Government of Western Australia
Department of Water and Environmental Regulation

Amendment Notice 1

Licence Number	L8934/2015/1
Licensee	Big Bell Gold Operations Pty Ltd
ACN	090 642 809
File Number:	DER2015/002680
Premises	Central Murchison Gold Project – Big Bell Mining Tenements M20/17, M20/99, M20/192, L20/21, L20/40, G20/2, G20/3, L20/39, L20/41, M20/252, M20/307, M20/333, M20/418, M20/435 and G20/1 As depicted in Schedule 1
Date of Amendment	**19 December 2018**

Amendment

The Chief Executive Officer (CEO) of the Department of Water and Environmental Regulation (DWER) has amended the above Licence in accordance with section 59 of the *Environmental Protection Act 1986* as set out in this Amendment Notice. This Amendment Notice constitutes written notice of the amendment in accordance with section 59B(9) of the EP Act.

Alana Kidd
Digitally signed by Alana Kidd
Date: 2018.12.19 08:44:22 +08'00'

Alana Kidd

Manager, Resource Industries

an officer delegated under section 20 of the *Environmental Protection Act 1986* (WA)

Definitions and interpretation

Definitions

In this Amendment Notice, the terms in Table 1 have the meanings defined.

Table 1: Definitions

Term	Definition
ACN	Australian Company Number
AER	Annual Environment Report
ANZECC	means the most recent version and relevant parts of the *Australian and New Zealand Environment guidelines for fresh and marine water quality Volume 1 – 3* (Australian and New Zealand Environment and Conservation Council, Agriculture and Resource Management Council of Australia and New Zealand);
Category/ Categories/ Cat.	categories of Prescribed Premises as set out in Schedule 1 of the EP Regulations
CEO	means Chief Executive Officer. CEO for the purposes of notification means: Director General Department Administering the *Environmental Protection Act 1986* Locked Bag 33 Cloisters Square PERTH WA 6850 info@dwer.wa.gov.au
DBCA	Department of Biodiversity, Conservation and Attractions
Decision Report	refers to this document
Delegated Officer	an officer under section 20 of the EP Act
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority
EP Act	*Environmental Protection Act 1986* (WA)
EP Regulations	*Environmental Protection Regulations 1987* (WA)
Existing Licence	The Licence issued under Part V, Division 3 of the EP Act and in force prior to the commencement of and during this Review
Licensee	Big Bell Gold Operations Pty Ltd
mg/L	Milligrams per Litre

Prescribed Premises	has the same meaning given to that term under the EP Act.
Premises	refers to the premises to which this Decision Report applies, as specified at the front of this Decision Report.
Risk Event	as described in *Guidance Statement: Risk Assessment*
TDS	Total Dissolved Solids
TEC	Threatened Ecological Community
µs/cm	microsiemens per centimetre

Amendment Notice

This amendment is made pursuant to section 59 of the *Environmental Protection Act 1986* (EP Act) to amend the Licence issued under the EP Act for a prescribed premises as set out below. This notice of amendment is given under section 59B(9) of the EP Act.

This notice is limited to an amendment for Category 6, which is the only Prescribed Premises category on Licence L8934/2015/1. No other amendment requests have been made by the Licensee in this application.

The following guidance statements have informed the decision made on this amendment

- *Guidance Statement: Regulatory Principles (July 2015)*
- *Guidance Statement: Setting Conditions (October 2015)*
- *Guidance Statement: Environmental Siting (November 2016)*
- *Guidance Statement: Land Use Planning (February 2017)*
- *Guidance Statement: Decision Making (February 2017)*
- *Guidance Statement: Risk Assessment (February 2017)*

Amendment description

The Licensee has applied to amend Licence L8934/2015/1 to facilitate dewatering of water from the Black Swan South pit at the Cuddingwarra mine. This is to enable deepening and cutting-back of the Black Swan South Pit. The Licensee proposes to dewater 1,824,556 tonnes of water from the Black Swan South pit over a 12 month period using a pontoon mounted pump positioned on the pit lake, and then up to 1,000,000 tonnes per year thereafter using a mobile trailer mounted pump at the areas where water may pool in the base of the pit. The current mining schedule does not allow for mining underground.

The discharge from the Black Swan South pit will be added to the existing licensed discharge volume of up to 3,500,000 tonnes per year from the Big Bell mine, which lies approximately 15 km to the west of the Black Swan South pit. This will result in a maximum combined dewatering discharge capacity of up to 5,324,556 tonnes per year. However, as some dewatering water from the Big Bell mine is used on site and ongoing annual discharge from the Black Swan South pit is expected to be approximately 45 percent lower (1,000,000 tonnes as opposed to 1,824,556 tonnes), ongoing discharge volumes are expected to be less than the maximum.

The combined effluent will be discharged into Lake Austin, which lies approximately 13km south and south-west of the Black Swan South pit. The location of the Black Swan South pit which is located at the Cuddingwarra mine is shown in Figure 1, while the mining tenements for the Licence are shown in Figure 2. The pipeline corridor for the amendment runs from the Black Swan South pit on mining tenement M20/252, along L20/40 and L21/14 prior to its discharge into Lake Austin. The pipeline from Black Swan South consists of 14.5km of 250mm diameter butt welded polyvinylchloride piping that has been buried, except in areas of caprock, with catch pits and bunding installed along the length of the pipeline. In Lake Austin, the pipeline has been anchored to the ground by the use of star pickets and galvanised wire ties. Erosion protection at the pipeline outlet consists of two strips of rubber conveyor belts.

The Licensee has advised that duplication of the pipeline may be required from the point where the pipelines from the Big Bell and Cuddingwarra mines join to accommodate the total discharge of 5,324,556 tonnes per year. If required, the duplicated pipeline will be built with butt welded polyvinylchloride, follow the same route, discharge at the same point and use the same erosion controls as the existing pipeline. The construction method used for the pipeline will replicate the existing pipeline whereby the piping will be buried, except in areas of caprock, with catch pits and bunding installed along the length of the pipeline. The applicant has advised that no vegetation clearing will be required.

Figure 1: Locational diagram of the Big Bell and Cuddingwarra (incorporating Black Swan South) mines and Lake Austin

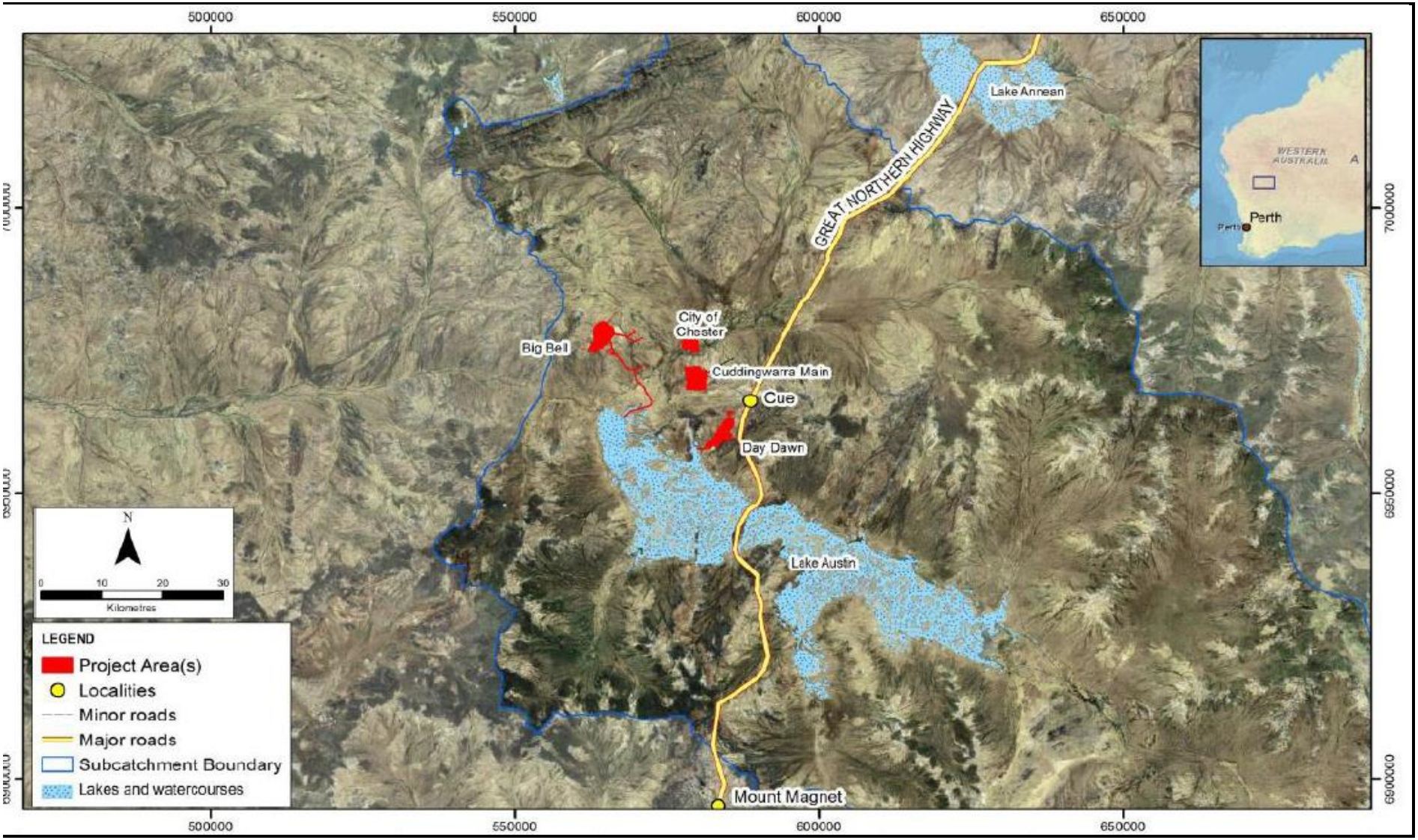
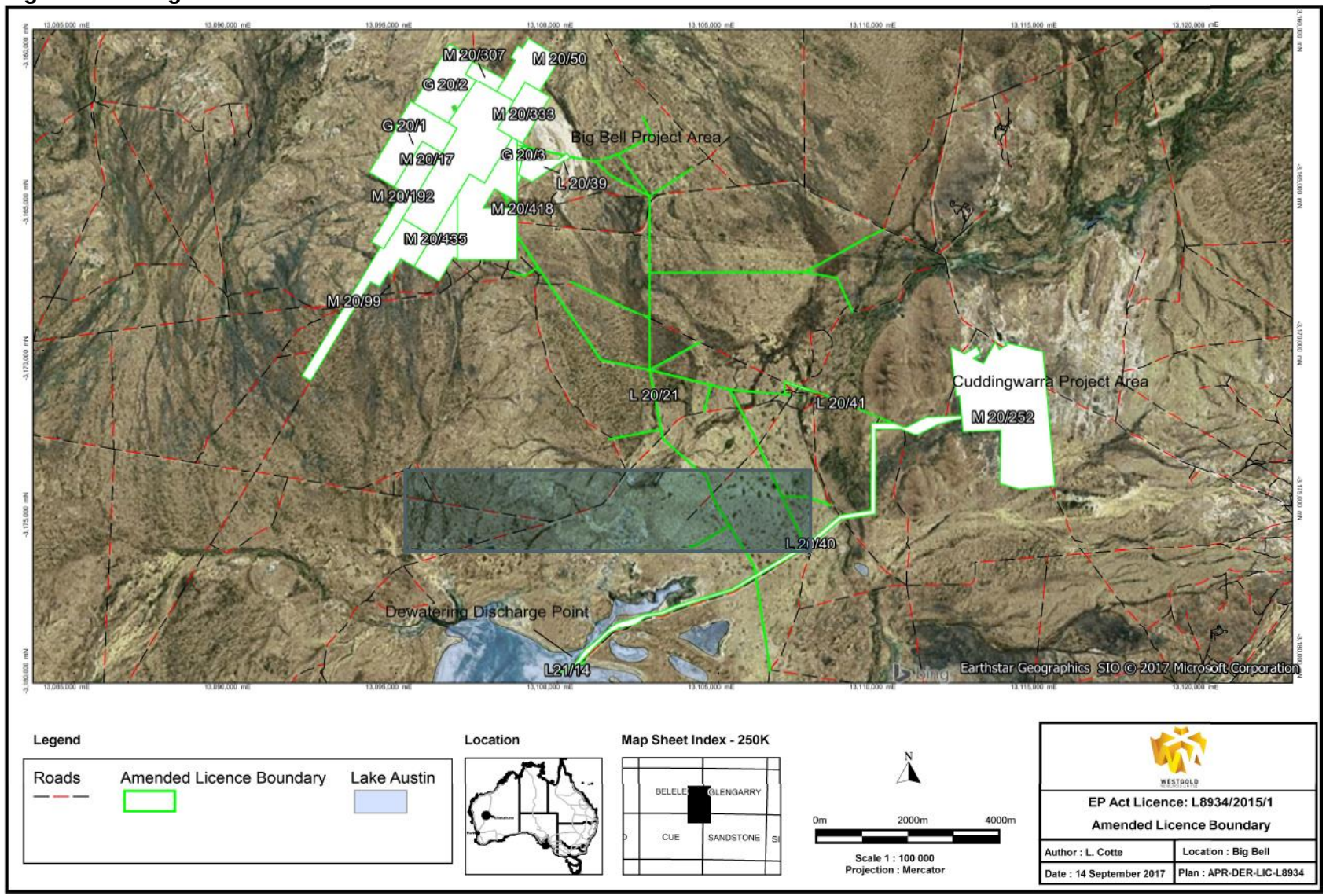


Figure 2: Mining tenements in the Prescribed Premises



No change will occur to the discharge process from the Big Bell mine, with dewatering water held in staging pit voids (Shocker and 1600 N pits) prior to discharge to Lake Austin. Dewatering water from Black Swan South pit will, however, discharge directly to Lake Austin, with no staging in pit voids or other storage facilities. The Licence Holder considers the sediment in the pit lake is low (less than 20 mg/L) due to no underground workings in the pit and limited wall subsidence. The Licence Holder only expects the sediment in the column of water in the pit to increase (approximately 60 mg/L) as it nears the floor of the pit. The Licence Holder has identified an existing transfer dam is available if required to reduce the suspended solids in the discharge water.

The pits at Cuddingwarra and Big Bell are connected by several mining tenements, which the applicant has requested be added to Licence L8934/2015/1. The proposed changes to the Licence are shown in Table 2, while the mining tenements to be added to Licence L8934/2015/1 are shown in Table 3.

Table 2: Proposed changes

Category	Description	Current capacity	Proposed capacity	Description of proposed amendment
6	Mine Dewatering: Premises on which water is extracted and discharged in the environment to allow mining of ore	3,500,000 tonnes per annual period	5,324,556 tonnes	Increase dewatering capacity by 1,824,556 tonnes per annual period to allow the dewatering of the Black Swan South pit

Table 3: Additional mining tenements

Existing mining tenements	Additional mining tenements to be added from this amendment	Full list of mining tenements in the amended Licence
M20/17, M20/99, M20/192, L20/21 and L20/40	G20/2, G20/3, L20/39, L20/41, M20/252, M20/307, M20/333, M20/418, M20/435 and G20/1	M20/17, M20/99, M20/192, L20/21, L20/40, G20/2, G20/3, L20/39, L20/41, M20/252, M20/307, M20/333, M20/418, M20/435 and G20/1

Consultation

Public and stakeholder comment was sought on the application. It was referred to the Shire of Cue and the Department of Biodiversity, Conservation and Attractions (DBCA) for their review as well as being publically advertised in media and on DWER's website between 10 July and 31 July 2017. The only response received was from DBCA on 22 August 2017, who advised that they were unlikely to have any comments on the activity.

Amendment history

The only amendment to Licence L8934/2015/1 was an omnibus amendment that was applied to a broad range of Licences to amend their expiry date as shown in Table 4.

Table 4: Licence amendments

Issued	Amendment
29/4/2016	Notice of amendment of licence expiry date

Location and receptors

Table 5 below lists the relevant sensitive land uses in the vicinity of the Prescribed Premises which may be receptors relevant to the proposed amendment.

Table 5: Receptors and distance from activity boundary

Residential and sensitive premises	Distance from Prescribed Premises
Austin Downs Station Homestead	20km

Table 6 below lists the relevant environmental receptors in the vicinity of the Prescribed Premises which may be receptors relevant to the proposed amendment.

Table 6: Environmental receptors and distance from activity boundary

Specified ecosystems	Distance from the Premises
Lake Austin	A regional significant salt lake system that supports micro-organisms which form a food source for various bird species. Lake Austin is an ephemeral lake that represents the terminal point of an internally draining basin in the Murchison River catchment, with surface and groundwater flows draining centrally into the lake. Surface runoff is sourced from three main creeks that drain the Weld Ranges to the north. However, these are active only during rainfall, with the lake usually dry for lengthy periods. The lake consists of a long stretch of playa (approximately 75km in length and up to 20km wide) that is dominated by sandy islands. The centre of the lake is bisected by the Great Northern Highway, with bathymetry ranging from 0.5m to 2.0m depth and a flat basin, with surveys not detecting any slope of the lake floor. The Licensee has estimated the total surface area of the lake, excluding islands, as 444km^2 and 773km^2 including islands.
Ramsar Sites in Western Australia	There are no Ramsar sites within 100km
Important wetlands – Western Australia	There are no important wetland sites within 100km
Parks and Wildlife Managed Lands and Waters	The water disposal site of Lake Austin is a former pastoral lease that is now unallocated crown land that has been proposed for addition to the conservation estate.
Threatened Ecological Communities and Priority Ecological Communities	The existing dewatering pipeline route passes through the buffer zone of a priority 1 Threatened Ecological Community (TEC). A second priority 1 TEC lies less than 1km north of the existing Cuddingwarra mine, however, this is not near the pipeline.
Biological component	**Distance from the Premises**
Threatened/Priority Flora	The nearest priority flora on the DWER GIS database is 28 km south east of the Premises. The Licensee has reported the presence of the Priority 3 *Tecticornia fimbriata* on the lake margins and two *Tecticornia* species that may be undescribed.
Threatened/Priority Fauna	The nearest record of priority fauna on the DWER GIS database is 13 km south west of the Premises. The Licensee's surveys have not identified any species of conservation significance to be present.

Risk assessment

Table 7 below describes the Risk Events associated with the amendment consistent with the *Guidance Statement: Risk Assessments*, and whether the emissions present a material risk to public health or the environment, requiring regulatory controls.

Table 7: Risk assessment for proposed amendments during operation

Risk Event						Consequence rating	Likelihood rating	Risk	Reasoning
Source/Activities		**Potential emissions**	**Potential receptors**	**Potential pathway**	**Potential adverse impacts**				
Cat. 6 Dewatering	Construction of potential duplicate dewatering pipeline	Dust Noise	No Receptor (Austin Downs Station Homestead 20 km away is the closest receptor)	Air / wind dispersion	Amenity	N/A	N/A	N/A	No residences within 20 km of the Premises. Water cart used when required to manage dust. No additional regulatory controls are required to mitigate this risk. The distance is considered too great to impact offsite receptors.
	Discharge to Lake Austin	Discharge of mine water to lake Austin	Lake and riparian ecosystems Groundwater	Direct discharge	Disruption of normal ecosystem function Reduction in diversity / change in species composition Changes to salinity levels impacting health and survival of flora and fauna Potential eutrophication	Moderate	Possible	Medium	1. Refer to detailed risk assessment (risk event 1) below.

					Sedimentation				
	Pipeline rupture	Discharge of mine water to land	Vegetation Groundwater	Direct discharge	Disruption of normal ecosystem function Reduction in diversity / change in species composition Changes to salinity levels impacting health and survival of flora and fauna	Moderate	Possible	Medium	Excluding the presence of a Priority 1 Threatened Ecological Community and Priority 3 Species, no significant receptors have been identified. The TDS of the groundwater in the Cuddingwarra mine area ranges between 65,000 to 157,000 mg/L. The Licensee's management practices involve: • No vegetation clearing. • Burial of the pipeline where practical. • Daily inspections. • Bunding along the pipeline length. • Where pipeline outlet duplication is required, the same practices will be used. • Telemetry systems and pressure sensors along pipeline to allow for detection of leaks or failures. • Pipelines fitted with automatic cut-outs in the event of a pipeline failure. Existing licence condition 1.2.4 requires the Licensee to ensure all dewatering pipelines are equipped with pressure sensors, automatic cut-outs or secondary containment. Existing condition 1.2.5 requires the Licensee to undertake daily inspections of the dewatering pipelines and take corrective actions where needed. The impacts from dewatering water on groundwater and vegetation due to

									pipeline failure will be **moderate** due to the pipeline route passes through the buffer zone of a priority 1 Threatened Ecological Community and the groundwater has no beneficial use. The likelihood of an occurrence is possible. The risk rating for dewatering discharge to vegetation or groundwater due to pipeline failure is therefore **medium**.

Detailed Risk Assessment

1. Risk Event: Discharge of dewatering effluent into Lake Austin

Description of Risk Event

The discharge of 1,824,556 tonnes per year of highly saline dewatering effluent, with a potential of containing some elevated metals, to Lake Austin.

Identification and general characterisation of emission

The quality of the water contained within the Black Swan South pit was assessed by the Licensee in late 2016. The quality of the water was also assessed during 2005, 2006 and 2007 by previous licence holders. The results from the water sampling are presented in Table 8 below.

Table 8: Black Swan South Pit Water Quality

		Black Swan south pit				ANZECC Marine Criteria[1]
		15/10/2005	10/1/2006	18/1/2007	30/12/12016	
Ca	mg/L	910	980	990	760	
Mg	mg/L	4300	4500	5000	5700	
Na	mg/L	29000	31000	34000	52000	
K	mg/L	680	660	730	1100	
HCO_3^-	mg/L	220	230	240	250	
Cl	mg/L	54000	48000	64000	82000	
SO_4^{-2}	mg/L	16000	134000	17000	20000	
TDS	mg/L	103000	99000	122000	170000	
EC	µS/cm	115000	109000	128000	170000	
pH		7.85	7.55	7.9	7.7	8.0-8.4
CO_2	mg/L		<1	<1	<1	
NO_3^-	mg/L	88	74	81	71	0.7
Al	mg/L	0.11	0.11	0.83	<0.5	0.005
Cd	mg/L	0.017	0.035	0.017	0.018	0.036
Cr	mg/L	0.038	0.015	0.035	<0.1	0.09
Cu	mg/L	0.008	0.024	<0.03	<0.1	0.008
Fe	mg/L	<0.01	0.13	0.12	<0.5	
Mn	mg/L	0.02	1.8	<0.005	<0.1	0.08
Ni	mg/L	0.29	0.89	0.13	<0.1	0.56

Si	mg/L	29	23	21	7.6	
Zn	mg/L	0.1	0.16	0.12	<0.5	0.043
Pb	mg/L	<0.05	<0.001	<0.05	<0.1	0.012
As	mg/L				<0.1	0.0045

1: Sourced from the ANZECC water quality guidelines

The water from the Black Swan South pit is classified as sodium-chloride type water and is highly saline with a TDS of up to 170,000 mg/L (2016 sampling result). The salinity of the water in the pit is comparable to water at Lake Austin and groundwater. Groundwater in the Cuddingwarra mine area (location of Black Swan South pit) ranges between 65,000 to 157,000 mg/L of Total Dissolved Solids (TDS), with a neutral pH of 6.7 – 7.1. Higher salt levels are related to proximity to the Lake Austin salt lake system and paleochannel, with sodium and chloride being the dominant ions. The Groundwater at Lake Austin is reported as being more hypersaline at up to 200,000mg/L TDS.

Nitrate concentrations measured in the water at the Black Swan South pit were high (up to 71 mg/L) however this is more commonly of natural origin in internally-draining (*i.e*. in regions where surface water flows into salt-lakes) semi-arid regions in Australia. In these regions, nitrate is derived from cyanobacterial crusts on soil surfaces and from leaching from termite mounds, and these sources can give rise to nitrate concentrations in groundwater that often exceed 100 mg/L (Barnes *et al*., 1992).

The values for a range of ions and metals were compared against ANZECC guidelines values for marine systems as shown in the table (high saline environment). Exceedances against marine criteria were reported for pH, nitrate, aluminium, copper, manganese, nickel and zinc.

Description of the receiving environment

An aquatic assessment of Lake Austin undertaken by Outback Ecology in 2011 notes that dewatering discharge to Lake Austin has previously taken place at two locations on the lake, at monitoring area LA5 and LA7 as shown in Figure 3 below, from the dewatering of the Cuddingwarra and Golden Crown pits respectively. The Licensee proposes to discharge dewatering effluent from the Black Swan South pit, in conjunction with discharge from the Big Bell mines, to the discharge location LA5.

Outback Ecology noted that lake sediments in semi-arid and arid regions of Western Australia typically display a high degree of spatial heterogeneity, both horizontally and vertically. This observation was consistent with their findings on water and sediment quality, with Outback Ecology concluding that the variations reflected the diversity in bathymetry and habitat. Lake salinity ranged from 20,500 µs/cm (hyposaline) to 210,000 µs/cm (hypersaline), with a neutral to alkaline water column pH (7.53-8.64), as shown in Table 9. Lake sediments showed a variation in salinity of between 900 to 22,300 µs/cm and pH of 7.1 – 8.3, as shown in Table 10.

Total nitrogen concentrations were high in the water column, varying between 1.70-4.20mg/L, which is above the ANZECC 80 percent (%) marine protection guideline level of 0.1mg/L. Total phosphate concentrations were below detection levels at 6 of the 8 monitoring locations, with values at the other sites being 0.25mg/L, which is higher than the ANZECC 80% marine protection level of 0.10mg/L. While the ANZECC sediment guidelines do not provide a guidelines level for nitrogen or phosphorous concentrations, total nitrogen was reported as varying between 10-90mg/kg and total phosphorous between 56-260mg/kg.

Metal concentrations were low in water and sediments, with the exception of copper, which was elevated in surface waters (varying between 0.001 – 0.039mg/L where detected, while the ANZECC 80% marine protection criteria is 0.008mg/L). Outback Ecology concluded that the

elevated levels were likely due to mineralisation from the catchment and not past dewatering practices, owing to not detecting copper at monitoring site L5 where the discharge outlet is located. They also concluded that the copper was unlikely to pose a risk to biota as a result of the hypersaline conditions. The values recorded by Outback Ecology are also consistent with those reported by the Licensee over the period 1998-2011, with these shown in Table 11.

Outback Ecology also undertook an assessment of biota in and around the lake including plankton, invertebrates, macrophytes, birds, fish and riparian vegetation. They noted that the salinity of previous discharges was typically lower than values recorded during the survey and concluded that previous dewatering discharge has had no apparent effect on lake ecology, including phytoplankton diversity, diatom communities, invertebrates and fish. Previous dewatering was considered not to have had a detectable effect with the lake habitat diversity providing sufficient refuge areas for recolonisation and biota dispersal after flood events and cessation of dewatering discharge.

The justification for this was based on the highest phytoplankton diversity levels being recorded at the former Golden Crown discharge site (at monitoring location LA7) and high diversity of salt tolerant diatoms at the proposed discharge site of LA5 and also at LA7. Similarly, while invertebrate sampling identified variations in species composition, this was attributed to variations in salinity levels, which would change as lake levels declined increasing salinity, and was not attributed to previous dewatering.

Riparian vegetation exhibited zonation consistent with drainage and soil salinity levels. The proposed discharge site of LA5 exhibited the highest percentage cover, but low density reflecting the presence of large mature plants. The Outback Ecology survey identified one priority 3 species (*Tecticornia fimbriata*) and two *Tecticornia* species that may be undescribed.

Figure 3: Lake Austin water quality monitoring sites (Outback Ecology, 2012)

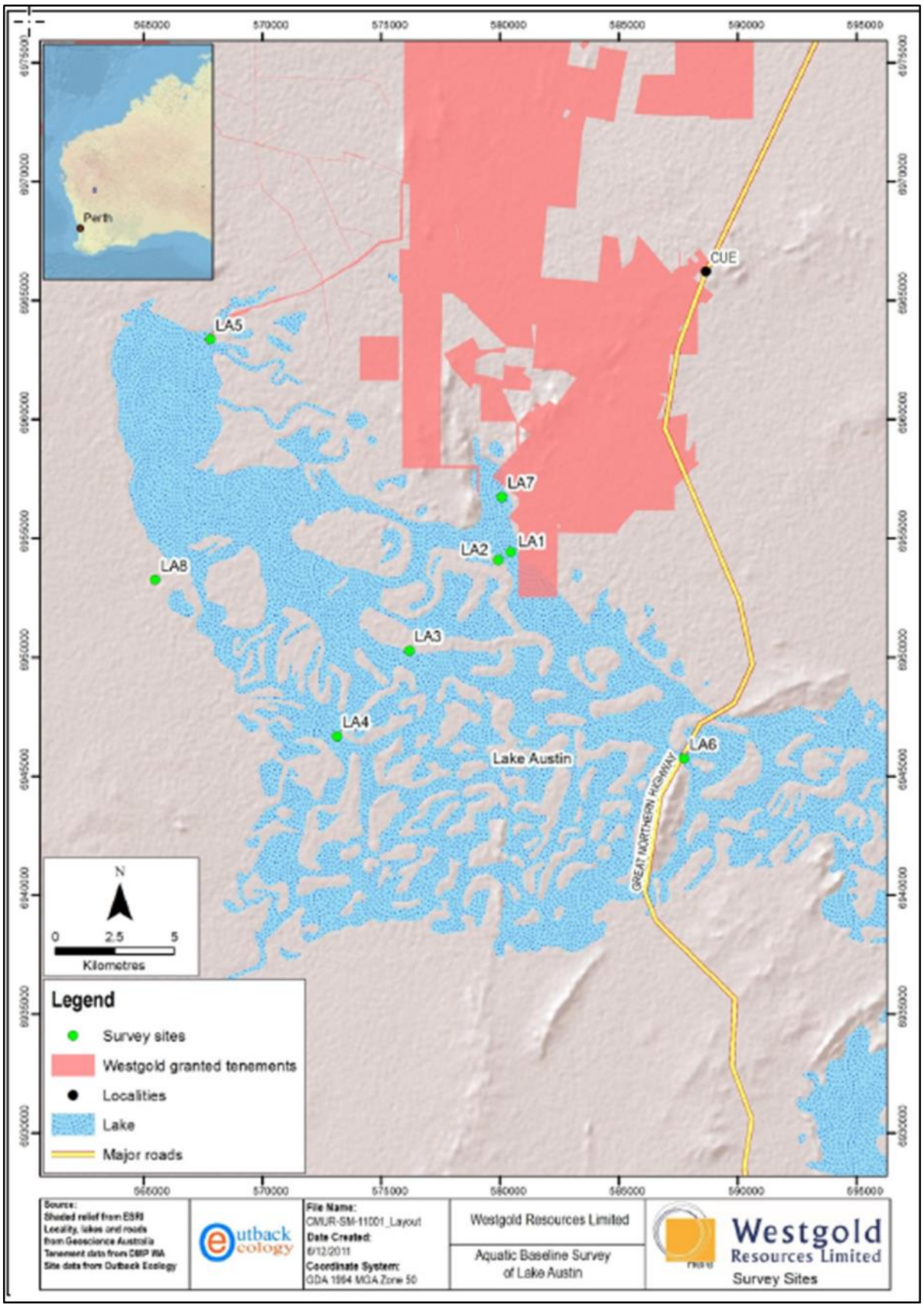


Table 9: Lake Austin water quality 2011 (Outback Ecology, 2012)

Parameter[1]	LA1	LA2	LA3	LA4	LA5	LA6	LA7	LA8	ANZECC
Depth (CM)	25	20	5	10	30	3	60	15	
Dissolved Oxygen (%)	86.1	127.7	103	94.3	16.5	52.6	85.7	101.6	90
Temperature (ºC)	8	10	13	15	15	3	10	13	
Redox Potential (mV)	92	120	112	115	56	119	110	119	
pH (pH Units)	7.53	8.41	8.14	8.28	8.64	7.54	8.43	7.93	
TDS	40,100	45,600	39,600	81,000	14,200	250,000	65,400	43,800	
EC (µS/CM)	55,400	59,500	50,800	101,000	20,500	210,000	62,900	59,500	
Turbidity (NTU)	27.1	22.7	22.6	4.5	4.5	26.4	15.2	14.3	
NH_3^+	0.08	0.14	0.12	0.20	0.09	0.28	0.12	0.12	1.70
NO_2^-	0.02	BD	BD	BD	BD	BD	BD	BD	
NO_3^-	BD	BD	BD	BD	BD	BD	BD	BD	
TN	2.00	1.70	2.00	3.30	0.60	4.20	1.70	3.30	0.10
TP	0.25	BD	BD	BD	BD	BD	BD	0.25	0.015
Hardness	6470	6810	6210	9860	2430	21200	7130	6210	
CO_3^{-2}	BD	4	BD	BD	5	BD	5	BD	
HCO_3^-	51	38	44	55	18	117	39	37	
Ca^{+2}	1,430	1,460	1,400	1,740	561	779	1,550	1,210	
Cl^-	20,300	22,200	19,000	40,600	7,310	137,000	23,300	21,900	
K^+	526	585	512	1,220	189	2,700	582	579	
Mg^{+2}	705	769	659	1340	251	4,620	792	775	
Na^+	11,900	13,100	11,400	25,400	3,940	74,200	13,300	13,200	
SO_4^{-2}	4,420	4,760	4,390	6,880	1,920	14,000	5,230	4,220	
Al	BD	BD	BD	BD	BD	BD	BD	BD	
As	BD	BD	BD	BD	BD	BD	BD	BD	
Cd	BD	BD	BD	BD	BD	BD	BD	BD	0.036
Cr	BD	BD	BD	BD	BD	BD	BD	BD	0.085
Cu	0.001	0.014	0.013	0.019	BD	0.039	0.018	0.014	0.008
Fe	BD	BD	BD	BD	BD	BD	BD	BD	
Hg	BD	BD	BD	BD	BD	BD	BD	BD	0.001
Mn	BD	BD	BD	BD	BD	BD	BD	BD	
Ni	BD	BD	BD	BD	BD	BD	BD	BD	0.560
Pb	BD	BD	BD	BD	BD	BD	BD	BD	0.012
Si	BD	BD	BD	BD	BD	BD	BD	BD	
WADCN	BD	BD	BD	BD	BD	BD	BD	BD	
Zn	BD	BD	BD	BD	BD	BD	BD	BD	0.043

1. Units in mg/L unless specified
2. ANZECC water quality guidelines

Table 10: Lake Austin sediment quality 2011 (Outback Ecology, 2012)

Parameter[1]	LA1	LA2	LA3	LA4	LA5	LA6	LA7	LA8	ANZECC
pH (pH Units)	7.60	8.20	8.20	8.00	8.30	7.80	8.00	7.10	
TSS	13,700	14,100	11,000	24,400	2,920	72,500	14,000	7,700	
EC (µS/CM)	4,220	4,350	3,400	7,510	900	22,300	4,310	2,370	
MC (%)	30.2	30.0	22.9	48.4	24.5	49.4	30.7	23.6	
TN	320	210	390	920	100	360	140	200	
TP	206	260	145	87	84	85	181	56	
TOC (%)	45	23	27	48	28	90	95	15	
Ca^{+2}	5,150	4,890	4,460	8,240	330	11,800	5,210	310	
Cl^{-}	7,380	7,600	5,960	28,600	2,440	125,000	9,180	6,980	
K^{+}	380	450	270	1,030	100	3,080	460	230	
Mg^{+2}	360	370	250	950	80	4,720	400	220	
Na^{+}	5,100	5,510	3,960	17,700	1,360	77,200	6,240	4,340	
SO_4^{-2}	14,400	15,100	12,200	23,600	1,030	41,600	15,000	1,630	
Al	5,110	9,410	2,820	1,640	1,830	4,530	6,220	1,760	
As	9	16	BD	BD	BD	BD	31	BD	20
Cd	BD	BD	BD	BD	BD	BD	BD	BD	2
Cr	34	49	21	6	29	22	49	24	80
Cu	14	25	6	BD	BD	10	23	BD	65
Fe	12,200	21,300	6,060	3,020	5,230	8,350	20,400	4,050	
Hg	BD	BD	BD	BD	BD	BD	BD	BD	0.15
Mn	103	302	69	22	28	109	396	19	
Ni	8	15	3	BD	8	6	14	BD	21
Pb	BD	7	BD	BD	BD	BD	6	BD	50
Si	6	12	7	6	5	18	12	7	
WADCN	BD	BD	BD	BD	BD	BD	BD	BD	
Zn	13	23	6	BD	BD	15	29	BD	200

1. Units in mg/kg unless specified

2: ANZECC sediment quality guidelines

Table 11: Lake Austin water quality 1998 – 2011

Year	Location	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	HCO_3^- (mg/L)	SO_4^{-2} (mg/L)	Cl (mg/L)	TDS (mg/L)	EC µS/cm	pH	CO_2 (mg/L)	DO%
1998	LA1	1,100	1,300	23,000	780	45	4,100	37,000	67,500	81,500	9.32	1	126.7
1998	LA3	770	3,500	71,000	1,600	60	3,000	120,000	210,000	81,500	9.42	1	106.5
1998	LA5	1,400	2,700	51,000	1,600	52	8,000	79,000	145,000	161,600	7.89	1	121
1998	LA7	980	940	20,000	670	19	5,300	31,000	58,500	86,500	8	1	107.5
1998	LA9	220	270	5,000	190	78	1,900	10,000	21,000	29,800	9.69	27	128.6
2000	LA1	610	880	11,000	350	55	3,500	19,000	46,000	49,400	9.75	6	133.9
2000	LA3	690	850	11,000	380	39	5,000	19,000	45,000	49,200	9.69	18	101.7
2000	LA5	630	730	8,900	320	17	3,700	18,000	39,000	45,800	9.38	15	92.6
2000	LA7	600	500	7,700	290	120	2,700	12,000	25,000	37,200	9.17	1	129.6
2011	L1	1,430	705	11,900	526	51	4,420	20,300	40,100	55,400	7.53	<0.1	86.1
2011	L2	1,460	769	13,100	585	38	4,760	22,200	45,600	59,500	8.41	4	127.7
2011	L3	1,400	659	11,400	512	44	4,390	1,900	39,600	50,800	8.14	<0.1	103
2011	L4	1,740	1,340	25,400	1,220	55	6,880	40,600	81,000	101,000	8.28	<0.1	94.3
2011	L5	561	251	3,940	189	18	1,920	7,310	14,200	20,500	8.64	5	16.5
2011	L6	779	4,620	74,200	2,700	117	14,000	137,000	250,000	210,000	7.54	<0.1	52.6
2011	L7	1,550	792	13,300	582	39	5,230	23,300	65,400	62,900	8.43	5	85.7
2011	L8	1,210	775	13,200	579	37	4,220	21,900	43,800	59,500	7.93	<0.1	101.6

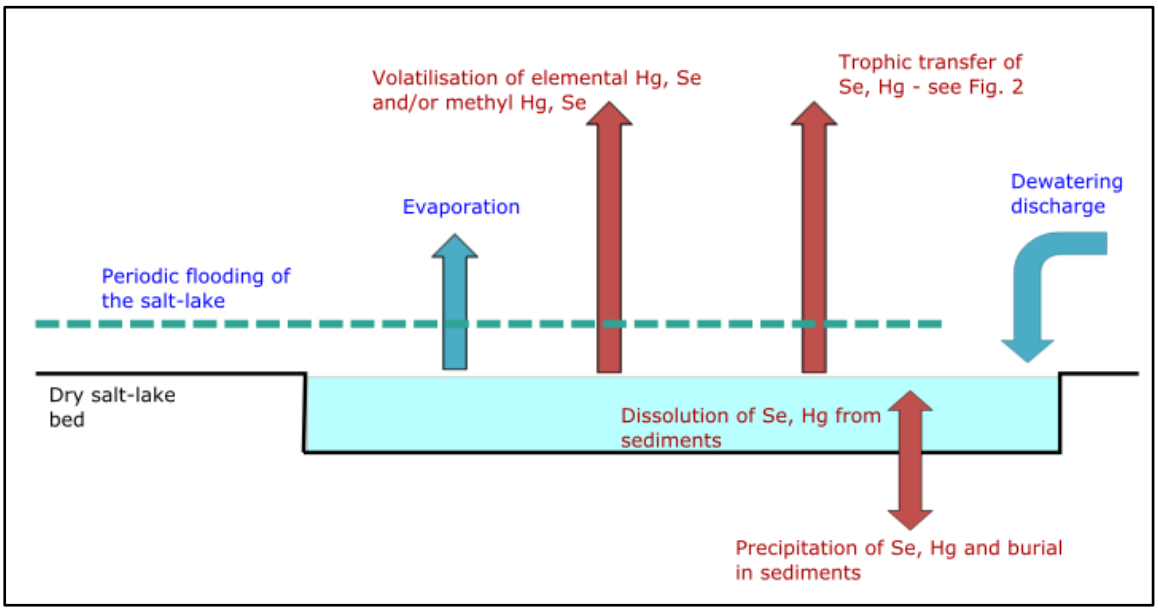
Description of potential impacts from the emission

Research on both artificial (*e.g*. Tanner *et al*., 1999) and natural (*e.g*. Wurtsbaugh *et al*., 2011) closed saline-water systems indicates that selenium and mercury are the contaminants of principal concern in these systems due to the ability of these elements to be biomagnified in food webs that typically develop under conditions where there are high evaporation rates.

This is shown schematically in Figures 4 and 5 in a situation where these elements are constantly introduced into an artificial wetland with dewatering discharge. Figure 4 shows that the principal sinks for the removal of selenium and mercury from the water column (shown with red arrows in Figure 4) are:

- through co-precipitation with iron oxides and other minerals and burial in the underlying sediment profile (although periodically conditions may occur where these elements are released again into the water column);
- through volatilisation of either elemental selenium and mercury and/or methyl compounds of the elements; and
- through trophic transfer in local food webs and removal in biomass (such as in insects and birds).

Figure 4. Sinks for selenium and mercury in a closed saline water ecosystem



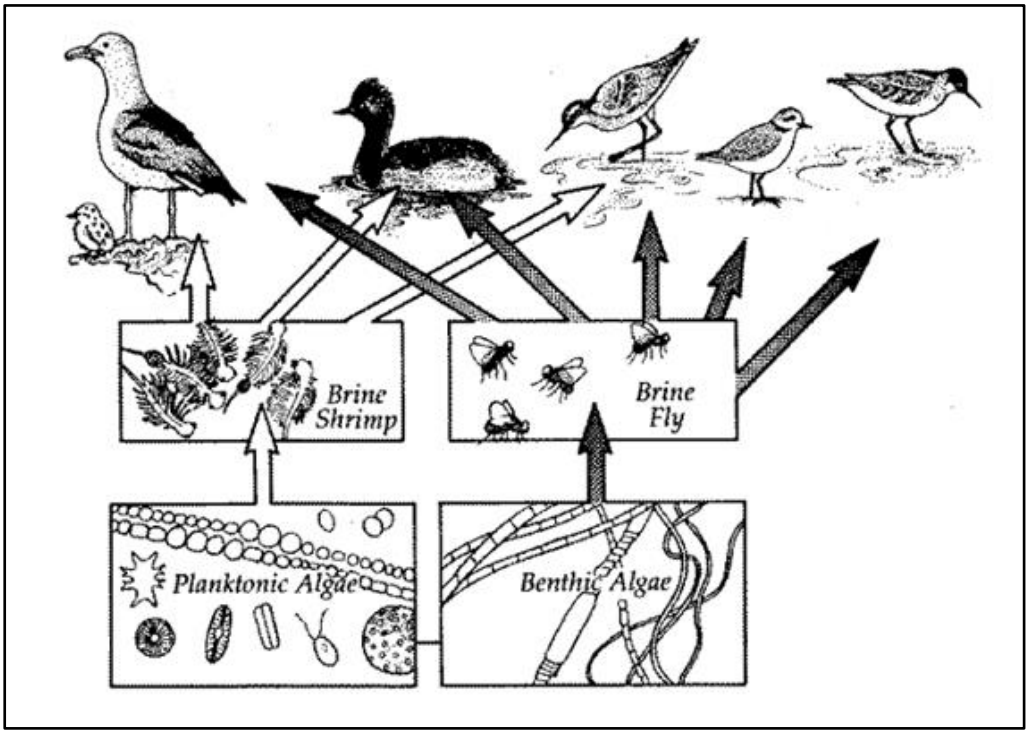
The magnitude of these sinks has not been determined at Lake Austin.

Another potential sink for the removal of these elements from the pond occurs during infrequent heavy rainfall events when Lake Austin becomes flooded (Figure 4). Under these circumstances, water and sediment from the ponded area is dispersed over a much larger area of the lake bed, and conditions within the pond are 'reset' for the next dry spell. However, these events occur infrequently and cannot be relied upon as a management option for ensuring that mercury and selenium inputs do not cause environmental harm.

Closed saline-water systems such as the discharge area in Lake Austin generally contain algae, brine shrimp, aquatic insects and insect larvae which form a food source for various bird species (Figure 5). The trophic transfer of selenium and mercury in this food web has the potential to affect bird populations through impacts on developing embryos in eggs. The principal environmental receptors for these elements are therefore birds rather than toxicity to organisms in the water column (which is assumed in the ANZECC guidelines).

This means that criteria for mercury and selenium levels in water and in biomass in the water body must be developed at a sufficiently low level to ensure bird populations are protected, even if the concentrations in the water column appear to be harmless to aquatic organisms.

Figure 5. Pathways for the trophic transfer of selenium and mercury in a saline wetland



There is currently no information available on the amount of mercury and selenium that is being discharged in mine dewatering effluent to Lake Austin. Elevated selenium concentrations, in particular, are often associated with elevated sulfate concentrations in mine discharges as is the case with the discharge of dewatering effluent to Lake Austin.

Recent water sampling results for nitrates in the Black Swan South pit indicate the concentrations are high, however elevated nitrate levels in the mine discharge to Lake Austin are unlikely to cause significant eutrophication problems. This is because the productivity of the ephemeral aquatic ecosystem in this lake is probably limited by the availability of phosphorus rather than nitrogen, and cyanobacteria in the lake are probably able to produce all of the nitrogen they require for growth by the fixation of atmospheric nitrogen.

Other potential impacts from dewatering highly saline dewatering effluent into a lake system are:

- scouring of the lake bed;
- impacts on riparian vegetation; and
- contamination of the groundwater

Criteria for assessment

Department of Water, *Western Australian water in mining guidelines*, Report no. 12, May 2013.

Relevant water quality criteria for comparison include ANZECC guidelines for marine water quality.

Relevant sediment quality criteria for comparison include ANZECC sediment quality guidelines

Licensee controls

Dewatering discharge outlet will be located in the playa, avoiding the lake edges and creeklines to minimise impacts on riparian vegetation, shallow and fringing habitats and potential drought refuge areas for birds.

The dewatering discharge outlet will be located and designed with energy diffusion devices (i.e. perforated pipe work) to minimise scouring of the lake bed. Erosion management at the discharge outlet involves using the existing matting and staking the piping to the ground with star pickets and wire ties.

The dewatering discharge outlet is located so as to direct flows to deeper parts of the basin and prevent backflow of saline water into creeks and tributaries.

The Licence Holder proposes the following monitoring program after the recommencement of dewatering activities:

- Monthly recording of the water drawn from the Black Swan South pit and the volumes discharged to Lake Austin;
- Quarterly field sampling for pH, TDS and electrical conductivity (EC) in the discharge water and surface water at the discharge point into Lake Austin;
- Biannually sampling for Total Recoverable Hydrocarbons in water at the Transfer Dam (currently not required) and Lake Austin (currently quarterly);
- Biannually comprehensive analysis (currently annually) of water from dewatered pits, discharge points to pits, transfer dam and Lake Austin; and
- Monthly visual monitoring of sediment at the discharge point into Lake Austin, and sampling for laboratory analysis of major components.

Consequence

The consequence of discharging dewatering effluent into Lake Austin is considered **moderate** as there is currently no information available on the amount of mercury and selenium that is being discharged in mine dewatering effluent to Lake Austin, which could have an impact on sensitive receptors such as bird species.

Likelihood of Risk Event

The likelihood of an occurrence is **possible,** even though the current dewatering discharge water quality is comparable to water and groundwater quality at Lake Austin, as the concentrations of metals can increase as the depth of the mine pit increases or underground mining occurs.

Overall rating of Risk Event

The risk rating for the discharge of dewatering effluent to Lake Austin is therefore considered **moderate.**

Decision

The Delegated Officer has determined the key emissions associated with increasing dewatering discharge to Lake Austin from the dewatering of the Black Swan South pit. Based on the application supporting documentation, the Delegated Officer has determined that the increased dewatering discharge to Lake Austin presents a medium risk to the environment as a result of the dewatering effluent discharge and accidental discharge of dewatering effluent to land from pipeline failure. However, these risks may be acceptable subject to the commitments made by the Licensee and the additional regulatory controls outlined below.

The approved premises production or design capacity for Category 6 has been amended to

5,324,556 tonnes per year.

The inclusion of new condition 1.2.6 for the construction of a duplicate dewatering pipeline.

Table 2.2.2 has been amended by increasing the limit of the emission to Lake Austin.

Existing condition 3.2.1 requires monitoring of discharges into Lake Austin for flow rate (continuous basis), pH, total recoverable hydrocarbons, total dissolved solids, total suspended solids (all on a quarterly basis) and nine metals on an annual basis (arsenic, cadmium, chromium, cobalt, copper, lead, nickel, selenium and zinc). As elevated levels of some metals can potentially impact ephemeral wetland systems, the frequency of monitoring for the metals has been increased to biannually. Mercury has also been included in the monitoring regime as this is a contaminate of environmental concern in dewatering discharges to inland lake systems.

Therefore condition 3.2.1 Table 3.2.1 has been amended by:

- increasing the sampling frequency for arsenic, cadmium, chromium, cobalt, copper, lead, nickel, selenium and zinc from annually to biannually;
- including biannual sampling for total nitrogen, total phosphorus, nitrate, sulfate, aluminium, and manganese as these were identified as being elevated when compared with ANZECC marine criteria; and
- setting a reportable limit of 100 mg/L for total suspended solids in the dewatering discharge to Lake Austin as there are no staging in-pit voids or other storage facilities to reduce the sediment load.

The inclusion of new condition 3.4.1 that requires the Licensee to monitor sediment at the Lake Austin discharge point. No sediment monitoring is currently required preventing detection of changes to the substrate. The frequency of sampling is biannually to coincide with the dewatering discharge monitoring.

The inclusion of new condition 3.5.1 that requires the Licensee to conduct an aquatic assessment at various locations on Lake Austin within 6 months from the commencement of dewatering discharge to Lake Austin.

Table 4.2.1 has been amended to include the AER reporting requirements for tables 3.4.1 and 3.5.1.

Table 4.3.1 has been amended to include the requirement for the Licensee to:

- notify DWER at least three months prior to the commencement of underground mining at the Black Swan South pit; and
- undertake a gap analysis and review within 6 months from the commencement of dewatering of the Black Swan South pit, with comparison of the results from the Outback Ecology aquatic assessment of Lake Austin conducted in 2011 and current data achieved through the monitoring requirements of Condition 3.5.1.

The Delegated Officer has also made other administrative changes to the Licence as follows:

- Include the new mining tenements in the Licence;
- Removed condition 1.1.5 as it is an explanatory condition to provide clarification of the operation of the Licence and DWER considers it is not enforceable or risk based; and
- Include an updated map of the Premises to show the new mining tenements.

Licensee's comments

The Licensee was provided with the draft Amendment Notice on 11 December 2018. Comments received from the Licensee have been considered by the Delegated Officer as shown in Appendix 2.

Amendment

1. The following mining tenements are added to Licence L8934/2015/1: G20/2, G20/3, L20/39, L20/41, M20/252, M20/307, M20/333, M20/418, M20/435 and G20/1.

2. The approved Premises production capacity on page 1 of the Licence is amended by deleting the text shown in strikethrough below and the insertion of the bold text shown in underline below:

Category number	***Category description***	***Category production or design capacity***	***Approved Premises production or design capacity***
6	*Mine dewatering: premises on which water is extracted and discharged into the environment to allow mining or ore*	*50,000 tonnes or more per year*	~~*3,500,000*~~ ***5,324,556*** *tonnes per annual period (discharged)*

3. Condition 1.1.5 is removed by the deletion of the text shown in strikethrough below:

~~*1.1.5 Nothing in the Licence shall be taken to authorise any emission that is not mentioned in the Licence, where the emission amounts to:*~~
~~*(a) pollution;*~~
~~*(b) unreasonable emission;*~~
~~*(c) discharge of waste in circumstances likely to cause pollution; or*~~
~~*(d) being contrary to any written law.*~~

4. New condition 1.2.6 is inserted and is shown in bold and underline below:

1.2.6 The Licensee must install and undertake the works for the infrastructure and equipment:

(a) specified in Column 1; and

(b) to the requirements specified in Column 2;

of Table 1.3.3 below.

Table 1.3.3: Infrastructure and equipment requirements table

Column 1	***Column 2***
Infrastructure	***Requirements (design and construction)***
Duplicate dewatering pipeline to Lake Austin	• ***built with butt welded polyvinylchloride;*** • ***is located within the existing dewatering pipeline corridor whereby the piping will be buried, except in areas of caprock, with catch pits and bunding installed along the length of the pipeline;*** • ***discharges to the same location as the existing dewatering pipeline discharge point on Lake Austin; and*** • ***includes energy diffusion devices to minimise scouring and erosion of the lake bed.***

5. The Licence is amended by deleting the text shown in strikethrough below and the insertion of the bold text shown in underline below:

Table 2.2.2*: *Point source emission limits to surface water			
Emission point reference	*parameter*	*Limit (including units)*	*Averaging Period*
Lake Austin discharge	*Dewatering effluent water*	~~*3,500,000*~~ ***5,324,556*** *tonnes*	*Annual period*

Table 2.3.1: Emission points to ~~surface water~~ groundwater		
Emission point reference	***Description***	***Source including abatement***
Shocker and 1600N pits	*Discharge of dewatering effluent into the Shocker and 1600N pits*	*Water from dewatering of mine pits and underground operations*

6. Condition 3.2.1 of the Licence is amended by deleting the following text shown in strikethrough below and the insertion of the bold text shown in underline below:

Table 3.2.1: Monitoring of point source emissions to surface water					
Emission point reference	***Parameter***	***Units***	***Reportable limit***	***Averaging Period***	***Frequency***
Lake Austin dewatering discharge sampling point	*Volumetric flow rate*	*m^3/day*	*-*	*Monthly*	*Continuous*
	pH[1]	*-*	*-*	*Spot sample*	~~*Annual*~~ ***Quarterly (December, March, June and September)***
	Total recoverable hydrocarbons		*15mg/L*		
	Total dissolved solids		*-*		
	Total Suspended Solids		***100 mg/L***		
	Total phosphorus		*-*		***Biannually (March, September)***
	Total nitrogen				
	Sulfate				
	Aluminium				
	Arsenic				
	Cadmium				
	Chromium				
	Cobalt				
	Copper				
	Lead				
	Manganese				
	Mercury				
	Nickel				
	Selenium				
	Zinc				

Note 1: In-field non NATA accredited analysis permitted

7. New condition 3.4.1 is inserted and is shown in bold and underline below:

The Licensee shall undertake monitoring of sediment as shown in Table 3.4.1 according to the specifications in that table.

Table 3.4.1				
Sampling point reference	***Parameter***	***Units***	***Averaging Period***	***Frequency***
Lake Austin dewatering discharge sampling point	***pH***	***-***	***Spot sample***	***Prior to the commencement of dewatering discharge to Lake Austin, then biannually (March, September)***
	Total phosphorus	***mg/kg***		
	Total nitrogen			
	Sulfate			
	Aluminium			
	Arsenic			
	Cadmium			
	Chromium			
	Cobalt			
	Copper			
	Lead			
	Manganese			
	Nickel			
	Mercury			
	Selenium			
	Zinc			

8. New condition 3.5.1 is inserted and is shown in bold and underline below:

The Licensee shall undertake an aquatic assessment at the locations shown in Table 3.5.1 according to the specifications in that table.

Table 3.5.1		
Sampling point reference	***Parameter***	***Frequency***
Lake Austin monitoring locations LA1, LA2, LA3, LA4, LA5, LA6, LA7 and LA8 as shown in Schedule 1	***Assessment of the lake ecology. The assessment shall include a review of the water quality, sediment quality, phytoplankton, periphyton diatoms), macrophytes, aquatic invertebrates, fish, and the riparian vegetation***	***Within 6 months from the commencement of dewatering of the Black Swan South pit***

9. Tables 4.2.1 and 4.3.1 are amended by insertion of the text shown in underline and bold below:

Table 4.2.1 Annual Environmental Report		
Condition or table	***Parameter***	***Format of Form***
-	*Summary of any failure or malfunction of any pollution control equipment and any environmental incidents that have occurred during the annual period and any action taken*	*None specified*
Table 3.2.1	*Point source emissions to surface water monitoring results*	*None specified*
Table 3.3.1	*Point source emissions to groundwater monitoring results*	*None specified*
Table 3.4.1	***Monitoring of sediment results***	***None specified***
Table 3.5.1	***Aquatic assessment monitoring results***	***None specified***
4.1.2	*Compliance*	*Annual Audit Compliance Report (AACR)*
4.1.3	*Complaints summary*	*None specified*

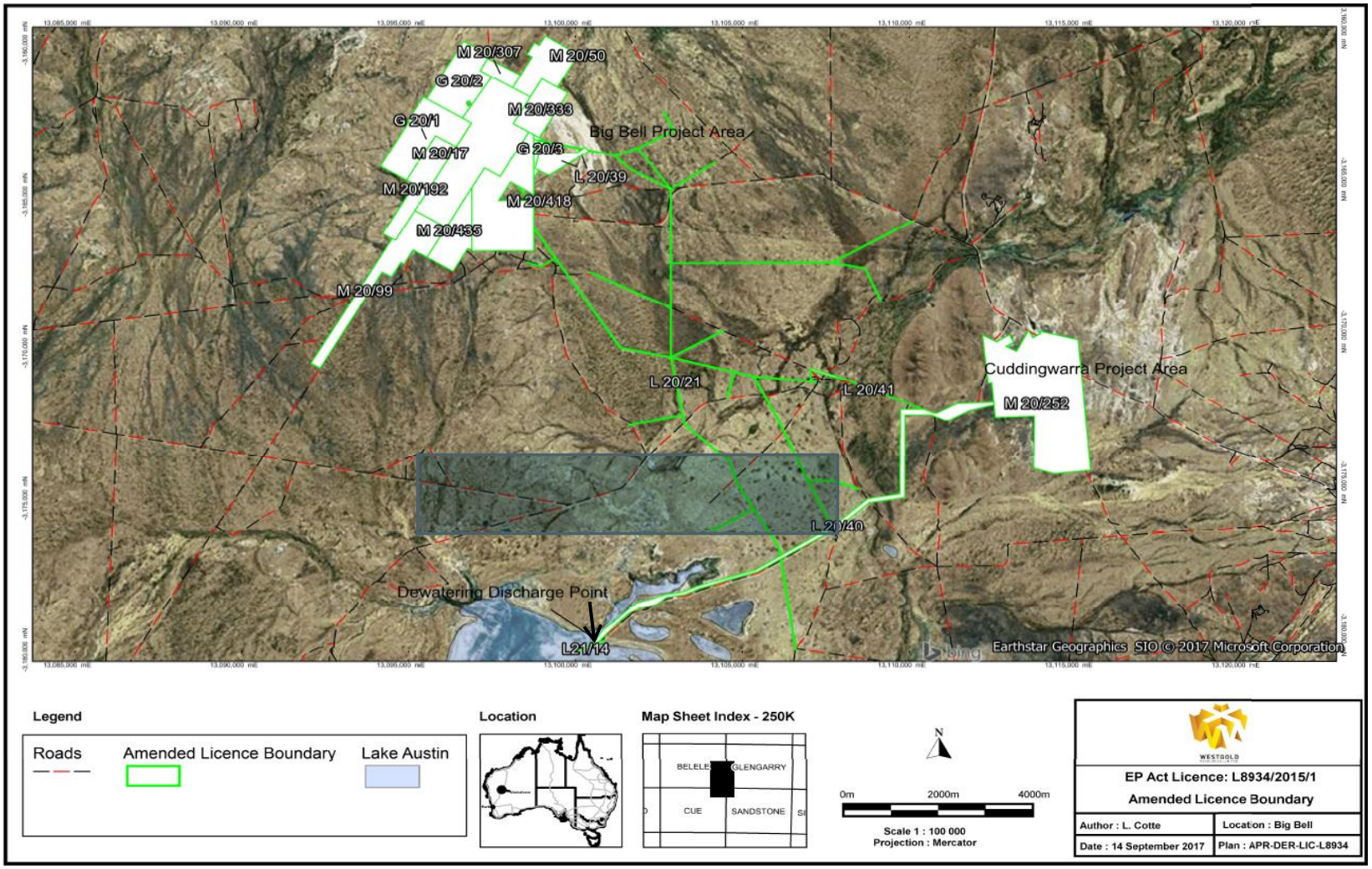
Note 1: Forms are in Schedule 2

Table 4.3.1: Notification requirements			
Condition or table (if relevant)	***Parameter***	***Notification requirement[1]***	***Format or form[1]***
2.2.2, 3.2.1 and 3.3.1	*Breach of any limit specified in the Licence*	*Part A: As soon as practicable but no later than 5pm of the next usual working day.* *Part B: As soon as practicable*	*N1*
-	***Commencement of underground operations at the Black Swan South pit***	***Three months prior to the commencement of underground operations.***	*-*
3.5.1	***Undertake a gap analysis and review with comparison of the results from the Outback Ecology aquatic assessment of Lake Austin conducted in 2011, and the results collected from the monitoring requirements of condition 3.5.1***	***Within 6 months from the commencement of dewatering of the Black Swan South pit***	*-*

10. The Licence is amended by replacing the existing Premises Map in Schedule 1 with the figure below and by deleting the text shown in strikethrough and replacing with the text shown in underline and bold below:

~~*The Premises is shown in the map below. The red line depicts the premises boundary. The location of the emission point and monitoring location defined in Tables 2.2.1 and 2.3.1 are shown in the map below.*~~

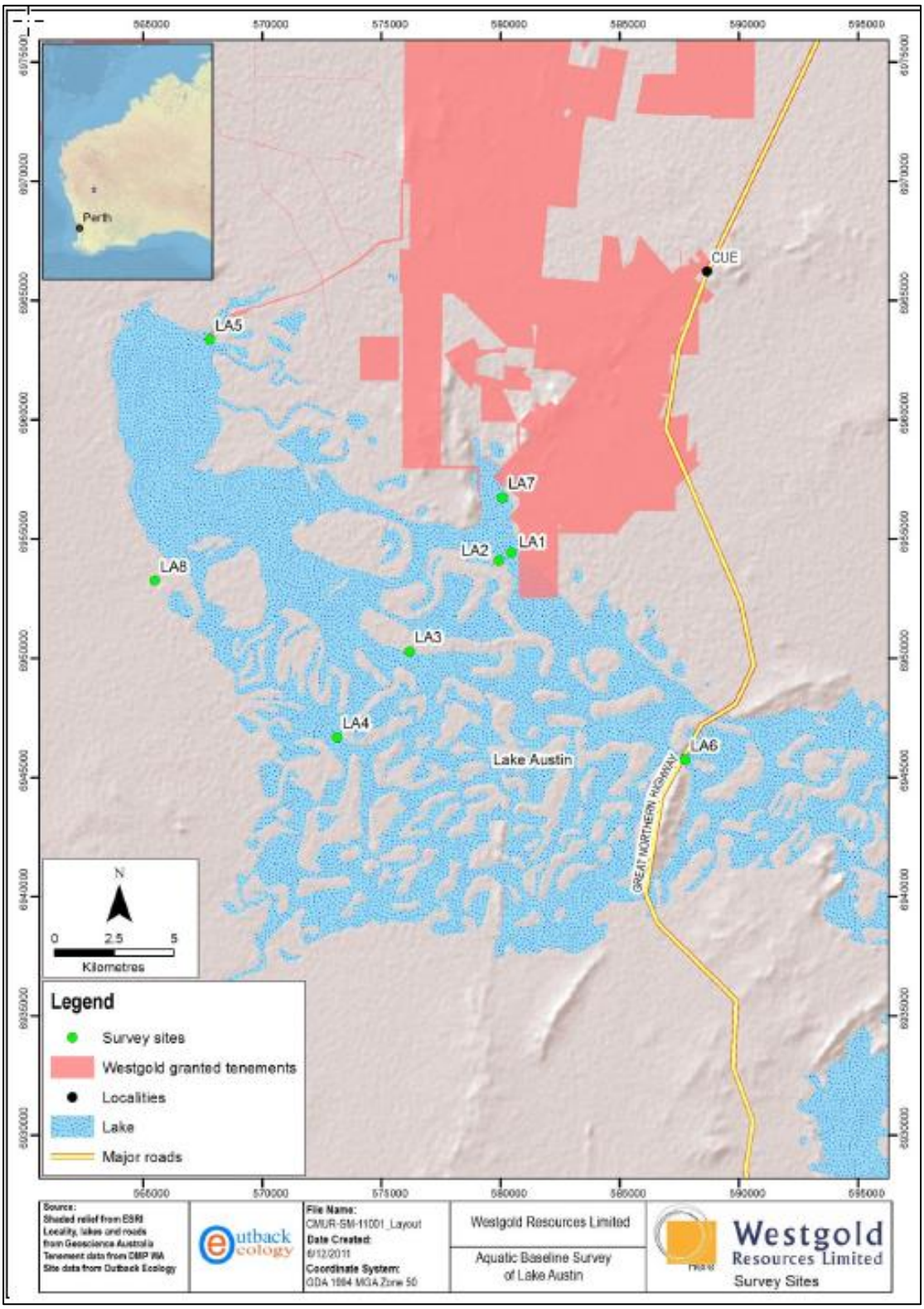
The Premises is shown in the map below: L8934/2015/1 Amended Licence boundary. The green line shows the mining tenements of the Premises and is the Premises boundary, The dewatering discharge point is also shown on the map.


M 20/307
M 20/50
G 20/2
M 20/333
G 20/1
Big Bell Project Area
M 20/17
G 20/3
L 20/39
M 20/192
M 20/418
M 20/435
M 20/99
L 20/21
L 20/41
Cuddingwarra Project Area
M 20/252
L 20/40
Dewatering Discharge Point
L21/14
Earthstar Geographics SIO © 2017 Microsoft Corporation
Legend
Roads
Amended Licence Boundary
Lake Austin
Location
Map Sheet Index - 250K
BELELE
GLENGARRY
CUE
SANDSTONE
N
0m
2000m
4000m
Scale 1 : 100 000
Projection : Mercator
WESTGOLD
EP Act Licence: L8934/2015/1
Amended Licence Boundary
Author : L. Cotte
Location : Big Bell
Date : 14 September 2017
Plan : APR-DER-LIC-L8934

11. Schedule 1 Maps is amended by adding in the text and figure below.

Map of Lake Austin aquatic assessment monitoring points.

The locations of the aquatic assessment monitoring points (LA1 to LA8) as defined in condition 3.5.1 is shown below.



Appendix 1: Key documents

	Document title	Availability
1.	Licence L8934/2015/1	accessed at www.dwer.wa.gov.au
2.	Notice of amendment of Licence expiry	accessed at www.dwer.wa.gov.au
3.	Response from the DBCA on the Application	DWER records (A1509922)
4.	Rockwater, 2011, *Big Bell and Cue Environs: Summary of Hydrogeology*, Report for Westgold Resources limited.	DWER records (A1500685)
5.	Outback Ecology, 2012, *Aquatic Assessment of Lake Austin*, Report for Westgold Resources Limited: Central Murchison Gold Project	DWER records (A1500684)
6.	Outback Ecology, 2009, *Development of Framework for Assessing the Cumulative Impacts of Dewatering Discharge to Salt Lakes in the Goldfields of Western Australia,* prepared for the Department of Water	Accessed at https://www.water.wa.gov.au/__data/assets/pdf_file/0019/5149/102743.pdf
7.	Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, 2000, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*	Accessed at http://www.agriculture.gov.au/water/quality/guidelines
8.	Supplementary information email L8934 Amendment clarification (water quality)	DWER records (A1509922)
9.	Supplementary information email Big Bell dewatering L8934 – revised map	DWER records (A1455925)
10.	DWER, July 2015. *Guidance Statement: Regulatory principles.* Department of Environment Regulation, Perth.	Accessed at www.dwer.wa.gov.au
11.	DWER, October 2015. *Guidance Statement: Setting conditions.* Department of Environment Regulation, Perth.	
12.	DWER, November 2016. *Guidance Statement: Environmental Siting*. Department of Environment Regulation, Perth.	
13.	DWER, February 2017. *Guidance Statement: Decision Making.* Department of Environment Regulation, Perth.	
14.	DWER, February 2017. *Guidance Statement: Risk Assessments*. Department of Environment Regulation, Perth.	
15.	DWER, February 2017. *Guidance Statement: Land Use Planning*. Department of Environment Regulation, Perth.	
16.	Tanner, R., Glenn, E.P. and Moore, D., 1999. Food chain organisms in hypersaline industrial	The paper is available from web site

	evaporation ponds. *Water Environment Research*, **71(4)**, 494-505.	http://www.jstor.org/stable/25045243
17.	Wurtsbaugh, W.A., Gardberg, J. and Izdepski, C., 2011. Biostrome communities and mercury and selenium bioaccumulation in the Great Salt Lake (Utah, USA). *Science of the Total Environment*, **409**, 4425-4434.	The paper is available from web site https://www.researchgate.net/profile/Jodi_Gardberg/publication/51565518_Biostrome_communities_and_mercury_and_selenium_bioaccumulation_in_the_Great_Salt_Lake_Utah_USA/links/00463524d85ec0b357000000/Biostrome-communities-and-mercury-and-selenium-bioaccumulation-in-the-Great-Salt-Lake-Utah-USA.pdf
18.	Barnes, C.J., Jacobson, G. and Smith, G.D., 1992. The origin of high-nitrate ground waters in the Australian arid zone. Journal of Hydrology, 137, 181-197.	-

Appendix 2: Summary of Licensee comments

The Licensee was provided with the draft Amendment Notice on 11 December 2018 for review and comment. The Licensee responded on 12 December 2018 waiving the remaining comment period. No comments were received on the proposed Amendment Notice.