COWAL GOLD OPERATIONS

2019 ANNUAL REVIEW

COWAL GOLD OPERATIONS
2019 Annual Review

Name of Operation	*Cowal Gold Operations*
Name of Operator	*Evolution Mining (Cowal) Pty Limited*
Development Consent	*DA 14/98*
Name of Holder of Development Consent	*Evolution Mining (Cowal) Pty Limited*
Mining Lease #	*ML 1535*
Name of Holder of Mining Lease	*Evolution Mining (Cowal) Pty Limited*
Mining Lease #	*ML 1791*
Name of Holder of Mining Lease	*Evolution Mining (Cowal) Pty Limited*
Environmental Protection Licence #	*EPL11912*
Name of Holder of EPL	*Evolution Mining (Cowal) Pty Limited*
Water Licence #	*WAL 36569, WAL 31864, WAL 36615, WAL 36617, WAL 13749, WAL 14981, WAL 13748, WAL 13748, WAL 31568, WAL 31563, WAL 42993*
Name of Holder of Water Licences	*Evolution Mining (Cowal) Pty Limited*
MOP Start Date (1)	*1 January 2019*
MOP End Date (1)	*31 December 2019 extended to 30 June 2020)*
MOP End Date (2)	*31 December 2019*
Annual Review Start Date	*1 January 2019*
Annual Review End Date	*31 December 2019*

I, Greg Walker, certify that this audit report is a true and accurate record of the compliance status of the Cowal Gold Operations for the period 1 January – 31 December 2019 and that I am authorised to make this statement on behalf of Evolution Mining (Cowal) Pty Limited.

Note.

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

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

Name of Authorised Reporting Officer	*Greg Walker*
Title of Authorised Reporting Officer	*Interim General Manager*
Signature of Authorised Reporting Officer	
Date	*30 July 2020*

Prepared by	
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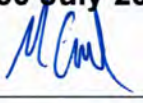
Signature	
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Name	**Greg Walker**
Title	**Interim General Manager**
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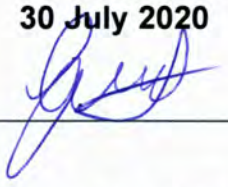
Signature	

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Issued to	**Steve O'Donoghue – Department of Planning, Industry and Environment**
Date	**30 July 2020**

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1 STATEMENT OF COMPLIANCE

The compliance status of the Cowal Gold Operations (CGO) with its relevant approval conditions at the end of the reporting period (31 December 2019) is provided in Table 1.

Table 1: Statement of Compliance

Were all conditions of the relevant approval(s) complied with?	
Development Consent DA 14/98	YES
Environmental Protection Licence (EPL) 11912	YES
Mining Lease (ML) 1535	YES
Mining Lease (ML) 1791	YES

2 INTRODUCTION

The 2019 Annual Review (AR) has been prepared by Evolution Mining (Cowal) Pty Limited (Evolution) for the CGO in accordance with the requirements of Condition 9.1(b) of the development consent (DA 14/98) for the CGO (granted on 26 February 1999) (development consent) (as modified) and Condition 26 of the Conditions of Authority for ML 1535 (granted on 13 June 2003). This AR is also consistent with the New South Wales (NSW) Government's (2015) Annual Review Guideline – Post-approval Requirements for State Significant Mining Developments.

2.1 CGO BACKGROUND

The CGO is a gold-silver mine owned and operated by Evolution and is located approximately 38 kilometres (km) north-east of West Wyalong, NSW (Figure 1). The land immediately adjacent to and surrounding the CGO consists of Lake Cowal and farming land (Figure 2 shows the land tenure of properties in the vicinity of the CGO). A satellite image of the CGO was captured in September 2019 and is presented on Figure 3, which also presents the current operational disturbance footprint and general arrangement of the CGO components. Land preparation areas and the extent of rehabilitation during the reporting period is presented on Figure 4, while the offset areas are presented on Figure 5.

North Limited (North) commenced exploration along the western side of Lake Cowal in 1981. From 1981 to 1994, exploration was concentrated on the Endeavour 42 (E42) ore body to increase the size and confidence of the resource by infill and deep drilling.

North received Development Consent for the Cowal Gold Project in February 1999. North was later acquired by Rio Tinto which subsequently sold the Cowal Gold Project to Homestake Australia Limited (Homestake). Homestake commenced advanced drilling on E42 in late 2001. In December 2001, Barrick (Cowal) Pty Ltd (Barrick) acquired Homestake and its operating subsidiary. Barrick continued the drilling programme of the E42 ore body between 2001 and 2005. During 2003 and 2004, the CGO underwent a detailed design phase and construction commenced on 12 January 2004. Mining operations commenced in April 2005, followed by operation of the final stage of the open pit dewatering system in June 2005. Processing operations commenced in April 2006. Evolution acquired Barrick on 24 July 2015.

2.2 MINE CONTACTS

Contact details for key Evolution employees at the CGO are provided below:

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The street and postal addresses for the CGO are provided below:

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LAKE COWAL NSW 2671

Postal Address
PO Box 210
WEST WYALONG NSW 2671

3 APPROVALS

3.1 CURRENT LIST OF CONSENTS, LEASES, LICENCES AND PERMITS

The key consents, leases, licences and permits under which the CGO operates (relevant to the reporting period) are presented in Table 2. Any applicable changes to these approvals during the reporting period are also outlined in Table 2.

Table 2: Key Consents, Leases, Licences and Permits

Instrument	Relevant Authority	Date of Grant	Expiry Date	Last Issue Date	Changes During AR Period
EPBC 2017/7989	DAWE	5/02/2019	31/12/2032	05/02/2019	Nil
Development Consent (DA 14/98)	DP&E	26/02/1999	31/12/2032	26/08/2019	Administrative changes.
Development Consent (DA2011/64) (Eastern Saline Borefield [ESB])	FSC	20/12/2010	Life of ML	2010	Nil
Mining Lease (ML 1535)	DRG	13/06/2003	13/06/2024	13/06/2003	Nil
Mining Lease (ML 1791)	DRG	20/06/2019	20/06/2040	20/06/2019	Nil
Environment Protection Licence (EPL 11912)	EPA	23/12/2003	N/A	19/04/2018	Evolution submitted a licence variation to update the EPL to rectify an administrative error. The EPL variation was approved on 19 April 2018.
Permit #1361 under section 87(1) of the NPW Act	OEH	23/05/2002	Life of ML	2002	Nil
Consent #1467 under section 90 of the NPW Act	OEH	27/11/2002	Life of ML	2002	Nil
Permit #1468 under section 87(1) of the NPW Act	OEH	27/10/2003	Life of ML	2003	Nil
Consent #1680 under section 90 of the NPW Act	OEH	28/07/2003	Life of ML	2003	Nil
Permit #1681 under section 87(1) of the NPW Act	OEH	28/07/2003	Life of ML	2003	Nil
AHIP number: C0004570	OEH	27/06/2019	27/06/2033	27/06/2019	Nil
Care Agreement C0004976	OEH	01/07/2019	31/12/2032	01/07/2019	Nil
Bland Creek Palaeochannel (BCPC) borefield Water Access Licence (WAL) 31864 Water supply work approval 70WA614076	DI-Lands & Water	14/09/2012	13/9/2025	2015	Nil
Eastern Saline Borefield WAL 36569 Water supply work approval 70WA614933	DI-Lands & Water	10/06/2011	09/06/2026	14/09/2014	Nil

Table 2 (Continued): Key Consents, Leases, Licences and Permits

Instrument	Relevant Authority	Date of Grant	Expiry Date	Last Issue Date	Changes During AR Period
Saline groundwater supply borefield within ML 1535 WAL 36615 Water supply works approval 70WA614090	DI-Lands & Water	21/03/2014	13/09/2025	13/09/2015	Nil
Pit dewatering WAL 36615 Water supply works approval 70WA614090	DI-Lands & Water	21/03/2014	13/09/2025	13/09/2015	Nil
Pit dewatering WAL 36617 Water supply works approval 70WA614090	DI-Lands & Water	21/03/2014	13/09/2025	13/9/2015	Nil
Monitoring and test bore licences	DI-Lands & Water	Various	Various	2015	Nil
High Security Title WAL13749	DI-Lands & Water	21/12/2006	Life of ML	21/12/2006	Nil
High Security Title WAL14981 (80 Units)	DI-Lands & Water	15/09/2011	Life of ML	15/092011	Nil
General Security WAL13748	DI-Lands & Water	21/12/2006	Life of ML	21/12/2006	Nil
Lake Cowal pipeline and Temporary Isolation Bund and Lake Protection Bund structures Water Supply Works Approval 614805	DI-Lands & Water	12/01/2010	13/9/2025	13/9/2015	Nil
NSW Dangerous Goods Acknowledgement (NDG037143)	WorkCover	2005	Life of ML	2005	Ongoing – upon change basis since 2015.

DP&E: NSW Department of Planning and Environment.

DI-Lands & Water: Department of Industry – Lands & Water.

DRG: Division of Resources and Geoscience – within the Department of Planning and Environment (previously the Division of Resources and Energy).

EPA: NSW Environmental Protection Authority.

FSC: Forbes Shire Council.

NPW Act: NSW *National Parks and Wildlife Act 1974.*

OEH: NSW Office of Environment and Heritage.

3.2 STATUS OF ENVIRONMENTAL MANAGEMENT PLANS REVIEW

The following Environmental Management Plans (EMPs) were approved by the DP&E during the reporting period:

- Transport management plan (Dec 2019)

4 OPERATIONS SUMMARY

4.1 MINING AND PROCESSING OPERATIONS

During the reporting period, mining operations from the E42 open pit continued as per relevant approvals outlined in Section 3.1. The processing plant also operated as per all relevant approvals. A summary of key production statistics for the reporting period are provided in Table 3 below.

Table 3: Production Summary

Material	Approved Limit	2018 AR	2019 AR	2020 AR (Forecast)
Ore (t)	N/A	7,119,947	3,963,558	2,156,123
Mineralised Waste (t)	N/A	670,907	638,904	1,144,388
Waste Rock (t)	N/A	24,404,148	13,807,518	17,622,286
Northern Waste Rock Emplacement (NWRE) (m AHD)	308[1]	268[3]	268	1288
Southern Waste Rock Emplacement (SWRE) (m AHD)	283[1]	278	283	283
Perimeter Waste Rock Emplacement (PWRE) (m AHD)	233[1]	209	223	223
Tailings Storage Facilities (TSFs)				
Northern TSF (NTSF) (m AHD)	264[1]	236	240.5	240.5
Southern TSF (STSF) (m AHD)	272[1]	243.7	243.7	243.7
Mill Throughput (Mtpa)	7.5[2]	7.94	8.36	10.61
Saleable Product (oz)	N/A	244,217	270,492	256,780

[1] Development Consent Condition 1.2(c). Following approval of MOD14 on 4 October 2018 the limit for the NTSF and STSF were revised to 240.5 m AHD and 248.4 m AHD respectively.

[2] Development Consent Condition 1.2(b).

t – tonne; m AHD – metres Australian Height Datum; Mtpa – million tonnes per annum; Oz – ounce.

4.1.1 Mining

Mining of the open pit during 2019 occurred in Stage G and Stage H. Mining in Stage G occurred from Relative Level (RL) 840 metres (m) to RL 755 metres, representing a vertical advance of 85 metres. Stage G was completed in 2019. Meanwhile, mining in Stage H during 2019 occurred from RL 1155 metres in the North-West area to RL 1065 metres at its lowest bench with two ramps access set up in the North and in the South.

Vertical dewatering systems were maintained throughout the reporting period. Horizontal holes were drilled as mining progressed through Stage H in order to de-pressurise specific areas from January to December 2019.

Initially, waste rock mined from the open pit was stockpiled for the NTSF Stage 6 lift works, and outer slope rehabilitation on the waste emplacements. IWL project commenced in November 2019 and henceforth any waste rock mined from the open pit was sent to the IWL.

As per condition 1.2(d) of the Development Consent, construction works on the TSF embankments is permitted to be undertaken during the hours of 7am-6pm, seven days per week. During the reporting period, construction was undertaken on the NTSF Stage 6 lift Monday – Sunday during the permitted hours.

Mining operations will continue in Stage H during the 2020 reporting period.

4.1.2 Processing

Processing continued throughout the reporting period. No changes to the processing operation took place during the reporting period. The floats tail leach circuit upgrades within the process plant were fully completed, with this circuit operational by the end of the reporting period.

Tailings were deposited into the stage 6 lift (5th augmentation) of the STSF from the 1st January 2019- 2nd October 2019. Tailings deposition was switched to the NTSF from the 2nd October 2019 and continued on for the remainder of the period. Construction work on the IWL was initiated toward the end of the period.

In accordance with Development Consent Condition 5.3(a), cyanide levels in the aqueous component of the tailings slurry stream did not exceed 20 mg cyanide weak acid dissociable per litre (CN_{WAD}/L) (90 percentile over six months), and 30 mg CN_{WAD}/L (maximum permissible limit at any time at the process plant).

Processing operations will continue in 2020, including general process improvements.

4.2 EXPLORATION

Exploration activities within ML 1535 undertaken during the reporting period included exploration and resource development drilling within and surrounding the main E42 open pit and proximal deposits, including the Endeavour 46, Galway/Regal and Endeavour 41 deposits.

A total of approximately 116,563 m of drilling was completed within ML 1535 during the reporting period including:

- A total of 976 holes for 31,856m in-pit RC drilling.
- A total of 162 holes for 62,346m diamond drilling.
- A total of 223 holes for 22,361m air core drilling.

With the exception of the in-pit RC drilling, all holes were fully cement grouted. Land disturbance within ML 1535 was minimal as a result of the exploration activities, and rehabilitation of the drilling areas was undertaken on completion of each program.

Exploration and resource development drilling is expected to continue within ML 1535 throughout 2020, and is outlined in the currently approved MOP. Further Geotechnical and Underground drilling are also proposed to be undertaken during 2020.

4.3 HAZARD AUDIT

The triennial hazard audit was conducted from 15-17 April 2019 and report provided to the Department on 14 May 2019. All actions arising for the audit were closed out by the 5th of December.

5 ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

The 2018 AR meeting was held on 05 December 2019 at CGO. There were no actions arising from this meeting. No additional directions were given during site visits within the reporting period.

6 ENVIRONMENTAL PERFORMANCE

Environmental management at the CGO during the reporting period has been conducted under the guidance of and in accordance with the EMPs prepared for the CGO, required under the Development Consent.

Overall Performance against Licences, Approvals and Environmental Management Plans and Effectiveness of Environmental Management

Evolution has fully complied with the commitments of the Resources regulator (formerly DRG/DRE) approved MOP during the reporting period, and any subsequent updates approved by the Resources Regulator.

The EPL 11912 Annual Return for the 23 December 2018 to 22 December 2019 reporting period was submitted to the EPA on 19 February 2019. In the 2019 Annual Return, Evolution identified non-compliances related to monitoring not being undertaken at some monitoring points. A summary of the EPL 11912 non-compliances is provided on the EPA website at: http://www.epa.nsw.gov.au/prpoeoapp/.

Evolution has all the relevant project management systems, staffing and consultancy arrangements in place to be in a position of confidence regarding compliance with all relevant licences, approvals and EMPs. Evolution expects to undertake CGO activities for the next reporting year in accordance with all relevant licences, approvals and EMPs. Section 6 discusses the management objectives and targets for the CGO during this and the next reporting period.

Overall, due to Evolution's substantial compliance with the EMPs, environmental management for the CGO during the reporting period has been highly effective.

6.1 AIR QUALITY

Development Consent Condition 6.1(a) details the air quality impact assessment criteria against which air quality monitoring results are compared for the CGO. As required by Development Consent Condition 6.1(c) the CGO Air Quality Management Plan (AQMP) has been prepared, submitted and approved by DP&E (18 February 2016).

Monitoring and management of air quality and meteorology during the reporting period was undertaken in accordance with the relevant Development Consent conditions, the approved AQMP and the EPL 11912.

Evolution reported to the National Greenhouse and Energy Reporting Scheme and National Pollutant Inventory for the CGO during the reporting period.

6.1.1 Environmental Management

6.1.1.1 Control Strategies

Air quality safeguards and control strategies were implemented at CGO during the reporting period to minimise dust emissions from mining activities and exposed areas in accordance with the Development Consent conditions, the approved AQMP and the EPL 11912. These control strategies are summarised in Table 4.

Table 4: Air Quality Safeguards and Control Strategies Implemented During the Reporting Period

Source	Control Strategies
Disturbed Surfaces	• Disturbed surfaces were watered using water trucks to suppress dust. • Areas for soil stripping were minimised to reduce the area of exposed ground at any one time.
Access Roads	• Access roads were watered and regularly maintained. • A dust suppressant chemical (PetroTac) was applied to unsealed ML 1535 roads around the general administration and processing plant area to reduce dust generation. • Site access routes are clearly marked and workplace inductions specify routes. • The speed of vehicles travelling on unsealed surfaces is restricted.
Soil Stripping	• Access tracks used for soil stripping during the loading and unloading cycle were watered. • Soil stripping was limited to areas required for future mining operations.

6.1.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

6.1.1.3 Variations from Proposed Control Strategies

There were no variations from the proposed control strategies during the reporting period.

6.1.2 Environmental Performance

6.1.2.1 Monitoring

Meteorological Monitoring

The CGO Automatic Weather Station (AWS) meteorological station located near the southern ML 1535 boundary, collected meteorological data throughout the reporting period. The station measures real-time wind speed and direction, standard deviation of wind direction, temperature (2 m, 10 m), barometric pressure, humidity, solar radiation and rainfall. The CGO AWS is supported by quarterly independent maintenance and calibration, and daily summary reports and automatic alerts.

Monthly total rainfall measured at the CGO AWS is shown in Table 5. Total annual rainfall for the reporting period was 202.6 millimetres (mm). Other parameters recorded by the CGO AWS meteorological station during the reporting period are presented in Table 6.

Annual and monthly wind roses from the CGO AWS are presented in Figures 6a and 6b.

Air Quality Monitoring

During the reporting period, dust monitoring was carried out in accordance with the AQMP utilising depositional (static or gravimetric) and high-volume Total Suspended Particulate (TSP) sampling equipment.

A network of static dust deposition gauges was used throughout 2019 to collect monthly dust samples. The dust gauges are located at varying distances from the CGO open pit, and in a range of directions from the pit. A number of the gauges are situated near homesteads of properties that adjoin the mine site, and a number are near areas of ecological importance.

The high volume air sampler (HVAS) was used throughout 2019 to obtain measurements of suspended solids, every 7 days. The HVAS collects suspended particles with diameters less than approximately 50 µm. This enables determination of dust concentrations in units of mass per cubic metre (µg/m^3).

Table 5: Monthly Rainfall Measured at CGO AWS 2010 – 2019

Month	2010 (mm)	2011 (mm)	2012 (mm)	2013 (mm)	2014 (mm)	2015 (mm)	2016 (mm)	2017 (mm)	2018 (mm)	2019 (mm)
January	2.8	24.4	26.6	5.2	32	75.8	67	24.8	21	24.8
February	95.6	138.6	129.2	26	23.2	11	1.4	8.6	3.6	31.8
March	44.6	146.2	78	45.4	71	0.4	16.8	45.4	1.2	57.4
April	50.6	20.2	15.6	3.4	20.2	56.8	11.4	18.6	7.8	0
May	40	22	32.6	30.4	21.2	12.8	61.8	31	22	19.8
June	22.8	29.4	29.6	87.8	59.4	27.2	122.6	7.6	40	21.2
July	62.2	11.8	49.8	33.4	9	77.2	72.6	27.8	2.2	9
August	34	41.8	19	18.8	10.8	49	31.2	22.4	4.4	10.2
September	64.2	13.8	25	60.4	16.8	8.6	136.8	0.8	4.2	5
October	94	31	16	7.2	15.2	52.6	28.8	38	30.4	8.6
November	60.2	130.4	36.4	9	1.6	24.6	28	50.6	38	13.2
December	111.7	135	27	14.6	48.4	19.2	24.8	123.8	24.8	1.6
TOTAL	**682.7**	**744.6**	**484.8**	**341.6**	**328.8**	**415.2**	**603.2**	**399.4**	**199.6**	**202.6**

Table 6: Monthly Average Meteorological Data (2019)

Aspect	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Mean Humidity (%)	40.8	46.4	49.1	49.1	61.4	71.4	70.7	62.2	44.1	34.2	43.3	59.1
Mean Pressure (mbar)	984	987	989	997	997	999	996	994	994	991	986	985
Mean Wind Direction (o)	177	153	171	155	211	179	201	206	201	195	229	214
Mean Wind Velocity (m/s) 15min	4.1	3.6	3.1	2.4	2.8	2.6	2.6	3.2	3.7	3.2	4.2	3.9
2m Temp Min (oC)	23.7	18.6	13	12.3	6	3.3	6.8	5.9	9.3	13.3	13.7	15
2m Temp Max (oC)	38	31.6	28.6	23.4	22.3	15.9	12.7	14.2	21.3	26.8	31.6	35.9

% - percentage; mbar – millibar; m/s – metres per second; ^{o} – degrees; ^{o}C – degrees Celsius.

The HVAS monitor is located at a company owned residence near the CGO. The TSP criteria adopted by the EPA were recommended by the National Health and Medical Research Council of Australia as the maximum permissible level of TSP in the air to protect public health in residential environments.

Two duplicate dust gauges are installed near pre-existing dust gauges (DG01 and DG13), with dust samples collected and analysed quarterly for metal concentrations. Duplicate dust gauges allow for a longer sampling period and a larger sample size for analysis, and are used to compare and verify monitoring results against the monthly CGO dust monitoring programme.

Air Quality Impact Assessment Criteria

Table 7 details the long-term impact assessment criteria for deposited dust for any residence on privately-owned land as required by Development Consent Condition 6.1(a).

Table 7: Long-term Impact Assessment Criteria for Deposited Dust

Pollutant	Averaging Period	Maximum Increase in Deposited Dust Level	Maximum Total Deposited Dust Level
Deposited dust[1]	Annual	2 g/m²/month[2]	4 g/m²/month[3]

[1] Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: *Methods for Sampling and Analysis of Ambient Air – Determination of Particulate Matter – Deposited Matter – Gravimetric Method.*

[2] Incremental impact (i.e. incremental increase in concentrations due to the development on its own).

[3] Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources).

g/m^2/month – grams per square metre per month.

Table 8 and Table 9 detail the long–term and short-term impact assessment criteria for TSP and particulate matter less than (<) 10 µm (PM_{10}) for any residence on privately-owned land as required under Development Consent Condition 6.1(a).

Table 8: Long-term Impact Assessment Criteria for Particulate Matter

Pollutant	Averaging Period	Criterion [1]
Total suspended particulate (TSP) matter	Annual	90 µg/m^3 [2]
Particulate matter < 10 µm (PM_{10})	Annual	25 µg/m^3 [2]

[1] Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed by the Secretary.

[2] Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources).

Table 9: Short-term Impact Assessment Criteria for Particulate Matter

Pollutant	Averaging Period	Criterion [1]
Particulate matter < 10 µm (PM_{10})	24 hour	50 µg/m^3 [2]

[1] Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed by the Secretary.

[2] Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources).

6.1.2.2 Performance Outcomes

Total Suspended Particulates

On an annual average basis, the TSP data collected by the HVAS of 64 µg/m^3 is below the NSW EPA (2001) assessment criterion for TSP matter (90 µg/m^3). Compared to previous years, however, the mean TSP level in 2019 (64 µg/m^3) was appreciably higher than those of all years between 2010 and 2017 (27–46 µg/m^3), reflecting the heightened dust storm activity across NSW in 2019. The mean TSP level in 2019 also exceeded that of the dry and dusty year 2018 (53 µg/m^3). For nine of the sampling periods in 2019, the 7-day TSP value exceeded 90 µg/m^3 and one extremely large value of 408 µg/m^3 was recorded for the sampling period ending on January 15th, 2019. Dust storm activity, regional fires and low regional rainfall all contributed to the high readings.

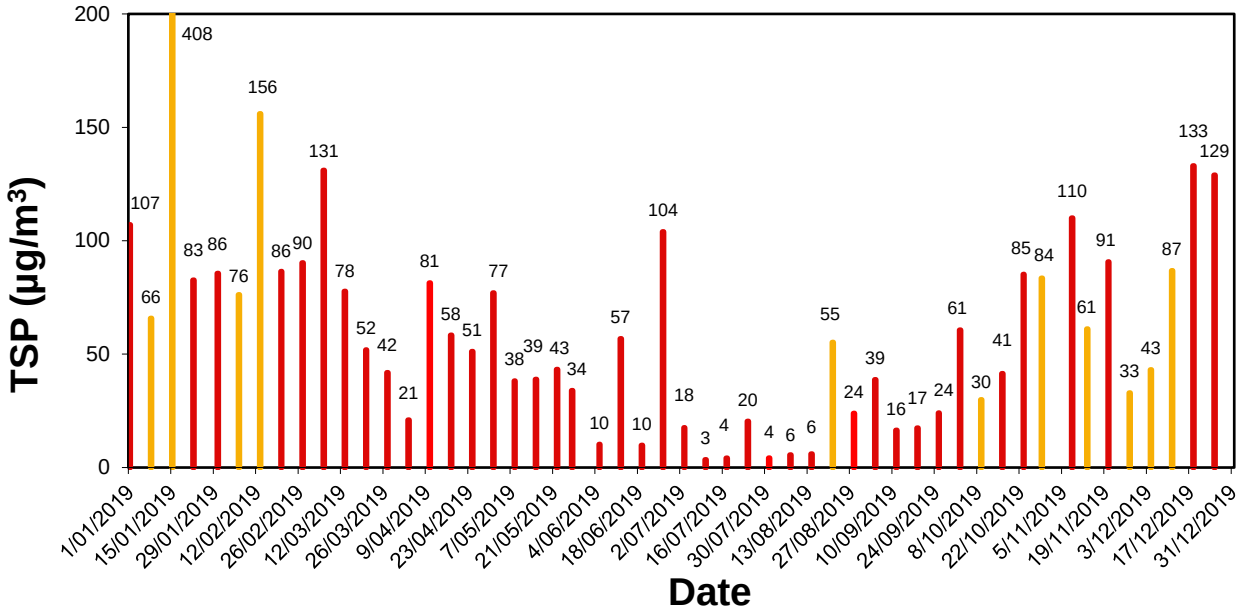
The seasonality of the TSP data in 2019 was strong, and closely reflected the temporal variation in rates of deposited dust. During the summer and early autumn months of January to March, inclusive, the mean TSP value was 112 µg/m^3, whereas between the cooler months of April and September, inclusive, the mean TSP value was only 33 □g/m^3. In the late spring and early summer months of October to December, inclusive, the mean TSP value jumped to 76 □g/m^3. Notably, there were observed high levels of district-wide dust activity and/or dust storms at CGO in mid-January, early February, late August, October, November and early December. The two largest TSP values occurred in the weeks ending on January 15th and February 13th; for the month of January, the DustWatch report indicated “widespread dust activity recorded every week of the month (across NSW)” (DustWatch, 2019a),

while for the month of February, the DustWatch report indicated “a massive statewide dust storm on 12 and 13 February”.

Despite the obvious correlation of heightened regional dust activity and higher TSP values in 2019, the location of the HVAS 4 km to the north of the ML area means that dust generated and transported from the mine site on southerly or south-south easterly winds may potentially have been intercepted.

According to the AWS records of wind direction for 2019, southerly winds were prominent during a number of the monthly sampling periods, including January, June, August and September. Specifically January, TSP values were high to very high, it is possible that there was at least some fine-grained particulates from the ML, transported on southerly winds to the HVAS site. South-south easterlies were only prominent in July, when TSP values were generally very low, so it is very unlikely that these winds transported an appreciable amount of fine-grained particulates from the ML to the HVAS site.

Graph 1: TSP masses measured at the Coniston Homestead during 2019. (Orange-coloured columns represent those sampling periods with strong regional dust activity or large dust storms observed at the CGO.)



Particulate matter < 10 µm (PM_{10})

As described in the *Cowal Gold Mine Extension Modification Air Quality Impact Assessment* undertaken by Pacific Environment Limited (PEL) (2013), PM_{10} can be calculated as 40% of measured TSP (NSW Minerals Council, 2000). The annual average TSP collected by the HVAS in the reporting period was 64 µg/m^3 (University of Sydney, 2018). Accordingly, the annual average PM_{10} is calculated at 25.4µg/m^3, at the 25µg/m^3 long term impact assessment criteria (Table 8). The annual average drops to 22 once two extraordinary events on January 15th and February 13th (dust storms) are removed as per (Table 8 clause 1).

The short-term impact assessment criterion for PM_{10} is 50 µg/m^3 (Table 9). The short-term impact assessment criterion for PM_{10} of 50 µg/m^3 was excided five times during the reporting period with results of 163 µg/m^3, 62 µg/m^3, 52 µg/m^3, 53 µg/m^3 and 51 µg/m^3 exceedances occurred during recorded high wind dust storm days. These high readings are viewed as extraordinary events and therefore not considered as licence exceedances. As per table numbers 3-5 DA 14/98, excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed by the Secretary.

Deposited Dust

A detailed discussion of the dust monitoring results (including laboratory analysis of dust results) is provided in the University of Sydney's (2019) *Interpretation and Discussion of 2019 Air Quality Monitoring Results Cowal Gold Operations*. A summary of the key findings is provided below and in Table 10 (University of Sydney, 2019):

- Temporal and spatial variation in reported monthly dust deposition was strong during 2019. Monthly deposition of 10 g insoluble solids/m2 was exceeded 25 times in 2019, across six different months and across all twelve gauges. The average monthly dust deposition across all gauges in 2019 was 5.9 g/m2.
- Changes in monthly dust deposition rates were very strongly correlated with season for all of the gauges, with the highest average dust deposition occurring in the late summer, early autumn and spring months, and the lowest occurring during late autumn and winter. Monthly dust deposition rates averaged across all gauges ranged from 2.4 to 11.7 g/m2, and in the January, February, March, October and November sampling periods the majority of gauges received relatively high rates of deposition.
- Compliance with the assessment criterion of 4 g/m2/month average annual deposited dust was achieved at none of the six compliance gauges during 2019. The average monthly dust deposition rate across these six gauges was 5.6 g/m2.
- The cause of the exceedances in all of the compliance gauges can largely be attributed to substantial deposits (>10 g/m2/month) in some or all of the January, February, March, October and November sampling periods. During these sampling periods, repeated dust events affected the entire region.
- The dust gauges DG11, DG12, DG13 and DG14, all located within the ML area, recorded an annual average dust deposition above the assessment criterion. Again, these exceedances can largely be attributed to substantial deposits (>10 g/m2/month) in some or all of the January, February, March, October and November sampling periods. Levels recorded in these gauges are not relevant to the CGO Development Consent conditions.

The assessment criterion for acceptable increases in dust deposition at a site is 2 g/m2/month, and the acceptable limit for the annual average deposition rate has been set at 4 g/m2/month, as shown in Table 1. However, distinguishing an increase in dust deposition due to a particular source (such as a mine) is difficult unless a large quantity of baseline monitoring data is available to determine natural variability. Cattle et al. (2012) report that the average rate of background dust deposition in the area of the CGO, estimated over thirty months during the 2007-2010 period (which included several substantial dust storm events), is 4.8 g/m2/month, with a little under two-thirds of this amount being comprised of macro-organic matter. The estimate of background dust deposition as being 2 g/m2/month for this area would appear to be well-founded if only inorganic (mineral) dust is considered.

Nevertheless, the analysis in this report focusses on whether or not the total deposited dust data (inorganic + organic components) complies with the annual average deposition rate of 4 g/m2/month per gauge.

Table 10: Monthly and Mean Dust (Insoluble Solids) Deposition Rates (2019)

Dust Gauge Site	Monthly deposition of insoluble solids in dust (g/m^2/month)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
DG1*	13.5	8.2	12.0	1.0	0.8	0.5	0.5	1.0	4.4	6.7	9.9	1.4	**5.0**
DG6*	3.9	8.6	14.5	9.3	6.7	3.8	2.5	3.6	2.9	9.5	8.8	2.9	**6.4**
DG7	14.8	13.6	2.9	4.1	6.0	2.2	1.5	7.4	4.4	8.7	7.1	2.4	**6.2**
DG9*	8.0	18.5	4.1	1.8	0.7	0.3	0.8	0.6	3.6	8.5	10.8	0.7	**4.9**
DG11	6.3	10.4	4.8	3.1	6.2	3.2	2.3	3.8	5.3	5.7	13.7	0.3	**5.4**
DG12	9.4	14.7	18.6	10.9	6.8	4.4	5.4	3.2	7.2	10.9	14.5	1.7	**9.0**
DG13	12.4	10.1	5.7	2.3	2.0	1.7	5.9	6.4	5.6	6.9	8.2	1.1	**5.7**
DG14	3.5	17.5	18.0	1.7	0.8	0.5	0.7	1.1	2.5	3.6	7.2	1.5	**4.9**
McLintock's Shed*	14.4	13.1	11.1	2.4	2.3	7.5	3.3	0.9	1.9	8.1	9.2	1.7	**6.3**
Site Office*	6.0	8.2	18.2	0.7	0.9	3.4	2.5	2.4	2.6	9.2	5.7	0.9	**5.1**
Site 52*	17.3	11.7	3.3	2.4	1.8	1.2	2.1	3.5	7.3	8.4	7.9	2.3	**5.8**
I5	28.1	5.6	9.5	1.3	0.9	1.4	0.9	0.8	6.3	6.5	4.2	1.1	**5.5**
Mean	**11.5**	**11.7**	**10.2**	**3.4**	**3.0**	**2.5**	**2.4**	**2.9**	**4.5**	**7.7**	**8.9**	**1.5**	

** Compliance Point*

Temporal and spatial variation in reported monthly dust deposition was strong during 2019. The average dust deposition rate across all gauges in 2019 was 5.5 g/m2/month, compared to 4.1 g/m2/month in 2018, 3.8 g/m2/month in 2017, 2.7 g/m2/month in 2015 and 2.8 g/m2/month in 2014. This larger average deposition rate for 2019 can be largely explained by increased dust storm activity in the region in 2019, as well as by the de-commissioning (in 2017, 2016) of some of the more remote dust gauges (from the mine), which have historically received low amounts of deposited dust, thus reducing the annual average of those earlier years.

The gauges DG1, DG9, DG14 and I5 all received less than 2.0 g dust/m2 for at least six of the twelve monthly sampling periods, while the gauges DG1, DG6, DG7, DG11, DG12, DG13, McLintock's Shed and I5 all received more than 4.0 g dust/m2 for six or more of the twelve sampling periods. In five of the monthly sampling periods (January, February, March, October, November), average dust deposition across all gauges exceeded 4.0 g/m2/month. Twenty-five dust deposits were comprised of 10 g/m2/month or more in 2019; of these, twenty-one contained an inorganic (mineral dust) component of more than 50%, while only four contained an organic component comprising more than 50% of the deposit.

Changes in monthly dust deposition rates were strongly correlated with season for all of the gauges, with the highest average dust deposition occurring in the late summer, early autumn and spring months (i.e. January, February, March, October and November). The lowest dust deposition rates occurred in the winter months of June, July and August.

During much of 2019, the CGO area and much of western NSW received well-below average rainfall and experienced drought conditions. As a result, dust storm activity across NSW was greater than that of the dry and dusty year 2018, and significantly higher than the years previous to that. The NSW Government-funded DustWatch program reported that 2019 saw, for the state of NSW, the dustiest January since 2005 (when records commenced), the dustiest February since 2005, the dustiest March since 2005, the dustiest October since 2005 and the dustiest November since 2005 (DustWatch, 2019a,b,c,d,e). In fact, November 2019 became the dustiest month across NSW

since DustWatch records began in July 2005. At the West Wyalong DustWatch node, 15, 28, 6, 12 and 38 hours of dust activity were recorded for January, February, March, October and November, respectively (DustWatch, 2019a,b,c,d,e). Hence, it appears very likely that the relatively high amounts of dust deposited at all gauges during these five months of 2019 was largely due to the heightened dust activity in the region.

Each dust deposit is comprised of a soluble component and an insoluble component.

The soluble component is generally comprised of salts transported in rainfall or on dust particles, plus bird urine, the white-coloured component of bird droppings. Although the salt content of deposited dust varies greatly depending on factors such as the time elapsed since the previous rainfall event, even in central NSW, which is a large distance from the coast, salt loadings of dust can be significant (e.g. Blackburn & McLeod, 1983).

The insoluble solids component of each deposited dust sample is the one compared to the impact assessment criterion for deposited dust (NSW EPA, 2001). This insoluble solids component is comprised of combustible (generally organic material) and ash (generally inorganic mineral material) fractions. The combustible fraction of most samples is likely to include soil organic matter (Boon et al. 1998), fragments of plant materials, seeds, insects and bird droppings. For many of the 2019 field log entries of dust sampling from the gauges, the presence of insects, bird droppings and algae is noted, and occasionally vegetative matter.

Although there is no indication of the amount of soil organic matter in the dust samples, given the prominent description of insects, bird droppings and algae in the 2019 field log, the combustible fraction of the insoluble solids may be used as a proxy for these organic materials. Examining the twenty-five instances where the insoluble solids component was 10 g/m2/month or more, the combustible fraction comprised between 8 and 66%, with an average of 31%. This average value is appreciably less than previous years, reflecting the dominance of (mineral) raised dust and dust storms in 2019. Soil organic matter, insects, bird droppings, algae and vegetative matter look to have contributed only moderately to some of the dust loads within and surrounding the CGO in 2019.

Comparison with Environmental Impact Statement (EIS) Predictions

PEL's (2013) modelling predicted the Coniston residence (i.e. the location of the HVAS [hv1]) as the receiver with the highest predictions for 24 hour average PM_{10}, annual average PM_{10}, TSP and depositional dust. Table 11 summarises the 2018 monitoring results for 24 hour average PM_{10}, annual average PM_{10}, TSP and depositional dust and the predicted results at Coniston in comparison with the relevant Development Consent air quality impact assessment criteria for 24 hour and annual average PM_{10}, TSP and depositional dust.

Table 11: Summary of Predicted PM_{10}, TSP and Dust Deposition at HV1

Emission Parameter	2019 Monitoring Results	Predicted Result at Coniston[1]	Development Consent Air Quality Impact Assessment Criteria
Maximum 24 Hour Average PM_{10} [3]	53.2 µg/m^3	28.8 µg/m^3	50 µg/m^3
Annual Average PM_{10} [4]	22 µg/m^3	3.7 µg/m^3	25 µg/m^3
TSP	64 µg/m^3	3.9 µg/m^3	90 µg/m^3
Depositional Dust[2]	5.6 g/m^2/month	0.16 g/m^2/month	4 g/m^2/month

[1] Source: PEL (2013).

[2] Compliance gauges only.

[3] Two recorded extraordinary events removed from annual average, (163.2 µg/m3)

[4] Two recorded extraordinary events removed from annual average, (25 µg/m3)

Monitoring data records from the HVAS recorded influence from local environmental factors (i.e. strong winds) and other off-site influences such as strong regional dust activity, large dust storms and smoke haze observed at the CGO on some dates of the 24 hour average PM_{10} monitoring results. The 24-hour average PM_{10} monitoring results exceeded 50 µg/m^3 five times during the reporting period, 4 of these occurred during recorded dust storms, regional smoke haze and high winds (i.e. extraordinary events) and are therefore not considered non-compliances (i.e. the result of non-mining related weather conditions). All other PM_{10} results fell below the 50 µg/m^3 limit.

6.1.3 Reportable Incidents

As discussed above CGO experienced drought conditions and received well-below average rainfall contributing to heightened dust activity in the region and some of the dustiest months since 2005. These factors contributed the 2019 monitoring results for maximum 24 hour average PM10 and depositional dust, to be over Development Consent criteria limits. Theses exceedances are not considered to be directly caused by mine activity and CGO consider there to be no reportable incidents during the reporting period.

Regional dust conditions in early 2020 were also extreme however higher rainfall for the middle of 2020 has been experienced with a corresponding reduction in dust regionally and on site.

6.1.4 Further Improvements

The key recommendations of the University of Sydney's (2019) review are summarised as follows:

- The issue of unrealistically high mean dust Zn concentrations appears to have 're-surfaced' in 2019, with both monthly and three-monthly Duplicate samples, both inside and outside the ML, returning mean Zn values much greater than those of CGO soils and rocks. Given that the three-monthly Duplicate samples collected over the last several years have not consistently shown a benefit of (assumed) greater sample mass, in terms of providing realistic dust Zn concentrations, it is recommended that consideration be given to discontinuing the practice of collecting these Duplicate samples.
- It is recommended that an updated set of local soil or dust source (e.g. rock crusher or tailings) samples should be analysed for the same suite of metals as the dust samples. It is recommended that the soil/dust source samples be provided and analysed both as a 'bulk sample' of several tens of grams mass and also as a sample of comparable mass to the dust samples. This way, any dilution effects caused by small sample size should become immediately obvious, and any systematic laboratory errors (e.g. consistently high Cd or Zn values, incomplete extraction of all Al from mineral grains) should also be apparent.

6.2 BLASTING

Development Consent Condition 6.3(a) details the blast impact assessment criteria relevant to the CGO. As required by Development Consent condition 6.3(e), the Blast Management Plan (BLMP) was approved by the DP&E on 10 December 2015.

Monitoring and management of blasting during the reporting period was undertaken in accordance with the relevant Development Consent conditions, the approved BLMP and the EPL 11912.

6.2.1 Environmental Management

In accordance with Development Consent Condition 6.3, the BLMP and EPL 11912 Conditions L5 and M7, four blast monitors have been installed at designated locations around the CGO to record ground vibration and airblast overpressure (Figure 7). In addition, a 'control' monitor is installed at BM10, located on the eastern edge of the open pit (Figure 7).

6.2.1.1 Control Strategies

In accordance with the BLMP, the control strategies for blasting during the operation of the open pit include the following:

- Reducing the Maximum Instantaneous Charge (MIC) to lowest possible level.
- Use of crushed aggregate material for stemming in blast holes to maximise confinement of the explosives in the blast hole thereby minimising the airblast effects.
- Design of drill patterns to ensure stemming heights in the blast holes are adequate to ensure confinement of the explosives.
- Delaying or postponing blast times in unfavourable weather conditions.

Additionally, Evolution has adopted a practice of spacing pre-split and production blasts by one to two minutes to reduce the potential for cumulative overpressure impact on the immediate surrounds of Lake Cowal.

In accordance with Development Consent Condition 6.3, the BLMP and EPL 11912 Condition M7, airblast overpressure and ground vibration levels must be measured at nearby residences BM01, BM02, BM03 and BM08.1, and at the general monitoring site BM10.

6.2.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period are considered to be effective as demonstrated by the environmental performance indicators.

6.2.1.3 Variations from Proposed Control Strategies

There were no variations from the proposed control strategies during the reporting period.

6.2.2 Environmental Performance

6.2.2.1 Monitoring

Monitoring locations BM01 (Gumbelah) and BM08.1 (Cowal North) are categorised as *'residence on privately owned land'* and required to comply with the compliance limits specified in Condition 6.3 of the Development Consent (Table 12). Monitoring was also undertaken at locations BM02 (Hillgrove Residence), and BM03 (Coniston Residence) located on company owned land (Figure 7).

In addition to the monitors described above at sensitive locations, one non-reported monitor (BM10) was located adjacent to the pit within ML 1535.

Ground vibration and air overpressure monitoring was conducted with the use of Instantel Series III blast monitors. Five units were used located at fixed monitoring stations in accordance with the BLMP. All blast monitoring equipment underwent an annual calibration, in accordance with Australian Standard specifications. Additional to the monitor and sensor calibrations, all batteries were replaced and routine maintenance was carried out on all units.

Table 12: Blasting Impact Assessment Criteria

Location and Time	Airblast Overpressure (dB[Lin Peak])	Ground Vibration (mm/s)	Allowable Exceedance
Residence on privately-owned land - Anytime	120	10	0%
Residence on privately-owned land - Monday to Saturday during day	115	5	5% of the total number of blasts over a period of 12 months
Residence on privately-owned land - Monday to Saturday during Evening	105	2	
Residence on privately-owned land - Monday to Saturday at Night, Sundays and Public holidays	95	1	

Notes: mm/s – millimetres per second; dB – decibel.

During the 12-month monitoring period there were several incidents where a unit was offline for more than 24 hours, as follows:

- The monitoring unit at BM02 (Hillgrove residence) was offline on the 9th, 10th, 22nd, 23rd, 26th - 28th February, 1st - 5th March, 29th - 30th April, 1st May, 14th August and 23rd November 2019
- The monitoring unit at BM10 (Near Field) was offline on the 1st, 3rd, 9th and 16th August 2019
- The monitoring unit at BM10.1 (Near Field) was offline on the 23rd November 2019
- The monitoring unit at BM08.1 was offline on the 29th April, 7th & 14th August and the 6th -11th November 2019
- The monitoring unit at BM03 (Coniston residence) was offline on the 9th, 13th and 14th October, the 23rd November 2019 and 11th December 2019
- The monitoring location BM01 (Gumbelah Residence) was offline on the 26th September 2019

6.2.2.2 Performance Outcomes

Ground Vibration

A total of 807 blasts were fired during the reporting period. Based on the monitoring data and blasting information available, recorded levels of ground vibration induced by blasting activities conducted at the CGO were compliant with respect to the relevant ground vibration limits. Underground blasting initially occurred during the day-time operating hours but 24-hour underground scheduling commenced on the 14th of April 2019. The monitors were reconfigured to 24-hour monitoring on the 29th of April. As a result, a total of 12 underground blasts were not monitored at any residence or company owned land between the 14th to the 29th of April 2019.

The peak vibration level recorded at the time of blasting was 2.17mm/s at BM08.1 – Cowal North on the 18th February 2019. Further analysis of the monitoring results at and around the time of this blast determined this peak was the result of localised, spurious activity and was not blast related. The peak vibration levels at BM08.1 – Cowal North relating to blast did not exceed 0.5mm/s during this assessment period. The 12 underground blasts not monitored during the month of April equate to 1.48% of the total blasts fired

Air Overpressure

A detailed examination of the monitoring data and blasting information was undertaken to ascertain the overpressure levels recorded around the time of the blast. A total of 104 events were identified as having a peak overpressure level exceeding the relevant compliance criteria.
The events have been analysed in detail to determine the likely source of overpressure. Of the 104 events that exceeded compliance levels, six (6) of these was assessed to be most likely related to blasting practices, with the remaining 98 being identified as localised environmental factors such as wind. (Table 13)
These have been identified by the extended durations of high overpressure readings within the 30minute histogram blast window.

Table 13: Overpressure Events most likely related to blasting practices (2019)

Monitoring Location	Date	Time	Level		Compliance Limit	Comments
			PPV mm/s	O' Press dB(L)		
BM02 - Hillgrove	31/03/2019	12:56:11	0.18	95.9	95dB(L) - Sundays' and Public Holidays	Likely blast related.
BM03 - Hillgrove	30/06/2019	11:20:00	0.12	101.0	95dB(L) - Night time limit	Likely blast related.
BM03 - Coniston	28/09/2019	2:55:00	0.11	95.9	95dB(L) - Night time limit	Likely blast related.
BM03 - Coniston	1/12/2019	12:28:50	0.11	114.2	95dB(L) - Sundays' and Public Holidays	Likely blast related.
BM01 - Gumbelah	5/12/2019	12:40:32	0.1	117.2	95dB(L) - Sundays' and Public Holidays	Likely blast related.
BM01 - Gumbelah	5/12/2019	12:40:32	0.1	117.2	95dB(L) - Sundays' and Public Holidays	Likely blast related.

The majority of the exceedances identified at blast times were related to the Sundays' and Public Holidays' compliance limit of 95dB(L). This is to be anticipated given the Sundays' and Public Holiday's overpressure level of 95dB(L) is a significant reduction to the normal weekday and Saturday limit of 115dB(L).
It is important to note that this 20dB(L) reduction is equivalent to reducing the weekday and Saturday limit by 90% for Sunday and Public Holiday blasting.

The CGO achieved compliance in relation to the specified air overpressure levels for the reporting period.

Table 14: Blasting Impact Exceedances

Monitoring Location	Date	Time	Level		Compliance Limit	Comments
			PPV mm/s	O' Press dB(L)		
BM08.1 - Cowal North	1/01/2019	12:36:21	0.02	95.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove	6/01/2019	12:29:37	0.15	97.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	6/01/2019	12:29:37	0.07	98.8	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove	6/01/2020	13:03:55	0.13	97.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	6/01/2020	13:03:55	0.05	100.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM03 - Coniston	28/01/2019	13:00:12	0.1	100.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	28/01/2019	13:00:12	0.07	109.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM03 - Coniston	28/01/2019	13:00:12	0.10	100.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	28/01/2019	13:00:12	0.07	109.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM03 - Coniston	10/02/2019	15:15:03	0.09	100.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	10/02/2019	15:15:03	0.05	100.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove	31/03/2019	12:56:11	0.18	95.9	95dB(L) - Sundays' and Public Holidays	Likely blast related.
BM02 - Hillgrove	7/04/2019	12:37:50	0.12	95.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	7/04/2019	12:37:50	0.01	98.8	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	7/04/2019	12:37:55	0.01	95.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove	3/05/2019	6:15:43	0.12	95.9	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	5/05/2019	12:36:10	0.03	97.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove	5/05/2019	12:57:30	0.12	98.8	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	5/05/2019	12:57:30	0.01	100.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove	8/05/2019	6:24:30	0.13	102.8	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	8/05/2019	6:24:30	0.01	101.0	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM03 - Coniston	4/06/2019	1:45:00	0.12	95.9	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM12 - Lakeview	4/06/2019	1:45:00	0.13	98.5	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM01 - Gumbelah	23/06/2019	15:05:01	0.08	98.8	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM03 - Coniston	23/06/2019	15:05:01	0.18	97.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	23/06/2019	15:05:01	0.07	97.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove	30/06/2019	11:20:00	0.12	101.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.

Monitoring Location	Date	Time	Level		Compliance Limit	Comments
			PPV mm/s	O' Press dB(L)		
BM08.1 - Cowal North	11/07/2019	6:15:00	0.01	95.9	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove	13/07/2019	0:30:00	0.13	100.0	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM03 - Coniston	13/07/2019	0:30:00	0.12	100.0	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove	14/07/2019	12:30:00	0.12	97.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove	15/07/2019	1:05:00	0.16	95.9	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	15/07/2019	1:05:00	0.05	104.9	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM01 - Gumbelah	18/07/2019	4:40:00	0.07	97.5	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM01 - Gumbelah	21/07/2019	12:39:22	0.07	98.8	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM01 - Gumbelah	9/08/2019	6:25:00	0.07	113.3	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove	9/08/2019	6:25:00	0.13	102.8	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	9/08/2019	6:25:00	0.05	111.2	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM01 - Gumbelah	11/08/2019	1:55:12	0.08	97.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM01 - Gumbelah	11/08/2019	5:55:00	0.08	105.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove	11/08/2019	5:55:00	0.13	107.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	11/08/2019	5:55:00	0.03	104.2	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM01 - Gumbelah	18/08/2019	12:38:48	0.07	104.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove	18/08/2019	12:38:48	0.14	101.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM03 - Coniston	18/08/2019	12:38:48	0.1	97.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	18/08/2019	12:38:48	0.23	101.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM01 - Gumbelah	18/08/2019	18:00:00	0.08	114.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove	18/08/2019	18:00:00	0.12	117.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM03 - Coniston	18/08/2019	18:00:00	0.1	95.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	18/08/2019	18:00:00	0.04	101.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	21/08/2019	5:20:00	0.01	98.9	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM01 - Gumbelah	22/08/2019	3:40:00	0.07	95.9	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove	22/08/2019	3:40:00	0.13	100.0	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.

Monitoring Location	Date	Time	Level		Compliance Limit	Comments
			PPV mm/s	O' Press dB(L)		
BM08.1 - Cowal North	1/09/2019	11:07:58	0.04	95.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove	8/09/2019	3:30:00	0.11	95.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove	8/09/2019	16:37:12	0.09	97.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	8/09/2019	16:37:12	0.05	101.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove	9/09/2019	6:15:00	0.12	101.0	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	9/09/2019	6:15:00	0.01	95.9	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	9/09/2019	12:26:52	0.07	116.1	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	16/09/2019	4:50:00	0.01	95.9	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM03 - Coniston	17/09/2019	21:50:00	0.11	95.9	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM01 - Gumbelah	21/09/2019	5:30:00	0.11	100.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove	21/09/2019	5:30:00	0.09	112.8	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM03 - Coniston	21/09/2019	5:30:30	0.1	98.8	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	21/09/2019	5:30:30	0.06	109.5	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM03 - Coniston	28/09/2019	2:55:00	0.11	95.9	95dB(L) - Night time limit	Likely blast related.
BM02 - Hillgrove	6/10/2019	1:52:00	0.09	98.8	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove	7/09/2019	16:30:00	0.07	97.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	7/09/2019	16:30:00	0.03	101.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove	13/10/2019	11:45:00	0.07	97.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove	25/10/2019	2:40:00	0.08	97.5	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	25/10/2019	12:22:58	0.21	118.2	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove	3/11/2019	10:45:00	0.08	101.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM03 - Coniston	3/11/2019	10:45:00	0.09	98.8	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM01 - Gumbelah	3/11/2019	16:25:00	0.11	101.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove	3/11/2019	16:25:00	0.09	95.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	3/11/2019	16:25:00	0.01	95.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.

Monitoring Location	Date	Time	Level		Compliance Limit	Comments
			PPV mm/s	O' Press dB(L)		
BM02 - Hillgrove	4/11/2019	5:56:00	0.11	95.9	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM03 - Coniston	6/11/2019	20:50:00	0.09	100.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM01 - Gumbelah	8/11/2019	22:00:00	0.13	97.5	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM03 - Coniston	10/11/2019	10:35:00	0.09	101.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM01 - Gumbelah	12/11/2019	12:43:23	0.1	115.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	12/11/2019	12:43:23	0.09	119.7	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM01 - Gumbelah	12/11/2019	12:43:23	0.1	115.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	12/11/2019	12:43:23	0.09	119.7	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove	13/11/2019	0:01:00	0.1	95.9	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM03 - Coniston	13/11/2019	0:01:00	0.11	95.9	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM03 - Coniston	24/11/2019	12:28:56	0.08	95.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM03 - Coniston	26/11/2019	20:55:00	0.1	100.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove	30/11/2019	2:05:00	0.09	97.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM01 - Gumbelah	1/12/2019	12:28:50	0.1	101.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM03 - Coniston	1/12/2019	12:28:50	0.11	114.2	95dB(L) - Sundays' and Public Holidays	Likely blast related.
BM08.1 - Cowal North	1/12/2019	12:28:50	0.05	104.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM01 - Gumbelah	1/12/2019	12:45:00	0.11	104.2	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove	1/12/2019	12:45:00	0.07	101.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	1/12/2019	12:45:00	0.05	106.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM01 - Gumbelah	1/12/2019	18:16:00	0.11	97.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove	1/12/2019	18:16:00	0.09	101.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	1/12/2019	18:16:00	0.07	97.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM01 - Gumbelah	5/12/2019	12:40:32	0.1	117.2	95dB(L) - Sundays' and Public Holidays	Likely blast related.
BM01 - Gumbelah	5/12/2019	12:40:32	0.1	117.2	95dB(L) - Sundays' and Public Holidays	Likely blast related.
BM08.1 - Cowal North	21/12/2019	23:50:00	0.02	95.9	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove	22/12/2019	6:00:00	0.09	95.9	95dB(L) - Night time limit	Not blast related, Localised enviromental factors likely.
BM03 - Coniston	29/12/2019	15:00:21	0.1	97.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	29/12/2019	15:00:21	0.03	101.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.

Community Complaints

During the reporting period there were no community complaints received in relation to blasting:

Comparison with EIS Predictions

Blasting monitoring results during the reporting period are consistent with previous years and with the predictions detailed in the *Cowal Gold Operations Mine Life Extension Modification Environmental Assessment* (Evolution, 2016) in that there was:

- No exceedance of the airblast overpressure level of 120 dB(L) or ground vibration level of 10 mm/s at any residence on privately-owned land at anytime.
- Not more than 5% of the total number of blasts at any residence on privately-owned land exceeding the airblast overpressure levels or ground vibration levels Monday to Saturday during the day, evening, night or on Sundays and public holidays.
- 100% of ground vibration levels were compliant with licence conditions
- The largest ground vibration level recorded at blast time in the monitoring period (2.17mm/s) was at BM08.1 - Cowal North residence on the 18th February 2019, however after analysis this was found not to be blast related
- Following a detailed review of overpressure results for events that were above the compliance levels, six (6) was identified as being most likely blast related. This is 0.74% of the total blasts for the monitoring period. All other peak levels above the compliance limitations were affected by localised environmental factors and were not distinguishable above background levels
- A total of twelve (12) underground blasts were not monitored by any of the sensitive monitoring locations. These have been classified as exceedances and represent a total of 1.48% of the total number of blasts fired
- Combining the recorded overpressure results and the blasts not monitored equates to a total of eighteen (18) or 2.23% of the total number of blasts in 2019
- Blast induced overpressure impacts were compliant within licence conditions
- Compliance was achieved with the blasting limits whether assessed on the 12-month review period from the 1st January 2019 to the 31st December 2019 or based on a 12-month moving window

6.2.3 Reportable Incidents

There were no reportable incidents during the reporting period.

6.2.4 Further Improvements

No further improvements are proposed for the next reporting period.

6.3 OPERATIONAL NOISE

Development Consent Condition 6.4(c) details the noise impact assessment criteria relevant to CGO. As required by Development Consent condition 6.4(e), the Noise Management Plan (NMP) was approved by the DP&E on 5 March 2015.

Monitoring and management of noise during the reporting period was undertaken in accordance with the relevant Development Consent conditions, approved NMP and the EPL 11912.

6.3.1 Environmental Management

6.3.1.1 Control Strategies

In accordance with the NMP, control strategies used at the CGO during the reporting period utilised best management practices and the best available technology that is economically achievable.

Best Management Practice

Best management practices applied during the reporting period to minimise CGO noise emissions included:

- Restricting movement of trucks on ridgelines and exposed haul routes where their noise can propagate over a wide area, especially at night. This means restricting night-time movement of material to areas shielded by barriers or mounds, and reserving large-scale material movement for daytime. The Lake Protection Bund provides noise shielding, thereby reducing noise levels that could propagate from the open pit across Lake Cowal.
- Scheduling the use of any noisy equipment during daytime.
- Locating noisy equipment behind structures that act as barriers, or at the greatest distance from any noise-sensitive areas or orienting the equipment so that noise emissions are directed away from any sensitive areas, to achieve the maximum attenuation of noise.
- Where there are several noisy pieces of equipment, scheduling operations so they are used separately rather than concurrently.
- Keeping equipment well maintained.
- Employing ‘quiet’ practices when operating equipment (i.e. positioning idling trucks in appropriate areas).
- Educating staff on the effects of noise and the use of quiet work practices.
- Specify maximum noise/sound levels when purchasing equipment.
- Including maximum noise/sound levels in tender documents and contracts.

Best Available Technology that is Economically Achievable

Best available technology economically achievable applied during the reporting period to minimise CGO noise emissions included:

- adjusting reversing alarms on heavy equipment limiting acoustic range to the immediate danger area;
- minimising night time tracking of dozers on top of stockpiles;
- restricting working hours on faces closest to neighbours during wall lift project works;
- using equipment with efficient mufflers; and/or
- employing active noise control measures during normal and maintenance shutdown periods.

6.3.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

6.3.1.3 Variations from Proposed Strategies

There were no variations from the proposed control strategies during the reporting period.

6.3.2 Environmental Performance

6.3.2.1 Monitoring

Noise monitoring was undertaken during the reporting period to demonstrate compliance with the noise impact assessment criteria set out in Development Consent Condition 6.4(c), which requires that noise generated by the CGO does not exceed the criteria in Table 15 below, at any residence on privately-owned land.

Table 15: Noise Impact Assessment Criteria dB(A) $L_{Aeq\ (15minute)}$

Location (Figure 7)	MOD14 - Day/Evening/Night
Lakeview III	38
The Glen	37
Lakeview, Foxham Downs II	36
All other privately-owned land	35

Spectrum Acoustics conducted mine operational noise monitoring at quarterly intervals throughout the reporting period in accordance with the NMP and Development Consent. Table 15 provides a summary of the quarterly attended noise monitoring results for the Laurel Park, Bramboyne, Lakeview, Lakeview III, The Glen, Caloola and Foxam Downs II properties recorded during the reporting period (Spectrum Acoustics, 2019a, 2019b, 2019c, 2019d).

Table 16: Summary of Attended Noise Monitoring Results

Property	February 2019	May 2019	August 2019	November 2019
Laurel Park (N11)	D - <20, <20 E - 29, 28 N - 30, 28	D - 29, 28 E - <20, <20 N - 21, 22	D - <20, <20 E - <20, <20 N - <20, <20	D - <20, 15 E - 35, 36 N - <20, <20
Lakeview III (N09)	D - <20, <20 E - <20, <20 N - <20, <20	D - <20, <20 E - 25, 23 N - <20, <20	D - 26, 27 E - <20, <20 N - <20, <20	D - 32, 28 E - <20, <20 N - <20, <20
Bramboyne (N10)	D - <20, <20 E - 21, 20 N - 30, 29	D - 28, 27 E - <20, <20 N - 20, 21	D - <20, <20 E - <20, <20 N - <20, <20	D - 26, 24 E - <20, <20 N - <20, <20
The Glen (N12)	D - <20, <20 E - 20, 17 N - <20, <20	D - 22, 20 E - <20, <20 N - <20, <20	D - 26, 30 E - <20, <20 N - <20, <20	D - <20, <20 E - <20, <20 N - <20, <20
Caloola 2 (N15)	D - <20, <20 E - <20, <20 N - <20, <20	D - 32, 31 E - <20, <20 N - 20, 20	D - 32, 28 E - <20, <20 N - <20, <20	D - 22, 20 E - 20, 22 N - <20, <20
Lakeview (N17)	D - <20, <20 E - <20, <20 N - <20, <20	D - 20, 21 E - 20, <20 N - 23, 23	D - 20, 22 E - <20, <20 N - <20, <20	D - <20, <20 E - <20, <20 N - <20, <20
Foxham Downs II (N16)	D - <20, <20 E - <20, <20 N - <20, <20	D - 31, 31 E - <20, <20 N - 22, 21	D - 35, 34 E - <20, <20 N - <20, <20	D - <20, <20 E - <20, <20 N - <20, <20

Source: Spectrum Acoustics (2019a, b, c, d).
Notes: D = day; E = evening; N = night.

6.3.2.2 Performance Outcomes

Attended noise monitoring results for all the properties are well below the noise impact assessment criteria for these properties defined in Development Consent Condition 6.4(c).

Comparison with EIS Predictions

Table 17 summarises SLR's (2013) predicted $L_{Aeq(15\ minute)}$ noise levels at the nearest privately-owned residential receivers (excluding those properties already afforded acquisition rights [i.e. Westella]) during day, evening and night-time periods during a strong inversion, in comparison to the noise impact assessment criteria for these properties listed in Development Consent Condition 6.4(c).

Table 17: Summary of Predicted Intrusive $L_{Aeq(15\ minute)}$ Noise Levels at Nearest Privately-owned Residential Receivers

Privately-owned Residential Receiver	Predicted Noise Level $L_{Aeq(15\ minute)}$ Day/Evening/Night-time during Strong Inversion (1800 – 0700 hours)	Noise Impact Assessment Criteria defined in Development Consent Condition 6.4(c)
Laurel Park	37	35
Bramboyne	36	35
Bungabulla	35	35
The Glen	36	37
Gumbelah	35	35

Source: SLR (2013).

6.3.3 Reportable Incidents

There were no reportable incidents during the reporting period.

6.3.4 Further Improvements

No further improvements are proposed for the next reporting period.

6.4 VISUAL, STRAY LIGHT

Development Consent Condition 6.5(b) details the requirements for the management of visual and off-site lighting impacts from CGO.

Monitoring and management of visual and off-site lighting impacts during the reporting period was undertaken in accordance with the relevant Development Consent conditions.

6.4.1 Environmental Management

6.4.1.1 Control Strategies

In accordance with Development Consent Condition 6.5(b), visual impact mitigation measures that have been employed at the CGO during the reporting period included landscaping and design specifically conducted for visual impact mitigation purposes. Specific landscaping strategies during the reporting period included:

- utilising existing vegetation as visual screens;
- planting of vegetation screens around the ML 1535 boundary;
- construction of the waste emplacements, reducing visual impact of the processing plant from the eastern side of Lake Cowal;
- placement of topsoil stockpiles on the southern and western sides of the STSF to break the view from the relocated Travelling Stock Route;
- outdoor lighting set-up in accordance with *AS 4282-1997 Control of the obtrusive effects of outdoor lighting*; and
- selecting the colour of the processing plant buildings to blend with the adjacent landscape in accordance with the requirements of Bland Shire Council (BSC).

6.4.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period were considered effective as demonstrated by the environmental performance indicators.

6.4.1.3 Variations from Proposed Control Strategies

There were no variations from the proposed control strategies during the reporting period.

6.4.2 Environmental Performance

6.4.2.1 Monitoring

A summary of the landscape maintenance and monitoring programme implemented during the reporting period is provided in Table 18.

Table 18: Landscape Maintenance and Monitoring Summary

Component	Monitoring Frequency	Monitoring Method	Typical Maintenance
Landscaping Works			
• General Inspections	Annual	Visual assessment of moisture stress, plant survival, presence of weeds and erosion/ sedimentation.	• Supplementary watering if required. • Control of invasive weed species. • Supplementary planting of failed plants where necessary.
• Erosion Inspections	Following significant, high intensity rainfall events.	Visual assessment of earth mound screening to determine if significant erosion or washouts have occurred in accordance with the ESCMP.	• Repair any significant erosion or washout areas on earth mounds. • Stabilisation with Jute mesh or other materials as required. • Additional revegetation planting or sowing if required.
Buildings, Structures and Facilities	Annual	Visual assessment by a suitably qualified individual, as required.	• Replace or repair items as necessary to maintain structural integrity. • Repaint any exterior surfaces where the finish has deteriorated. • Maintain fixed outdoor and in-pit mobile lighting.
Rehabilitation Works			
• General Inspections	Annual	Monitoring in accordance with the RMP, the BOMP and MOP (with reporting in the AR).	• Repair any significant erosion or washout areas. • Control of invasive weed species in accordance with the Land Management Plan. • Supplementary planting or seeding of failed plants where necessary.
• Erosion Inspections	Following significant, high intensity rainfall events.	Visual assessment of rehabilitation works to determine if significant erosion or washouts have occurred in accordance with the ESCMP.	• Repair any significant erosion or washout areas on earth mounds. • Stabilisation with Jute mesh or other materials as required. • Additional revegetation planting or sowing if required.

BOMP – Biodiversity Offset Management Plan.

6.4.2.2 Performance Outcomes

Visual impact management and landscape maintenance and monitoring measures conducted during the reporting period included:

- inspections and maintenance of fixed outdoor lighting and in-pit mobile lighting;
- general inspections of landscaping (i.e. visual screens) and rehabilitation works;
- monitoring of tree and shrub survival rates of landscape plantings; and
- erosion inspections of landscaping and rehabilitation works following periods of significant, high intensity rainfall.

As a result of this visual landscape monitoring the following maintenance activities were undertaken:

- weed control within landscaping and rehabilitation areas by manual removal or chemical application; and
- maintenance of erosion control structures.

6.4.3 Reportable Incidents

There were no reportable incidents during the reporting period.

6.4.4 Further Improvements

No further improvements are proposed for the next reporting period.

6.5 EROSION AND SEDIMENT

Development Consent Condition 3.5(a) provides erosion and sediment control strategies for works to be undertaken throughout the life of the CGO (i.e. construction and operations).

Monitoring and management of erosion and sediment control during the reporting period was undertaken in accordance with the relevant Development Consent Conditions, relevant ML 1535 conditions, the approved ESCMP and EPL 11912.

6.5.1 Environmental Management

6.5.1.1 Control Strategies

A summary of the control strategies/management measures implemented during the reporting period in accordance with the ESCMP is provided in Table 19.

Table 19: Summary of Erosion and Sediment Control Strategies/ Management Measures

Project Development	Control Strategy/Management Measure
Temporary Erosion and Sediment Controls Systems	
Internal Mine Access Road	• Minimisation of disturbance to watercourses that cross the road. • Provision of culverts and diversion of runoff from undisturbed areas. • Erection of sediment control barrier downslope of small, disturbed areas. • Provision of sediment basins for concentrated runoff areas. • Stabilisation of the access road surface. • Rapid stabilisation and revegetation of road batters.
ML 1535 Fences	• Minimising the area disturbed and restricting access to non-disturbed areas.
Ore Stockpile and Process Plant Area	• Minimising the area disturbed and restricting access to non-disturbed areas. • Settlement/plant runoff storage. • Installation of sediment control barrier. • Installation of runoff collections drains. • Dewatering of settlement storage following rainfall events. • Ripping and rehabilitation of hardstand areas.

Table 19 (Continued): Summary of Erosion and Sediment Control Strategies/ Management Measures

Project Development	Control Strategy/Management Measure
Soil Stockpiles	• Use of sediment control barrier and sediment traps to minimise soil movement. • Use of diversion banks, channels and rip-rap structures to divert surface water around disturbed areas and control runoff velocity.

Internal Mine Roads	• Constructing all access roads at an appropriated slope along the contour, where practicable. • The use of spoon drains, table drains and concrete culverts to control surface runoff from access roads. • Ripping and rehabilitation of roads no longer required for access.
Contractors' Area	• Minimising the area disturbed and restricting access to non-disturbed areas. • Erection of sediment control barrier downslope of small, disturbed areas. • Provision of sediment basins for concentrated runoff areas. • Ripping and rehabilitation of hardstand areas.
Earthworks Associated with Landscaping	• Use of sediment control barriers and sediment traps to minimise soil movement.
Internal Catchment Drainage System (ICDS)	• Construction of the ICDS as described in the ESCMP. • Construction of sediment retention storages to reduce non-colloidal fraction of sediment carried in runoff from large disturbed areas. Storages sized to provide flow detention and effective settlement during small to medium sized flood events (1 in 20 year 1 hour event). • Use of small-scale runoff controls comprising hay bales and rockfill bunds to control sediment loads in runoff from small areas. Silt control hay bale weirs installed downslope of all disturbed areas. • Rapid stabilisation of disturbed areas using contour banks and furrows, erosion-stable drainage paths and early revegetation or armouring of disturbed areas. Disturbed areas rapidly stabilised to reduce sediment fluxes.
Permanent Erosion and Sediment Controls Systems	
Lake Isolation System	• Construction of the Temporary Isolation Bund and Lake Protection Bund as described in the ESCMP. • Stabilisation and revegetation of the batters of the Temporary Isolation Bund and Lake Protection Bund.
Up-Catchment Diversion System (UCDS)	• Construction of the UCDS as described in the ESCMP to divert upper catchment water around the CGO. • Installation of rip-rap structures along UCDS and rock outfalls at confluences with existing natural drainage lines. • Vegetation stabilisation.
Earth Mounds (associated with the ICDS)	• Vegetative stabilisation.
Monitoring and Maintenance	• Water quality monitoring in accordance with the Surface Water, Groundwater, Meteorological and Biological Monitoring Program (SWGMBMP). • Maintenance of erosion and sediment control structure where necessary.

6.5.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

6.5.1.3 Variations from Proposed Control Strategies

There were no variations to the proposed control strategies during the reporting period.

6.5.2 Environmental Performance

6.5.2.1 Monitoring

In accordance with the ESCMP, inspections and maintenance of erosion and sediment control structures (e.g. silt fences, hay-bales, sediment ponds and diversion structures) occurred as required during the reporting period.

The ESCMP also requires the following to be reported in the AR:

- Surface and groundwater monitoring results.
- Comparison of surface water and groundwater monitoring results with criteria in the SWGMBMP.
- Interpretation and discussion of the surface and groundwater monitoring programme results.
- Community Environmental Monitoring & Consultative Community (CEMCC) decisions relating to ESCMP issues.

6.5.2.2 Performance Outcomes

The CGO geotechnical department conducted monthly monitoring and assessment of structures such as all water holding facilities on site, waste emplacements and the lake protection bund for sediment movement and erosion control effectiveness in accordance with the CGO's *Monitoring Programme for the Detection of Movement of the Lake Protection Bund, Water Storage and Tailings Structures and Pit/Void Walls*. The monthly monitoring and assessments indicated no significant sediment movement, ponding or erosion incidence of the contained water storages, waste rock emplacements, lake protection bund and temporary isolation bund.

During the reporting period minor scaling and reshaping works were carried out on the SWRE (south waste rock emplacement) to correct minor rilling of dispersive soils which during inspections has proved to be effective.

The progressive rehabilitation for final landform slopes continues to demonstrate effective erosion control as evidenced by independent specialists DnA Environmental (DnA Environmental, 2019a).

6.5.3 Reportable Incidents

There were no reportable incidents during the reporting period.

6.5.4 Further Improvements

No further improvements are proposed for the next reporting period.

6.6 CYANIDE MANAGEMENT

Development Consent Condition 5.3 outlines requirements in relation to the management of cyanide at the CGO. A cyanide monitoring programme has been developed for CGO and is incorporated into the CGO's Cyanide Management Plan (CMP), which has been prepared in accordance with Development Consent Condition 5.3(b).

The EPL 11912 requires Evolution to undertake cyanide monitoring at the points identified in EPL 11912 Condition P1.3. The cyanide monitoring points and frequencies required by the EPL 11912 are consistent with monitoring required by the Development Consent and the CMP. The CMP has also been prepared to address the relevant requirements of ML 1535.

Monitoring and management of cyanide during the reporting period was undertaken in accordance with the relevant Development Consent Conditions, the approved CMP and EPL 11912.

Evolution has continued to report monthly weak acid dissociable cyanide (CN_{WAD}) results on the company's website during the reporting period. Evolution Continues to report and discussed these results with the CEMCC at all quarterly meetings.

6.6.1 Environmental Management

6.6.1.1 Control Strategies

A summary of the control strategies maintained during the reporting period in accordance with the CMP is provided below:

- Containment of all tailings waters within the TSFs, processing plant and processing plant dams. Maintenance of the Lake Protection Bund and upper catchment diversion drain systems.
- Provision of emergency containment channels alongside tailings storage pipelines to and from the TSFs. Maintenance of process pipe work, equipment and leak detection equipment.
- Terrestrial fauna protection fencing and avifauna deterrent methods to minimise the potential for impacts of tailings operations.
- Use of sodium metabisulphite to destruct cyanide in tailings slurry to permissible levels before the processing plant slurry discharge is pumped to the TSFs (with standby Caro's Acid circuit).
- Routine monitoring and reporting of tailings facility flows, ground and surface waters, and employee work areas for cyanide levels.
- Maintenance of emergency preparedness of employees and supply chain in reporting and response capability.
- Routine patrols of tailings and process areas to ensure the potential for spillage, dust or native fauna and flora impacts are minimised.

The CGO is certified under the International Cyanide Management Institute's (ICMI) Code for Cyanide Management. Details regarding the re-certification audit are provided on the ICMI's website: http://www.cyanidecode.org/signatory-company-categories/evolution-mining-cowal-pty-ltd-australia

6.6.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

6.6.1.3 Variations from Proposed Control Strategies

There were no variations from the proposed control strategies during the reporting period.

6.6.2 Environmental Performance

6.6.2.1 Monitoring

In accordance with the CMP and Development Consent Condition 5.3(d), results of CN_{WAD} monitoring of tailings discharge (at the processing plant) and decant water were monitored during the reporting period. Levels of CN_{WAD} recorded are presented in Table 20.

6.6.2.2 Performance Outcomes

In accordance with Consent Condition 5.3(d)(i), CN_{WAD} levels of the aqueous component of the tailings slurry stream were maintained so that they do not exceed 20 milligrams (mg) CN_{WAD}/L (90 percentile over six months) and 30 mg CN_{WAD}/L (maximum permissible limit at any time) at the process plant during the reporting period. Monitoring results have remained low and within licence conditions.

Groundwater results for cyanide during the reporting period remained below the laboratory detection limit. Two sample locations (TSFNC and TSFNC) tested positive just above detection limit, sample points were re tested and came back bellow detection limit suggesting lab error in positive samples.

Table 20 : CN_{WAD} Levels of the Aqueous Component of the Tailings Slurry

			CN_{WAD} (mg/L)	
Frequency	**Month**	**No. Sampled during Month**	**Minimum**	**Maximum**
Twice daily	January	56	0	11.1
Twice daily	February	54	0	8.7
Twice daily	March	52	0	8.6
Twice daily	April	56	0.02	6.6
Twice daily	May	62	1.11	13.7
Twice daily	June	40	0.06	5.6
Twice daily	July	62	0	15.1
Twice daily	August	52	0.04	7.2
Twice daily	September	60	0.3	6.4
Twice daily	October	62	0	8.9
Twice daily	November	57	0	8.4
Twice daily	December	62	0	8.5

6.6.3 Reportable Incidents

No incidents occurred during the reporting period.

6.6.4 Further Improvements

No further improvements are proposed for the next reporting period.

6.7 FLORA

Development Consent Condition 3.2 details the requirements for the CGO in relation to the management of flora and fauna. A Flora and Fauna Management Plan (FFMP) and Threatened Species Management Protocol (TSMP) have been developed for the CGO in accordance with Development Consent Conditions 3.2(b) and 3.2(c), respectively. The FFMP has also been prepared to address the relevant requirements of ML 1535.

Monitoring and management of flora continued in accordance with the requirements of the FFMP, the TSMP, the BOMP and the RMP during the reporting period.

6.7.1 Environmental Management

6.7.1.1 Control Strategies

Flora control strategies for the CGO are described in the FFMP. The following control strategies were implemented at the CGO during the reporting period:

- implementation of Compensatory Wetland Management Plan (CWMP) initiatives and the Remnant Vegetation Enhancement Program (RVEP);
- incorporation of flora management initiatives during operational design;
- implementation of the Vegetation Clearance Protocol (VCP);
- implementation of the TSMP;

- weed management and pest control;
- flora monitoring programme;
- observance of the Threatened Species Management Strategies (TSMSs) for the relevant Endangered Ecological Communities:
  - Inland Grey Box Woodland Myall Woodland
  - Aquatic Ecosystems (lower Lachlan River)
  - Weeping Myall Woodland
- provision of information relevant to the management of native flora during employee and contractor inductions;
- development and submission of a RMP (including mine site rehabilitation performance and completion criteria and a mine site rehabilitation monitoring programme relevant to the approved CGO); and
- development and submission of a BOMP (including an offset performance and completion criteria and an offset monitoring programme relevant to the approved CGO offset areas).

6.7.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

6.7.1.3 Variations from Proposed Control Strategies

There were no variations from the proposed control strategies during the reporting period.

6.7.2 Environmental Performance

6.7.2.1 Monitoring

Monitoring and management of flora continued in accordance with the requirements of the FFMP (Section 6.7.1.1), the BOMP and the RMP during the reporting period.

Flora monitoring was conducted during the reporting period in accordance with the RMP, including within the following areas:

- Compensatory Wetland (CW);
- Rehabilitation areas and rehabilitation trial areas;
- Offset management areas;
- *Pilularia novae-hollandiae* (Austral Pillwort) habitat; and
- RVEP areas (Figure 5).

6.7.2.2 Performance Outcomes

Flora monitoring within the CW and RVEP areas was undertaken by DnA Environmental (2019b) during the reporting period. A summary of the results from this monitoring survey are outlined below.

Compensatory Wetland

In 2019, total annual rainfall was 202.6mm and almost half of what is expected for the second consecutive year. The Lake was completely dry and native grasses had become well colonised in the lakebed.
In 2019, all monitoring sites were dry and had sufficient time for the native grasses to colonise the otherwise bare lake sediments. Ground cover in the compensatory wetland sites ranged from 67 – 96%, while the grazed sites, there was 82 – 100% ground cover as the grazed sites had not recently been grazed by livestock. Ground cover was slightly lower in the remaining wetland areas as they were situated in the deepest parts of the lake with less development time, and ground cover ranged from 36 – 86% cover.
During this reporting period, floristic diversity was at an all-time low since monitoring had begun ranging from a low of 6 – 22 species. Native plants continued to be more diverse than exotic species in all sites and this year exotic species were limited with a maximum of three exotic species recorded in five sites.
This year, native plants provide all of the live plant cover in most sites. Exceptions included RW1 and RW2 with 65% and 92% native plant cover and GW2 and GW5 where native plants provided 57% and 93% of the live pant cover.
No threatened species have been recorded in any Compensatory Wetland monitoring site. In previous years Lycium ferocissimum (African Boxthorn), a priority weed of the Bland Shire was recorded in some of the Compensatory Monitoring sites. This year no priority weeds were recorded in any of the monitoring sites.

Most changes in the wetlands have occurred as a result of climatic and biophysical factors. These however compounded in areas subjected to livestock grazing, especially during the dry conditions when stock were allowed to graze which resulted in the general deterioration of the grassland and interity of the protective ground covers. Livestock also exacerbate a decline tree health due to increased compaction, nutrients and disturbane which also reslt in erosion.

The results to date have generally indicated significant improvement in the health of the lake and the lake foreshore environments with extensive colonisation of native perennial grasses and natural regeneration of endemic lake species including River Red Gum, Lignum and Native Liquorice despite the ongoing drought, however floristic diversity was very low this year.

Pilularia novae-hollandiae (Austral Pillwort) Habitat

The annual surveys conducted since 2006 have failed to locate Austral Pillwort in the Lake Cowal area despite extensive and targeted searches. This year, the lake and all gilgias were completely dry and the seasonal conditions continued to be unsuitable for the Austral Pillwort.

During the reporting period, floristic diversity in a range of long-term CGO monitoring sites has declined as result of the drought and increased grazing from macropods.

During this reporting period, no Austral Pillwort were located (DnA Environmental, 2019c).

The increasing vegetation cover and extremes in seasonal conditions, particularly periods of extended hot dry conditions is likely to have impacted on populations of Austral Pillwort but the extent that this has occurred is unknown as none have been located since monitoring began.

Grazing of the grasslands and gilgais by macropods (such as kangaroos) has reduced the abundance of competitive ground covers and deep litter layers in many areas. While the drought has not provided suitable conditions for Austral Pillwort thus far, it is possible that its habitat condition could be improved inadvertently as a result of this increased grazing activity.

Remnant Vegetation Enhancement Program (RVEP)

The six permanent monitoring sites, Hill01, Hill02, Hill03, Hill04, RVEP3 and RVEP4 are surveyed annually (when accessible) to monitor changes in vegetation cover, species diversity and to determine the extent of regeneration occurring within these conservation areas. The monitoring methodology has been a simplified version of the CGO annual rehabilitation monitoring program and includes an assessment of ecosystem characteristics using an adaptation of methodologies derived from CSIRO Grassy woodland Benchmarking project and associated Biometric Model. It does not include Landscape Function Analysis or comprehensive soil sampling. RVEP monitoring has been undertaken in spring in all years, with the 2019 monitoring undertaken during 28th October and the 6th November.

The highest stem densities continued to be recorded in Hill03 which had 49 live individuals recorded this year, despite the loss of two as a result of drought induced mortality . There was 17 individuals recorded at Hill01, as the acacia saplings continue to grow. There was no change in tree densities in the remaining sites, where there were 1 – 8 mature trees.

In the Hill sites, the most common trees were Eucalyptus dwyeri (Dwyer's Red Gum), E. microcarpa (Grey Box), E. sideroxylon (Mugga Ironbark), Geijera parviflora (Wilga), Alectryon oleifolius (Rosewood) and Allocasuarina verticillata (Drooping Sheoak). Mature shrubs were A. doratoxylon (Spearwood) and Pittosporum angustifolium (Butterbush). In the RVEP3 and 4 sites the trees included old growth E. camaldulensis (River Red Gum).

Dead stags were a common feature within the Fellman's Hill woodland sites Hill01, Hill02 and Hill03.The prolonged dry conditions appear to be having an ongoing effect on tree health, with an additional individual having died in Fellman's Hill sites. All sites had trees that were bearing reproductive structures such as buds, flowers or fruits. Most sites except Hill02 and Hill04 contained trees with hollows suitable for use by wildlife.

All sites contained a population of shrubs and juvenile trees (dbh<5cm) with densities being highly variable across the range of sites, ranging from a low of 1 in Hill01 to a high of 236 in RVEP3. Densities of shrub and juvenile trees in Hill01, Hill02 and Hill03 have tended to decline since 2013 due to the prolonged dry conditions combined with increased grazing pressure by resident macropods.

In the Hill sites, the most common shrub species were A. doratoxylon, A. deanei and Cassinia laevis (Cough Bush). Juvenile Allocasuarina verticillata, Callitris glaucophylla, Geijera parviflora, E. dwyeri, were also recorded in low densities in some sites. In RVEP3 and RVEP4, shrubs and juvenile tree species included Eucalyptus camaldulensis, Glycyrrhiza acanthocarpa (Native Liquorice) and Duma [Muehlenbeckia] florulenta (Lignum).

In 2017 prolonged dry conditions again resulted in a significant decline in species diversity in all RVEP sites, especially those on Fellman's Hill. In 2018 the lake water had further receded resulting in further increase in seedlings on RVEP 3 and 4, and in 2019 the lake was completely dry again increasing seedling numbers to 236.

This year, no species were recorded in all six sites, and only one species Sclerolaena muricata (Black Roly Poly) was common to three of the six sites. There were a variety of hardy native ground covers and subshrubs in Hill04, RVEP3 and RVEP4 including Atriplex semibaccata (Creeping Saltbush), Enchylaena tomentose (Ruby Saltbush), Salsola australis (Buckbush), Rytidosperma caespitosum (Wallaby Grass) and Vittadinia condyloides (Fuzzweed). Duma florulenta (Lignum) and E. camaldulensis were recorded in both RVEP3 and RVEP4.

The particularly dry conditions since 2017 has resulted in a decline in ground covers and floristic diversity in all RVEP sites, with these being compounded by an increase in grazing pressure especially by macropod populations. It must be noted that an approved Kangaroo culling operation had been undertaken at "Hillgrove" as part of the Southern Offset Area Biodiversity Offset Strategy just prior to and during the annual monitoring event in 2017, towards the end of 2018 and an additional program would be considered in 2020.

Vegetation Clearance

Several campaigns of vegetation clearance activities were undertaken during the reporting period, including:

- February 2019, to allow for construction of the IWL.
- March 2019, to allow for construction of the IWL.
- June 2019, to allow the Lake Cowal Road realignment.
- August 2019, to allow for construction of the IWL.
- September 2019, to allow for construction of the IWL.
- Other minor clearances in November and December for ancillary infrastructure, stockpiles and fences within ML 1535 and ML 1791.

All clearance works were undertaken consistent with the requirements of the VCP.

6.7.3 Reportable Incidents

There were no reportable incidents during the reporting period.

6.7.4 Further Improvements

No further improvements are proposed for the next reporting period.

6.8 BIODIVERSITY OFFSET AREAS

Development Consent Condition 3.4 details the requirements for the CGO in relation to the biodiversity offset strategy. A BOMP has been developed for the CGO in accordance with Development Consent Condition 3.4(c). The BOMP has also been prepared to reflect the approved biodiversity offset strategy described in subsequent Environmental Assessments and approvals. The BOMP was approved by the DP&E on 10 September 2015.

Monitoring and management of the biodiversity offset areas continued in accordance with the requirements of the BOMP and the Development Consent during the reporting period.

6.8.1 Environmental Management

6.8.1.1 Control Strategies

The Biodiversity Offset Strategy is described in the BOMP and includes:

- a description of the offsets;
- objectives for the offsets;
- short, medium and long-term management measures and performance criteria;
- a description of how the strategy integrates with the CGO's rehabilitation programme;
- a monitoring programme;
- revegetation and regeneration performance indicators and completion criteria;
- details for the long-term protection mechanism for the offset areas; and
- the conservation bond requirements relevant to implementation of the biodiversity offset strategy.

The following control strategies were implemented at the CGO during the reporting period:

- Progression in securing the tenure of the offset areas and calculating the required bond, to the satisfaction of the Secretary.
- Weed management and pest control.
- Offset monitoring programme.

6.8.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

6.8.1.3 Variations from Proposed Control Strategies

Evolution completed a cull of Eastern Grey Kangaroos within the Felman's Hill area in 2017 and 2018, as the population became unsustainable (Section 6.7.2.2). The CGO applied for 200 drop tags from the Griffith NSW National Parks & Wildlife Services prior to conducting the cull. No Culling program was conducted in the reporting period, but would be considered in 2020.

6.8.2 Environmental Performance

As required by Development Consent Condition 3.4(b), Evolution is required to enter into a Voluntary Planning Agreement (VPA) with the NSW Minister for Planning to secure tenure over 440 hectares (ha) of land to the north and south of ML 1535 as a biodiversity offset for the CGO. The VPA and associated bank guarantee are currently with DPE awaiting execution and public exhibition

6.8.2.1 Monitoring

Monitoring and management of the offset management areas continued in accordance with the requirements of the BOMP during the reporting period.

6.8.2.2 Performance Outcomes

In 2018, biodiversity offset monitoring was undertaken by DnA Environmental (2018a). A summary of the results from this monitoring survey are outlined in the sections below.

Northern Offset Area

The Northern Offset Area (NOA) contains approximately 74 ha of Weeping Myall Woodland Endangered Ecological Community (EEC) listed under both the Commonwealth Environment Protection and Biodiversity Conservation Act, 1999 (EPBC Act) and the NSW Biodiversity Conservation Act, 2016 (BC Act) and approximately 1 ha of Grey Box Woodlands EEC listed under the EPBC Act.

The Acacia pendula – Casuarina cristata (Myall – Belah) woodland reference sites (RSlope01, RSlope02) contained some large bare areas which are often typical of these communities. High levels of ground cover and functional patch area however have been maintained in RSlope01, up until last year where increased macropod grazing has resulted in the deterioration of the plant, litter and cryptogammic layers and this year no functional patch area was recorded.

In the Northern Offset Area (NOA) there was a decline in ground cover but still remained relatively high with 80 – 91.5% cover.

This year NOA02 was the most ecologically functional Myall woodland community and scored a total of 134, despite the lack of trees or shrubs. NOA01 was the next most functional community with a sum of 120. The two slope reference sites RSlope01 and RSlope02 were the least functional with scores of 95 and 91 respectively. The deterioration of the diverse grasslands from these sites has therefore had a profound effect on the ecological function of these communities.

In the northern offset sites, there was a comparable number of herbs and grasses and reed species, however, there was an absence of trees and shrubs in the NOA sites.

No individual species was in sufficient abundance to meet the minimum criteria (i.e. 5/30) in NOA01 or SOA05 this year however Enteropogon acicularis (Curly Windmill Grass) continued to be the most dominant species in NOA02 but overall scores have declined.

The soils in the NOA had a similar chemistry as the slope reference sites which were slightly to moderately alkaline and there was a marginal decrease in pH in all offset sites, The soils were therefore slightly acidic to neutral and within local and desirable levels.

There has been an increase in EC in both reference sites this year. Both sites continued to exceed the desirable agricultural level and were slightly to moderately saline. A marginal increase in EC was also recorded in all offset sites. At these concentrations, EC in the offset sites remained much lower than the reference sites but exceeded desirable levels and were slightly saline in NOA01 this year.

Southern Offset Area

The Southern Offset Area (SOA) contains approximately 122 ha of Weeping Myall Woodland EEC listed under both the EPBC Act and the BC Act, and approximately 150 ha of Grey Box Woodlands EEC listed under the EPBC Act. These areas have been defined as offset enhancement areas. The cleared 100 ha of agricultural land mapped as Spear Grass – Windmill Grass Grassland to the west of Fellman's Hill in the SOA has been identified as the offset revegetation area.

The SOA monitoring sites are situated in old cropping paddocks and have become very stable due to the relatively high levels of litter largely derived from dead annual plants and very hard compacted soils. In previous years, the four SOA's have remained well vegetated grassland areas with 100% functional patch areas, despite grazing by livestock in SOA03 and SOA04 in 2016. This year a decrease in total ground covers was also recorded in all reference and offset sites.

This year all sites in the SOA, especially those on the Eastern side and on Fellman's Hill, including the woodland reference sites (Grey01, Dwyers01 and Dwyers02) had become significantly degraded over the last two years due to ongoing drought conditions and overgrazing by macropods. This year little to no functional patch area was recorded in the monitoring sites on the SOA eastern enhancement areas (SOA03, SOA04, SOA05, Grey02) or in the Myall- Belah reference site. The deterioration of the diverse grasslands from these sites and resultant erosion has therefore had a profound effect on the ecological function of these communities.

During this reporting period, there has been a significant decrease in floristic diversity in all hill woodland reference sites as a result of the dry conditions and increased macropod grazing and disturbance by animals. This year all sites had an acceptable diversity of native species as diversity were significantly low, however SOA01 was the only site to have an acceptable diversity of exotic species compared to the Hill reference sites.

In the slope reference sites, there was a tree and mature shrub population (>5cm dbh) which has slightly declined in Slope01 as a mature tree had died, while an increasing population was recorded in Slope02 as young saplings continue to grow, 120-270 individuals per hectare. Most trees were in medium heath with a small number of stags and hollows recorded.

In SOA02, there were 67 tubestock planted in October 2016 which included a mix of endemic trees and shrubs, with 46 individuals remaining this year. This year there was an adequate density of shrubs and juvenile trees in SOA02 compared to the reference sites, however the remaining sites did not. In 2017, ~7000 tubestock were planted in ~5 ha of the western side of the SOA with significantly higher survival rates of around 75% survival, and dead seedlings from previous plantings were replaced (T. Rawson pers. comm. 2017). Therefore, survival rates and tree and shrub densities are likely to be much greater in some parts of the western side of the SOA enhancement area than was recorded in SOA01 and SOA02.

In SOA01, Digitaria divaricatissima (Umbrella Grass) continue to provide the most live plant cover while in SOA02, Atriplex semibaccata (Creeping Saltbush) was increasing in abundance and provided the most live ground cover this year. In SOA03, no ground cover was sufficiently abundant, while in SOA04 Austrostipa continued to be the most dominant species. In Grey02 Ruby Saltbush continued to provide the most ground cover but overall cover scores were low, and no other species were sufficiently abundant to meet the criteria in the other three reference sites this year.

One Lycium ferocissimum (African Boxthorn) was recorded in RSlope01. No threatened species were recorded within the range of hill monitoring sites.

All SOA monitoring sites had a soil pH that were comparable with the local woodlands or fell within desirable agricultural levels. EC in the all the SOA sites had an EC lower than or comparable to the local woodlands and are non-saline Organic matter levels were lower than desirable levels in all sites, except in the reference sites. This year there was a slight increase in Phosphorous across the offset monitoring sites. In SOA01 and SOA04 concentrations were comparable to the local woodlands, but these were quite low compared to desirable agricultural levels.
Other soil analysis in SOA indicate elevated levels of manganese, iron and silicon. Iron concentrations were also significantly high in Grey01 and Dwyers01 suggesting that iron may naturally occur in high levels within ridges and hills in the Lake Cowal environment or they have been the result of a long mining and/or agricultural legacy.

In terms of meeting completion targets there was an absence of trees and shrubs and associated structure and habitat in both NOA and SOA monitoring sites. This year there was however an adequate density of shrubs and juvenile trees in SOA02 compared to the reference sites due to the planting of tubestock in 2017. Therefore, shrub and juvenile tree densities are likely to be much greater in some parts of the Western side of the SOA enhancement area than were recorded in either SOA01 or SOA02 monitoring sites. The revegetation activities across the SOA should result in the development of woodlands which are characteristically similar to the adjacent ridge and hill communities, and demonstrate an ongoing improvement in ecological performance, providing adequate grazing management is implemented.

6.8.3 Reportable Incidents

There were no reportable incidents during the reporting period.

6.8.4 Further Improvements

No further improvements are proposed for the next reporting period.

6.9 FAUNA

As outlined in Section 6.7, Development Consent Condition 3.2 details the requirements for the CGO in relation to the management of flora and fauna. A FFMP and TSMP have been developed for the CGO in accordance with Development Consent Conditions 3.2(b) and 3.2(c), respectively. The FFMP has also been prepared to address the relevant requirements of ML 1535.

Monitoring and management of fauna continued in accordance with the requirements of the FFMP, the TSMP, the BOMP and the RMP during the reporting period.

Evolution has not received formal approval of the TSMSs however, verbal advice was received from the DP&E (Kane Winward) on 26 September 2013 advising that Evolution can implement the EMPs and strategies (including the TSMSs) at the CGO which were pending formal approval by the DP&E.

6.9.1 Environmental Management

6.9.1.1 Control Strategies

The relevant control strategies for the management of fauna species are described in the FFMP, RMP and BOMP and include:

- implementation of CWMP initiatives and the RVEP;
- incorporation of fauna management initiatives during operational design;
- implementation of the VCP (including pre-clearance surveys);
- implementation of the TSMP;
- management of impacts on terrestrial and aquatic fauna;
- rehabilitation of disturbance areas;
- weed management and pest control;
- fauna monitoring program;
- maintaining a clean, rubbish free environment to discourage scavenging;
- prohibition for the introduction of animals including domestic pets on ML 1535;
- imposing speed limits within ML 1535 to reduce the risk of fauna mortality via vehicular strike; and
- provision of information relevant to the management of native fauna during employee and contractor inductions.

6.9.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

6.9.1.3 Variations from proposed Control Strategies

There were no variations from the proposed control strategies during the reporting period.

6.9.2 Environmental Performance

6.9.2.1 Monitoring

In accordance with the FFMP, monitoring activities in relation to fauna were conducted during the reporting period, including:

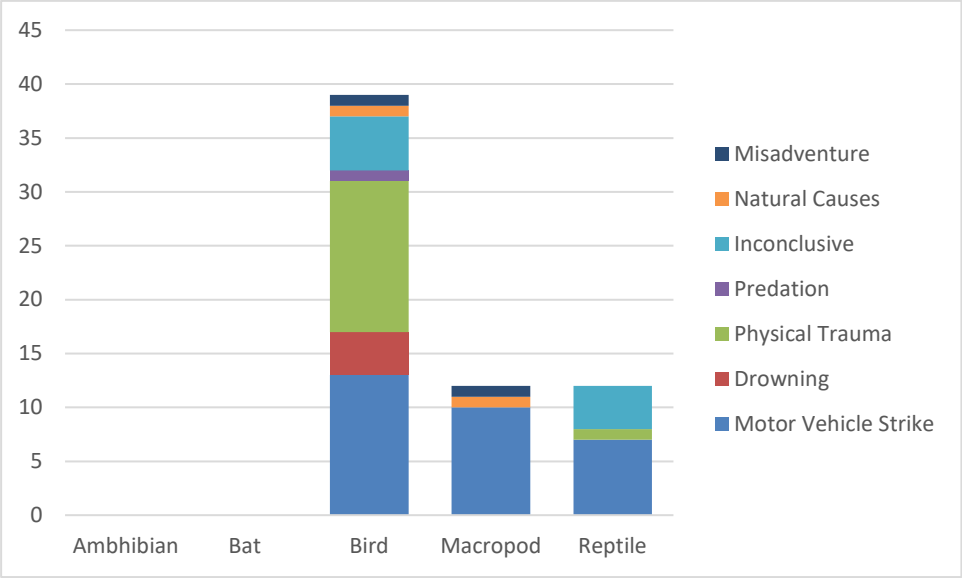
- continuation of long-term monitoring of bird breeding;
- bat call monitoring at the active TSF and control site;
- twice daily monitoring of any fauna usage of the TSFs;
- weekly boundary inspections of ML 1535;
- regular checking of the main diesel tank and hydrogen peroxide tank concrete bund sumps after rainfall events to rescue and relocate frogs; and
- daily and weekly fauna incident inspections and field patrols.
-

6.9.2.2 Performance Outcomes

Reported Fauna Deaths

There were a total of 61 fauna incidents on ML 1535 during the reporting period. All injured or deceased fauna were taken to the local vet for examination as required (i.e. in instances where cause of death cannot be immediately determined). Motor vehicle strike was the most prominent cause of death during the reporting period (Graph 1). There were no cyanide related fauna incidents or deaths.

Graph 1: Graph of Fauna Deaths for the Reporting Period



Lake Cowal Waterbird Monitoring

The long-term monitoring of bird breeding continued during January, August and October of the reporting period. A summary of monitoring results undertaken by Professor Peter Gell (2019a, 2019b, 2019c) during the reporting period is provided below. The location of waterbird monitoring transects are presented on Figure 8.

January 2019

The first survey for 2019 was carried out on 8th and 9th of January 2019. The lake waters had receded greatly to the point where the margins were ill defined. The exposed mudflats had been colonised by grasses and herbs. DetailsA total of 18 species were observed along the two transects surveyed (Table 3). The total of 8445 birds observed was higher than most surveys since 2010. This was due to large numbers of ducks recorded at the southern end of transect 1.

The most commonly recorded species were Grey Teal (7314), Pink-eared Duck (327), Great Egret (63), Glossy Ibis (55), Yellow-billed Spoonbill (233), Masked Lapwing (208) and Sharp-tailed Sandpiper (92). Other than 33 Australian Pelican, the bird assemblage at Lake Cowal supported only low numbers of fish-eating species. The fauna remained dominated by ducks (91%) and wading birds (7%), with the proportions of ducks inflated by the high numbers of Grey Teal. These proportions reflect the widespread availability of shallow water habitat. Relatively large numbers of large waders e.g. Great Egret (63), Yellow-billed Spoonbill (233), Glossy Ibis (55) and Masked Lapwing (208), may reflect the growth of cane grass over what were previously mudflats, among shallow water.

The numbers of Grey Teal, Pink-eared Duck, Yellow-billed Spoonbill, Sharp-tailed Sandpiper and Red-capped Plover were the highest recorded in January since 2011 (Table 4). This January survey is the first in this wetting-drying cycle that no records were made of any cormorants, Australian Wood Duck, Black-tailed Native-hen, Eurasian Coot, Purple Swamphen, White-necked Heron or Straw-necked Ibis, but also the first in which Brolga were observed.

The extreme rainfall event and flooding across the Lachlan valley in September 2016 has been followed by a severe drought and the lake level has continued to fall as a result. While only two transect lines were close enough to the remaining water to warrant survey, the shallow water habitat promoted high bird species richness (18), and high abundance (8445). The widespread shallow habitat, and likely the prevailing drought conditions across the region, ensured Lake Cowal remained attractive to dabbling ducks (Pacific Black Duck, Grey Teal, Pink-eared Duck) and the waders Great Egret, Yellow-billed Spoonbill, Glossy Ibis, Masked Lapwing and Sharp-tailed Sandpiper. The shallow conditions, and prevalence of cane grass, supported an unusual assemblage relative to previous January surveys.
Owing to the complete drying of the northern section of the lake the usual colonial breeding areas were exposed to land-based predation and no colonial breeding activity was evident.

August 2019

Lake Cowal was visited on 14th of August 2019, The lake proved to be dry and so no transect surveys, or surveys for colonial waterbird breeding, was attempted. No data was collected on ambient conditions or vegetation.
The extended drought conditions through NSW resulted in Lake Cowal being completely dry for the first time since 2009. While the Lake did not support waterbirds, there was some waterbirds roosting near farm dams around the lake margin.

October 2019

Lake Cowal was visited on October 16th, 2019. The lake proved to be dry and so no transect surveys, or surveys for colonial waterbird breeding, was attempted. No data was collected on ambient conditions or vegetation.
The extended drought conditions through NSW resulted in Lake Cowal being completely dry. This continues the conditions observed in August 2019. While the Lake did not support waterbirds, there was some waterbirds roosting near farm dams around the lake margin.

Fauna Monitoring of TSFs and ML 1535 Boundary

Fauna usage reports in relation to the TSF areas were prepared by Donato Environmental Services (DES) (2019a; 2019b) during the reporting period being, 1 January 2019 to 30 June 2019 and 1 July 2019 to 31 December 2019, respectively.

The main findings included:

- The cyanide discharge concentrations were below those required by the Development Consent.
- Monitoring of cyanide concentrations within the active TSFs and other water bodies has been conducted frequently and at a high standard consistent with industry best practice.
- Considering currently accepted knowledge of cyanide toxicosis in the gold industry, the range of concentrations reported at CGO are considered benign to wildlife.
- No cyanide-related wildlife mortality or effect was recorded at the TSFs.
- No insectivorous bat deaths were recorded at the TSF during the current monitoring period or since systematic wildlife monitoring commenced in April 2006.
- Nocturnal surveys indicate that insectivorous bats were consistently present in the airspace above the active TSF and the control site.
- Monthly nocturnal surveying conducted at CGO represents a proactive approach to environmental monitoring.
- Birds were the only diurnal vertebrate wildlife recorded to visit and interact with the active TSFs.
- The frequency of systematic wildlife surveys makes it very unlikely that cyanide-related wildlife deaths were occurring undetected.
- Lake Cowal is considered to be a vital influence in the composition and abundance of species occurring at the TSFs.

6.9.3 Reportable Incidents

There were no reportable incidents during the reporting period.

6.9.4 Further Improvements

No further improvements are proposed for the next reporting period.

6.10 WEEDS AND PESTS

General weed and pest management activities within ML 1535 and the biodiversity offset areas have been managed during the reporting period in accordance with the Land Management Plan (LMP), the FFMP and the BOMP.

6.10.1 Environmental Management

6.10.1.1 Control Strategies

In accordance with the LMP, FFMP and the BOMP, the control strategies for weed management on Evolution-owned land (including the biodiversity offset areas) include (but are not limited to) the following:

- identification of weeds by regular and annual site inspections;
- communication with other landholders/leaseholders and regulatory authorities to keep weed management practices in line with regional weed control activities;
- mechanical removal of identified noxious weeds and/or the application of approved herbicides in authorised areas (herbicide use in wetland areas will be strictly controlled);
- implementing follow-up site inspections to determine the effectiveness of the weed control measures; and
- pest control activities.

The implementation of weed management strategies typically occurs according to seasonal and climatic requirements.

The pest control activities within ML 1535 and the offset areas described in the LMP, FFMP and the BOMP include the following measures:

- regular property inspections to assess the status of pest populations within Evolution-owned land;
- mandatory pest control for declared pests (i.e. rabbits, foxes, pigs and wild dogs) in accordance with Pest Control Orders under the NSW *Local Land Services Act, 2013*; and
- inspections to assess the effectiveness of control measures implemented and review these if necessary.

Evolution undertakes pest control activities in conjunction with adjacent landholders for more effective pest control. This process is facilitated via consultation with local landholders and landholder groups through the CEMCC process.

6.10.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

6.10.1.3 Variations from Proposed Control Strategies

There were no variations from the proposed control strategies during the reporting period.

6.10.2 Environmental Performance

6.10.2.1 Monitoring

In accordance with the LMP, the FFMP and the BOMP, Evolution has implemented a weed monitoring program at the CGO. Evolution-owned land including the biodiversity offset areas continues to be surveyed for weeds annually. Follow-up inspections are also to be made for specific areas following the implementation of weed control measures (to assess the success of the weed controls). Weed monitoring is conducted by suitably qualified personnel from a slow moving vehicle or on foot when required.

Weed monitoring includes identification of:

- extent of weed occurrence (noxious or otherwise);
- details of weed distribution (i.e. locations of infested areas) and possible reasons for any infestations (e.g. a change in land use practices);
- optimum herbicide application or physical removal timing (for implementation of controls);
- any resistance to a herbicide type or herbicide application technique (on the basis of success of previous controls); and
- identification of any new weed species that may be carried into the CGO area on vehicles accessing the site and become established near the vehicle wash-down area.

6.10.2.2 Performance Outcomes

Weed Management

During the weed survey undertaken for the reporting period, one Priority Weed in the Riverina Local Land Services Area was recorded, namely African Boxthorn (*Lycium ferocissimum*) (NGH Environmental, 2019).

Scattered individuals of African Boxthorn (*Lycium ferocissimum*) were observed during this survey on transects 1, 4, 14, 24 & 50 (**Error! Reference source not found.**). These were previously treated plants which were re-shooting from the base alongside a small number of mature plants. These mostly occurred as isolated plants under mature trees. Transect 6 and 46 were heavily infested by African Boxthorn in 2018, however recent weed control has been effective in eliminating this species in those areas. Transect 4 contained several records along its length. The removal of the entire plant through cut and paint methods has reduced the seed available for dispersal. African boxthorn was not observed in any transect where it had not been previously recorded. Transect 50, new for 2019, had approximately five African Boxthorn plants. A comparison of the results from 2018 and 2019 shows an overall reduction in boxthorn present in the study area. There were considerably less plants recorded on transect 24 compared to the previous year. This is likely the result of targeted spraying.

Seven species listed as weeds of concern in the Riverina area were identified, including:

- Bathurst Burr (**Xanthium spinosum*)
- Fleabane (**Conyza bonariensis*)
- Galvanised Burr (**Sclerolaena birchii*)
- Lippia (**Phyla canescens*)
- Noogoora Burr (**Xanthium occidentale)*
- Patterson's Curse (**Echium plantagineum*)
- Saffron Thistle (**Carthamus lanatus*)
- Scotch Thistle (**Onopordum acanthium*)

These weeds all have a **General Biosecurity Duty** which means any person who deals with these plants has a duty to ensure the biosecurity risk is prevented, eliminated or minimised so far as reasonably practicable.

Bathurst Burr was present transects 2, 3, 22, 28, 45, 46, and 48 where it was not found in 2018 which indicate that additional weed control measures are required in these transects.
Fleabane was present only in transects 9 and 28, with 20-50 individuals present.

In 2019, Galvanised Burr was present in transects 3, 6, 9, 10, 11,12,14,15, 17, 19, 21, 22, 24, 26, 27, 41, 42, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 56 & 57 (**Error! Reference source not found.**). The highest abundances occurred in transects in the new lease areas (50, 51, 52, 54 & 57). Weed control is recommended in these areas. In 2019, Lippia was observed in transects 1, 2, 4, 31, 45 & 47. Continued weed control is required. Continued dry conditions provide a good opportunity to reduce seed spread.

Noogoora Burr was recorded on transects 4 & 9 (**Error! Reference source not found.**). These transects are along the floodplain and creek of Lake Cowal which suggests seed dispersal via water to these areas (DPI VIC, 2020). In 2019 Pattersons Curse was present in 2, 6, 8, 9, 12, 14, 18, 20, 21, 24, 25, & 28. This indicated the weed is being effectively managed in transects 36-49.

In 2019, Scotch Thistle has increased in distribution and abundance. The weed was observed in transects 0, 1, 2, 14, 22, 26, 28, 31, 37, 38, 43, 45, 46, 43 & 53 in high numbers (**Error! Reference source not found.**).Continued

weed control should target any patches. Saffron Thistle was present in transects 9, 10, 11, 13, 14, 16, 22, 24, 30, 31, 33 & 47 (**Error! Reference source not found.**). Abundance was highest on transect 31, a lakebed site, where multiple instances of 100+ weeds were recorded at the northern end of the transect.
Infestations will need to be monitored and controlled using herbicides.

Pest Management

A pest eradication program continued during the reporting period using collapsible traps**,** 1080 Fox baits and Talon mouse bait blocks and traps. Pindone treated poison carrots continued from last reporting period and were laid during the reporting period. The population of pest (rabbits) within ML 1535 was a concern in a concentrated area to the south in the ML 1535, as a result a successful baiting program was initiated in accordance with DPI SOP and approved FFMP. After the program completion, monitoring deemed the program to have been successful.

6.10.3 Reportable Incidents

No incidents were recorded in the reporting period.

6.10.4 Further Improvements

No further improvements are proposed for the next reporting period.

6.11 ABORIGINAL HERITAGE

Development Consent Condition 3.1(a)(ii) outlines the requirements in relation to salvage, excavation and monitoring of archaeological sites within the CGO area prior to and during development. An Indigenous Archaeology and Cultural Heritage Management Plan (IACMP) has been prepared and approved for the CGO.

Monitoring and management of Aboriginal objects and archaeological sites continued in accordance with the IACHMP and relevant permits and consents (under section 87 and section 90 of the NPW Act during the reporting period.

6.11.1 Environmental Management

6.11.1.1 Control Strategies

The IACHMP sets out the salvage, excavation, monitoring and other management measures that have been undertaken for each of the registered archaeological sites and other Aboriginal objects within the CGO area.

In general, the strategies include: protection; investigation; collection; excavation; documentation and storage of Aboriginal objects in an on-site temporary "Keeping Place".

During the reporting period, a total of six registered sites were remaining within the ML 1535 boundary. Registered Sites (exposures) D and H were subject to ongoing conservation works during the reporting period including covering by geo-textile blanket and sign posting to protect the site. Should the location of these sites be proposed to be utilised, the procedure detailed in Special Condition 8 of Permit 1468 would apply after notice is provided to the Director-General of the OEH and in consultation with the local Aboriginal community.

Sites LC2, LC3 and LC4 are managed in accordance with Special Conditions 6, 12 and 13 of Permit 1468.

Management measures are not limited to registered sites. Permit 1468 and Permit 1681 authorise a range of management measures proposed in the Research Design and Study Plan for other Aboriginal objects in the CGO area that are not contained within the Registered Sites. The details of the management and mitigation measures for other Aboriginal objects is contained in the Research Design and Study Plan (Pardoe, 2002) for the CGO as amended by Permit 1468 and Permit 1681.

Activities undertaken during the reporting period included the following:

- Numerous cultural heritage and due diligence inspections with archaeologists and representatives from the Aboriginal community.
- Archaeological salvage activities with archaeologists and representatives from the Aboriginal community.

It is noted that the majority of cultural heritage work continues to be surface and subsurface monitoring for exploration drill pads and roads.

6.11.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

6.11.1.3 Variations from Proposed Control Strategies

There were no variations from the proposed control strategies during the reporting period.

6.11.2 Environmental Performance

6.11.2.1 Monitoring

During the reporting period, due diligence inspections were undertaken within proposed exploration areas within ML 1535.

6.11.2.2 Performance Outcomes

No non-compliance issues were reported.

6.11.3 Reportable Incidents

There were no reportable incidents during the reporting period.

6.11.4 Further Improvements

No further improvements are proposed for the next reporting period.

6.12 EUROPEAN HERITAGE

The Heritage Management Plan (HMP) was prepared in accordance with Development Consent Condition 3.1. Monitoring and management of European heritage continued in accordance with the HMP during the reporting period.

6.12.1 Environmental Management

6.12.1.1 Control Strategies

An interpretive display has been established at the Lake Cowal Conservation Centre (LCCC) in consultation with the Lake Cowal Foundation (LCF), BSC and Bland District Historical Society. The display includes maps, photographs, narrative, and fragments/elements salvaged from the Cowal West Homestead Complex to illustrate its history. Other items containing a level of local heritage significance identified in the HMP will continue to be maintained in accordance with the HMP.

6.12.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

6.12.1.3 Variations from Proposed Control Strategies

There were no variations from the proposed control strategies during the reporting period.

6.12.2 Environmental Performance

6.12.2.1 Monitoring

Inspections of heritage sites are conducted periodically in accordance with the HMP.

6.12.2.2 Performance Outcomes

The maintenance works carried out within the Lake Cowal Homestead during the reporting have been effective in preserving the integrity and heritage value of the buildings.

6.12.3 Reportable Incidents

There were no reportable incidents during the reporting period.

6.12.4 Further Improvements

No further improvements are proposed for the next reporting period.

6.13 BUSHFIRE

Development Consent Condition 3.6 and the Emergency Response Plan (ERP), RMP and BOMP describe fire preventative measures and fuel management measures for the mine site, rehabilitation areas and biodiversity offset areas.

Monitoring and management of bushfire risk continued in accordance with Development Consent Condition 3.6, the ERP, RMP and BOMP during the reporting period.

6.13.1 Environmental Management

6.13.1.1 Control Strategies

In accordance with the RMP and BOMP, bushfire preventative and control strategies for the CGO and the CGO offset areas include:

- educating employees and contractors on general fire awareness and response procedures;
- fire track (and fire break) maintenance for fire control;
- annual inspections to identify areas requiring bushfire control measures including assessment of fuel loads; and
- fuel management (e.g. hazard reduction burns) in consultation with the NSW Rural Fire Service.

6.13.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators

6.13.1.3 Variations from Proposed Control Strategies

There were no variations from the proposed control strategies during the reporting period.

6.13.2 Environmental Performance

6.13.2.1 Monitoring

In accordance with Development Consent Condition 6.2, data from the meteorological station maintained on-site was used to determine whether current weather conditions were suitable for fire management activities, and to assist in the management of bushfire fighting activities.

The Kattron lightning tracking system was introduced to operations in early-2012. The Mining Dispatch Control Room operators continually monitor and pass on alert levels between red, orange and yellow to other employee groups and the Emergency Response Team until all clear conditions resume.

6.13.2.2 Performance Outcomes

There were no uncontrolled bushfires within ML 1535 or the biodiversity offset areas during the reporting period. However, there was one fire in Revegetation area 3, the fire started in 10th February and smoldered in the leaf litter along the lake shore until the 19th February. Site ERT attended the fire promptly, due to the leaf and organic litter present fire fighting was carried out daily as the fire slowly smoldered under the leaf litter and regular flare ups were managed.

The fire trail register was maintained during the reporting period. A number of all-weather access tracks are established and have been maintained during the reporting period – within the ML 1535, on Evolution-owned land and within Lake Cowal.

6.13.3 Reportable Incidents

There was a small 5ha grass fire located along the foreshore early in the reporting period that was controlled by onsite emergency response team
There were no other reportable incidents during the reporting period.

6.13.4 Further Improvements

No further improvements are proposed for the next reporting period.

6.14 HYDROCARBON CONTAMINATION

A Hazardous Waste and Chemical Management Plan (HWCMP) has been prepared for the CGO in accordance with Development Consent Condition 5.7, The HWCMP was revised and updated in July 2018. Monitoring and management of hazardous waste and chemicals continued in accordance with the HWCMP during the reporting period.

6.14.1 Environmental Management

6.14.1.1 Control Strategies

Based on the principles detailed in *Leading Practice Sustainable Development Program for the Mining Industry - Hazardous Materials Management* handbook (Department of Foreign Affairs and Trade, 2017), Evolution employees and contractors have adopted a Chemical Management Strategy as part of the HWCMP. This strategy allows for the management of each chemical used at the CGO.

Control strategies include:

- Site wide inductions, awareness and training on Hazardous Substances and Hydrocarbon spill response.
- Annual concrete bunding and tankage integrity audits.
- Area planned general inspections.
- Hazardous Substance and Dangerous Goods Register.
- Incident reporting and follow up action items.
- Bioremediation Facility for treatment of hydrocarbon contaminated soils.

6.14.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

6.14.1.3 Variations from Proposed Control Strategies

There were no variations from the proposed control strategies during the reporting period.

6.14.2 Environmental Performance

6.14.2.1 Monitoring

Hydrocarbon contamination continued to be monitored during the reporting period in accordance with the HWCMP.

6.14.2.2 Performance Outcomes

A number of minor substance spillage incidents occurred during the reporting period, however these spills were classified as low risk and were fully contained and treated in the bioremediation facility.

6.14.3 Reportable Incidents

There were no reportable incidents during the reporting period.

6.14.4 Further Improvements

No further improvements are proposed for the next reporting period.

6.15 WASTE GEOCHEMISTRY

During annual on-site AR performance review meetings in 2005 and 2006, the then DPI Mineral Resources requested confirmatory test-work of waste rock geochemistry to be undertaken. In their 2007 report, the Independent Monitoring Panel also recommended that Evolution continue to monitor the waste rock being removed from the open pit, to facilitate identification of potentially acid-generating material (if present) and selective placement of that material within the waste emplacements.

6.15.1 Environmental Management

The regional and local geology of the E42 Deposit has been described by Miles, Brooker, McInnes, *et al* [1993-1998]). The complex consists of calc-alkaline to shoshonitic volcanic rocks and related sedimentary rocks deposited in a deep water environment and are unconformably overlain, in parts, by the Siluro-Devonian Manna Conglomerate. The auriferous quartz-carbonate-sulphide and carbonate-quartz-sulphide veins occur throughout the deposit and have a consistent dip of 305° and dip of 35° to the southwest. McInnes *et al.* (1998) describe the gold-bearing veins as generally being associated with one of two alteration styles: ankerite-quartz-pyrite-sphalerite-chalcopyrite-galena veins, which are associated with ankerite-quartz-sericite-carbonate alteration; and quartz, potassium feldspar, pyrite, sphalerite, and chalcopyrite veins associated with the chlorite-carbonate-pyrite alteration. Oxide blankets occur at the base of tertiary transported lacustrine cover, saprolite-saprock transition and at the base of oxidation (*pers. comm*, McInnes, Freer [2007]). These flat lying blankets can be up to several hundred metres wide and 1 m to 15 m thick and are interpreted to have formed as a result of remobilisation of gold during weathering processes in association with water table fluctuations.

6.15.1.1 Control Strategies

Based on prior test work there is no indication that the E42 Deposit or the process tailings are acid forming (Environmental Geochemistry International Pty Ltd [EGi], 2004; and Geo-Environmental Management [GEM], 2009; 2013). Overall, the EGi (2004) results indicated a very low likelihood of Acid Rock Drainage (ARD) generation from waste rock, Carbon in Leach tailings and combined primary tailings represented by the samples included in the testing programs. Therefore, no special handling requirements were indicated for ARD control at the CGO. However, operational monitoring and testing was recommended to be a carried out on an occasional and as needed basis to confirm the low ARD potential of all waste types with particular focus on any unexpected rock types or alteration types which may be exposed during mining.

Chemical groundwater data will continue to be collected as part of the groundwater monitoring programme detailed in the SGWMBMP. Leachate water quality monitoring will continue to be undertaken at the NWRE, SWRE and PWRE external toe drain points in accordance with the EPL 11912.

6.15.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

6.15.1.3 Variations from Proposed Control Strategies

There were no variations from the proposed control strategies during the reporting period.

6.15.2 Environmental Performance

The results of detailed geochemical investigations of waste rock and tailings were reported in the EIS and in subsequent environmental assessments undertaken for the CGO. Ongoing periodic field observations undertaken during the reporting period confirmed the low salinity potential of waste hard rock types mined during the reporting period.

Barrick commissioned O'Kane in late-2007 to conduct repeat test work of the Waste Rock Emplacement and the contents of the TSFs. O'Kane representatives visited site to obtain samples in January 2008. A report was delivered in June 2008 (O'Kane, 2008) and was provided to the DRE. O'Kane (2008) concluded that the results are generally consistent with previous investigations, which predicated that waste rock would be predominantly non-acid forming. GEM (2009) also verified these findings.

6.15.3 Reportable Incidents

There were no reportable incidents during the reporting period.

6.15.4 Further Improvements

No further improvements are proposed for the next reporting period.

7 WATER MANAGEMENT

7.1 WATER SUPPLY

Water taken by CGO during the reporting period is summarised in Table 21 below.

Table 21: Water Taken for CGO

Water Licence #	Water Sharing Plan, Source, Management Zone	Entitlement (ML)	Passive Take/Inflows	Active Pumping (ML)	TOTAL
WAL 31864 (BCPC)	*Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources 2012.*	15ML/day and 3,650ML/yr	-	716.6	716.6
WAL 36569 (ESB)	Upper Lachlan Alluvial Groundwater Source. Upper Lachlan Alluvial Zone 7 Management Zone	0 ML (with temporary transfer of 750 ML per bore per yr)	-	95.6	95.6
WAL 36615 (Saline groundwater supply borefield within ML 1535 and pit dewatering bores)		3,660 ML/yr	-	-	-
WAL 36617 (pit dewatering)	*Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2011.* Lachlan Fold Belt Murray Darling Basin Groundwater Source. Lachlan Fold Belt Mdb (Other) Management Zone	3,294 ML/yr	1.0	299.6	299.6
WAL 13749 (High Security Title)	*Water Sharing Plan for the Lachlan Regulated River Water Source 2003.* Lachlan Regulated River Water Source. That Part Of The Water Source Upstream Of Lake Cargelligo Weir.	Zero share component enabling temporary trade of water from regulated Lachlan River source.	-	3335.0	3335.0
WAL 13748 (General Security)			-		
WAL 14981 (High Security Title)	*Water Sharing Plan for the Lachlan Regulated River Water Source 2003.* Lachlan Regulated River Water Source. That Part Of The Water Source Downstream Of Lake Cargelligo Weir.	80 unit shares.	-		

Notes: ML – megalitre; ML/day – megalitres per day; ML/year – megalitres per year.

7.1.1 Groundwater

The quantity of water approved to be extracted from the BCPC is limited by:

1. Development Consent Condition 4.1(b) which states:

The maximum daily extraction of water from the Bland Creek Palaeochannel shall not exceed 15 ML/day, or 3,650 ML/year; and

2. The current bore water licences.

A total of 1201.21 ML of water was extracted from the BCPC borefield during the reporting period (Table 20). The groundwater level associated with the BCPC borefield is monitored on a continuous basis by the DI-Lands & Water groundwater monitoring bore on Burcher Road (GW036553). Contingency measures have been developed for implementation when water levels reach either RL 137.5 m AHD or RL 134 m AHD. These trigger levels were developed in consultation with the then NSW Office of Water (NoW) and other water users within the BCPC including stock and domestic users and irrigators. The trigger levels were not reached during the reporting period.

In addition, as agreed with the then NoW and BCPC Water Users Group, Evolution conducted regular surveys to monitor 11 monuments on the east side of Lake Cowal for any evidence of soil compaction. Monitoring of these monuments has indicated no significant movement to date and shows no specific trends that would be of concern.

Development Application No. 2011/0064 was granted by the FSC on 20 December 2010 for the construction and operation of the ESB, located approximately 10 km east of Lake Cowal's eastern shoreline (Figure 7). Water extraction from the ESB is licensed under WAL 36569. The total volume extracted from the ESB during the reporting period was 236.0 ML. The annual maximum extraction limit is 750 ML per bore.

The saline groundwater supply borefield on the floor of Lake Cowal within ML 1535 (Figure 9a) was commissioned in mid-2009. Water extraction from the saline groundwater supply borefield within Lake Cowal is licensed under WAL 36615. However, no extraction has occurred since April 2010 due to access restrictions resulting from the inundation of Lake Cowal. The production and monitoring bores on the floor of Lake Cowal remain capped. Access via a gravel track to these bores was reinstated during 2015, however extraction from these bores did not occur during the reporting period.

An open pit dewatering borefield has been established external to the perimeter of the open pit. A total of 390 ML was extracted from the open pit dewatering sump (which collected water from rock wall seepage and rainfall) during the reporting period. Water extraction from the open pit dewatering borefield is licensed under WAL 36615 and WAL 36617.

Extracted water was used mainly for ore treatment within the processing plant, dust suppression on haul roads and soil conditioning to achieve optimal compaction rates during TSF lift construction works.

7.1.2 Surface Water

A total of 3335.0 ML was pumped from the Jemalong Irrigation Channel during the reporting period. The Jemalong Irrigation Channel water was purchased from the regulated Lachlan River trading market.

Water access from the Lachlan River Regulated Water Source is licensed under Evolution's High Security WALs 14981 and 13749 (80 Units) and General Security (zero allocation) WAL 13748. Licenced water from the Lachlan River is supplied via a pipeline from the Jemalong Irrigation Channel to the BCPC Bore 4 pumping station (Figure 9b).

The CGO water management system is conceptually shown in Figure 10.

The CGO's Water Management Plan (WMP) and MOP provide further detail regarding water management at the CGO.

7.2 SURFACE WATER

The WMP and the SWGMBMP have been prepared in accordance with Development Consent Conditions 4.4(a) and 4.5(b) (and other relevant Development Consent Conditions) to guide water management and detail the CGO's water monitoring programme, respectively. The WMP and the SWGMBMP were approved in July 2018.

Monitoring and management of surface water during the reporting period has been undertaken in accordance with relevant Development Consent Conditions, the WMP, the SWGMBMP and the EPL 11912.

7.2.2 Environmental Management

7.2.2.1 Control Strategies

The site water management system is designed to contain all potentially contaminated water and comprises the following major components:

(i) Up Catchment Diversion System (UCDS).

(ii) Lake Isolation System (comprising the Temporary Isolation Bund (TIB), Lake Protection Bund (Lake Protection Bund) and PWRE.

(iii) Internal Catchment Drainage System (including the permanent catchment divide and contained water storages).

(iv) Integrated Erosion and Sediment Control System.

(v) E42 Open Pit Dewatering System.

The site water management system is designed to contain all potentially contaminated water generated within the closed catchment of the ML 1535 area while diverting all other water around the perimeter of the site. The UCDS, Lake Isolation System and Internal Catchment Drainage System are designed to minimise the volume of surface water entering ML 1535 by isolating the site from Lake Cowal and the up-slope catchment above the UCDS. Surface water collected within ML 1535 is controlled using a number of water management structures which are designed to prevent discharge to Lake Cowal. No discharge to Lake Cowal has occurred to date or during the reporting period.

7.2.2.2 Effectiveness of the Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

7.2.2.3 Variations from Proposed Control Strategies

There were no variations from the proposed control strategies during the reporting period.

7.2.3 Environmental Performance

7.2.3.1 Monitoring

During the reporting period surface water monitoring was conducted in accordance with the WMP, SWGMBMP and EPL 11912. Surface water monitoring locations within ML 1535 are shown in Figure 9a.

7.2.3.2 Performance Outcomes

Surface Water Quality

pH, electrical conductivity (EC) and Total Suspended Solids (TSS) results fluctuated across the on-site surface water ponds throughout the reporting period likely due to changes in the standing water level within the ponds. pH results were the most stable throughout the reporting period, and ranged from 5.59 to 10.43 across the on-site surface water ponds. EC ranged from 104 to 57,725 microSeimens per centimeter (µS/cm) and TSS ranged from <5 to 13,700 milligrams per litre (mg/L) and were both significantly influenced by the filling and drying of the ponds with increases observed in the summer months due to decreasing standing water levels (Table 21).

These monitoring results and fluctuations are generally consistent with previous reporting periods.

A comparison of surface water results with the Australian and New Zealand Environmental Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) (2000) guidelines has not been undertaken for on-site surface water ponds as they are contained inside a closed catchment in the mining lease area. The closed catchment is engineered to contain all runoff on the mining lease and physically separates mine water from offsite waters in the upstream diversion drains and Lake Cowal**.**

Table 22: Summary of Monthly and Quarterly Surface Water Monitoring Results for the Reporting Period

Monthly Surface Water Monitoring - D1, D4, UCD North and UCD South				
Dam D1	**COUNT**	**MIN**	**MEAN**	**MAX**
pH - Field	4	5.6	7.3	8.5
Electrical Conductivity - Field (µS/cm)	4	21540	39537	57725
Total Suspended Solids (mg/L)	4	18	150	413
Dam D4	**COUNT**	**MIN**	**MEAN**	**MAX**
pH - Field	3	5.6	7.2	8.7
Electrical Conductivity - Field (µS/cm)	3	308	904	1671
Total Suspended Solids (mg/L)	3	208	4732	13700
UCD North	**COUNT**	**MIN**	**MEAN**	**MAX**
pH - Field	12	6.36	8.03	9.13
Electrical Conductivity - Field (µS/cm)	12	570	1047	1752
Total Suspended Solids (mg/L)	12	99	227	538
UCD South	**COUNT**	**MIN**	**MEAN**	**MAX**
pH – Field	9	5.78	8.01	10.43
Electrical Conductivity - Field (µS/cm)	9	104	574	1132
Total Suspended Solids (mg/L)	9	6	99	402
Quarterly Surface Water Monitoring – D2, D3, D8B, D9, D6, D5 and Pit Sumps				
Dam D5	**COUNT**	**MIN**	**MEAN**	**MAX**
pH - Field	4	6.08	6.83	8.03
Electrical Conductivity - Field (µS/cm)	4	5067	10726	16545
Total Suspended Solids (mg/L)	4	7	256.25	884
Dam D6	**COUNT**	**MIN**	**MEAN**	**MAX**
pH - Field	4	5.59	6.66	7.81
Electrical Conductivity - Field (µS/cm)	4	4863	8182	9785
Total Suspended Solids (mg/L)	4	36	71	102
Pit Sump 1	**COUNT**	**MIN**	**MEAN**	**MAX**
pH - Field	9	5.47	6.86	7.99
Electrical Conductivity - Field (µS/cm)	9	35711	46371	61947
Total Suspended Solids (mg/L)	9	3	33	137
Dam D2	**COUNT**	**MIN**	**MEAN**	**MAX**
pH - Field	3	5.90	7.13	8.10
Electrical Conductivity - Field (µS/cm)	3	1993	8376	17709
Oil & Grease (mg/L)	3	<5	<5	<5
Dam D3	**COUNT**	**MIN**	**MEAN**	**MAX**
pH - Field	4	6.59	7.36	7.91
Electrical Conductivity - Field (µS/cm)	4	19711	33341	42098
Oil & Grease (mg/L)	4	<5	<5	<5

Table 22 (Continued): Summary of Monthly and Quarterly Surface Water Monitoring Results for the Reporting Period

Dam D9	COUNT	MIN	MEAN	MAX
pH - Field	4	5.95	7.05	8.45
Electrical Conductivity - Field (µS/cm)^	4	7443	11656	15192
Total Suspended Solids (mg/L)	4	12	18	28
Oil & Grease (mg/L)	4	<5	<5	<5
Dam D8B	**COUNT**	**MIN**	**MEAN**	**MAX**
pH - Field	4	5.59	6.56	8.23
Electrical Conductivity - Field (µS/cm)^	4	2463	24826	54451
Total Suspended Solids (mg/L)	4	8	150	522

^ Dam D9 was used as storage for water collected from surface water runoff dams after heavy rain.

EC and TSS results fluctuated across both UCD North and UCD South throughout the reporting period due to changes in the standing water level within the ponds. pH results were generally stable throughout the reporting period and ranged from 5.78 to 10.43 across both ponds.

EC ranged from 104 to 1752 µS/cm and TSS ranged from 6 to 538 mg/L and were both significantly influenced by fluctuations due to changes in standing water levels

These monitoring results and fluctuations due to changes in standing water levels are consistent with previous reporting periods and base line monitoring results for the 1991-1992 periods which are above the ANZECC and ARMCANZ (2000) guidelines for pH, EC and turbidity.

Lake Cowal

During the reporting period, Lake Cowal was predominantly dry with the lake receding to by dry by mid-February, no samples were taken during this period as a result.

Plate 2: Aerial Photograph of the Lake Protection Bund

2016

2020

Graph 2: Lake Cowal Water Level 2011 - 2019

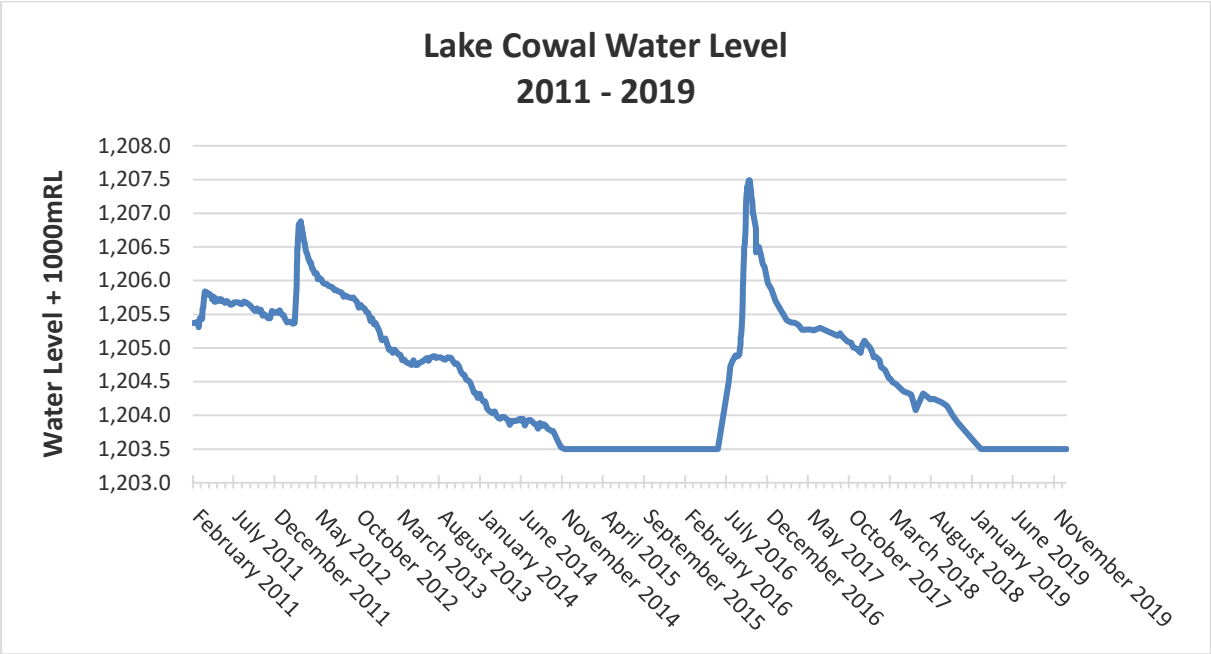


Table 22: Summary of Lake Cowal Water Monitoring – 2010 – 2018

Parameter	Lake Cowal Water Quality Results (November 2010 – Mean[#])	Lake Cowal Water Quality Results (2011) Ranges (Mean)	Lake Cowal Water Quality Results (2012) Ranges (Mean)	Lake Cowal Water Quality Results (2013) Ranges (Mean)	Lake Cowal Water Quality Results (2014) Ranges (Mean)	Lake Cowal Water Quality Results (2016) Ranges (Mean)	Lake Cowal Water Quality Results (2017) Ranges (Mean)	Lake Cowal Water Quality Results (2018) Ranges (Mean)	Lake Cowal Baseline Water Quality Results (1991 -1992)	Fresh Waters ^ ~
Alkalinity (mg/L)	105	64 – 142 (100)	50 – 152 (87)	113 – 178 (157)	191 – 322 (269)	44 – 356 (160)	102 – 192 (140)	199 – 320 (244)	NA	NA
Suspended Solids (mg/L)	6 - 192	5 – 184 (38)	7 – 274 (67)	66 – 472 (216)	57 – 556 (233)	13 – 417 (145)	24 – 650 (361)	36 – 130 (70)	NA	NA
Acidity – Alkalinity scale (pH)	7.03 – 8.27	7.22 – 8.82 (8.14)	5.56 – 9.78 (7.81)	7.82 – 8.43 (8.19)	8.45 – 8.97 (8.72)	7.05 – 8.76 (7.8)	7.12 – 8.44 (7.88)	8.27 – 9.01 (8.61)	8.27 – 8.67	6.5 to 8.0
Electrical Conductivity (µS/cm)	100 – 701	190 – 727 (322)	107 – 433 (236)	351 – 572 (503)	882 – 1350 (1193)	119 – 1350 (583)	299 – 511 (409)	514 – 838 (641)	222 – 1557[1, 3]	20 to 30 µS/cm[1]
Turbidity (NTU)	8.2 – 211	11.5 – 144 (53.3)	7.8 – 829 (246.1)	271 – 755 (470)	189 – 671 (391)	57 – 644 (366)	26.7 – 640 (360.6)	58.4 – 300 (180.9)	22 – 224	1 to 20[2]
Dissolved Oxygen (mg/L)	0.84 – 8.89	1.64 – 14.74 (9.76)	2.24 – 17.89 (8.95)	1.84 – 12.70 (9.03)	5.65 – 13.83 (9.0)	0.08 – 8.57 (6.46)	0.04 – 15.97 (9.4)	3.18 – 23.53 (9.51)	7.3 – 11.5	90 to 110 (derived from daytime measurements)
Temperature (°C)	24.9	9.6 – 29.8 (18.4)	7.5 – 28.8 (16.7)	9.80 – 27 (17.4)	7.8 – 30 (18.6)	11.7 – 27.3 (18.3)	7.6 – 29.2 (16.7)	20.0 – 27.6 (23.0)	NA	Not applicable
Depth (m)	0.10 – 1.20	0.60 – 2.50 (1.7)	0.50 – 3.60 (2.0)	0.40 – 2.00 (1.2)	0.25 – 1.0 (0.54)	0.8 – 4.5 (2.6)	0.6 – 3.1 (1.64)	0.4 – 1.8 (1.18)	0.2 – 2.0	Not applicable
Lake Water Level (m)	204.5	205.25 – 205.75	205.40 – 206.88	204.33 - 205.24	203.5 - 204.78	204.88 – 207.45	204.93 - 205.86	204.95 – 203.62	205.1	Not applicable

Table 22 (Continued): Summary of Lake Cowal Water Monitoring – 2010 – 2018

Parameter	Lake Cowal Water Quality Results (November 2010 – Mean[#])	Lake Cowal Water Quality Results (2011) Ranges (Mean)	Lake Cowal Water Quality Results (2012) Ranges (Mean)	Lake Cowal Water Quality Results (2013) Ranges (Mean)	Lake Cowal Water Quality Results (2014) Ranges (Mean)	Lake Cowal Water Quality Results (2016) Ranges (Mean)	Lake Cowal Water Quality Results (2017) Ranges (Mean)	Lake Cowal Water Quality Results (2018) Ranges (Mean)	Lake Cowal Baseline Water Quality Results (1991 -1992)	Fresh Waters ^ ~
Total Iron (mg/L)	6.50	0.36 – 11.00 (2.50)	0.92 – 22.6 (9.55)	2.54 – 33.6 (21.49)	4.76 – 21.7 (11.7)	4.05 – 21.7 (14.81)	10.7 – 25.4 (16.6)	<0.05 – 12.8 (7.47)	NA	NA (insufficient data)
Calcium (mg/L)	17	10 – 26 (19)	8 – 28 (14)	22 – 32 (26)	20 – 50 (42)	8 – 41 (22)	15 – 30 (23)	24 – 47 (36)	NA	NA
Magnesium (mg/L)	10	6 – 12 (9)	4 – 14 (7)	9 – 17 (13.4)	16 – 32 (29)	4 – 32 (14)	9 – 20 (12)	15 – 25 (19)	NA	NA
Potassium (mg/L)	15	12 – 19 (15)	12 – 19 (14)	14 – 27 (21)	26 – 36 (31)	5 - 27 (15)	12 – 18 (16)	17 – 25 (22)	NA	NA
Sodium (mg/L)	19	13 – 35 (24)	12 – 38 (22)	35 – 59 (50)	105 – 168 (144)	9 – 164 (64)	27 – 43 (37)	50 – 91 (64)	NA	NA
Chloride (mg/L)	25	19 – 41 (28)	12 – 66 (22)	36 – 61 (51)	91 – 194 (155)	9 – 194 (77)	26 – 39 (34)	42 – 77 (56)	NA	NA
Sulphate (mg/L)	3	1 – 10 (2)	1 – 10 (4)	14 -38 (21)	29 – 37 (33)	1 - 37 (16)	6 – 15 (8)	9 – 18 (11)	NA	NA
Cations (mg/L)	2.81	1.98 – 3.77 (3.02)	1.56 – 3.82 (2.11)	3.74 – 5.85 (5.13)	8.85 – 12.6 (11.51)	1.35 – 12.4 (5.4)	3.09 – 5.4 (4.13)	5.58 – 8.56 (6.73)	NA	NA
Anions (mg/L)	2.83	1.93 – 3.67 (2.91)	1.45 – 3.77 (2.00)	3.76 – 5.78 (5.02)	1.1 – 13.2 (11.05)	0.35 – 13.2 (5.40)	3.00 – 5.11 (3.93)	5.37 – 8.70 (6.7)	NA	NA

Table 22 (Continued): Summary of Lake Cowal Water Monitoring – 2010 – 2018

Parameter	Lake Cowal Water Quality Results (November 2010 – Mean[#])	Lake Cowal Water Quality Results (2011) Ranges (Mean)	Lake Cowal Water Quality Results (2012) Ranges (Mean)	Lake Cowal Water Quality Results (2013) Ranges (Mean)	Lake Cowal Water Quality Results (2014) Ranges (Mean)	Lake Cowal Water Quality Results (2016) Ranges (Mean)	Lake Cowal Water Quality Results (2017) Ranges (Mean)	Lake Cowal Water Quality Results (2018) Ranges (Mean)	Lake Cowal Baseline Water Quality Results (1991 -1992)	Fresh Waters ^ ~
Arsenic (mg/L)	0.006[3] (total)	<0.001 – 0.007 (0.003[3]) (total)	0.002 – 0.007 (0.004[3]) (total)	0.006 – 0.014 (0.009[3]) (total)	0.014 – 0.023 (0.018[3]) (total)	0.002 – 0.02 (0.00748[3]) (total)	<0.001 – 0.01 (0.005) (total)	0.008 – 0.012 (0.0098) (total	0.0026[3] (total)	0.008
	0.005[3] (dissolved)	<0.0003 – 0.006 (0.0026[3]) (dissolved)	0.001 – 0.006 (0.003[3]) (dissolved)	0.003 – 0.011 (0.007[3]) (dissolved)	0.012 – 0.024 (0.017[3]) (dissolved)	0.0001 – 0.014 (0.00561[3]) (dissolved)	0.003 – 0.006 (0.0045) (dissolved)	0.007 – 0.013 (0.0092) (dissolved)	0.0016[3] (dissolved)	
Cadmium (mg/L)	0.0001[3] (total)	<0.0001 - 0.001 (0.0001[3]) (total)	<0.0001 – 0.005 (0.0002[3]) (total)	0.0001 – 0.0002 (0.0001[3]) (total)	0.0001 – 0.0001 (0.0001[3]) (total)	0.0001 – 0.0002 (0.0001[3]) (total)	0.0001 – 0.0002 (0.0001) (total)	<0.0001 – <0.0001 (<0.0001) (total)	0.000055[3] (total)	0.0006
	0.0001[3] (dissolved)	<0.0001 – 0.0004 (0.0001[3]) (dissolved)	<0.00001 – <0.0001 (0.00001[3]) (dissolved)	0.0001 – 0.0002 (0.0001[3]) (dissolved)	0.0001 – 0.0002 (0.0001[3]) (dissolved)	0.0001 – 0.0001 (0.0001[3]) (dissolved)	<0.0001 – <0.0001 (<0.0001) (dissolved)	<0.0001 – <0.0001 (<0.0001) (dissolved)	0.00005[3] (dissolved)	
Molybdenum (mg/L)	0.001[3] (total)	<0.001 – 0.006 (0.0012[3]) (total)	<0.001 – 0.004 (0.001[3]) (total)	0.001 – 0.003 (0.0014[3]) (total)	0.002 – 0.005 (0.003[3]) (total)	0.001 – 0.003 (0.0016[3]) (total)	<0.001 – 0.002 (0.001) (total)	0.001 – 0.004 (0.0017[3]) (total)	NA	NA (insufficient data)
	0.001[3] (dissolved)	<0.001 - 0.001 (0.001[3]) (dissolved)	<0.001 – 0.001 (0.001[3]) (dissolved)	0.001 – 0.002 (0.0014[3]) (dissolved)	0.003 – 0.004 (0.035[3]) (dissolved)	0.001 – 0.004 (0.0019[3]) (dissolved)	<0.001 -0.003 (0.0012) (dissolved)	<0.001 – 0.003 (0.001[3]) (dissolved)	NA	

Table 22 (Continued): Summary of Lake Cowal Water Monitoring – 2010 – 2018

Parameter	Lake Cowal Water Quality Results (November 2010 – Mean[#])	Lake Cowal Water Quality Results (2011) Ranges (Mean)	Lake Cowal Water Quality Results (2012) Ranges (Mean)	Lake Cowal Water Quality Results (2013) Ranges (Mean)	Lake Cowal Water Quality Results (2014) Ranges (Mean)	Lake Cowal Water Quality Results (2016) Ranges (Mean)	Lake Cowal Water Quality Results (2017) Ranges (Mean)	Lake Cowal Water Quality Results (2018) Ranges (Mean)	Lake Cowal Baseline Water Quality Results (1991 -1992)	Fresh Waters ^ ~
Nickel (mg/L)	0.007[3] (total)	<0.001 – 0.009 (0.0036[3]) (total)	<0.001 – 0.018 (0.009[3]) (total)	0.006 – 0.025 (0.018[3]) (total)	0.010 – 0.025 (0.016[3]) (total)	0.004 – 0.025 (0.015[3]) (total)	0.009 – 0.021 (0.0147) (total)	0.003 – 0.012 (0.008[3]) (total)	NA	0.008
	0.004[3] (dissolved)	<0.001 – 0.004 (0.0023)[3] (dissolved)	<0.001 – 0.004 (0.003[3]) (dissolved)	0.002 – 0.005 (0.0035[3]) (dissolved)	0.004 – 0.007 (0.006[3]) (dissolved)	0.002 – 0.007 (0.0052[3]) (dissolved)	0.002 – 0.02 (0.0032) (dissolved)	0.001 – 0.005 (0.0032[3]) (dissolved)	NA	
Lead (mg/L)	0.003[3] (total)	<0.001 – 0.004 (0.0013[3]) (total)	<0.001 – 0.009 (0.004[3]) (total)	0.003 – 0.015 (0.009[3]) (total)	0.003 – 0.010 (0.006[3]) (total)	0.002 – 0.011 (0.0067[3]) (total)	0.003 – 0.06 (0.008) (total)	<0.001 – 0.005 (0.0029[3]) (total)	0.0029[3](total)	0.001
	0.001[3] (dissolved)	<0.001 - 0.001 (0.001[3]) (dissolved)	<0.001 – 0.003 (0.001[3]) (dissolved)	0.001 – 0.001 (0.001[3]) (dissolved)	0.001 – 0.001 (0.001[3]) (dissolved)	0.001 – 0.01 (0.0015[3]) (dissolved)	<0.001 – 0.01 (0.003) (dissolved)	<0.001 - <0.001 (<0.001[3]) (dissolved)	0.0005[3] (dissolved)	
Antimony (mg/L)	0.001[3] (total)	<0.001 – 0.004 (0.0014[3]) (total)	<0.001 – <0.001 (0.001[3]) (total)	0.001 – 0.001 (0.001[3]) (total)	0.001 – 0.050 (0.017[3]) (total)	0.001 – 0.05 (0.017[3]) (total)	<0.001 - <0.001 (<0.001) (total)	<0.001 – <0.001 (<0.001[3]) (total)	NA	NA (insufficient data)
	0.001[3] (dissolved)	<0.001 - 0.001 (0.001[3]) (dissolved)	<0.001 – <0.001 (0.001[3]) (dissolved)	0.001 – 0.001 (0.001[3]) (dissolved)	0.001 – 0.001 (0.001[3]) (dissolved)	0.001 – 0.0001 (0.001[3]) (dissolved)	<0.001 - <0.001 (<0.001) (dissolved)	<0.001 - <0.001 (<0.001) (dissolved)	NA	

Table 22 (Continued): Summary of Lake Cowal Water Monitoring – 2010 – 2018

Parameter	Lake Cowal Water Quality Results (November 2010 – Mean[#])	Lake Cowal Water Quality Results (2011) Ranges (Mean)	Lake Cowal Water Quality Results (2012) Ranges (Mean)	Lake Cowal Water Quality Results (2013) Ranges (Mean)	Lake Cowal Water Quality Results (2014) Ranges (Mean)	Lake Cowal Water Quality Results (2016) Ranges (Mean)	Lake Cowal Water Quality Results (2017) Ranges (Mean)	Lake Cowal Water Quality Results (2018) Ranges (Mean)	Lake Cowal Baseline Water Quality Results (1991 -1992)	Fresh Waters ^ ~
Zinc (mg/L)	0.012[3] (total)	<0.005 – 0.038 (0.0074[3]) (total)	<0.005 – 0.04 (0.016[3]) (total)	0.008 – 0.079 (0.036[3]) (total)	0.009 – 0.047 (0.023[3]) (total)	0.006 – 0.047 (0.028[3]) (total)	0.015 – 0.045 (0.027) (total)	<0.005 – 0.020 (0.011[3]) (total)	0.012[3](total)	0.0024
	0.015[3] (dissolved)	<0.005 – 0.022 (0.0109[3]) (dissolved)	<0.005 – 0.264 (0.035[3]) (dissolved)	0.005 – 0.067 (0.018[3]) (dissolved)	0.005 – 0.03 (0.011[3]) (dissolved)	0.005 – 0.052 (0.014[3]) (dissolved)	<0.005 – 0.017 (0.0064) (dissolved)	<0.005 – <0.005 (<0.005) (dissolved)	0.00306[3] (dissolved)	

Source: DM McMahon, 2018.

Table 23: Summary of Lake Cowal Inflow Water Quality Results – 2010 – 2018

	Lake Inflow Water Quality Results (November 2010 – Mean[#])	Lake Inflow Water Quality Results (2011) Ranges (Mean)	Lake Inflow Water Quality Results (2012) Ranges (Mean)	Lake Inflow Water Quality Results (2013) Ranges (Mean)	Lake Inflow Water Quality Results (2014) Ranges (Mean)	Lake Inflow Water Quality Results (2016) Ranges (Mean)	Lake Inflow Water Quality Results (2017) Ranges (Mean)	Lake Inflow Water Quality Results (2018) Ranges (Mean)	Lake Cowal Baseline Water Quality Results (1991 -1992) [#]	Fresh Waters ^ ~
Alkalinity (mg/L)	50	16 – 79 (56)	39 – 101 (67)	95 – 170 (133)	NA	51 – 148 (78) [3]	131-131 (131)	NA	NA	NA
Suspended Solids (mg/L)	14	11 – 201 (53)	23 – 372 (124)	210 – 640 (425)	NA	4 – 63 (31) [3]	77-77 (77)	NA	NA	NA
Acidity – Alkalinity scale (pH)	7.3	7.17 – 7.73 (7.37)	7.55 – 7.90 (7.73)	7.73 – 7.87 (7.80)	NA	7.09 – 8.31 (7.52) [3]	7.58-7.58 (7.58)	NA	8.27 – 8.67	6.5 to 8.0
Electrical Conductivity (µS/cm)	178	126 – 348 (199)	89 – 871 (246)	365 – 551 (458)	NA	139 – 721 (262) [3]	435-435 (435)	NA	222 – 1557[1, 3]	20 to 30 µS/cm[1]
Turbidity (NTU)	116	31 – 807 (237)	18.6 – 693 (296)	337 – 2560 (1449)	NA	51 – 270 (122) [3]	357-357 (357)	NA	22 – 224	1 to 20[2]
Total Iron (mg/L)	6.5	0.90 – 42.8 (10.7)	2.09 – 36.7 (13.68)	20.8 – 180 (100)	NA	2.6 – 16.1 (8.6) [3]	0.12-0.12 (0.12)	NA	NA	NA
Calcium (mg/L)	9	3 – 15 (8)	5 – 23 (11.3)	10 – 29 (19.5)	NA	4 – 32 (15) [3]	21-21 (21)	NA	NA	NA
Magnesium (mg/L)	5.5	2 – 9 (5)	3 – 16 (6.9)	6 – 15 (10.5)	NA	3 – 28 (8.4) [3]	13-13 (13)	NA	NA	NA
Potassium (mg/L)	10.5	8 – 17 (12)	10 – 16 (12.6)	21 – 23 (22)	NA	2 – 9 (6.9) [3]	14-14 (14)	NA	NA	NA

Table 23 (Continued): Summary of Lake Cowal Inflow Water Quality Results – 2010 – 2018

	Lake Inflow Water Quality Results (November 2010 – Mean[#])	Lake Inflow Water Quality Results (2011) Ranges (Mean)	Lake Inflow Water Quality Results (2012) Ranges (Mean)	Lake Inflow Water Quality Results (2013) Ranges (Mean)	Lake Inflow Water Quality Results (2014) Ranges (Mean)	Lake Inflow Water Quality Results (2016) Ranges (Mean)	Lake Inflow Water Quality Results (2017) Ranges (Mean)	Lake Inflow Water Quality Results (2018) Ranges (Mean)	Lake Cowal Baseline Water Quality Results (1991 -1992) [#]	Fresh Waters ^ ~
Sodium (mg/L)	15.5	11 – 34 (17)	14 – 45 (22.4)	48 – 51 (49.5)	NA	10 – 58 (20.4) [3]	50-50 (50)	NA	NA	NA
Chloride (mg/L)	18	9 – 28 (18)	12 – 94 (31)	40 – 55 (47.5)	NA	5 – 128 (31.8) [3]	49-49 (49)	NA	NA	NA
Sulphate (mg/L)	4.5	1 – 13 (5)[3]	2 – 11 (6.2)[3]	23 – 28 (25.5)[3]	NA	1- 27 (7) [3]	16-16 (16)	NA	NA	NA
Cations (mg/L)	1.7	1.11 – 2.40 (1.71)[3]	1.43 – 4.78 (2.46)[3]	3.62 – 5.49 (4.55)[3]	NA	1.38 – 3.45 (2.1) [3]	4.65-4.65 (4.65)	NA	NA	NA
Anions (mg/L)	1.6	1.26 – 2.27 (1.74)[3]	1.27 – 4.64 (2.33)[3]	3.61 – 5.43 (4.52)[3]	NA	1.38 – 6.65 (2.53) [3]	4.33-4.33 (4.33)	NA	NA	NA
Arsenic (mg/L)	0.0035[3] (total)	0.001 – 0.007 (0.003)[3] (total)	0.003 – 0.007 (0.004)[3] (total)	0.008 – 0.026 (0.017)[3] (total)	NA	0.002 – 0.005 (0.0028) [3] (total)	0.006-0.006 (0.0060)	NA	0.0026[3] (total)	0.008
	0.0015[3] (dissolved)	<0.001 – 0.004 (0.002)[3] (dissolved)	0.001 – 0.003 (0.002)[3] (dissolved)	0.002 – 0.006 (0.004)[3] (dissolved)	NA	0.001 – 0.004 (0.0016) [3] (dissolved)	0.002-0.002 (0.002)	NA	0.0016[3] (dissolved)	
Cadmium (mg/L)	<0.0001[3] (total)	<0.0001 - <0.001 (<0.0001)[3] (total)	<0.001 - <0.001 (0.001)[3] (total)	<0.0001 - <0.001 (<0.0001)[3] (total)	NA	0.0001 – 0.0001 (0.0001) [3] (total)	0.0001-0.0001 (0.0001)	NA	0.000055[3] (total)	0.0006
	<0.0001[3] dissolved)	<0.0001 – <0.0002 (<0.0001)[3] (dissolved)	<0.001 - <0.001 (0.001)[3] (dissolved)	<0.001 - <0.001 (0.001)[3] (dissolved)	NA	0.0001 – 0.0001 (0.0001) [3] (dissolved)	0.0001-0.0001 (0.0001)	NA	0.00005[3] (dissolved)	

Table 23 (Continued): Summary of Lake Cowal Inflow Water Quality Results – 2010 – 2018

	Lake Inflow Water Quality Results (November 2010 – Mean[#])	Lake Inflow Water Quality Results (2011) Ranges (Mean)	Lake Inflow Water Quality Results (2012) Ranges (Mean)	Lake Inflow Water Quality Results (2013) Ranges (Mean)	Lake Inflow Water Quality Results (2014) Ranges (Mean)	Lake Inflow Water Quality Results (2016) Ranges (Mean)	Lake Inflow Water Quality Results (2017) Ranges (Mean)	Lake Inflow Water Quality Results (2018) Ranges (Mean)	Lake Cowal Baseline Water Quality Results (1991 -1992) [#]	Fresh Waters ^ ~
Molybdenum (mg/L)	<0.001[3] (total)	0.001 – 0.004 (0.0015)[3] (total)	<0.001 - <0.001 (0.001)[3] (total)	<0.001 - <0.001 (0.001)[3] (total)	NA	0.001 – 0.001 (0.001) [3] (total)	0.001-0.001 (0.001)	NA	NA	NA (insufficient data)
	<0.001[3] (dissolved)	<0.001 - <0.001 (<0.001)[3] (dissolved)	<0.001 - <0.001 (0.001)[3] (dissolved)	<0.001 - <0.001 (0.001)[3] (dissolved)	NA	0.001 – 0.001 (0.001) [3] (dissolved)	0.001-0.001 (0.001)	NA	NA	
Nickel (mg/L)	0.007[3] (total)	0.001 – 0.026 (0.008)[3] (total)	0.005 – 0.021 (0.011) [3] (total)	0.017 – 0.077 (0.047)[3] (total)	NA	0.005 – 0.013 (0.0078) [3] (total)	0.014-0.014 (0.014)	NA	NA	0.008
	0.002 – 0.003 (0.0025)[3] (dissolved)	0.002 – 0.005 (0.003)[3] (dissolved)	0.003 – 0.005 (0.004)[3] (dissolved)	0.004 – 0.004 (0.004)[3] (dissolved)	NA	0.001 – 0.006 (0.0039) [3] (dissolved)	0.004-0.004 (0.004)	NA	NA	
Lead (mg/L)	0.0035[3] (total)	<0.001 – 0.029 (0.006)[3] (total)	<0.001 – 0.021 (0.007)[3] (total)	0.007 – 0.097 (0.052)[3] (total)	NA	0.001 – 0.006 (0.0029) (total) [3]	0007-0.007 (0.007)	NA	0.0029[3] (total)	0.001
	0.001[3] (dissolved)	<0.001 - 0.003 (0.002)[3] (dissolved)	<0.001 – 0.007 (0.002)[3] (dissolved)	<0.001 – 0.001 (0.001)[3] (dissolved)	NA	0.001 – 0.002 (0.001) [3] (dissolved)	<0.001-<0.001 (<0.001)	NA	0.0005[3] (dissolved)	
Antimony (mg/L)	<0.001[3] (total)	<0.001 – 0.004 (0.002)[3] (total)	<0.001 - <0.001 (0.001)[3] (total)	<0.001 - <0.001 (<0.001)[3] (total)	NA	0.001 – 0.001 (0.001) [3] (total)	<0.001-<0.001 (<0.001)	NA	NA	NA (insufficient data)
	<0.001[3] (dissolved)	<0.001 - <0.001 (<0.001)[3] (dissolved)	<0.001 - <0.001 (0.001)[3] (dissolved)	<0.001 - <0.001 (<0.001)[3] (dissolved)	NA	0.001 – 0.001 (0.001) [3] (dissolved)	<0.001-<0.001 (<0.001)	NA	NA	

Table 23 (Continued): Summary of Lake Cowal Inflow Water Quality Results – 2010 – 2018

	Lake Inflow Water Quality Results (November 2010 – Mean[#])	Lake Inflow Water Quality Results (2011) Ranges (Mean)	Lake Inflow Water Quality Results (2012) Ranges (Mean)	Lake Inflow Water Quality Results (2013) Ranges (Mean)	Lake Inflow Water Quality Results (2014) Ranges (Mean)	Lake Inflow Water Quality Results (2016) Ranges (Mean)	Lake Inflow Water Quality Results (2017) Ranges (Mean)	Lake Inflow Water Quality Results (2018) Ranges (Mean)	Lake Cowal Baseline Water Quality Results (1991 -1992) [#]	Fresh Waters ^ ~
Zinc (mg/L)	0.015[3] (total)	<0.005 – 0.074 (0.0022)[3] (total)	0.009 – 0.051 (0.024)[3] (total)	0.033 – 0.234 (0.134)[3] (total)	NA	0.007 – 0.027 (0.014) [3] (total)	0.025-0.025 (0.025)	NA	0.012[3] (total)	0.0024
	0.03[3] (dissolved)	<0.005 – 0.219 (0.046)[3] (dissolved)	<0.005 – 0.068 (0.036)[3] (dissolved)	0.005 – 0.009 (0.007)[3] (dissolved)	NA	0.005 – 0.008 (0.0055) [3] (dissolved)	0.13-0.013 (0.013)	NA	0.00306[3] (dissolved)	

Source: DM McMahon, 2018, North Limited (1998) and NSR Environmental Consultants (1995)

^ Guideline values in accordance with ANZECC and ARMCANZ (2000).

~ 99% protection level trigger values for toxicants – lakes and reservoirs.

NA – Not Available.

[1] ANZECC and ARMCANZ (2000) notes that conductivity in lakes is generally low, but will vary depending upon catchment geology.

[2] ANZECC and ARMCANZ (2000) notes that lakes in catchments with highly dispersible soils will have high turbidity.

[3] Mean value.

Two readings only for December 2010

7.2.4 Reportable Incidents

There were no reportable incidents during the reporting period.

7.2.5 Further Improvements

No further improvements are proposed for the next reporting period.

Table 24: Summary of Lake Cowal Sediment Results

Parameter	Lake Cowal Sediment Results (November 2010)	Lake Cowal Sediment Results (2011) Range (Mean)	Lake Cowal Sediment Results (2012) Range (Mean)	Lake Cowal Sediment Results (2013) Range (Mean)	Lake Cowal Sediment Results (2014) Range (Mean)	Lake Cowal Sediment Results (2016) Range (Mean)	Lake Cowal Sediment Results (2017) Range (Mean)	Lake Cowal Sediment Results (2018) Range (Mean)	DVG^
Electrical Conductivity (µS/cm)	33 – 142 (94)	3 – 162 (99)	49 – 215 (94)	53 – 187 (105)	70 – 207 (133)	45 – 218 (105)	46 – 184 (90)	47 – 162 (90.7)	No data
Arsenic (mg/L)	2.6 (total)	0.02 – 5.6 (3.1)[1] (total)	1 – 6 (3.2)[1] (total)	1.9 – 5.8 (3.2)[1] (total)	2.2 – 6.0 (3.62)[1] (total)	1.6 – 5.8 (3.2)[1] (total)	1.3 – 5.6 (2.8) (total)	1.8 – 3.3 (2.62) (Total)	20
	1.5 (extractable)	<0.1 – 1.8 (1.25)[1] (extractable)	1 – 3.1 (1.4)[1] (extractable)	1 – 3.1 (1.2)[1] (extractable)	1 – 2.2 (1.38)[1] (extractable)	1 – 3.4 (1.7)[1] (extractable)	<1 – 3.4 (1.4) (extractable)	<1 - 1.8 (1.26) (extractable)	
Cadmium (mg/L)	1 (total)	<1 - <1 (1)[1] (total)	1 – 1 (1)[1] (total)	1 – 1 (1)[1] (total)	1 – 1 (1)[1] (total)	1 – 1 (1)[1] (total)	<1 - <1 (<1) (total)	<1 - <1 (<1) (total)	1.5
	0.1 (extractable)	<0.1 - <0.1 (0.1)[1] (extractable)	0.1 – 0.1 (0.1)[1] (extractable)	0.1 -0.1 (0.1)[1] (extractable)	0.1 – 0.1 (0.1)[1] (extractable)	0.1 – 0.1 (0.1)[1] (extractable)	<0.1 - <0.1 (<0.1) (extractable)	<0.1 - <0.1 (<0.1) (extractable)	
Lead (mg/L)	15 (total)	8 – 20 (13.7)[1] (total)	7 – 20 (12.6)[1] (total)	8 – 23 (14.2)[1] (total)	9 – 20 (13.53)[1] (total)	5 – 18 (12.55)[1] (total)	7 – 22 (12) (total)	6 - 13 (10.36) (total)	50
	8.7 (extractable)	3.8 – 15 (8.8)[1] (extractable)	4.3 – 14.5 (8.6)[1] (extractable)	3.5 –13.3 (7.33)[1] (extractable)	5.3 -13.5 (8.51)[1] (extractable)	3.5 – 14.8 (8.09)[1] (extractable)	4.4 – 16.3 (8.4) (extractable)	4.2 – 9 (7.0) (extractable)	

Table 24 (Continued): Summary of Lake Cowal Sediment Results

Parameter	Lake Cowal Sediment Results (November 2010)	Lake Cowal Sediment Results (2011) Range (Mean)	Lake Cowal Sediment Results (2012) Range (Mean)	Lake Cowal Sediment Results (2013) Range (Mean)	Lake Cowal Sediment Results (2014) Range (Mean)	Lake Cowal Sediment Results (2016) Range (Mean)	Lake Cowal Sediment Results (2017) Range (Mean)	Lake Cowal Sediment Results (2018) Range (Mean)	DVG^
Zinc (mg/L)	31.5 (total)	14 – 57 (32.5)[1] (total)	11 – 43 (23.3)[1] (total)	13 – 63 (33.2)[1] (total)	16 – 100(36.8)[1] (total)	11 – 39 (25.8)[1] (total)	11 – 37 (22) (total)	10 - 23 (16.5) (total)	200
	3.5 (extractable)	1 - 14.8 (3.9)[1] (extractable)	1.1 – 7.7 (3.6)[1] (extractable)	1 – 11.4 (3.4)[1] (extractable)	3.3 – 52 (27.19)[1] (extractable)	1.2 – 6.3 (2.83)[1] (extractable)	<1 – 10.5 (3.3) (extractable)	1.2 – 4.4 (2.5) (extractable)	
Antimony (mg/L)	5 (total)	<5 - <5 (5)[1] (total)	5 – 5 (5)[1] (total)	<5 - <5 (5)[1] (total)	<5 – <5 (5)[1] (total)	5 – 5 (5)[1] (total)	<5 - <5 (<5) (total)	<5 - <5 (<5) (total)	2
	1 (extractable)	<1 – 6.9 (1.1)[1] (extractable)	1 – 7.6 (1.1)[1] (extractable)	1 - 4.8 (1.18)[1] (extractable)	1- 2 (1.03)[1] (extractable)	1 – 2.2 (1.02)[1] (extractable)	<1 – 1.9 (1.1) (extractable)	<1 – 3.4 (1.19) (extractable)	

After: NSR Environmental Consultants (1995) and DM McMahon (2018).

^ Guideline values in accordance with ANZECC and ARMCANZ (2000) recommended sediment quality guidelines.

[1] Mean value.

7.3 GROUNDWATER

The WMP and the SWGMBMP have been prepared in accordance with Development Consent Conditions 4.4(a) and 4.5(b) (and other relevant Development Consent Conditions) to guide water management and detail the CGO's water monitoring programme, respectively. The WMP and the SWGMBMP were approved in July 2018.

Evolution also holds various licences for monitoring bores, open pit dewatering bores and CGO supply water/production bores.

Monitoring and management of groundwater during the reporting period has been undertaken in accordance with relevant Development Consent Conditions, the WMP, the SWGMBMP and the EPL 11912.

7.3.1 Environmental Management

7.3.1.1 Control Strategies

The WMP establishes the following objectives for the CGO site water management system including groundwater:

- Prevent the quality of any surface water (including waters within Lake Cowal) and groundwater being degraded, through the containment of all potentially contaminated water (contained water) generated within the CGO and diversion of all other water around the perimeter of the site.
- Manage the quantity of surface water and groundwater within and around the mine site through appropriate design (i.e. sizing), construction and operation of water management structures.
- Establish a monitoring, review and reporting programme that facilitates the identification of potential surface water and groundwater impacts and the development of ameliorative measures as necessary, including provision of appropriate compensation measures for landholders affected by changes to the flood regime of Nerang Cowal.

The review procedure relevant to groundwater monitoring detailed in the SWGMBMP provides:

> *Groundwater Monitoring: Groundwater quantity and quality data will be compared to relevant baseline data, data collected since the commencement of operations and assessment presented in the Project EIS. Where the data analysis indicates that an adverse impact is occurring to the efficiency of surrounding bores an investigation will be undertaken to determine the need and type of ameliorative measures. The scope and timeframe of the investigation will be developed in consultation with the relevant authorities. The results of the investigation will be presented to the relevant authorities and the CEMCC within the agreed timeframe.*

In order to monitor important background and predicted future water level draw-downs, monitoring bores and piezometers have been installed within ML 1535 and within aquifers potentially affected by the CGO (i.e. surrounding the BCPC Borefield and ESB) (Figures 9a and 9b).

In accordance with the SWGMBMP, groundwater monitoring includes:

- monitoring of bores in aquifers potentially affected by the CGO (drawdown levels); and
- feedback from private groundwater users regarding adverse changes in groundwater quantity.

7.3.1.2 Effectiveness of the Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

7.3.1.3 Variations from Proposed Control Strategies

There were no variations from the control strategies during the reporting period.

7.3.2 Environmental Performance

7.3.2.1 Monitoring

During the reporting period groundwater monitoring was conducted in accordance with the SWGMBMP and EPL 11912. Groundwater monitoring locations within ML 1535 are shown in Figure 9a and regional groundwater monitoring locations shown on Figure 9b. The CGO water management system is outlined in Figure 10.

7.3.2.2 Performance Outcomes

A Groundwater Monitoring Review 2019 report has been prepared by Coffey Geotechnics (2019) which provides a detailed description and interpretation of the groundwater monitoring results during the reporting period.

Stiff plots of water quality results for the BCPC Borefield, processing plant area bores, pit area bores and TSF bores are provided in Figures 11a and 11b. Piper Plots of groundwater chemistry of the BCPC Borefield, processing plant area bores, pit area bores and TSF bores are provided on Figure 12. Deep and shallow groundwater contours are presented in Figures 13a and 13b.

Key summaries of the groundwater monitoring results presented in the Coffey Geotechnics (2019) report are provided in the subsections below.

Groundwater Levels

The Cowal groundwater system generally shows limited response to rainfall. The main groundwater level response is to pumping for water supply and pit dewatering. From 2004 to 2019, water supply pumping has resulted in a maximum drawdown of approximately 67 m in the Bland Creek Palaeochannel Borefield, and pit dewatering has resulted in a maximum drawdown of approximately 79 m in the pit area monitoring bores. In general, vertical hydraulic gradients within the groundwater system surrounding the mine pit are downward. Measured piezometric levels within the Transported material tend to change more slowly than those for the Saprolite and Saprock.
Piezometric levels decline toward the pit with little reduction below the pre-mining level of approximately 200 m AHD at distances greater than approximately 2 km from the pit centre. Groundwater levels tend to be highest in the Transported material and lowest in the Saprock. The zone of influence after 14 years of mine dewatering is limited, indicating low lateral permeability.
A localised increase in groundwater levels has been observed in the vicinity of the TSF area. A separate groundwater level investigation was conducted by Coffey to further assess the change in groundwater level in this area (Coffey, 2009b). A model of the groundwater system adjacent to the southern TSF was developed and calibrated to provide reasonable agreement with the measured groundwater levels in the area. It was concluded that increasing groundwater levels south of the southern TSF at bores MON02A and MON02B, and northeast of the southern TSF at P412A-R, are related to the movement of seepage from the TSF (Coffey, 2009b). The direction of seepage flow towards the open pit is consistent with the seepage flow direction predicted in the EIS and in hydrogeological assessments (Coffey, 2011b and 2012). It was also assessed that groundwater level rises associated with the TSF are not expected to reach the ground surface (Coffey, 2009b).

Standing water levels measured during the reporting period are presented in Figure 14.

Groundwater Quality

Variations in groundwater chemistry can be due to natural conditions such as drought and biological activity, changes in groundwater level due to pit dewatering or water supply pumping, or possible anthropogenic inputs such as the introduction of cyanide in the gold extraction process. Possible reasons for changes in water quality are discussed below.

Physiochemical parameters pH and EC have generally remained stable for the groundwater data reviewed since mining operations began in 2004. ANZG 2018 default guideline values for pH range between 6.5 and 8 and are based on values for NSW upland rivers. Some pH results are below the guideline value of pH 6.5. However, pH levels have generally remained stable, are slightly acidic to neutral, and are similar to baseline EIS levels. EC results have generally remained stable and are similar to, or higher than, the baseline EIS levels.

Trends in major ions have generally remained stable, though statistical analyses suggest slight increases in sodium concentrations for one of the seven Bland Creek Palaeochannel bores (BLPR2) and one of the monitoring bores in

the TSF area (P417B). In general, a broad trend of increasing sodium concentrations is seen between 2004 and 2010, beyond which sodium concentrations begin falling. This trend is stronger for the mine site than for the Bland Creek Palaeochannel borefield, suggesting the cause may be related to severe drought conditions between 2004 and 2010. Groundwater with higher TDS, in high evaporation climates, is more prone to impact by drought conditions.

Mine site sulphate concentrations appear to show an inverse correlation with annual rainfall at Station 50017 (West Wyalong Airport), with increasing concentrations during sustained dry conditions. Sulphate concentrations fall in 2010, when about double the annual rainfall fell, compared to average annual rainfall since 2000.

Fluctuations in pH, EC, sodium, sulphate and iron levels at the Bland Creek Palaeochannel borefield at bore BLPR2 may be related to bore completion or localised ground conditions, as the trend is not reproduced in other monitoring bores.

Fluctuations in pH, EC, sodium, sulphate and bicarbonate levels at MON01B to the east of the northern TSF may reflect a response to increased rainfall recharge over this period.

Variations in metal concentrations are assessed to reflect the natural heterogeneity in ground conditions, rather than direct impacts from mining. Regional groundwater is located in a metalliferous geological terrain in which iron and manganese naturally dominate the metal concentrations. Local fluctuations in manganese and iron concentrations were evident in the pit area and this may be related to ground disturbance and proximity to the pit.

There were no cyanide detections in the groundwater monitoring network from 2013 to 2018. During the 2019 reporting period total cyanide was detected above the DGV of 0.007 mg/L on 15 October 2019 at two bores east of the northern TSF, TSFNB (0.252 mg/L) and TSFNC (0.027 mg/L). These bores were resampled on 25 October 2019 and results were below the laboratory detection limit.

7.3.3 Reportable Incidents

There were no reportable incidents during the reporting period.

7.3.4 Further Improvements

No further improvements are proposed for the next reporting period.

8 REHABILITATION

Condition 2.4(c) of the Development Consent requires Evolution to prepare a Rehabilitation Management Plan (RMP). The RMP was revised to reflect Development consent as modified on 7 February 2017 and was approved by the DRG via the MOP approval on 16 October 2017.

As the currently approved RMP was not approved for the entire reporting period, the CGO was operated in accordance with the previously approved RMP for earlier part of 2017. In accordance with Development Consent Condition 2.4(c)(vii), the RMP includes a rehabilitation monitoring programme that was developed to monitor the effectiveness of the short, medium and long-term mine site rehabilitation measures and progress against performance and completion criteria.

Monitoring and management of rehabilitation areas was undertaken during the reporting period in accordance with relevant conditions in the Development Consent, ML 1535, and the RMP.

8.1 REHABILITATION OF DISTURBED LAND

The total active disturbance area for ML (1535 and ML (1791) was 1,360 ha at the end of the reporting period. Land being prepared for rehabilitation or under active rehabilitation was approximately 153 ha at the end of the reporting. There was no completed rehabilitation at the end of the reporting period.

A summary of rehabilitation undertaken at the CGO during the reporting period is described below:

- NWRE – North Wall – continued monitoring of 47.9ha on all lower, mid and upper batters, post seeding last reporting period;
- SWRE – West Wall – applied rock mulch, topsoil, gypsum and direct seeded 13.2 ha all batters;
- SWRE – South Wall – applied rock mulch, topsoil, gypsum and direct seeded 5ha west end upper batters;
- SWRE – South Wall – continued monitoring 37.7ha on all lower, mid and upper batters post seeding last reporting period;
- SWRE – South Wall (rock – topsoil trial plots) ongoing monitoring of the direct seeding of November 2011;
- PWRE – Inner and outer Perimeter wall – shaped oxide layer to design of approximately 5.7ha;
- Temporary Isolation Bund and Lake Protection Bund – road and weed maintenance; and

Table 25 provides a summary of rehabilitation activities at the CGO during the reporting period. The table includes details of rehabilitation at the start of the reporting period and estimated for the next repor**t.**

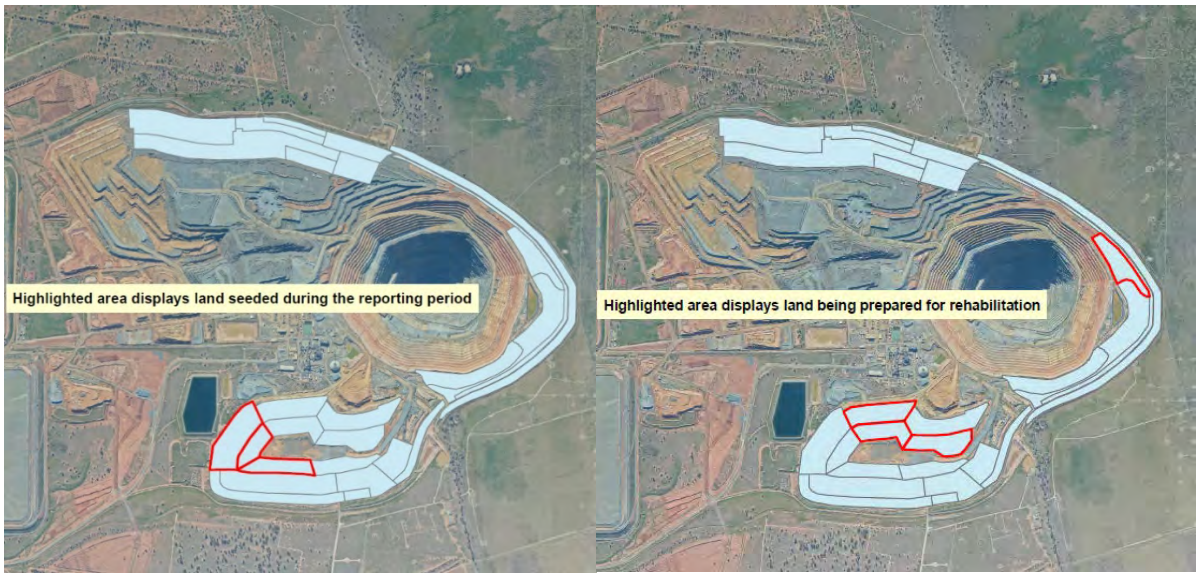
Table 25: Rehabilitation Summary

		Area Affected/Rehabilitated (hectares)		
		Previous Reporting Period (2018)	**Current Reporting Period (2019)**	**Next Reporting Period (estimated) (2020)**
A	Total Mine Footprint	1,095	1,668	1,668
B	Total Active Disturbance	1,095	1,360	1,668
C	Land being prepared for Rehabilitation	166	46	23
D	Land under active Rehabilitation	90	20	17.6
E	Completed Rehabilitation	0	0	0

During the next reporting period, rehabilitation activities at the CGO will continue in accordance with the approved MOP and RMP.

Table 26 provides details of the nature of disturbance and the rehabilitation status for areas that have been disturbed up to and including the reporting period. Plate 3 shows the areas rehabilitated during the reporting period.

Plate 3: Conceptual View of Rehabilitated Areas During the Reporting Period



All disturbed areas/structures had temporary erosion and sediment control measures implemented during construction in accordance with the ESCMP. Control measures included temporary sediment traps, sediment filters, diversion banks and silt fences. Further detail of erosion and sediment control measures for these areas/structures is described in the ESCMP.

No major building renovations or removal occurred during the reporting period, however some smaller minor construction works were undertaken including additional demountable structures and storage shipping containers.

Table 26: Nature of Disturbance and Rehabilitation Status of Disturbed Land

Disturbed Area	Nature of Disturbance				Area (ha) (approximate)	Rehabilitation Status
	Vegetation Cleared	Topsoil and Subsoil Stripped	Earthworks	Construction Works Status*		
NTSF						
• Floor	✓	✓	✓	Complete	168	Not yet rehabilitated
• Starter embankment	✓	✓	✓	Complete	12	Rehab removed
• Upstream lift	N/A	N/A	✓	Complete	8	Rehab removed
• Upstream lift	N/A	N/A	✓	Complete	16	Not yet rehabilitated
• Upstream lift	N/A	N/A	✓	Complete	24	Not yet rehabilitated
• Upstream lift	N/A	N/A	✓	Complete	32	Not yet rehabilitated
• Upstream lift	N/A	N/A	✓	In Progress		
STSF						
• Floor	✓	✓	✓	Complete	156	Not yet rehabilitated
• Downstream lift	✓	✓	✓	Complete	13	Shaped and covered
• Upstream lift	✓	✓	✓	Complete	24	Not yet rehabilitated
• Upstream lift	N/A	N/A	✓	Complete	32	Not yet rehabilitated
• Upstream lift	N/A	N/A	✓	Complete	40	Not yet rehabilitated
• Upstream lift	N/A	N/A	✓	Complete	48	Not yet rehabilitated
• Upstream lift	N/A	N/A	✓	Complete	56	Not yet rehabilitated
Open Pit	✓	✓	✓	Commenced	120	Not yet rehabilitated
PWE	✓	✓	✓	Commenced	60	All sections shaped and covered
NWRE (excluding outer batters)	✓	✓	✓	Commenced	248	Not yet rehabilitated
SWRE (excluding outer batters)	✓	✓	✓	Commenced	140	Southern section shaped
NWRE outer batters	✓	✓	✓	Commenced	65	Some sections shaped and covered
SWRE outer batters	✓	✓	✓	Commenced	45	Some sections shaped and covered
Ore Stockpiles	✓	✓	✓	Commenced	74	Not yet rehabilitated
Tailings service corridor	✓	✓	✓	Complete	5	Not yet rehabilitated

Table 26 (Continued): Nature of Disturbance and Rehabilitation Status of Disturbed Land

Disturbed Area	Nature of Disturbance				Area (ha) (approximate)	Rehabilitation Status
	Vegetation Cleared	Topsoil and Subsoil Stripped	Earthworks	Construction Works Status*		
Soil stockpiles	✓	✓	✓	Commenced	91	Not yet rehabilitated
Processing plant (including contained water storages D5 and D6)	✓	✓	✓	Complete	20	Not yet rehabilitated
Mining Hardstand (including workshop and fuel farm)	✓	✓	✓	Complete	8	Not yet rehabilitated
Internal mine access road	✓	✓	✓	Complete	8	Not yet rehabilitated
Contained water storages D1 and D4	✓	✓	✓	Complete	5	Not yet rehabilitated
Contained water storages D2, D3 & D8B	✓	✓	✓	Complete	11	Not yet rehabilitated
Contained Water Storage D9	✓	✓	✓	Complete	13	Not yet rehabilitated
Stilling basin and outfall	✓	✓	✓	Complete	1	Not yet rehabilitated
Temporary tank and holding pond for bore field water	✓	✓	✓	Complete	<1	Not yet rehabilitated
Mine dewatering bores	✓	N/A	✓	Complete	<1	Not yet rehabilitated
Minor internal roads and haul roads	✓	✓	✓	Commenced	40	Not yet rehabilitated
Temporary laydown areas	✓	✓	✓	Complete	2	Not yet rehabilitated
Exploration Geology office	✓	✓	✓	Complete	1	Not yet rehabilitated
Administration office	✓	✓	✓	Complete	1	Not yet rehabilitated
Temporary administration office	✓	✓	✓	Complete	1	Not yet rehabilitated
ML 1535 perimeter fence	✓	N/A	✓	Complete	<1	Not yet rehabilitated
Magazine compound	✓	✓	✓	Complete	2	Not yet rehabilitated
Temporary isolation bund	✓	✓	✓	Complete	10	Rehabilitated
Lake protection bund	✓	✓	✓	Complete	10	Rehabilitated
Up-catchment diversion system	✓	✓	✓	Complete	2	Rehabilitated and under maintenance
Internal catchment drainage system (permanent catchment divide)	✓	✓	✓	Complete	2	Rehabilitated and under maintenance
BCPC water supply pipeline	✓	✓	✓	Complete	2	Not yet rehabilitated

Table 26 (Continued): Nature of Disturbance and Rehabilitation Status of Disturbed Land

Disturbed Area	Nature of Disturbance				Area (ha) (approximate)	Rehabilitation Status
	Vegetation Cleared	Topsoil and Subsoil Stripped	Earthworks	Construction Works Status*		
Saline groundwater supply borefield and associated pipeline	N/A	✓	✓	Commenced	10	Not yet rehabilitated
Boart Longyear office	✓	✓	✓	Complete	1	Not yet rehabilitated
Bioremediation area	✓	✓	✓	Complete	1	Not yet rehabilitated
Waste management yard	✓	✓	✓	Complete	1	Not yet rehabilitated
TSF construction compound	✓	✓	✓	Complete	2	Not yet rehabilitated

N/A: Not applicable.

* Construction works status refers to earthworks, excavations and/or emplacement of material.

The following text provides detail of the rehabilitation of each key final landform at the CGO that was undertaken during the reporting period.

Annual rehabilitation (and visual) monitoring of revegetated landforms is conducted to ensure vegetation is establishing and to determine the need for any maintenance and/or contingency measures (such as the requirement for supplementary plantings, erosion control and weed control). The rehabilitation works are subject to ongoing independent consultant review of effectiveness.

Progressive rehabilitation of each key final landform will continue to be undertaken in accordance with relevant environmental assessments and approvals, the RMP and the MOP.

Perimeter Waste Emplacement

The PWRE has been constructed to approximately 223 m RL and surrounds the pit to the north, east and south (Figure 3). The emplacement occupies an area of approximately 60 ha and forms part of the series of embankments (i.e. Temporary Isolation Bund and Lake Protection Bund) between the open pit and Lake Cowal. The emplacement elevation has been designed to reduce potential noise and light impacts of mining and processing on the surrounding environment and sensitive receptors.

Approximately 5.7ha of the inner and outer perimeter wall was reshaped and rock armour was positioned ready for shaping in the reporting period.

Approximately 7.8ha of the inner perimeter wall was re-ripped in the reporting period due to lack of covers from prolonged dry periods and wind/splash erosion was corrected (Plate 4).

Plate 4: South Eastern Side of Perimeter Waste Rock Emplacement during Topsoil Movement 2018

Northern Waste Rock Emplacement – Outer Batters

The NWRE is approved to be constructed to approximately 308 m AHD and will occupy an area of approximately 269 ha northwest of the pit (Plate 5).

No additional rehabilitation was conducted on the NWRE during the reporting period.

Approximately 47.9ha of the entire NWRE was re ripped and direct seeded with native species in the previous reporting period, and was monitored during this reporting period.

Tube stock planted in previous years on the NWRE was monitored during the reporting period.

Plate 5: North Side of Northern Waste Rock Emplacement (May 2019)

Southern Waste Rock Emplacement – Outer Batters

Area of approximately 5ha on the south side of the SWRE upper batters and areas of 3.7ha and 9.5ha on the west side of the SWRE lower, mid and upper batters were rock armoured, topsoiled, gypsum spread and were direct seeded via aerial application during the reporting period.

Approximately 17.6ha of area on the northern side of the SWRE was being shaped during the reporting period.

Approximately 37.5ha was also re ripped and direct seeded with native species in the previous reporting period and continued to be monitored during this reporting period.

Plate 6: West End of Southern Waste Rock Emplacement (May 2019)

Northern and Southern Tailings Storage Facility – Starter Embankments and Lifts

The TSFs are located 3.4km west of the Lake Cowal shoreline. Starter embankments have been progressively raised throughout the mine life with tailings disposal alternating between each facility.

No rehabilitation occurred on the NTSF and the STSF during the reporting period due to the requirement for buttressing on subsequent lifts in future years (i.e. active landforms). The outer face of the lift was constructed with primary waste rock and therefore will be protected from erosion.

The long-term rehabilitation objectives for the tailings storage facilities include the re-establishment of woodland communities and will commence following the cessation of tailings deposition.

Any emergent deeper rooted species that germinate in the walls of the TSF structures continued to be poisoned by stump paste with glyphosate. As per ongoing TSF fauna protection practices, no trees shall be encouraged to grow until after the final capping is completed on the TSFs.

Boundary Amenity Plantings

Inspections of the vegetation screening surrounding the CGO identified that no additional tubestock was required to be planted during the reporting period.

8.2 REHABILITATION MONITORING RESULTS

Monitoring within the active rehabilitation areas was undertaken by DnA Environmental (2019a) during the reporting period. A summary of the results from this monitoring survey are outlined below. The indicative location of soil stockpiles and the location of rehabilitation, offset and RVEP monitoring sites are presented on Figures 15 and 16, respectively. Final landforms and final land use areas are presented on Figure 17.

8.2.1 Waste Rock Emplacement Monitoring Results

The older NWRE rehabilitation sites have undergone significant transformation over the past few years, largely due to the voluntary establishment of Lolium rigidum (Wimmera Ryegrass) and on the SWRE, Avena fatua (Wild Oats, which have essentially provided a thick mulch cover across much of the rehabilitation areas. The data also indicate that hardy native perennial species were becoming naturally colonised across many rehabilitation areas and were increasing in abundance. This year all sites were ecologically more functional than the Grey Box reference site Grey02, except for NWRE03 which was close and two new areas on the SWRE (SWRE02 and SWRE04).

This year rehabilitation sites SWRE01 and PWRE had scores of 130 and 119 respectively and these were more functional than the Grey Box woodland site Grey01 which had a score of 117. Numerous rehabilitation sites were more functional than Grey02 which had a sum of 104, and NWRE was close to this with a score of 101. Two of the youngest sites SWRE02 and SWRE04, were the least functional of the monitoring sites with a sum of scores of 90 and 86 respectively.

The density of shrubs and juvenile trees in the Hill reference sites was highly variable with significant numbers of small *Cassinia laevis* seedlings being recorded in Dwyers02 in 2017. There has continued to be high mortality rates recorded in the reference sites, especially in Dwyers02 as young seedlings suffer from the drought. This year there were 26 – 56 individuals in the reference equating to densities of 260 – 560 per hectare with these being represented by 1 – 5 different species. In Grey02 and Dwyers02 most individuals were less than 1.0m in height, while in Grey01 and Dwyers01 most individuals were >2.0m in height. No trees or mature shrubs were yet recorded in the WRE rehabilitation areas. On the rehabilitation areas, a small number of seedlings continue to be recorded in NWRE02 and NWRE03 with 20 and 11 seedlings, while one or two were recorded in NWRE05 and SWRE03 this year. In NWRE02 and NWRE03 rehabilitation areas, there was an increased number of *Glycyrrhiza acanthocarpa* seedlings and one lignum seedling was recorded in NWRE02. There was one *Acacia hakeoides* (Hakea Wattle) in SWRE03. In NWRE03, tubestock were planted just prior to monitoring in 2016 where 42 seedlings at a survival rate of 51% was recorded. This year 11 individuals had survived.

This year there has been a significant decrease in floristic diversity in all hill woodland reference sites as a result of the dry conditions. Despite the dry conditions, an increase in floristic diversity was recorded in numerous rehabilitation sites where there were 16 (NWRE04) - 35 (NWRE02) species recorded, except in SWRE04 which had none. Species diversity in the WRE rehabilitation areas continued to far exceed that recorded in the Dwyer's Red Gum woodlands, and all sites except the SWRE04 had a diversity comparable to the Grey Box woodlands There were 13 (PWRE01) – 26 (NWRE02) native species recorded on the WRE rehabilitation sites this year and all rehabilitation sites except SWRE04 had a diversity of native species comparable to the reference sites.

On the WREs, there was an increase in native plant cover in all sites except in SWRE01 this year and no live plant cover was present in SWRE04. While native plants provided 80 – 100% cover in most sites, sites NWRE02, NWRE04, SWRE03 and both PWRE sites had a higher percentage cover of exotic species than the reference sites this year. There was also considerable variation in the diversity of growth forms in the rehabilitation areas on the WRE's with most rehabilitation sites having an acceptable diversity of sub-shrubs, herbs and grasses which were more diverse than the reference sites and typically more similar to the Grey Box woodlands. There was however a lack of tree and shrub species in all rehabilitation areas, except in NWRE02 which had a diversity of growth forms comparable to the reference sites, while NWRE02 there was only a lack of tree species. No reeds, ferns or vines were recorded in any rehabilitation site this year.

This year few species provided sufficient levels of ground cover to meet the minimum criteria (i.e. >5/30) in most monitoring sites, including the woodland reference sites. *Walwhalleya proluta* (Rigid Panic) had increased in abundance and provided the most ground cover in numerous sites on the NWRE and PWRE02. At NWRE02 *Sclerolaena diacantha* (Grey Copperburr) was the most abundant species but overall cover scores were low. At SWRE02 *Einadia nutans* subsp*. nutans* (Climbing Saltbush) had significantly increased in abundance and scored 16/30. At Grey02 *Enchylaena tomentosa* (Ruby Saltbush) provided the highest cover abundance scores, but overall cover scores were very low.

In the rehabilitation sites in the WRE's, the pH was significantly higher than the local reference sites and also exceeded desirable agricultural levels. In the rehabilitation areas, EC continued to decline in NWRE01 and NWRE03, with a significant decrease being recorded in SWRE02 and SWRE03 this year, however increased EC was recorded in the remaining sites. All sites continued to have an EC that continued to exceed local and desirable levels, except in NWRE03 with 0.150 dS/m which was at the maximum threshold. EC in the remaining sites ranged

from a low of 0.243 dS/m in PWRE01 and are just within saline limits this year, to extremely high concentrations of 1.111 and 1.813 dS/m in SWRE02 and the new site SWRE04 respectively, which are highly saline.

This year there was a slight increase in P in all rehabilitation sites and P concentrations were comparable to the local woodlands in NWRE02, NWRE03 and both PWRE rehabilitation sites. In the remaining sites P was low, with only 6.9 mg/kg recorded in NWRE04. In the NWRE and SWRE rehabilitation sites there were exceptionally high levels of sulfur in most rehabilitation sites compared to the recommended guideline of 8.0 mg/kg. While sulfur was also slightly elevated in the Dwyer's Red Gum woodland compared to the recommended guidelines, the rehabilitation sites exceeded these levels. This year there continued to be elevated levels of iron in all four of the hill woodland reference sites.

8.2.2 Rehabilitation Trial Monitoring Results

The NWRE rehabilitation trial (Plate 7) aims to further assess the effectiveness of a variety of rehabilitation treatments or combination of treatments known to improve rehabilitation objectives in a replicated experimental design. The design has incorporated "standard" rehabilitation procedures such as a rock mulch underlay, topsoil and gypsum application which have proven to be essential components in the rehabilitation of saline, sodic and dispersive topsoils and the extreme climatic conditions of the semi-arid Lake Cowal environment. These rehabilitation trials aim to determine if adequate rehabilitation outcomes can be obtained by reducing the depth of topsoil from the recommended 300 mm application whilst achieving a selection of primary ecological completion targets. Due to the various issues associated with the implementation of the rehabilitation trial and difficulties in the timing and applying uniformity to the experimental design, there was high variability within and across the experimental treatments, therefore all results should be treated with caution.

Due to the various issues associated with the implementation of the rehabilitation trial and difficulties in the timing and applying uniformity to the experimental design, there was high variability within and across the experimental treatments, therefore all results should be treated with caution.
Most trial treatments have been demonstrating positive ecological succession, with significant improvements in function, ground cover and structure being recorded during the first few years. Since 2018 however, ecological function has declined in all trial treatments as a result of the drought and this was also recorded in the local woodland reference sites. The dry conditions combined with increased grazing and disturbance by macropods has resulted in the loss of perennial ground covers and a deterioration of the litter layers, across most trial treatment sites. Sites that had a higher level of grass cover and higher levels of shade provided by the establishing trees tended to have a higher levels of animal disturbance.
The Dwyer's Gum woodland reference sites were the most ecologically functional sites this year with total scores of 157 and 143. These were followed by 14-300Straw and 200Nil rehabilitation treatments with a total of 138 and 131 respectively. Despite the decline in ecological function at all sites this year, there was no topsoil depth or mulching type that consistently outperformed any other, but mulching was beneficial. Mulching with either straw or NPH tended to enhance the ecological function of the sites and assisted in the development of the sites compared to those without a mulch treatment especially in the early developmental stages. All treatments with an application of straw of NPH in both trial areas had functional patch areas that were comparable to the local woodlands on Hills and so did 150Nil02, but patch areas in the Grey Box woodlands were particularly low this year.

It is also apparent that the age of the rehabilitation area must also be considered as the older sites have had more developmental time, especially for the voluntary establishment of *Lolium* (and other ground covers) to have an effect of the stability and function of the sites. The 200Nil treatment was very slow to develop, but there has been a significant improvement in function since 2015 largely due to the voluntary establishment of *Lolium*. It is also observed that there has been less disturbance by macropods as grass cover was lower and tubestock were much smaller and provided limited shade. Subsequently this site overall performed well this year compared to the many others, but most other Nil treatments did not, and this is likely to be implicated with adverse soil chemistry. The topsoil used in the 200mm trial area was from different origin making comparison of results difficult.

In the short to medium term, it appears all trial areas regardless of topsoil depth or mulching technique were improving in ecological function and were developing in structure and composition. Despite the drought, there has been an increase in growth in the tubestock populations with trees and mature shrubs >5cm dbh now being recorded in all but one trial plot and are indicative of good growth rates. The maturing trees and shrubs are likely to have an impact on the diversity and composition of the grassy understorey which are likely to undergo significant change over time as mature canopy covers. This was already being observed this year as macropods congregated under trees that provided high levels of shade, thus reducing the integrity of the ground covers. In previous years, there

has been an increase in diversity and abundance of native perennial grasses and ground covers and many of the planted acacias and some eucalypts are of reproductive age and setting seed.
It appears that many of the undesirable soil attributes such as high Electrical Conductivity (EC), ESP and sulfur (S) have not had a significant effect on the ecological development of the area as the data indicate there have been significant improvements in most of the treatment sites during the early developmental phases. Over the past two years a reduction in ecological function has been apparent in most of the trial sites due to the drought, however many ecological attributes remain comparable to the woodlands occurring on the local hills and ridges which have also been negatively affected by the drought. Results to date have typically indicated positive successional trends are occurring, despite some experimental setbacks and the extreme climatic conditions experienced since the trials commenced.

These trials will continue during the next reporting period.
Plate 7: NWRE – Pond D1 North Trial Tubestock (May 2019)

9 COMMUNITY RELATIONS

Evolution recognises developing and maintaining a positive relationship with the local community is essential to running a successful mining operation.

Evolution strives to earn the trust of all with whom we interact, whether they be our employees, the communities where we live and work, the governments that host us, or other stakeholders with whom we engage in the sustainable development of mineral resources. The Community Relations Policy guides Evolution in its conduct of business around the world, including at the CGO.

9.1 COMMUNITY COMPLAINTS

The Development Consent and EPL 11912 require implementation of a complaints mechanism. A community line for enquiries, feedback or complaints was established on 9 December 2003 and operates 24 hours per day. Complaints and/or concerns can be made by dialling (02) 6975 3454 where an operator advises the caller that they have reached the Evolution Cowal Community Line. Details of the Community Line are also advertised quarterly in the following local newspapers; The West Wyalong Advocate, The Forbes Advocate, The Condobolin Argus, and The Lachlander. Finally, the Complaints Hotline is advertised within the Cowal Update community newsletter, released by Evolution and distributed to all households within West Wyalong, Forbes, and Condobolin and via the aforementioned local newspapers as inserts.

When a call is made to the Complaints Hotline, the operator requests the caller's name, the nature of their complaint/concern, and a return phone number. The information is logged along with the date and time that the call was made. A record of each call is immediately forwarded to the CGO Community Relations Department via the community.cowal@evolutionmining.com.au email. For immediate notification of complaints logged outside of regular business hours, the community team receives a copy of the notice emailed to their assigned mobile phone. Upon receiving an enquiry, the community team conducts necessary investigations and prepares a response. The caller is contacted within 24 hours of the complaint, to gather further information and notify of any action taken or proposed CGO.

Complaints may also be submitted through regular stakeholder interactions that may occur between CGO personnel and community members from time to time. All employees and contractors receive information about the CGO's Complaints Management Process during General Induction.

A summary of the community complaints received during the reporting period (as required by the Development Consent) is provided in Table 27.

Table 27: Summary of Community Complaints during the Reporting Period

Summary of Community Complaints 2019	
Record No 1	
Details	Media
Complaint/Concern	Community
Date	10/03/2019
Outcome	1. An "oversize" semi-trailer carrying a mine truck bound for Cowal, hit low-hanging powerlines 2. No actions required
Date of Response	Initial response – 10/03/2019 Complaint closed – 12/03/2019
Record No 2	
Details	Resident of Lake Cowal
Complaint/Concern	Community
Date	24/04/2019
Outcome	1. Near neighbours advised of loud noises and bright lights waking them up during the night.. 2. The Superintendent Environment & Social Responsibility (SESR) commenced an investigation into the matter. 3. Phone call to neighbours to collect more info. 4. Noise mitigation installed at relevant landholder residences. No further action required. No subsequent complaints
Date of Response	Initial response – 24/04/2019 Complaint closed – 27/04/2020
Record No 3	
Details	Resident of West Wyalong
Complaint/Concern	Community
Date	27/05/2019
Outcome	1. Complaint - local business owner; perceived unfair approach to local procurement opportunities & lack of appropriate site response to his concerns. The Superintendent Environment & Social Responsibility (SESR) commenced an investigation into the matter. 2. Outcome: Site GM met face-to-face with positive result.
Date of Response	Initial response – 27/05/2019 Complaint closed – 18/06/2019
Record No 6	
Details	Resident of Lake Cowal
Complaint/Concern	Community
Date	02/09/2019
Outcome	1. Near neighbour called to advise the recent blast had shaken house. No damage reported. 2. Senior Advisor - Social Responsibility commenced investigation. Investigation found both over pressure and vibration were well under compliance limits and there were no exceedances. 3. Near neighbour advised.
Date of Response	Initial response – 02/09/2019 Complaint closed – 05/09/2019
Record No 7	
Details	Resident of Lake Cowal
Complaint/Concern	Community
Date	24/09/2019

Outcome	1. Near neighbour called to advise they were concerned road construction would prevent water flow to farm dam. 2. Superintendent – Environment and Social Responsibility commenced investigation.
Date of Response	Initial response – 24/09/2019 Complaint closed – 21/07/2020
Record No 8	
Details	Resident of Wyalong
Complaint/Concern	Community
Date	10/10/2019
Outcome	1. Local resident called to advise employee vehicles are blocking access to local business in Wyalong. 2. Superintendent – Environment and Social Responsibility commenced investigation. 3. Community liaison officer followed up on concerns No further action required
Date of Response	Initial response – 16/10/2019 Complaint closed – 18/11/2019
Record No 9	
Details	Resident of Burcher
Complaint/Concern	Community
Date	22/10/2019
Outcome	1. A Contractor employee knocked on the door of a house of a Burcher resident at 11:30pm. The visit was not expected and not welcomed 2. The employee involved no longer works at the Cowal site and has returned to their point of hire. They are no longer being accommodated in the local community.
Date of Response	Initial response – 23/10/2019 Complaint closed – 30/10/2019
Record No 10	
Details	Resident of Lake Cowal
Complaint/Concern	Community
Date	28/11/2019
Outcome	1. Near neighbour called to advise the recent blast had shaken house. No damage reported. 2. Investigation found both over pressure and vibration were well under compliance limits and there were no exceedances. 3. Near neighbour advised.
Date of Response	Initial response – 28/11/2019 Complaint closed – 28/11/2019
Record No 11	
Details	Resident of West Wyalong
Complaint/Concern	Community
Date	28/11/2019
Outcome	1. Community member complained regarding parking. 2. Investigation took place and a communication to all staff was prepared to advise staff not to park in front of or block any access to businesses. 3. Complainant advised.
Date of Response	Initial response – 28/11/2019 Complaint closed – 28/11/2019

9.2 COMMUNITY LIAISON

Community Environmental Monitoring and Consultative Committee

During the reporting period, quarterly meetings of the CEMCC were conducted in accordance with the Development Consent.

The CEMCC was established prior to commencement of construction works, in accordance with the Development Consent requirements. The CEMCC monitors compliance with conditions of the Development Consent and other matters relevant to the operation of the mine.

The CEMCC meets on-site or in local communities, undertakes regular inspections, reviews environmental and audit reports and discusses any incidents or complaints that may have been registered. The CEMCC members are an active conduit between local communities and the CGO. Minutes are taken from each meeting and published on the BSC website. The Minutes of the CEMCC are published on the Cowal Gold Mine website (http://www.evolutionmining.com.au/cowal/).

Community Consultation

The "Cowal Update" is the CGO community newsletter that is distributed to all households in West Wyalong, Condobolin, and Forbes, and via insert within the four local newspapers covering the Bland, Lachlan and Forbes Shires. The Cowal Update was released in January 2019 during the reporting period.

Evolution extended invitations to numerous community groups to visit the CGO for presentations and site visits. Site visits were undertaken by a number of groups during the reporting period including:

- Bland, Forbes and Lachlan Shire Councils;
- various community and charity groups from neighbouring towns and villages; and
- various primary and secondary schools.

A Schools open day was held on the 11th of November with schools from around the local Bland Shire region attending information displays and mine tour.

In addition, CGO regularly hosts school and community group visits. Stakeholder meetings are carried out on-site or in the local community depending upon the group and topic. These meetings can consist of 3 to 20 people, for example:

- CEMCC meetings (held quarterly)
- Local landholders, local community and charitable groups
- Local Government and State agency meetings.

Evolution also attended several off-site presentations involving the community including:

- local community and charitable groups;
- Wiradjuri Condobolin Corporation
- Lachlan, Bland and Forbes Shire Councils; and
- Local secondary schools.

Indigenous Consultation

Evolution continued to work with the Wiradjuri Community through the Wiradjuri Condobolin Corporation and a number of formal committees, including:

- the Cowal Project Coordinating Committee; and
- the Employment, Training and Business Committee.

The CGO meets with the Wiradjuri Condobolin Corporation on a regular basis.

Community Development

Evolution continued to support numerous donation, sponsorships and partnerships to a variety of local schools, annual events, charity and not for profit groups, community infrastructure and town advancement groups.

Evolution operated the Cowal Partnering Program, the Cowal Cares Program, the Shared Value Projects and the Endeavour and Wiradjuri Scholarship programs to facilitate financial contributions to the community during the reporting period.

The Lake Cowal Foundation Limited

The Lake Cowal Foundation (LCF) continues to grow into an important local independent “Environmental Trust”. The Foundation is actively supported financially and in-kind by CGO. The LCF Board meet as required, some meetings are held via teleconference.

In addition to housing the LCCC on Evolution-owned property ‘Hillgrove’, Evolution has also provided the LCF with considerable freehold property to undertake conservation and research projects. Evolution also provides secretariat services to the LCF.

The LCF has now been involved in approximately 50 conservation projects in the Lake Cowal region and has developed a relationship with 40 project partners, including:

- numerous local land owners and managers;
- Riverina and Central West Local Land Services;
- LachLandcare, National Malleefowl Recovery Team, National Landcare Program, Natural Heritage Trust, Environmental Trust, Greening Australia and DPI (Fisheries);
- Bland, Forbes, Lachlan, Weddin, and Temora Shire Councils;
- Charles Sturt University, CSIRO, Western Research Institute, Western Institute of TAFE and West Wyalong High School; and
- numerous local bodies such as the West Wyalong Anglers and Gardening Clubs.

Some of the projects that the LCF have completed or are involved in include:

- the LCCC where over 8,000 people visit and participate in environmental education and activities each year;
- Lake Cowal and Bland Creek revegetation projects;
- Bland Creek Catchment Incentives Grants Project that has combined contributions of approximately $5 million;
- a Natural Sequence Farming project which aims to reconnect the hydrologic function of the 10 km Spring Creek with its floodplain;
- collaborative research with CSIRO Plant Industry into native grassland population dynamics;
- Pasture Re-establishment Trials and Pasture Cropping Trials;
- the restocking of Bland and Sandy Creeks with native fingerlings; and
- seed collection, assessment of remnant vegetation and establishment of a herbarium.

The LCF continues to be an important organisation with conservation, pastoral, community, government, educational and mining groups working collaboratively together to achieve considerable outcomes for the Lake Cowal region.

10 INDEPENDENT ENVIRONMENTAL AUDIT

An Independent Environmental Audit was conducted in 2019, as addressed in the 2018 Annual Review. With the removal of the Independent Monitoring Panel from Development Consent 14/98 conditions during Modification 15, the requirement to conduct an annual IEA is no longer valid. The next triennial IEA will be conducted in 2022.

11 INCIDENTS AND NON-COMPLIANCES DURING THE REPORTING PERIOD

11.1 NON-COMPLIANCES DURING THE REPORTING PERIOD

Summaries of any non-compliances during the audit period have been described in Sections 1 and 10 of this AR report.

11.2 INCIDENTS DURING THE REPORTING PERIOD

Summaries of any incidents during the reporting period have been described in the 'Reportable Incidents' sections throughout this AR, including in relation to the TSF Seepage Incident and the THMS investigation.

12 ACTIVITIES TO BE COMPLETED IN THE NEXT REPORTING PERIOD

Summaries of the activities to be completed in the next reporting period have been described in the 'Further Improvements' sections included throughout this AR.

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Spectrum Acoustics (2019b) *Cowal Gold Operations – Attended Noise Monitoring – May 2019*.

Spectrum Acoustics (2019c) *Cowal Gold Operations – Attended Noise Monitoring – August 2019*.

Spectrum Acoustics (2019d) *Cowal Gold Operations – Attended Noise Monitoring – December 2019.*

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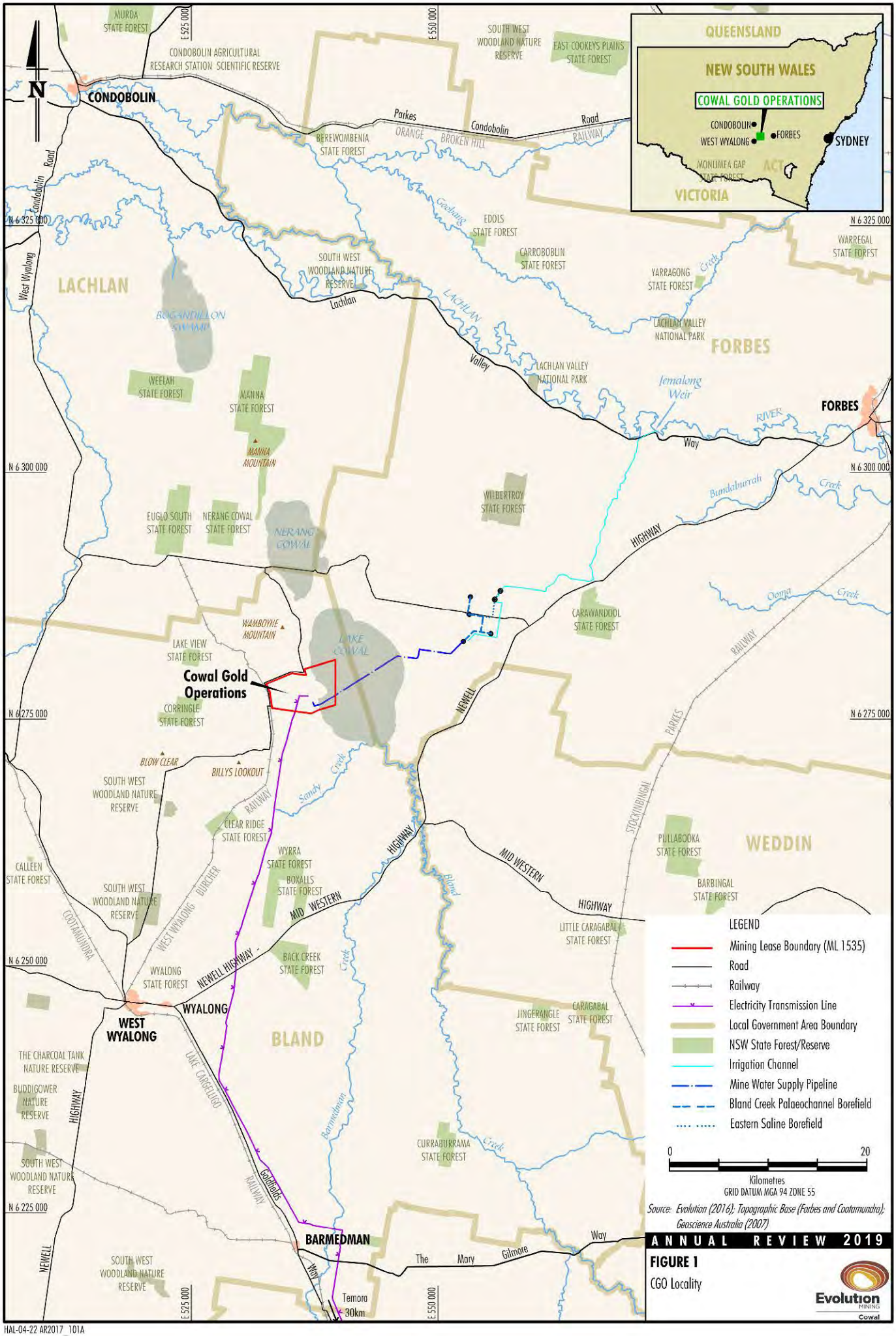
GLOSSARY OF TERMS

AR	Annual Review
ANZECC	Australian New Zealand Environmental Conservation Council
ARD	Acid Rock Drainage
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
AWS	Automatic Weather Station
BCPC	Bland Creek Paleochannel
BLMP	Blast Management Plan
BOMP	Biodiversity Offset Management Plan
BSC	Bland Shire Council
CEMCC	Community Environmental Monitoring & Consultative Committee
CGO	Cowal Gold Operations
CMP	Cyanide Management Plan
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CW	Compensatory Wetland
CWMP	Compensatory Wetland Management Plan
DP&I	Department of Planning and Infrastructure
DP&E	Department of Planning and Environment
DECCW	Department of Environment, Climate Change and Water (now EPA)
DPI	Department of Primary Industries
DRE	Department of Resources and Energy
DRG	Division of Resources and Geoscience
EC	Electrical Conductivity
ECCC	Evolution Cowal Consultation Centre
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EPA	Environment Protection Authority
EPL	Environment Protection License
ESB	Eastern Saline Borefield
ESCMP	Erosion and Sediment Control Management Plan
ETBC	Employment Training Business Council (WCC – Evolution)
Evolution	Evolution Mining (Cowal) Pty Limited
FFMP	Flora and Fauna Management Plan
HMP	Heritage Management Plan
HWCMP	Hazardous Waste and Chemical Management Plan
IACHMP	Indigenous Archaeology and Cultural Heritage Management Plan
IEA	Independent Environmental Audit
LMP	Land Management Plan
ML	Mining Lease
MOP	Mining Operations Plan
NPWS	National Park and Wildlife Service
NTSF	Northern Tailings Storage Facility
NWRE	Northern Waste Rock Emplacement
OEH	Office of Environment and Heritage
PWRE	Perimeter Waste Rock Emplacement
RL	Relative Level metres
RMP	Rehabilitation Management Plan
RMP	Rehabilitation and Offset Management Plan
RVEP	Remnant Revegetation Enhancement Programme
STSF	Southern Tailings Storage Facility
SWRE	Southern Waste Rock Emplacement
SWGMBMP	Surface Water, Groundwater, Meteorological and Biological Monitoring Programme
TSF	Tailings Storage Facility
TSMP	Threatened Species Management Protocol
TSMS	Threatened Species Management Strategy
TSP	Total Suspended Particulates
WAD	Weak Acid Dissociated
WIRES	Wildlife Information Rescue and Education Service
WMP	Water Management Plan

FIGURES



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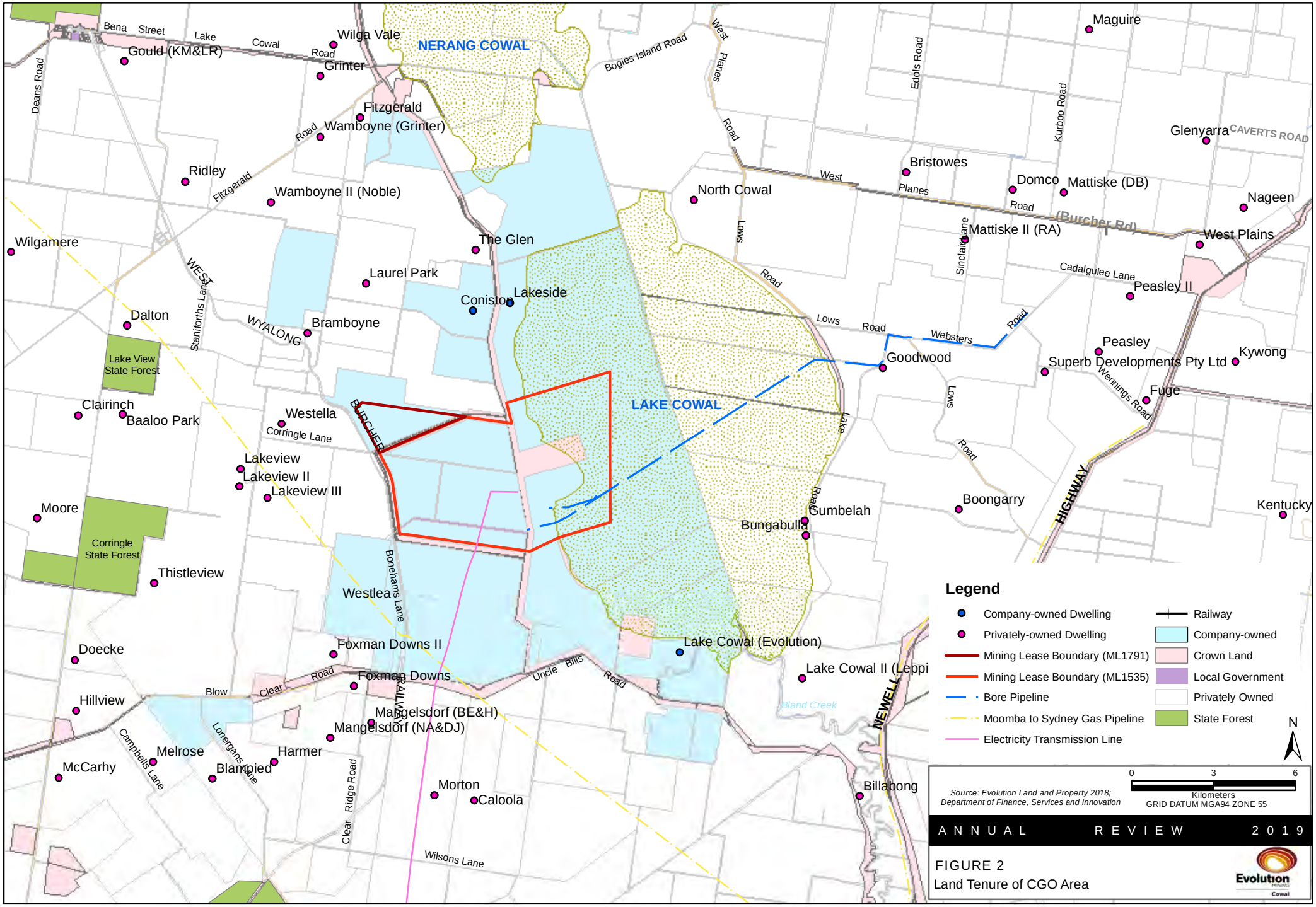
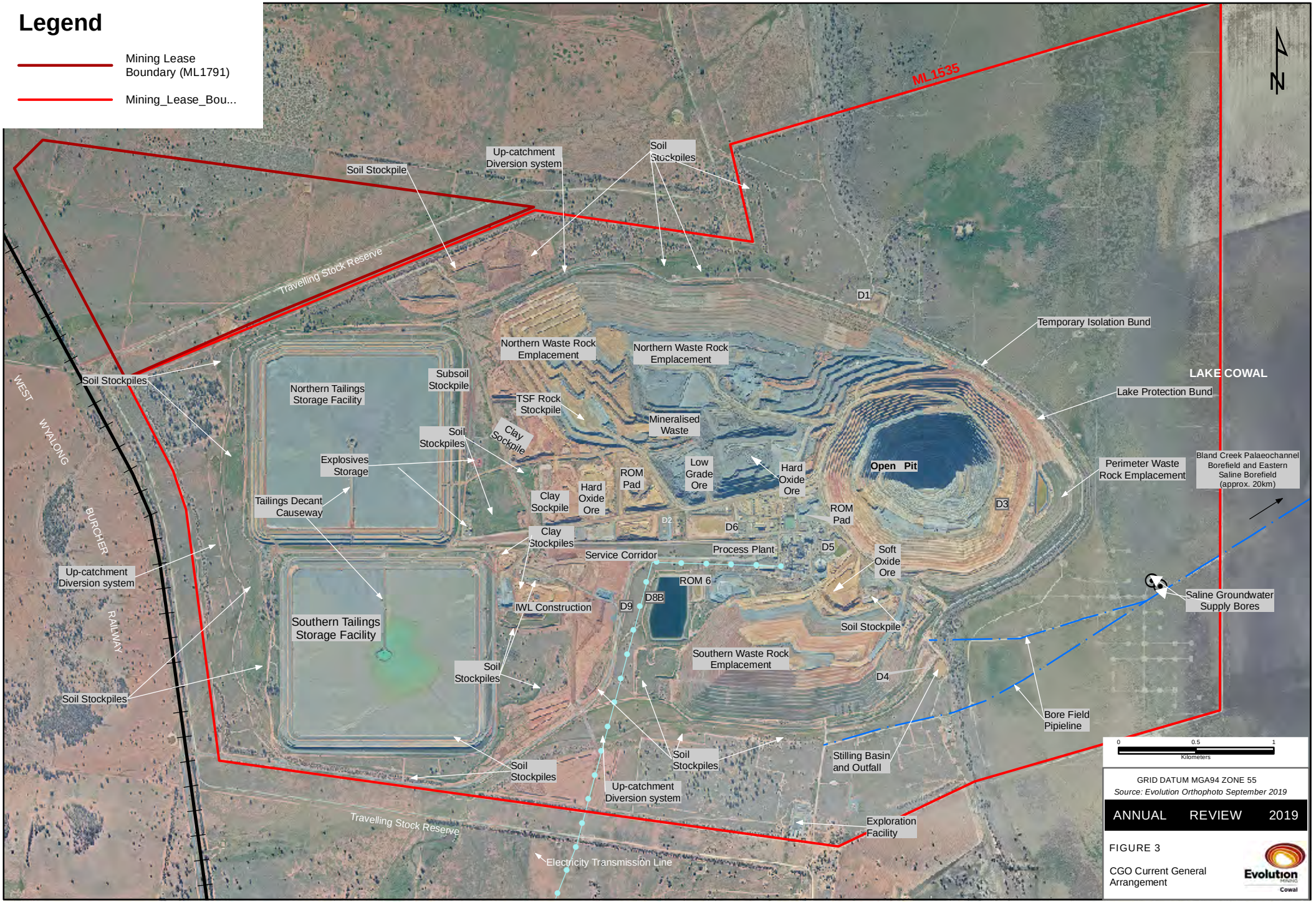
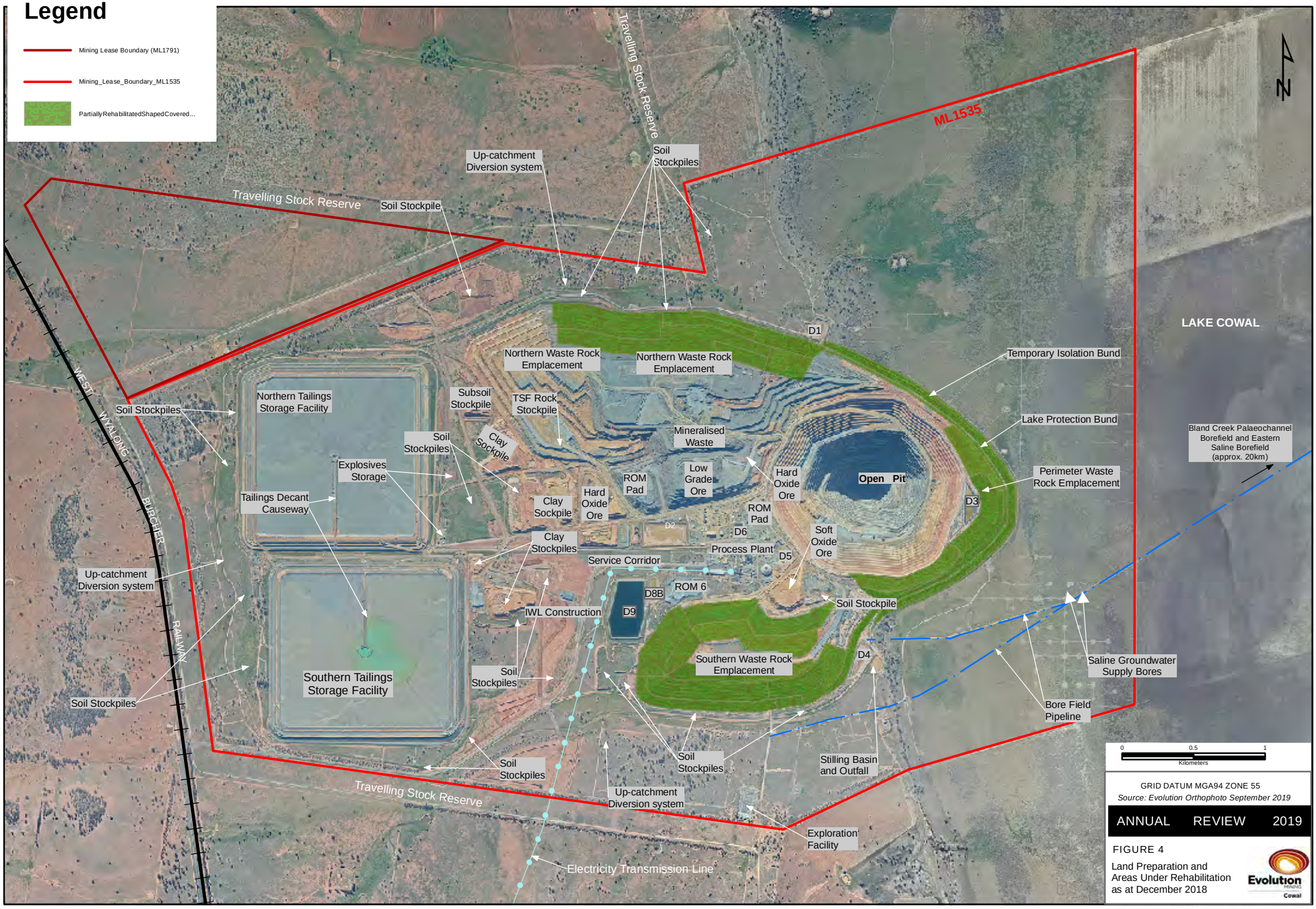
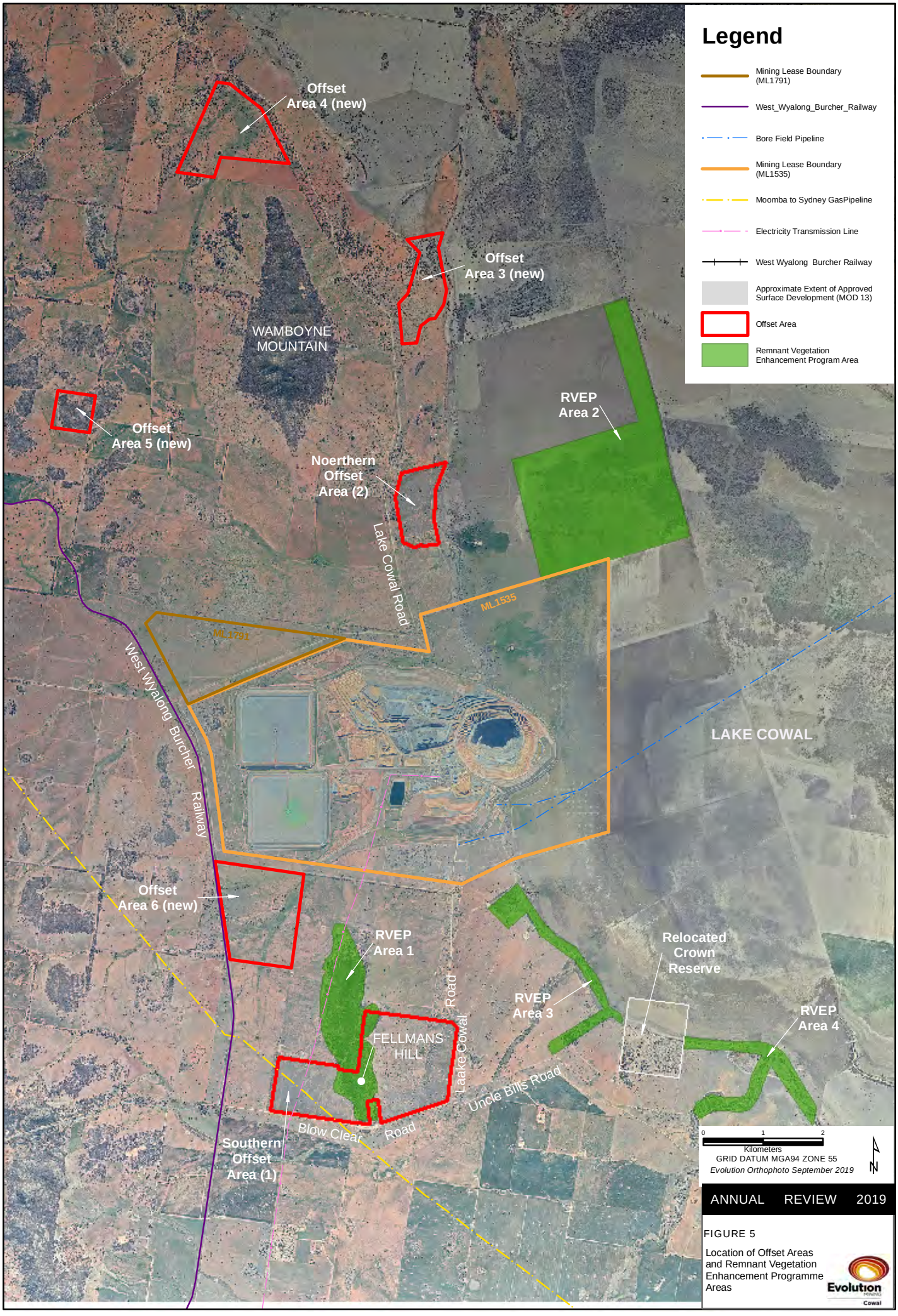
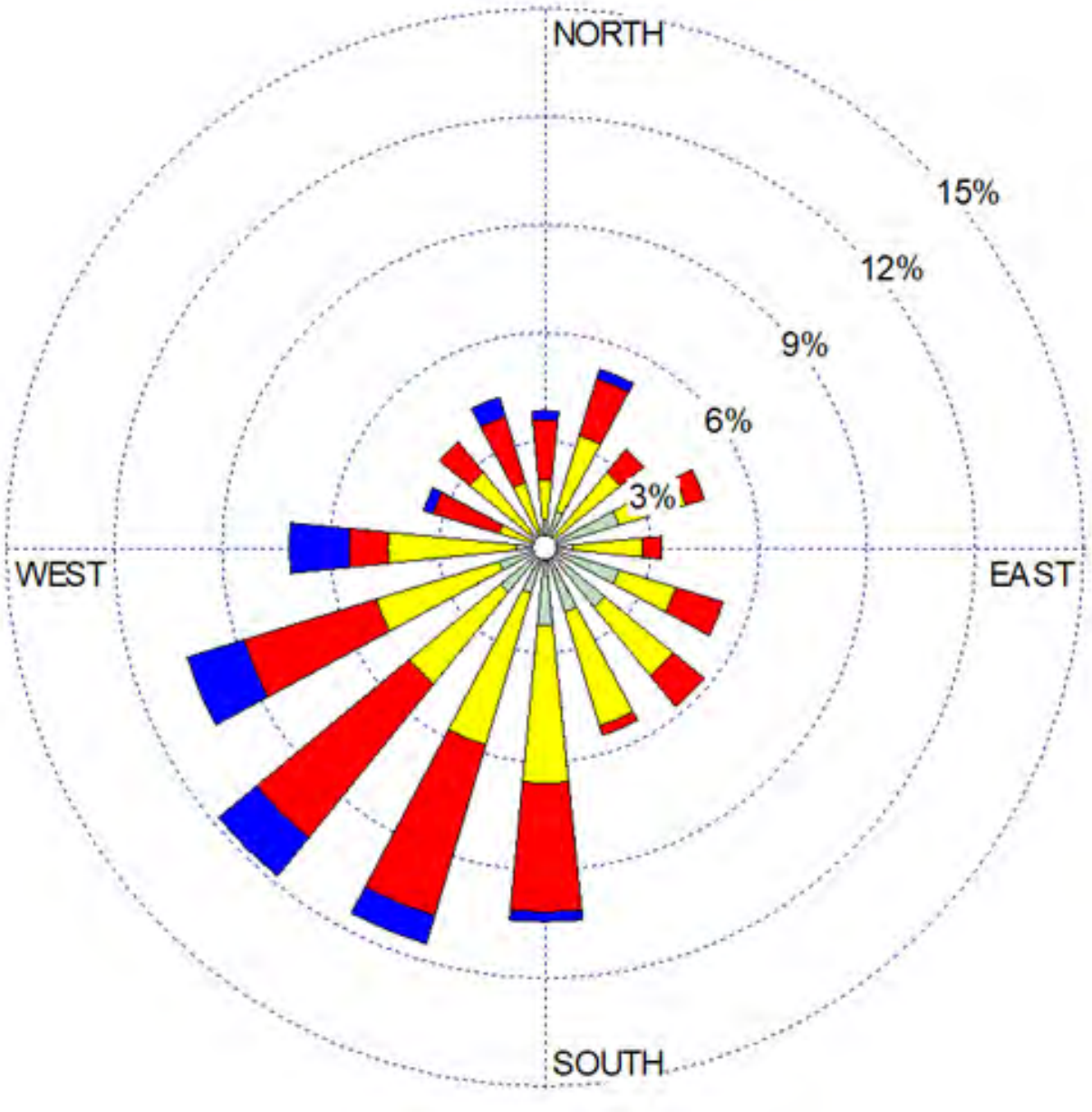

NERANG COWAL
LAKE COWAL
Bena Street
Lake Cowal Road
Gould (KM&LR)
Wilga Vale
Grinter
Fitzgerald
Wamboyne (Grinter)
Ridley
Wamboyne II (Noble)
Wilgamere
Dalton
Lake View State Forest
Clairinch
Baaloo Park
Moore
Corringle State Forest
Thistleview
Doecke
Hillview
McCarhy
Melrose
Blampied
Harmer
Mangelsdorf (BE&H)
Mangelsdorf (NA&DJ)
Foxman Downs
Foxman Downs II
Westlea
Westella
Corringle Lane
Lakeview
Lakeview II
Lakeview III
Laurel Park
Coniston
Lakeside
The Glen
Bramboyne
Bogies Island Road
North Cowal
Bristowes
Domco
Mattiske (DB)
Mattiske II (RA)
Glenyarra
CAVERTS ROAD
Nageen
West Plains
Peasley II
Peasley
Superb Developments Pty Ltd
Kywong
Fuge
Goodwood
Websters Road
Cadalgulee Lane
Lows Road
Sinclairs Lane
Kurboo Road
Edols Road
West Plains Road
(Burcher Rd)
Boongarry
Kentucky
Gumbelah
Bungabulla
Lake Cowal (Evolution)
Lake Cowal II (Leppi
Billabong
Morton
Caloola
Bland Creek
Uncle Bills Road
Wilsons Lane
Clear Ridge Road
Longarms Lane
Campbells Lane
Bonehams Lane
Staniforths Lane
WYALONG
BURCHER
NEWELL
HIGHWAY
Legend
Company-owned Dwelling
Privately-owned Dwelling
Mining Lease Boundary (ML1791)
Mining Lease Boundary (ML1535)
Bore Pipeline
Moomba to Sydney Gas Pipeline
Electricity Transmission Line
Railway
Company-owned
Crown Land
Local Government
Privately Owned
State Forest
N
0 3 6
Kilometers
GRID DATUM MGA94 ZONE 55
Source: Evolution Land and Property 2018; Department of Finance, Services and Innovation
ANNUAL REVIEW 2019
FIGURE 2
Land Tenure of CGO Area
Evolution Mining Cowal


Legend
Mining Lease Boundary (ML1791)
Mining_Lease_Bou...
ML1535
N
Soil Stockpile
Up-catchment Diversion system
Soil Stockpiles
Travelling Stock Reserve
D1
Temporary Isolation Bund
Northern Waste Rock Emplacement
Northern Waste Rock Emplacement
LAKE COWAL
Soil Stockpiles
Subsoil Stockpile
Northern Tailings Storage Facility
TSF Rock Stockpile
Lake Protection Bund
Mineralised Waste
Soil Stockpiles
Clay Sockpile
WEST WYALONG
Explosives Storage
Low Grade Ore
Hard Oxide Ore
Open Pit
Perimeter Waste Rock Emplacement
Bland Creek Palaeochannel Borefield and Eastern Saline Borefield (approx. 20km)
ROM Pad
Tailings Decant Causeway
Clay Sockpile
Hard Oxide Ore
ROM Pad
D3
D2
D6
Clay Stockpiles
Service Corridor
Process Plant
D5
Soft Oxide Ore
BURCHER
Up-catchment Diversion system
ROM 6
Saline Groundwater Supply Bores
D8B
D9
IWL Construction
RAILWAY
Southern Tailings Storage Facility
Soil Stockpile
Southern Waste Rock Emplacement
Soil Stockpiles
D4
Soil Stockpiles
Bore Field Pipieline
Soil Stockpiles
Soil Stockpiles
Stilling Basin and Outfall
Up-catchment Diversion system
Travelling Stock Reserve
Exploration Facility
Electricity Transmission Line
0
0.5
1
Kilometers
GRID DATUM MGA94 ZONE 55
Source: Evolution Orthophoto September 2019
ANNUAL REVIEW 2019
FIGURE 3
CGO Current General Arrangement
Evolution MINING Cowal


Legend
Mining Lease Boundary (ML1791)
Mining_Lease_Boundary_ML1535
PartiallyRehabilitatedShapedCovered...
N
ML1535
Travelling Stock Reserve
Travelling Stock Reserve
Soil Stockpile
Up-catchment Diversion system
Soil Stockpiles
LAKE COWAL
D1
Northern Waste Rock Emplacement
Northern Waste Rock Emplacement
Temporary Isolation Bund
Lake Protection Bund
Bland Creek Palaeochannel Borefield and Eastern Saline Borefield (approx. 20km)
Perimeter Waste Rock Emplacement
Soil Stockpiles
Northern Tailings Storage Facility
Subsoil Stockpile
TSF Rock Stockpile
Soil Stockpiles
Clay Stockpile
Mineralised Waste
Explosives Storage
ROM Pad
Low Grade Ore
Hard Oxide Ore
Open Pit
Tailings Decant Causeway
Clay Stockpile
Hard Oxide Ore
ROM Pad
D3
D2
D6
Clay Stockpiles
Soft Oxide Ore
Process Plant
D5
Service Corridor
Up-catchment Diversion system
ROM 6
D8B
D9
IWL Construction
Soil Stockpile
Southern Tailings Storage Facility
Soil Stockpiles
Southern Waste Rock Emplacement
D4
Saline Groundwater Supply Bores
Soil Stockpiles
Soil Stockpiles
Bore Field Pipeline
Soil Stockpiles
Stilling Basin and Outfall
Travelling Stock Reserve
Up-catchment Diversion system
Exploration Facility
Electricity Transmission Line
WESTERN WYALONG BURCHER RAILWAY
0
0.5
1
Kilometers
GRID DATUM MGA94 ZONE 55
Source: Evolution Orthophoto September 2019
ANNUAL REVIEW 2019
FIGURE 4
Land Preparation and Areas Under Rehabilitation as at December 2018
Evolution MINING Cowal


Legend
Mining Lease Boundary (ML1791)
West_Wyalong_Burcher_Railway
Bore Field Pipeline
Mining Lease Boundary (ML1535)
Moomba to Sydney GasPipeline
Electricity Transmission Line
West Wyalong Burcher Railway
Approximate Extent of Approved Surface Development (MOD 13)
Offset Area
Remnant Vegetation Enhancement Program Area
Offset Area 4 (new)
Offset Area 3 (new)
WAMBOYNE MOUNTAIN
Offset Area 5 (new)
RVEP Area 2
Noerthern Offset Area (2)
Lake Cowal Road
ML1535
ML1791
West Wyalong Burcher Railway
LAKE COWAL
Offset Area 6 (new)
RVEP Area 1
Road
Laake Cowal
Relocated Crown Reserve
RVEP Area 3
RVEP Area 4
FELLMANS HILL
Uncle Bills Road
Blow Clear
Road
Southern Offset Area (1)
0 1 2
Kilometers
GRID DATUM MGA94 ZONE 55
Evolution Orthophoto September 2019
N
ANNUAL REVIEW 2019
FIGURE 5
Location of Offset Areas and Remnant Vegetation Enhancement Programme Areas
Evolution MINING
Cowal



Wind speed (km/hr)

2–8	21–32
8–13	32–40
13–21	>40

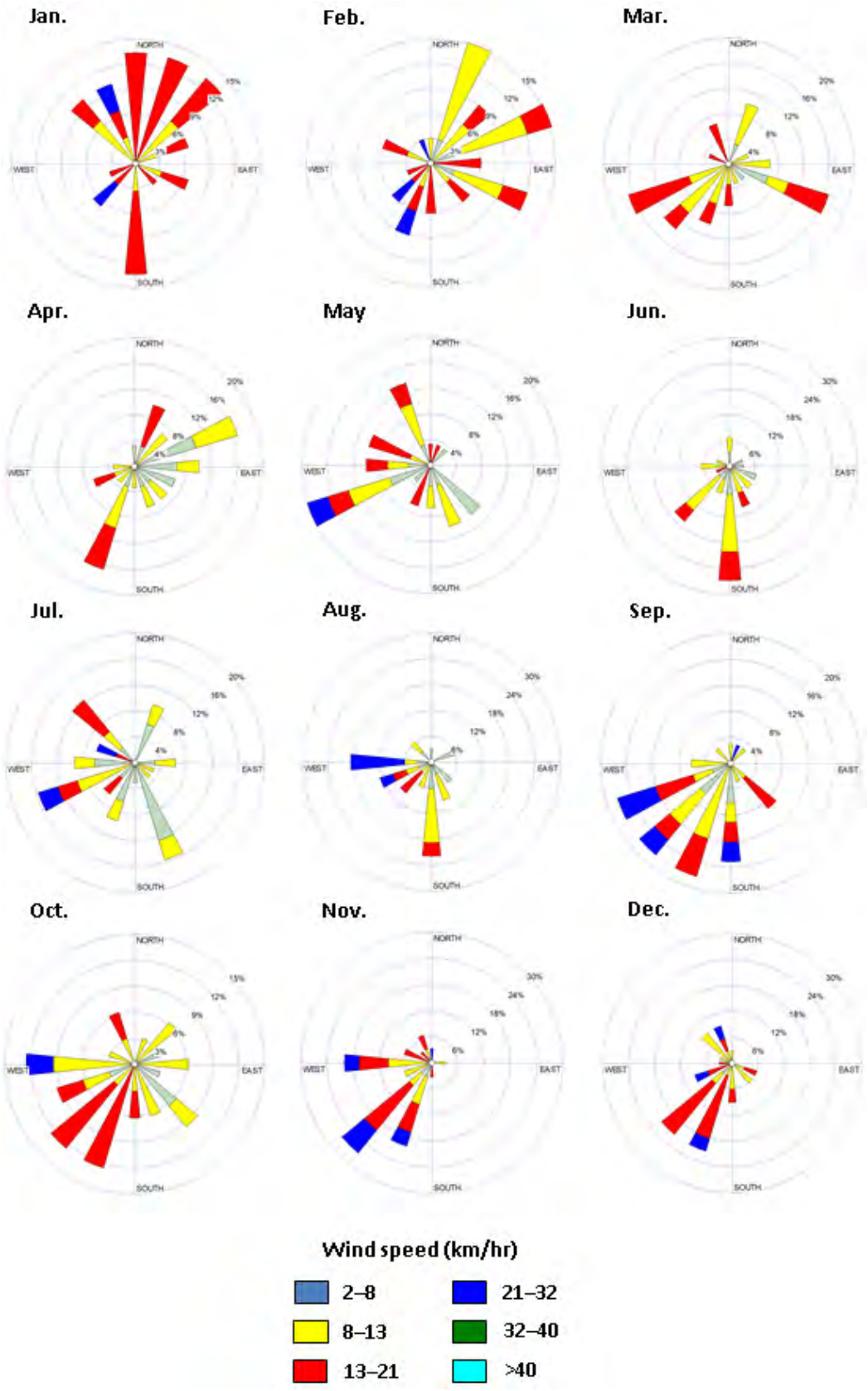
Source: University of Sydney (2020)

ANNUAL REVIEW 2019

FIGURE 6a

Annual Wind Rose for 2019

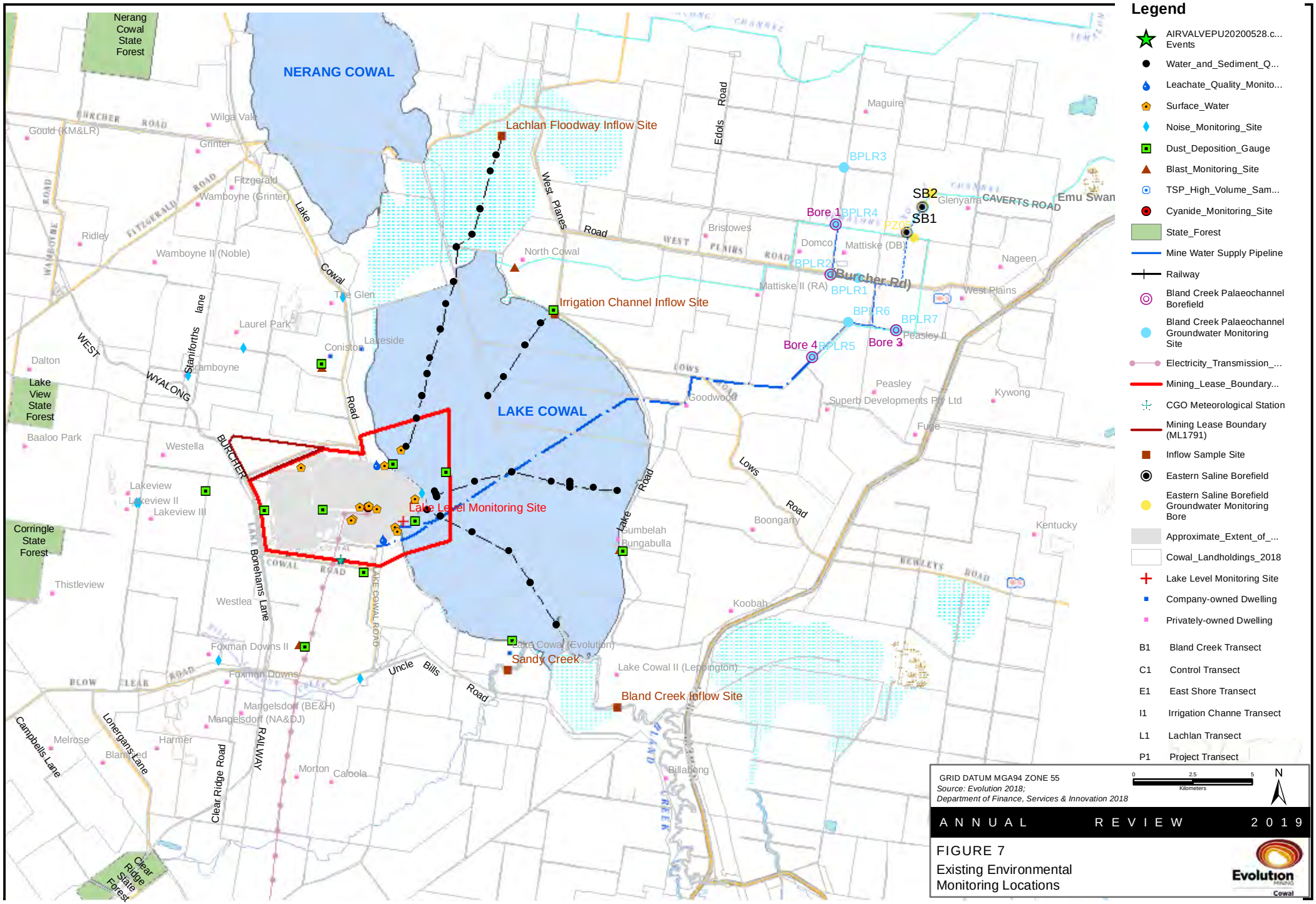
Evolution Mining Cowal

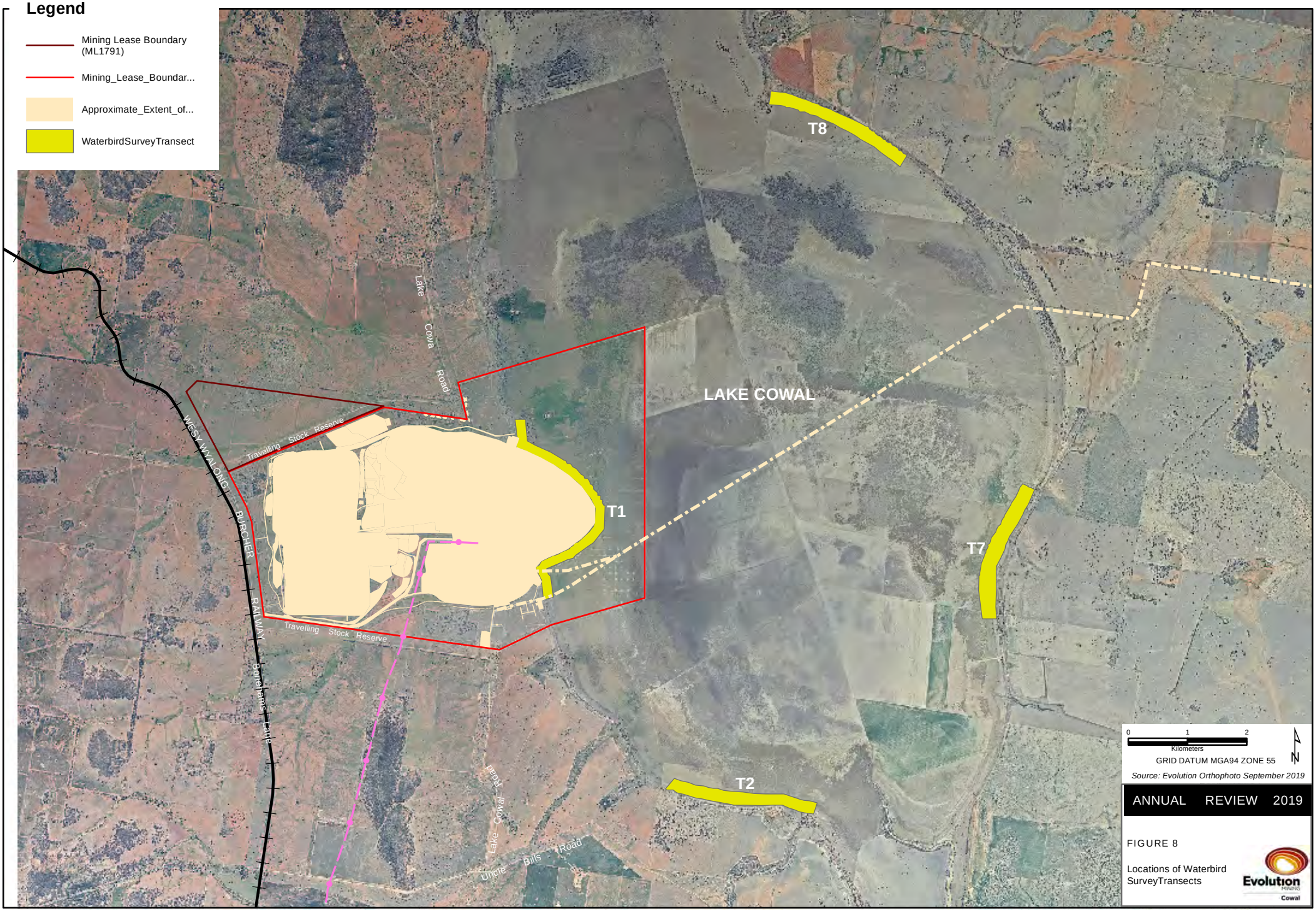


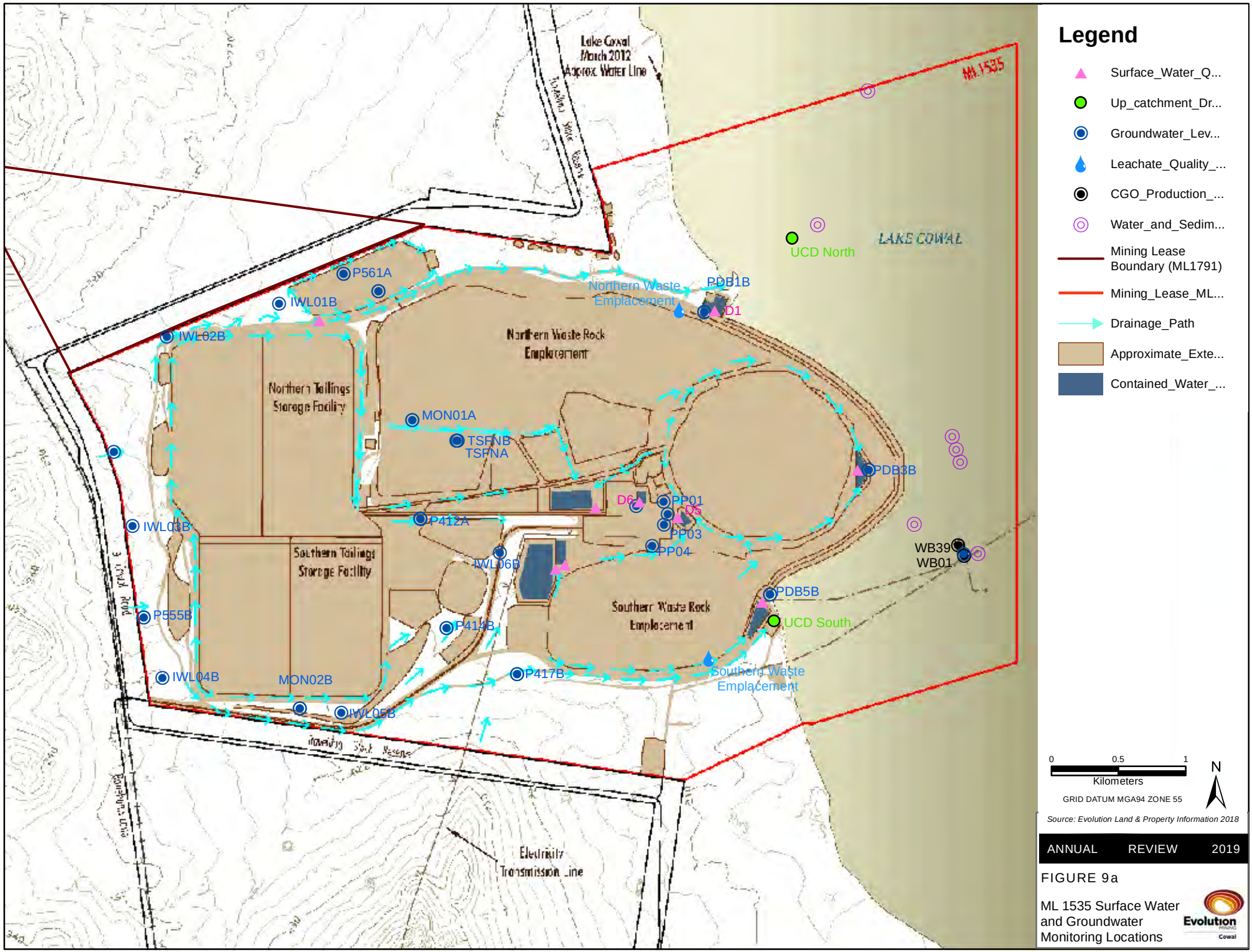
Source: University of Sydney (2020)

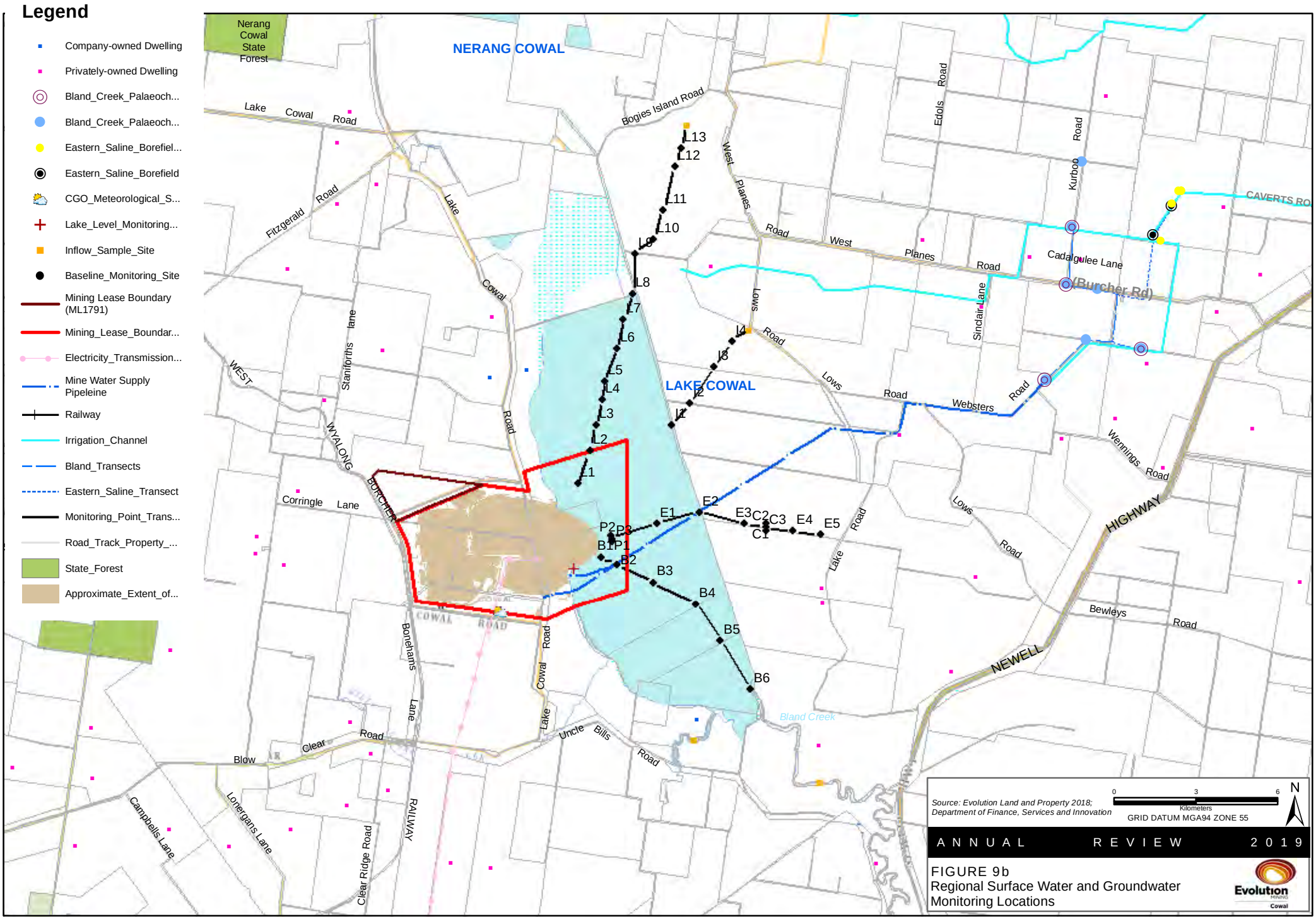
FIGURE 6b

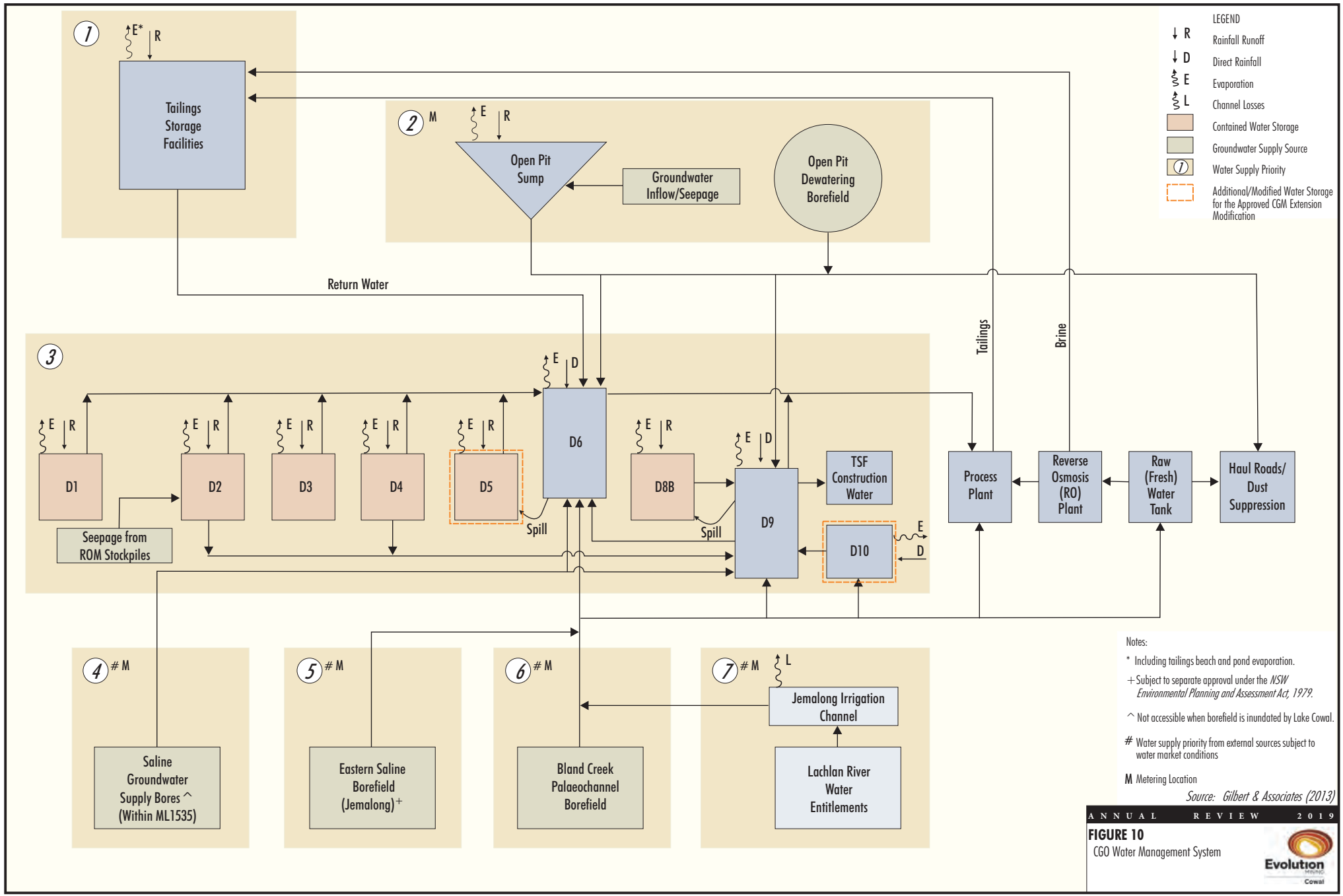
Monthly Wind Roses for January - December 2019


NERANG COWAL
LAKE COWAL
Nerang Cowal State Forest
Lake View State Forest
Corringle State Forest
Clear Ridge State Forest
Lachlan Floodway Inflow Site
Irrigation Channel Inflow Site
Lake Level Monitoring Site
Sandy Creek
Bland Creek Inflow Site
Lake Cowal (Evolution)
Lake Cowal II (Lennington)
Bore 1
Bore 2
Bore 3
Bore 4
BPLR1
BPLR2
BPLR3
BPLR4
BPLR5
BPLR6
BPLR7
SB1
SB2
PZ05
Burcher Rd)
Gould (KM&LR)
Wilga Vale
Grinter
Fitzgerald
Wamboyne (Grinter)
Ridley
Wamboyne II (Noble)
Tree Glen
Laurel Park
Coniston
Lakeside
Dalton
Wamboyne
Baaloo Park
Westella
Lakeview
Lakeview II
Lakeview III
Thistleview
Westlea
Foxman Downs II
Foxman Downs
Mangelsdorf (BE&H)
Mangelsdorf (NA&DJ)
Melrose
Harmer
Blamire Rd
Morton
Caloola
North Cowal
Maguire
Bristowes
Domco
Mattiske (DB)
Mattiske II (RA)
Nageen
West Plains
Glenyarra
Emu Swan
Peasley II
Peasley
Superb Developments Pty Ltd
Kywong
Fuge
Goodwood
Boongarry
Kentucky
Koobah
Billabong
Gumbelah
Bungabulla
Edols Road
West Planes Road
Cowal Lake
Staniforths lane
Bonehams Lane
Uncle Bills Road
Lows Road
Bewleys Road
Lake Cowal Road
Campbells Lane
Lonergans Lane
Clear Ridge Road
RAILWAY
Legend
AIRVALVEPU20200528.c... Events
Water_and_Sediment_Q...
Leachate_Quality_Monito...
Surface_Water
Noise_Monitoring_Site
Dust_Deposition_Gauge
Blast_Monitoring_Site
TSP_High_Volume_Sam...
Cyanide_Monitoring_Site
State_Forest
Mine Water Supply Pipeline
Railway
Bland Creek Palaeochannel Borefield
Bland Creek Palaeochannel Groundwater Monitoring Site
Electricity_Transmission_...
Mining_Lease_Boundary...
CGO Meteorological Station
Mining Lease Boundary (ML1791)
Inflow Sample Site
Eastern Saline Borefield
Eastern Saline Borefield Groundwater Monitoring Bore
Approximate_Extent_of_...
Cowal_Landholdings_2018
Lake Level Monitoring Site
Company-owned Dwelling
Privately-owned Dwelling
B1 Bland Creek Transect
C1 Control Transect
E1 East Shore Transect
I1 Irrigation Channe Transect
L1 Lachlan Transect
P1 Project Transect
GRID DATUM MGA94 ZONE 55
Source: Evolution 2018;
Department of Finance, Services & Innovation 2018
0 2.5 5 Kilometers
N
ANNUAL REVIEW 2019
FIGURE 7
Existing Environmental Monitoring Locations
Evolution Mining Cowal


Legend
Mining Lease Boundary (ML1791)
Mining_Lease_Boundar...
Approximate_Extent_of...
WaterbirdSurveyTransect
T8
T1
T2
T7
LAKE COWAL
Lake Cowal Road
Travelling Stock Reserve
Travelling Stock Reserve
WESTERN RAILWAY
BURCHER
Borehams Lane
Lake Cowal Road
Uncle Bills Road
0
1
2
Kilometers
N
GRID DATUM MGA94 ZONE 55
Source: Evolution Orthophoto September 2019
ANNUAL REVIEW 2019
FIGURE 8
Locations of Waterbird SurveyTransects
Evolution MINING
Cowal


Lake Cowal
March 2012
Approx. Water Line
ML1535
LAKE COWAL
UCD North
P561A
IWL01B
IWL02B
Northern Waste
Emplacement
PDB1B
D1
Northern Waste Rock
Emplacement
Northern Tailings
Storage Facility
MON01A
TSFNB
TSFNA
PDB3B
D6
PP01
D5
PP03
PP04
P412A
IWL01B
Southern Tailings
Storage Facility
IWL06B
WB39
WB01
PDB5B
P555B
P414B
Southern Waste Rock
Emplacement
UCD South
IWL04B
MON02B
P417B
Southern Waste
Emplacement
IWL05B
Electricity
Transmission Line
Legend
Surface_Water_Q...
Up_catchment_Dr...
Groundwater_Lev...
Leachate_Quality_...
CGO_Production_...
Water_and_Sedim...
Mining Lease
Boundary (ML1791)
Mining_Lease_ML...
Drainage_Path
Approximate_Exte...
Contained_Water_...
0
0.5
1
Kilometers
N
GRID DATUM MGA94 ZONE 55
Source: Evolution Land & Property Information 2018
ANNUAL REVIEW 2019
FIGURE 9a
ML 1535 Surface Water
and Groundwater
Monitoring Locations
Evolution
Cowal

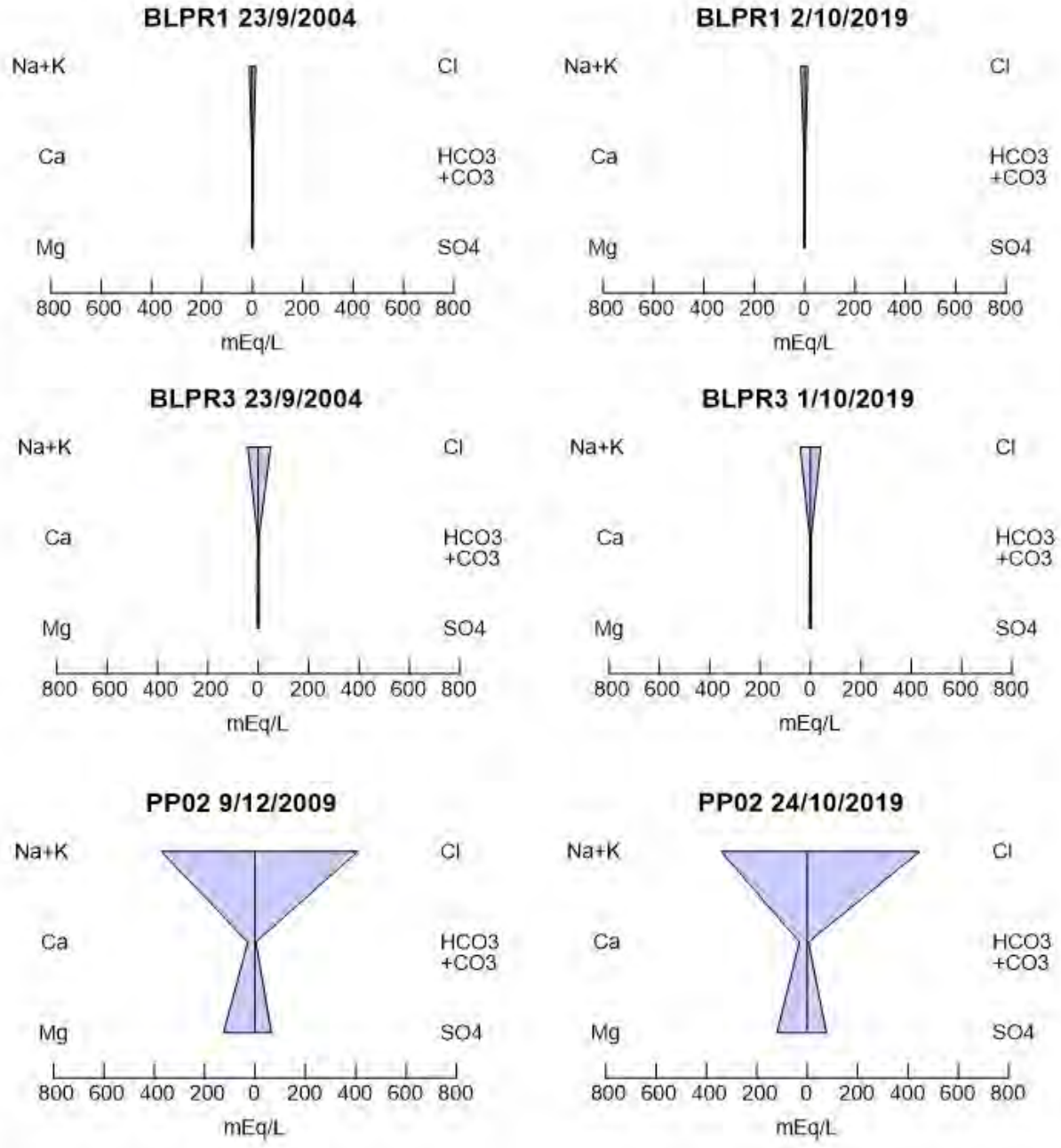

Legend
Company-owned Dwelling
Privately-owned Dwelling
Bland_Creek_Palaeoch...
Bland_Creek_Palaeoch...
Eastern_Saline_Borefiel...
Eastern_Saline_Borefield
CGO_Meteorological_S...
Lake_Level_Monitoring...
Inflow_Sample_Site
Baseline_Monitoring_Site
Mining Lease Boundary (ML1791)
Mining_Lease_Boundar...
Electricity_Transmission...
Mine Water Supply Pipeleine
Railway
Irrigation_Channel
Bland_Transects
Eastern_Saline_Transect
Monitoring_Point_Trans...
Road_Track_Property_...
State_Forest
Approximate_Extent_of...
Nerang Cowal State Forest
NERANG COWAL
LAKE COWAL
Bland Creek
L13
L12
L11
L10
L9
L8
L7
L6
L5
L4
L3
L2
L1
I4
I3
I2
I1
E1
E2
E3
E4
E5
C1
C2
C3
P1
P2
P3
B1
B2
B3
B4
B5
B6
Lake Cowal Road
Bogies Island Road
Edols Road
Kurboo Road
CAVERTS RO
Cadalgulee Lane
(Burcher Rd)
West Planes Road
Sinclair Lane
Lows Road
Websters Road
Wennings Road
HIGHWAY
NEWELL
Bewleys Road
Fitzgerald Road
Staniforths lane
WEST
WYALONG
BURCHER
Corringle Lane
Cowal Road
Bonehams Lane
Uncle Bills Road
Blow
Clear Road
Campbells Lane
Lonergans Lane
Clear Ridge Road
RAILWAY
Source: Evolution Land and Property 2018; Department of Finance, Services and Innovation
0 3 6
Kilometers
GRID DATUM MGA94 ZONE 55
N
ANNUAL REVIEW 2019
FIGURE 9b
Regional Surface Water and Groundwater Monitoring Locations
Evolution Mining Cowal



ANNUAL REVIEW 2019

FIGURE 10
CGO Water Management System

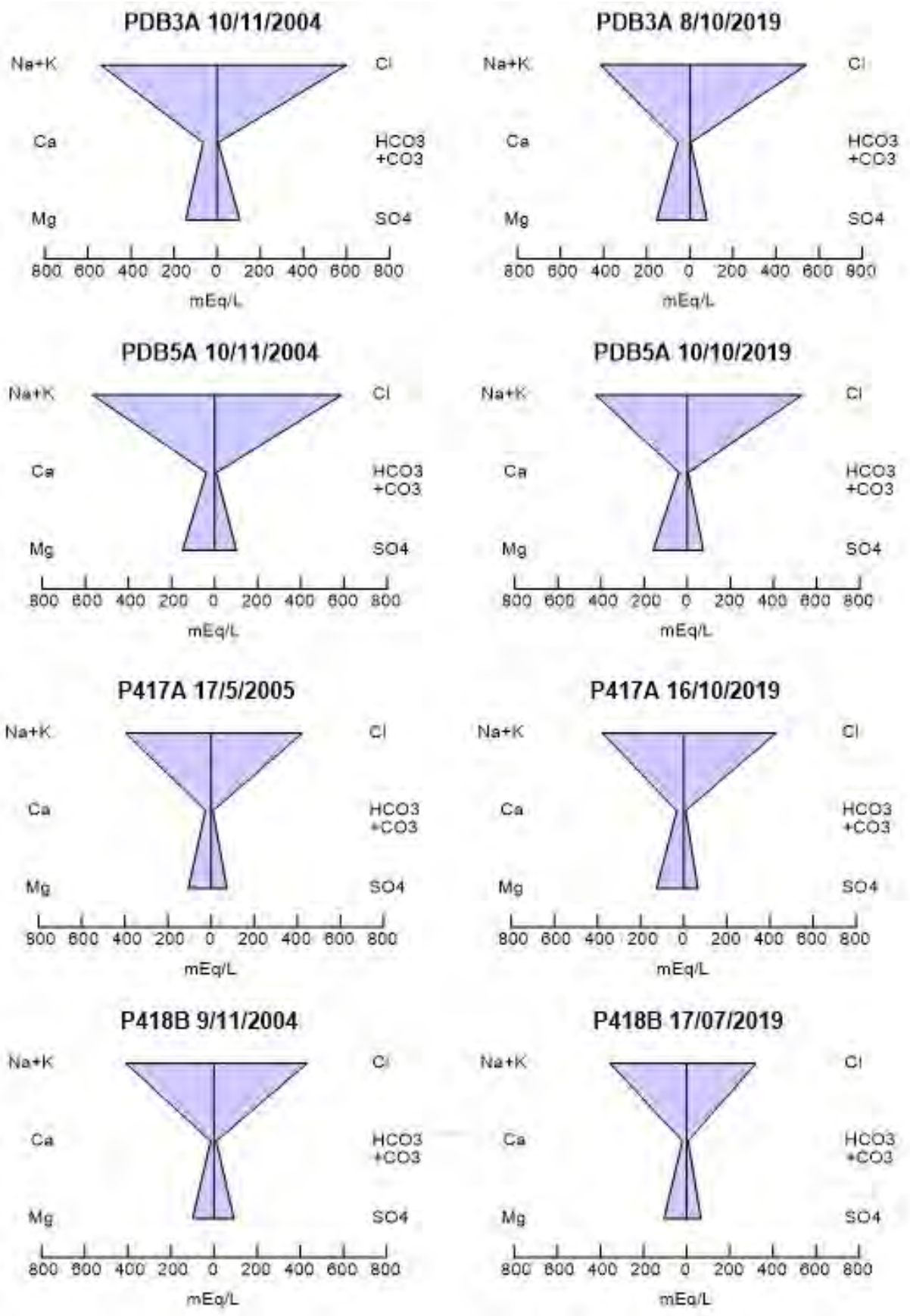
HAL-04-22_AR2017_005A



Source: Coffey Geotechnics Pty Ltd (2020)

FIGURE 11a

Stiff Plots of Groundwater Chemistry (Bland Creek Palaeochannel Borefield and Processing Plant Area)

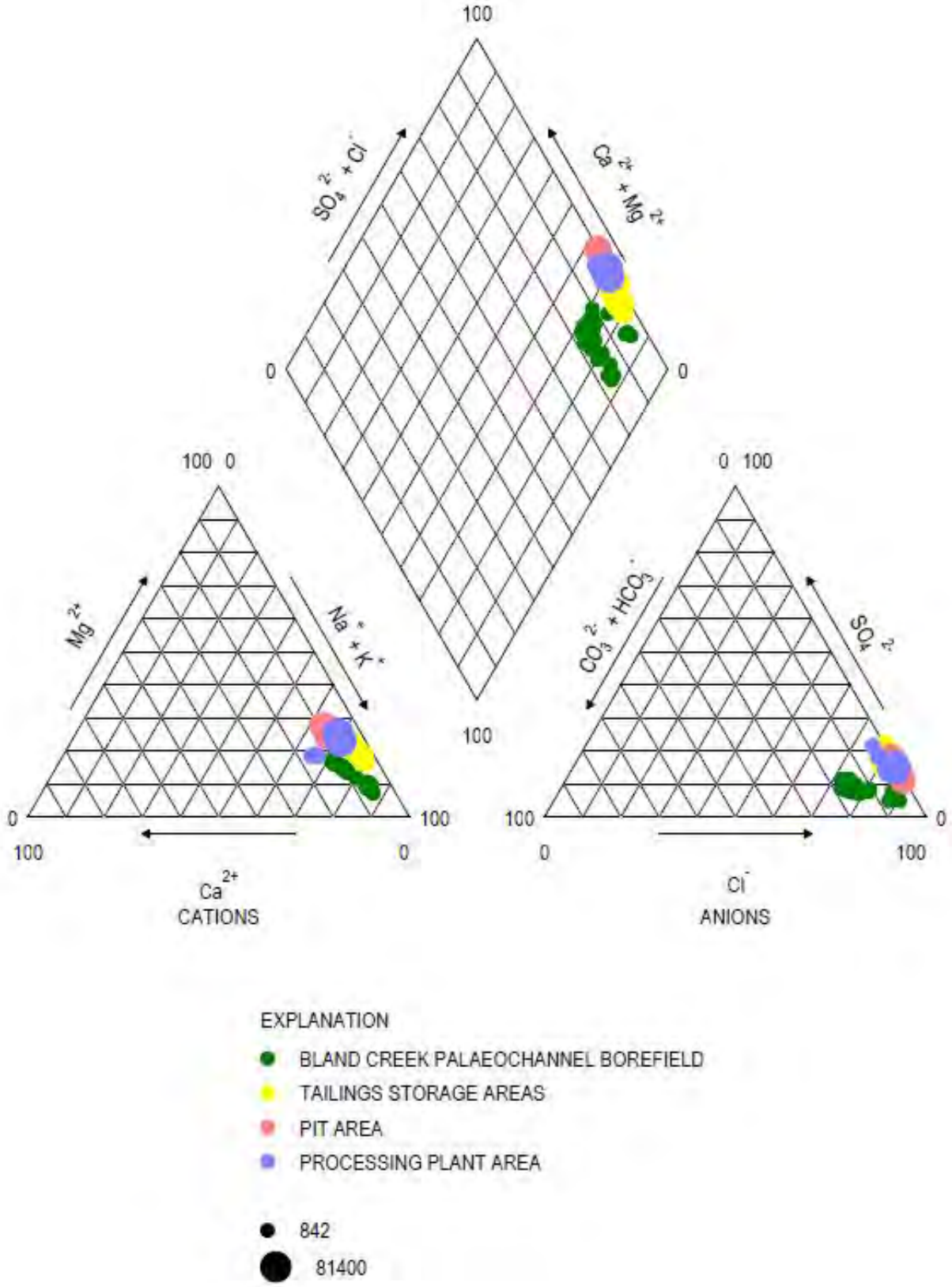


Source: Coffey Geotechnics Pty Ltd (2020)

FIGURE 11b

Stiff Plots of Groundwater Chemistry
(Pit Area and Tailings Storage Facility)

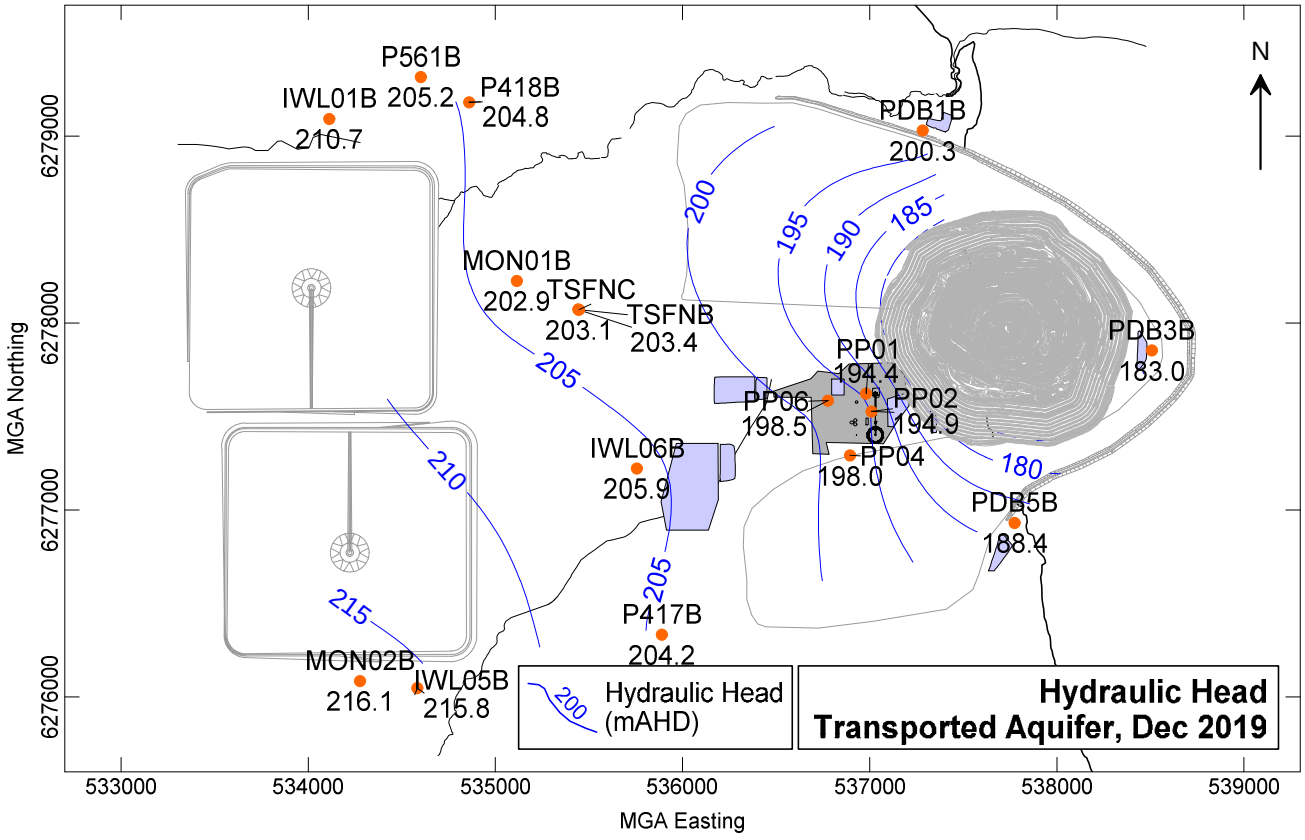
Evolution Mining Cowal

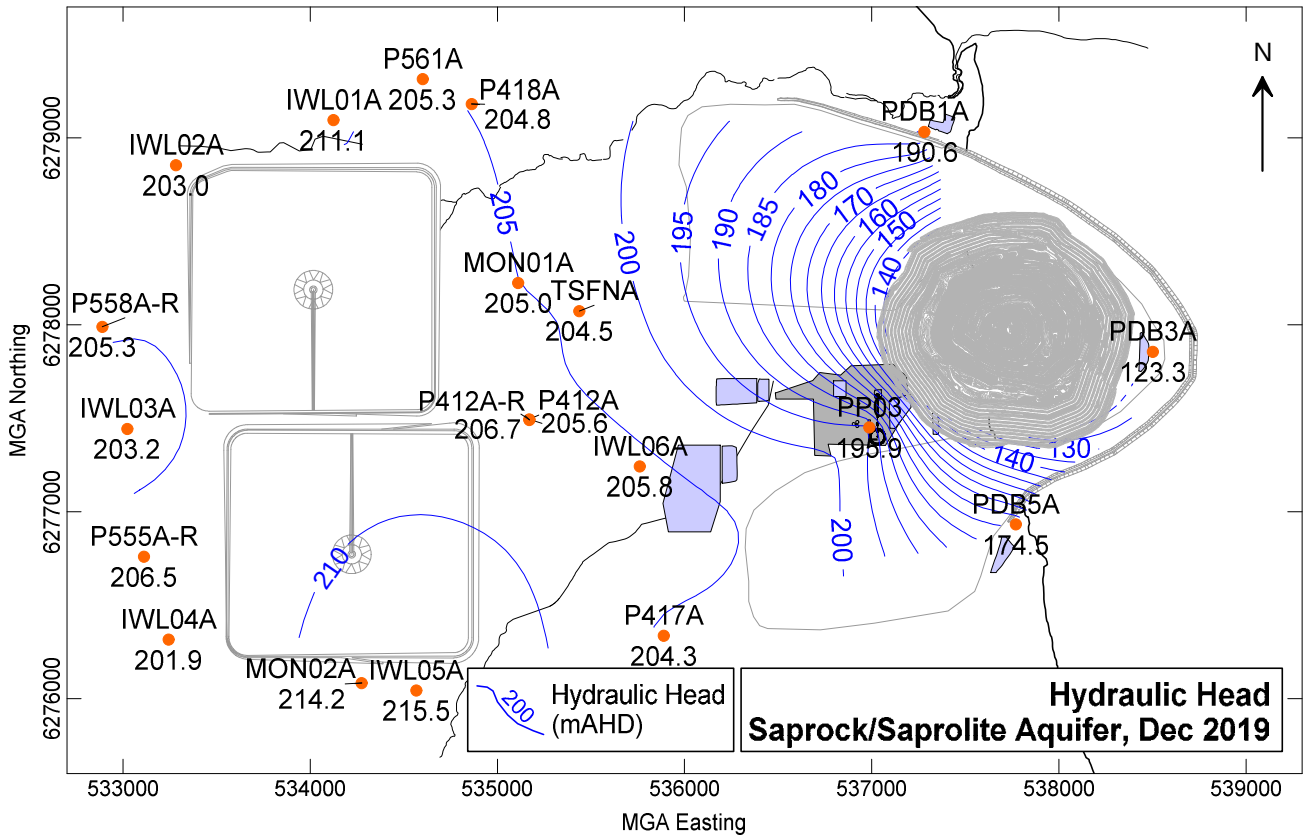


Source: Coffey Geotechnics Pty Ltd (2019)

FIGURE 12

Piper Plot of Ground Chemistry





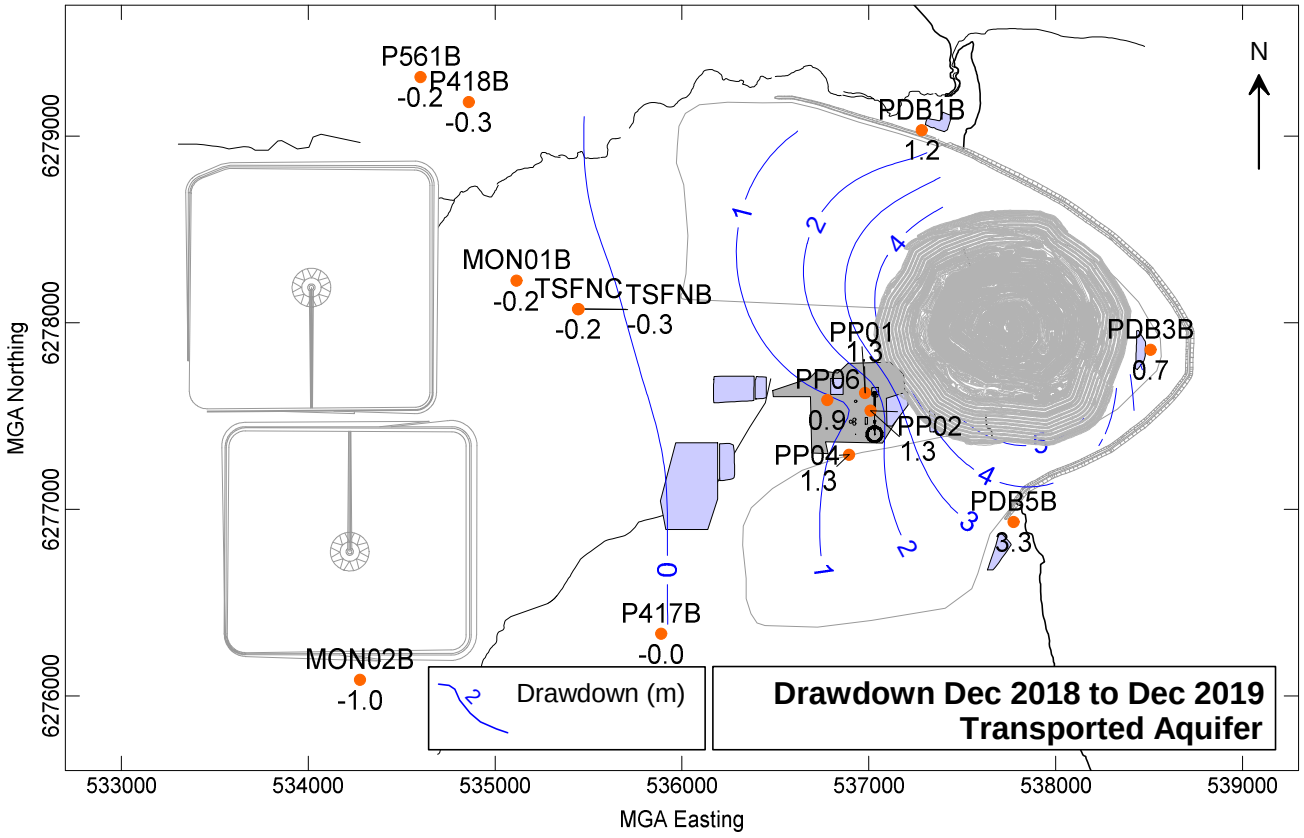
Source: Coffey Geotechnics Pty Ltd (2020)

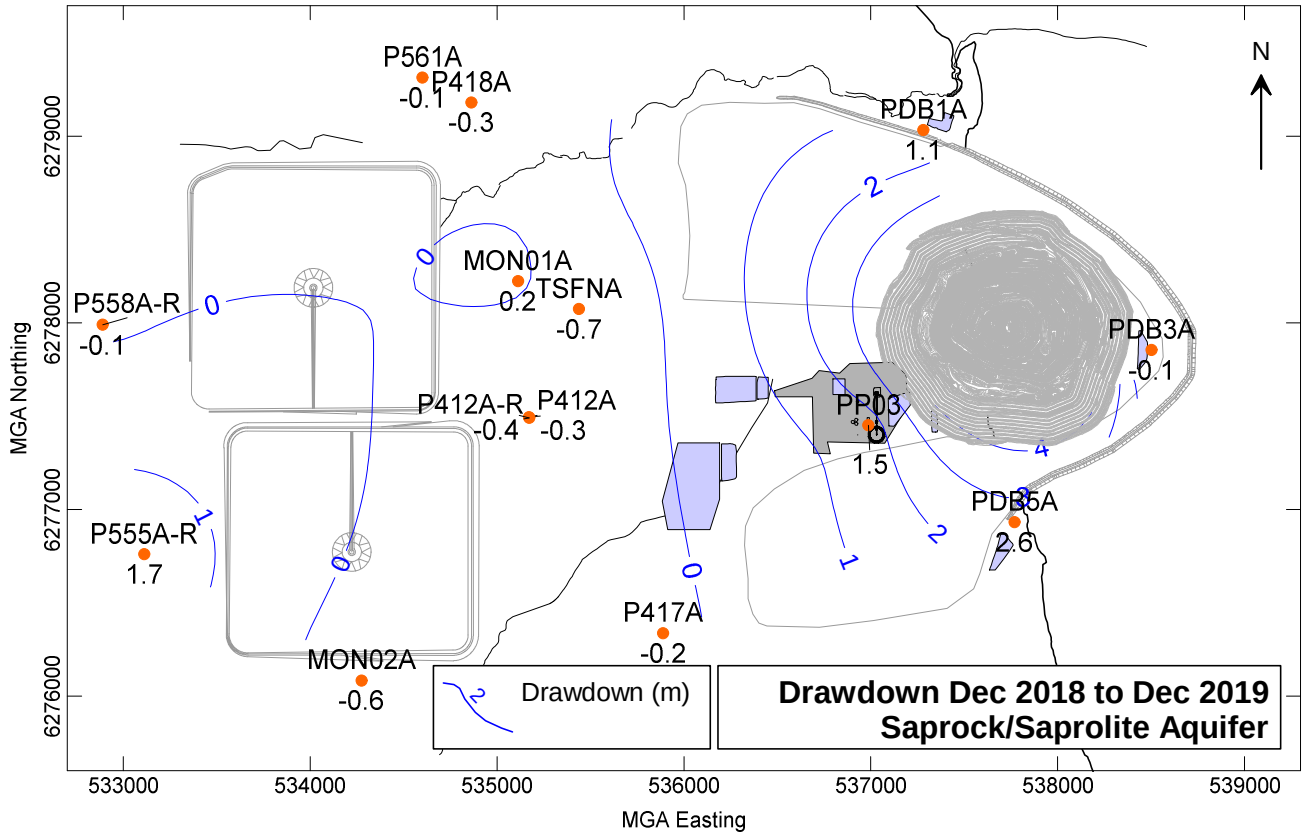
ANNUAL REVIEW 2019

FIGURE 13a

Deep Groundwater Contours

Evolution Mining Cowal





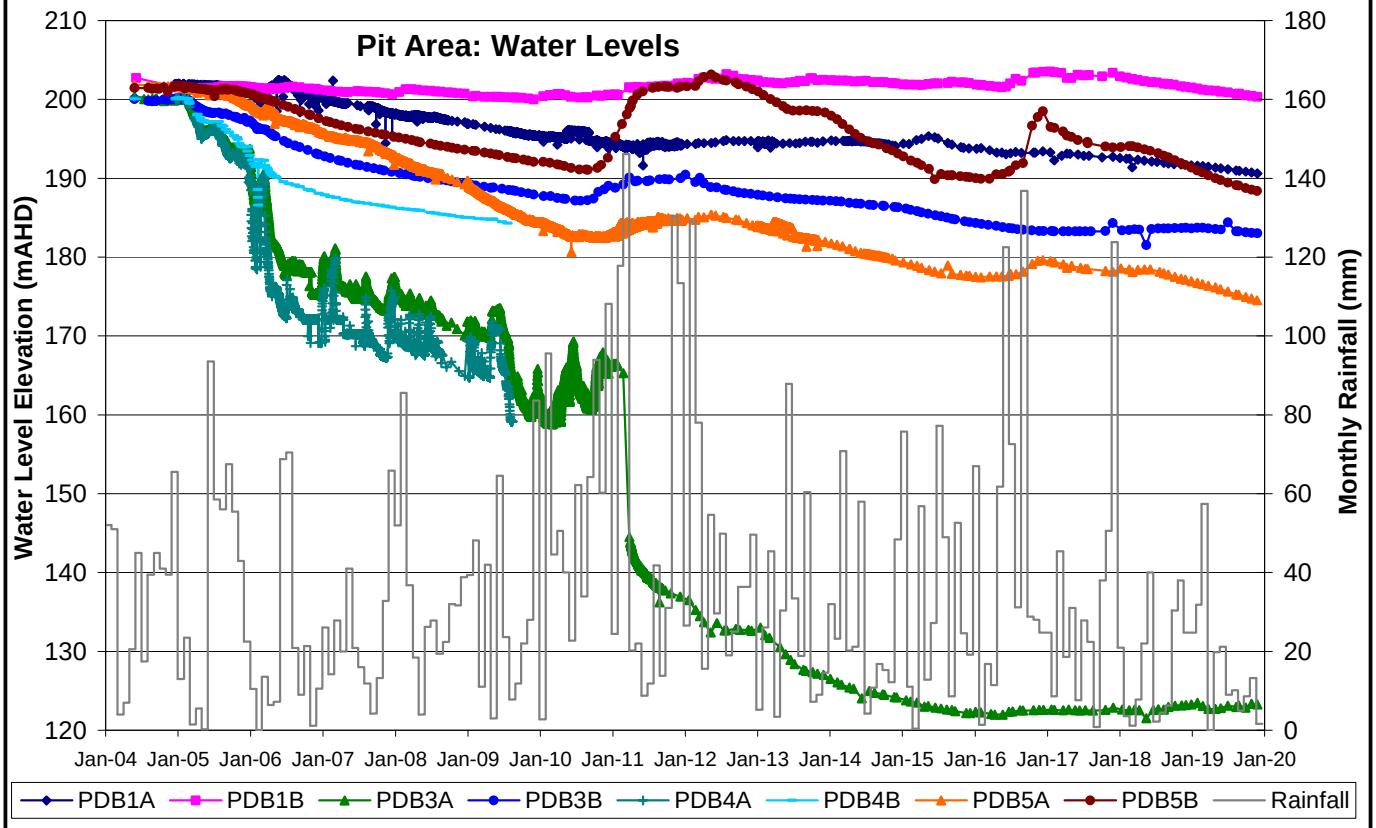
Source: Coffey Geotechnics Pty Ltd (2020)

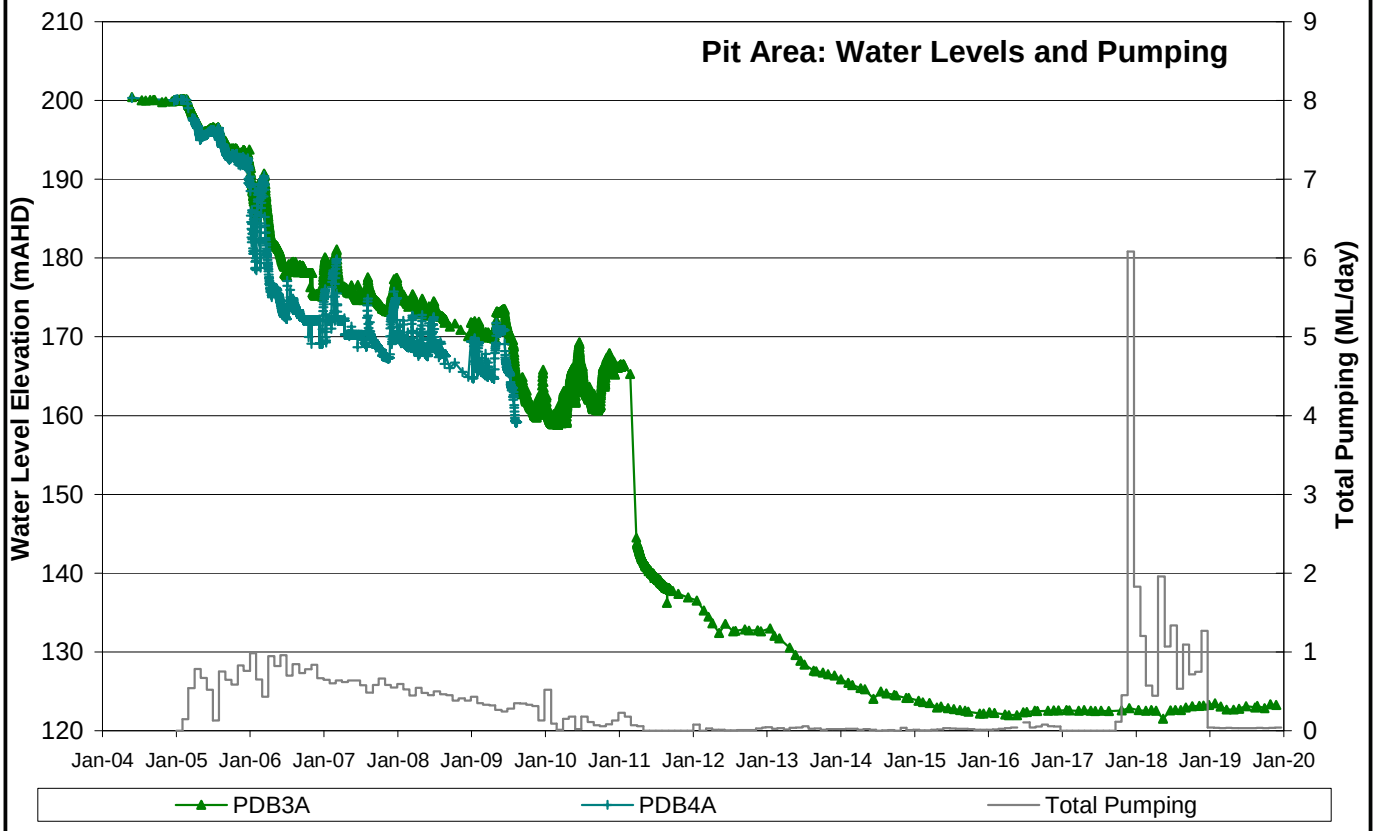
ANNUAL REVIEW 2019

FIGURE 13b

Shallow Groundwater Contours

Evolution Mining Cowal





Source: Coffey Geotechnics Pty Ltd (2020)

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FIGURE 14

Standing Water Levels Measured During the Reporting Period

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Legend
Mining Lease Boundary (ML1791)
Mining_Lease_Bou...
Stockpile Boundary
Subsoil
Topsoil
ML1535
Travelling Stock Reserve
Topsoil 26
Topsoil 23
Topsoil 19
Topsoil 10
Topsoil 23 West
D1
LAKE COWAL
Northern Waste Rock Emplacement
Temporary Isolation Bund
Topsoil 20 South
Subsoil 07
Northern Tailings Storage facility
TSF Rock Stockpile
Lake Protection Bund
Mineralised Waste
Topsoil 07
Topsoil 02C
Topsoil 06
Clay Sockpile
Topsoil 12
ROM Pad
Low Grade Ore
Open Pit
Hard Oxide Ore
Perimeter Waste Rock Emplacement
Bland Creek Palaeochannel Borefield and Eastern Saline Borefield (approx. 20km)
LG SOX
Clay Sockpile
ROM Pad
D3
Topsoil 01
Subsoil 01
D2
D6
Clay Stockpiles
Service Corridor
Process Plant
D5
Soft Oxide Ore
ROM 6
Subsoil 02
Topsoil 03
D8B
Topsoil 08
D9
Southern Tailings Storage facility
Subsoil 04
Topsoil 04
Topsoil 02B
Southern Waste Rock Emplacement
Topsoil 13
Topsoil 02A
Subsoil 03
D4
Saline Groundwater Supply Bores
Topsoil 27
Topsoil 14B
Pipeline
Topsoil 22
Topsoil 15
Stilling Basin and Outfall
Southern Topsoil Stockpile
Topsoil 14A
Travelling Stock Reserve
Exploration Facility
Electricity Transmission Line
WEST WYALONG
BURCHER
RAILWAY
0
0.5
1
Kilometers
GRID DATUM MGA94 ZONE 55
Source: Evolution Orthophoto September 2019
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FIGURE 15
Indicative Location of Soil Stockpiles - December 2019
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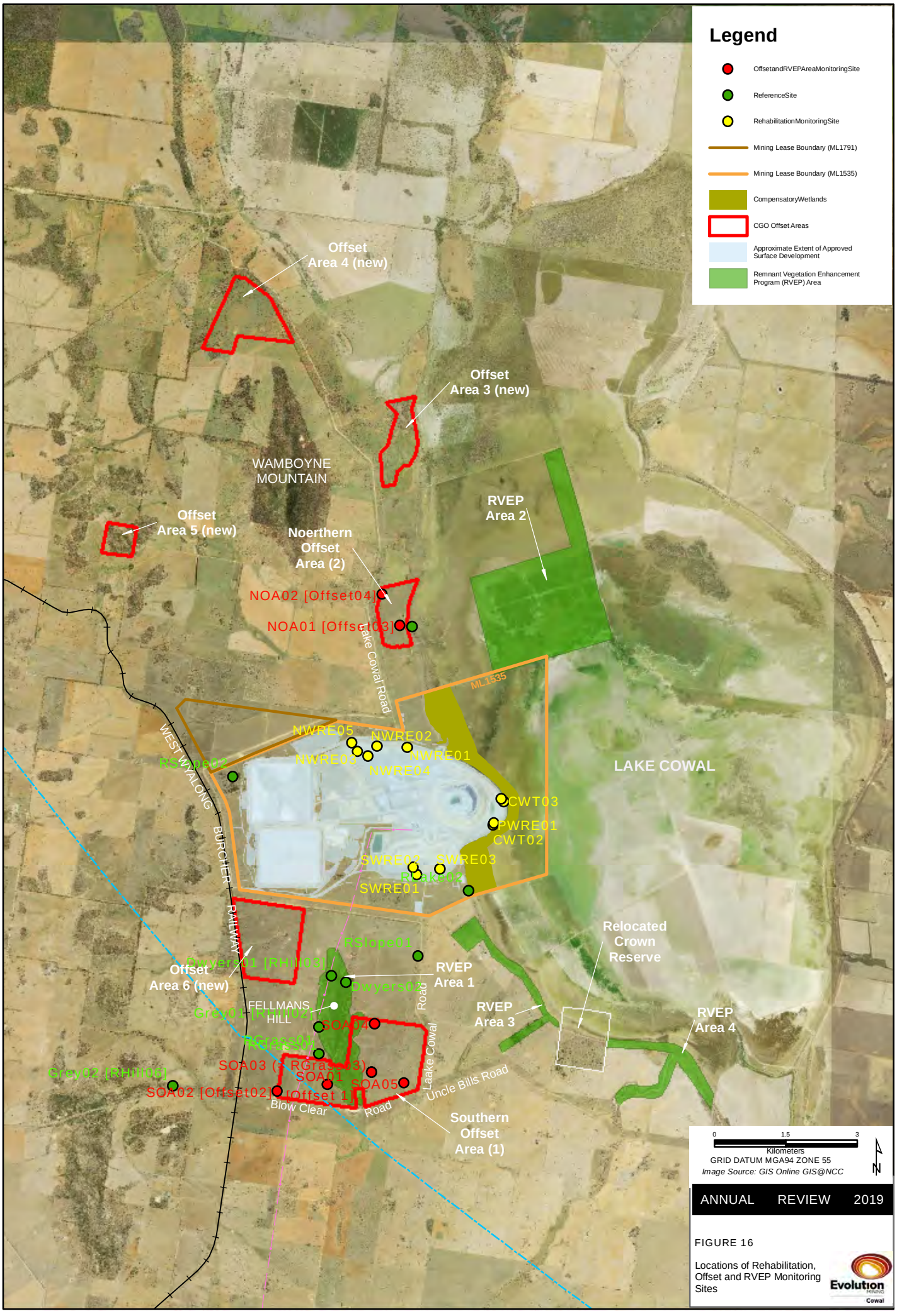
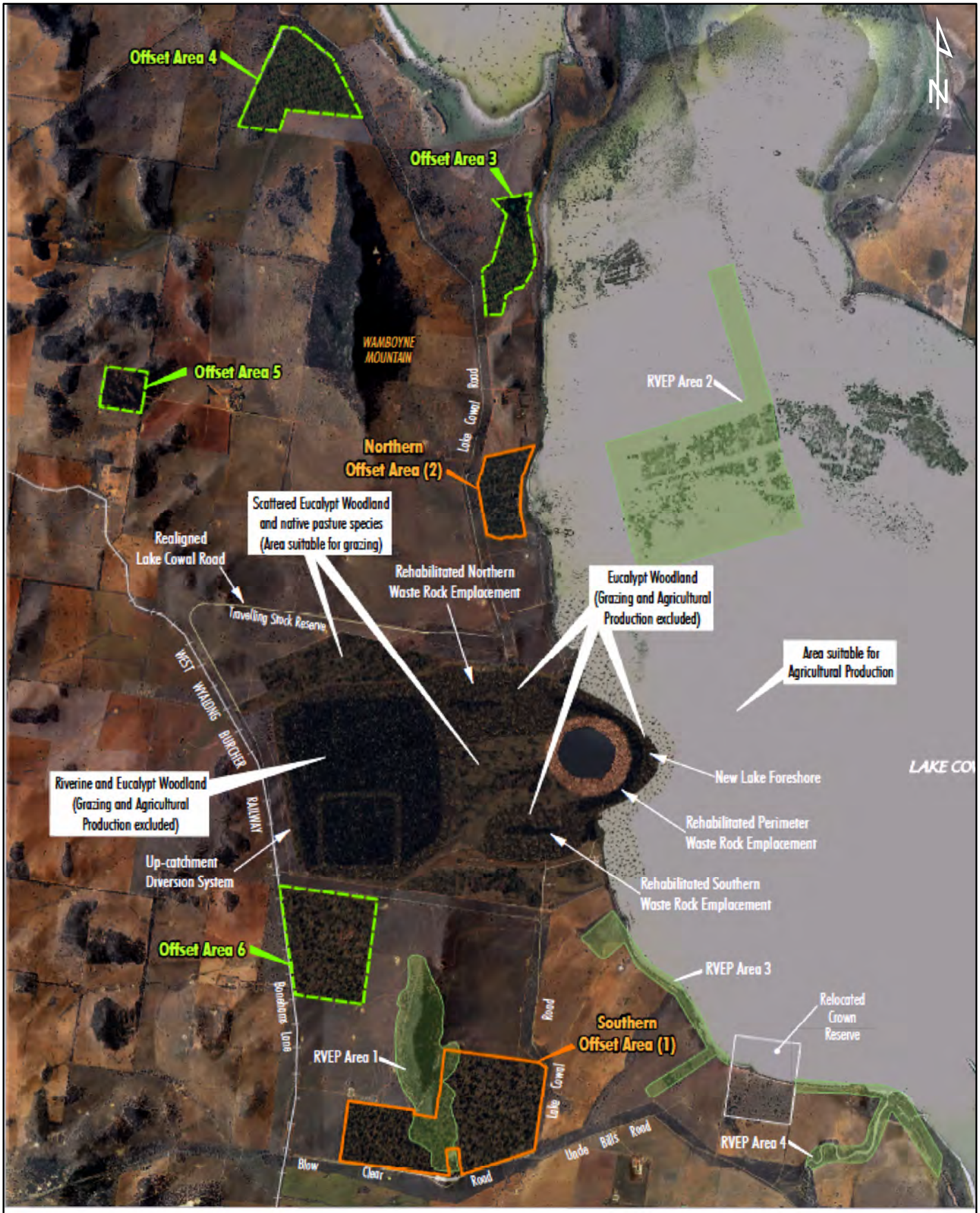

Legend
OffsetandRVEPAreaMonitoringSite
ReferenceSite
RehabilitationMonitoringSite
Mining Lease Boundary (ML1791)
Mining Lease Boundary (ML1535)
CompensatoryWetlands
CGO Offset Areas
Approximate Extent of Approved Surface Development
Remnant Vegetation Enhancement Program (RVEP) Area
Offset Area 4 (new)
Offset Area 3 (new)
WAMBOYNE MOUNTAIN
Offset Area 5 (new)
Noerthern Offset Area (2)
RVEP Area 2
NOA02 [Offset04]
NOA01 [Offset03]
Lake Cowal Road
ML1535
NWRE05
NWRE02
NWRE03
NWRE01
NWRE04
RSlope02
LAKE COWAL
CWT03
PWRE01
CWT02
SWRE02
SWRE03
RLake02
SWRE01
WEST WALLAROO
BURCHER
RAILWAY
RSlope01
Dwyers01 [RHill03]
Offset Area 6 (new)
RVEP Area 1
Dwyers02
Relocated Crown Reserve
FELLMANS HILL
Grey01 [RHill02]
SOA04
RVEP Area 3
RVEP Area 4
RGrass01
RGrass02
SOA03 (+RGrass03)
Grey02 [RHill06]
SOA01
SOA05
SOA02 [Offset02]
Offset 1
Blow Clear
Road
Laake Cowal Road
Uncle Bills Road
Southern Offset Area (1)
0
1.5
3
Kilometers
GRID DATUM MGA94 ZONE 55
Image Source: GIS Online GIS@NCC
N
ANNUAL REVIEW 2019
FIGURE 16
Locations of Rehabilitation, Offset and RVEP Monitoring Sites
Evolution MINING
Cowal



GRID DATUM MGA94 ZONE 55
Source: Evolution Orthophoto October 2017

FIGURE 17
Conceptual Final Landform and Proposed Final Land Use Areas

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