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7 April 2025
Project Number: 1001622

[redacted]
Department of Water and Environmental Regulation
Lacked Bag 10 Joondalup DC
WA 6919

[redacted]
Please find below responses to the Request for Information received on the 27 March 2025.

[redacted]

DWER:1. An annual maximum production/design capacity for category 6 – this needs to be a specified hard limit number in tonnes that is greater than the estimated annual throughput, not a range. This is the number that cannot be exceeded in an annual period.

1,400,000 tonnes of water per annum.

Note design capacity of infrastructure is 1,261,440 tonnes.

DWER 2. We require more information about the risks to the lake/downstream/nearby receptors and controls – please include the predicted risks, method of sampling and parameters to be sampled, and vegetation monitoring methods to be used. These should be backed by scientific reasoning.

Environmental Risk Assessment

We have performed a desktop environmental risk assessment based on the risk ratings detailed in DWER Guideline: Risk Assessments (2017). The anticipated discharge from the dewatering of Golden Pig underground to Lake Koordoorkine is expected to take place over two years because the dewatered groundwater will be used for dust management during operations. As such, this risk assessment assumes a two-year discharge timeframe.

Risk assessment presented in Table 1

Table 1 Golden Pig Discharge Lake Koorkoordine Environmental Risk Assessment

Receptor	Risk	Assessment of Potential Impact	Environmental Context	Controls	Risk Rating
Surface Waters	Alterations in surface water chemistry for Lake Koorkoordine.	Over the duration of the dewatering, nutrients, salts and metals will be added to the ecosystem. Which could have a negative impact on fauna and flora.	Water samples have been collected from three locations: ▪ exploration drill hole (GPRL1006) located along strike from the Golden Pig Underground ▪ the portal in the Golden Pig north pit, and ▪ surface waters from Lake Koorkoordine. The results indicate that the receiving environment for the Golden Pig discharge at Lake Koorkoordine has a greater Electrical Conductivity (salinity), Total Dissolved Solids (TDS) and similar pH to the water stored in the Golden Pig underground (Table 2 and Table 3). Metals: Arsenic, Cadmium, Lead had lower concentrations within the Golden Pig discharge water when compared to the Lake Koorkoordine samples (Table 3). Mercury was below detection limits for all samples.	Initial discharge rates will be low and slowly ramp up to design rates. If vegetation monitoring identifies impacts to vegetation discharge rates will be reduced.	Consequence: Minor Likelihood: Rare Risk Rating: Low Low risk of alteration in surface water chemistry.
Downstream	Impacts to downstream receptors.	Discharged water has lower salinity than the receiving environment would not cause an impact from increased soil chemistry. Lake Koorkoordine is large enough to absorb rainfall and discharge volumes.	As above the Golden Pig water chemistry shows similar properties to the discharge location. In high rainfall events the discharged water will be diluted by fresh rainfall prior to continued flow downstream. The design maximum discharge rate for the dewatering infrastructure is 40L/s, this will be reduced in high rainfall events if the receiving environment is unable to accommodate the additional water.	Low rate of discharge to prevent mobilisation of salts across the receiving environment. Reduce discharge is rainfall events and monitor downstream receptors.	Consequence: Minor Likelihood: Rare Risk Rating: Low Low risk of alteration in surface water chemistry.

Receptor	Risk	Assessment of Potential Impact	Environmental Context	Controls	Risk Rating
Erosion	Erosion of creek line at the discharge location.	Discharged waters may cause erosion of the creek banks at the discharge location.	Sandy soil surface of the region is susceptible to erosion.	Rock rip rap to be installed at discharge location to slow surface water flows and prevent erosive forces.	Consequence: Slight Likelihood: Rare Risk Rating: Low The risk of erosion to creek lines is low.
Fringing Vegetation	Loss of endemic vegetation communities or protected species	Fringing vegetation community present on the shoreline of lake Koorkoordine contains species known to persist in highly saline environments.	The baseline flora and vegetation survey conducted in 2023 (AECOM 2024, as attached to works approval application) did not identify any declared rare or priority flora within the fringing vegetation of Lake Koorkoordine. The fringing vegetation community is described as: Tecticornia Samphire Shrublands - *Tecticornia pruinosa*, *Tecticornia halocnemoides* and *Roycea divaricata* low samphire shrubland over *Disphyma crassifolium* subsp. *clavellatum*, *Eragrostis falcata* and *Aristida holathera* mixed. All species are known to inhabit saline environments surrounding salt lakes and inland waters. As discussed above the discharged water will have a similar salinity the lake salinity.	Initial discharge rates will be low and slowly ramp up design rates. If vegetation monitoring identifies impacts to vegetation discharge rates will be reduced.	Consequence: Slight Likelihood: Rare Risk Rating: Low The risk of negative consequences for the fringing vegetation surrounding the lake is considered low.

Receptor	Risk	Assessment of Potential Impact	Environmental Context	Controls	Risk Rating
Fauna	Loss of habitat of endangered species	One Endangered species with the potential to use the area, Common Greenshank, is migratory and likely to use the habitat on occasion.	The baseline fauna survey was conducted in 2023 (AECOM 2024, as attached to works approval application). The Salt Pan fauna habitat represents 167.22 ha (23%) of the survey area. Described as *Tecticornia* shrubland over native shrubs and grasses, common bare ground over orange sandy clay. This habitat is linked with the Salt Pan habitat and serves as fringing vegetation. It may offer shelter, food and breeding grounds for fauna species, however no ecological benefits for significant fauna species were identified for this area. The Common Greenshank (*Tringia nebularia)* (conservation status as Endangered under the EPBC Act) may potentially utilise the fringe of the habitat near the riparian vegetation during the wet periods, should the habitat sustain water. Due to the migratory nature of the Common Greenshank, this habitat is unlikely to provide any additional ecological value and/or core habitat for this species.	If vegetation monitoring identifies impacts to vegetation discharge rates will be reduced.	Consequence: Slight Likelihood: Rare Risk Ratting: Low The risk to Fauna species utilising the lake and surrounding vegetation is determined to be low.
Community	Community perception of impact to use of public spaces	Increased standing water level in the lake and discharge location may prevent utilisation by community.	Lake Koorkoordine is located 7 km north of Southern Cross. There is a day use area and public golf course on the northern bank of the lake. Both locations are 500m down stream of the discharge location	Community consultation	Consequence: Slight Likelihood: Rare Risk Ratting: Low There is unlikely to be any loss of public amenity as a result of this project.

Table 2 Water Sample: Physical Parameters

Field ID	Sample type	Date	SWL (m btoc)	pH	EC (µS/cm)	TDS (mg/L)
GPRL1006	Exploration RC hole	21/11/23	43	7.29	151,000	129,000
Golden Pig Portal	Surface Water	26/3/24	36	7.42	9,220	5,280
Golden Pig Portal	Surface Water	4/9/24	36	7.34	10,300	6,090
Lake Koorkoordine	Surface Water	21/11/23	0	7.26	215,000	337,000

Table 3 Water Sample: Metals Analysis

Sample ID	GPRL1006	Golden Pig Portal	Lake Koorkoordine
Area	Southern Cross Central Area	Southern Cross Central Area	Lake Koorkoordine
Sample Location	Exploration RC hole	Surface Water	Surface Water
Aluminium (mg/L) - Filtered	<0.2	<0.01	<1
Aluminium (mg/L) - Total	0.91	0.01	<1.05
Arsenic (mg/L) - Filtered	0.023	<0.001	<0.1
Arsenic (mg/L) - Total	0.032	<0.001	<0.105
Bicarbonate Alkalinity as $CaCO_3$ (mg/L) - Total	318	52	172
Cadmium (mg/L) - Filtered	<0.002	0.0002	<0.01
Cadmium (mg/L) - Total	<0.0021	0.0003	<0.0105
Calcium (mg/L) - Filtered	1,170	198	716
Carbonate Alkalinity as $CaCO_3$ (mg/L) - Total	<1	<1	<1
Chloride (mg/L) - Total	70,000	3010	171,000
Chromium (mg/L) - Filtered	<0.02	<0.001	<0.1
Chromium (mg/L) - Total	0.035	<0.001	<0.105
Cobalt (mg/L) - Filtered	0.054	0.002	<0.1
Cobalt (mg/L) - Total	0.06	0.002	<0.105
Copper (mg/L) - Filtered	0.025	0.003	<0.1
Copper (mg/L) - Total	0.036	0.006	<0.105
Electrical Conductivity @ 25°C (µS/cm) - Total	151,000	10300	215,000
Fluoride (mg/L) - Total	<0.5	0.01	0.7
Hydroxide Alkalinity as $CaCO_3$ (mg/L) - Total	<1	<1	<1
Ionic Balance (%) - Total	1.82	1.58	1.28

Sample ID	GPRL1006	Golden Pig Portal	Lake Koorkoordine
Iron (mg/L) - Filtered	<1	<0.05	<5
Iron (mg/L) - Total	2.32	0.48	<5.25
Lead (mg/L) - Filtered	<0.02	<0.001	<0.1
Lead (mg/L) - Total	<0.021	<0.001	<0.105
Magnesium (mg/L) - Filtered	5,330	132	17,900
Manganese (mg/L) - Filtered	1.79	0.4	1.61
Manganese (mg/L) - Total	1.77	0.447	1.65
Mercury (mg/L) - Filtered	<0.0005	<0.0001	<0.0005
Mercury (mg/L) - Total	<0.0005	<0.0001	<0.0005
Nickel (mg/L) - Filtered	1.04	0.009	<0.1
Nickel (mg/L) - Total	1.07	0.01	<0.105
Nitrate as N (mg/L) - Total	7.9	<0.01	0.89
Nitrite + Nitrate as N (mg/L) - Total	7.93	1.53	0.93
Nitrite as N (mg/L) - Total	0.03	1.53	0.04
pH Value (pH Unit) - Total	7.29	7.34	7.26
Potassium (mg/L) - Filtered	676	26	2330
Selenium (mg/L) - Filtered	<0.2	<0.01	<1
Selenium (mg/L) - Total	<0.21	<0.01	<1.05
Silicon as SiO2 (mg/L) - Filtered	25.4	5.1	5.7
Silicon as SiO2 (mg/L) - Total	34.2	5.6	<5.4
Sodium (mg/L) - Filtered	39,600	1710	86,200
Sulfate as SO4 - Turbidimetric (mg/L) - Filtered	8,440	621	17,100
Suspended Solids (SS) (mg/L) - Total	176	16	556
Total Alkalinity as CaCO3 (mg/L) - Total	318	52	172
Total Anions (meq/L) - Total	2,160	98.9	5,180
Total Cations (meq/L) - Total	2,240	95.8	5,320
Total Dissolved Solids @180°C (mg/L) - Total	129,000	6090	337,000
Zinc (mg/L) - Filtered	<0.1	0.313	<0.5
Zinc (mg/L) - Total	<0.105	0.353	<0.525

Monitoring

Water monitoring – Water samples will be collected from the Golden Pig abstraction point (1 sample) and Lake Koorkoordine discharge location (1 sample). Samples will be undertaken 6-monthly in the same month for each monitoring event. The following parameters will be analysed:

- Metals (Al, As, Cd, Co, Cr, Cu, F, Fe, Hg, Mn, Ni, Pb, Se, Zn)
- Major ions (Ca, Cl, K, Mg, Na, $CaCO_3$ (bicarbonate alkalinity, carbonate, hydroxide alkalinity), SO_4, SiO_2)
- pH, EC, TDS, TSS
- Nutrients (nitrate and nitrite).

Vegetation Health Monitoring – Vegetation quadrats will be installed every 200 m downstream from the discharge location to the eastern extent of Lake Koorkoordine. Vegetation health will be assessed within a 10 x 10 m quadrat at each site. The quadrat will be scored as a single unit using the Casson et al. (2009) Vegetation Health Scale (see **Error! Reference source not found.**), providing a comprehensive assessment of the overall vegetation health within the designated area. As far as is practical, the vegetation community assessed will be consistent across all monitoring locations. Quadrats will be installed used fence droppers in each corner with one edge abutting the salt lake. Annual assessments will negate the impacts of seasonal variations in vegetation health and provide a consistent approach to the vegetation assessments over time.

Note: a baseline assessment of vegetation will commence during construction of the discharge pipeline and this will dictate the annual month of assessment. The annual assessments will occur 12 months from this date.

Table 4 Casson et al – Vegetation Health Scale

Vegetation Health Rating	Description
4	Healthy no signs of stress
3	Some early signs of stress, a few individuals, likely one species
2	Signs of stress in several individuals, one or more species
1	Signs of stress in many individuals, several species
0	Advanced decline and/or death of many individuals and several or most species

References

Casson, N., Downes, S. & Harris, A. 2009. Native vegetation condition assessment and monitoring manual for Western Australia. Australian Government and Department of Environment and Conservation. Unpublished report prepared for the Native Vegetation Integrity Project.