a second self-recruitment generation), *A. falcata, A. irrorata* and *O. diosmifolius*. The shrub stratum consisted

of plants <2m tall. It was calculated to have 452 stems/ha at a spacing of 4.70m. Species recorded were *Acacia longissima, B. oblongifolia, L. juniperinus, Notelaea microcarpa* and O*. diosmifolius. Acacia* die-off was evident, as were the presence of numerous seedlings. Diversity was observed to be quite high in the vicinity of the transect with numerous native species observed including *E. crebra, A. longifolia, Exocarpos cupressiformis, Lomandra longifolia* and the vines *Cassytha glabella, Glycine clandestina, Kennedia rubicunda* and *Stephania japonica.* The groundcover was generally patchy and was dominated by the exotic grass *Chloris gayana* although the native grasses *Entolasia stricta* and *Digitaria spp.* and some native forbs and herbs were also observed. Weeds were not considered to be a major issue for this area with *S. mauritianum* the only woody weed species observed.

3.2.3 2011 Rehabilitation

The 2011 rehabilitation area (Transect 3043) (**Plate 13**) had a density of 15,632 stems/ha and a total woody vegetation volume of 52,402 m^3/ha consisting of three strata. The canopy stratum was dominated by *C. maculata* with only a few *E. punctata.* They ranged in height from 9.0m to 175.0m with a density of 184 stems/ha at an average spacing of 7.37m. The midstory stratum consisted of a mix of younger Eucalypts, *A. falcata* and *Acacia implexa* at a very dense 12695.9 stems/ha varying between 2.0 m and 11.0m at an average spacing of 0.89m. The shrub stratum consisted of a mix of younger Eucalypts, *A. falcata, A. implexa* and *A. ulicifolia* <2m height with 2752 stems/ha at an average spacing of 1.91m. Diversity was observed to be relatively high and very similar to the adjacent 2010 rehabilitation. Observations of the vegetation in this area suggest three generations of *Eucalyptus* and at least three generations of *Acacia* species given the die-off of the original *Acacias* and the newly germinated seedlings observed. Weeds observed in the vicinity of this transect included young plants of *Lantana camara* (Lantana) and *Solanum mauritianum* (Wild Tobacco).

3.2.4 2012 Rehabilitation

The 2012 rehabilitation area is the largest area on the Duralie Spoil Emplacement and three transects were surveyed this year. The average total stem density was 781 stems/ha and an average total woody vegetation volume of 7,187 m^3/ha, but as with the 2008 rehabilitation, this rehabilitation area is variable in plant density and diversity.

Transect 3044 (**Plate 16**) recorded a total stem density 785 stems/ha and a total woody vegetation volume of 19,616 m^3/ha. This consisted of a canopy stratum dominated

overwhelmingly by *C. maculata* with 235 stems/ha at 6.52m between stems. These stems were estimated to be between 9m and 13m in height. The midstorey was more diverse, consisting of *C. maculata, E. crebra, E. moluccana* and *E. punctata* that were between 1.0m and 6.0m in height. This stratum was also denser at 447 stems/ha and 4.73m spacing. The shrub stratum as measured here, consisted of non-Eucalypt species. Species recorded were *A. implexa, A. irrorata*, *B. oblongifolia, L. juniperinus, L. polygalifolium, O, diosmifolius* and *T. tomentosa*. These were between 0.8 and 2.0m in height, but sparse at 102 stems/ha with a spacing of 9.88m between stems. As with much of the rehabilitation there was evidence of a massive *Acacia* die-off and seedlings germinating. Other native species observed in the vicinity of the transect included shrub and midstorey species *A. falcata, E. cupressiformis* and *Solanum prinophyllum* and the vine/twiners *G. clandestina* and *S. japonica.* Groundcover was variable across this area with exotic grasses dominating where gaps in the canopy cover permitted light to penetrate to the ground, otherwise the groundcover was litter dominated with sparse grass, forbs, and herbs.

Transect 3049 (**Plate 18**) recorded an overall stem density of 1,297 stems/ha and a total woody vegetation volume of 1,686 m^3/ha measured in two strata, with no true shrub stratum present. This area had *Acacia* die-off and many Eucalyptus saplings. The Eucalypt stratum was predominantly *C. maculata,* but *E. crebra* and an unidentified *Eucalyptus* spp. were recorded along the transect. These stems were between 0.7m and 5m in height at 623 stems/ha and an average spacing of 4.01m. The second stratum consisted of *Acacias* (*A. falcata* and *A. implexa* only) that were between 0.8m and 4.6m in height at a density of 674 stems/ha at an average distance of 3.85m. The heights recorded suggested that there have been at least a second generation of both Eucalypts and Acacias in this area. Other species observed in the vicinity included *E. punctata, A. irrorata, A. longifolia, L. juniperinus* and *T. tomentosa.* The grassy groundcover was moderate to dense, dominated by the exotic grasses *Setaria sphacelata* and *C. gayana.* There were no weed species requiring control works recorded in the vicinity of this transect.

The final transect in this rehabilitation area, Transect 3055 has had a massive *Acacia* die-off since last surveyed and is now a much more open area. The total stem density was measured at a relatively sparse 259 stems/ha and a total woody vegetation volume of 1,387 m^3/ha. This consisted of a very sparse canopy stratum that was dominated by *C. maculata,* and a few *E. punctata* and *Allocasuarina torulosa* varying in height between 1.6m and 12.0m (This suggests at least three generations of Eucalypts), with 42 stems/ha and 15.38m between stems. The second stratum consisted of a denser *Acacia* layer consisting of *A. falcata, A. implexa* and *A. irrorata.* This stratum had 217 stems/ha at a spacing of 6.79m. Other species observed in the

vicinity included *L. juniperinus* and *T. tomentosa.* The groundcover was moderate to dense and dominated by exotic grasses, forbs, and herbs. *L. camara* was observed in the area, requiring some control work.

3.2.5 2013 Rehabilitation

This transect recorded a total stem density of 657 stems/ha and total woody vegetation volume of 2,171 m^3/ha. The vegetation structure of the 2013 rehabilitation area (transect 3503) (Error! Reference source not found.) was recorded as two strata again this year. The first was composed of relatively sparse Eucalypts – *C. maculata* and *E. punctata* – varying in height from 6.0m to 13.0m at a density of 55 stems/ha and a spacing of 13.48m. The second stratum consisted of all other species with both young Eucalypts and *Acacias* recorded *A. falcata, A. implexa, A. irrorata* and *E. cupressiformis*). Heights ranged from 1.0m to 6.0m, with many young *Eucalyptus* saplings. Density was 602 stems/ha at a spacing of 4.08m. *A. longifolia* was the only other native species observed in the vicinity of the transect. The groundcover consisted of dense exotic grasses dominated by *S. sphacelata*.

3.2.6 2016 Rehabilitation

The survey of the 2016 rehabilitation recorded an average stem density of 3600 stems/ha and an average total woody vegetation volume of 7,799 m^3/ha. Previous surveys have measured the vegetation structure as “nearest stem” with no division by species or height. This year the vegetation structure of these transects had progressed so that the structure could be subdivided into two strata as detailed below.

The vegetation structure of this transect - 3501 - (**Plate 24**) recorded a total stem density of 4244 stems/ha and total woody vegetation volume of 6,560 m^3/ha. This was assessed in two strata – all stems >2m and all stems <2m in height. The >2m stratum was dominated by *Acacia* species (*A. decurrens, A. implexa, A. irrorata* and *A. ulicifolia*) with a few Eucalypts (*C. maculata*) that were up to 5m in height. This stratum had a stem density of 834 stems/ha at a mean spacing of 3.46m. The <2m stratum recorded the same *Acacia* species and *C. maculata* but also recorded *A. longifolia* and *D. ulicifolia*. This stratum had stem density of 3409 stems/ha at mean spacing of 1.71m between stems. This rehabilitation area has progressed significantly since the previous survey with the increased growth allowing many of the plants to show above the dense *S. sphacelata* groundcover. Other native species observed in this area included *E.*

punctata, O. diosmifolius and *Pultenaea villosa.* No significant weeds were observed, but there were some small patches of bare soil where vegetation had not established.

The vegetation structure of Transect 3502 (**Plate 26**) was measured in two strata producing a total stem density of 2955 stems/ha and a total woody vegetation volume of 9,037 m^3/ha. The upper stratum consisted only of *Acacia* species >2m in height up to 5m. These species were *A. decurrens, A. falcata, A. irrorata* and *A. ulicifolia.* This stratum recorded a stem density of 967 stems/ha at mean spacing of 3.21m. The lower stratum consisted of the above *Acacia* species plus *D. ulicifolia* and *P. villosa.* This stratum had a density of 1986 stems/ha at a mean spacing of 2.24m. other native species observed in the vicinity of the transect included *A. implexa, C. maculata,* and the vine *Kennedia rubicunda*. The appearance of canopy species is especially important in this area as previous surveys have failed to locate any such species. There was evidence of *Acacia* die-off observed, but *Acacia* seedlings were also observed to be germinating, indicating a second generation of these species. The groundcover is again dominated by exotic grasses.

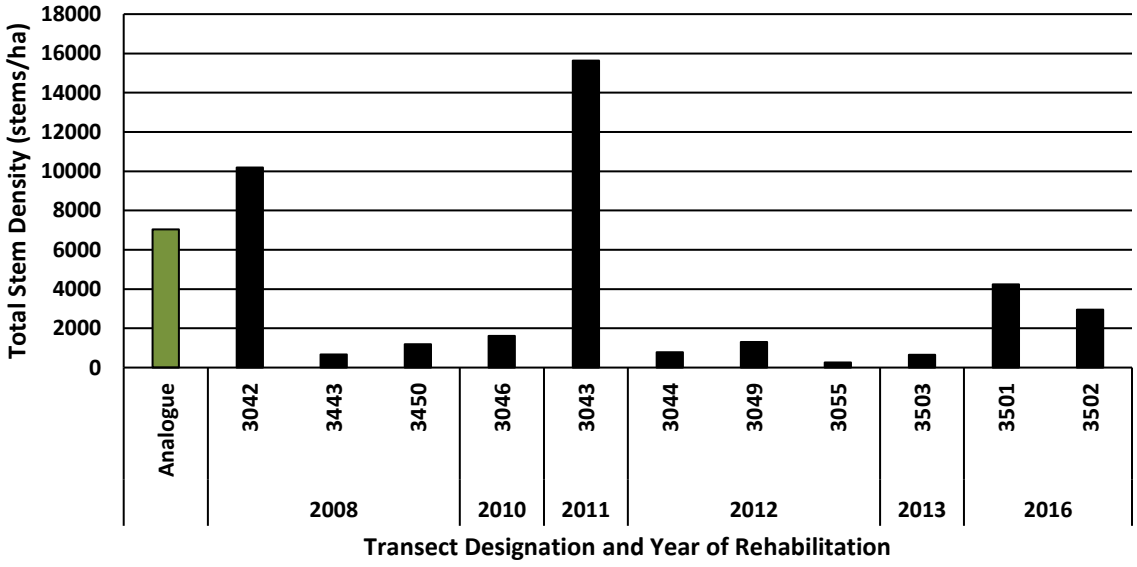

Figure 6: **2020 survey data Total Stem Densities for the individual Duralie Spoil Emplacement LFA Transects compared to average Analogue data surveyed in 2017**

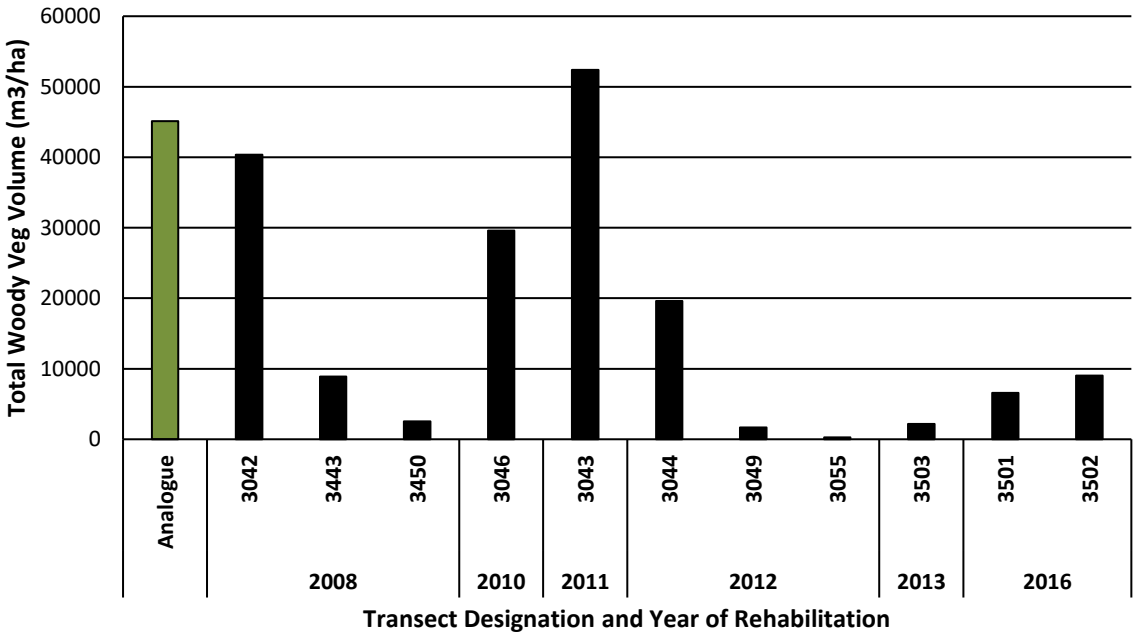

Figure 7: **2020 survey data Total Woody Vegetation Volume for the individual Duralie Spoil Emplacement LFA Transects compared to average Analogue data surveyed in 2017**

Table 6: 2020 survey stem densities and canopy volume of the woody vegetation for the Duralie Coal Mine spoil emplacement monitoring transects and the Average Analogue site values derived from the Biodiversity Offsets areas

Year Rehab	Transect	Canopy			Midstorey			Shrubs			Totals		Averages		Comments
		Density (stems/ ha)	Distance between stems (m)	Canopy Vol/ha (m^3/ha)	Density (stems/ ha)	Distance between stems (m)	Canopy Vol/ha (m^3/ha)	Density (stems/ ha)	Distance between stems (m)	Canopy Vol/ha (m^3/ha)	Stem Density (stems /ha)	Woody Veg Volume (m^3/ha)	Stem Density (stems/ ha)	Woody Veg Volume (m^3/ha)	Attributes Measured
2017	Analogue	188.2	7.60		1320.7	3.80		5528.3	2.20		7037.2	45121.2	7037.2	45121.2	All strata - canopy, midstorey and shrubs
2008	3042	688	3.81	24585	8171	1.11	15560	1328	2.74	198.75	10188	40343	4015	17266	Eucalypt spp. to 17m, Eucalypt spp. to 11m, Eucalypt spp. & shrubs <2m
	3443	33	17.35	4195	398	5.01	4580	238	6.48	124	669	8900			Eucalypt spp. to 15m, Mixed spp. to 9m, Mixed spp. <2m
	3450	0	0.00	0	0	0.00	0	1189	2.90	2556	1189	2556			Mixed shrub spp. to 4m
2010	3046	606	4.06	27335	550	4.26	2264	453	4.70	23	1609	29621	1609	29621	Eucalypt spp. to 13m, Mixed spp. to 6m, Mixed spp. <2m
2011	3043	184	7.37	10242	12696	0.89	41999	2752	1.91	161	15632	52402	15632	52402	Eucalypt spp. to 17 m, Eucalypt spp. & Acacia spp. to 8m, Shrub spp. <2m
2012	3044	235	6.52	17647	447	4.73	1227	103	9.88	742	785	19616	781	7187	Eucalypt spp. to 16m, Eucalypt spp. to 6.0m, Shrub spp. to 2.5m
	3049	623	4.01	1637	675	3.85	48	0	0.00	0	1298	1686			Eucalypt spp. to 7.5 m, Acacia spp. to 4.5m
	3055	42	15.38	1297	217	6.79	91	0	0.00	0	259	1387			Eucalypt spp. to 12m, Acacia spp. to 6m
2013	3503	55	13.48	1216	602	4.08	955	0	0.00	0	657	2171	657	2171	Eucalypt spp. to 13m, Acacia spp. and Eucalypt spp. <6m
2016	3501	0	0.00	0	834	3.46	5766	3410	1.71	795	4244	6560	3600	7799	Mixed spp. <2m – 5m, Mixed spp. <2m
	3502	0	0.00	0	969	3.21	8729	1986	2.24	309	2955	9037			Acacia spp. <2m – 5m, Mixed spp. <2m

"Eucalypt spp." - refers to some or all of these species in combination - *Corymbia maculata* (Spotted Gum), *Eucalyptus crebra* (Narrow-leaved Ironbark), *Eucalyptus fibrosa* (Broad-leaved Ironbark) *Eucalyptus moluccana* (Grey Box) and *Eucalyptus punctata* (Grey Gum).

"Acacia spp." – refers to some, or all of these species in combination – *Acacia decurrens* (Black Wattle), *Acacia falcata* (Sickle Wattle), *Acacia implexa* (Hickory Wattle), *Acacia irrorata* (Green Wattle), *Acacia mearnsii* (Black Wattle), *Acacia ulicifolia* (Prickly Moses).

"Shrub spp." - refers to some, or all of these species in combination – *Acacia longifolia* (Coastal Wattle), *Breynia oblongifolia* (Coffee Bush), *Leucopogon juniperinus* (Prickly Beard-heath), *Ozothamnus diosmifolius* (Rice Flower), *Pultenaea villosa* (Hairy Bush-pea), *Trema tomentosa* (Native Peach).

"Mixed spp." - refers to some, or all of the above species in combination.

3.2.7 Historical Comparison

The results of the 2020 survey are compared to the previous surveys in **Figure 8** for Average Stem Densities and **Figure 9** for Average Woody Vegetation Volume.

The 2008 rehabilitation transects surveyed this year have recorded average stem densities that were very similar to the 2019 survey, with an average of 4015 stems/ha in 2020 and 4309 stems/ha in 2019. These are similar to the densities recorded early in the monitoring program in 2013 (4256 stems/ha), 2014 (4162 stems/ha) and 2016 (3617 stems/ha) (**Figure 8**). The 2017 survey recorded the highest average stem densities for any of the surveys conducted to date (12, 813 stems/ha) while the 2018 survey recorded the lowest average density at 814 stems/ha. While stem densities can be expected to be variable across parts of the rehabilitation, canopy volumes have trended upwards despite the variability in the data (**Figure 9**).

With alternate transects being surveyed each year, the 2020 survey (1609 stems/ha) for the 2010 rehabilitation area requires comparison to the 2018 survey (1860 stems/ha), and then the 2016 survey (5950 stems/ha) (**Figure 8**). Likewise, the 2017 and 2019 survey results are directly comparable with 8900 and 5378 stems/ha respectively. Thus, the trend for a decrease in stems density is apparent across this aged rehabilitation. With the same rationale for comparison, canopy volume has increased as the vegetation has matured (**Figure 9**). For instance, 2016 recorded 14, 354 m^3/ha, 2018 recorded 24, 070 m^3/ha and the 2020 survey recorded 28, 621 m^3/ha.

Despite having the same survey situation (alternating transects) the 2011 rehabilitation does not follow the same pattern as the 2010 rehabilitation stem densities with some variation in the numbers – i.e. the 2018 survey recorded higher stem densities than the 2016 survey (22, 531 stems/ha and 17, 155 stems/ha respectively) with a decrease to the 2020 survey (15, 632 stems/ha). Canopy volumes have followed the pattern with each area surveyed increasing in volume as the vegetation matures (Figure 9).

The 2012 rehabilitation has recorded a steady decline in average stem densities over the period of the surveys with this survey recording the least – 781 stems/ha (**Figure 8**). Canopy volume had increased with each survey, but this survey has recorded a considerable reduction to an average of 7187 m^3/ha from the highest recorded volume of 46, 904 m^3/ha last survey.

The 2013 rehabilitation recorded a decrease in stem density from 3592 stems/ha to 657 stems/ha, continuing the downward trend over the four monitoring events (Figure 8). Average woody vegetation volume has decreased substantially to 2171 m^3/ha this survey compared to 22,373 m^3/ha for the 2019 survey. The 2018 survey recorded 5613 m^3/ha much lower than the volume of 17,800 m^3/ha recorded in 2017 (**Figure 9**).

The 2016 rehabilitation has recorded a decrease in the average stem density in 2020 (3600 stems/ha) compared to the 2019 survey (6548 stems/ha) and the 2018 survey (4988 stems/ha) (**Figure 8**). Canopy volume has also recorded a decrease this survey (7808 m^3/ha) compared to the 2019 survey (11,486 m^3/ha), after increasing substantially when compared to the 2018 survey (2168 m^3/ha) (**Figure 9**).

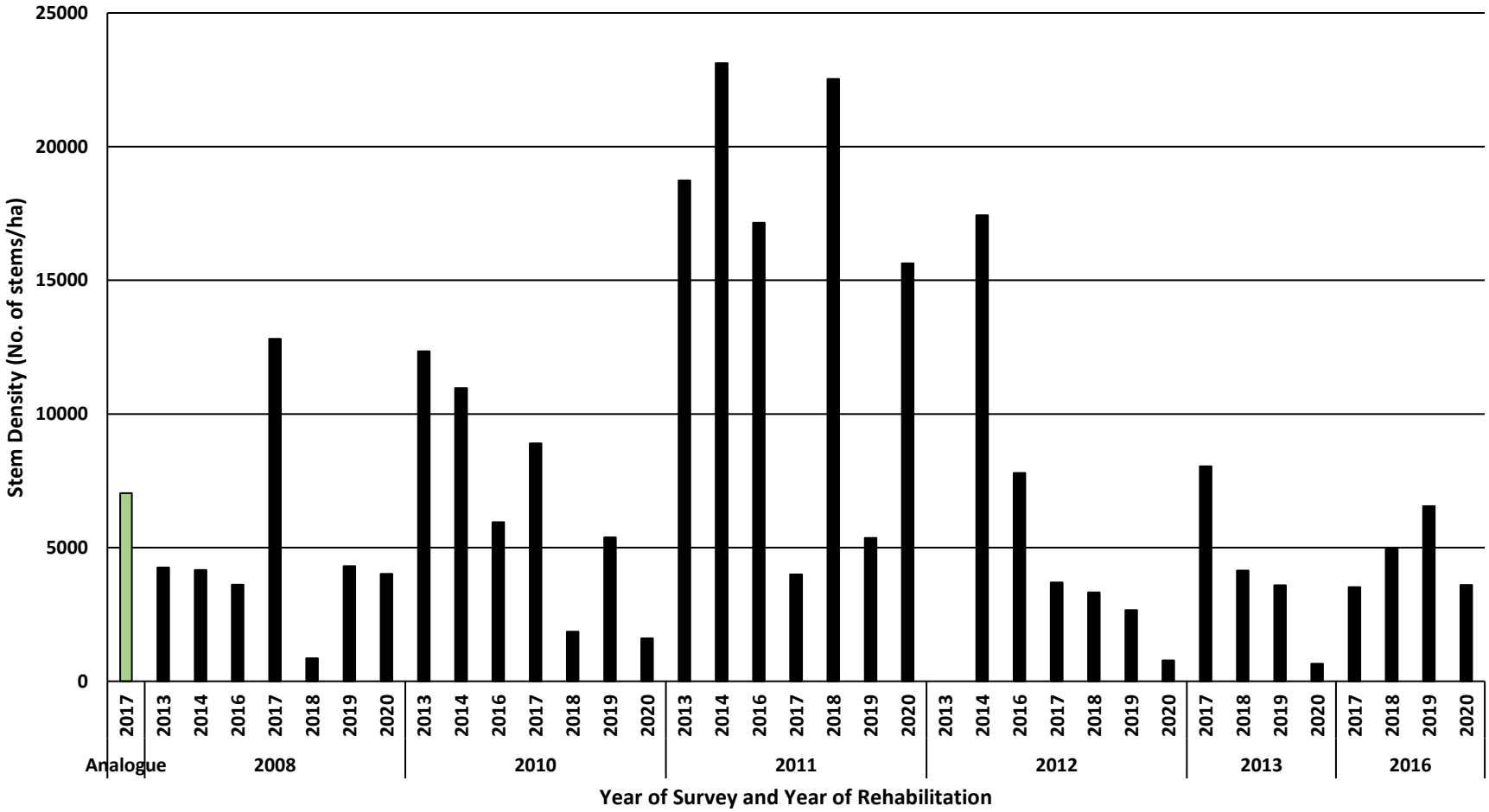

Figure 8: **Average Total Stem Density (stems/ha) values recorded from the 2020 survey, comparison to previous surveys and the 2017 Average Analogue values derived from the Biodiversity Offsets Areas**

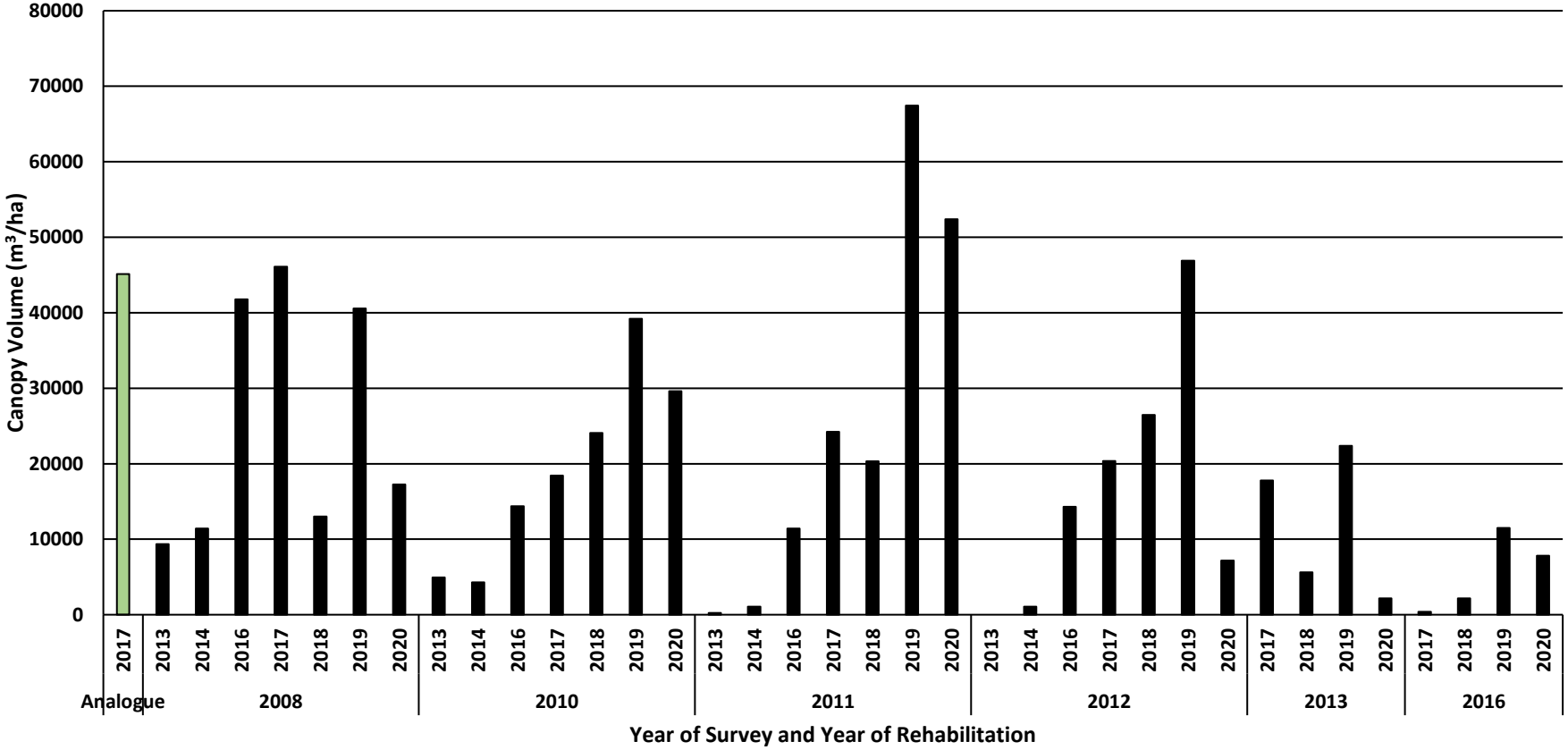

Figure 9: **Average Total Woody Vegetation Volume (m^3) values recorded from the 2020 survey, comparison to previous surveys and the 2014 and 2017 Average Analogue values derived from the Biodiversity Offsets Areas**

4. DISCUSSION AND RECOMMENDATIONS

Soil surface indicators for the various ages of rehabilitation are overall positive and indicate progression towards sustainable ecosystem functions. There are variations for some of the indicators for some of the ages of the rehabilitation but since the commencement of monitoring, the trend has been towards the analogue values.

Landscape Functional Analysis

The LFA indices continue to trend in the direction of the of analogue values, a feature that has been noted in previous reports. The Stability Index scores for the older rehabilitation areas have achieved or exceeded Analogue values, a pattern that appears to be well established suggesting that in with the rotation of survey transects across the spoil emplacement soil surface stability has been established. As stated in the last Monitoring Report (Kleinfelder, 2019) further increases in the Stability Index will come from the build-up of litter and maturation of the vegetation itself. It is therefore pleasing to see that the Landscape Organisation Index scores – the arrangement of the soil surface into nutrient accumulating and shedding "patches" and "interpatches"– have become uniformly even across the rehabilitation areas. All LOI's were recorded as 1.00, indicating that the soil surfaces of the transect areas were not shedding resources, but accumulating nutrients and able to limit rain run-off. Within the rehabilitation areas, there tends to be two main patch types identified. Where the canopy has thinned out due to *Acacia* die-off, grassy sward dominates (**Plate 1**), whereas under the dense plantings – especially dense *Eucalyptus* – litter is the dominant ground covering (**Plate 2**). Either type of patch serves to stabilise the soil surface and traps and recycles nutrients, although in terms of revegetation both patch types have issues with regards to the rates of nutrient cycling.

Despite some of the issues that are associated with the monitoring methodology – alternate/different transects monitored each year - the data recorded shows that the biophysical processes are on track for successful rehabilitation, and while no recommendations are made to attempt improvement or accelerate development that are directly related to the indices, it should be noted that improvements to vegetation structure and densities will act directly upon some of the inputs (such as litter quality and quantity) into the LFA indices.

Plate 1: **Transect 3049 (2012 rehab) – looking down LFA transect. Note the open nature of the woody vegetation due to sparse canopy species and some *Acacia* species die-off and the dense exotic groundcover**

Plate 2: **Photograph of Transect 3043 LFA in the 2010 rehabilitation area. Note the dense Eucalypts, litter layer and sparser groundcover**

Vegetation Structure

The vegetation structure of the rehabilitation areas continues to develop with changes in stem densities, strata proportions and species mixes varying due to initial seed mixes and the successful germination or otherwise of these species, age of the rehabilitation and natural life cycles of species and natural recruitment of new species.

Stem densities are extremely variable across many of the rehabilitation areas highlighting the differences in vegetation coverage. Where the rehabilitation was dominated by *Acacias* have experienced die-off as these species have reached the end of their life cycles, and in many cases the *Eucalyptus* species that form the canopy are not dense enough to compensate. Examples observed during this survey included:

- The northern section of the spoil emplacement represented by Transect 3055. Canopy species are below analogue densities and the die-off of the *Acacias* has resulted in the area being much more open with an increase in the density of the exotic grasses as groundcover.
- The area represented by Transect 3503 in the 2013 rehabilitation has also experienced a substantial die-off of the initial seeded *Acacias* and this has resulted in a more open and grassy rehabilitation area with a substantial reduction in density and volume.
- The 2016 rehabilitation area represented by Transect 3502 has also experienced *Acacia* die-off but with the added complication that no *Eucalyptus* or other canopy species had been observed in the vicinity of the transect in past surveys resulting in the decline in both stem density and canopy volume.

In the above areas, *Acacia* seedlings were observed to be germinating albeit in much less dense quantities, but these seedlings do provide an indication of the establishment of a self-sustaining ecosystem.

Increasing diversity will be improve structure and ecological niches for fauna usage but also improves the vegetative structure of the rehabilitation. One of the major differences in the vegetation between the rehabilitation and analogue sites is the relative proportion of the strata, with the rehabilitation lacking in species that form a key structural component, such as canopy or true shrub species. Examples from this year's survey include:

- The south-east section of the 2008 rehabilitation (Transect 3450) does not currently have any *Eucalyptus* or other canopy species, the first survey undertaken by Kleinfelder in this area in 2016 (Kleinfelder, 2016) noted that the canopy consisted entirely of tall *Acacias.* These were identified as *A. mearnsii* and *A. irrorata* which have now senesced leaving

vegetation consisting of tall shrubby species, a very dense exotic grass cover and prolific woody weeds.

- The 2016 rehabilitation (Transect 3502) as mentioned above.
- The 2008 rehabilitation (Transect 3042) where the dense canopy has resulted in only sparse groundcover and almost no true shrub species.

To counter the above stated lack of diversity in certain areas of the rehabilitation is the ongoing natural recruitment and proliferation of native species. Many of these species were not in the original rehabilitation seed mix and include mainly shrub and mid-storey species such as *B. oblongifolia, Cassinia arcuata, E. cupressiformis, L. juniperinus*, *Logania albiflora*, *L. longifolia, O. diosmifolius, Solanum prinophyllum* and *T. tomentosa.* These species are those that can be wind and/or fauna dispersed from nearby native vegetation. The maturation or increasing age of the rehabilitation has also contributed to the very high stem densities in other areas of the rehabilitation. In areas such as Transect 3042 (and the area below this represented by Transects 3045 and 3444) there are the multiple generations of canopy species. This year it was estimated that there are at least three generations of *C. maculata* and *E. punctata* in this area, with similar estimations for the 2011 and 2010 rehabilitation areas. Additionally this year, a small *C. maculata* was observed on slope below the Transect 3502 (but not recorded in the EFA survey) which is an excellent result and is assumed to be natural recruitment given the length of time since initial seeding occurred.

It should also be noted the most recent rehabilitation area, 2016 rehabilitation represented by Transect 3501 is an example of excellent revegetation where diversity and density appear to have been successfully achieved. This area is still maturing and while many of the *Acacias* has attained considerable height, the canopy species have yet to mature and emerge above the groundcovers (**Plate 24**). The approach to revegetation used int his area has been applied to the newest native woodland revegetation areas.

A major impediment to the recruitment and spread of native vegetation on the spoil emplacement is the spread of woody weed species such as *L. camara*, *L. sinense* and *S. mauritianum.* These weeds were particularly pronounced in the 2008 rehabilitation areas where canopy is non-existent or sparse i.e. Transect 3450 and 3443. As noted in **Section 3.2.1**, *L. sinense* has become well established in the vicinity of the latter transect and is beginning to pose a barrier to further native revegetation forming thickets. *L. camara,* and *S. mauritianum* are also present in many of the drains where sunlight is available. As has been noted in previous reports, these species are also spread by fauna and are often co-located with the above-mentioned native species.

The one area of pasture surveyed (Transect 3504) recorded LFA indices showing considerable variation internally and when compared to last year 's results. As this is still very young rehabilitation, further monitoring is required to determine if there are any issues that require remediation. The only management action recommended here is to slash this area as many young *Acacias* were observed to be colonising the pasture.

4.1 RECOMMENDATIONS FOR MANAGEMENT

Management actions suggested for the 2020 rehabilitation report include:

- The area represented by Transects 3502 and 3450 require seeding or planting with canopy species, but the area near Transect 3450 would require groundcover biomass reduction.
- Older areas of the rehabilitation where *Acacia* die-off has occurred and opened-up the area to sunlight (becoming dominated by exotic grasses) could be seeded with shrub species not included in the original seed mix to increase diversity.
- More generally further introduction of a wider variety of shrub species, especially those that do not spread by avian fauna could be facilitated with a modest seeding and/or planting program.
- *Leucopogon juniperinus* (Prickly Beard-heath) is a common species through the analogue sites but is not available commercially. It would be beneficial to attempt to collect seed from on site to use in the rehabilitation introducing it to younger rehabilitation areas or where it has not yet colonised. The PAF area and VMU AG both have dense populations of this species and it may be possible to collect seed from these areas. PlantNET states that seed are mature from August to January.
- Woody weed control works should be undertaken in the areas identified above where *L. camara*, *L. sinense* and *S. mauritianum* have become established and pose a threat to successful revegetation.
- As part of the above the drains could be mulched (as opposed to slashed) to provide access for weed control works, any revegetation program and fire breaks.
- Use of hazard reduction burns should be investigated for feasibility. The continuing build-up of litter (including the die-off of *Acacias*) combined with the either dense and tall grassy groundcover or high stem density of woody vegetation poses a risk if an uncontrolled fire were to occur (e.g. lightning strike). A controlled burn would have the added advantages of:
    - Reducing the biomass of the groundcovers and allowing ease of movement off tracks and drains. Presently the combination of woody litter and dense groundcovers presents a hazard for the movement of personnel on foot.

- Promote the germination of the seed bank from the species on the spoil emplacement – although this can lead to a large increase in the density of the *Acacias.*
- Help with control of the woody weeds – *L. camara* in particular. *L. sinense* is not controlled by fire as it acts as a firebreak and can resprout from roots (NSW WeedWise website). However, fire can be used to remove the above ground vegetation and then follow-up with herbicide application when re-sprouting.

4.2 CONCLUSIONS

The rehabilitation of the Duralie spoil emplacement continues to be on track for successful re-establishment of native woodland and pasture. The Landscape Functional Analysis indices have either achieved analogue or on track to achieve analogue values. Vegetation will take much longer to achieve “natural” woodland vegetation structure and composition, but indications from the older rehabilitation areas show that this is occurring in areas where the right combination of species were seeded. Species diversity and structure is improving through natural recruitment, although seeding with further shrub and midstorey species in particular but also canopy in selected areas, would increase the rate of diversification and provide greater fauna habitat.

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APPENDIX 1. LANDSCAPE FUNCTIONAL ANALYSIS (LFA) AND VEGETATION STRUCTURE TRANSECT DATA

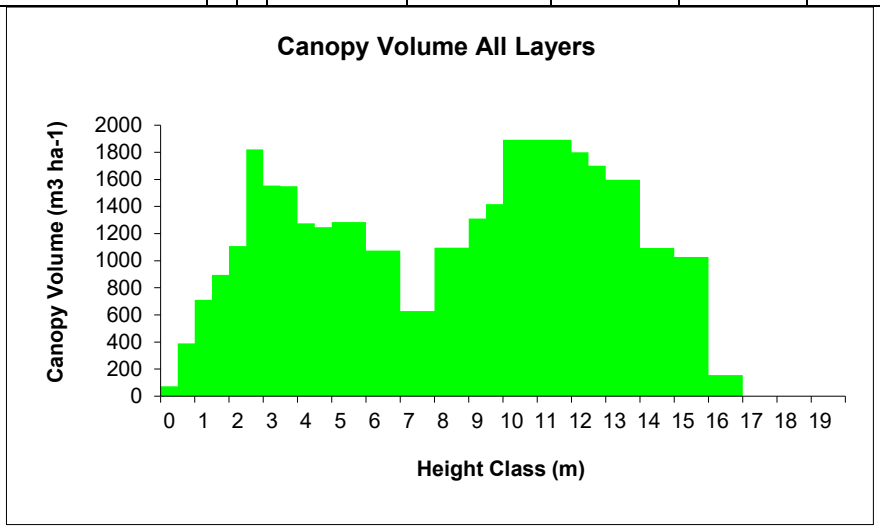
Table 7: Soil Surface Indicators for the LFA transects for the monitoring conducted to date. Transects are grouped by year of rehabilitation.

Year of Rehabilitation (No. of transects surveyed 2020)		Stability Index					Infiltration Index					Nutrient Cycling Index					Ave Distance Between Patches (m)					Ave Patch Width (m)				
		2013	2014	2016	2017	2020	2013	2014	2016	2017	2020	2013	2014	2016	2017	2020	2013	2014	2016	2017	2020	2013	2014	2016	2017	2020
Analogue	Mean	71.7	73.2	-	76.9		46.4	53.5	-	68.9		40.6	47.1	-	61.7		5.8	0.7	-	0		-	-	-	6.63	
(6)	SE	2.32	3.92		1.9		2.03	2.73		5.5		2.71	2.62		5.1		0.94	0.17								
2008	Mean	71.95	72.83	72.23	78.9	77.71	37.45	44.15	52.28	63.7	59.76	38.45	42.48	42.18	64.85	54.17	19.15	0.96	0.36	0	0	0.13	0.51	0.75	10	10
(3)	SE	2.31	3.61	3.34	0.8	0.8	3.96	2.97	5.09	0.9	1.39	4.72	3.39	4.52	5.56	1.91	5.85	0.58	0.36			0.13	0.25	0.21		
2010	Mean	76.5	73.4	71.9	78.1	79.38	34.8	41.6	57.9	51.4	56.2	36.5	36.3	43.5	45.7	53.21	25	0	0	0	0	0	1	1	10	10
(1)	SE					1.71					6.02	Not applicable														
2011	Mean	62.3	54.2	61.45	77.1	77	23.1	27.9	39.1	56.4	58.68	31.9	21.65	25.6	52.9	50.48	13	7.98	1.54	0	0	1	0.9	0.89	10	10
(1)	SE					2.52					2.64	Not applicable														
2012	Mean	44.47	58.93	73.87	73.7	70.78	19.97	28.57	37.1	59.9	42.23	12.2	22.57	34.93	54.5	39.28	0	3.16	0.4	0	0	0.00	0.32	0.76	0.67	9.13
(3)	SE	0.67	6.08	6.82	4.38	1.97	1.88	2.62	5.23	1.79	2.16	0.92	2.64	7.42	5.3	3.04	0	0.66	0.4			0	0.02	0.24		
2013	Mean				75.5	73.25				54.2	49.79				46.4	40.67				0	0				10	10
(1)	SE					3.52					3.99	Not applicable														
2016	Mean				59.25	75.39				39.65	46.84				25.2	40.44				1.3	0				1.99	10
(2)	SE				1.75	1.19				3.65	2.02				6.4	2.36				0.3						
2018	Mean					63.17					42.4					31.86					0					10
(1)	SE					2.13					4.19					7.37										

Vegetation Structure Data from Native Woodland Transects Surveyed in 2020

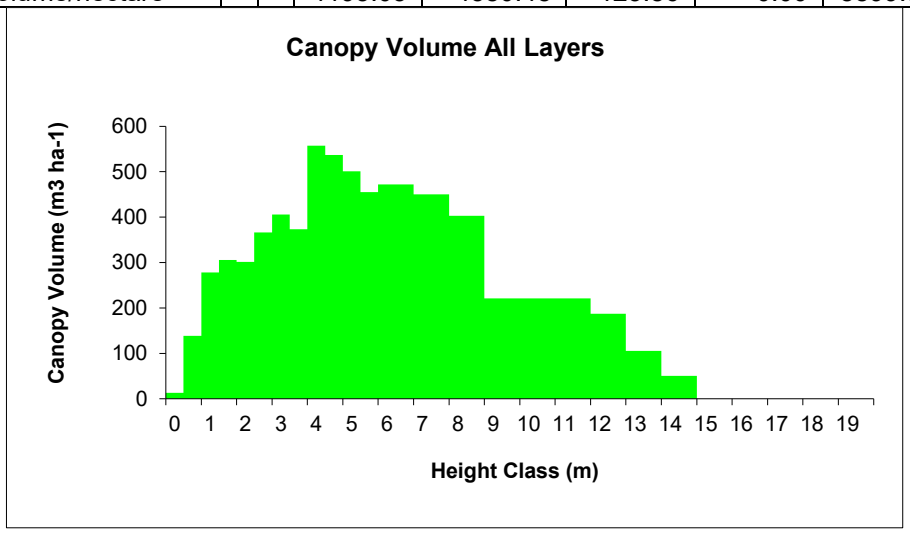
Transect 3042 - 2008 Rehabilitation

Stratum	Canopy	Midstorey	Shrubs	Layer4	Total
No Plants/hectare	687.99	8171.34	1328.35	0.00	10187.68
Mean Distance /b/ plants	3.81	1.11	2.74	0.00	n/a
Canopy Volume/hectare	24584.63	15559.83	198.75	0.00	40343.22



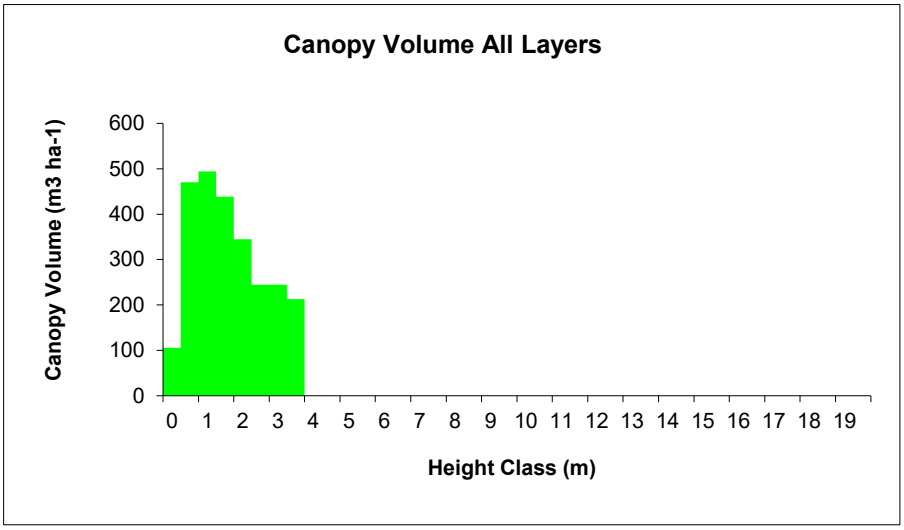
Transect 3443 - 2008 Rehabilitation

Stratum	Canopy	Midstorey	Shrubs	Layer4	Total
No Plants/hectare	33.22	398.01	238.06	0.00	669.29
Mean Distance /b/ plants	17.35	5.01	6.48	0.00	n/a
Canopy Volume/hectare	4195.05	4580.48	123.86	0.00	8899.39



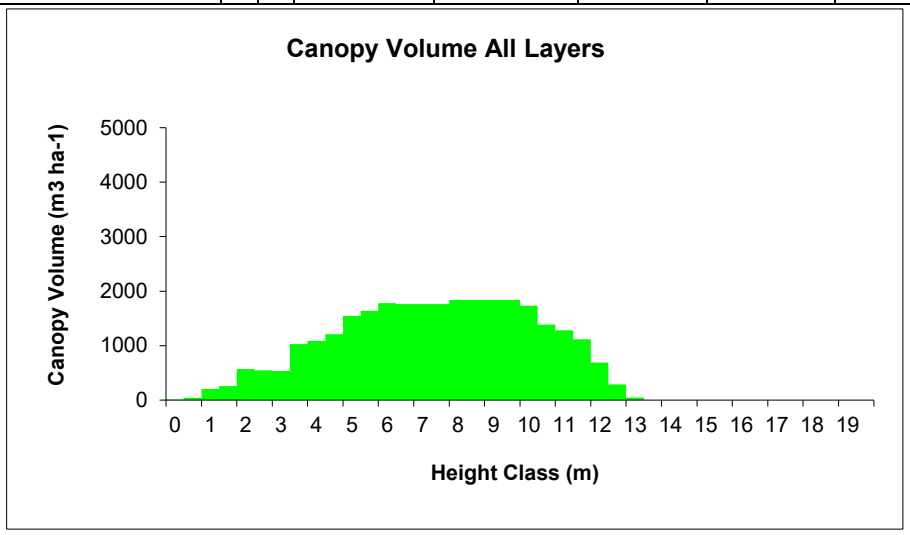
Transect 3450 - 2008 Rehabilitation

Stratum	Canopy	Midstorey	Shrubs	Layer4	Total
No Plants/hectare	1189.06	0.00	0.00	0.00	1189.06
Mean Distance /b/ plants	2.90	0.00	0.00	0.00	n/a
Canopy Volume/hectare	2555.60	0.00	0.00	0.00	2555.60



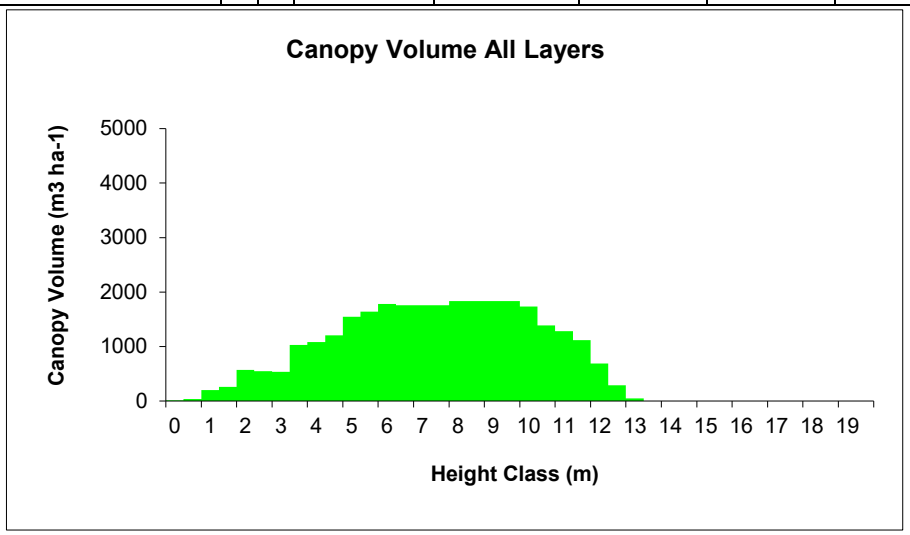
Transect 3046 - 2010 Rehabilitation

Stratum	Canopy	Midstorey	Shrubs	Layer4	Total
No Plants/hectare	605.92	550.39	452.69	0.00	1609.00
Mean Distance /b/ plants	4.06	4.26	4.70	0.00	n/a
Canopy Volume/hectare	27334.58	2263.76	22.83	0.00	29621.17



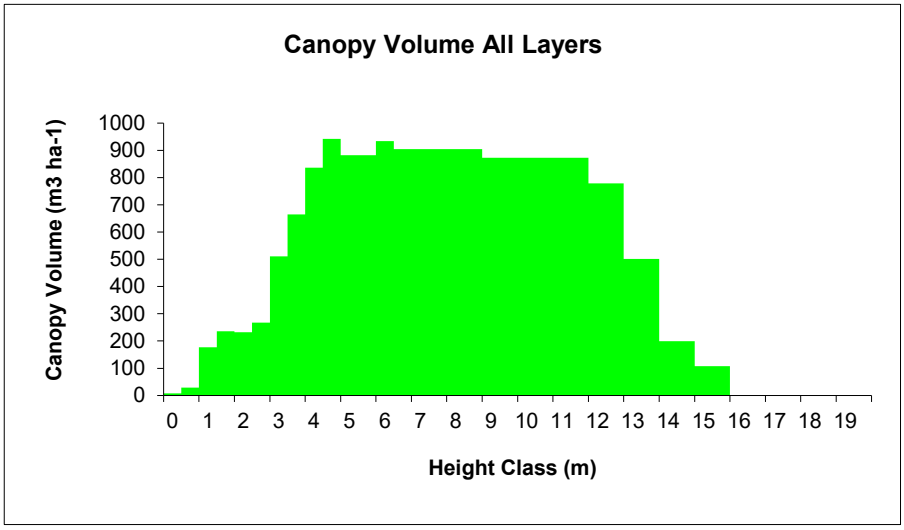
Transect 3046 – 2011 Rehabilitation

Stratum	Canopy	Midstorey	Shrubs	Layer4	Total
No Plants/hectare	605.92	550.39	452.69	0.00	1609.00
Mean Distance /b/ plants	4.06	4.26	4.70	0.00	n/a
Canopy Volume/hectare	27334.58	2263.76	22.83	0.00	29621.17



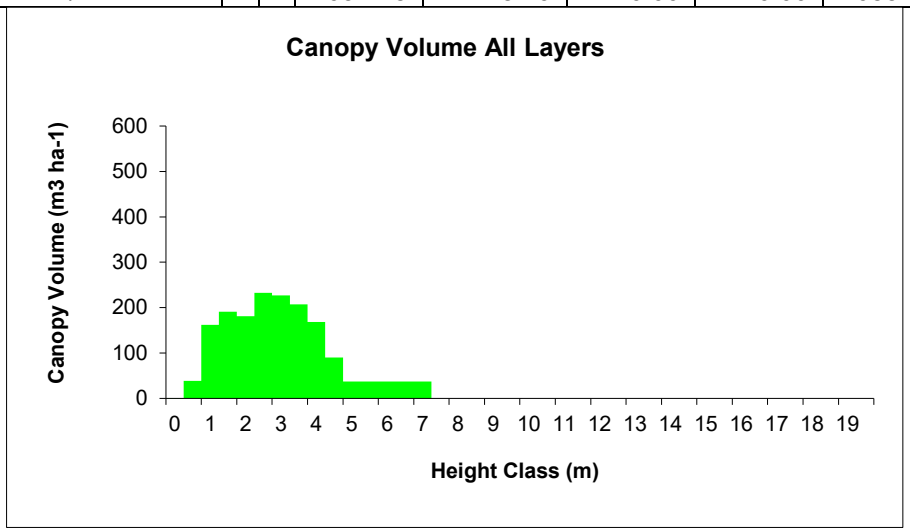
Transect 3044 – 2012 Rehabilitation

Stratum	Canopy	Midstorey	Shrubs	Layer4	Total
No Plants/hectare	235.33	446.73	102.55	0.00	784.61
Mean Distance /b/ plants	6.52	4.73	9.88	0.00	n/a
Canopy Volume/hectare	17646.83	1227.43	741.63	0.00	19615.88



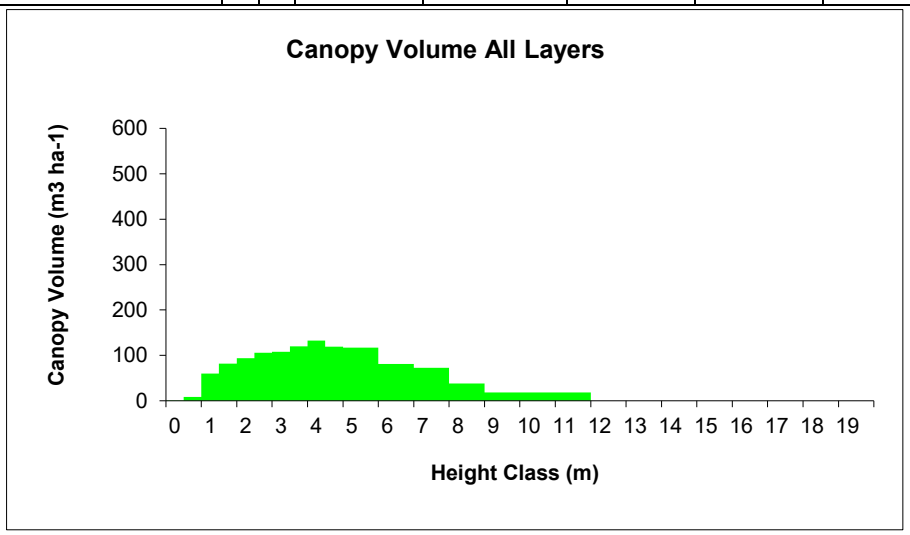
Transect 3049 – 2012 Rehabilitation

Stratum	Canopy	Midstorey	Shrubs	Layer4	Total
No Plants/hectare	623.05	674.65	0.00	0.00	1297.70
Mean Distance /b/ plants	4.01	3.85	0.00	0.00	n/a
Canopy Volume/hectare	1637.28	48.49	0.00	0.00	1685.77



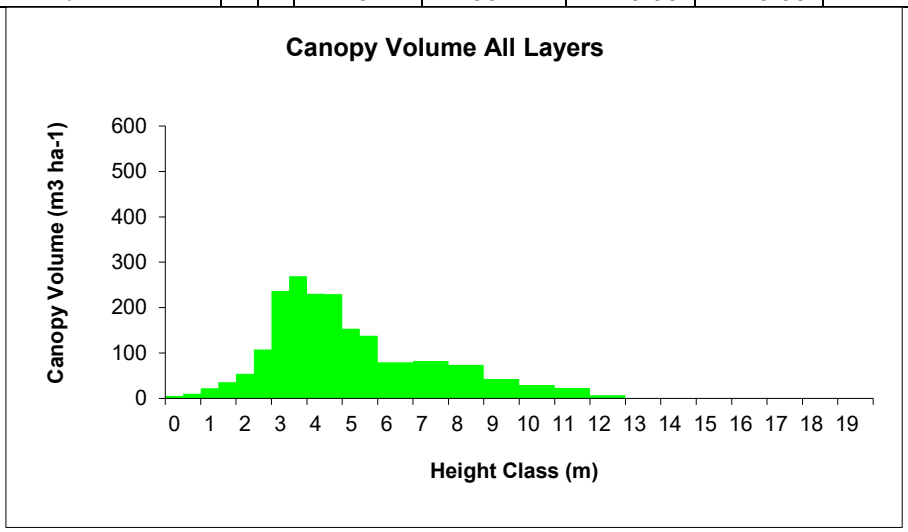
Transect 3055 – 2012 Rehabilitation

Stratum	Canopy	Midstorey	Shrubs	Layer4	Total
No Plants/hectare	42.27	217.06	0.00	0.00	259.33
Mean Distance /b/ plants	15.38	6.79	0.00	0.00	n/a
Canopy Volume/hectare	1296.90	90.92	0.00	0.00	1387.82



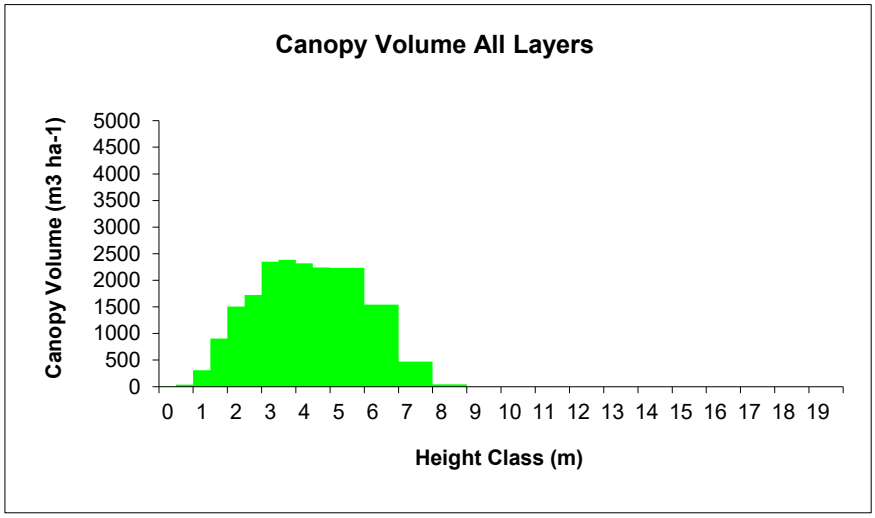
Transect 3503 - 2013 Rehabilitation

Stratum	Canopy	Midstorey	Shrubs	Layer4	Total
No Plants/hectare	55.07	602.21	0.00	0.00	657.28
Mean Distance /b/ plants	13.48	4.08	0.00	0.00	n/a
Canopy Volume/hectare	1216.22	954.77	0.00	0.00	2171.00



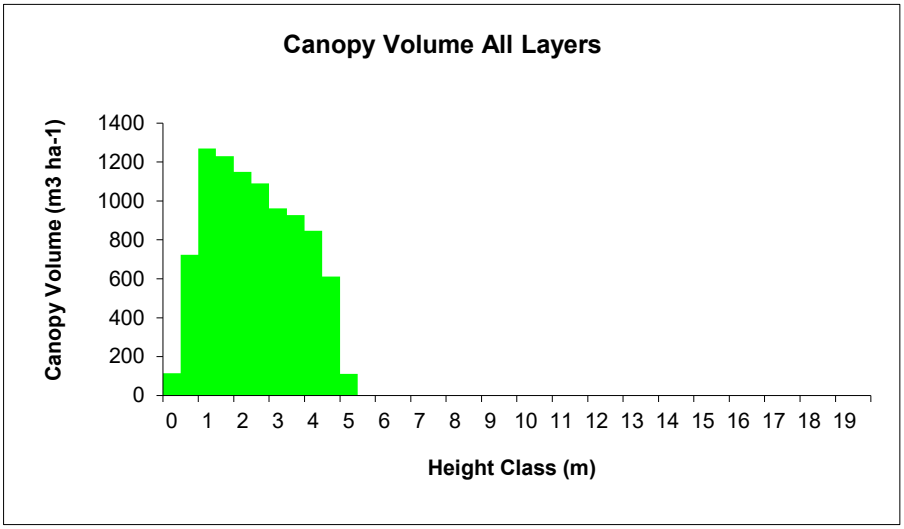
Transect 3501 – 2016 Rehabilitation

Stratum	Canopy	Midstorey	Shrubs	Layer4	Total
No Plants/hectare	0.00	834.10	3409.88	0.00	4243.98
Mean Distance /b/ plants	0.00	3.46	1.71	0.00	n/a
Canopy Volume/hectare	0.00	5765.69	794.53	0.00	6560.22



Transect 3502 – 206 Rehabilitation

Stratum	Canopy	Midstorey	Shrubs	Layer4	Total
No Plants/hectare	0.00	968.98	1986.33	0.00	2955.31
Mean Distance /b/ plants	0.00	3.21	2.24	0.00	n/a
Canopy Volume/hectare	0.00	8728.57	308.70	0.00	9037.27



APPENDIX 2. TRANSECT MONITORING PHOTOGRAPHS

Plate 3: **Transect 3042 (2008 rehabilitation) looking down LFA transect.**

Plate 4: **Transect 3042 – view of typical groundcover taken at the 2-3m point on the LFA transect. Dense litter cover.**

Plate 5: **Top of Transect 3443. Note the relatively open nature of the vegetation**

Plate 6: **Transect 3443 showing groundcover at the 24m point – herbaceous groundcovers and litter**

Plate 7: **Transect 3443 showing grassy sward groundcover at the 16-17m point on the LFA transect.**

Plate 8: **Transect 3443 showing typical groundcover of litter at the 2-3m point on the LFA transect**

Plate 9: **Start of Transect 3450 (2008 rehabilitation) looking down LFA transect. Note the lack of canopy allowing the growth of the dense grass sward**

Plate 10: **Transect 3450 showing typical ground cover at the 1 – 2m point on transect – dense grass with woody debris**

Plate 11: **Transect 3450 looking south from the transect start (perpendicular to LFA transect) showing dense exotic grasses and the death of the *Acacias* that were the main canopy in this section of the rehabilitation. Note the proliferation of woody weeds – visible here are Lantana, Wild Tobacco and Privet.**

Plate 12: **Top of Transect 3046 (2010 rehabilitation) looking down LFA transect – canopy cover increases down transect**

Plate 13: **Transect 3046 at the 1-2m point showing typical grassy litter groundcover**

Plate 14: **Top of Transect 3043 (2011 rehabilitation) looking down LFA transect – note the dense proliferation of saplings and litter covered ground with little vegetation**

Plate 15: **Transect 3043 showing typical groundcover at the 20 - 21m point**

Plate 16: **Start of Transect 3044 (2012 rehabilitation area) looking down the LFA transect**

Plate 17: **Transect 3049 along down the LFA transect – this area was flat and very open**

Plate 18: **Transect 3049 (2012 rehabilitation area) showing the typical ground cover (grassy sward) at the 10 - 11m point**

Plate 19: **Transect 3049 at the 21 - 22m point showing typical groundcover of litter, forbs and sparse grass**

Plate 20: **Start of Transect 3055 (2012 rehabilitation area) looking down the LFA transect. Note the massive die-off of *Acacia* species**

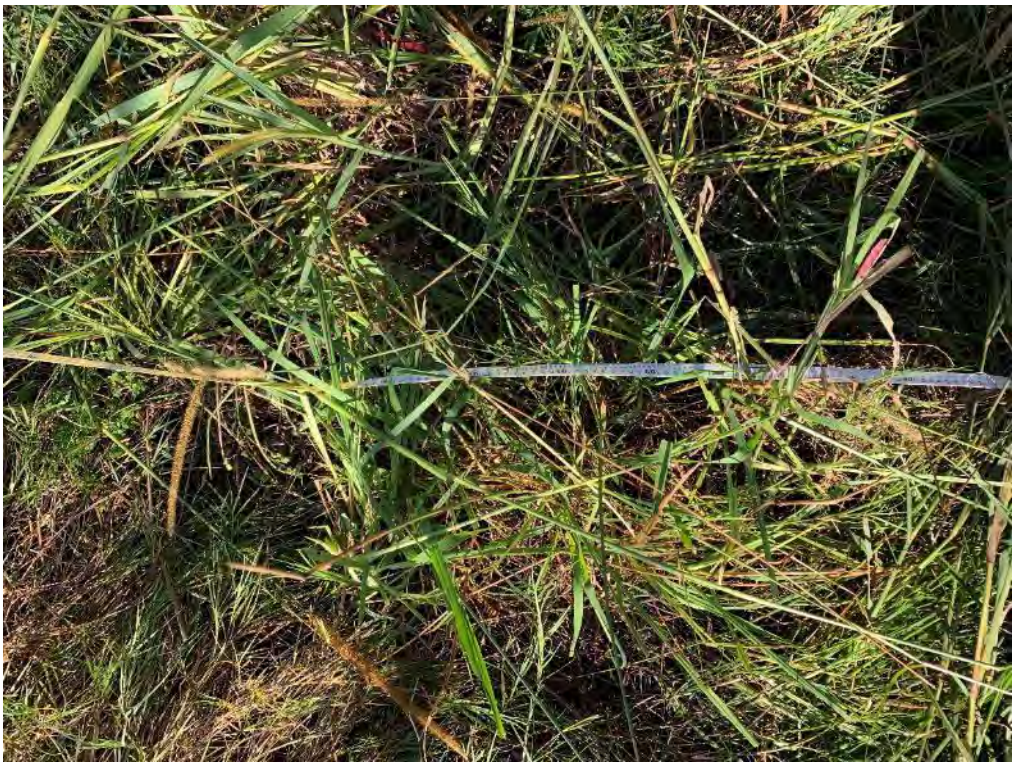


Plate 21: **Transect 3055 at the 10 - 11m point showing the grassy groundcover and grassy litter that have colonised the soil surface since the die-off of the canopy**

Plate 22: **Transect 3503 (2013 rehab) looking down the transect. Note the open nature of the cover at the top of the transect due to *Acacia die-off*. Canopy cover increases down the transect**

Plate 23: **Transect 3503 at the 1 - 2m point showing ground cover of dense grass**

Plate 24: **Start of Transect 3501 (2016 rehabilitation) looking down the LFA transect.**

Plate 25: **Transect 3501 groundcover at 17m along the transect**

Plate 26: **Start of Transect 3502 (2016 rehabilitation area) looking down the LFA transect. Note the die-off of *Acacias***

Plate 27: **Transect 3502 at the 23m point showing typical exotic grassy groundcover**

Plate 28: **Start of Transect 3504 (2018 rehab) looking along the transect**

Plate 29: **Transect 3504 at the 14m showing typical groundcover for the transect**

Plate 30: Transect 3505 (2020 pasture rehab) looking along future transect

Plate 31: Transect 3506 (native woodland) looking down future transect

APPENDIX 3. STAFF CONTRIBUTIONS

The following staff were involved in the compilation of this report.

Name	Qualification	Title/Experience	Contribution
Gayle Joyce	BSc (Forestry) (Hons)	GIS Specialist	GIS & Mapping
Ashley Owen	DipSc. BSc (In progress)	Ecologist	Field Work & Report Writing
Nigel Fisher	BSc (Hons) PhD	Senior Restoration Ecologist	Project Mgt, Field Work, Report Writing and Review