



Risk Assessment for Bathynellidae at the Central West Coal Project

**Prepared for
Aviva Corporation Ltd
by Bennelongia Pty Ltd**

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Client – Aviva Corporation Ltd

Report	Version	Prepared by	Checked by	Submitted to Client Method	Date
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1.0 Introduction

Aviva Corporation Ltd is investigating development of an open-pit mine to extract coal from the Cattamarra Coal Measures about 10-20 km south of Eneabba in south-west Western Australia (Rockwater 2008). The development will be known as the Central West Coal Project. Mining will extend below the watertable and de-watering will be required, which creates a situation where stygofauna may potentially be impacted.

As part of the assessment of the mine's potential environmental impact, stygofauna were sampled in four seasons between January 2007 and March 2008. The only recognized stygobyte collected was a species of Bathynellidae, a family of microscopic crustaceans commonly found in groundwater. It was collected from bore EFB2 in both May 2007 and March 2008. Results of stygofauna sampling, together with an assessment of the potential environmental impact of the mine in relation to stygofauna, were collated in Rockwater (2008).

The Environmental Management Branch (EMB) of the Department of Environment and Conservation made the following comments on the Rockwater (2008) report:

DEC is unable to assess the impacts to Bathynellid sp.1 (the species of Bathynellidae collected) as distribution data has not been provided to support the statement that "...it is unlikely to be restricted to the Cattamarra Coal Measures aquifer in the immediate project area", and on the basis that current information suggests this species is restricted to the area of impact with expert opinion suggesting this species be treated as a short-range endemic.

Recommendation 1: *Aviva should demonstrate that the undescribed Bathynellid sp.1 is not confined to the area of impact.*

Recommendation 2: *Aviva should undertake another sampling program/s, outside the area of impact, to more accurately define the distribution of Bathynellid sp.1 to clarify its conservation significance, particularly with a view to determining if this species is found outside of the area of impact.*

Recommendation 3: *DEC supports the recommendation that the Bathynellid specimens recovered from the bore EFB2 be lodged with the WA Museum.*

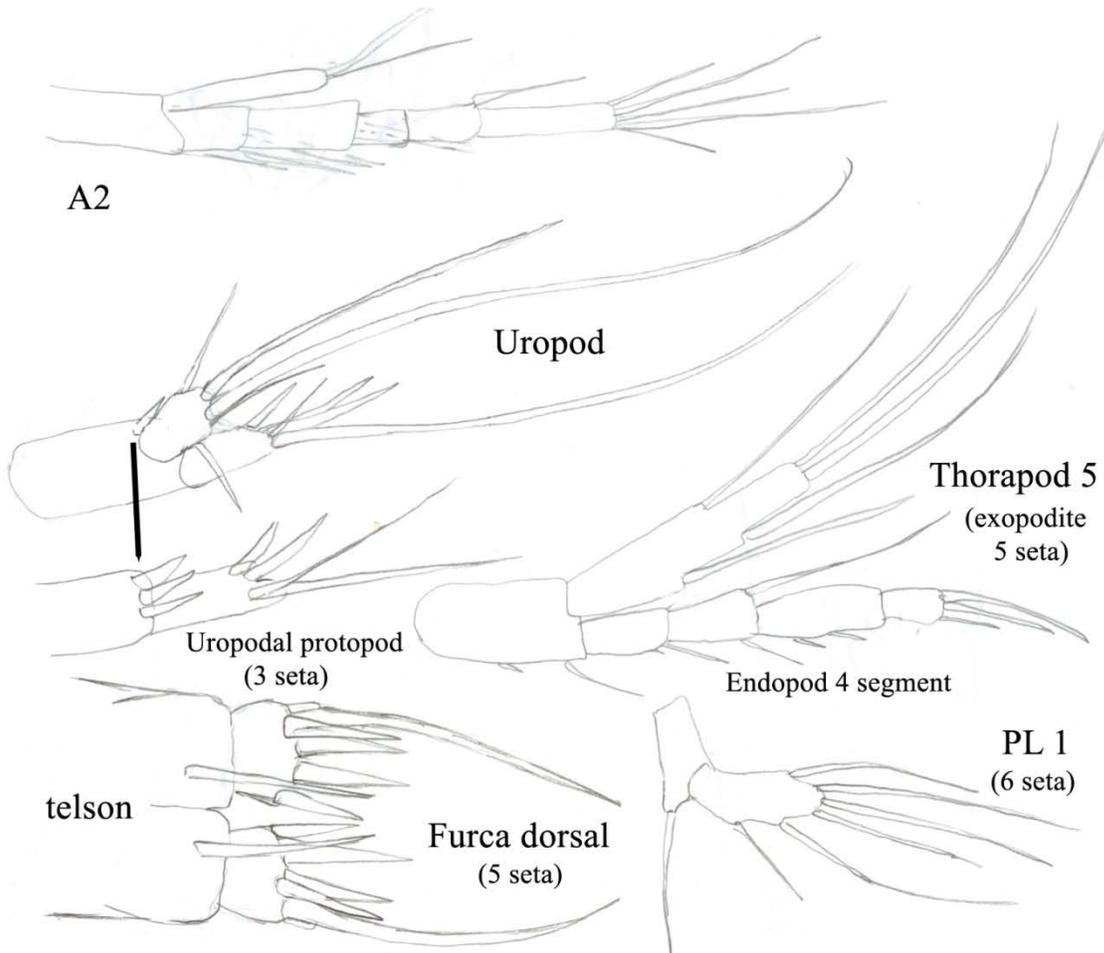
Recommendation 4: *If taxonomic verification can be determined from existing Bathynellid specimens that this taxa has been collected outside of the area of impact, further sampling will not be required.*

In response to the comments made by EMB, and in consultation with it, Aviva commissioned Bennelongia to undertake an independent assessment of the risk of mining to the Bathynellidae species with the following scope (reduced from the original proposal because of the actual results for point 1):

1. Obtain the bathynellid specimens, photograph or illustrate them and determine whether the specimens collected from bore EFB2 are the same species as collected by the Museum from bore LS26D 35 km north-west. If the species are the same, cease risk analysis
2. Review existing information on bathynellid species ranges and habitat preferences
3. Relate information in point 2 above to expected size of the pit excavation and drawdown cone to produce an estimate of probable threat to the species.

This report provides Bennelongia's assessment of the potential risk to the Bathynellidae species associated with the Central West Coal Project.

Bathynella sp. (Eneabba WA EFB2)



Length 1mm

Figure 1. Bathynellidae species from bore EFB2, showing photo of whole animal and pencil drawings of some limbs. Female

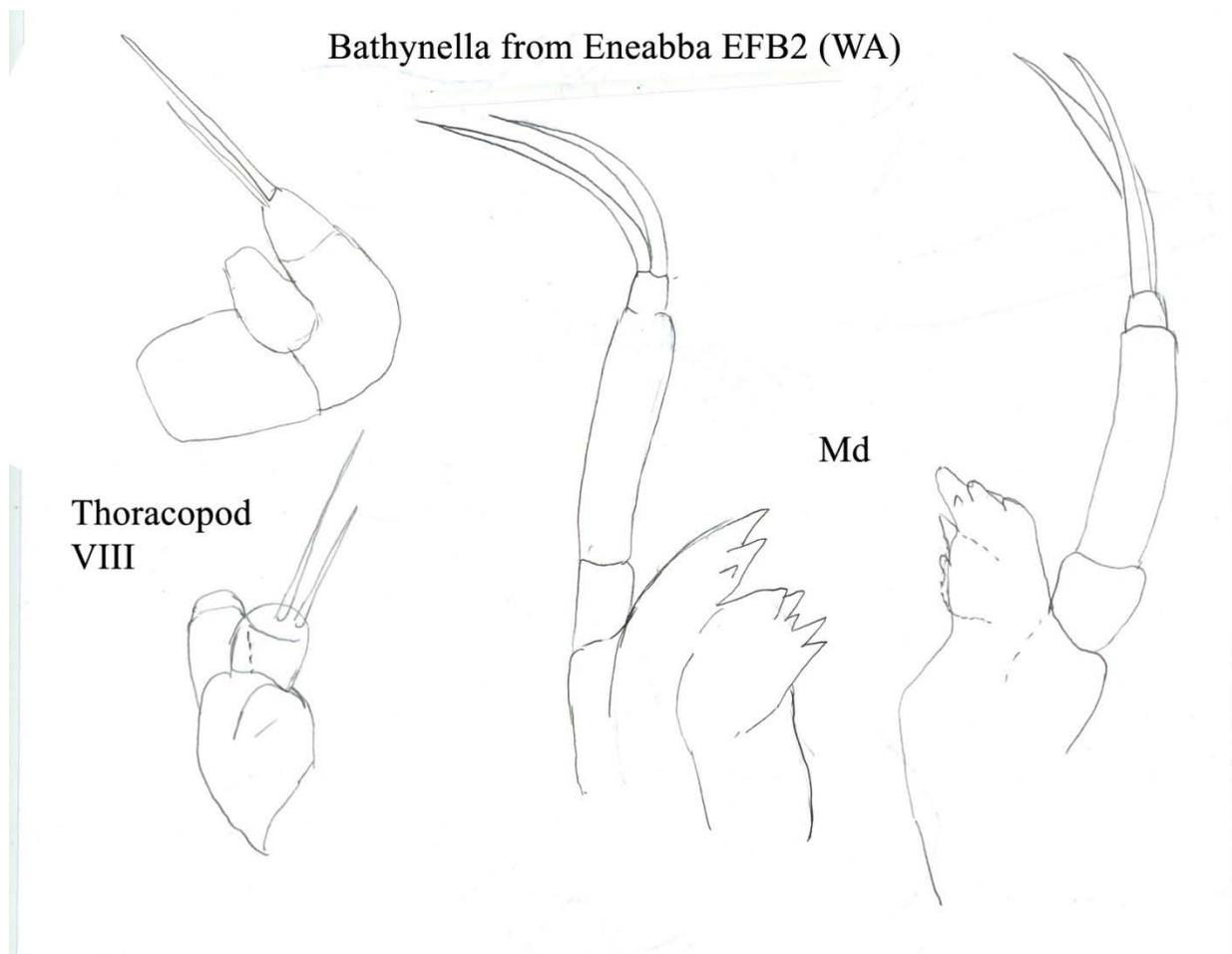


Figure 2. Bathynellidae species from EFB2, showing male mandibles and thoracopod VIII, which are important taxonomic characters

2.0 Risk Assessment

2.1 Identity of *Bathynellidae* species

The specimens of Bathynellidae from the Central West Coal Project were collected by Rockwater Pty Ltd. Three of the specimens were subsequently forwarded to Dr Brenton Knott, University of Western Australia, for examination and taxonomic description (see Rockwater 2008).

Bennelongia obtained two specimens from Dr Knott and one from Subterranean Ecology. Appendages of two animals were drawn (Figures 1 & 2) and the drawings were sent to Prof. Joo-Lae Cho, International Drinking Water Centre, South Korea. Prof. Cho is a world authority on Bathynellidae and Parabathynellidae and has described all known Western Australian species to date (see Cho et al. 2006; Guzik et al. 2008). He currently has on loan a substantial part of the Western Australian Museum's collection of Bathynellidae and Parabathynellidae, including animals collected from bore LS26D in June 1998. Prof. Cho stated by email on 28 November 2008 that he believes the specimens from bore EFB2 are the same species as those from bore LS26D, which he has dissected and illustrated.

Bore LS26D is slightly over 50 km to the north-west of bore EFB2, which is located within the impact area of the proposed mine (Rockwater 2008 state the distance is about 50 km). Bore LS26D is approximately 33 km north of any influence of groundwater drawdown associated with the proposed mine (see Figure 4 in Rockwater 2008) and, therefore, it can be stated that the species of Bathynellidae found at EFB2 is known to occur outside the zone of mine impact.

2.1.1 Recommendation 1

Recommendation 1 of EMB has been achieved. Prof. Cho's identification demonstrates (or at least very strongly suggests) that "*the undescribed Bathynellid sp.1 is not confined to the area of impact*".

2.2 Bathynellid species ranges and habitats

Bathynellidae belong to the crustacean Super-Order Syncarida and are relatively poorly known in Australia. The related family Parabathynellidae has received more attention because it is easy to study taxonomically and because it appears to occur more frequently. According to Serov (2002), there is currently only one species of Bathynellidae described from Australia: *Bathynella primaustraliensis* from the Murray-Darling basin. However, he recognized that the family occurs more widely and, in Western Australia, species have been collected from the Pilbara and Yilgarn as well as Eneabba. Both Bathynellidae and Parabathynellidae typically inhabit freshwater interstitial species in alluvium.

While awaiting determination of whether the specimens from bore LS26D were the same species as occurred within the mine impact area, a short review was completed of known ranges of species of Bathynellidae and Parabathynellidae (the families have similar size and habits). The overwhelming picture is of very small ranges with two-thirds of species in the review having known range of less than 10 km (Table 1). However, two species had ranges extending across several hundred kilometres and Camacho & Valdecasas (2008, p. 264) recently pointed out in their review of global diversity of syncarids that, when intensive sampling occurs, many species previously thought to be restricted are shown to have wide distributions.

2.2.1 Species at EFB2

In line with Camacho & Valdecasas' comments, examination of additional animals strongly suggests that the species at EFB2 extends at least as far as bore LS26D. Bore EFB2 lies within the Cattamarra Coal Measures. Geological connectivity between the two bores is not clear-cut because it is uncertain whether LS26D is also in the Cattamarra Coal Measures, or in one of either the Cadda or Yarragadee Formations. Furthermore, there are faults between the two bores across which groundwater flow is reduced (Figure 3). However, a study by (Camacho et al. 2006) of the distribution of five bathynellid species within an area of about 100 km² in the Iberian Peninsula, Spain, showed quite clearly that species are able to cross geological faults and that these are not necessarily barriers to dispersal.

Specimens of Bathynellidae have also been collected by the Department of Environment and Conservation at some tumulus springs to the north-east of EFB2 (Pinder & Penniford 2001) (Figure 3). Although lying in the Parmelia Formation, rather than Cattamarra Coal Measures, the tumulus springs may also support the species occurring at EFB2. Unfortunately, the tumulus spring animals are now in New South Wales with Peter Serov, University of New England, and could not be retrieved for comparison.

2.2.2 Summary of bathynellid range information

Bathynellidae usually occur in freshwater interstitial spaces in alluvium. In an area such as the Eneabba sand plains, a bathynellid species could be expected to spread by movement through shallow groundwater. The occurrence of the same species at bores EFB2 and LS26D, and perhaps the TS springs,

Table 1. Maximum known distances across ranges of some species of bathynellids for which at least two exact locations are given

Family	Species	Location	Greatest distance	No of locations	Reference
Parabathynellidae	<i>Brevisomabathynella cooperi</i>	Jundee Station, Gascoyne, Western Australia	3.2	10	Cho (2006b)
	<i>Atopobatynella wattsi</i>	Millbillillie Station, Gascoyne, Western Australia	55	2	Cho (2006a)
	<i>Atopobatynella glenayleensis</i>	Glenayle Stattion, Gascoyne, Western Australia	40	2	Cho (2006a)
	Gen. A sp. 13a	Lake Violet, Yilgarn, Western Australia	8.2	2	Guzik et al. (2008)
	Gen. A sp. 14a	Lake Violet, Yilgarn, Western Australia	3.2	2	Guzik et al. (2008)
	Gen. A sp. 2	Uramurdah Lake, Yilgarn, Western Australia	1	4	Guzik et al. (2008)
	<i>Kimberleybathynella kimberleyensis</i>	Weber Plains, Kimberley, Western Australia	6	2	Cho (2005)
	<i>Kimberleybathynella argylensis</i>	Argyle Diamond Mine, Kimberley, Western Australia	3	2	Cho (2005)
	<i>Kimberleybathynella pleochaeta</i>	Argyle Diamond Mine, Kimberley, Western Australia	2	2	Cho (2005)
	<i>Hexabathynella minuta</i>	Portugal/Spain	430	3	Camacho (2005)
	<i>Iberobathynella (A.) cornejoensis</i> n. sp.	Trema stream, Burgos, Spain	1.4	3	Camacho (2005)
	<i>Iberobathynella (A.) imuniensis</i>	Iberian Peninsula, Spain	300	11	Camacho et a. (2006)
	Bathynellidae	<i>Vejdovskybathynella edelweiss</i>	Ojo Guarena Cave, Burgos, Spain	5.7	4
<i>Vejdovskybathynella caroloi</i>		Molino Cave, Cantabria, Spain	10.5	2	Camacho (2007)

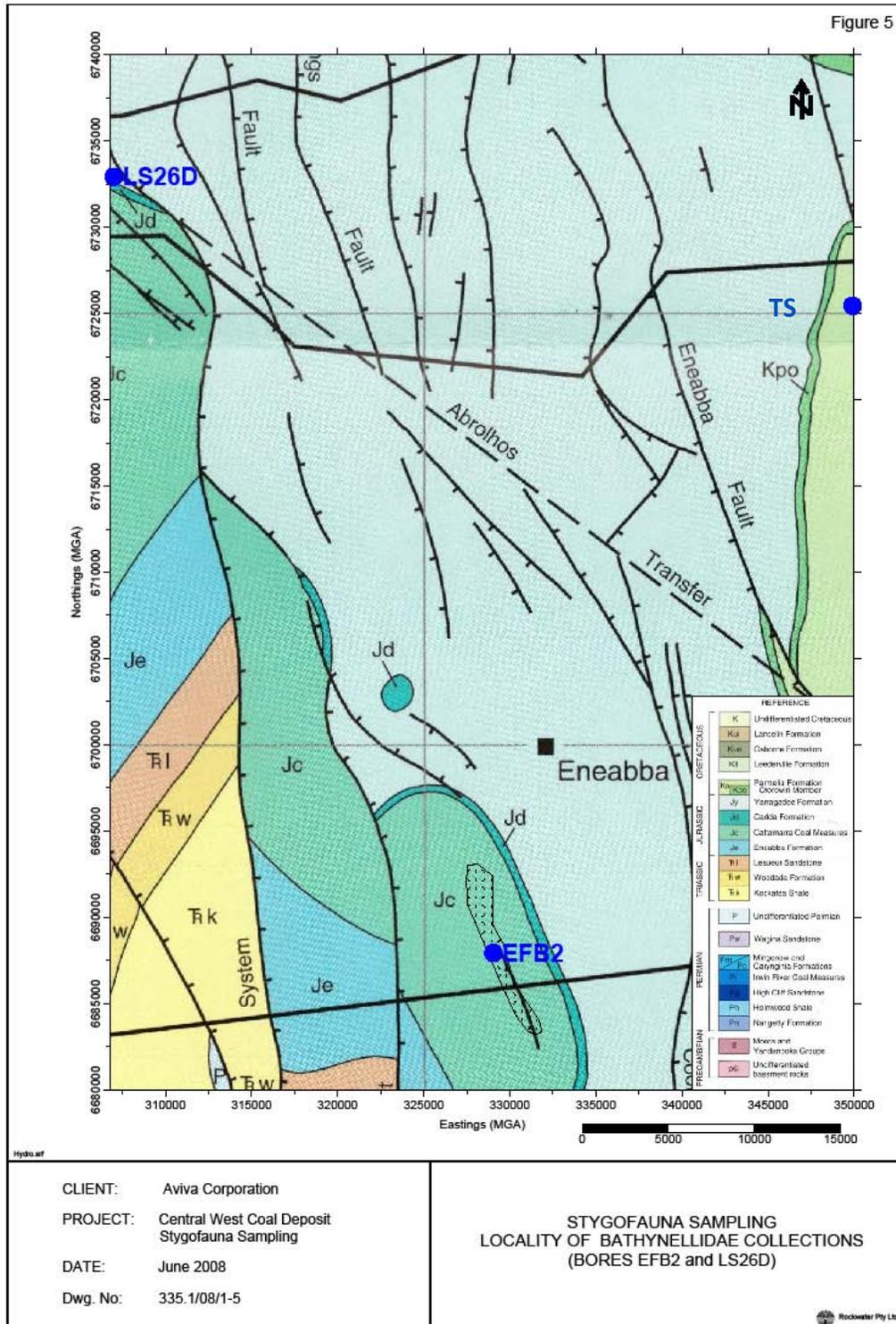


Figure 3. Hydrogeology of the Central West Coal Project and surrounding areas, showing location of bores EFB2 and LS26D in relation to the Cuttamura Coal Measures. TS, Tumulus springs

fits with what is known of family characteristics. The distance between bores EFB2 and LS26D is an order of magnitude less than the known ranges of some syncarid species (Table 1) and does not represent an unusually large range when the comments of Camacho & Valdecasas (2008) about ranges increasing with sampling intensity are considered. Furthermore, shallow groundwater of the Eneabba sandplain would appear historically to have provided an easy means of species distribution.

3.0 Risk assessment and recommendations

The risk posed by the Central West Coal Project to the species of Bathynellidae appears to be minimal. After reviewing drawings of the species from bore EFB2 Prof. Cho, who has described all named parabathynellid species in Western Australia, considered there is strong morphological evidence that the species extends beyond the zone of influence of the proposed mine to bore LS26D. It is possible the species has also been recorded to the north-east. Thus, the principal criterion of demonstrating lack of risk, according to EPA (2003) guidelines, has been met and EMB's Recommendation 1 has been satisfied.

Given the lack of risk to the Bathynellidae species from mining, further survey of its distribution appears to be unnecessary. Recommendation 4 of EMB applies "*further sampling will not be required*".

Recommendation 2 applies only where the species appears to be restricted to the impact area and Recommendation 3 (*lodge material with the WA Museum*) is not relevant to risk.

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