



# **ENVIRONMENTAL MANAGEMENT PLAN (EMP) FOR THE ARGYLE UNDERGROUND PROJECT**

## **SUBTERRANEAN FAUNA MANAGEMENT PLAN**



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# 1. INTRODUCTION

## 1.1 PURPOSE

The management of subterranean fauna at Argyle will be carried out in accordance with the documents listed in Section. Management objectives are to ensure that no subterranean fauna species become extinct and that unnecessary disturbance to them or their habitat is avoided.

These objectives will be achieved by minimising dewatering drawdown without comprising underground mine safety and by minimising contamination of groundwater, particularly with hazardous materials. Management actions, which will ensure that these objectives are met, are outlined in Table B9-1 Subterranean Fauna Management.

## 1.2 SCOPE

This Management Plan provides an overview of what is currently known about subterranean fauna at the site and how any potential impacts on the subterranean fauna from dewatering and underground mining will be managed. Actions to meet the objectives during mining and closure operations are allocated to responsible people, with timelines for completion and performance targets in Table B9-1 Subterranean Fauna Management.

## 1.3 AREA

Argyle mining lease and miscellaneous licence areas.



## 2. DEFINITIONS

### **Subterranean fauna**

Includes both stygofauna, aquatic animals that live in interstitial spaces within groundwater systems and troglofauna, which occurs in open underground, caves or voids. They are usually characterised by having no eyes or body pigment.



### 3. DETAILS

A relatively diverse subterranean assemblage has been recorded on the site since 2002. Many of these species have currently only been recorded within the vicinity of the mine. A troglobitic community was found in some of the samples on Limestone Creek, outside the immediate effects of underground mining drawdown. Previously, they had been recorded in the Kimberley Devonian Reef system (Ningbing Range and Jeremiah Hills), northwest of Kununurra (Humphreys, 1995). Troglobitic fauna are not directly dependent on groundwater and may even inhabit relict rainforest if there is a suitable void rich subterranean matrix supporting a water-saturated atmosphere.

The projected groundwater drawdown zone from underground mining operations is predicted to impact on one site where subterranean fauna were located, PB1 south west of Gap Dam (Humphreys, 2003) Figure B9-1 of the Environmental Protection Statement (EPS). The taxon from this site has been identified as Kimberley bathynella n. gen Argylei n. sp., which has also been identified at monitoring Site 37 (Humphreys, 2003). Site 37 is in a separate drainage channel, just outside the projected zone of groundwater drawdown from dewatering for the underground mine. The presence of this species on either side of the water divide suggests that it will also occur in the upper reaches of both the Limestone Creek and Smoke Creek drainages until their confluences, many kilometres downstream (pers. com. W. Humphreys, 2004).

It is important to protect groundwater quality during mining operations at Argyle and thus maintain subterranean fauna populations. This includes minimising and cleaning up hazardous material spills and preventing nutrients from explosives manufacture from entering the groundwater. In addition, should the drawdown model change and graduate outward, impacts on subterranean fauna will be reassessed.

Regular reviews of the subterranean data in respect to their distribution and requirements for further surveys will be organised with CALM, the WA Museum and other relevant specialists as required.

#### 3.1 MONITORING

Subterranean fauna has been monitored annually in deep and shallow regional and Lease Area bores since 2002. The number of monitoring sites has varied each year, however if the Project proceeds, the subterranean fauna-sampling programme will be expanded to include new bores specifically constructed to sample subterranean fauna, including macrofauna species. Previously, the small slot size in bore casing may have precluded larger subterranean fauna from being sampled. Additional regional bores will be sourced to improve understanding of the regional distribution of subterranean fauna species.

Appropriately qualified personnel, supported by Argyle's Environmental Section, will undertake the sampling programme and subsequent interpretation of results. Bores will be sampled within and around the open cut mine, generally within the Designated Area, underground mine and at a few outer locations where access is available between the Weaber Range and Texas Downs Station. Samples will be taken from boreholes, springs and pastoral wells.

Bores will be sampled using weighted plankton nets of a size appropriate for the bore and have a mesh size of 150 or 250 µm. The bottom of the bore will be agitated where possible and the net hauled repeatedly through the water column.

Springs will be sampled with a Bou-Rouch pump (a hollow lance through which water could be pumped) inserted as deep as possible into the spring either manually, or with a sledgehammer as required by the substrate. On occasion a filtration pit (a Karaman-Chappuis pit) may be made alongside the spring and the filtered water sampled through a net before refilling the pit.

Samples will be sorted live on site, in a petri dish under a dissecting microscope, using intense lateral

illumination, and preserved in 75% special alcohol, or in 100% ethanol if required for DNA extraction.

The specimens will be sent to respective specialist taxonomists to determine their broad affinities as far as can be ascertained without dissection and from the state of knowledge of the group in question.

Physico-chemical attributes of the water at most locations will be measured using a Quanta-G (Hydrolab Corporation, Austin, Texas), water quality monitoring system attached to a 50 m cable to permit profiling through depth. The attributes to be measured include temperature, specific conductance (or TDS), pH, dissolved oxygen, oxidation reduction potential (redox), and depth, the latter facilitating the determination of any vertical stratification present in the water column in some boreholes. The instrument will be calibrated against the standards recommended for the instrument.

The next sampling programme will commence with the development of the underground mine, and then will be conducted on an biannual basis for the first 1-2 years. The programme will be discussed with CALM and the WA Museum and continue as required and agreed.



## 4. RESPONSIBLE PEOPLE

The following people are responsible for actions to manage terrestrial fauna:

### 4.1 SUPERINTENDENT ENVIRONMENT

The Superintendent Environment is responsible for ensuring that a new procedure for sampling subterranean fauna is completed, subterranean fauna and groundwater are monitored and new monitoring sites are established and subsequently sampled. The Superintendent Environment is responsible for ensuring that the results of subterranean fauna monitoring are included in the AER, liaising with Government agencies and scientific specialists to determine subterranean fauna species identifications and to review monitoring sites.



## 5. RELATED DOCUMENTS

### Management and Operational Plans

- Nill

### Procedures and Work Instructions

- Humphreys W.F. (2003) Report on 2003 Stygofauna Sampling at the Argyle Diamond Mine, Kimberley, Western Australia. Report prepared for Argyle by the WA Museum, December 2003.
- Metago (2004a) Environmental Water Monitoring Handbook Report prepared for Argyle by

Subterranean fauna research references and other background documents are listed in Part C References of the Environmental Protection Statement (EPS).

## 6. RECORDS MANAGEMENT

As subsequent revisions of this document are carried out, previous versions are retained within DM5 for records management purposes in accordance with the **Management of Controlled Documents Procedure #AD-226750**.

## 7. APPENDICES

### 7.1 TABLE B 9-1: SUBTERRANEAN FAUNA MANAGEMENT

Action	Key Issue	Objective	Management Action	Timing	Responsibility	Target	Work Instruction - Procedure
B.9.1	Presence of subterranean fauna species on site.	Determine the distribution and endemism of subterranean fauna species.	<p>Construct new groundwater monitoring bores to facilitate the sampling of subterranean fauna.</p> <p>The location and bore specifications of any new bores will be developed together with CALM and the WA Museum. The new bores may be established downstream of Smoke Creek in vicinity of alluvial blocks or C6, and other locations within the drawdown zone..</p> <p>Locate additional pastoral or other bores suitable for sampling subterranean fauna and include in monitoring programme.</p>	Following approval of the Project.	Superintendent Environment.	<p>Dedicated subterranean fauna sampling bores constructed within and outside of the dewatering zone.</p> <p>At least four bores are to be established outside the area likely to be influenced by underground operations.</p>	Explanatory notes (Humphreys, 2003)
B.9.2			Develop and implement a procedure for subterranean fauna sampling and data management.	Prior to recommencement of monitoring programme	Superintendent Environment.	Subterranean fauna surveys completed.	Sampling methodology (Humphreys, 2003)



Action	Key Issue	Objective	Management Action	Timing	Responsibility	Target	Work Instruction - Procedure
B.9.3			<p>Conduct subterranean fauna sampling programme in monitoring bores and springs on the mining lease and miscellaneous licence areas, within the groundwater drawdown zone of influence and as recommended in consultation with CALM and the WA Museum.</p> <p>The subterranean fauna sampling programme will be reviewed with the WA Museum and CALM.</p> <p>Identify subterranean fauna taxa to species level where possible.</p> <p>Reassess the programme if further species are identified and are at risk due to the mining activities.</p>	<p>Biannual for the first 1-2 years</p> <p>Following the initial sampling programme</p> <p>Ongoing</p>	Superintendent Environment	Subterranean fauna are sampled and identified.	Nil
B.9.4	Impact of dewatering on subterranean species.	To maintain the abundance, species diversity, geographic distribution and productivity of subterranean fauna found in the mine area.	<p>Review sampling data (subterranean and groundwater) and determine whether changes in dewatering, ARD management or drainage are required.</p> <p>Report sampling results and findings in the AER.</p>	<p>Annually</p> <p>Annually</p>	Superintendent Environment	To detect trends in distribution and concentration of subterranean fauna over the survey area.	Nil



APPENDICES

Action	Key Issue	Objective	Management Action	Timing	Responsibility	Target	Work Instruction - Procedure
B.9.5 (Also see Table B1.1 action B1.4)	Impact of dewatering on subterranean species.	To maintain the abundance, species diversity, geographic distribution and productivity of subterranean fauna found in the mine area.	Review hydrological data and review dewatering zone of influence. If zone of influence exceeds or is likely to exceed, the predicted area, then examine the abstraction rates to ascertain whether licence conditions require review.	Every two years.  As required	Superintendent Environment Superintendent Production Process	Dewatering zone of influence is within the predicted range.	Environmental Water Monitoring Handbook (Metago, 2004b)
B.9.6			Reassess potential impacts on subterranean fauna if groundwater drawdown exceeds the modelled drawdown area.	As required	Superintendent Environment.	Potential impact is re-evaluated if drawdown area increases.	Nil
B.9.7	Groundwater contamination and impacts on subterranean fauna.	To prevent pollution of groundwater and impacts on subterranean fauna.	Monitor water quality of groundwater and evaluate remedial actions when baseline values exceeded.	Annually	Superintendent Environment.	Annual review of water quality data. No adverse trends in plots of water quality.	Environmental Water Monitoring Handbook (Metago, 2004b)

