COWAL GOLD OPERATIONS

2018 ANNUAL REVIEW

COWAL GOLD OPERATIONS
2018 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*
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*
Name of Holder of Water Licences	*Evolution Mining (Cowal) Pty Limited*
MOP Start Date (1)	*1 September 2016*
MOP End Date (1)	*31 August 2018 (extended to 1 January 2019)*
MOP Start Date (2)	*1 January 2019*
MOP End Date (2)	*31 December 2019*
Annual Review Start Date	*1 January 2018*
Annual Review End Date	*31 December 2018*

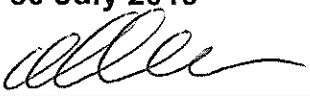
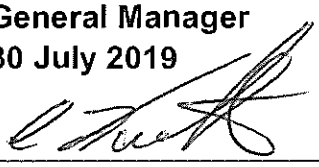
I, Craig Fawcett, certify that this audit report is a true and accurate record of the compliance status of the Cowal Gold Operations for the period 1 January – 31 December 2018 and that I am authorised to make this statement on behalf of Evolution Mining (Cowal) Pty Limited.

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	*Craig Fawcett*
Title of Authorised Reporting Officer	*General Manager*
Signature of Authorised Reporting Officer	
Date	*30 July 2019*

Prepared by	
Name	**Danielle Wallace**
Title	**Superintendent - Environment & Social Responsibility**
Date	**30 July 2019**
Signature	
Reviewed by	
Name	**Craig Fawcett**
Title	**General Manager**
Date	**30 July 2019**
Signature	

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Issued to	**Steve O'Donoghue – Department of Planning, Industry and Environment**
Date	**30 July 2019**

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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 2018) is provided in Tables 1a and 1b.

Table 1a: Statement of Compliance

Were all conditions of the relevant approval(s) complied with?	
Development Consent DA 14/98	NO
Environmental Protection Licence (EPL) 11912	NO
Mining Lease (ML) 1535	YES

Table 1b: Summary of Non-Compliances

Relevant Approval Instrument/Condition	Condition Description Summary	Compliance Status
Condition 1.3 of Development Consent DA 14/98	Requirements for all new buildings and structures to be constructed in accordance with the Building Code of Australia.	NC
Condition 3.4(d) of Development Consent DA 14/98	Condition in relation to Conservation Bond requirements.	ANC
Condition 5.5 of Development Consent DA 14/98	Requirement to dispose of all solid waste and putrescible matter from the site.	NC
Condition 6.5(b) of Development Consent DA 14/98	Operating conditions in relation to visual and off-site lighting impacts.	NC
Condition L4.1 of EPL 11912	Operating conditions relating to noise criteria.	ANC
Condition O2.2 of EPL 11912	Condition relating to ensuring employees and contractors are aware of responsibilities and liabilities under the NSW Protection of the Environment Operations Act, 1997.	NC
Condition 3.1(a) of Development Consent DA 14/98	Condition relating to Heritage Management Plan.	ANC
Condition L3.1 of EPL 11912	Condition relating to Heritage Waste and Chemical Management Plan.	ANC
Condition L3.2 of EPL 11912	Condition relating to Heritage Waste and Chemical Management Plan.	ANC

Further details relating to the non-compliances identified in Table 1b, including Evolution's responses, are provided in Section 10.

2 INTRODUCTION

The 2018 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 October 2018 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:

Craig Fawcett
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Danielle Wallace
Superintendent - Environment & Social Responsibility
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Email: Danielle.Wallace@evolutionmining.com.au

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

Street Address
Lake Cowal Road
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
Development Consent (DA 14/98)	DP&E	26/02/1999	31/12/2024	4/10/2018	Modification 14 (processing rate increase modification) was approved on 4 October 2018.
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
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
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 of Hazardous Materials Study addendum (hydrochloric acid, sulphuric acid, caustic soda, sodium cyanide, ammonium nitrate and ammonium nitrate emulsion) (approved July 2018);
- Cyanide Management Plan (approved July 2018);
- Noise Management Plan (approved July 2018);
- Erosion and Sediment Control Management Plan (approved July 2018);
- Environmental Management Strategy (approved July 2018);
- Surface Water, Groundwater, Meteorological, Biological Monitoring Programme (approved July 2018);
- Lake Protection Bund, Water Storage and Tailings Structures and Pit Void Walls Monitoring Program (approved July 2018);
- Water Management Plan (approved July 2018);

- Hazardous Waste and Chemical Management Plan (approved July 2018); and
- Emergency Response Plan (approved July 2018).

In addition, the Rehabilitation Management Plan (RMP) was submitted to the DRG in August 2018 and December 2018 (as part of amendments to the Mining Operations Plan [MOP]).

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	2017 AR	2018 AR	2019 AR (Forecast)
Ore (t)	N/A	9,236,053	7,119,947	4,420,339
Mineralised Waste (t)	N/A	1,186,787	670,907	1,027,971
Waste Rock (t)	N/A	5,074,806	24,404,148	16,875,875
Northern Waste Rock Emplacement (NWRE) (m AHD)	308[1]	268[3]	268[3]	278[3]
Southern Waste Rock Emplacement (SWRE) (m AHD)	283[1]	278	278	278
Perimeter Waste Rock Emplacement (PWRE) (m AHD)	233[1]	209	209	209
Tailings Storage Facilities (TSFs)				
Northern TSF (NTSF) (m AHD)	264[1]	236	236	240.5
Southern TSF (STSF) (m AHD)	272[1]	244	243.7	243.7
Mill Throughput (Mtpa)	7.5[2]	7.4	7.94	8.26
Saleable Product (oz)	N/A	259,480	244,217	253,767

[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 the reporting period occurred in Stage G and from Relative Level (RL) 875 metres (m) to RL 831m, representing a vertical advance of 44 m. Mining also occurred in the open pit in Stage H during the reporting period.

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 2018.

Waste rock mined from the open pit was stockpiled for the STSF Stage 6 and NTSF Stage 6 lift works, and outer slope rehabilitation on the waste emplacements. Rock buttressing associated with the Stage 6 STSF and Stage 6 NTSF lift occurred during 2018 using ROM waste rock.

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 STSF Stage 6 lift and NTSF Stage 6 lift Monday – Sunday during the permitted hours. The STSF Stage 6 lift was completed in March 2018 and NTSF Stage 6 construction commenced in August 2018.

The Stage H cutback resulted in an expansion to the E42 pit during the reporting period. This led to an increase in the open pit circumference, fleet size, material movement, NWRE footprint and volume of material stockpiled.

Mining operations will continue in both Stages G and H during the 2019 reporting period, including development associated with MOD14 and the GRE46 exploration decline.

4.1.2 Processing

Processing continued throughout the reporting period. No changes to the processing operation took place during the reporting period. Construction of the floats tail leach circuit upgrades within the process plant were near completion by the end of the reporting period, with successful commissioning of some components carried out toward the end of the reporting period.

Tailings were deposited into the Stage 5 lift (4th augmentation) of the NTSF from 1 January to 22 April 2018 when the seepage event was identified on the downstream face of Stage 5 lift (4th augmentation) (further detail is provided in relation to this incident in Section 6.6.4). Tailings deposition was switched to the Stage 6 lift (5th Augmentation) of the STSF from the 22nd April until switching to the Stage 5 lift (4th augmentation) of the NTSF on the 20th Sept 2018, following repairs. Completion of deposition on Stage 5 lift (4th Augmentation) of the NTSF occurred on the 28th Nov, with tailings deposition switched back to the Stage 6 lift (5th Augmentation) of the STSF for the remainder of the period. Construction works started on the Stage 6 lift (5th augmentation) of the NTSF in the reporting 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 2019, 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 92,829 m of drilling was completed within ML 1535 during the reporting period including:

- A total of 1,884 holes for 48,364m in-pit RC drilling.
- A total of 82 holes for 43,798m diamond drilling.
- A total of 10 holes for 667m air core drilling.

A vast majority of the diamond drilling was conducted from collar locations within the active mining areas of the CGO, leading to no additional ground disturbance. 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 2019, and is outlined in the currently approved MOP. Geotechnical and underground drilling are also proposed to be undertaken during 2019.

4.3 HAZARD AUDIT

The next Hazard Audit is scheduled for 2019.

5 ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

The 2017 AR meeting was held on 18 September 2018 at the CGO. There were no actions arising from this meeting. No additional directions were given during site visits within the reporting period.

The Independent Monitoring Panel for the Cowal Gold Project completed a review in November 2017 and provided several recommendations in their Thirteenth Annual Report. These recommendations are summarised below with the CGO responses (relevant to the 2018 reporting period), with further details on the Evolution Mining CGO website: https://evolutionmining.com.au

Summary of Recommendations and CGO Responses:

1. *Direct seeding trial ongoing monitoring and review*: reviews are underway and will continue annually. The review in December 2017 by DnA Environment indicated that the application of seed directly onto freshly prepared rehabilitation areas that have a rocky soil surface resulted in higher establishment. Should a review indicate that future treatments are necessary, CGO will take appropriate action to ensure implementation of required additional actions.

2. *Substrate Profile Trial implementation at the SWRE*: this trial is to be undertaken when the SWRE has reached its final height.

3. *Reporting of metal concentrations in dust samples in the 2017 Annual Review*: there is no requirement for monitoring of metals in dust in either EPL 11912 or the currently approved CGO Air Quality Management Plan (2015). As a result, Evolution will no longer report metal concentrations in dust samples.

4. *Implement 'Effective Rehabilitation' as a KPI for a senior mining department decision maker*: Targeted rehabilitation areas are included in the mining operations weekly plan which ensures project completion, timelines and accountability for all personnel involved.

5. *Ensure SOPS for revegetation are followed and procedures in place to cover gaps in staff capability to deliver rehabilitation activities*: Additional Environmental team resources have been incorporated at CGO and Evolution will continue to consult with DRG in the coming months regarding rehabilitation commitments in future Mining Operations Plans.

6. *Application for removal of the requirement to conduct an annual Austral Pilwort survey*: Monitoring results since 2012 have not detected the presence of Austral Pilwort and Evolution proposes to consult with OEH in relation to the potential removal of this requirement.

7. *CGM to explore a coordinated approach to Lippia control around Lake Cowal with Council and the Lake Cowal Foundation*: Evolution will seek to consult with the Bland Shire Council and Lake Cowal Foundation to assist in further controlling Lippia on Evolution-owned land with frontage to Lake Cowal.

8. *CGM to record the IMP's recommendations in the 2017 Annual Review*: completed.

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

The 2018 Independent Environmental Audit (IEA) was conducted between 1 and 4 April 2019 by Mr Oliver Moore and Ms Wei-Lin Chem Yi Mei of Environmental Resources Management Australia Pty Ltd (ERM) to assess compliance with the requirements of the CGO's relevant approvals, licences and EMPs. The IEA results generally confirmed a high degree of compliance with the Development Consent conditions, EPL 11912 conditions and requirements of the Conditions of Authority for ML 1535. The 2018 IEA is provided on Evolution's website - http://evolutionmining.com.au/cowal/.

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 2017 to 22 December 2018 reporting period was submitted to the EPA on 20 February 2018. In the 2018 Annual Return, Evolution identified non-compliances related to monitoring not being undertaken at some surface water, dust and blast monitoring points. The reasons for the non-compliances included no water present at sample locations, broken sample jars during transit, equipment faults etc. 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 199.6 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 2018 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 2018 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 ($\mu g/m^3$).

Table 5: Monthly Rainfall Measured at CGO AWS 2010 – 2018

Month	2010 (mm)	2011 (mm)	2012 (mm)	2013 (mm)	2014 (mm)	2015 (mm)	2016 (mm)	2017 (mm)	2018 (mm)
January	2.8	24.4	26.6	5.20	32.0	75.8	67.0	24.8	21.0
February	95.6	138.6	129.2	26.0	23.2	11.0	1.4	8.6	3.6
March	44.6	146.2	78.0	45.4	71.0	0.4	16.8	45.4	1.2
April	50.6	20.2	15.6	3.4	20.2	56.8	11.4	18.6	7.8
May	40.0	22.0	32.6	30.4	21.2	12.8	61.8	31.0	22.0
June	22.8	29.4	29.6	87.8	59.4	27.2	122.6	7.6	40.0
July	62.2	11.8	49.8	33.4	9.0	77.2	72.6	27.8	2.2
August	34.0	41.8	19.0	18.8	10.8	49.0	31.2	22.4	4.4
September	64.2	13.8	25.0	60.4	16.8	8.6	136.8	0.8	4.2
October	94.0	31.0	16.0	7.2	15.2	52.6	28.8	38.0	30.4
November	60.2	130.4	36.4	9.0	1.6	24.6	28.0	50.6	38.0
December	111.7	135.0	27.0	14.6	48.4	19.2	24.8	123.8	24.8
TOTAL	**682.7**	**744.6**	**484.8**	**341.6**	**328.8**	**415.2**	**603.2**	**399.4**	**199.6**

Table 6: Monthly Average Meteorological Data (2018)

Aspect	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Mean Humidity (%)	38.5	35.4	36.3	41.3	61.6	71.0	64.8	54.6	44.1	44.4	50.2	47.6
Mean Pressure (mbar)	984.8	986.6	990.0	991.4	996.3	996.6	993.1	990.9	993.4	990.8	985.5	985.0
Mean Wind Direction (o)	136	152	157	181	188	156	199	216	189	153	206	174
Mean Wind Velocity (m/s) 15min	3.5	3.7	3.5	2.7	2.9	2.6	2.5	3.3	3.2	3.4	3.9	3.8
2m Temp Min (oC)	18.4	17.0	14.6	12.2	6.1	3.3	1.9	2.8	4.9	10.1	13.7	18.5
2m Temp Max (oC)	37.6	35.7	33.7	31.3	21.1	17.7	17.5	18.4	23.8	29.0	30.4	35.7

% - percentage; mbar – millibar; m/s – metres per second; ° – degrees; °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/m³ [2]
Particulate matter < 10 µm (PM_{10})	Annual	25 µg/m³ [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/m³ [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 is well below the EPA (2001) assessment criterion for TSP matter (90 micrograms per cubic metre [µg/m^3]). Compared to previous years, the mean TSP level in 2018 (53 µg/m^3) was appreciably higher than those of previous years between 2010 and 2017 (27–63 µg/m^3), reflecting the heightened (likely drought-related) dust storm activity across NSW in 2018. For three of the reportable sampling periods in 2018, the 7-day TSP value exceeded 90 µg/m^3) including April, November and December 2018.

As a consequence of a number of missing data points across 2018 (technical issues), the seasonality of the TSP data is somewhat difficult to assess, but between July and mid-October (winter, early spring) the mean TSP value was only 39 µg/m^3, compared to 64 µg/m^{3}through April and May, and 70 µg/m^{3}through November and December. Notably, there were dust storms observed at CGO in April, late July, late August, November and late December. For the January to April period, the DustWatch reports indicated substantial dust activity around West Wyalong due to both far-travelled dust storms and also dust raised from "local dryland cropping paddocks" (DustWatch, 2018a,b,c). The highest TSP value in November (137 µg/m^3), coincided with a dust storm event that commenced in western NSW (DustWatch, 2018e), while the second-highest TSP value of 126 µg/m^{3}coincided with another widespread dust event across western NSW in early April (DustWatch, 2018c).

A number of technical issues affected the performance of the HVAS during the reporting period, including power outages, external lab errors and unit faults. These issues were reported in the 2018 Annual Return submitted to the EPA.

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 53 µg/m^3 (University of Sydney, 2018). Accordingly, the annual average PM_{10} is calculated at 21µg/m^3, below the 25µg/m^3 long term impact assessment criteria (Table 8).

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 twice during the reporting period with results of 54.8 and 50.4 both exceedances occurred during recorded high wind dust storm days.

Deposited Dust

A detailed discussion of the dust monitoring results (including laboratory analysis of dust results) is provided in the University of Sydney's (2018) *Interpretation and Discussion of 2018 Air Quality Monitoring Results Cowal Gold Operations*. Plate 1 includes a photograph of a depositional dust gauge within Lake Cowal A summary of the key findings is provided below and in Table 10 (University of Sydney, 2018):

- Temporal and spatial variation in reported monthly dust deposition was moderately strong during 2018. Monthly deposition of 10 g insoluble solids/m^2 was exceeded 11 times in 2018, across four different months and across nine different gauges.
- Changes in monthly dust deposition rates were strongly correlated with season for most of the gauges, with the highest average dust deposition occurring in the late spring and summer months, and the lowest occurring during autumn and winter. Monthly dust deposition rates averaged across all gauges ranged from 1.7 to 9.7 g/m^2, and in the January, October, November and December sampling periods the majority of gauges receive relatively high rates of deposition.
- Compliance with the assessment criterion of 4 g/m^2/month average annual deposited dust was achieved at four out of the seven compliance gauges located outside of the ML 1535 during 2018. Of these four, two (*DG1*, *DG9*) were located at residences.
- Of the three remaining compliance gauges external to the ML that exceeded the assessment criterion of 4 g/m^2/month, the cause of the exceedances can largely be attributed to substantial deposits (>10 g/m^2/month) in the January and/or November sampling periods (caused by factors external to the CGO). The *DG6* gauge received 15.3 g/m^2/month during the November sampling period, the *DG7* gauge received 11.5 and 18.0 g/m^2/month, respectively, during the January and November sampling periods, and the *I5* gauge received 16.2 g/m^2/month during the November sampling period.
- In addition, the final compliance dust gauge within ML 1535 (Site 52) recorded an exceedance of the average dust deposition assessment criterion. At Site 52, the exceedance was largely due to deposits of 10.7 and 9.2 g/m^2/month in January and November, respectively.

Temporal and spatial variation in reported monthly dust deposition was moderately strong during 2018. The average dust deposition rate across all gauges in 2018 was 4.1 g/m^2/month, compared to 3.8 g/m^2/month in 2017, 2.7 g/m^2/month in 2015 and 2.8 g/m^2/month in 2014. This larger average deposition rate for 2018 can be partially explained by increased dust storm activity in the region in 2018, 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. However, despite this the average dust deposition rate across all compliance gauges in 2018 was 4.0 g/m^2/month.

Plate 1: Elevated Depositional Dust Gauge within Lake Cowal

Table 10: Monthly and Mean Dust (Insoluble Solids) Deposition Rates (2018)

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	3.3	1.2	1.4	1.5	1.4	0.3	0.7	1.1	0.3	1.0	6.5	2.4	1.8
DG6	3.8	1.5	3.5	1.3	6.1	0.7	0.7	1.8	7.0	1.4	15.3	8.5	4.3
DG7	11.5	8.6	0.9	1.0	1.2	4.3	2.0	8.2	4.8	5.7	18.0	5.3	6.0
DG9	5.0	1.5	1.6	2.0	2.3	0.4	4.2	1.8	0.2	12.9	7.5	2.1	3.5
DG11	5.1	4.8	3.6	1.3	6.7	5.9	4.6	3.0	6.2	9.9	4.4	2.6	4.8
DG12	15.1	6.5	2.5	3.9	4.1	2.3	6.1	8.1	5.8	7.0	7.9	7.4	6.4
DG13	14.5	1.8	1.1	2.0	1.8	0.7	1.0	1.4	1.0	2.8	1.7	9.3	3.3
DG14	7.5	2.7	1.1	1.7	1.2	0.5	0.7	1.4	0.6	1.4	8.4	3.5	2.6
McLintock's Shed*	9.2	1.8	–	2.0	2.7	1.0	0.8	1.2	0.9	5.3	10.1	7.8	3.9
Site Office	6.0	1.8	11.7	2.2	1.2	1.2	2.2	1.3	0.3	1.0	10.9	3.7	3.6
Site 52	10.7	4.0	2.3	1.9	5.3	1.3	3.6	3.5	4.3	3.1	9.2	2.9	4.3
I5*	5.8	1.3	2.1	–	2.9	1.5	5.7	5.7	3.3	6.9	16.2	4.2	5.1
Mean	8.1	3.1	2.9	1.9	3.1	1.7	2.7	3.2	2.9	4.9	9.7	5.0	

* The March 2018 sample for McLintock's Shed and the April 2018 sample for I5 were both destroyed in transit to the laboratory.

The gauges *DG1*, *DG6*, *DG13, DG14* and *Site Office* all received less than 2.0 g/m^2/month for at least six of the 12 monthly sampling periods, while the gauges *DG7*, *DG11*, *DG12* and *I5* all received more than 4.0 g/m^2/month for six or more of the 12 sampling periods. In four of the monthly sampling periods (January, October, November, December), average dust deposition across all gauges exceeded 4 g/m^2/month. Eleven dust deposits were comprised of 10 g/m^2/month or more in 2018; of these, seven contained an organic component comprising more than 50% of the deposit, suggesting 'contamination' by insects, bird droppings and vegetative matter (straw).

Changes in monthly dust deposition rates were strongly correlated with season for most of the gauges, with the highest average dust deposition occurring in the late spring and summer months (i.e. January, October, November and December). The two gauges with the least seasonality in deposited dust amounts were *DG11* and *DG12*, which experienced moderate to high dust deposits across most of the year, including winter.

The University of Sydney (2018 review has concluded that the relatively high amounts of dust deposited at gauges in January, November and December 2018 are likely due to the heightened dust storm activity.

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	2018 Monitoring Results	Predicted Result at Coniston[1]	Development Consent Air Quality Impact Assessment Criteria
Maximum 24 Hour Average PM_{10}	54.8 µg/m^3	28.8 µg/m^3	50 µg/m^3
Annual Average PM_{10}	21.0 µg/m^3	3.7 µg/m^3	25 µg/m^3
TSP	52.6 µg/m^3	3.9 µg/m^3	90 µg/m^3
Depositional Dust[2]	4 g/m^2/month	0.16 g/m^2/month	4 g/m^2/month

[1] Source: PEL (2013).

[2] Compliance gauges only.

Monitoring data records from the HVAS recorded influence from local environmental factors (i.e. strong winds) and other off-site influences (i.e. dust generation from ploughing and dust storm activity) 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 twice during the reporting period, these occurred during recorded dust storms 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

There were no reportable incidents during the reporting period.

6.1.4 Further Improvements

The key recommendations of the University of Sydney's (2018) review are summarised as follows:

- Given that the three-monthly duplicate dust 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 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, five 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 were 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. The three (3) lake monitoring locations (BM04.1, BM05, BM09.1) were non-operational during 2018 after being destroyed by rising water in 2016 (and hence have not been included on Figure 7).

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 reporting period there were two instances where units were offline for more than 24 hours, including the following:

- The monitoring unit at BM01 (Gumbelah residence) was offline on 4 September 2018.
- On 21 December a blast was fired at 11:29:54 which coincided with the scheduled daily monitor report time of 11:30. This resulted in all of the units recording vibration only, with no air overpressure results recorded.

6.2.2.2 Performance Outcomes

Ground Vibration

A total of 269 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. The maximum vibration level recorded coinciding with a blast time in the monitoring period was at BM02 – Hillgrove residence on 8 January 2018 (1.24 mm/s), however after further detailed analysis this was found to be unrelated to the blast.

Air Overpressure

Following a detailed review of overpressure results for events that were above the compliance levels, one event was identified as being blast related. This represents only 0.37% of the total blasts for the reporting period. All other peak levels above the compliance limitations were affected by localised environmental factors and were not distinguishable above background levels.

Of the 49 events that exceeded compliance levels, only one of these was assessed to be related to blasting practices, with the other 48 of these identified as localised environmental factors such as wind. This has been identified by the extended durations of high overpressure readings within the 30 minute histogram blast window (Saros, 2019). The majority of the exceedances identified at blast times were related to the Sundays' and Public Holidays' compliance limit of 95 dB(L).

Out of a total of 269 blasts during the reporting period:

- no blast related events exceeded the maximum compliance level of 120dB(L);
- no blast related events exceeded the 115dB(L) level on normal weekdays and Saturdays; and
- a total of one event or 0.37% of the total blasts exceeded the 95dB(L) level on Sundays and Public Holidays (Table 13).

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

Table 13: Blasting Impact Exceedances

Monitoring Location	Date	Time	Level		Compliance Limit	Comments
			PPV mm/s	O' Press dB(L)		
BM01 - Gumbelah Residence	6/05/2018	12:30:24	0.10	97.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove Residence	6/05/2018	12:30:24	0.12	97.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	6/05/2018	12:30:24	0.06	97.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM01 - Gumbelah Residence	3/06/2018	12:31:13	0.10	103.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove Residence	3/06/2018	12:31:13	0.13	97.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	3/06/2018	12:31:13	0.04	102.8	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	1/07/2018	15:11:20	0.03	95.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM01 - Gumbelah Residence	8/07/2018	12:35:42	0.10	97.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove Residence	8/07/2018	12:35:42	0.15	102.8	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	8/07/2018	12:35:42	0.03	106.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM01 - Gumbelah Residence	15/07/2018	12:30:17	0.10	95.9	95dB(L) - Sundays' and Public Holidays	Likely blast related.
BM02 - Hillgrove Residence	29/07/2018	12:27:14	0.15	97.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	29/07/2018	12:27:14	0.03	97.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove Residence	3/08/2018	12:25:23	0.19	122.2	115dB(L) -Compliance Limit	Not blast related, Localised enviromental factors likely.
BM01 - Gumbelah Residence	5/08/2018	12:28:22	0.12	101.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove Residence	5/08/2018	12:28:22	0.13	103.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM01 - Gumbelah Residence	5/08/2018	12:48:15	0.1	100.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove Residence	5/08/2018	12:48:15	0.13	101.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM03 - Coniston Residence	5/08/2018	12:48:15	0.11	98.8	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	5/08/2018	12:48:15	0.03	95.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM01 - Gumbelah Residence	6/08/2018	12:31:48	0.11	104.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove Residence	6/08/2018	12:31:48	0.15	112.6	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM03 - Coniston Residence	6/08/2018	12:31:48	0.12	95.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	6/08/2018	12:31:48	0.05	114.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.

Table 13 (Continued): Blasting Impact Exceedances

Monitoring Location	Date	Time	Level		Compliance Limit	Comments
			PPV mm/s	O' Press dB(L)		
BM02 - Hillgrove Residence	12/08/2018	12:38:31	0.18	102.8	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM03 - Coniston Residence	12/08/2018	12:38:31	0.26	97.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	12/08/2018	12:38:31	0.1	95.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	18/08/2018	12:49:29	0.06	116.3	115dB(L) -Compliance Limit	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove Residence	9/09/2018	12:32:03	0.15	101.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	9/09/2018	12:32:03	0.08	105.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove Residence	16/09/2018	12:23:05	0.13	97.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM03 - Coniston Residence	16/09/2018	12:23:05	0.11	100.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	16/09/2018	12:23:05	0.03	97.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove Residence	1/10/2018	12:40:44	0.13	95.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	1/10/2018	12:40:44	0.03	95.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	21/10/2018	12:23:45	0.07	95.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	4/11/2018	12:31:24	0.02	95.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	5/11/2018	12:29:47	0.07	116.6	115dB(L) -Compliance Limit	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove Residence	18/11/2018	12:25:36	0.14	97.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	18/11/2018	12:25:36	0.05	97.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove Residence	2/12/2018	12:29:41	0.13	102.8	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM03 - Coniston Residence	2/12/2018	12:29:41	0.09	110.6	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	2/12/2018	12:29:41	0.06	100.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove Residence	16/12/2018	12:40:43	0.14	97.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	25/12/2018	12:16:26	0.04	95.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	26/12/2018	11:03:20	0.03	98.8	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM01 - Gumbelah Residence	30/12/2018	12:32:44	0.07	101.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove Residence	30/12/2018	12:32:44	0.17	102.8	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	30/12/2018	12:32:44	0.10	109.2	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.

Notes: PPV – peak particle velocity.

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.

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 14a below, at any residence on privately-owned land. The noise impact criteria outlined in Table 14a was revised during the reporting period following the approval of MOD14 for the CGO. Accordingly, both sets of criteria have been provided in Table 14b.

Table 14a: Noise Impact Assessment Criteria dB(A) $L_{Aeq\ (15minute)}$

Location (Figure 7)	Day/Evening/Night
Laurel Park, Lakeview III	39
Bramboyne, The Glen and Caloola	38
Lakeview, Foxham Downs II	37
Any other privately-owned residence	35

Note: Table 14a was relevant from 1 January 2018 to 3 October 2018.

Table 14b: MOD 14 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

Note: Table 14b was relevant from 4 October 2018 to 31 December 2018, following approval of MOD14.

As at the end of the reporting period, Evolution had completed noise mitigation works at the Laurel Park, Bramboyne and Westlea properties, and entered into noise mitigation agreements with owners of The Glen.

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, 2018a, 2018b, 2018c, 2018d).

Table 15: Summary of Attended Noise Monitoring Results

Property	January 2017	June 2017	August 2017	November 2017
Laurel Park	D - <20, <20	D - <20, <20	D - <20, <20	D - <20, <20
	E - <20, <20	E - <20, <20	E - 29, 21	E - <20, <20
	N - 20, 20	N - <20, <20	N - 31, 30	N - 17, 17
Lakeview III	D - <20, <20	D - <20, <20	D - 34, 33	D - 15, <20
	E - <20, <20	E - <20, <20	E - 24, 22	E - <20, <20
	N - <20, <20	N - <20, <20	N - 24, 24	N - 15, 15
Bramboyne	D - <20, <20	D - 25, <20	D - 27, 25	D - 18, 20
	E - <20, <20	E - <20, 24	E - 27, 28	E - 18, 18
	N - <20, <20	N - 22, <20	N - 31, 31	N - 20, 19
The Glen	D - <20, <20	D - <20, <20	D - <20, <20	D - <20, <20
	E - <20, <20	E - <20, <20	E - 20, <20	E - <20, <20
	N - <20, <20	N - <20, <20	N - <20, <20	N - <20, <20
Caloola 2	D - <20, <20	D - <20, <20	D - 30, 29	D - 30, 25
	E - <20, <20	E - <20, <20	E - 24, 24	E - <20, <20
	N - 23, 24	N - 23, 20	N - 20, 20	N - 18, 21
Lakeview	D - <20, <20	D - <20, <20	D - 34, 33	D - 15, <20
	E - <20, <20	E - 22, <20	E - 24, 22	E - <20, <20
	N - 20, 20	N - <20, <20	N - 24, 24	N - 15, 15
Foxham Downs II	D - <20, <20	D - <20, <20	D - 29, 28	D - <20, <20
	E - 20, <20	E - 21, <20	E - 27, 27	E - <20, <20
	N - 18, 20	N - <20, <20	N - 22, 22	N - 16, 20

Source: Spectrum Acoustics (2018a, 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 16 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 16: 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)	MOD14 - Noise Impact Assessment Criteria defined in Development Consent Condition 6.4(c)*
Laurel Park	37	37	35
Bramboyne	36	36	35
Bungabulla	35	36	35
The Glen	36	36	37
Gumbelah	35	36	35

Source: SLR (2013).

* Criteria relevant from 4 October 2018 to 31 December 2018, following approval of MOD14.

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 17.

Table 17: 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 18.

Table 18: 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 18 (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 stabilization.
Monitoring and Maintenance	• Water quality monitoring in accordance with the Surface Water, Groundwater, Meteorological and Biological Monitoring Programme (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, 2018a).

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 also reported 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 19.

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.

All groundwater results for cyanide during the reporting period remained below the laboratory detection limit.

Table 19 : 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	61	1.2	13.8
Twice daily	February	56	1.1	10.6
Twice daily	March	49	0.3	14.0
Twice daily	April	58	1.1	11.2
Twice daily	May	58	1.1	11.2
Twice daily	June	49	0.2	5.5
Twice daily	July	62	1.3	6.8
Twice daily	August	54	0.6	9.8
Twice daily	September	60	2.0	6.7
Twice daily	October	62	0.5	12.8
Twice daily	November	60	1.3	11.0
Twice daily	December	50	0	9.6

6.6.3 Reportable Incidents

On 21 April 2018, during a routine inspection of the Northern Tailings Storage Facility (NTSF), it was noted that there was minor seepage on the eastern bank. The seepage occurred at the toe of the most recent lift at the time (NTSF lift 5) and was captured by the berm at the bottom of this lift, meaning the seepage was contained on the NTSF wall. The seepage extended approximately 200m and was predominately comprised of water with some tailings slurry material and clay.

Immediate actions taken following the identification of the incident were as follows:

- The processing plant was immediately shut down and pumping to the NTSF was ceased.
- The location was monitored 24hr/day to ensure no further seepage.
- An investigation into the cause of the seepage was commenced.
- CGO completed the regulatory notifications, initially verbally followed by written notification to DP&E, EPA, DRG, DPI (Water) and Dam Safety Committee NSW.
- CGO moved tailing pumping to the Southern Tailings Storage Facility (STSF).

A number of agencies undertook a site visit to inspect the incident location, including EPA, mine inspectors, DPE and Resources Regulator.

The EPA advised CGO on 3 May 2018 (ref. DOC18/249317-02) that it was satisfied with the actions taken by CGO and only required the investigation findings be submitted for review.

CGO also received a Section 240(1)(c) notice from DP&E on 14 May 2018 (ref. DI 0684 2018) which also required an investigation to be carried out and a report to be developed by 30 June 2018.

The investigation undertaken determined that the seepage occurred due to the design of spigot which caused the clay lining of the NTSF to be eroded away and thus leading to the seepage event. Following this incident, Evolution updated the spigot design for the pumping occurring into STSF and have been monitoring the improved design which has shown to be successful.

No environmental material harm was caused by this incident.

CGO retained AECOM to conduct an incident investigation and remediation activities associated with the incident which were completed between April and November 2018.

The DPE and Resource Regulator finalised their investigation confirming no breach of the NSW Mining Act 1992 on the 14 August 2018. Correspondence from the EPA (dated 4 February 2019) confirmed that no further action in relation to the incident was required.

No other 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 (2018b) during the reporting period. A summary of the results from this monitoring survey are outlined below.

Compensatory Wetland

Extremely dry conditions extended throughout 2018, including the key growing seasons of autumn and spring, where only 243mm of rainfall was received, which is only slightly more than half the average expected rainfall.

In 2018, the monitoring undertaken at sites CW1, CW2 and GW5 identified that there had not been sufficient time since the water had receded for the vegetation to become well established with total ground cover having decreased since they were last assessed. At these sites ground cover ranged from 16.5% in CW2 to 68% in CW1. Increased ground cover was recorded in CW3 as the native perennial grasses had sufficiently re-established after the lake water had receded to provide 87% cover. In GW1, there was little change in total ground cover with 85%.

During this reporting period there was reduction in floristic diversity in CW1 and GW1 with 32 and 22 species respectively as a result of the ongoing drought conditions.

In 2018, native ground covers continued to be more dominant than exotics and these had increased to provide 91% and 73% of the observed live plant cover respectively. In CW1, CW2 and GW5, exotic annual plants were colonising the recently exposed sites resulting in a decline in the percentage of native plant cover. Nonetheless, native plants continued to be more abundant than exotics, with endemic cover scores of 67%, 60% and 73% respectively.

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.

The data obtained presently do not indicate any adverse effects occurring within the CW areas. Rather, the absence of grazing has promoted extensive regeneration of Duma (Muehlenbeckia) florulenta (Lignum) growing within the lake environment, which were readily observed from the foreshore back in 2009. The mature Lignums have now become well established and are able to provide habitat and nesting sites for a range of migratory birds during the subsequent years that Lake Cowal has been inundated. In the remaining and grazed wetland areas the extent of Duma (Muehlenbeckia) florulenta (Lignum) regeneration has been lower due to a combination of a cultivation history and heavy grazing by livestock.

There have been two significant regeneration events as a result of the flooding and drying of Lake Cowal which resulted in changes in seedling densities. In 2017 seedlings ~ < 2.0m in height had drowned, however with the receding water levels, another new regeneration event was occurring on the otherwise exposed lake sediments. Mature trees had improved in health and have been heavily laden with fruit, flowers and bud and the old growth trees are providing valuable nesting sites. Scattered fallen branches and washed up flood debris continue to provide reptile habitat.

Pilularia novae-hollandiae (Austral Pillwort) Habitat

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. In the Northern Offset Area recent germination of a range of species had occurred as a result of some rainfall just prior to the surveys, with some of these occurring within gilgais that had recently dried out.

During this reporting period, no Austral Pillwort were located (DnA Environmental, 2018c).

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 2018 monitoring undertaken during 22nd - 31st October.

The highest stem densities continued to be recorded in Hill03 which had 51 live individuals recorded this year. This increase from the last reporting period is likely due to the growth and development of the larger shrubs and/or juvenile trees. There was one additional individual in Hill01. 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 RVEP sites the trees included old growth E. camaldulensis (River Red Gum).

Hill01, Hill02 and Hill03 contained numerous trees with small trunk diameters and are indicative of regrowth stands, and there were a range of tree sizes and ages from a series of past recruitment events with occasional old growth trees scattered throughout. Trees in the Hill woodland sites also tended to have multiple limbs. Dead stags were a common feature within the Fellman's Hill woodland sites Hill01, Hill02 and Hill03 with 21 - 48% of the total tree counts being dead. The prolonged dry conditions appear to be having an ongoing affect on tree health, with several 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 2 in Hill01 to a high of 194 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, E. sideroxylon and/or E. microcarpa were also relatively common 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.

This year, only four species were common to three of the six RVEP sites. These included the hardy native perennial sub-shrubs Atriplex semibaccata (Creeping Saltbush) and Sclerolaena muricata (Black Roly Poly) and the native grasses Enteropogon acicularis (Curly Windmill Grass) and Rytidosperma caespitosum (Wallaby Grass).

The particularly dry conditions throughout 2017 and 2018 has resulted in a decline in ground covers and floristic diversity in most terrestrial 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. An additional cull was planned for December 2018 following this year's monitoring.

Vegetation Clearance

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

- Approximately 17.8 ha in May 2018, to allow for subsoil/topsoil stockpiles in the north west of ML1535.
- Approximately 3 ha in August 2018, to allow infrastructure and road widening for the NWRE extension.
- Approximately 6 ha in November 2018, to allow for stockpiles to the east of the TSFs.
- Other minor clearances for ancillary infrastructure and stockpiles within ML 1535.

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, 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. The cull was conducted during the reporting period in November/December 2018, and was undertaken consistent with the recommendations of the 2017 Independent Environmental Audit (Section 10).

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 this year where increased macropod grazing has resulted in the slight deterioration of the plant, litter and cryptogammic layers.

In the Northern Offset Area (NOA) enhancement sites, there continued to be 100% cover along the LFA transects, and the large bare areas occurring on the rises between the gilgais were becoming increasingly more stable with the colonisation of vegetation and cryptogam cover.

NOA01 continued to be the most ecologically functional Myall woodland community and scored a total of 156, despite the lack of trees or shrubs as this site maintained native grassland structure in the absence of heavy grazing. This year NOA02 was the next most functional community with a sum of 150. RSlope01 scored a slightly lower total of 127, while the least functional community was recorded in RSlope02 with a sum of scores of 110 this year.

In the northern offset sites, there was an abundance of herbs and grasses and there were two reed species and a species of fern, however, there was an absence of trees and shrubs in the NOA sites and there were a low number of sub-shrubs in all offset sites.

Despite the drought there was an increase in species at both NOA sites this year as numerous annual species had recently germinated and the gilgais had only just dried out leaving some semi-aquatic species in the drying mud. In NOA01 and NOA02 there were 52 and 48 species respectively and these sites continued to be more diverse than the slope reference sites.

In the NOA sites, most diversity can be attributed to herbs and grasses and there were three reed species this year and an aquatic fern (Marsilea drummondii (Common Nardoo)) was recorded in both NOA sites. Compared to the reference sites however there was an absence of trees and shrubs and there were no shrubs in SOA05. No sub-shrubs were recorded in any BOA area.

The soils in the NOA had a similar chemistry as the slope reference sites or were within desirable agricultural levels, except that the soils were more alkaline in NOA01, while in NOA02 they had elevated levels of nitrates and the ESP was higher. Both NOA sites had low levels of organic matter and phosphorous.

The soil EC in both reference sites was high and RSlope02 had high ESP indicating that the soils are naturally slightly to moderately saline and sodic. The results of the soil analyses also indicate that there were elevated levels of calcium, magnesium, potassium and iron in the offset sites. These elements were also recorded in elevated levels within the reference sites suggesting that these elements can occur at naturally high levels within the undulating slopes around Lake Cowal. For example in the reference sites, there were up to ten times higher concentrations of calcium and magnesium than the recommended levels.

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 there continued to be high levels of ground cover and functional patch areas in SOA01 and SOA02. Extensive overgrazing by macropods however had occurred in SOA03 and SOA04 which has significantly reduced the integrity of the plant, litter and cryptogam covers and thus functional patch areas. In SOA05, there has previously been good ground, however these have deteriorated as a result of overgrazing this year.

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. Native species were more diverse than exotic species in all offset sites. Compared to the reference sites, only SOA01 had an acceptable cover abundance of native ground cover plants.

The Dwyer's Red Gum woodland reference sites were the most ecologically functional sites this year with total scores of 164 and 157. These sites contained relatively high patch area, a mature tree canopy, scattered shrubs and a well developed litter layer with high levels of decomposing litter with limited soil surface crusting.

The Grey Box woodlands were the next most functional communities with scores that were similar to each other with total scores of 143 and 140. Ecological function in SOA01 and SOA02 were marginally lower and similar to each other with scores of 139 and 138. Sites SOA03 and SOA04 were the least functional sites with scores of 118 and 111 respectively.

In SOA02, there were 67 tubestock planted in October 2016 which included a mix of endemic trees and shrubs, with 41 individuals (61%) remaining this year. All species are affiliated with the woodlands occurring on the local hills and ridges. One Geijera parviflora (Wilga) seedling continued to be recorded in SOA03 and five Geijera parviflora were recorded in SOA04. No seedlings were recorded in SOA01. 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.

The SOA sites tended to be dominated by different species with most being hardy native perennial ground covers with the exception of the exotic annual species Lolium rigidum (Wimmera Ryegrass) which provided some cover in SOA02 this year. In SOA01, Digitaria divaricatissima (Umbrella Grass) provided the most live plant cover while in SOA02 Walwhalleya proluta and Lolium rigidum were the most abundant but cover scores were very low. In SOA03, the Austrostipa species were difficult to identify to individual species due to overgrazing this year but they continued to provide the most cover along with Chloris truncata (Windmill Grass) and Sida corrugata (Corrugated Sida). Austrostipa nodosa was the most dominant species in SOA04.

One Lycium ferocissimum (African Boxthorn) was recorded in Grey02. No threatened species were recorded within the range of hill monitoring sites.

All SOA monitoring sites had a soil pH and EC that were comparable with the local woodlands or fell within desirable agricultural levels, however organic matter and phosphorous levels were low in most sites. Sites SOA01 and SOA02 continue to have high ESP and sodic soils, while nitrates were very high in SOA01 this year. In soils in the Southern Offset Area there were elevated levels of magnesium, potassium and iron with these also occurring in elevated concentrations in the reference sites suggesting they naturally occur in high levels within the ridges and hills in the Lake Cowal environment. Iron concentrations in all of the reference sites were up to 8 times higher than recommended guidelines. There were also slightly elevated concentrations of sulfur in SOA01 and both Dwyer's Red Gum sites.

In terms of meeting completion targets there was a low density and diversity tree and shrub species and associated structure and habitat requirements in the SOA monitoring sites compared to the reference sites, except in SOA02. The species planted in SOA02 are local endemic species and are affiliated with the woodlands occurring on the local hills and ridges. The ongoing revegetation activities across the SOA revegetation areas on the western side of Fellman's Hill should show an improvement in ecological performance such that they develop into woodlands which are characteristically similar to the adjacent ridge and hill communities, providing grazing management strategies are 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:

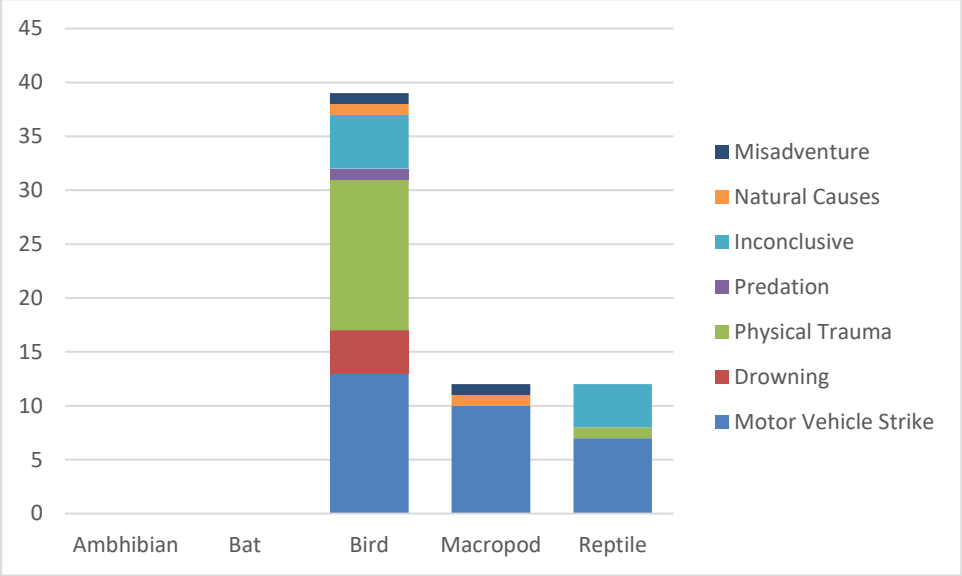
- continuation of long-term monitoring of bird breeding;
- bat call monitoring at the active TSF and control site;
- twice daily monitoring of any fauna usage of the TSFs;
- weekly boundary inspections of ML 1535;
- regular checking of the main diesel tank and hydrogen peroxide tank concrete bund sumps 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 63 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). Just under half of the fauna incidents were reported as motor vehicle strike, while none were reported as cyanide related (Graph 1).

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 (2018a, 2018b, 2018c) during the reporting period is provided below. The location of waterbird monitoring transects are presented on Figure 8.

January 2018

The first survey for 2018 was carried out on 8th and 9th of January 2018. Lake levels were similar to the previous survey four weeks prior. Few birds were observed visiting the areas that typically host colonial breeding suggesting that even the low levels of activity observed in December 2017 had ceased. While the lake waters had receded slightly the lake remained relatively full. Some margins had become exposed and these had been colonised by grasses and herbs.

A total of 28 species were observed along the transects, the lowest January tally since refilling of the Lake in 2010. Also, the total of 952 birds observed was considerably lower than previous January surveys, continuing a trend of low bird numbers through the second half of 2017. Transect 1 supported the greatest number of species while transect 7 the greatest number of birds.

The most commonly recorded species were Australian Pelican (189), Pacific Black Duck (92), Grey Teal (217), Australian Wood Duck (62), Black-tailed Native hen (61) and Eurasian Coot (86). The bird assemblage at Lake Cowal comprised an even representation of fish-eating species, ducks and water hens. This ongoing rise in the number of fish-eating species is continued with a diverse suite of species comprising Australian Pelican, Darter, cormorants, egrets, herons and Whiskered Tern.

Typically, the diversity and abundance of birds is lowest when the lake is full as this limits the availability of shallow habitat suitable for wading and dabbling duck species. The very low level of breeding activity may be on account of the receding water levels which may have more influence on bird behaviour that the absolute water level.

The observation of breeding by Magpie Geese for a second consecutive season (Gell 2016c, 2017a) confirms observations that they are increasingly recorded breeding in the region. While Lake Cowal remains full, it is a likely site to host Magpie Geese in greater numbers should this regional trend continue into the future.

August 2018

Lake Cowal was visited on 13th and 14th August 2018, Lake levels were lower than the previous survey. Few birds were observed visiting the areas that typically host colonial breeding suggesting the water levels were too low to promote breeding activity.

A total of 31 species were observed along transects, the equal highest August tally since refilling in 2010. The total of 2,600 birds observed was slightly lower than the average for August from 2010-17. Transect 1 supported the greatest number of species while transect 8 the greatest number of birds.

The most commonly recorded species were Australian Pelican (118), Australian Shelduck (123), Grey Teal (1054), Pink-eared Duck (446), Australian Wood Duck (83), Eurasian Coot (287) and Red-necked Avocet (135). The bird assemblage at Lake Cowal retained low numbers of several fish-eating species, but had become dominated by ducks (66%) and wading birds (12%). This shift reflects the shallowing of the lake and the increased availability of shallow water habitat for feeding.

The high numbers of Australian Pelican are likely attributable to the activities of fishers on the western shore. The count was the second highest August tally since 2010 for both Grey Teal and Pink-eared Duck. Red-capped Plovers were common at the south end of T7 and the presence of Double-banded Plovers were an unusual observation with only one other record from these surveys since 1992.

The increased availability of shallow water habitat has seen an increase in bird species richness along transects with the remaining fish-eaters being accompanied by a range of wading and dabbling duck species. In particular, the availability of mudflats attracted four species of small plovers in relatively high numbers.

October 2018

Lake Cowal was visited on October 15th and 16th, 2018. The lake waters had receded further and the margins were exposed as mudflats or had been colonised by grasses and herbs. Observations for this survey period are taken from transects 1, 2 and 8 owing to the complete drying of the lake at transect 7.

A total of 27 species were observed along transects. The total of 3,754 birds observed was slightly above the average for October from 2010-17. As in August 2018, transect 1 supported the greatest number of species while transect 8 the greatest number of birds.

The most commonly recorded species were Australian Pelican (633), Grey Teal (1686), Pink-eared Duck (513), Australian Wood Duck (210), Yellow-billed Spoonbill (115), Sharp-tailed Sandpiper (129), Black-winged Stilt (1240 and Whiskered Tern (123). Other than large numbers of Australian Pelican, the bird assemblage at Lake Cowal supported only low numbers of fish-eating species. The fauna remained dominated by ducks (66%) and wading birds (12%), in the same proportions as the previous survey. These proportions reflect the shallow nature of the lake and the widespread availability of shallow water habitat for feeding.

The increased availability of shallow water habitat has seen high bird species richness (27), and high abundance (3754), along transects despite there being no survey of transect 7. The widespread shallows provided suitable habitat for dabbling ducks (Pacific Black Duck, Grey Teal, Pink-eared Duck) and the waders Yellow-billed Spoonbill, Masked Lapwing, Sharp-tailed Sandpiper and Black-winged Stilt.

Fauna Monitoring of TSFs and ML 1535 Boundary

Fauna usage reports in relation to the TSF areas were prepared by Donato Environmental Services (DES) (2018a; 2018b) during the reporting period being, 1 January 2018 to 30 June 2018 and 1 July 2018 to 31 December 2018, 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.

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, 2018).

Scattered individuals of African Boxthorn (*Lycium ferocissimum*) were observed during this survey on transect 2, 3, 4, 5, 6, 7, 9, 14, 20, 22, 24, 25, 35, 39, 41, 46, & 47. These were predominantly previously treated plants which were re-shooting from the base. These mostly occurred as isolated plants under mature trees. Heavier infestations of African Boxthorn occurred on transect 6 & 46. Transect 46 had a dense infestation of Box thorn in 2017 however, recent weed control has significantly reduced the density of plants in this area. Some of the transects which previously had African Boxthorn did not have them in 2018.

Seven additional species listed as weeds of concern in the Riverina area were identified during the surveys (NGH Environmental, 2018) in various quantities and locations, including:

- Bathurst Burr (*Xanthium spinosum*).
- Caltrop (*Tribulus terrestris*).
- Galvanised Burr (*Sclerolaena birchii*).
- Horehound (*Marrubrium vulgare*).
- Lippia (*Phyla canescens*).
- Scotch Thistle (*Onopordum acanthium*).
- St Barnaby's Thistle (*Centaurea solstitialis*).

A comparison of the 2017 survey results shows an overall reduction in African Boxthorn, Bathurst Burr, and Galvanised Burr in the number of transects it occurs on and in density along the transects where it is still present.

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 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.

6.10.3 Reportable Incidents

The following complaint was received during the reporting period:

- Near neighbour contacted to report Bathurst burr (*Xanthium spinosum*) growing in recently graded firebreak (January 2018), Spraying was undertaken to rectify including follow up inspections;
- Near neighbour contacted to advise Bathurst Burr (Xanthium spinosum) growing near boundary fence. Spraying was conducted to rectify including follow up inspections.

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.

System upgrade from analogue to digital radio occurred during the reporting period which allows automated recordings of lightning alert warnings to be broadcast over multiple functioning channels.

6.13.2.2 Performance Outcomes

There were no uncontrolled bushfires within ML 1535 or the biodiversity offset areas during the reporting period.

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 were no 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

The THMS for the CGO was approved by the DPE in January 2006 under Condition 5.4(b)(i) of the Development Consent (DA 14/98) for the CGO. The NSW Environmental Protection Authority, the NSW Roads and Maritime Services and various relevant local councils were consulted during the preparation of the documentation. Following initial approval of the THMS, subsequent addenda were prepared and approved for further changes to the transport routes.

During the reporting period, Evolution reported to the DPE a number of identified inconsistencies in relation to the requirements of the THMS. These inconsistencies were identified following an internal review of systems and management measures, and were notified to the DPE on several occasions in May and June 2018. The inconsistencies included variations to the prescribed transport routes, variations to the prescribed supplier storage locations and variations to the prescribed volumes/number of deliveries. In many cases, the changes have been the result of a change in supplier, or the closure of an existing route or facility.

Following these initial reports, the DPE issued a request for information (dated 8 June 2018), and Evolution provided a response on 2 July 2018.

Following the completion of the investigation, Evolution received a penalty notice on 16 August 2018 in relation to the various non-compliances.

There were no other 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 20 below.

Table 20: 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	-	1,201.2	1,201.2
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)	-	236.0	236.0
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	389.0	390.0
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.	-	1,824.4	1,824.4
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 1,824.4 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. The long-term strategy for decommissioning water management structures (within the WMP) was also updated to include the new water management components associated with the approved CGO (i.e. the new contained water storage D10 and the modified design of contained water storage D5).

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 6.334 to 9.366 across the on-site surface water ponds. EC ranged from 404 to 20,417 microSeimens per centimeter (µS/cm) and TSS ranged from <1 to 1,250 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 21: 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**	**MAX**	**MEAN**
pH - Field	13	7.77	8.92	8.49
Electrical Conductivity - Field (µS/cm)	13	6814	22781	11225
Total Suspended Solids (mg/L)	14	1	112	48
Dam D4	**COUNT**	**MIN**	**MAX**	**MEAN**
pH - Field	8	6.33	9.36	8.41
Electrical Conductivity - Field (µS/cm)	8	499.2	8270	4354
Total Suspended Solids (mg/L)	8	12	1000	261
UCD North	**COUNT**	**MIN**	**MAX**	**MEAN**
pH - Field	14	7.96	8.89	8.44
Electrical Conductivity - Field (µS/cm)	14	582.9	1355	898
Total Suspended Solids (mg/L)	13	26	211	102
UCD South	**COUNT**	**MIN**	**MAX**	**MEAN**
pH – Field	12	8.7	9.24	8.96
Electrical Conductivity - Field (µS/cm)	12	404.7	3430	1368
Total Suspended Solids (mg/L)	12	17	1250	223
Quarterly Surface Water Monitoring – D2, D3, D8B, D9, D6, D5 and Pit Sumps				
Dam D5	**COUNT**	**MIN**	**MAX**	**MEAN**
pH - Field	4	7.94	8.81	8.36
Electrical Conductivity - Field (µS/cm)	4	6395.4	46200	19099
Total Suspended Solids (mg/L)	4	7	126	48
Dam D6	**COUNT**	**MIN**	**MAX**	**MEAN**
pH - Field	4	7.26	8.14	9.01
Electrical Conductivity - Field (µS/cm)	4	8944.8	32261	17334
Total Suspended Solids (mg/L)	4	5	46	22
Pit Sump 1	**COUNT**	**MIN**	**MAX**	**MEAN**
pH - Field	12	5.84	7.58	7.13
Electrical Conductivity - Field (µS/cm)	12	27701	59322.2	48232
Total Suspended Solids (mg/L)	13	1	11000	891
Dam D2	**COUNT**	**MIN**	**MAX**	**MEAN**
pH - Field	4	7.86	8.38	8.16
Electrical Conductivity - Field (µS/cm)	4	3298	17740	8520
Oil & Grease (mg/L)	4	8	114	43
Dam D3	**COUNT**	**MIN**	**MAX**	**MEAN**
pH - Field	4	7.42	8.13	7.86
Electrical Conductivity - Field (µS/cm)	4	19188.1	57900	33595
Oil & Grease (mg/L)	4	6	23	14

Table 21 (Continued): Summary of Monthly and Quarterly Surface Water Monitoring Results for the Reporting Period

Dam D9	COUNT	MIN	MAX	MEAN
pH - Field	4	7.84	8.31	8.12
Electrical Conductivity - Field (µS/cm)^	4	7237.4	20417.8	14929
Total Suspended Solids (mg/L)	4	4	16	8
Oil & Grease (mg/L)	4	< 5	< 5	< 5
Dam D8B	**COUNT**	**MIN**	**MAX**	**MEAN**
pH - Field	4	8.03	8.56	8.40
Electrical Conductivity - Field (µS/cm)^	4	2056.3	13870	7666
Total Suspended Solids (mg/L)	4	8	54	30

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

UCD North, which collects upstream water flowing through the diversion channel around the perimeter of the closed catchment remained inundated throughout the first half of 2018, following the 2016 flooding of Lake Cowal. Therefore sampling results are reflective of lake water quality rather than diversion water. UCD South was not inundated in 2018 and results are reflective of diversion runoff.

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 7.96 to 9.24 across both ponds.

EC ranged from 404.7.4 to 3,430 µS/cm and TSS ranged from 17 to 1,250 mg/L and were both significantly influenced by two factors, fluctuations due to changes in standing water levels and the lake water inundating the UCD North. The 1,250 mg/g TSS result occurred during the December 2018 sampling when the standing water level was very low and muddy.

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 remained partially inundated following high rainfall events in 2016 and subsequent flooding of the Lachlan River and Bland Creek (Plate 2).

Lake Cowal peaked at a height of 207.49 m RL on 10 October 2016, before steadily receding back to 1,203.903 by the end of 2018 (Graph 2).

Lake Cowal Water Quality

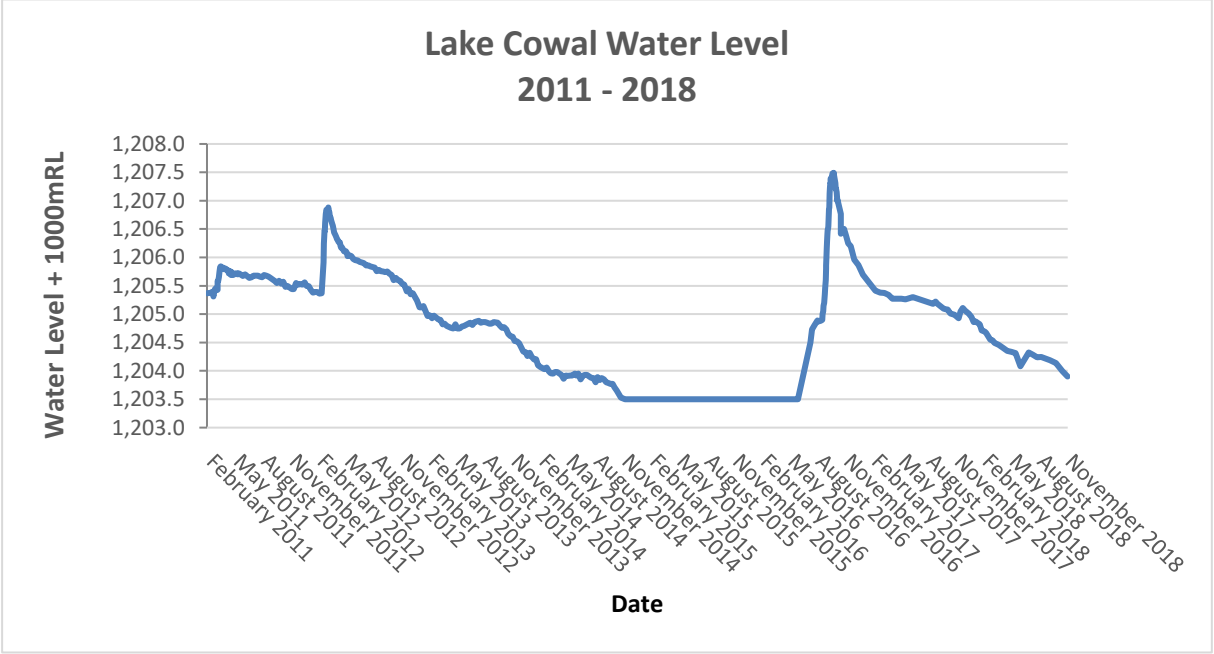
Water quality monitoring at Lake Cowal was undertaken by DM McMahon Pty Ltd, including a detailed description and interpretation of the results. Key summaries of the lake water monitoring results (DM McMahon, 2018) are provided in the subsections below.

A comparison of the 2018 Lake Cowal water quality results against the ANZECC and ARMCANZ (2000) default trigger values for surface water (lakes) indicates that the 2018 monitoring results (totals and dissolved) are below or only marginally above the default trigger values. Heavy metal readings are similar to historical data. Overall, the pH and EC is within the range of values previously recorded.

A comparison of the 2018 CGO lake sediment results against the ANZECC and ARMCANZ (2000) trigger values indicates the results were all below the recommended default trigger values, apart from total Antimony. These results are generally consistent with historical data.

Plate 2: Aerial Photograph of the Lake Protection Bund

Graph 2: Lake Cowal Water Level 2011 - 2017



pH and Electrical Conductivity

pH results ranged from 8.27 to 9.01 with a mean of 8.61, which is slightly higher than the results observed during the last reporting period. The mean is within the baseline water quality data collected in 1991 – 1992, and above the ANZECC AND ARMCANZ (2000) upper level of 8, refer to Table 22.

EC results ranged from 514 to 838 µS/cm with a mean of 641µS/cm which is mid-range compared to the baseline data and also higher than the ANZECC AND ARMCANZ (2000) level of 30 µS/cm for freshwater. However, ANZECC AND ARMCANZ (2000) note that conductivity in lakes will vary depending on catchment geology. The data trends analysis undertaken demonstrates that lower EC levels correlate with high inflows and lake levels while higher EC levels occur when inflows and lake levels are lowest. This is consistent with the historical findings.

Turbidity and Suspended Solids

Turbidity results ranged from 58.4 to 300 mg/L NTU with a mean of 181 mg/L which is within the baseline data from 1991 – 1992. The turbidity results are above the ANZECC AND ARMCANZ (2000) level of 20 mg/L for Fresh Waters. ANZECC AND ARMCANZ (2000) note that lakes in catchments with highly dispersive soils such as Lake Cowal will have high turbidity.

The suspended solids results ranged from 36 to 130 mg/L with a mean of 70 mg/L which is above the 2010-2012 and below the 2013-2017 results. The ANZECC AND ARMCANZ (2000) recommended guideline trigger values for toxicants do not include a trigger value for suspended solids. The maximum reading of suspended solids was the lowest yearly maximum reading since before 2010.

Dissolved Oxygen

Dissolved Oxygen results ranged from 3.18 to 23.53 mg/L with a mean of 9.51 mg/L which are similar to the 2011 and 2017 results but above the 2012 and 2016 results.

Heavy Metals (total and dissolved)

The mean 2016 and 2017 monitoring results for total heavy metals marginally exceeded the ANZECC AND ARMCANZ (2000) default trigger values for Nickel, Lead and Zinc as was the case in previous years.

The mean 2018 monitoring results for total heavy metals continue to exceed the ANZECC AND ARMCANZ (2000) default trigger values for Arsenic, Lead and Zinc. Concentrations are lower than previous years and similar to 2012 results.

The data trends analysis indicates that metals are in higher concentrations at times of low inflow and lake level, indicating accumulation through evaporation. The inverse is noted for times of high inflow and lake level.

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

Lake Cowal Inflow Water Quality

Some lake monitoring transect sites were accessible for the first half of the 2018 year however lake inflow water monitoring sites were not accessible in 2018 due to lower lake water levels which had reduced since the 2016 flood peak.

Lake Cowal Sediments

Of the 34 lake sediment sample sites specified only 16 were able to be sampled in 2018, including sites E1, E3, E5, B1, B2, B4, B6, P1-P3, C1-C3, L1, L2 and I1. The remaining monitoring sites associated with Sandy Creek, Bland Creek, the Lachlan Inflow and the Irrigation Inflow were too shallow to access safely.

Electrical Conductivity (EC)

EC results ranged from 47 to 162 µS/cm with a mean of 91 µS/cm. The overall mean for 2018 is lower than the 2012, 2013, 2014 and 2016 means and similar to the 2010 and 2017 levels. The ANZECC AND ARMCANZ (2000) recommended guideline trigger values for sediments do not include a trigger value for EC however electrical conductivity trends will continue to be monitored at Lake Cowal.

A summary of the mean 2018 sediment monitoring results compared with the ANZECC AND ARMCANZ (2000) trigger values and the 2010 to 2014, 2016 and 2017 mean monitoring results is provided in Table 24.

The majority of mean heavy metals results for 2018 were similar to the mean heavy metals results for 2011 – 2014, 2016 and especially 2017 with some minor variation noted.

No mean contaminant result was found above the default value guideline (ANZECC AND ARMCANZ (2000)) for the monitoring period.

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 2018 report has been prepared by Coffey Geotechnics (2018) 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 (2018) 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 a direct result of pumping for water supply and pit dewatering. With the exception of BLPR3, groundwater levels in the BCPB area reflect the pumping schedule for the mine water supply borefield. Pumping has resulted in a maximum groundwater drawdown of approximately 67 m (in bore BLPR5) since April 2004 (lowest level recorded for BLPR5 during 2018 was in October). As at December 2018, the average drawdown in the bores (since April 2004) was approximately 45 m. Less impact (drawdown of about 20 m) is observed in BLPR3 due to the higher screened interval of that bore, which intersects the Lower Cowra Formation rather than the Lachlan Formation. 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 continued 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, 2009). 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, 2009). 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, 2011, 2011b and 2012). It was also assessed that groundwater level rises associated with the TSF are not expected to reach the ground surface (Coffey, 2009).

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. ANZECC 2000 trigger values for pH range between 6.5 and 8 and are based on values for NSW upland rivers. Some pH results are below the ANZECC 2000 trigger 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 Sodium results have generally remained higher compared to the baseline EIS levels and sodium concentrations in the TSF area, pit area and Bland Creek Palaeochannel have increased at some bores. 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 BCPB, 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 (Coffey, 2018).

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 (Coffey, 2018).

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 (Coffey, 2018).

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 was 1,095 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 – applied rock mulch and topsoil to 4 ha of the upper three batters on the eastern end;
- NWRE – North Wall – re ripped 47.9ha on all lower, mid and upper batters;
- NWRE – North Wall – direct seeded 47.9ha on all lower, mid and upper batters with native seed mix;
- SWRE – South Wall – applied rock mulch and topsoil and gypsum to 4.1ha eastern end all batters;
- SWRE – South Wall – applied rock mulch and topsoil and gypsum to 5.3ha eastern end all batters;
- SWRE – South Wall – re ripped and direct seeded 37.7ha on all lower, mid and upper batters with native seed mix;
- SWRE – West Wall – reshaped oxide, applied rock mulch and topsoil to 9.6ha to lower and mid batters;
- SWRE – South Wall (rock – topsoil trial plots) ongoing monitoring of the direct seeding of November 2011;
- PWRE – Inner Perimeter wall – applied topsoil and gypsum to approximately 7.8 ha and direct seeded all batters with native seed mix;
- PWRE – Outer Perimeter wall – re ripped entire lower single batter and direct seeded 6.7ha with native seed mix;
- 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 report.

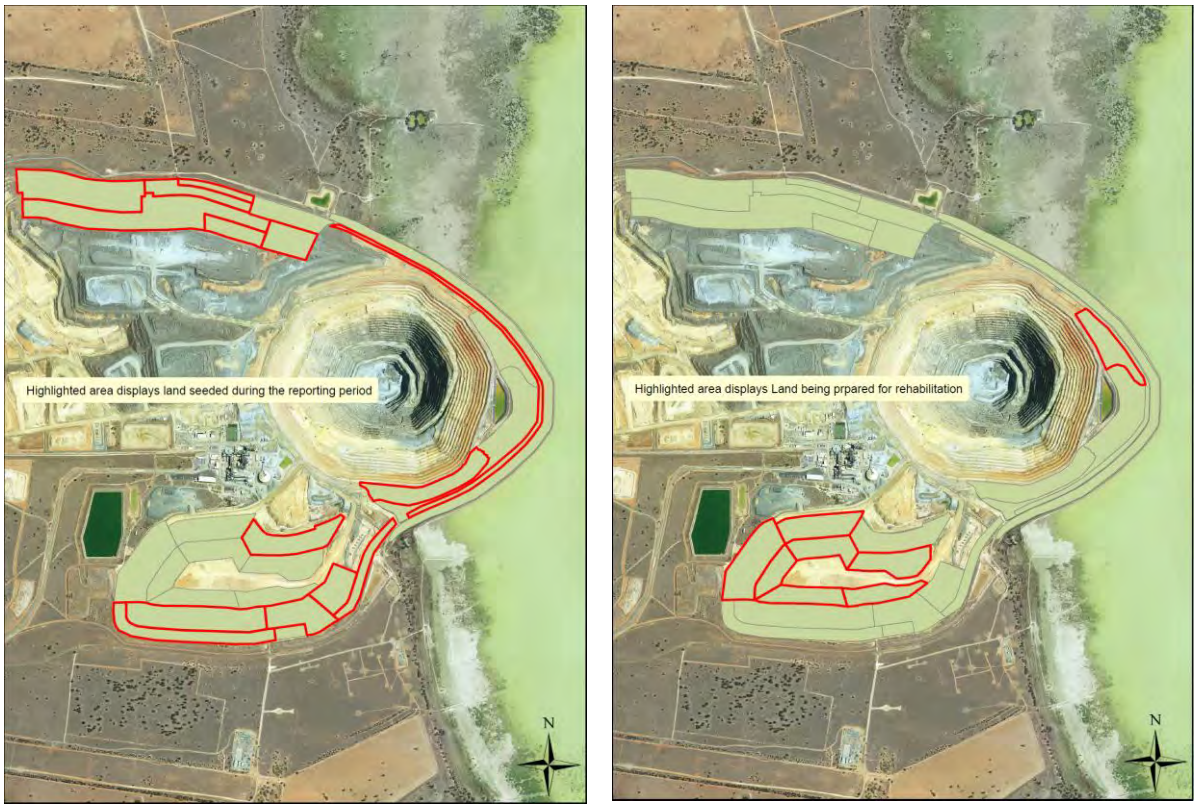
Table 25: Rehabilitation Summary

		Area Affected/Rehabilitated (hectares)		
		Previous Reporting Period (2017)	**Current Reporting Period (2018)**	**Next Reporting Period (estimated) (2019)**
A	Total Mine Footprint	1,095	1,668	1,668
B	Total Active Disturbance	1,095	1,316	1,668
C	Land being prepared for Rehabilitation	143	166	77.6
D	Land under active Rehabilitation	33	90	20
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 6.7ha of the outer perimeter wall was re ripped and direct seeded with native species in the reporting period.

Approximately 7.8ha of the inner perimeter wall was shaped and covered with 300mm topsoil was ripped, had gypsum spread and was direct seeded with native species in the reporting period (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).

An area of approximately 4ha was shaped, topsoiled, had gypsum applied and direct seeded. The application of rock mulch on this area was generally not required as most of this waste emplacement consists of primary waste rock (the material used as rock mulch in the rehabilitation).

Additionally approximately 47.9ha of the entire NWRE was re ripped and direct seeded with native species during the 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 (April 2018)

Southern Waste Rock Emplacement – Outer Batters

Areas of approximately 5.3ha and an area of 4.1ha to the south east were shaped, rock mulch applied, topsoil applied and were direct seeded during the reporting period. Gypsum was also applied to these areas.

Additionally approximately 37.5ha was also re ripped and direct seeded with native species during the reporting period.

Due to rain in 2016, some areas of the SWRE proposed for rehabilitation in the MOP were unable to be completed in the 2016 reporting period. These areas were rehabilitated during the 2017 reporting period and seeded during the 2018 reporting period (Plate 6).

Plate 6: South East End of Southern Waste Rock Emplacement (February 2018)

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 (2018a) 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). Due to the increase in protective litter cover and slight to moderate levels of litter decomposition there has been a decrease in surface crusting, increased soil coherency and there was less evidence of resources being mobilized across the sites. In 2018, these older sites had been re-ripped and seeded, exposing bare soil and scattered rocks, subsequently reducing the functional patch area and Landscape organisation index (LOI) in these sites. This was intentional to reduce competitive ground cover and to establish a suitable seedbed, prior to aerial sowing of the rehabilitation areas in autumn 2018.

The Hill woodland reference sites were the most ecologically functional woodland communities, followed by PWRE02, NWRE05, SWRE01 and NWRE01 which were functionally similar to each other despite the absence of a mature tree overstorey, lack of a shrub layer, and recent re-ripping. PWRE01 and NWRE02 had only slightly lower function, followed by NWRE03, while SWRE02 was overall the least functional site.

No trees or mature shrubs were yet recorded in the WRE rehabilitation areas. The density of shrubs and juvenile trees in the Hill reference sites was highly variable and there were high mortality rates recorded this year in the Dwyer's Red Gum woodlands. In the rehabilitation sites, shrubs and juvenile trees were only recorded in NWRE02, NWRE03 and SWRE02. In NWRE02 and NWRE03 seedlings mortalities were also recorded this year, leaving 10 – 12 individuals. In NWRE02, individuals were volunteer Glycyrrhiza acanthocarpa seedlings or Duma [Muehlenbeckia] florulenta. In NWRE03, tubestock were planted just prior to monitoring in 2016 where 42 seedlings at a survival rate of 51% was recorded. During the 2018 monitoring 10 individuals had survived, a survival rate of 24%. One volunteer Lycium ferocissimum (Boxthorn) seedling was recorded at SWRE02.

Floristic diversity typically declined across the range of sites due to the prolonged dry conditions which were also compounded by higher levels of grazing pressure by macropods in some sites, especially the reference sites. Native plants typically provided most of the live plant cover on sites on the NWRE and SWRE02 rehabilitation areas. Native plant cover was very low in PWRE, SWRE01 and SWRE03. Presently all rehabilitation sites were weedier than the Hill reference sites.

There was considerable variation in the diversity of growth forms in the rehabilitation areas on the WRE's with only NWRE03 having an acceptable composition of species, while NWRE02 only lacked tree species. All remaining sites had a comparable diversity of sub-shrubs, herbs, grasses, reeds, ferns and vines in comparison to the reference sites however they had a low diversity of tree and shrub species.

This year Lolium rigidum (Wimmera Ryegrass) and Walwhalleya proluta (Walwhalleya proluta) were recorded in all ten rehabilitation areas. Other common native species included Convolvulus erubescens (Australian Bindweed), Sclerolaena muricata (Black Roly Poly) and Salsola australis (Buckbush), Maireana brevifolia (Yanga Bush) and Enteropogon acicularis (Curly Windmill Grass). Common exotic species were Avena fatua (Wild Oats), Hordeum leporinum (Barley Grass), Sonchus oleraceus (Milk Thistle), Medicago polymorpha (Burr Medic) and Polygonum aviculare (Wireweed).

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. Lolium rigidum (Wimmera Ryegrass) frequently provided the most cover (despite most of it being dead) on the WRE's, with Walwhalleya proluta (Rigid Panic) being relatively abundant on NWRE01 and NWRE03. Other species that provided the highest levels of cover on some of the WRE's included the saltbushes Sclerolaena diacantha (Grey Copperburr) and Einadia nutans subsp. nutans (Climbing Saltbush) but overall cover scores were low.

Electrical Conductivity levels continued to decline in the older WRE rehabilitation areas however EC in all rehabilitation sites continued to exceed local and desirable levels and were exceptionally high in the new area on the SWRE and were extremely saline. The soils in the rehabilitation sites are moderately to strongly alkaline, low in organic matter and phosphorous and many were sodic, especially at SWRE01 and SWRE02.

Sulfur concentrations in the older rehabilitation sites appear to have been demonstrating a declining trend and are now significantly lower than when they were first measured in 2014. One exception is at NWRE03 where S concentrations were slightly higher this year. Despite this declining trend all rehabilitation sites had S concentrations that exceeded local levels with the exception of SWRE01 and PWRE02. Sulfur was especially high in the new rehabilitation sites on the SWRE where 576 – 1402 mg/kg of S were recorded compared to the recommended

guideline of 8.0 mg/kg. In the NWRE and SWRE rehabilitation sites there were elevated levels of calcium and magnesium and there continued to be elevated levels of iron in the hill woodland sites.

8.2.2 Rehabilitation Trial Monitoring Results

The NWRE rehabilitation trial (Plate 5) 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 top soils 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.

This year, only one full replicate (Replicate 2) of the 2012/2013 and 2014 trials was undertaken. There were five monitoring plots in the 2012/2013 trial area and six in the 2014 trial area.

On the NWRE rehabilitation trial area (Plate 7), the application of the straw and native pasture hay mulches has helped accelerate the development processes by providing immediate protective cover and organic materials which are vital in the nutrient decomposition and recycling processes, with slight to moderate states of decomposition being recorded in the straw and native pasture hay mulching treatments. Due to the high levels of mulch (ground cover), which also provided additional soil surface roughness, there was little evidence of erosion and deposition. Dead annual plants (such as Lolium rigidum) and the colonisation of cryptogams have been particularly important in stabilising the rehabilitation areas within the first few years of development and were beginning to play a vital role in the infiltration and nutrient recycling capacity of the sites, particularly in sites without a mulch application (Nil treatment).

There has also been an increase in litter and perennial plant covers in the rehabilitation areas as a result of the volunteer establishment and perennial ground covers continued to be increasing in abundance. Some scattered native grass tussocks were observed within the NPH trials areas probably as a result of the seed contained within the NPH, as the trial had intended. In sites without a mulching treatment, soil crusts have developed and there continued to be some slaking of the subsoils. There continued to be patches which were loose and crumbly especially in the 200mm trial area (most likely to be due to the soil chemistry), but generally there was an increase in litter decomposition and soil cohesion and stability.

Many undesirable attributes such as high Electrical Conductivity (EC), ESP and sulfur (S) have demonstrated a dramatic reduction in some of the trials areas since the rehabilitation areas were constructed. While most treatments had an EC and ESP higher than the reference sites and desirable thresholds in the older 2012/2013 trial area, the soils can be classified as non saline, but they are sodic. Sulfur concentrations have tended to demonstrate a reduction in some treatments plots, but most continued to be elevated in comparison to the recommended guidelines.

In the 2014 trial area the soils are moderately to highly saline with most being sodic. A significant reduction in S was recorded in the 300mm topsoil treatments where Straw and NPH were applied, but in the remaining treatments, S concentrations have significantly increased since they last measured in 2016. They did however remain lower than S concentrations recorded in 2014. All trial treatments had S concentrations that continue to far exceed the recommended guidelines.

These trials will continue during the next reporting period.

Plate 7: NWRE – Pond D1 North Trial Tubestock (April 2017)

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 Senior Social Responsibility Advisor receives a copy of the notice emailed to their assigned mobile phone. Upon receiving an enquiry, the Senior Social Responsibility Advisor 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 2018	
Record No 1	
Details	Resident of Lake Cowal
Complaint/Concern	Environmental – weeds
Date	08/01/2018
Outcome	Near neighbour called to advise Bathurst burrs are growing near graded firebreaks along a boundary fence Superintendent – Environment & Social Responsibility investigated property and arranged for weeds to be treated with herbicide
Date of Response	Initial response – 08/01/2018 Complaint closed – 23/01/2018
Record No 2	
Details	Resident of West Wyalong
Complaint/Concern	Community
Date	24/2/2018
Outcome	1. A resident of West Wyalong called to advise that he was unhappy with our local procurement policy and a noise complaint he had received. 2. The Superintendent Environment & Social Responsibility (SESR) commenced an investigation into the matter. 3. The investigation found that where possible CGO source local suppliers and contractors. The SESR offered to meet with the resident to discuss their concerns relating to local procurement. 4. The Senior Social Responsibility Advisor called to the resident to arrange a meeting, however the resident declined the invitation to meet. The resident advised they were happy with having their complaint listened too and asked that no further action be taken.
Date of Response	Initial response – 24/02/2018 Complaint closed – 6/4/2018
Record No 3	
Details	Resident of Lake Cowal
Complaint/Concern	Environmental - weeds
Date	28/02/2018
Outcome	1. A near neighbour called to advise Bathurst burrs (Xanthium spinosum) were growing near boundary fence. 2. The Superintendent Environment & Social Responsibility (SESR) commenced an investigation into the matter. 3. The investigation found that there were burrs growing on the property. The SESR arranged for the burrs to be sprayed with a herbicide. 4. The Senior Social Responsibility Advisor called to the near neighbour to discuss investigation results and treatment proposed. The neighbour advised they were happy with the results of the investigation.
Date of Response	Initial response – 28/02/2018 Complaint closed – 5/032018

Table 27 (Continued): Summary of Community Complaints during the Reporting Period

Record No 4	
Details	West Wyalong Business Owner
Complaint/Concern	Community
Date	06/03/18
Outcome	1. Investigation commenced. Senior Social Responsibility Advisor (SSRA) contacted the owner of the Outback Café who advised that was a Toyota RAV4 Registration no CF47GC blocking access to the skip bins. 2. The SSRA visited the Outback Café and found a Contractor on site for March 100 Shutdown had vehicle their parked in front of the bins as described. 3. The SSRA placed a note on the vehicle asking the owner not to park in this location again. 4. The SSRA placed barricades and flagging tape in front of the skip bins. 5. The SSRA contacted the rubbish removal company (JR Richards) and advised them that barricades were in place to prevent parking only, however, the skip bin could still be collected as scheduled the following morning 6. The SSRA met with the local sign maker and requested that No Parking signs be designed and installed for the Outback Café's car park.
Date of Response	Initial response – 06/03/18 Complaint closed – 06/03/2018
Record No 5	
Details	Community Member
Complaint/Concern	Community
Date	27/09/2018
Outcome	1. Following investigation by ESR Superintendent the vehicle and driver could not be identified with certainty. 2. Site-wide reminder email to be sent regarding driver behaviour to and from work.
Date of Response	Initial response – 27/09/2018 Complaint closed – 15/10/2018

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 2018 and June 2018 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.

Community and Family visit days are conducted annually with up to 600 people in attendance over the two days. The Community and Family days are conducted in October 2018.

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 IEA of the CGO was conducted between 1 and 4 April 2019 by Mr Oliver Moore (Lead Auditor) and Ms Wei-Lin Chen Yi Mei (Assistant Auditor) of ERM, to assess the status of the CGO with the Development Consent, Mining Lease and EPL 11912 conditions. The audit reviewed the status of compliance of the operations from 1 May 2016 to 30 April 2019, with a key focus on the period from 1 May 2018 to 30 April 2019.

The audit was undertaken generally in accordance with the Australian/New Zealand Standards AS/NZS ISO 19011:2017 - Guidelines for Auditing Management Systems. The documentation and files held at the CGO site and interviews/discussions with relevant site personnel, provided the auditors with the required information for verification of compliance of the CGO with the Development Consent and other statutory environmental approvals.

Recommendations and observations from the IEA are discussed in Table 28. The next Independent Environmental Audit is scheduled for April 2020.

Table 28: Recommendations and Observations from the 2019 Independent Environmental Audit

Approval Instrument/Condition	IEA Finding	IEA Recommendation	Evolution Response	Timeframe
Condition 1.3 of Development Consent DA 14/98	NC	CGO to secure building certificate for stores warehouse.	Evolution is currently in consultation with Bland Shire Council in relation to obtaining a building certificate for the stores warehouse structure. This action is currently ongoing.	December 2019*
Condition 3.4(d) of Development Consent DA 14/98	ANC	CGO to continue to proactively engage with DP&E to confirm Biodiversity Offset and Conservation Bond, as the date for securing the bond has passed this is an ANC. As at the 2019 audit, CGO were still awaiting response from DP&E in advance of next steps.	Evolution notes that as per the extension granted by the DPE on 5 July 2017, the biodiversity offset areas were required to be secured and the conservation bond lodged by 31 October 2017. In this regard, it is noted that the VPA has been submitted and is currently with the DPE for execution. Evolution is awaiting further correspondence from DPE in this regard.	Awaiting DPE response on VPA
Condition 5.5 of Development Consent DA 14/98	NC	Ensure batteries are stored in a designated bunded area until the new waste battery storage area has been established and deemed appropriate for storage. The auditor acknowledges that at the time of the audit, the new battery waste storage area was in the process of being constructed.	Evolution has commissioned the new waste battery storage area and deemed it appropriate for use. The area is now fully functional with all relevant employees and contractors aware of the storage process going forward.	Complete
Condition 6.5(b) of Development Consent DA 14/98	NC	Review placement of lighting and reaffirm requirements with night shift supervisors	Evolution has taken measures to ensure that all employees and contractors responsible for the lighting plant are aware of their obligations under the Development Consent (DA 14/98). As part of the process in moving and setting up lighting plants on site, operators are required to assess the light direction of the plant to avoid nuisance to people using the surrounding roads and landowners.	Complete
Condition L4.1 of EPL 11912	ANC	The EPL prescribes noise monitoring limits which are no longer applicable. The EPL should be updated to reflect MOD14 conditions.	Environment Protection Licence 11912 was recently varied to reflect the revised approval conditions in relation to Modification 14. The EPL 11912 was issued by the NSW Environment Protection Authority on 27 June 2019.	Complete

Table 28 (Continued): Recommendations and Observations from the 2019 Independent Environmental Audit

Approval Instrument/Condition	IEA Finding	IEA Recommendation	Evolution Response	Timeframe
Condition O2.2 of EPL 11912	NC	Ensure that contractor induction includes key environmental policies and training which adequately establishes CGO's requirements (i.e. spill management).	All contractors and employees at the CGO are required to undertake a site based induction, as well as completing general environmental awareness training. A gap analysis has been undertaken to ensure that all Pybar and BK Hire contractors that had not yet completed the general environmental awareness training at the time of the audit, have been scheduled to complete this training.	Complete
Condition O2.2 of EPL 11912	NC	Ensure batteries are stored in a designated bunded area until the new waste battery storage area has been established and deemed appropriate for storage. Appropriately sized containment should be provided for ICBs. The auditor acknowledges that at the time of the audit, the new battery waste storage area was in the process of being constructed.	Battery storage is as per previous comments for DA 14/98 Condition 5.5 above. Appropriate IBC storage has been established in the form of a concrete apron. All IBCs are now stored on apron to avoid any incidental spillage to ground.	Complete
Condition 3.1(a) of Development Consent DA 14/98	ANC	A detailed review and update of the HMP should be conducted to ensure the document aligns with current approval requirements.	As a result of the approval of Modification 14, the HMP has been revised. This plan is currently being updated based on feedback from the Department and will be submitted along with the other environmental management plans.	Complete
Condition L3.1 of EPL 11912	ANC	The HWCMP has not been updated to reflect this condition. Given the draft HMMP is scheduled to replace the HWCMP, it should also be updated to reflect this commitment.	Evolution recognises that waste management on site must comply with the conditions of EPL11912. Notwithstanding, Evolution considers that this is not relevant to this audit report, as this is draft document that was not yet finalised at the time of the audit.	-
Condition L3.2 of EPL 11912	ANC	As per L3.1, the draft HMMP should be updated to address waste management requirements stipulated within the EPL.	This is not relevant to this audit report, as this is draft document that was not yet finalised at the time of the audit.	-

*Subject to Bland Shire Council approval timeframes.

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.

13 REFERENCES

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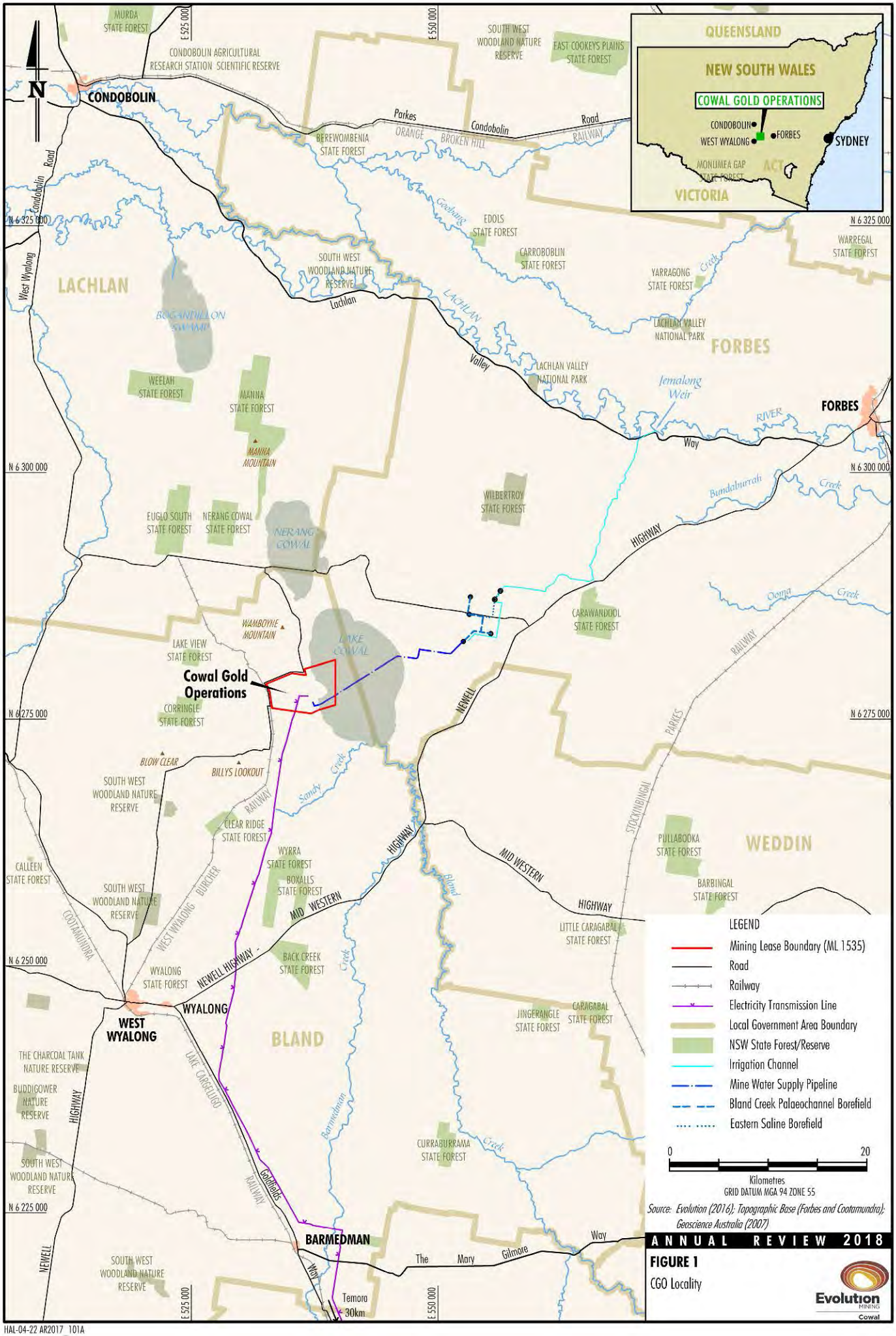
GLOSSARY OF TERMS

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



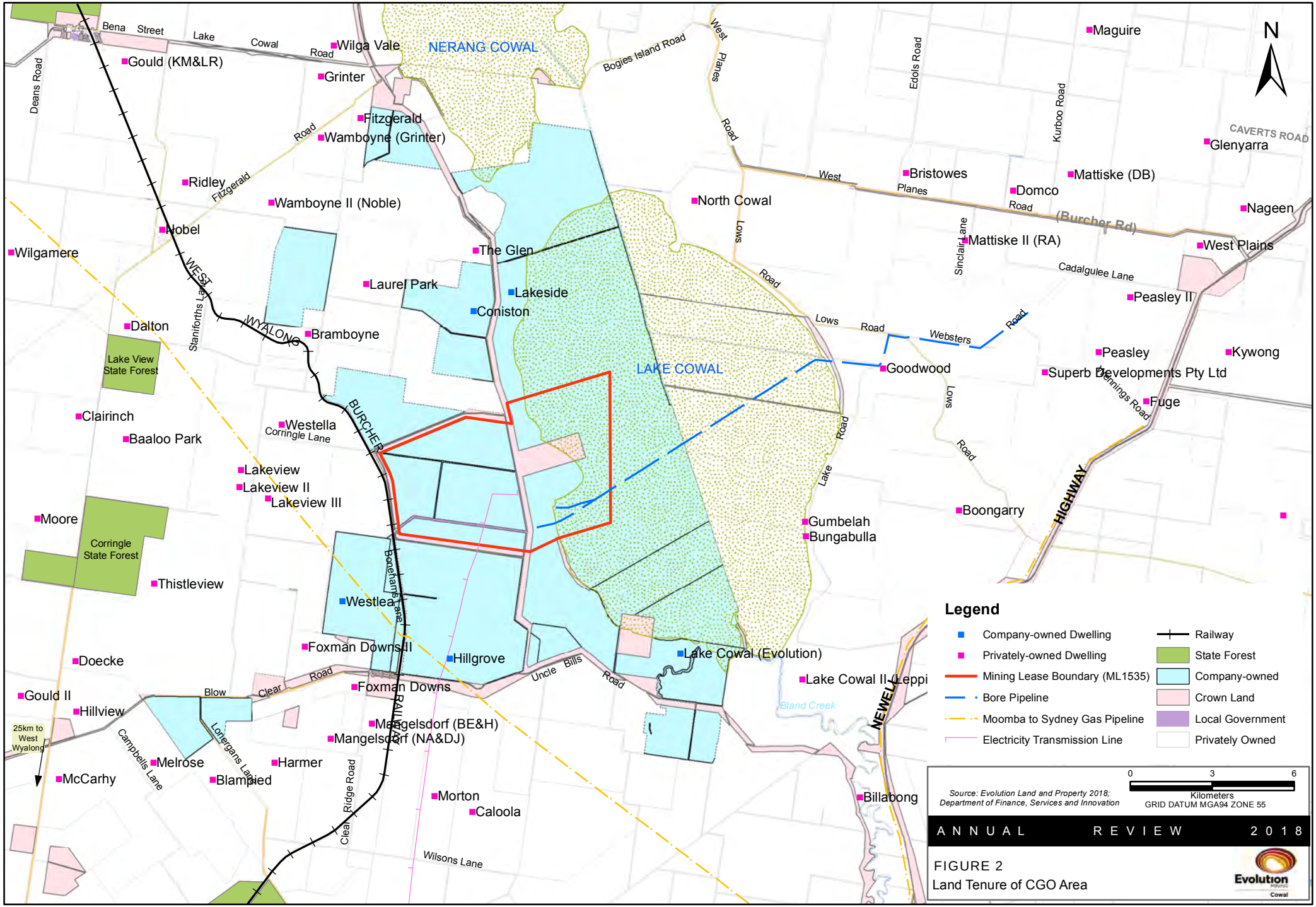
ANNUAL REVIEW 2018

FIGURE 1

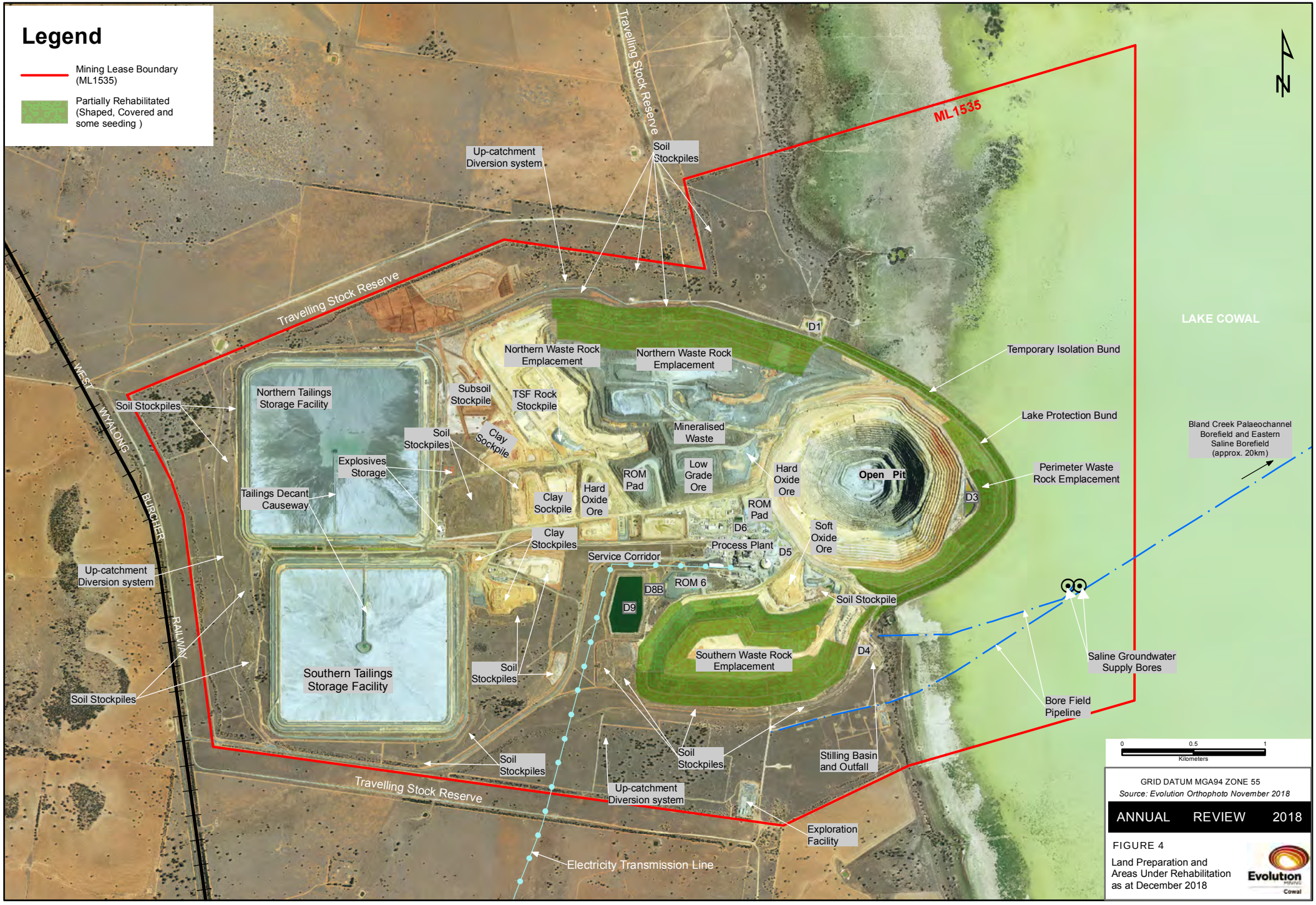
CGO Locality

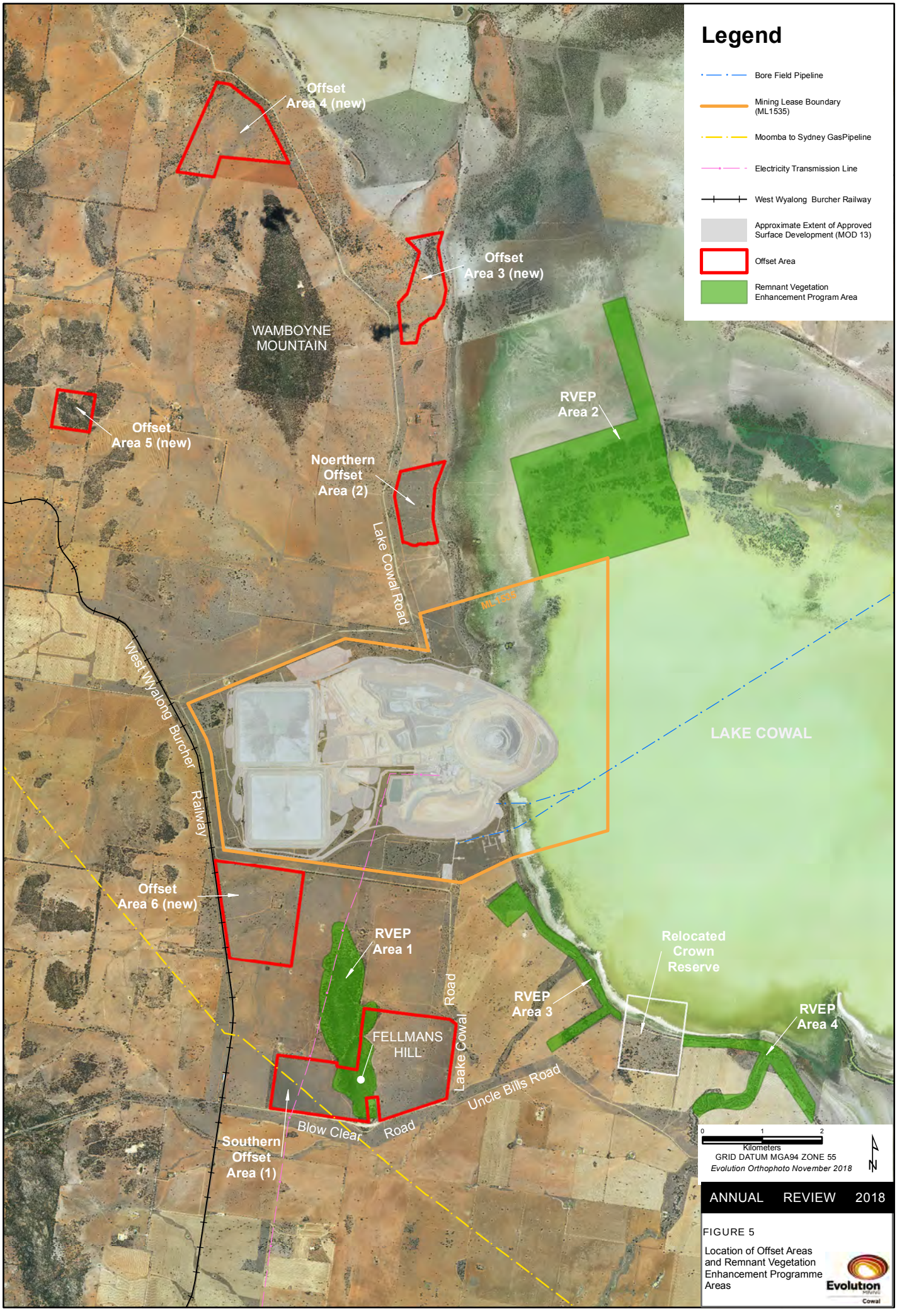
Evolution MINING Cowal

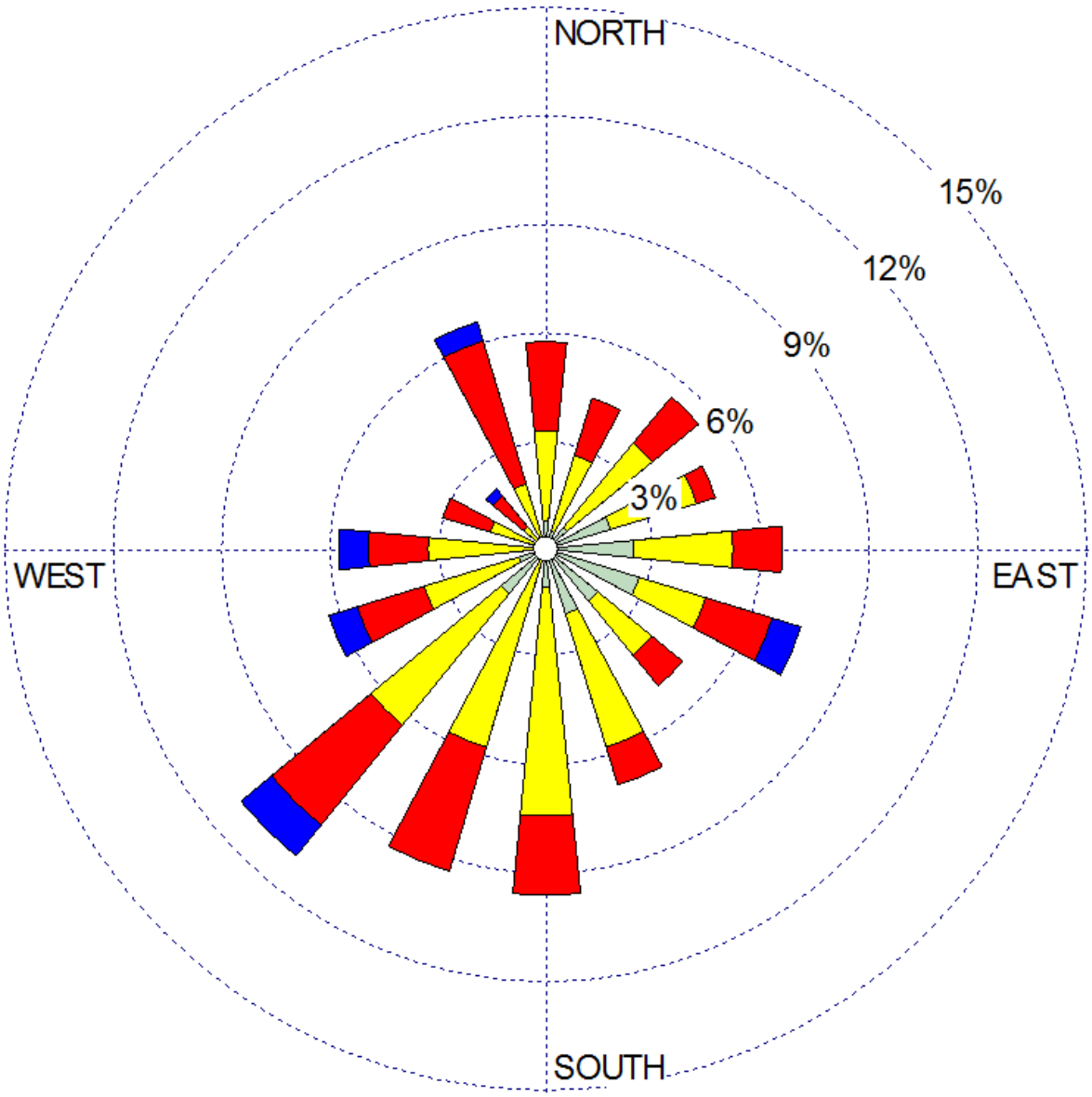
HAL-04-22 AR2017_101A


N
NERANG COWAL
LAKE COWAL
Bena Street
Lake Cowal Road
Wilga Vale
Gould (KM&LR)
Grinter
Fitzgerald
Wamboyne (Grinter)
Ridley
Wamboyne II (Noble)
Nobel
Wilgamere
Dalton
Lake View State Forest
Clairinch
Baaloo Park
Moore
Corringle State Forest
Thistleview
Doecke
Gould II
Hillview
25km to West Wyalong
McCarthy
Melrose
Campbells Lane
Lonergans Lane
Blampied
Harmer
Blow
Clear Road
Foxman Downs
Foxman Downs II
Hillgrove
Mangelsdorf (BE&H)
Mangelsdorf (NA&DJ)
Morton
Caloola
Clear Ridge Road
Wilsons Lane
Bonehams Lane
Westlea
Westella
Corringle Lane
Lakeview
Lakeview II
Lakeview III
Bramboyne
Laurel Park
Lakeside
Coniston
The Glen
North Cowal
Bogies Island Road
West Plains Road
Edols Road
Kurboo Road
Maguire
CAVERTS ROAD
Glenyarra
Bristowes
Mattiske (DB)
Domco
Nageen
Mattiske II (RA)
West Plains
Cadalgulee Lane
Peasley II
Peasley
Kywong
Superb Developments Pty Ltd
Fuge
Goodwood
Websters Road
Lows Road
Sinclair Lane
(Burcher Rd)
Boongarry
Gumbelah
Bungabulla
HIGHWAY
Lake Cowal (Evolution)
Lake Cowal II (Leppi)
Bland Creek
NEWELL
Billabong
Uncle Bills Road
RAILWAY
WYALONG
BURCHER
WEST
Staniforths Lane
Deans Road
Legend
Company-owned Dwelling
Privately-owned Dwelling
Mining Lease Boundary (ML1535)
Bore Pipeline
Moomba to Sydney Gas Pipeline
Electricity Transmission Line
Railway
State Forest
Company-owned
Crown Land
Local Government
Privately Owned
0 3 6
Kilometers
GRID DATUM MGA94 ZONE 55
Source: Evolution Land and Property 2018; Department of Finance, Services and Innovation
ANNUAL REVIEW 2018
FIGURE 2
Land Tenure of CGO Area
Evolution Mining Cowal


Legend
Mining Lease Boundary (ML1535)
ML 1535
N
Up-catchment Diversion system
Soil Stockpiles
Travelling Stock Reserve
D1
Northern Waste Rock Emplacement
Northern Waste Rock Emplacement
Temporary Isolation Bund
LAKE COWAL
Soil Stockpiles
Subsoil Stockpile
Northern Tailings Storage Facility
TSF Rock Stockpile
Lake Protection Bund
Mineralised Waste
Soil Stockpiles
Clay Sockpile
Explosives Storage
Low Grade Ore
Hard Oxide Ore
Open Pit
Perimeter Waste Rock Emplacement
Bland Creek Palaeochannel Borefield and Eastern Saline Borefield (approx. 20km)
Tailings Decant Causeway
ROM Pad
Clay Sockpile
Hard Oxide Ore
ROM Pad
D3
D2
D6
Clay Stockpiles
Service Corridor
Process Plant
D5
Soft Oxide Ore
WEST WYALONG
PURCHER
RAILWAY
Up-catchment Diversion system
ROM 6
D8B
D9
Saline Groundwater Supply Bores
Southern Tailings Storage Facility
Soil Stockpile
Southern Waste Rock Emplacement
Soil Stockpiles
D4
Soil Stockpiles
Bore Field Pipieline
Soil Stockpiles
Stilling Basin and Outfall
Soil Stockpiles
Up-catchment Diversion system
Exploration Facility
Travelling Stock Reserve
Electricity Transmission Line
0
0.5
1
Kilometers
GRID DATUM MGA94 ZONE 55
Source: Evolution Orthophoto November 2018
ANNUAL REVIEW 2018
FIGURE 3
CGO Current General Arrangement
Evolution MINING Cowal


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


Legend
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
West Wyalong Burcher Railway
LAKE COWAL
Offset Area 6 (new)
RVEP Area 1
Laake Cowal Road
FELLMANS HILL
RVEP Area 3
Relocated Crown Reserve
RVEP Area 4
Uncle Bills Road
Blow Clear Road
Southern Offset Area (1)
0 1 2
Kilometers
GRID DATUM MGA94 ZONE 55
Evolution Orthophoto November 2018
N
ANNUAL REVIEW 2018
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

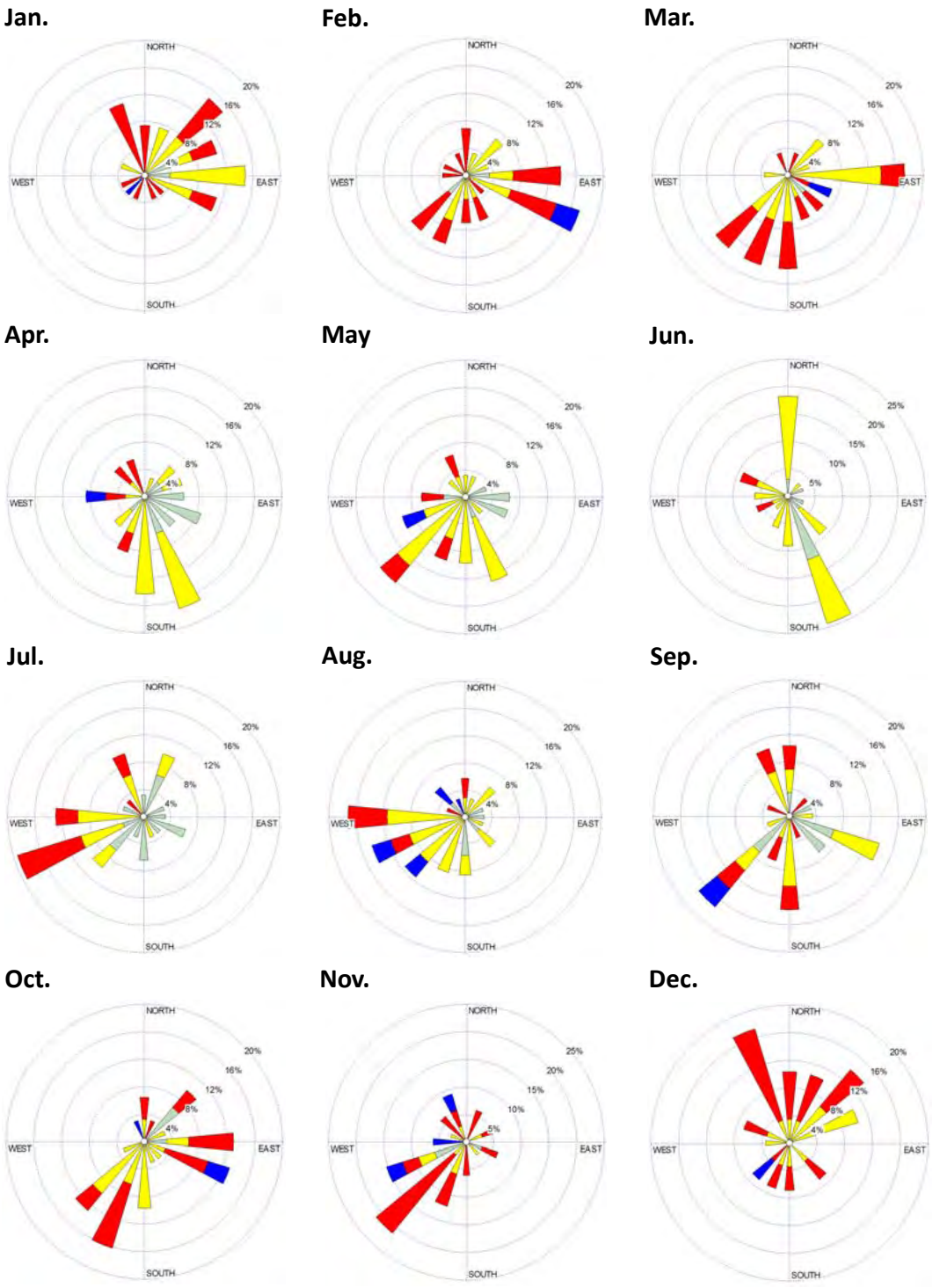
Source: University of Sydney (2019)

ANNUAL REVIEW 2018

FIGURE 6a

Annual Wind Rose for 2018

Evolution Mining Cowal



Source: University of Sydney (2019)

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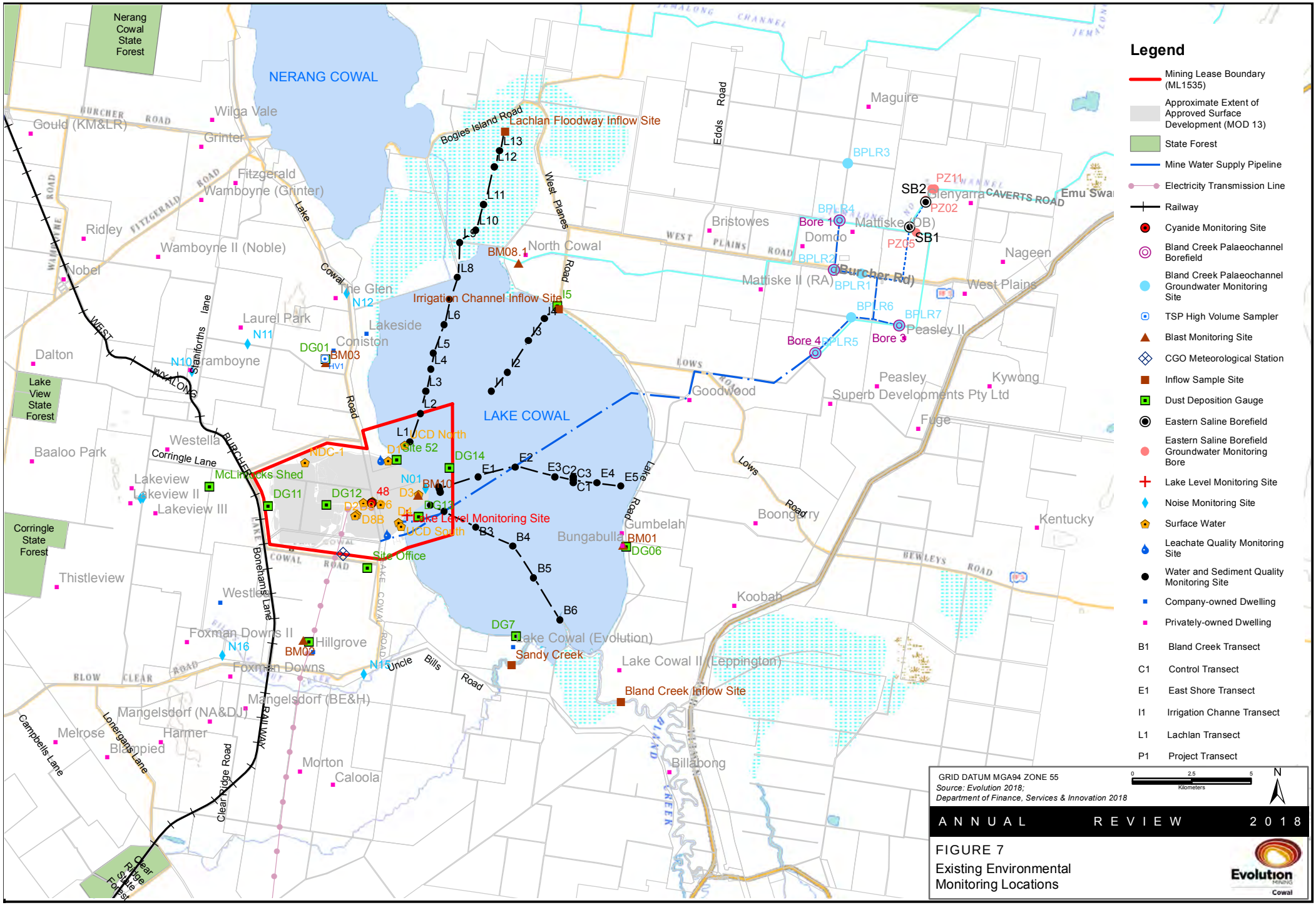
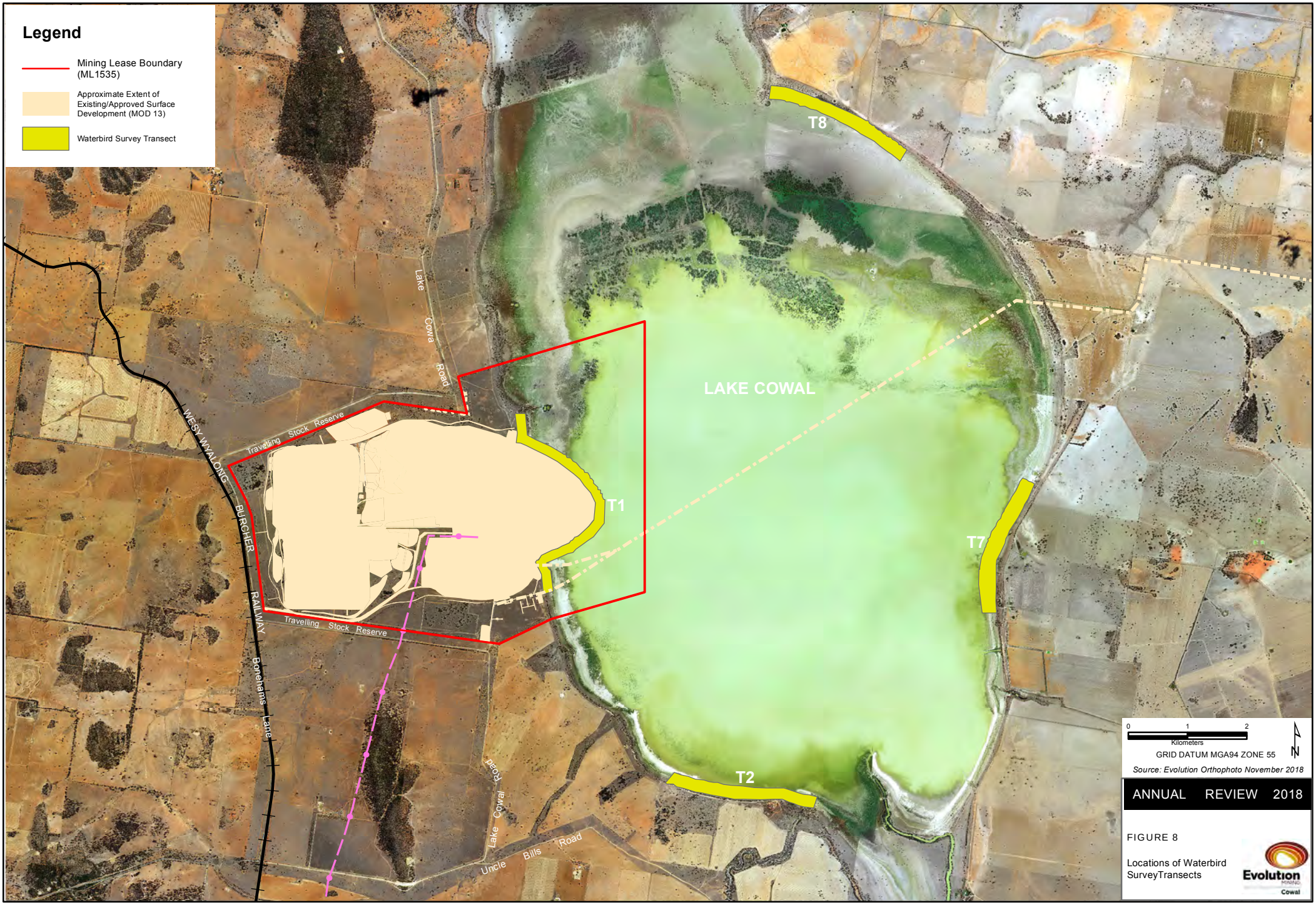
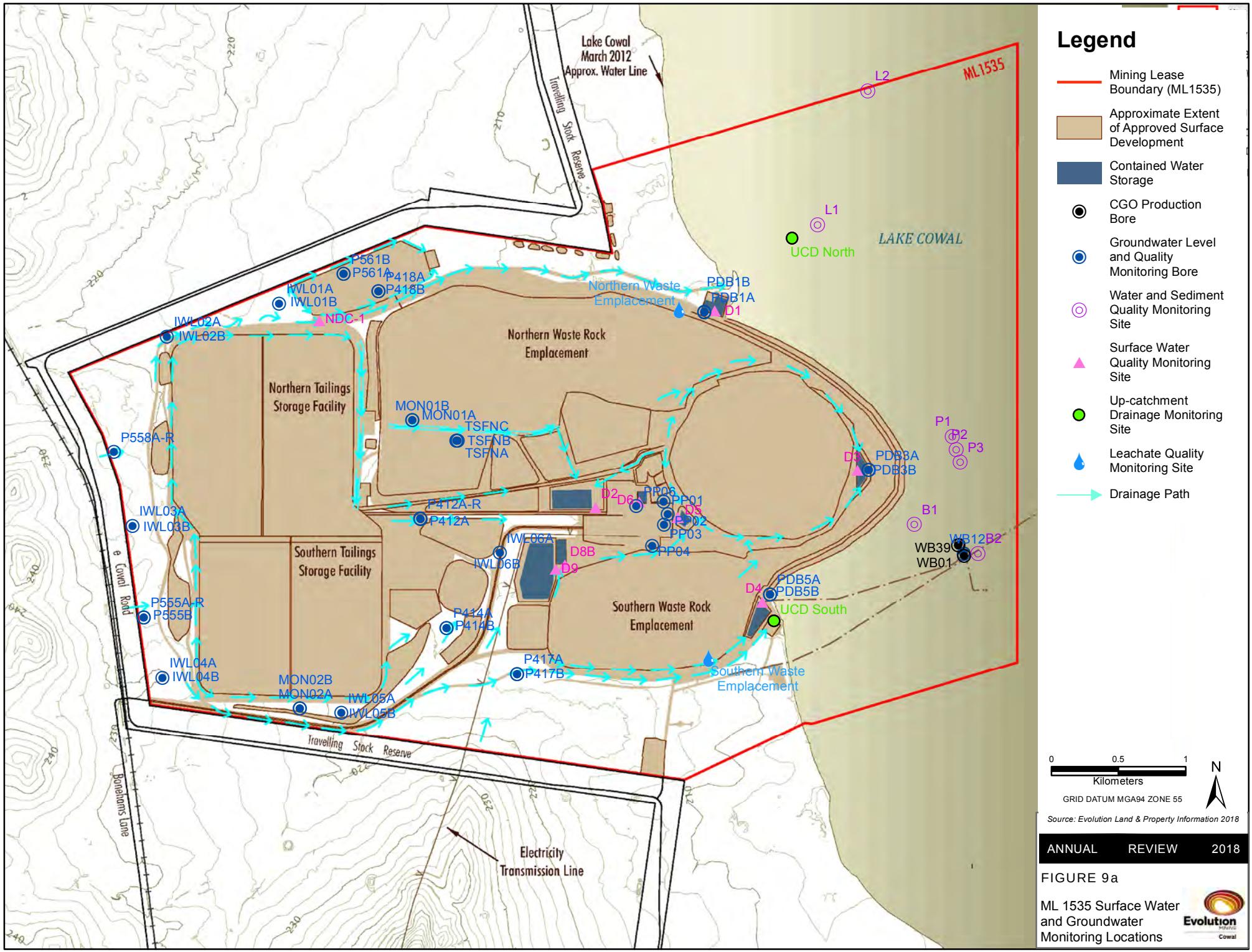
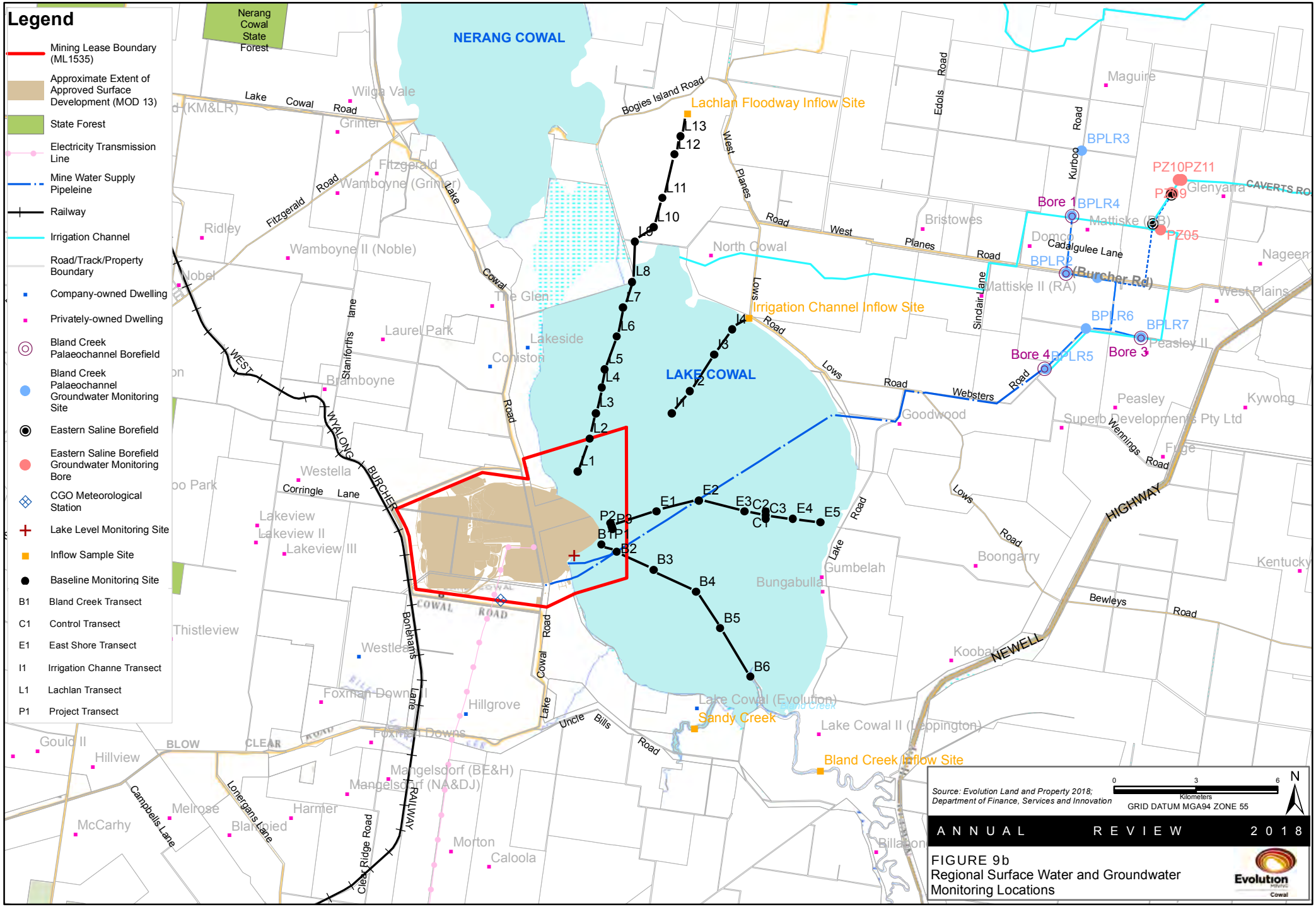
FIGURE 6b

Monthly Wind Roses for January - December 2018


Legend
Mining Lease Boundary (ML1535)
Approximate Extent of Approved Surface Development (MOD 13)
State Forest
Mine Water Supply Pipeline
Electricity Transmission Line
Railway
Cyanide Monitoring Site
Bland Creek Palaeochannel Borefield
Bland Creek Palaeochannel Groundwater Monitoring Site
TSP High Volume Sampler
Blast Monitoring Site
CGO Meteorological Station
Inflow Sample Site
Dust Deposition Gauge
Eastern Saline Borefield
Eastern Saline Borefield Groundwater Monitoring Bore
Lake Level Monitoring Site
Noise Monitoring Site
Surface Water
Leachate Quality Monitoring Site
Water and Sediment Quality 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
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
Bland Creek Inflow Site
Lake Level Monitoring Site
Site Office
UCD North
UCD South
Site 52
NDC-1
McLiddicks Shed
Sandy Creek
Lake Cowal (Evolution)
Lake Cowal II (Leppington)
North Cowal
Bungabulla
Gumbelah
Goodwood
Superb Developments Pty Ltd
Mattiske (DB)
Mattiske II (RA)
Domco
Bristowes
Maguire
Nageen
West Plains
Peasley
Peasley II
Kywong
Fuge
Kentucky
Koobah
Billabong
Boongary
Wilga Vale
Grinter
Gould (KM&LR)
Fitzgerald
Wamboyne (Grinter)
Ridley
Wamboyne II (Noble)
Nobel
Dalton
Wamboyne
Laurel Park
Lakeside
Coniston
The Glen
Westella
Baaloo Park
Lakeview
Lakeview II
Lakeview III
Thistleview
Westlea
Foxman Downs II
Foxman Downs
Hillgrove
Mangelsdorf (NA&DJ)
Mangelsdorf (BE&H)
Melrose
Harmer
Morton
Caloola
Bogies Island Road
Eddis Road
West Planes Road
Cowal Lake
Stanifortths lane
Corringle Lane
Bonehams Lane
Uncle Bills Road
Clear Ridge Road
Campbells Lane
Lonergans Lane
Lake Cowal Road
Lake Cowal Road
Lows Road
Burcher Rd
Caverts Road
Bewleys Road
Railway
Bland Creek
GRID DATUM MGA94 ZONE 55
Source: Evolution 2018;
Department of Finance, Services & Innovation 2018
0 2.5 5 Kilometers
N
ANNUAL REVIEW 2018
FIGURE 7
Existing Environmental Monitoring Locations
Evolution Mining Cowal


Legend
Mining Lease Boundary (ML1535)
Approximate Extent of Existing/Approved Surface Development (MOD 13)
Waterbird Survey Transect
T8
T1
T7
T2
LAKE COWAL
Lake Cowal Road
Travelling Stock Reserve
WESLY WYALONG
BURCHER
RAILWAY
Bonehams Lane
Travelling Stock Reserve
Lake Cowal Road
Uncle Bills Road
0 1 2
Kilometers
N
GRID DATUM MGA94 ZONE 55
Source: Evolution Orthophoto November 2018
ANNUAL REVIEW 2018
FIGURE 8
Locations of Waterbird SurveyTransects
Evolution MINING
Cowal


Lake Cowal
March 2012
Approx. Water Line
Travelling Stock Reserve
ML1535
L2
L1
LAKE COWAL
UCD North
P561B
P561A
P418A
P418B
IWL01A
IWL01B
NDC-1
IWL02A
IWL02B
Northern Waste
Emplacement
PDB1B
PDB1A
D1
Northern Waste Rock
Emplacement
Northern Tailings
Storage Facility
MON01B
MON01A
TSFNC
TSFNB
TSFNA
P558A-R
P1
P2
P3
D5
PDB3A
PDB3B
IWL03A
IWL03B
P412A-R
P412A
D2
D6
PP05
PP01
D3
PP02
PP03
PP04
B1
WB12B2
WB39
WB01
IWL06A
IWL06B
D8B
D9
Southern Tailings
Storage Facility
e Cowal Road
P555A-R
P555B
P414A
P414B
Southern Waste Rock
Emplacement
D4
PDB5A
PDB5B
UCD South
IWL04A
IWL04B
P417A
P417B
Southern Waste
Emplacement
MON02B
MON02A
IWL05A
IWL05B
Travelling Stock Reserve
Bonehams Lane
Electricity
Transmission Line
Legend
Mining Lease Boundary (ML1535)
Approximate Extent of Approved Surface Development
Contained Water Storage
CGO Production Bore
Groundwater Level and Quality Monitoring Bore
Water and Sediment Quality Monitoring Site
Surface Water Quality Monitoring Site
Up-catchment Drainage Monitoring Site
Leachate Quality Monitoring Site
Drainage Path
0
0.5
1
Kilometers
N
GRID DATUM MGA94 ZONE 55
Source: Evolution Land & Property Information 2018
ANNUAL REVIEW 2018
FIGURE 9a
ML 1535 Surface Water and Groundwater Monitoring Locations
Evolution
Cowal


Legend
Mining Lease Boundary (ML1535)
Approximate Extent of Approved Surface Development (MOD 13)
State Forest
Electricity Transmission Line
Mine Water Supply Pipeleine
Railway
Irrigation Channel
Road/Track/Property Boundary
Company-owned Dwelling
Privately-owned Dwelling
Bland Creek Palaeochannel Borefield
Bland Creek Palaeochannel Groundwater Monitoring Site
Eastern Saline Borefield
Eastern Saline Borefield Groundwater Monitoring Bore
CGO Meteorological Station
Lake Level Monitoring Site
Inflow Sample Site
Baseline Monitoring Site
B1 Bland Creek Transect
C1 Control Transect
E1 East Shore Transect
I1 Irrigation Channe Transect
L1 Lachlan Transect
P1 Project Transect
NERANG COWAL
LAKE COWAL
Nerang Cowal State Forest
Lachlan Floodway Inflow Site
Irrigation Channel Inflow Site
Bland Creek Inflow Site
Sandy Creek
Lake Cowal (Evolution)
Lake Cowal II (Leppington)
North Cowal
Bogies Island Road
Lake Cowal Road
Fitzgerald Road
Wyalong West Road
Burcher Road
Corringle Lane
Bonhams Lane
Uncle Bills Road
Websters Road
Cadalgulee Lane
Sinclair Lane
Bewleys Road
Wennings Road
Newell Highway
Campbells Lane
Lonergans Lane
Clear Ridge Road
Mangelsdorf Railway
Blow Clear Road
Wilga Vale
Grinter
Wamboyne (Grinter)
Wamboyne II (Noble)
Ridley
Nobel
The Glen
Laurel Park
Lakeside
Coniston
Bramboyne
Westella
Lakeview
Lakeview II
Lakeview III
Thistleview
Foxman Downs
Hillgrove
Gould II
Hillview
Melrose
McCarhy
Harmer
Mangelsdorf (BE&H)
Mangelsdorf (NA&DJ)
Morton
Caloola
Gumbelah
Bungabulla
Boongarry
Goodwood
Bristowes
Mattiske (RA)
Mattiske II (RA)
Domco
Maguire
Glenyarra
Peasley
Peasley II
Superb Developments Pty Ltd
Nageen
West Plains
Kywong
Kentucky
Koobak
Billabon
BPLR1
BPLR2
BPLR3
BPLR4
BPLR5
BPLR6
BPLR7
Bore 1
Bore 3
Bore 4
PZ05
PZ09
PZ10
PZ11
L1
L2
L3
L4
L5
L6
L7
L8
L9
L10
L11
L12
L13
I1
I2
I3
I4
E1
E2
E3
E4
E5
C1
C2
C3
B1
B2
B3
B4
B5
B6
P1
P2
P3
Source: Evolution Land and Property 2018; Department of Finance, Services and Innovation
0 3 6 Kilometers
GRID DATUM MGA94 ZONE 55
N
ANNUAL REVIEW 2018
FIGURE 9b
Regional Surface Water and Groundwater Monitoring Locations
Evolution Mining Cowal

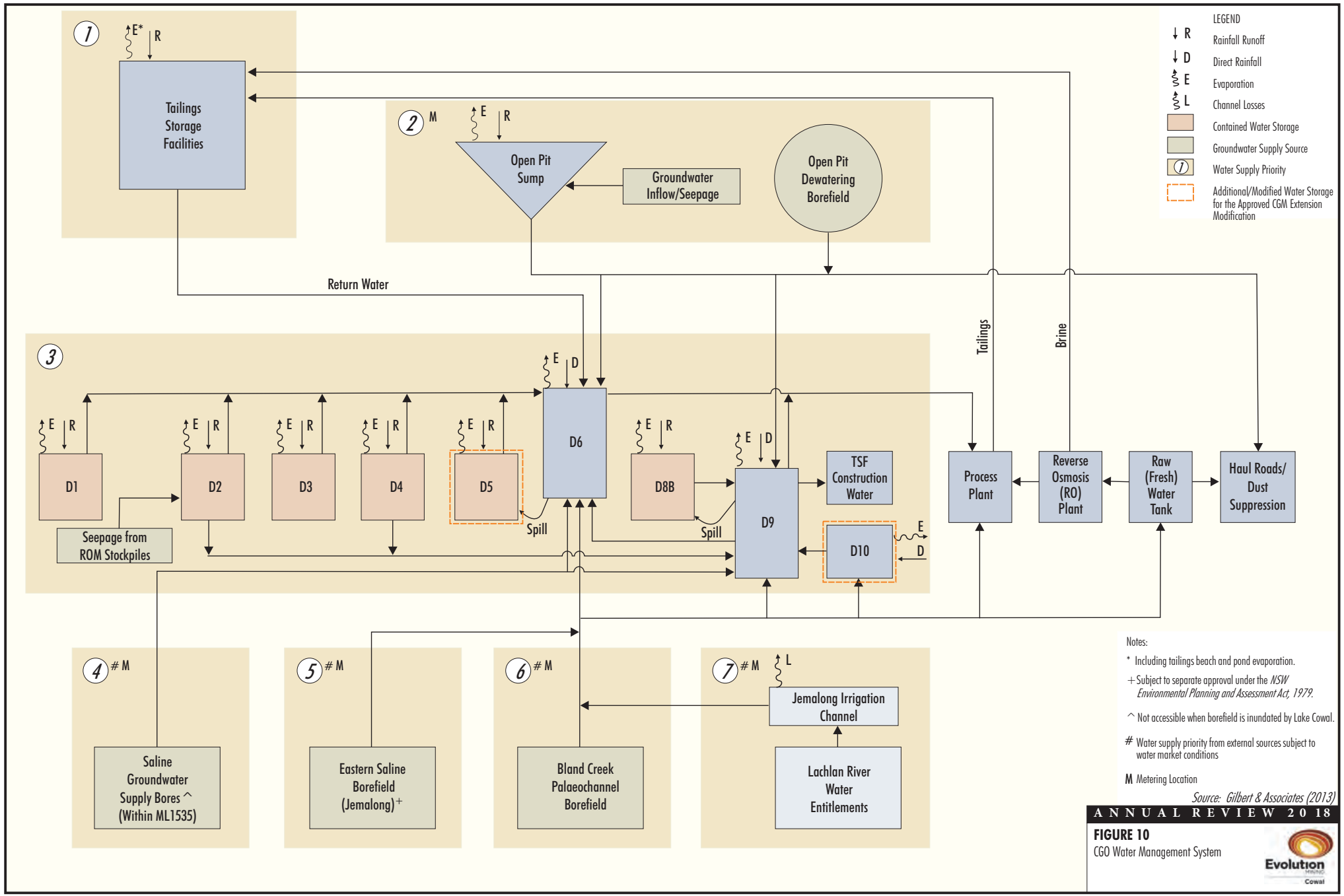


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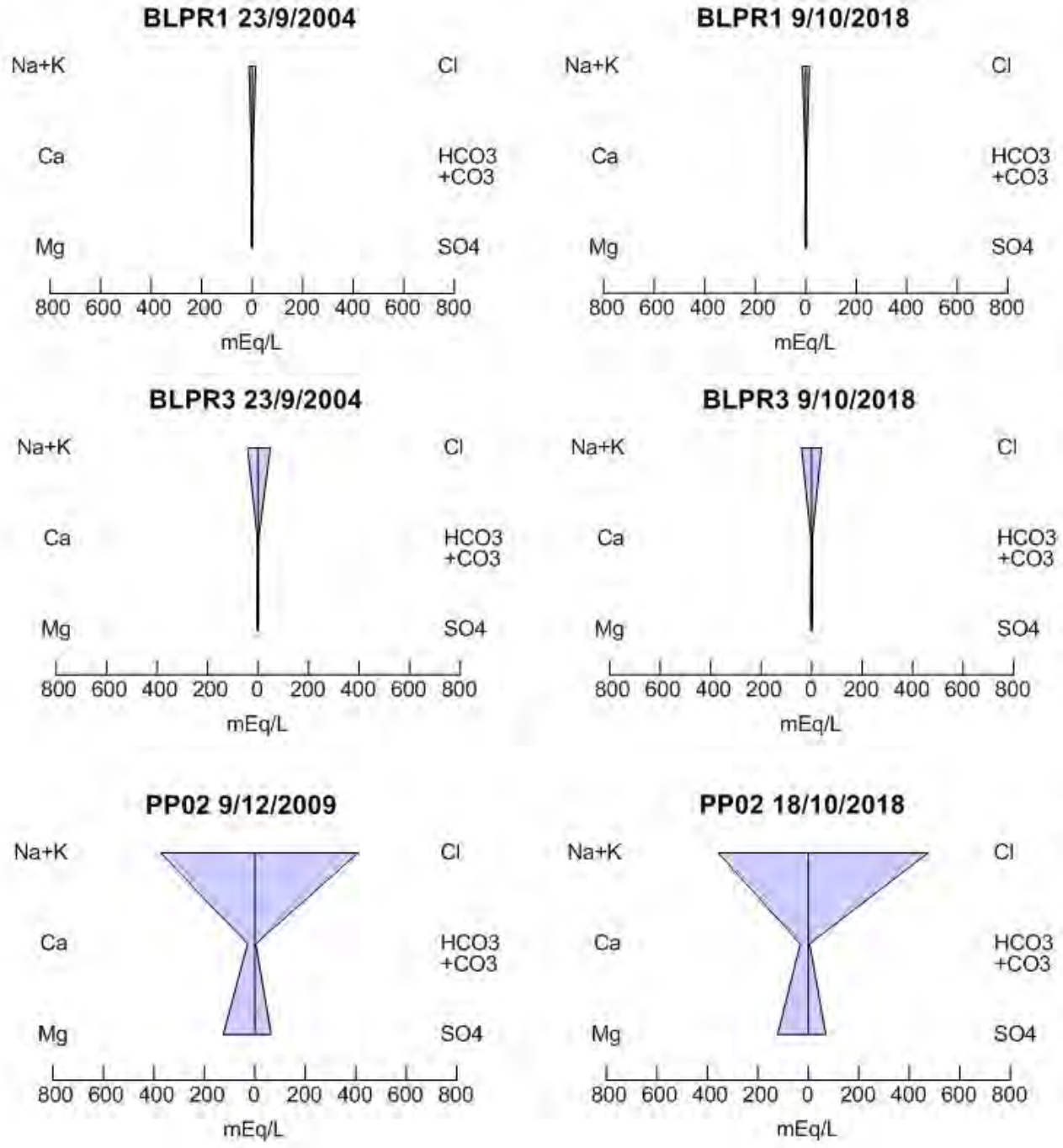
FIGURE 10
CGO Water Management System

HAL-04-22_AR2017_005A



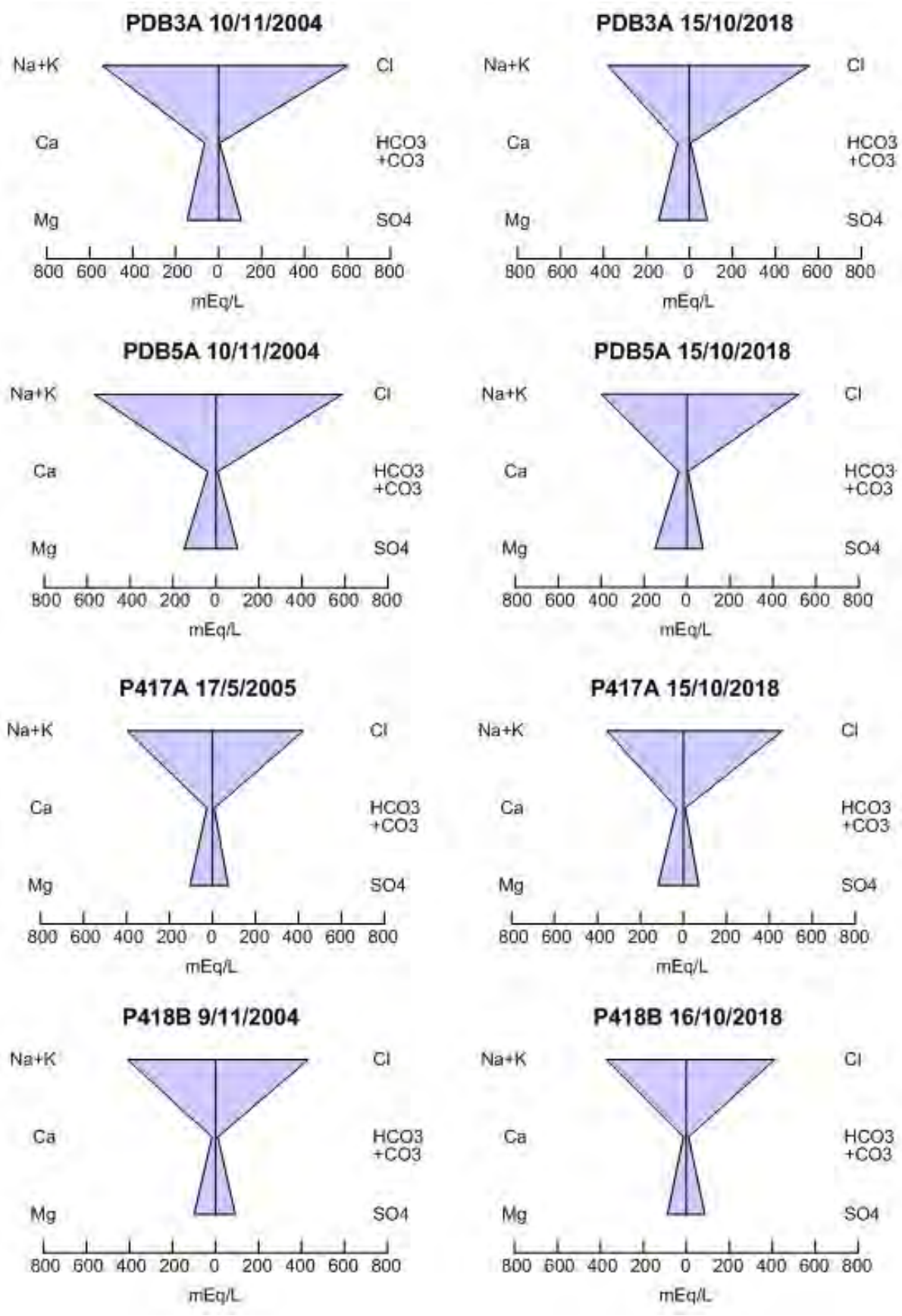
Source: Coffey Geotechnics Pty Ltd (2019)

ANNUAL REVIEW 2018

FIGURE 11a

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

Evolution Mining Cowal

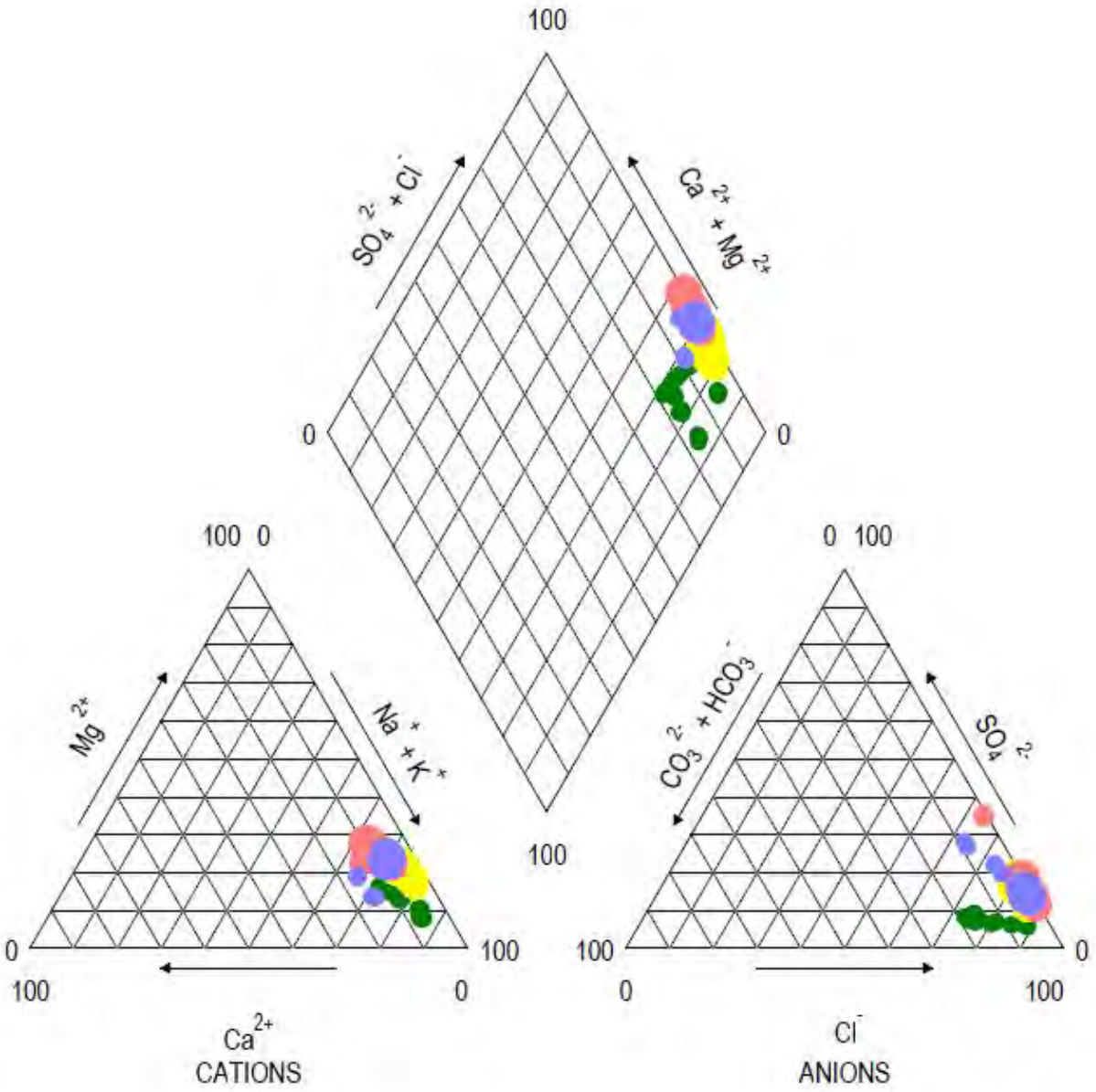


Source: Coffey Geotechnics Pty Ltd (2019)

FIGURE 11b

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

Evolution Mining Cowal



EXPLANATION

- BLAND CREEK PALAEOCHANNEL BOREFIELD
- TAILINGS STORAGE AREAS
- PIT AREA
- PROCESSING PLANT AREA

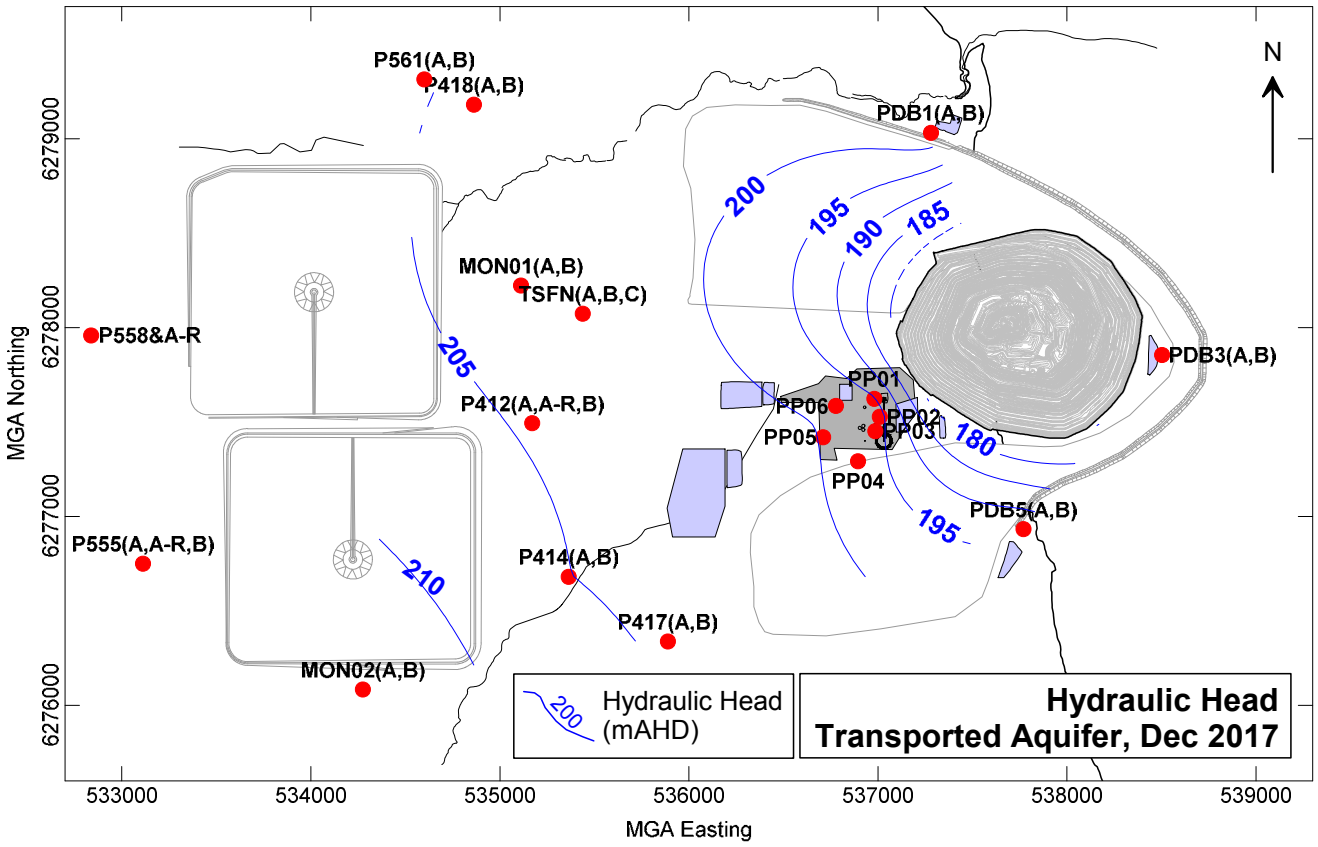
Symbol size is proportional to TDS concentration (mg/L):

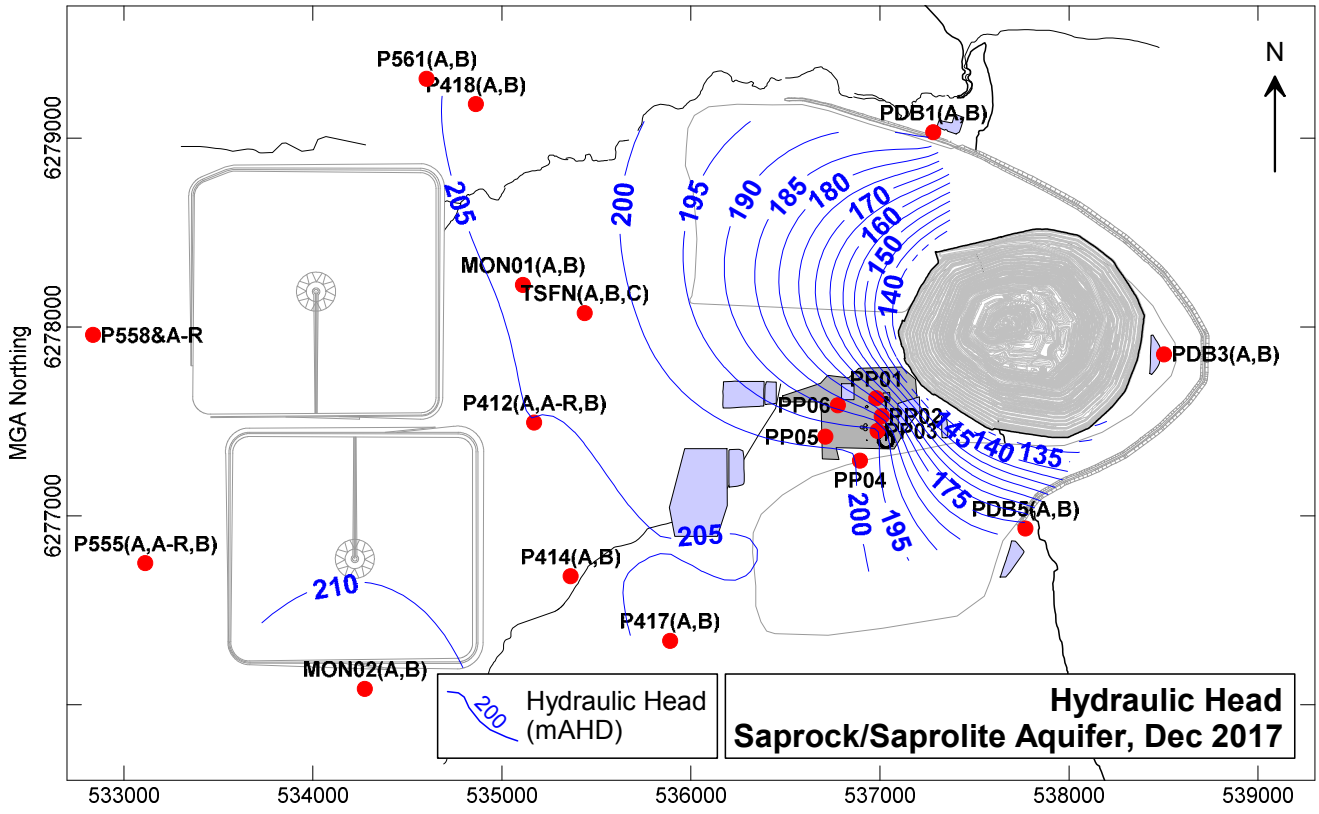
- 906
- 56400

Source: Coffey Geotechnics Pty Ltd (2019)

FIGURE 12

Piper Plot of Ground Chemistry





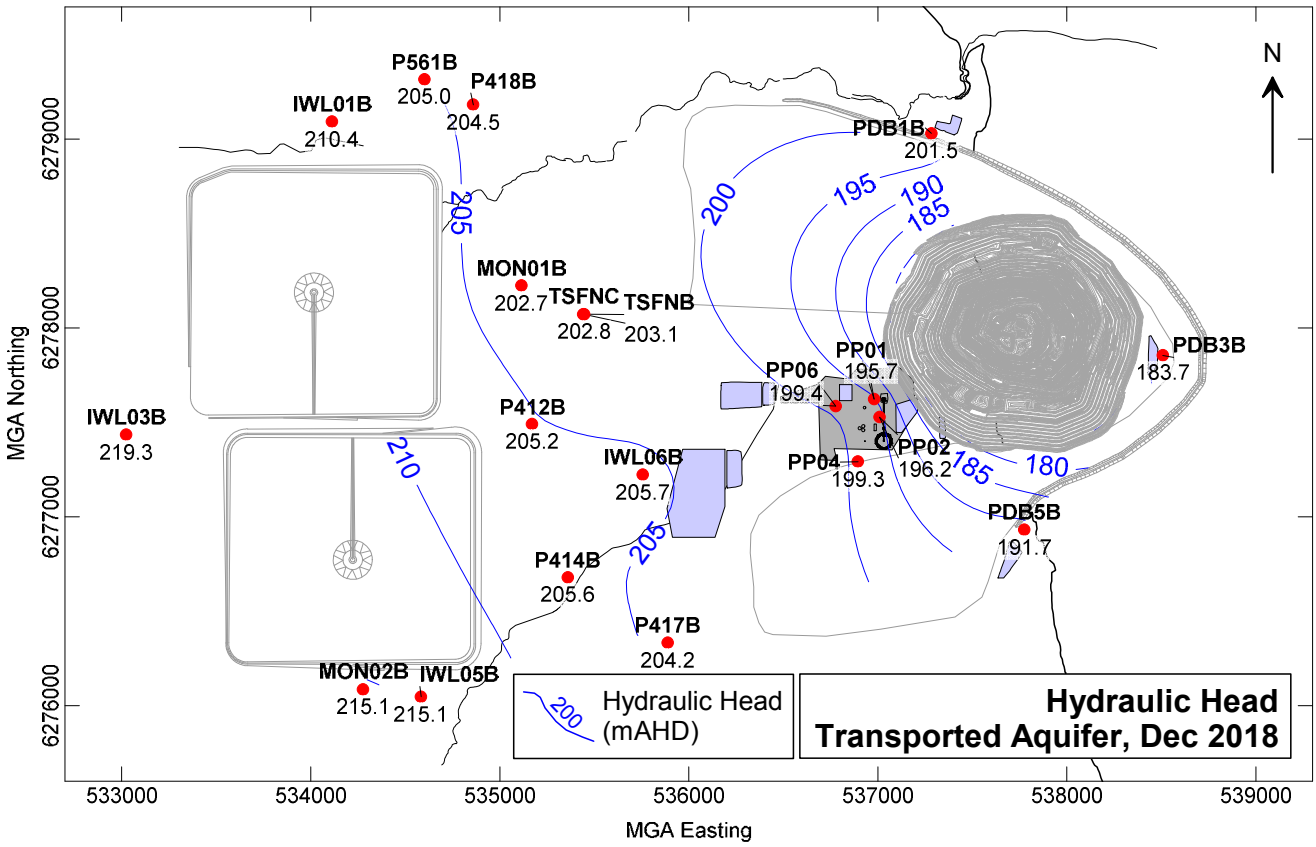
Source: Coffey Geotechnics Pty Ltd (2019)

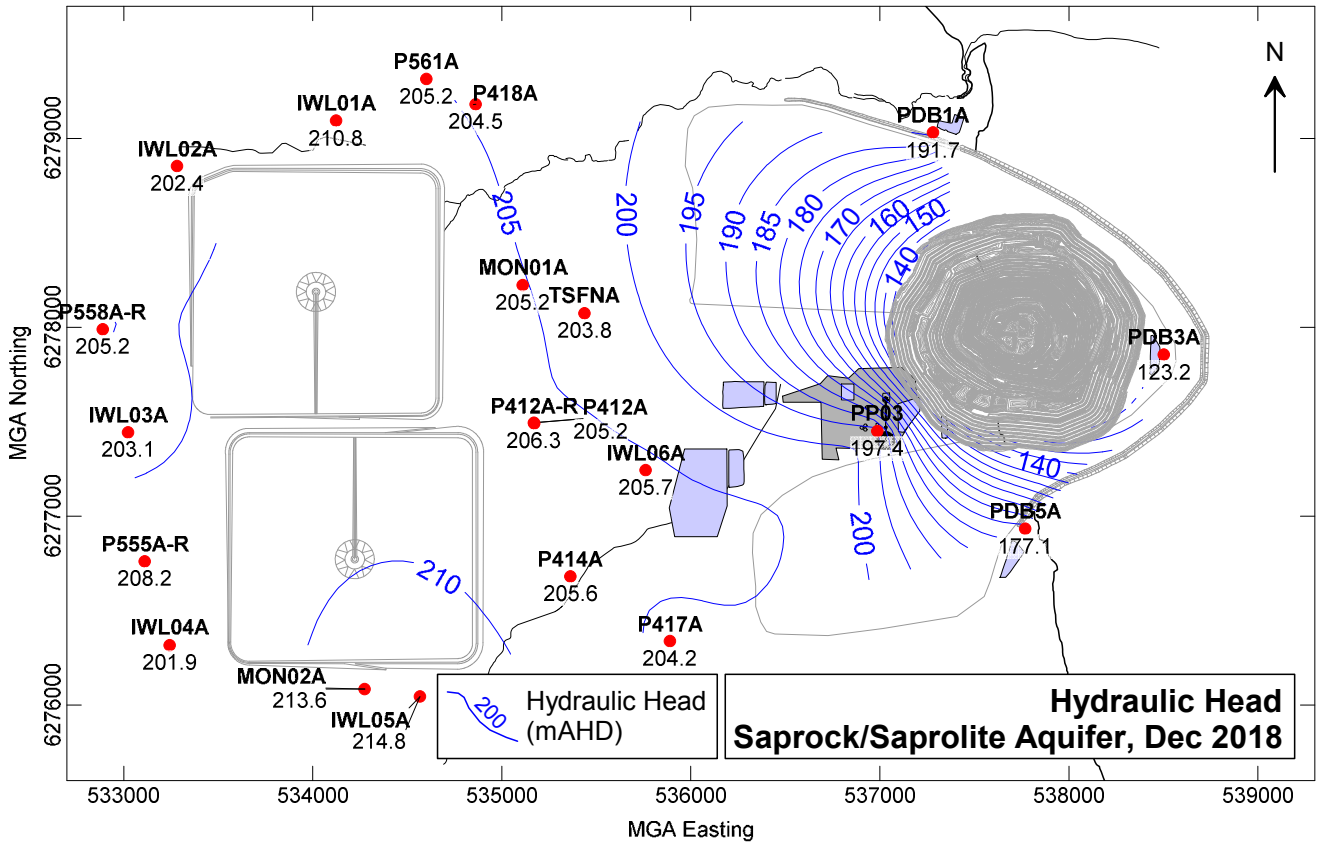
ANNUAL REVIEW 2018

FIGURE 13a

Deep Groundwater Contours

Evolution Mining Cowal





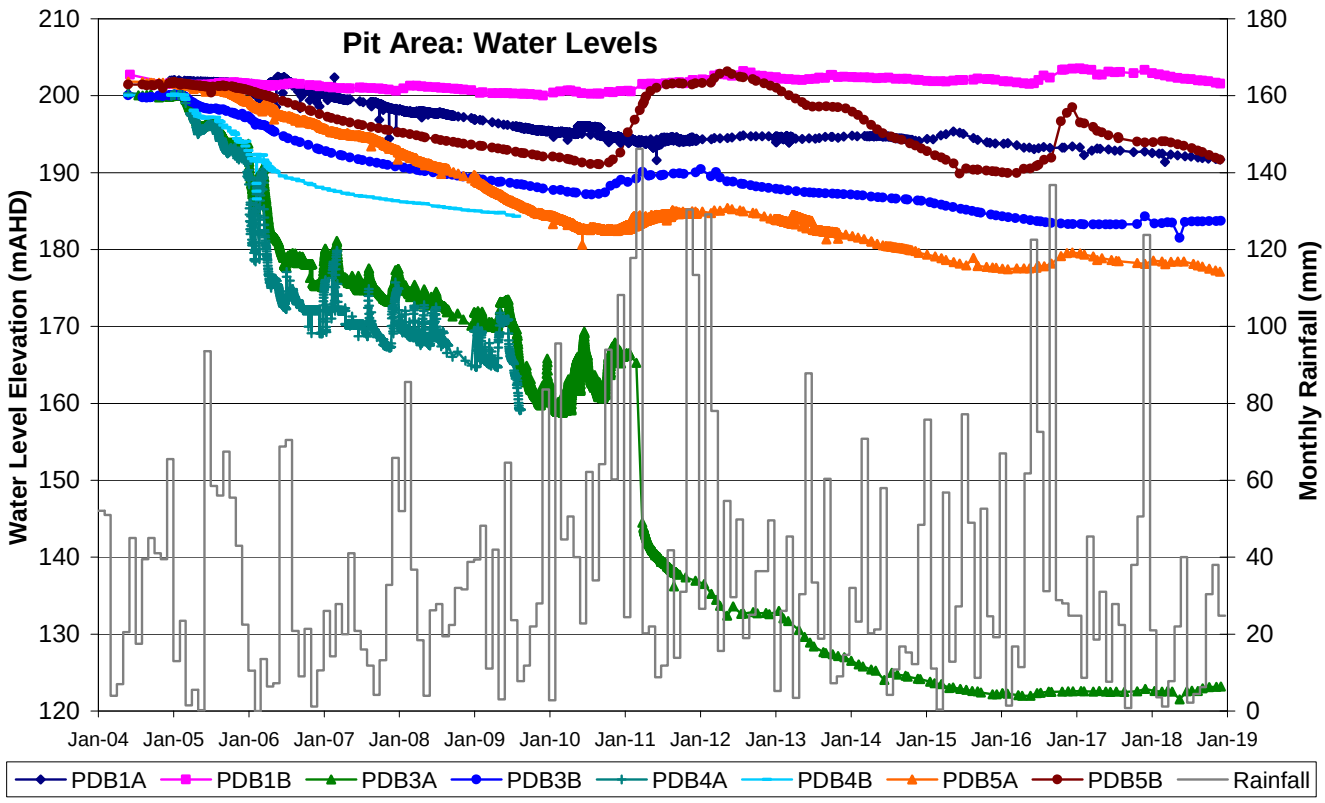
Source: Coffey Geotechnics Pty Ltd (2019)

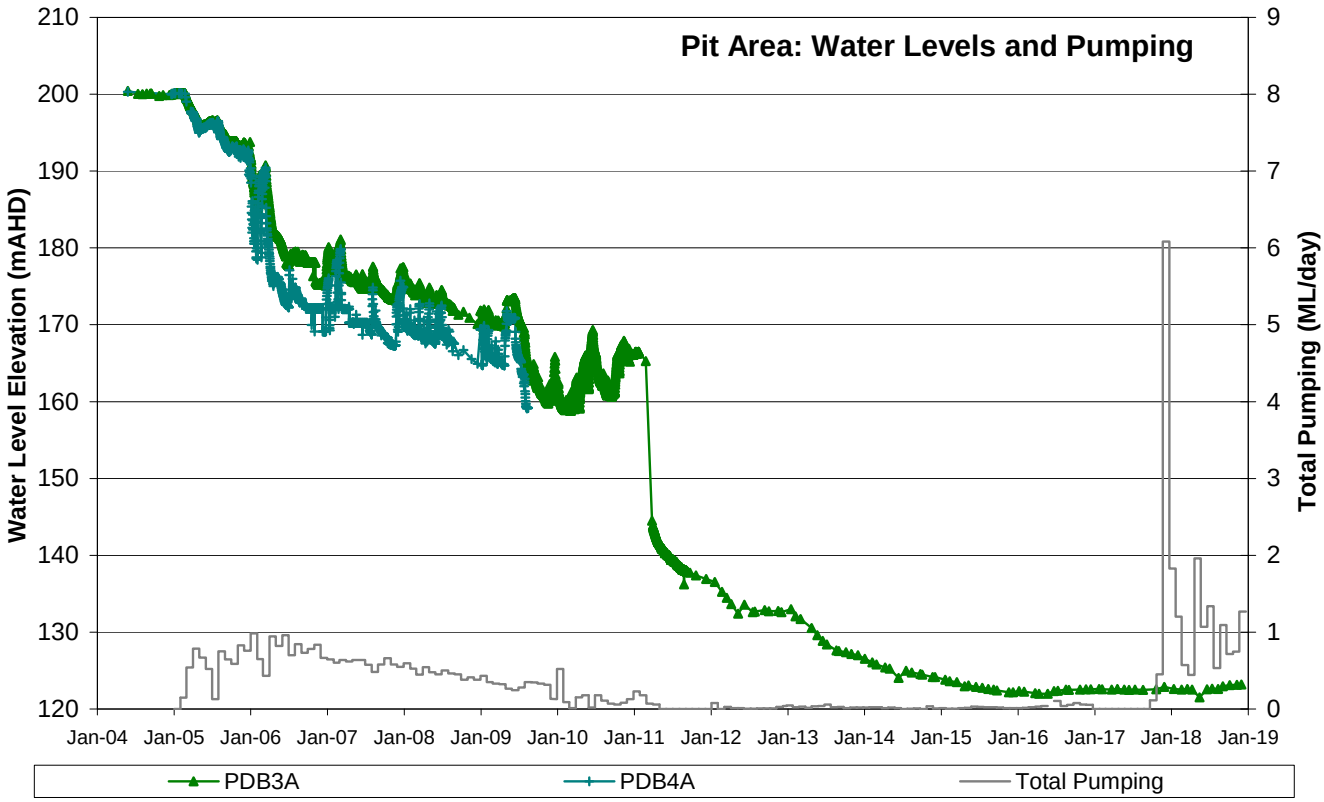
ANNUAL REVIEW 2018

FIGURE 13b

Shallow Groundwater Contours

Evolution Mining Cowal



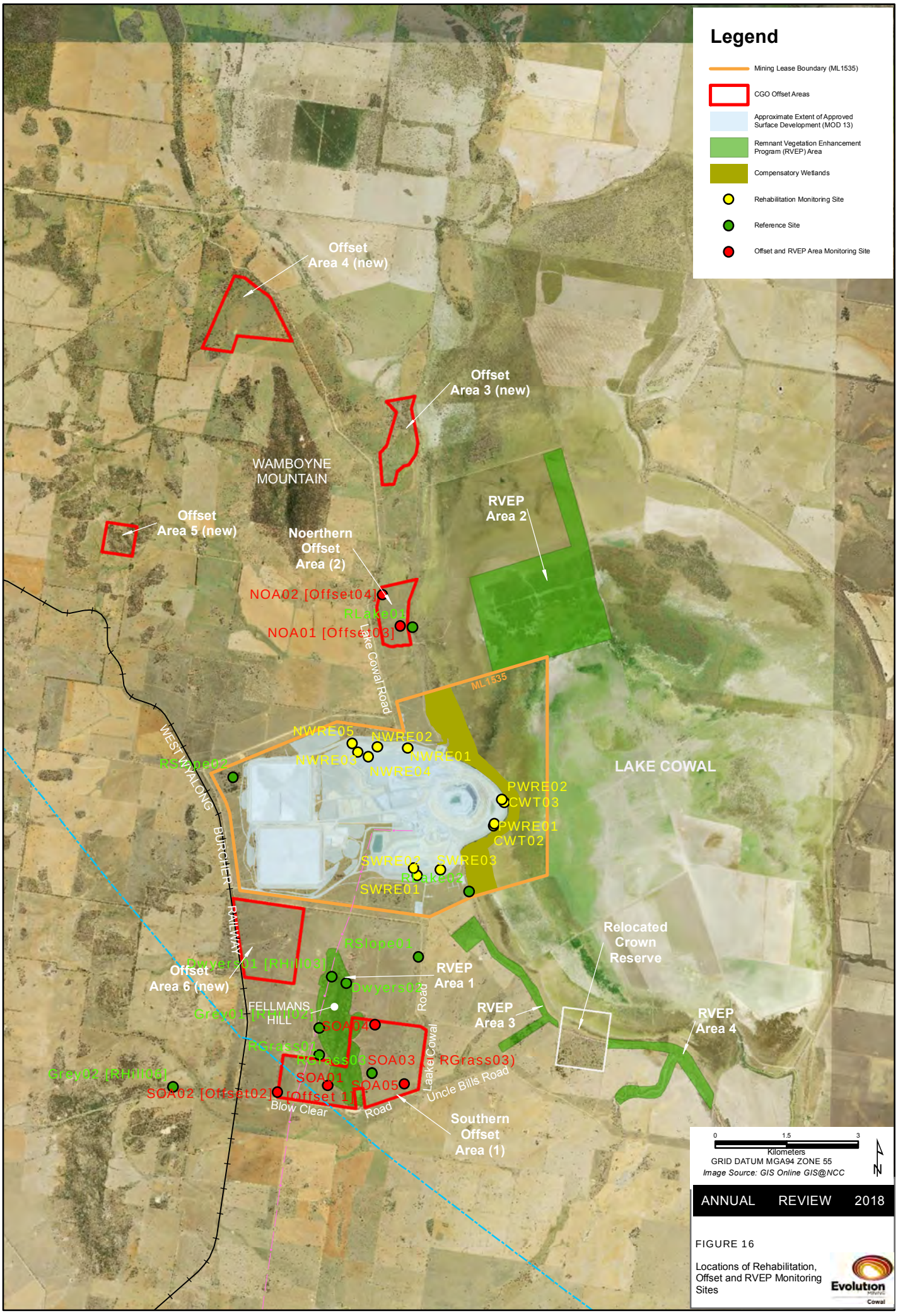


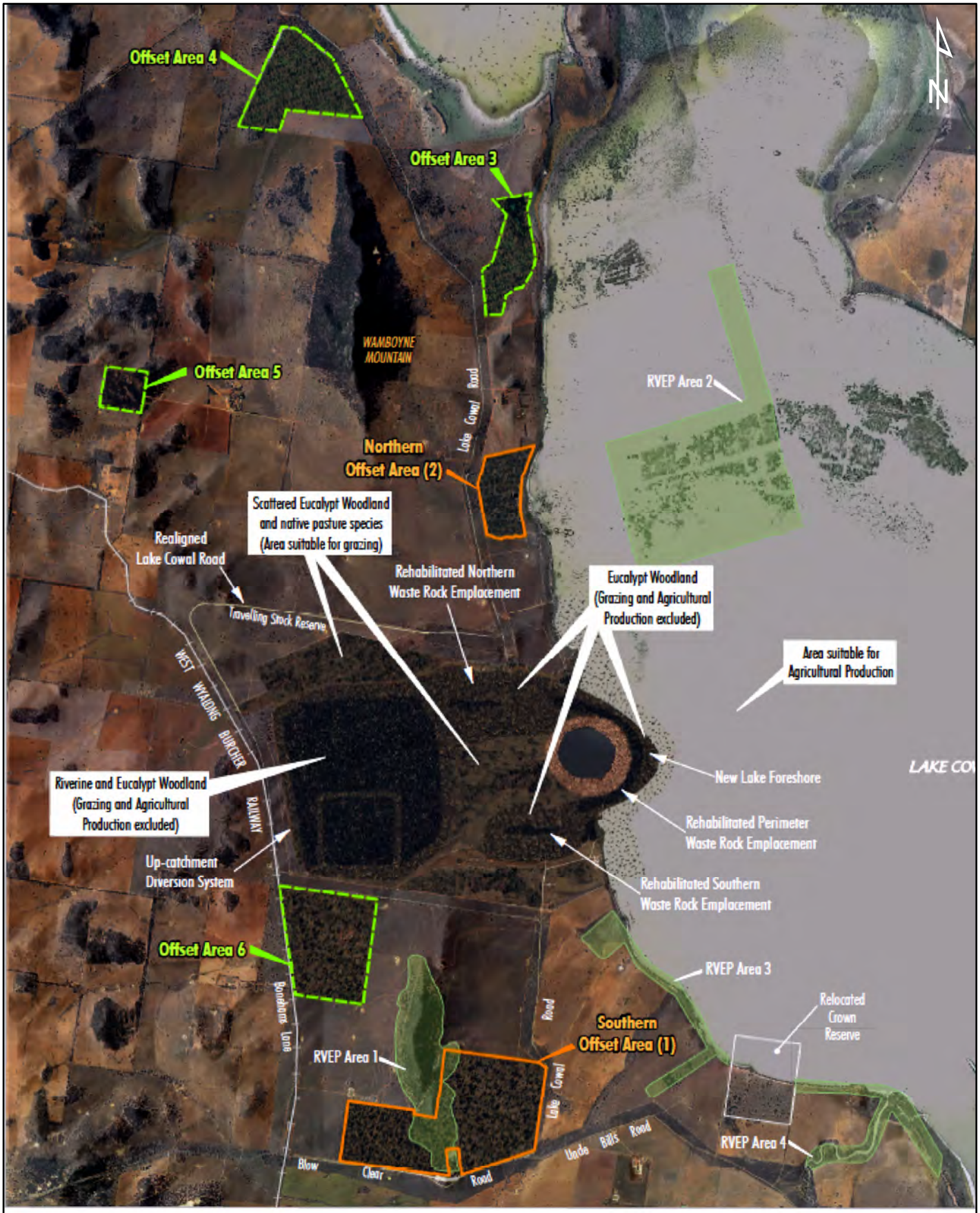
Source: Coffey Geotechnics Pty Ltd (2019)

FIGURE 14

Standing Water Levels Measured During the Reporting Period


Legend
Mining Lease Boundary (ML1535)
Stockpile Boundary
Subsoil
Topsoil
ML1535
N
LAKE COWAL
Travelling Stock Reserve
Topsoil 26
Topsoil 23
Topsoil 23 West
Topsoil 19
Topsoil 10
D1
Northern Waste Rock Emplacement
Temporary Isolation Bund
Topsoil 26 South
Subsoil 07
Topsoil 07
Topsoil 02C
Topsoil 06
Northern Tailings Storage Facility
TSF Rock Stockpile
Clay Sockpile
Mineralised Waste
Lake Protection Bund
Topsoil 12
ROM Pad
Low Grade Ore
Hard Oxide Ore
Open Pit
Perimeter Waste Rock Emplacement
Bland Creek Palaeochannel Borefield and Eastern Saline Borefield (approx. 20km)
Clay Sockpile
Hard Oxide Ore
ROM Pad
D3
Topsoil 01
Subsoil 01
D2
D6
Clay Stockpiles
Soft Oxide Ore
Service Corridor
Process Plant
D5
ROM 6
Subsoil 02
D8B
D9
Topsoil 08
Topsoil 03
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
Topsoil 22
Topsoil 15
Bore Field Pipeline
Stilling Basin and Outfall
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 November 2018
ANNUAL REVIEW 2018
FIGURE 15
Indicative Locations of Soil Stockpiles - December 2018
Evolution MINING Cowal


Legend
Mining Lease Boundary (ML1535)
CGO Offset Areas
Approximate Extent of Approved Surface Development (MOD 13)
Remnant Vegetation Enhancement Program (RVEP) Area
Compensatory Wetlands
Rehabilitation Monitoring Site
Reference Site
Offset and RVEP Area Monitoring Site
Offset Area 4 (new)
Offset Area 3 (new)
WAMBOYNE MOUNTAIN
Offset Area 5 (new)
Noerthern Offset Area (2)
RVEP Area 2
NOA02 [Offset04]
RLake01
NOA01 [Offset03]
Lake Cowal Road
ML1535
NWRE05
NWRE02
NWRE03
NWRE01
NWRE04
RSlope02
LAKE COWAL
PWRE02
CWT03
PWRE01
CWT02
SWRE02
SWRE03
RLake02
SWRE01
WEST WALONG
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
Lake Cowal
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 2018
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