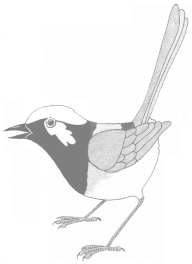
Thunderbird Project

Peer Review of Fauna Surveys



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1. Introduction

The Thunderbird Project is located 70km west of Derby on the Dampier Peninsula. Ecologia Environment (Ecologia) have undertaken a range of investsigations into the vertebrate fauna, troglofauna, stygofauna and Short Range Endemic (SRE) invertebrate fauna of the Thunderbird Project and Haul Road route.

This project was referred under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and determined to be a controlled action. It was further determined that assessment could occur under the bilateral agreement by the Environmental Protection Authority (EPA) as a Public Environmental Review (PER). The proponent has submitted their own Scoping Document which was approved and are now in the process of writing the PER. However, the EPA have requested that all baseline fauna surveys undergo a peer review by a suitably qualified person.

The reports for the seven surveys are:

- Thunderbird Dampier Peninsula Project: *Level 1 Flora and Fauna Assessment* (Ecologia 2012a)
- Environmental Heritage and Social Impact Services Thunderbird Dampier Peninsula Project: *Cultural Heritage Flora and Fauna Assessment* (Ecologia 2012b)
- Thunderbird Mineral Sands Project: *Flora and Fauna Survey Scoping Study Report* (Ecologia 2013)
- Thunderbird Project: *Short-range Endemic Invertebrate Targeted Survey* (Ecologia 2014a)
- Thunderbird Project: *Terrestrial and Subterranean Fauna Assessment* (Ecologia 2014b)
- Thunderbird Haul Road and Accommodation Camp: *Fauna and Flora Assessment* (Ecologia 2015)
- Thunderbird Project: *Targeted Greater Bilby Assessment* (Ecologia 2016)

1.2 Scope

The fauna reports were assessed against the following:

- That they are consistent will all EPA guidelines, policy, guidance statements and position statements for fauna surveys.
- That the surveys adequately covered the project development envelope and that there are no gaps within the surveys.
- That the survey effort was adequate for the project.
- That the surveys followed best industry practise and standards.
- That they report quantitative and qualitative data that is correct and accurate.
- That they correctly identify the sensitivity of the receiving environment and report on the need (if any) for any post impact studies.

1.3 Methodology

No site visit was undertaken to the Thunderbird Project site as part of this review. The adequacy of the fauna surveys undertaken was determined using only the information provided in the seven reports. Where a report included flora and vegetation survey results or assessments of cultural significance, the review was confined to the section of the reports pertaining to fauna.

2. The Review

2.1 Consistency with relevant State and Commonwealth guidelines.

Five of the seven reports were reviewed against compliance with the State and Commonwealth position statements, guidance statements and survey guidelines, as listed in Table 1. Reports were only assessed against Commonwealth survey guidelines (DSEWPaC 2010 and 2011), when the methodology in the report concerning searching for conservation significant fauna specifically refers to these documents.

Two reports (Ecologia 2012b and 2013) were not reviewed separately, as the fauna data and interpretations presented in these documents are based almost entirely on the Level 1 fauna survey reported in Ecologia (2012a). Commenting on the accuracy of assessments of the cultural significance of fauna is also outside the scope of this review.

2.1.1 EPA Position Statement No. 3

EPA Position Statement No. 3 (EPA 2002) provides a broad set of principles on biodiversity conservation and the requirements for terrestrial biological surveys for Environmental Impact Assessment (EIA) in Western Australia. All the reports assessed (Appendix 1) referred to this Position Statement as part of the legislative framework guiding the survey, including a discussion of the precautionary principle.

However, as none of these reports contain an EIA, the various principles listed in the Position Statement have not been further applied to the fauna species, faunal assemblages and ecosystem functions as part of an impact assessment, except where the precautionary principle has been used in the identification of potential SRE invertebrate taxa (Ecologia 2014a, 2014b).

Table 1. List of report reviewed against relevant guidance statements.

Guidance document	Report						
	Thunderbird Dampier Peninsula Project: Level 1 Flora and Fauna Assessment (Ecologia 2012a)	Environmental Heritage and Social Impact Services Thunderbird Dampier Peninsula Project: Cultural Heritage Flora and Fauna Assessment (Ecologia 2012b)	Thunderbird Mineral Sands Project: *Flora and Fauna Survey Scoping Study Report* (Ecologia 2013)	Thunderbird Project: Short-range Endemic Invertebrate Targeted Survey (Ecologia 2014a)	Thunderbird Project: *Terrestrial and Subterranean Fauna Assessment* (Ecologia 2014b)	Thunderbird Haul Road and Accommodation Camp: Fauna and Flora Assessment (Ecologia 2015)	Thunderbird Project: *Targeted Greater Bilby Assessment* (Ecologia 2016)
EPA Position Statement No.3 - *Terrestrial Biological Surveys as an element of biodiversity protection*. (EPA 2002)	✓			✓	✓	✓	✓
Guidance for the Assessment of Environmental Factors, Statement No. 56: *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004)	✓			✓	✓	✓	✓
Technical Guide – *Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA & DEC 2010)	✓				✓	✓	
Survey Guidelines for Australia's Threatened Mammals (DSEWPaC 2011)						✓	✓
Survey Guidelines for Australia's Threatened Birds (DSEWPaC 2010)						✓	
Guidance for the Assessment of Environmental Factors, Statement No. 20: *Sampling of Short range endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia* (EPA 2009)				✓	✓		
Environmental Assessment Guideline No.12: *Consideration of Subterranean Fauna in Environmental Impact Assessment in Western Australia* (EPA 2013)				✓	✓		

2.1.2 EPA Guidance Statement 56

EPA Guidance Statement 56 provides guidance on the level of survey required to assist in the collecting of data for decision-making in relation to protecting Western Australia's terrestrial fauna (EPA 2004). The five reports pertaining to the terrestrial faunal assemblages of the Project Area were reviewed against this Guidance Statement (Appendix 2). Overall, the reports were completed to a high standard, with appropriately detailed literature reviews, survey methodology and reporting of results. Some of the guidance presented in Guidance Statement 56 is difficult to assess from the report, as it pertains to considerations in survey intensity and design that are usually undertaken prior to the fauna survey and not typically reported on. Variances noted include:

- No impact assessment undertaken (Ecologia 2012a, 2014a, 2014b, 2015, 2016).
- No assessment of survey limitations on one survey (Ecologia 2015).
- Results not always provided in a quantitative form (Ecologia 2014a, 2014b).
- Field staff not involved with report preparation (Ecologia 2014a).

The main variance from the Guidance Statement is the lack of any assessment of the potential impacts the Project may have on fauna, faunal assemblages and ecosystem function. The remaining variances are unlikely to have a major impact on the quality of the work undertaken, but have resulted in a lack of clarity in some cases. For example, where results are not separated by habitat or sampling method, it is difficult to ascertain the relative success of various sampling methods.

2.1.3 Technical Guide – Terrestrial Vertebrate Fauna Surveys for EIA

Three reports pertaining to vertebrate fauna were reviewed against the Technical Guide - Terrestrial Vertebrate Fauna Surveys for EIA (EPA and DEC 2010) (Appendix 3). Overall, the reports adhered to a high standard, covering appropriate survey design and reporting for the level of survey conducted. Some variances from the Technical Guide were noted (Appendix 3), including:

- No justification for timing of Level 2 dry season survey in October instead of the April - August recommended (Ecologia 2014b).
- No description of prevailing weather conditions for Level 1 surveys (Ecologia 2012a, 2015).
- No assessment of survey limitations on one survey (Ecologia 2015).
- No list of fauna records by site on Level 1 surveys (Ecologia 2012a, 2015).
- Faunal assemblage lists contain many species unlikely to occur in the Project Area.

Of these, most variances are minor. However, the Level 2 dry season survey was conducted 14 - 23 October 2013. This is much later than the suggested 'early dry season April - August' timing given in the Technical Guide (EPA & DEC 2010). It is noted that the overall mammal abundance was low (Ecologia 2014b, p56), and this may in part be due to dry conditions. Although justification for this variance should have been given in the report, the timing of the survey may not have been limiting, as evidenced by the capture/records from that phase of the survey (Ecologia 2014b, Appendix F).

2.1.4 Survey Guidelines for Australia's Threatened Mammals

It should be noted that these Survey Guidelines are not mandatory, and it is recognised in the Survey Guidelines that desktop studies and other survey techniques may be used (DSEWPaC 2011). The Survey Guidelines are to help determine the presence (or probability of presence) of a species, rather than abundance (DSEWPaC 2011). In this respect, the Targeted Greater Bilby Survey (Ecologia 2016) exceeds the guidelines, as a detailed effort to determine the number of individuals in the study area was made using DNA analysis of scats.

The three surveys in which effort was made to target the Greater Bilby (Ecologia 2014b, 2015 and 2016) are generally compliant with the Survey Guidelines, though the methods and exact locations of transects are unclear in some surveys (Appendix 4). The fact that the Greater Bilby was recorded on all surveys demonstrates that the surveys conducted were sufficient to detect the presence of this species.

2.1.5 Survey Guidelines for Australia's Threatened Birds

It should be noted that these Survey Guidelines are not mandatory, and it is recognised in the Survey Guidelines that desktop studies and other survey techniques may be used (DSEWPaC 2010). The Survey Guidelines are to help determine the presence (or probability of presence) of a species, rather than abundance (DSEWPaC 2010).

The Level 2 fauna survey of the main Project Area did not specifically refer to this guideline, and although the methods state that conservation significant fauna were targeted, no specific methods were given for any bird species (Ecologia 2014b, p26). The Level 1 survey of the Haul Road refers specifically to surveying for Gouldian Finch using this guideline (Ecologia 2015, p18). The Gouldian Finch was not identified in this (or any other) survey for the Thunderbird Project. Although this species may not occur, it is unclear whether the methods used to detect this species were sufficient, as the methods were not clearly detailed (Appendix 5).

2.1.6 EPA Guidance Statement 20

Two reports (Ecologia 2014a, 2014b) were reviewed against Guidance Statement 20: *Sampling of Short range endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia* (EPA 2009). Overall, the surveys were mostly consistent with the Guidance Statement, the main inconsistencies related to:

- Survey timing.
- Lack of clear description of methods in regards to effort and habitats sampled.
- The presentation of quantitative results.

The three sampling periods were in April (Ecologia 2014b), May (Ecologia 2014a) and October (Ecologia 2014b). The Guidance Statement suggests November - March as an appropriate time to sample in the Kimberly, but recognizes that sampling can occur at other times as long as suitable methods are employed and this is discussed as a potential limitation (EPA 2009). The reports did not discuss timing as a potential limitation or detail the specific survey methods used to potentially address this (Appendix 6).

The description of methods given in Ecologia (2014a) were adequate, but those in Ecologia (2014b) were vague in terms of survey effort in each phase of survey, the habitats targeted by opportunistic sampling and the reason for concentrating all systematic trapping and leaf litter collection in a single habitat.

Similarly, the results were difficult to interpret with regards to the number of records of each potential SRE invertebrate taxa in each habitat. These were presented graphically in maps, but micro-habitat and habitat data were not presented in tables for easy comparison. Opportunistic search results were not attributed to a habitat type and were combined for all search sites, and it is not clear which records were from leaf litter sampling and which were from systematic trap sites.

2.1.7 Environmental Assessment Guideline No. 12

One report (Ecologia 2014b) was reviewed against Environmental Assessment Guideline No.12: *Consideration of Subterranean Fauna in Environmental Impact Assessment in Western Australia* (EPA 2013). This was the only survey undertaken for subterranean fauna (i.e. stygofauna and troglofauna), covering the main Project Area. The survey undertaken was Level 1, a combination of a desktop review and a reconnaissance survey.

Overall, the survey undertaken was consistent with Environmental Assessment Guideline No.12 (Appendix 7). The main variance was the lack of description about the potential impacts of the development on subterranean fauna, used to determine the level of survey and discussed with reference to the subterranean assemblage recorded. However, this did not impact the quality of the results produced, as the level of survey was sufficient for the Project Area.

2.2 Adequate coverage of survey areas

To adequately cover the survey areas, the fauna surveys must show:

- That the geographical extent of the survey area has been covered (within the constraints of access into rugged areas).
- That all the main habitats have been covered.
- That the survey has covered areas both within and outside the potential impact area.

2.2.1 Vertebrate fauna sampling

Sampling of vertebrate fauna was undertaken on a Level 1 and a two-phase Level 2 survey covering the main project area (Ecologia 2012a, 2014b) and a Level 1 survey covering the haul road route (Ecologia 2015). Overall, a good proportion of the expected vertebrate fauna assemblage was recorded, an indicator that the survey coverage was sufficient. Trapping occurred in each of the three broad fauna habitats identified, and areas unable to be trapped (e.g. very rocky areas) were targeted with other techniques such as camera traps and spot-lighting (Ecologia 2014b). Trapping sites were located both inside (four sites) and outside (three sites) the proposed impact area, as were the opportunistic searching sites.

The ephemeral spring identified in the Level 1 survey (Ecologia 2012a) was not referred to specifically in the Level 2 survey report (Ecologia 2014b), but the maps provided indicate that opportunistic searching was undertaken in this area.

Except for a dam, the haul road route habitats were the same as those in the main Project Area (Ecologia 2015). The opportunistic searching carried out covered all the habitats present on the haul road route, with sites evenly dispersed along the route. The dam, which contained water at the time of survey, was targeted for bird point count, camera trap and bat surveys. As the habitats were very similar to those in the main Project Area, it is reasonable to extend the findings of the Level 2 survey (Ecologia 2014b) to the haul road route.

Targeted surveys were undertaken for the Bilby (Ecologia 2014b, 2015, 2016). The targeted Bilby survey had good coverage of the Pindan Shrubland habitat in the main Project Area. It is unclear what proportion of the haul road route was targeted as the transects were not shown in maps, or any length of transect given. It is also uncertain why the Savannah Woodland habitat was excluded, as the literature review notes that Bilbies occur in open woodlands and Spinifex grasslands (Ecologia 2016, p2).

Targeted surveys were also undertaken for the Gouldian Finch (Ecologia 2015), but as the methodology was vague and the specific areas targeted not reported, it is not possible to determine whether adequate effort was made to detect this species.

2.2.2 SRE invertebrate sampling

Sampling of SRE invertebrate taxa was carried out on two surveys covering the main project area (Ecologia 2014a, 2014b). The haul road alignment was not sampled and SRE invertebrate taxa are not referred to in the fauna survey of this area (Ecologia 2015).

The sampling undertaken was heavily weighted toward the Pindan Shrubland habitat, though it's uncertain how much opportunistic foraging was undertaken in each habitat during the first survey, as this was not stated in the report (Table 2, Ecologia 2014b). It is stated that most of the records of SRE taxa were in the Pindan Shrubland habitat (Ecologia 2014b, p86), but this may be due to the unequal sampling effort. Pindan Shrubland is the dominant habitat type in the study area (>78% of the proposal area, or 3,125ha), the remaining habitats forming <10% or 395ha of the proposal area (Sandstone Range) and >11%, or 455ha of the proposal area (Savannah Woodland). The proportions vary when the whole study area is considered.

It is unclear as to why no further sampling in the savannah woodland habitat in the targeted SRE survey (Ecologia 2014a), as this habitat was suggested to provide good cover for SRE taxa (Ecologia 2014b, p87). An isopod (Buddelundinae 'NE Broome') was found only in this habitat in the impact area only during the first survey (Ecologia 2014b), and though it was found in other habitats in the targeted survey (Ecologia 2014a), this may not have occurred if this species only occurred in Savannah Woodland.

Species accumulation curves were prepared and used to suggest that the SRE invertebrate sampling was adequate in both surveys (Ecologia 2014a, 2014b). However, these curves apply only to the 'trappable' component of the fauna, and do not take into consideration factors such as the weather (i.e. in dry conditions less SRE invertebrates are trappable as they do not move around) or any bias in the habitats sampled (i.e. most systematic sampling was in one habitat).

2.2.3 Subterranean fauna sampling

Sampling of subterranean fauna is somewhat dependent on the presence of suitable boreholes. The survey undertaken took into consideration the geological and hydrological features of the boreholes in terms of their likelihood of intercepting likely habitat for subterranean fauna, and boreholes both inside and outside the proposed impact area were selected. Overall, the sampling for these taxa adequately covered the survey area within the constraints common to all surveys of this nature. The conclusions of this survey, (that conservation significant populations of subterranean fauna were unlikely to occur, Ecologia 2014b, p102), indicate that no further surveys were required for the haul road route, as the geology and hydrology is similar and also unlikely to support these taxa.

Table 2. SRE Invertebrate sampling effort undertaken (as per Ecologia 2014a, 201b).

Survey	Sampling strategy	Trap-nights/minutes foraging					
		Inside proposal area			Outside proposal area		
		Pindan Shrubland	Sandstone Range	Savannah Woodland	Pindan Shrubland	Sandstone Range	Savannah Woodland
Ecologia 2014b (Level 2 survey)	Dedicated SRE pit trap sites	360	0	0	0	0	0
	Vertebrate pit trap sites	420	0	140	280	140	0
Ecologia 2014a (targeted SRE survey)	Dedicated SRE pit trap sites	0	0	0	630	75	0
Total trap-nights per habitat:		**780**	**0**	**140**	**910**	**215**	**0**
Total trap-nights:		**920**			**1,125**		
Ecologia 2014b (Level 2 survey)	Leaf litter samples	6	0	0	0	0	0
Ecologia 2014a (targeted SRE survey)	Leaf litter samples	0	0	0	18	2	0
Total samples per habitat:		**6**	**0**	**0**	**18**	**2**	**0**
Total samples:		**6**			**18**		
Ecologia 2014b (Level 2 survey)	Systematic foraging	360	0	0	0	0	0
	Opportunistic foraging*	?	?	?	?	?	?
Ecologia 2014a (targeted SRE survey)	Opportunistic foraging	0	0	0	480	120	0
Total minutes foraging per habitat:		**360 + ?**	**0 + ?**	**0 + ?**	**480+ ?**	**120 + ?**	**0 + ?**
Total minutes foraging:		**360 + ?**			**500 + ?**		

*unable to determine proportion of 3,162 minutes for each category, as the number of minutes foraging at each site and the habitat for each site not given. However, from examining maps of SRE taxa records, it appears some foraging was completed in each habitat in both the proposal area and outside the proposal area.

2.3 Adequate survey effort

Survey effort refers to (but is not limited to):

- The number traps, days that traps are open and the total number of trap-nights.
- The number of minutes spent on opportunistic searches, bird surveys or similar activities.
- The number of bat detectors deployed and minutes of recording obtained.
- The total length of transects undertaken for conservation significant fauna searches.
- The number of boreholes sampled and total number of samples.

To a certain extent, survey effort and survey coverage (see section 2.2) are related.

2.3.1 Vertebrate fauna survey effort

Overall, sufficient effort was expended for the vertebrate fauna surveys reported on (Ecologia 2012a, 2014b, 2015 and 2016). The surveys included an array of standard sampling techniques appropriate for the level of survey, including:

- Trapping at seven sites using pitfalls, funnels, cages and Elliott traps.
- Bird surveys
- Opportunistic searching
- Camera trapping
- Bat recording
- Targeted searches for Greater Bilby

During the Level 2 survey, the number of sites and number of traps used per site were adequate to sample the vertebrate fauna present, and this is evidenced by a relatively high number of species recorded (Ecologia 2014b, Appendix F). It should be noted that when comparing the fauna recorded against the 'potential assemblage', that the potential assemblage contains many species that are unlikely to occur on the basis of habitat and/or distribution.

The Gouldian Finch is described as having a 'medium' likelihood of occurring, with both breeding and foraging habitat present, though degraded (Ecologia 2012a, 2014b). In the *Flora and Fauna Survey Scoping Study Report* (Ecologia 2013) it is stated that "further assessment of this species is currently in progress" as part of the Level 2 fauna survey. However, no specific methodology was described in Ecologia (2014b) and the methods given for this species in Ecologia (2015) were vague. Therefore it is unclear whether sufficient effort has been undertaken to detect this species.

The Bilby has been very well surveyed in the main Project Area (Ecologia 2016), but the survey effort on the haul road route is unclear as the transects undertaken are not provided.

2.3.2 SRE invertebrate fauna survey effort

The survey effort for SRE invertebrate fauna has been summarised in Table 2. While the overall survey effort is sufficient for the level of survey, the effort in each habitat is biased, with most systematic sampling in the Pindan Shrubland habitat.

2.3.3 Subterranean fauna survey effort

Subterranean fauna were sampled on a single survey, with 90 net hauls from 15 drill holes sampled for stygofauna and 12 traps and 12 scraping hauls at 6 drill holes samples for troglofauna (Ecologia 2014b, p39). The survey effort is sufficient for the level of survey.

2.4 Survey follows industry best practice

Industry best practice in fauna surveys is achieved when surveys are undertaken to a high standard. The EPA provides Guidance Statements and Technical Guides to encourage best practice in fauna and faunal assemblage surveys and reporting (EPA 2004, EPA and DEC 2010). Surveys should be compliant with Position Statements, Guidance Statements and Survey Guidelines, and be carried out at an appropriate level. Reports should provide detailed methods, a review of relevant literature, clear results and a discussion of the potential impacts.

Taken together, the fauna reports prepared for the Thunderbird Project generally follow industry best practice. The level of survey undertaken was appropriate for the Bioregion and habitats present. The survey design and intensity was appropriate for the site, though there is some lack of clarity in reporting in some areas as described previously. No impact assessment was undertaken as part of these surveys, but the data collected are generally sufficient for an assessment to be undertaken.

2.5 Data that are correct and accurate

The accuracy of some data, such as identification of specimens in the field or GPS locations, cannot be assessed directly, though there are no suggestions that these data are inaccurate.

2.5.1 Identification of fauna habitats

From the vegetation descriptions and representative photographs given in the fauna reports (Ecologia 201a2, 2014b, 2015), the fauna habitats identified appear reasonable. However, it is unclear why the boundaries of these habitats change between the Level 1 survey (Ecologia 2012a, 2012b) and the remaining surveys (Ecologia 2014b, 2015), despite the descriptions of the habitats themselves remaining similar. No explanation (e.g. changes due to updated vegetation data collected) is given in the text.

An ephemeral spring is identified in the Level 1 survey (Ecologia 2012a) and this is not discussed in terms of its significance (if any) to fauna, though the potential impact area outline appears to have been modified to exclude this in Ecologia (2014b). In the Level 2 fauna survey this feature appears to have been searched opportunistically for both vertebrate and SRE invertebrate taxa, judging from the position of these search areas on the maps provided, though the feature itself is not indicated (Ecologia 2014b, p36-37). Data collected at this site are not referred to specifically and the opportunistic fauna records are not separated by habitat, so it is uncertain if any species occur only in this habitat.

2.5.2 Identification of potential vertebrate faunal assemblage

In reports concerned with vertebrate fauna assemblages (Ecologia 2012a, 2014b and 2015), the potential vertebrate faunal assemblage was produced using databases and the results of other surveys in the region. The buffer area was large (as is appropriate in areas that are poorly known or under-surveyed), but no effort was undertaken to exclude species that are unlikely to occur on the basis of habitat or known range. This includes species known to only occur in coastal environments, mangroves or significant wetland habitats. The result is a potential fauna assemblage that contains many species that have no chance of occurring in the study area ('false positives'), though the likelihood of 'false absences' is low.

Reliance on database extracts and other fauna survey results without reference to published sources (such as field guides and reference books) when creating species lists may result in some species being omitted. This is ameliorated in this case as the buffer used for searches was very large, but did result in some species (e.g. *Ctenotus robustus*, *Menetia maini*, *Notoscincus ornatus* and *Anilios (Ramphotyphlops) grypus*) being omitted from Ecologia (2012a) lists, despite all potentially occur in the area according to published sources (e.g. Wilson and Swan 2008). The majority of these were added to the list in subsequent reports, as they were recorded during the Level 2 fauna survey (Ecologia 2014b).

2.5.3 Identification of invertebrate faunal assemblage

The SRE invertebrate, stygofauna and troglofauna assemblages of the study area were identified through a combination of a literature review and sampling in the field. All specimens collected were identified by experts in the field, and presumed to be correct. All appropriate invertebrate groups were searched for during field surveys. Within the constraints invertebrates being generally poorly known compared to vertebrates, the invertebrate faunal assemblage appears to be correctly identified and no significant groups overlooked.

2.5.4 Identification of conservation significant species

The large buffer area used when compiling the fauna assemblage lists has resulted in all likely conservation significant fauna being identified, plus a suite of conservation significant species that are not likely to occur (e.g. migratory shorebirds that favour coasts). All appropriate databases have been consulted. There are some errata in the identification of conservation status in the Level 1 survey (Ecologia 2012a, Appendix F), as follows:

- Yellow Wagtail - should be listed as Migratory under EPBC Act, JAMBA, CAMBA, ROKAMBA.
- Eastern Osprey - should be listed as Migratory under EPBC Act, Bonn Convention.
- Gull-billed Tern - should be listed as Migratory under EPBC Act, CAMBA.
- Masked Owl - in this region it is the Kimberly subspecies *Tyto novaehollandiae kimberli*. It is identified as Priority 4, but this species should also be listed as Vulnerable under the EPBC Act.
- Crest-tailed Mulgara (*Dasycercus cristicauda*) - members attributed to this species in WA are generally Brush-tailed Mulgara (*D. blythii*), Priority 4. There are no recent records of *D. cristicauda* in Western Australia.

Of the above, Eastern Osprey and Gull-billed Tern are (correctly) omitted from Ecologia (2014b) and (2015), and the Crest-tailed Mulgara omitted in Ecologia (2015). Correct conservation status is attributed to all listed species in Ecologia (2015). The incorrect conservation status attributed to some species is likely to have a minimal impact on the outcomes of the fauna survey, as these were species that were unlikely to occur.

Conservation significant SRE species were identified according to the precautionary principle, with all potential SRE taxa being treated as confirmed SRE taxa in the absence of sufficient data (Ecologia 2014a, 2014b). This conservative approach is appropriate when considering these taxa as there is little regional data available to place site records into context.

The likelihood of occurrence for all conservation significant species appears to have been correctly identified within the constraints of the limited data available for literature review.

2.6. Correct identification of the sensitivity of the receiving environment

The sensitivity of the receiving environment is discussed in Guidance Statement 56 as a factor to be considered in determining the level of survey required for a proposal (EPA 2004). All the reports assessed referred to Guidance Statement 56 as providing part of the legislative framework under which the fauna surveys were carried out (Appendix 2). The sensitivity of the receiving environment is determined in part by the Bioregion, and the Bioregion is correctly identified overall, although not discussed in all reports (Appendix 2). No areas of greater sensitivity were noted (e.g. wetlands, restricted soil types), and this appears to be a reasonable assessment given the vegetation and soils data provided in the reports.

The sensitivity of the receiving environment in part determines the level of survey expected, with more comprehensive effort in more sensitive environments. An appropriately high level of fauna survey was undertaken overall, given the sensitivity of the receiving environment and assuming the potential of a moderate or high scale of impact.

2.7 Correct identification of the requirement for post-impact studies

The only report that refers to post-impact studies is the Flora and Fauna Survey Scoping Study Report (Ecologia 2013). The montoring studies suggested are in the context of predicted conditons of the Project as set by the EPA. The statements are general in nature, for example "monitoring of the Bilby and/or Gouldian Finch for the duration of time impacting the species" (Ecologia 2013, p34).

As there the need (or not) for post-monitoring studies has not been addressed in the remaining reports, they are unable to be assessed against this criteria.

3. Conclusions

- Surveys are generally consistent with relevant State and Commonwealth Guidelines, with some variances generally concerning survey timing and clarity of reporting.
- Surveys for vertebrate fauna have been completed at an appropriate level and to a generally high standard.
- Surveys for Bilby sufficient to confirm presence of this species, but it is unclear how many (if any) transects were completed on the haul road route outside the main Project Area.
- From the method described it is unclear whether sufficient surveys have been undertaken to detect the Gouldian Finch in the Project Area, though literature review results suggest it is uncommon in the region.
- Surveys for SRE invertebrate taxa require clarification with regards to survey timing and focus of systematic trapping on a single habitat. However, the level of survey is appropriate.
- Surveys for subterranean fauna (stygofauna and troglofauna) appear to be of an appropriate level and provide adequate coverage of the Project Area.
- Post-impact studies are not detailed beyond the potential need for Bilby and Gouldian Finch Monitoring.
- Overall, sufficient data are provided to inform an impact assessment.

4. References

DSEWPaC (2010). *Survey guidelines for Australia's threatened birds*. EPBC Act policy statement: Canberra, ACT.

DSEWPaC (2011). *Survey guidelines for Australia's threatened mammals.* EPBC Act policy statement: Canberra, ACT.

Ecologia (2012a) *Thunderbird Dampier Penninsular Project: Level 1 Flora and Fauna Assessment*. Unpublished report prepared for Sheffield Resources Ltd, November 2012.

Ecologia (2013) *Thunderbird Mineral Sands Project: Flora and Fauna Survey Scoping Study Report.* Unpublished report prepared for Sheffield Resources Pty Ltd, August 2013.

Ecologia (2014a) *Thunderbird Project: Short Range Endemic Invertebrate Survey*. Unpublished report prepared for Sheffield Resources Pty Ltd, December 2014.

Ecologia (2014b) *Thunderbird Project: Terrestrial and Subteranean Fauna Assessment*. Unpublished report prepared for Sheffield Resources Pty Ltd, March 2014.

Ecologia (2015) *Thunderbird Haul Road and Accommodation Camp: Fauna and Flora Assessment*. Unpublished report prepared for Sheffield Resources Pty Ltd, July 2015.

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Appendix 1. Assessment against EPA Position Statement 3.

✓ = consistent with guideline, × = not consistent with guideline, ? = partially consistent or insufficient detail in report to determine consistency.

Criterion/Principle	Ecologia 2012a		Ecologia 2014a		Ecologia 2014b		Ecologia 2015		Ecologia 2016	
The EPA adopts the definition of Biological Diversity and the Principles as defined in the *National Strategy for the Conservation of Australia's Biological Diversity* (Commonwealth of Australia, 1996) and will have regard for these in undertaking its role.	?	Biodiversity considered in terms of faunal assemblages present. Biodiversity protection discussed as part of legislative framework for survey.	?	Biodiversity considered in terms of faunal assemblages present. Biodiversity protection discussed as part of legislative framework for survey.	?	Biodiversity considered in terms of faunal assemblages present. Biodiversity protection discussed as part of legislative framework for survey.	?	Biodiversity considered in terms of faunal assemblages present. Biodiversity protection discussed as part of legislative framework for survey.	✓	Biodiversity considered in terms of importance of local population of Bilbies. Biodiversity protection discussed as part of legislative framework for survey.
The EPA expects proponents to demonstrate in their proposals that all reasonable measures have been undertaken to avoid impacts on biodiversity. Where some impact on biodiversity cannot be avoided, it is for the proponent to demonstrate that the impact will not result in unacceptable loss.	×	No impact assessment undertaken.	×	No impact assessment undertaken.	×	No impact assessment undertaken.	×	No impact assessment undertaken.	×	No impact assessment undertaken.
The EPA aims to ensure that the information gathered for environmental impact assessment in Western Australia meets State, National, and International Agreements, Legislation and Policy in regard to biodiversity conservation.	✓	Legislative framework and EPA policy and guidance statement documents referred to.	✓	Legislative framework and EPA policy and guidance statement documents referred to.	✓	Legislative framework and EPA policy and guidance statement documents referred to.	✓	Legislative framework and EPA policy and guidance statement documents referred to.	✓	Legislative framework and EPA policy and guidance statement documents referred to.

Appendix 1 (cont).

Criterion/Principle	Ecologia 2012a		Ecologia 2014a		Ecologia 2014b		Ecologia 2015		Ecologia 2016	
The EPA requires that the quality of information and scope of field surveys meets the standards, requirements and protocols as determined and published by the EPA.	✓	Use of Guidance Statement 56 when scoping survey. Bioregion identified (Group 3). Scale and nature of impact not specified, but treated as 'moderate/high', with a Level 2 survey recommended.	✓	Use of Guidance Statement 56 when scoping survey. Bioregion identified (Group 3). Scale and nature of impact not specified, but treated as 'moderate/high', with a Level 1 survey to characterise the SRE invertebrate fauna of the study area.	✓	Use of Guidance Statement 56 when scoping survey. Bioregion identified (Group 3). Scale and nature of impact not specified, but treated as 'moderate/high', with a Level 2 survey undertaken.	✓	Use of Guidance Statement 56 when scoping survey. Bioregion identified (Group 3). Scale and nature of impact not specified, but treated as 'moderate' (haul road impact area low as it follows existing road), with a Level 1 survey undertaken.	✓	Use of Guidance Statement 56 when scoping survey. Bioregion identified (Group 3). Scale and nature of impact not specified, but treated as 'moderate/high', with this survey an additional targeted survey of a conservation significant species.
The EPA will use the Interim Biogeographic Regionalisation of Australia (IBRA) as the largest unit for EIA decision-making in relation to the conservation of biodiversity. The IBRA has identified 26 bioregions in the State (Figure 1) which are affected by a range of different threatening processes and have varying levels of sensitivity to impact.	?	Bioregion identified (Dampierland). No discussion of particular threatening processes in this bioregion.	×	Bioregion not indicated.	?	Bioregion identified (Dampierland). No discussion of particular threatening processes in this bioregion.	?	Bioregion identified (Dampierland). No discussion of particular threatening processes in this bioregion.	×	Bioregion not indicated.
The EPA expects proponents to ensure that terrestrial biological surveys provide sufficient information to address both biodiversity conservation and ecological function values within the context of the type of proposal being considered and the relevant EPA objectives for protection of the environment.	?	Biodiversity considered at the species level with a focus on conservation significant species. No consideration of ecosystem function values.	?	Biodiversity considered at the species level with a focus on conservation significant species. No consideration of ecosystem function values.	?	Biodiversity considered at the species level with a focus on conservation significant species. No consideration of ecosystem function values.	?	Biodiversity considered at the species level with a focus on conservation significant species. No consideration of ecosystem function values.	?	Biodiversity considered at the species level with a focus on conservation significant species (bilby only). No consideration of ecosystem function values.

Appendix 1 (cont).

Criterion/Principle	Ecologia 2012a		Ecologia 2014a		Ecologia 2014b		Ecologia 2015		Ecologia 2016	
The EPA expects that terrestrial biological surveys will be made publicly available and will contribute to the bank of data available for the particular region, to aid the overall biodiversity understanding and assessment by facilitating transfer into State biological databases.	✓	Presumably these reports will be publically available as part of the PER process. All fauna data was collected under Reg 17 licence and submitted to DPAW fauna database.	✓	Presumably these reports will be publically available as part of the PER process. All fauna data was collected under Reg 17 licence and submitted to DPAW fauna database. SRE invertebrate specimens were submitted to the WA Museum.	✓	Presumably these reports will be publically available as part of the PER process. All fauna data was collected under Reg 17 licence and submitted to DPAW fauna database. Vertebrate species representing range extensions were vouchered for the WA Museum. SRE invertebrate specimens, stygofauna and troglofauna were submitted to the WA Museum.	✓	Presumably these reports will be publically available as part of the PER process. All fauna data was collected under Reg 17 licence and submitted to DPAW fauna database.	✓	Presumably these reports will be publically available as part of the PER process. All fauna data was collected under Reg 17 licence and submitted to DPAW fauna database.
In the absence of information that could provide the EPA with assurance that biodiversity will be protected, the EPA will adopt the precautionary principle.	✓	Precautionary principle discussed as part of legislative framework of survey. However, no application of principle as no assessment of impacts.	✓	Precautionary principle discussed as part of legislative framework of survey. No application of principle on assessment of impacts, but used when identifying SRE taxa.	✓	Precautionary principle discussed as part of legislative framework of survey. No application of principle on assessment of impacts, but used when identifying SRE taxa.	✓	Precautionary principle discussed as part of legislative framework of survey. However, no application of principle as no assessment of impacts.	✓	Precautionary principle discussed as part of legislative framework of survey. However, no application of principle as no assessment of impacts.

Appendix 2. Assessment against EPA Guidance Statement 56.

✓ = consistent with guideline, × = not consistent with guideline, ? = partially consistent or insufficient detail in report to determine consistency.

Criterion		Ecologia 2012a		Ecologia 2014a		Ecologia 2014b		Ecologia 2015		Ecologia 2016	
Application of guidance											
Use of Guidance Statement 56		✓	Referred to.	✓	Referred to.	✓	Referred to.	✓	Referred to.	✓	Referred to.
Planning and design of fauna surveys											
Fully document the natural values, potential impacts, cumulative impacts and options to minimise impacts		×	No impact assessment undertaken. Fauna/habitat values presented.	×	No impact assessment undertaken. Fauna/habitat values presented.	×	No impact assessment undertaken. Fauna/habitat values presented.	×	No impact assessment undertaken. Fauna/habitat values presented.	×	No impact assessment undertaken.
Approaches, resources, standards.	Intensity of sampling to reflect the likely faunal diversity due to complexity of habitats.	✓	Allowance made to sample all habitats.	?	Not all habitats present sampled to the same intensity.	✓	Allowance made to sample all habitats. Range of techniques used.	✓	Allowance made to sample all habitats.	N/A	Single species survey.
	Adequate resources directed to fauna sampling and identification.	✓	Adequate resources for level of survey.	✓	Adequate resources for level of survey.	✓	Adequate resources for level of survey.	✓	Adequate resources for level of survey.	✓	High level of resources for level of survey.
	Adequate resources directed to data analysis and presentation.	✓	Adequate resources for level of survey.	✓	Adequate resources for level of survey.	✓	Adequate resources for level of survey.	✓	Adequate resources for level of survey.	✓	High level of resources for level of survey.
	High degree of rigour in reporting	✓	Overall, report is detailed, reports on fauna habitats, vertebrate fauna assemblages and conservation significant species.	✓	Overall, report is detailed, reports on SRE fauna habitats, SRE invertebrate assemblages and conservation significant species.	✓	Overall, report is detailed, reports on fauna habitats, vertebrate, SRE invertebrates and subterranean fauna assemblages and conservation significant species.	✓	Overall, report is detailed, reports on fauna habitats, vertebrate fauna assemblages and conservation significant species.	✓	Overall, report is detailed, reports bilby habitats in the study area, reports on findings of bilby survey.
	Standardisation of fauna sampling techniques and terminology.	✓	Standard techniques and terminology used.	✓	Standard techniques and terminology used.	✓	Standard techniques and terminology used.	✓	Standard techniques and terminology used.	✓	Standard techniques and terminology used, and specialised (DNA) techniques.

Appendix 2 (cont.)

Criterion		Ecologia 2012a		Ecologia 2014a		Ecologia 2014b		Ecologia 2015		Ecologia 2016	
Early consideration of fauna surveys in project planning		✓	Sufficient time to undertake a range of surveys.	✓	Sufficient time to undertake a range of surveys.	✓	Sufficient time to undertake a range of surveys.	✓	Sufficient time to undertake a range of surveys.	✓	Sufficient time to undertake a range of surveys.
Who should undertake fauna surveys	Co-ordinated and led by trained, experienced personnel, familiar with WA fauna.	✓	Field team with 7 and 11 yrs experience.	✓	Field team with 6 - 12 yrs experience.	✓	Field team with 3 - 9 yrs experience.	?	Experience not specified, at least one of the team present on previous survey, so 6 yrs experience inferred.	?	Experience not specified, team present on previous survey, so 7 - 12 yrs experience inferred.
	Less experienced team members supervised by more experienced personnel	?	Unable to assess.	?	Unable to assess.	?	Unable to assess.	?	Unable to assess.	?	Unable to assess.
	Fauna report to acknowledge all contributors.	✓	Table showing all field and reporting personnel.	✓	Table showing all field and reporting personnel.	✓	Table showing all field and reporting personnel.	✓	Table showing all field and reporting personnel.	✓	Table showing all field and reporting personnel.
When should surveys be conducted	Timing appropriate to faunal group being sampled	✓	Survey conducted in June. Timing not critical for level 1 survey.	?	Survey conducted in May, other Guidance Statement 20 suggests Nov - Apr in Kimberley, though other times permissible with explanation and discussion of limitations.	?	Survey conducted in April and October. April is appropriate (after the wet season) but the October survey corresponds to the late dry season and the Technical Guide recommends this is undertaken in Apr - Aug.	✓	Survey conducted in May. Timing not critical for level 1 survey.	✓	Bilby targeted.
	A survey in the season following maximum rainfall	N/A		?	As above.	✓	One of the two phase level 2 survey undertaken in this season.	N/A		N/A	
	A survey timed to target a species of particular importance	N/A		N/A		N/A		N/A		✓	Bilby targeted, but timing not critical for this species except in terms of their sometimes sporadic occurrence.

Appendix 2 (cont.)

Criterion		Ecologia 2012a		Ecologia 2014a		Ecologia 2014b		Ecologia 2015		Ecologia 2016	
Determining level and extent of survey required											
Determine sensitivity of the environment (Bioregion Groups)		✓	Bioregion identified (Group 3). Level 1 survey as reconnaissance, recommending level 2 survey.	✓	Bioregion identified (Group 3). Level 1 survey carried out for SRE invertebrate taxa, as appropriate given geological/hydrological conditions present.	✓	Bioregion identified (Group 3). Level 2 survey carried out.	✓	Bioregion identified (Group 3). Level 1 survey carried out as Level 2 survey already undertaken for adjacent Project Area in the same habitats. Targeted surveying for Bilby/Gouldian Finch.	✓	Bioregion identified (Group 3). Targeted Level 2 survey carried out as further investigation after identification of Bilby on previous surveys.
Determine scale and nature of impact (as per Appendix 2 of Guidance)		✓	Not specified, but proceeding as if scale and nature of impact 'high' (i.e. recommendation of Level 2 survey)	✓	Not specified, but proceeding as if scale and nature of impact 'high' (i.e. targeted survey to ascertain presence of these species in the study area)	✓	Not specified, but proceeding as if scale and nature of impact 'high' (i.e. 2 phase Level 2 survey carried out)	✓	List of factors considered and Level 1 survey deemed appropriate.	✓	Not specified, but proceeding as if scale and nature of impact 'high' (i.e. this is an additional targeted survey for a conservation significant species)
Determining survey sampling design and intensity											
Factors to consider	Bioregion (amount of existing knowledge)	✓	Bioregion described. Review of other fauna reports for region.	×	Bioregion not described.	✓	Bioregion described. Review of other fauna reports for region.	✓	Bioregion described. Review of other fauna reports for region.	×	Bioregion not described.
	Rare landforms, landform-specific taxa, context of landforms	✓	None noted.	✓	None noted.	✓	None noted.	✓	None noted.	✓	None noted.
	Species present (life forms, life cycles, seasonality)	✓	Considered. Not usually critical with a Level 1 survey.	?	Unclear if this was considered. Survey conducted outside recommended Nov - Mar.	✓	Two phase survey undertaken.	✓	Considered. Not usually critical with a Level 1 survey.	✓	Single species survey.

Appendix 2 (cont.)

Criterion		Ecologia 2012a		Ecologia 2014a		Ecologia 2014b		Ecologia 2015		Ecologia 2016	
Factors to consider	Level of existing regional knowledge	?	Unclear if this was considered, but suitable level of survey undertaken.	?	Unclear if this was considered, but suitable level of survey undertaken.	?	Unclear if this was considered, but suitable level of survey undertaken.	?	Unclear if this was considered, but suitable level of survey undertaken.	✓	Reviewed in report and purpose of survey was to increase local knowledge of this species in the Project Area.
	Number of habitats/degree of similarity between habitats.	✓	Considered. All habitats surveyed.	✓	Considered. All habitats surveyed.	✓	Considered. All habitats surveyed.	✓	Considered. All habitats surveyed.	?	Considered. Unclear why only one habitat targeted.
	Climatic constraints (e.g. of temp or rain)	✓	Not a constraint for a Level 1 survey	?	Unclear if this was considered. Survey conducted outside recommended Nov - Mar.	?	Considered, but second survey was conducted outside the recommended time for dry season surveys.	✓	Not a constraint for a Level 1 survey	✓	Not a major constraint for this survey.
	Sensitivity of receiving environment	?	Unclear if this was considered, but high level of survey recommended.	?	Unclear if this was considered, but suitable level of survey undertaken.	?	Unclear if this was considered, but suitable level of survey undertaken.	?	Only considered in terms of Ecologically Sensitive Areas.	?	Unclear if this was considered, but suitable level of survey undertaken.
	Size/shape/location of proposed activities	✓	Map of proposed impact area.	✓	Map of proposed impact area.	✓	Map of proposed impact area.	✓	Map of proposed impact area.	✓	Map of proposed impact area.
	Scale and impact of proposal	×	No detail on potential impacts, types of disturbances, longevity and long-term implications of project.	×	No detail on potential impacts, types of disturbances, longevity and long-term implications of project.	×	No detail on potential impacts, types of disturbances, longevity and long-term implications of project.	?	Limited detail on haul road and accommodation camp. No detail on potential impacts.	×	No detail on potential impacts, types of disturbances, longevity and long-term implications of project.
	Sampling bias tor some taxa.	✓	Not a major consideration for a level 1 survey.	?	Unclear if this was considered, but suitable level of survey undertaken.	?	Unclear if this was considered, but suitable level of survey undertaken.	✓	Not a major consideration for a level 1 survey.	N/A	Single species survey.

Appendix 2 (cont.)

Criterion		Ecologia 2012a		Ecologia 2014a		Ecologia 2014b		Ecologia 2015		Ecologia 2016	
Presentation and reporting											
Identifying limitations of the survey	competency and experience of consultant	✓	Assessed as not limiting.	✓	Assessed as not limiting.	✓	Assessed as not limiting.	×	Not assessed.	×	Not assessed.
	scope (which taxa sampled, any techniques unable to be used due to site conditions)	✓	Assessed as not limiting.	✓	Assessed as not limiting.	✓	Assessed as not limiting.	×	Not assessed.	×	Not assessed.
	proportion of fauna identified/recorded/collected	?	Assessed as not limiting. Should consider that Level 1 survey not likely to record full assemblage.	?	Assessed as not limiting, but may be limited by weather conditions/time of survey?	✓	Assessed as not limiting.	×	Not assessed.	×	Not assessed.
	sources of information and availability of Biogeographic data.	✓	Assessed as not limiting.	✓	Assessed as not limiting.	✓	Assessed as not limiting.	✓	Assessed as not limiting.	×	Not assessed.
	proportion of task achieved/need for further work	✓	Assessed as not limiting.	✓	Assessed as not limiting.	✓	Assessed as not limiting.	×	Not assessed.	✓	Considered in discussion, no list of limitations.
	timing/weather/season/cycle	✓	Assessed as not limiting.	?	Assessed as not limiting but survey undertaken in May, later than the Nov-Mar recommended.	?	Assessed as not limiting, but the second survey was in the late dry season, could be limiting for SRE taxa in particular.	?	Assessed as not limiting (weather/climate only)	×	Not assessed.
	disturbances (fire/flood/human intervention)	?	Assessed as not limiting, but listed as limiting for flora survey (fire impact).	✓	Assessed as not limiting.	✓	Assessed as not limiting.	×	Not assessed.	×	Not assessed.
	Sufficient survey intensity achieved	✓	Assessed as not limiting.	✓	Assessed as not limiting.	✓	Assessed as not limiting.	×	Not assessed.	✓	Considered in discussion, no list of limitations.
	Sufficient survey coverage achieved.	✓	Assessed as not limiting.	✓	Assessed as not limiting.	✓	Assessed as not limiting.	×	Not assessed.	✓	Considered in discussion, no list of limitations.

Appendix 2 (cont.)

Criterion		Ecologia 2012a		Ecologia 2014a		Ecologia 2014b		Ecologia 2015		Ecologia 2016	
	Resources (e.g. sufficient expertise available to identify fauna)	✓	Assessed as not limiting.	✓	Assessed as not limiting.	✓	Assessed as not limiting.	×	Not assessed.	×	Not assessed.
	Access issues	?	Limited number of tracks considered a limitation for the flora survey but not for the fauna survey.	✓	Assessed as not limiting.	✓	Assessed as not limiting.	×	Not assessed (but unlikely to be limiting - road access for entire site).	×	Not assessed.
Data presentation	Presented in quantitative form where possible.	✓	Areas of each fauna habitat given. Unlikely to be quantitative fauna data for a Level 1 survey.	?	The number of each taxa from each pitfall trapping site is given, but the opportunistically collected taxa are lumped to give number collected in each survey phase, but no numbers of how many in which habitats or inside/outside impact area. These data are presented in a set of Figures showing locations over habitat and proposed impact area, but numbers can only be ascertained from counting the dots on the map/s.	?	Table of all conservation significant fauna records with GPS co-ords, date and notes, plus map of records. For vertebrates, numbers of captures by site given in Appendix. For SRE invertebrate taxa The number of each taxa from each pitfall trapping site is given, but the opportunistically collected taxa are lumped.	✓	Areas of each fauna habitat given. Areas of critical/non-critical habitat for conservation significant species given. All fauna observed are listed. Unlikely to be quantitative fauna data for a Level 1 survey, but all bilby records listed.	✓	Table of all Bilby records with GPS locations.
	Nomenclature as per WA Museum.	✓	For most groups except birds (compliant with Technical Guide)	✓	Yes	✓	For most groups except birds (compliant with Technical Guide)	✓	For most groups except birds (compliant with Technical Guide)	✓	Yes

Appendix 2 (cont.)

Criterion		Ecologia 2012a		Ecologia 2014a		Ecologia 2014b		Ecologia 2015		Ecologia 2016	
Personnel	The person involved in the field survey should also be responsible for reporting.	✓	Field staff involved in reporting.	×	Field staff not involved with reporting or review of report.	✓	Field staff involved in reporting.	✓	Field staff involved in reporting.	✓	Field staff involved in reporting.
Setting context	Objectives of survey	✓	Detailed list of objectives	✓	Detailed list of objectives	✓	Detailed list of objectives	✓	Detailed list of objectives	✓	Described briefly in introduction.
	Review of background literature, databases, etc.	✓	List of databases consulted, detailed descriptions of land systems, bioregion, soils, hydrology etc.	✓	List of databases consulted, review of other survey results etc.	✓	List of databases consulted, detailed descriptions of land systems, bioregion, soils, hydrology etc.	✓	List of databases consulted, detailed descriptions of land systems, bioregion, soils, hydrology etc.	✓	List of databases consulted, detailed descriptions of land systems, bioregion, soils, hydrology etc. Review of published information on the Bilby.
	Appraisal of current knowledge base	?	Despite later surveys recognising the region is poorly known (Ecologia 2014b), this was not considered as a limitation in this survey	?	List of other surveys resented but no discussion as to whether this represents a poor or good amount of background information.	✓	Assessed for each group (vertebrates, SRE invertebrates, subterranean fauna)	?	No specific assessment, but a list of other surveys in region is given.	×	Not assessed, though literature review given.
	What specific areas of information will be investigated (e.g. species richness, conservation status, threatening processes)	✓	Listed in objectives.	✓	Listed in objectives.	✓	Listed in objectives.	✓	Listed in objectives.	✓	Described briefly in introduction.
	Review of other environmental work for the area.	✓	Review of the findings of other fauna reports in the region.	✓	Review of the findings of other fauna reports in the region.	✓	Review of the findings of other fauna reports in the region.	✓	Review of the findings of other fauna reports in the region.	✓	Review of the findings of other fauna reports in the region.
Report format	Standalone report or as an overview within an environmental review document.	✓	Standalone report (with flora and vegetation survey)	✓	Standalone report.	✓	Standalone report (with flora and vegetation survey)	✓	Standalone report (with flora and vegetation survey)	✓	Standalone report.

Appendix 2 (cont.)

Criterion		Ecologia 2012a		Ecologia 2014a		Ecologia 2014b		Ecologia 2015		Ecologia 2016	
Public availability of reports submitted for EIA		?	Presumably made available as part of PER.	?	Presumably made available as part of PER.	?	Presumably made available as part of PER.	?	Presumably made available as part of PER.	?	Presumably made available as part of PER.
Terminology	Should be standardised.	✓	Standardised terminology used.	✓	Standardised terminology used.	✓	Standardised terminology used.	✓	Standardised terminology used.	✓	Standardised terminology used.
Acknowledg - -ments	Of all contributors and data sources.	✓	All personnel involved with fieldwork, reporting, fauna identifications acknowledged. Literature review sources referenced.	✓	All personnel involved with fieldwork, reporting, fauna identifications acknowledged. Literature review sources referenced.	✓	All personnel involved with fieldwork, reporting, fauna identifications acknowledged. Literature review sources referenced.	✓	All personnel involved with fieldwork, reporting, fauna identifications acknowledged. Literature review sources referenced.	✓	All personnel involved with fieldwork, reporting, fauna identifications acknowledged. Literature review sources referenced.
Record-keeping	Source data to be kept for at least 7 years.	?	Unable to assess.	?	Unable to assess.	?	Unable to assess.	?	Unable to assess.	?	Unable to assess.
Role of the surveyor in increasing biological knowledge.	e.g. submission of specimens to WA museum in case of taxonomic anomaly or range extension.	N/A		✓	All SRE specimens submitted to WA Museum.	✓	Relevant specimens submitted to WA Museum. Vouchering of new reptile species.	N/A		✓	Collection of DNA samples.
	Identify any restricted species or assemblages in report, or any taxa on the extreme edges of their range.	N/A		✓	Potential SRE taxa identified.	✓	Potential SRE and troglofauna taxa identified. Potential range extensions of vertebrate species noted	✓	Potential range extensions noted.	N/A	Single species survey.

Appendix 3. Assessment against the Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment

✓ = consistent with guideline, × = not consistent with guideline, ? = partially consistent or insufficient detail in report to determine consistency.

Criterion		Ecologia 2012a		Ecologia 2014b		Ecologia 2015	
Introduction							
Use of the guide when planning/undertaking fauna survey		✓	Refers to guide in methods section.	✓	Refers to guide as part of guidelines to be addressed as part of EIA and as referred to when designing sampling methods.	✓	Refers to guide in methods section.
Protocols prior to survey							
Legislation	EPBC Act, EP Act, WC Act, CALM Act, Ramsar Convention, JAMBA, CAMBA, ROKAMBA.	✓	Detailed description of legislative requirements incl. guidance statements.	✓	Detailed description of legislative requirements incl. guidance statements.	✓	Detailed description of legislative requirements incl. guidance statements.
Licenses	Reg 17	✓	Licence held	✓	Licence held	✓	Licence held
Guide to level of survey							
	Use of Guidance Statement 56	✓	Refers to Guidance Statement 56	✓	Refers to Guidance Statement 56	✓	Refers to Guidance Statement 56
Level 1 survey	Desktop study -consult databases -description of location, proposal, scale and duration of direct and indirect impacts -background information on the region, species and habitats likely to occur. -use of major of major regional surveys to put proposal area into context	✓	List of databases consulted, detailed descriptions of land systems, bioregion, soils, hydrology etc, use of fauna studies in the region. No impact assessment as part of this survey.	✓	List of databases consulted, detailed descriptions of land systems, bioregion, soils, hydrology etc, use of fauna studies in the region. No impact assessment as part of this survey.	✓	List of databases consulted, detailed descriptions of land systems, bioregion, soils, hydrology etc, use of fauna studies in the region. No impact assessment as part of this survey.
	Reconnaissance survey -appropriate methods for faunal groups and conservation significant fauna -targeted searches for conservation significant fauna	✓	Scope was for opportunistic sampling of fauna only.	✓	This was completed in the previous survey (Ecologia 2012a) and used to inform this survey.	✓	This was completed in the previous survey/s (Ecologia 2012a, 2014b) and used to inform this survey.
Level 2 survey	-targeted or comprehensive survey depending on faunal groups and conservation significant fauna	N/A		✓	Detailed 2 season fauna survey undertaken, using a range of standard and widely-used techniques.	N/A	

Appendix 3 (cont.)

Criterion		Ecologia 2012a		Ecologia 2014b		Ecologia 2015	
Sampling Techniques							
Pit traps	Use of drift-fence, adequate spacing between traps, provision of shade in traps in hot weather.	N/A		✓	5 x PVC pipe, 5 x bucket each with 10m drift-fence at 7 sites, unknown if shelter provided in traps as not stated.	N/A	
Funnel traps	Shaded in hot weather.	N/A		✓	20 x funnels at 7 sites, shade used.	N/A	
Elliott traps	Shaded in hot weather.	N/A		✓	10 x Elliott at 7 sites, shade used.	N/A	
Cage traps	Shaded in hot weather.	N/A		✓	2 x cages at 7 sites, unknown if shade used as not stated.	N/A	
spotlighting/head-torching		N/A		✓	Nocturnal searching - road transects and searching with head-torches.	N/A	
Active searching		✓	Hand-searching at diurnal search sites.	✓	Hand-searching at trapping sites and opportunistically	✓	Hand-searching at trapping sites and opportunistically
Searching for tracks and other signs		✓	Recording of fauna opportunistically, recording of tracks, diggings, scats etc.	✓	Recording of fauna opportunistically, recording of tracks, diggings, scats etc.	✓	Recording of fauna opportunistically, recording of tracks, diggings, scats etc.
Bird observation	During period of optimal activity (dawn/dusk). Appropriate timing for seasonal species. Rotation of observers across survey sites	✓	Opportunistically at diurnal search sites.	✓	30 minute surveys with 500m across each trapping site. Within 3hrs of dawn.	✓	Opportunistically at diurnal search sites.
Bird or frog calls	Call-playback, recording of dawn chorus (birds) or frogs at suitable time of year	N/A		N/A		N/A	
Bat detector surveys	Recording of bat calls using Anabat or similar bat detector.	N/A		✓	Use of SM2 bat recorder, dusk - dawn.	✓	Use of SM2 bat recorder, dusk - dawn.
Bat surveys using mist-nests, harp-traps and trip lines		N/A		N/A		N/A	
Supplementary techniques	Camera traps, hair tubes, sand pads, checking scat/pellet contents/ examination of feral predator gut contents.	N/A		✓	Camera traps used.	✓	4 camera traps used on dam and bilby burrows

Appendix 3 (cont.)

Criterion		Ecologia 2012a		Ecologia 2014b		Ecologia 2015	
Survey Design							
Site selection and sampling effort	Sites selected with consideration of geographic extent and habitat variation present.	✓	Opportunistic sampling sites cover geographic extent of project area and all main habitats.	✓	Stated that survey sites selected for geographic spread and habitat. All 3 broad habitat types covered by trapping.	✓	Good spacing of survey locations along haul road route, all habitats surveyed.
Site selection and sampling effort	Adequate sampling effort (more required in poorly known regions)	✓	Sufficient sampling undertaken to meet Level 1 standard.	✓	Sufficient trap-nights and other complementary survey methods to meet Level 2 standard.	✓	Data available for the Project Area from previous surveys. Sufficient sampling undertaken to meet Level 1 standard.
Timing	(Northern Province) - wet season survey to coincide with peak faunal activity (Dec - Mar or as soon as practicable after), secondary survey early dry season (Apr - Aug).	N/A	Not critical for a Level 1 survey.	×	Dry season survey was conducted in October rather than the April - August recommended. No rationale given.	N/A	Not critical for a Level 1 survey.
Duration	Seven nights or more for general inventory surveys	N/A		✓	7 nights trapping each survey.	N/A	
	Seasonal or repeat surveys	N/A		✓	2 surveys carried out, April and October 2013.	N/A	
Trapping design for terrestrial mammals and herpetofauna	Pitfall trapping with drift-fences, 10 - 12 traps per site, pipes & buckets or buckets alone, replication of trap-lines in extensive habitats, Elliott traps in grids or transects	N/A		✓	10 pitfalls per site, line of 10 Elliotts, replication of sites in most extensive habitat.	N/A	
Field ID texts	Reference literature used to identify fauna.	✓	References listed in a table.	✓	References listed in a table.	✓	References listed in a table.
Analysis							
Any analyses appropriate to the data available.		N/A		?	Unclear if data collected support the analyses undertaken. Systematic sampling was skewed to one habitat type and species accumulation curves only measure 'trappable' fauna.	N/A	
Assessment of reliability of data (e.g. gaps in literature, records, habitats surveyed)		?	Noted that knowledge of region somewhat poor, but this is not then considered to be a limitation to the fauna survey. All habitats surveyed.	?	Noted that knowledge of region somewhat poor, but this is not then considered to be a limitation to the fauna survey. All habitats surveyed.	?	Not specifically assessed. All habitats surveyed.
Species richness/accumulation curves		N/A	Insufficient quantitative data collected in a Level 1 survey for these analyses.	✓	Detailed for systematic trapping sites and systematic bird surveys.	N/A	Insufficient quantitative data collected in a Level 1 survey for these analyses.

Appendix 3 (cont.)

Criterion		Ecologia 2012a		Ecologia 2014b		Ecologia 2015	
Reporting							
Introduction:	Clear statement of objectives	✓	Detailed list of objectives	✓	Detailed list of objectives	✓	Detailed list of objectives
	Scope of proposal	✓	Brief scope given in introduction.	✓	Brief scope given in introduction.	✓	Brief scope given in introduction.
	Background information collected as part of desktop study	✓	Detailed discussion of database records and previous survey results from region and faunal assemblages known to occur in the region.	✓	Detailed discussion of database records and previous survey results from region and faunal assemblages known to occur in the region.	✓	Detailed discussion of database records and previous survey results from region and faunal assemblages known to occur in the region.
	Climate	✓	Detailed table and description of two nearest BOM weather stations	✓	Detailed table and description of two nearest BOM weather stations	✓	Detailed table and description of two nearest BOM weather stations
	Land systems and biogeography	✓	Maps, tables and discussions of land systems and IBRA Bioregion.	✓	Maps, tables and discussions of land systems and IBRA Bioregion.	✓	Maps, tables and discussions of land systems and IBRA Bioregion.
	Justification of level of survey	✓	Refers to the survey as being an initial assessment of the site to assess need for further surveys	✓	Refers to results of Level 1 survey.	✓	Refers to review of relevant factors under Guidance Statement 56
	Justification of sampling design	✓	Initial assessment and ground-truthing of available fauna habitats.	✓	Detailed list of factors influencing survey design, including habitats present, size of proposal, amount of data in the literature.	✓	Refers to methods being aligned to this guideline and Guidance Statement 56.
	Justification of survey timing	N/A	Not highly relevant for Level 1 survey, where primary concern is habitat assessment rather than recording fauna directly.	?	Justification as per this guidance. However, actual dates of dry season vertebrate fauna survey are not consistent with guidance and no justification for inconsistency is given.	N/A	Not highly relevant for Level 1 survey, where primary concern is habitat assessment rather than recording fauna directly.
Methods:	Map of survey sites	✓	Map included	✓	Map of all trapping sites, SM2 bat recording sites, diurnal sites.	?	Map of diurnal search sites, camera trap sites, bird point counts and bat detector sites. No map of bilby transects conducted.
	Diagram of trap layout	N/A		✓	Detailed diagram provided.	N/A	
	Rationale for site selection	✓	Refers to review of aerial photography, vegetation and land systems.	✓	Refers to geographic spread of sites and sampling all major habitats.	✓	Refers to geographic spread of sites and sampling all major habitats.
	Prevailing weather conditions	×	Not given.	✓	Given in an Appendix for the duration of each field survey.	×	Not given.
	Timing of survey	✓	Dates given.	✓	Dates given for all surveys	✓	Dates given.

Appendix 3 (cont.)

Criterion		Ecologia 2012a		Ecologia 2014b		Ecologia 2015	
Methods:	Sampling techniques	✓	Techniques listed. Bird surveying and opportunistic sampling described.	✓	Full list of techniques (trapping, bird surveys, nocturnal and diurnal searching, bat recording, camera traps). Searching for conservation significant fauna, but not specific to Bilby.	✓	Techniques listed. Diurnal active searching (including bird survey), bat recording and camera trapping described. Searches for conservation significant fauna, (Bilby and Gouldian Finch), described.
	Sampling effort	?	Sampling sites shown and number of total person-days listed. No indication of amount of time spent at each site, which is not critical for this level of survey.	✓	Table of hours on each activity, trap-nights for each trap type.	?	Sampling sites shown and number of total person-days listed. No indication of amount of time spent at each site, which is not critical for this level of survey, but amount of time/length of bilby transects should be indicated.
	Rationale for methods used and reasons for any diversion from this or other guidance.	✓	Methods as per Level 1 survey (Guidance Statement 56)	✓	Methods as per Level 2 survey (Guidance Statement 56, this guideline)	✓	Methods as per Level 1 survey (Guidance Statement 56)
Limitations:	Statement of limitations, e.g. of access, weather conditions or season	✓	Extensive list of potential survey limitations and constraints. One limitation not correctly identified i.e. proportion of fauna collected - should reference that no trapping undertaken, as per level 1 survey, so many species would not be recorded on the site.	✓	Extensive list of potential survey limitations and constraints.	×	List of limitations not given. A list of factors likely to influence survey design is given, which covers some limitations.
	Role of each person involved in the survey, their qualifications and experience	✓	Name, position, qualification, years experience given for each team member	✓	Name, position, qualification, years experience given for each team member	✓	Name, position and qualification given for each team member
	Number of survey/person days indicated	✓	Dates of field survey and number of people given.	✓	Table showing duration of each survey and person-days in the field.	✓	Dates of field survey and number of people given.
	Details of licences held	✓	Reg 17 licence number given.	✓	Reg 17 licence number given.	✓	Reg 17 licence number given.
Results:	table of survey effort	?	List of sites, no indication of effort at each site.	✓	Table showing survey effort is provided.	?	List of sites, no indication of effort at each site.
	table of weather conditions	×	Not given.	✓	List of temperature/rainfall for survey dates given in appendix	×	Not given.

Appendix 3 (cont.)

Criterion		Ecologia 2012a		Ecologia 2014b		Ecologia 2015	
Results:	table/s of observations or captures by site, incl. GPS co-ords.	×	All fauna records attributed to study area as a whole, individual site records not presented. GPS locations for conservation significant species records.	✓	Table given in appendix. All captures for each site on each survey. Site descriptions/locations also given in separate appendix. GPS locations for conservation significant species records.	×	All fauna records attributed to study area as a whole, individual site records not presented. GPS locations (but not habitat) given for all bilby records.
	Quantitative data presented where possible	✓	Areas of each fauna habitat given. Unlikely to be quantitative fauna data for a Level 1 survey.	✓	Table of all conservation significant fauna records with GPS co-ords, date and notes, plus map of records. Numbers of captures by site given in Appendix.	✓	Areas of each fauna habitat given. Areas of critical/non-critical habitat for conservation significant species given. All fauna observed are listed. Unlikely to be quantitative fauna data for a Level 1 survey, but all bilby records listed.
	Description of faunal assemblage	?	Basic description of number of frogs, reptiles, birds and mammals potentially occurring in region, but this includes many spp. that would not occur (e.g. seabirds, mangrove specialists). No list or discussion of potential fauna assemblage of site only, other than spp. recorded on survey.	?	Description of faunal assemblage *recorded* during the Level 2 survey, given overall for vertebrates, and for frogs, reptiles, birds and mammals separately. No list of *potential* fauna assemblage for site only, only for region, this including coastal, mangrove and other habitats not present on the site. General description of overall assemblage and likely conservation significant fauna in each habitat.	?	Basic description of number of frogs, reptiles, birds and mammals potentially occurring in region, but this includes many spp. that would not occur (e.g. seabirds, mangrove specialists). No list or discussion of potential fauna assemblage of site only, other than spp. recorded on survey.
	Results of database, reports, publication or legislation searches	✓	List of all spp. identified in literature review in Appendix. Map of EPBC Act threatened spp. records in region	✓	List of all spp. identified in literature review in Appendix. Maps of conservation significant spp. records in region	✓	List of all spp. identified in literature review in Appendix. Maps of conservation significant spp. records in region
	Clear differentiation between survey data and literature review results	✓	Separate table for spp. recorded during survey. Appendix of spp. identified in literature review, with each source identified.	✓	Results of literature review and this survey obviously separated in Appendix of all potential fauna. Clear separation in text between regional assemblage from literature and observed assemblage from fauna survey.	✓	Separate table for spp. recorded during survey. Appendix of spp. identified in literature review, with each source identified.

Appendix 3 (cont.)

Criterion		Ecologia 2012a		Ecologia 2014b		Ecologia 2015	
Results:	Likelihood of each species occurring on the basis of habitat	?	Description of each fauna habitat with the observed and likely faunal assemblages. Likelihood of conservation significant spp. occurring is given.	?	Description of each fauna habitat with the observed and likely faunal assemblages. Likelihood of conservation significant spp. occurring is given.	?	Description of each fauna habitat with the observed and likely faunal assemblages. Likelihood of conservation significant spp. occurring is given.
	Detailed information on conservation significant species (status, distribution, location in study area, habitat use in study area)	✓	Detailed information in text for spp. identified as having a medium - high likelihood of occurring. Table of conservation significant species with status, general habitat requirements, records, likelihood of occurrence and habitat use in study area.	✓	Detailed information in text for spp. identified as having a medium - high likelihood of occurring. Table of conservation significant species with status, general habitat requirements, records, likelihood of occurrence and habitat use in study area.	✓	Detailed information in text for spp. identified as having a medium - high likelihood of occurring. Table of conservation significant species with status, general habitat requirements, records, likelihood of occurrence and habitat use in study area.
	Map of habitats	✓	Habitats mapped for whole study area.	✓	Habitats mapped for whole study area.	✓	Habitats mapped for whole study area.
Analysis:	Consider tabulation of effectiveness of sampling based on survey effort	N/A		N/A		N/A	
	Consider limitations of inventory through species accumulation curves etc.	N/A		?	Analysis of survey adequacy provided, but does not take into account potential seasonal differences. i.e. although majority of trappable fauna noted to be recorded for the survey period, there are likely to be seasonal and annual differences in species richness and abundance, and/or differences in fauna distribution across the site.	N/A	
	Consider use and relevance of diversity indices, estimates of species richness, measures of evenness or differences in the faunal assemblages among habitats	N/A		✓	Species richness given for overall study area. Faunal assemblage of each habitat compared (using systematic data only).	N/A	
	Consider analysis of fauna data taking into account sampling bias	N/A		?	Habitat analysis performed (any sig difference in vertebrate fauna assemblages between the three habitats) Uncertain whether it accounts for the fact that 5 sites were in one habitat, 1 site each in two remaining habitats.	N/A	

Appendix 3 (cont.)

Criterion		Ecologia 2012a		Ecologia 2014b		Ecologia 2015	
Discussion:	Discussion of species in a regional context (presence of regional endemics, range extensions)	✓	Range extension for *Lerista apoda* noted.	✓	Notes that several range extensions made.	✓	New species *Varanus sparnus* considered as a potentially conservation significant species.
	Likely threats and their potential impacts on species/assemblages	N/A	No impact assessment undertaken.	N/A	No impact assessment undertaken.	N/A	No impact assessment undertaken.
	Consider the nature, extent, frequency, timing and duration of impacts, as well as any cumulative impacts	N/A	No impact assessment undertaken.	N/A	No impact assessment undertaken.	N/A	No impact assessment undertaken.
	Indentify any expected species appearing to be missing from the site	N/A	None noted.	N/A	None noted.	N/A	None noted.
	Summary of the fauna values and potential direct and indirect impacts	N/A	No impact assessment undertaken.	N/A	No impact assessment undertaken.	N/A	No impact assessment undertaken.
	Recommendation on any further investigations	✓	Clear list of recommended further investigations	N/A		N/A	
Appendices	- complete list of all species recorded and the habitats in which they were found - list of all specimens lodged with WAM - complete list of all species expected to occur on the basis of literature review	?	No list of species by site. This is often the case for Level 1 surveys where most records are opportunistic rather than systematic, but this survey had 'sampling sites'. No specimens lodged, literature review species list complete and detailed.	✓	List of species by site, which can be referenced to habitat. List of 6 vertebrate specimens lodged. Literature review list complete and detailed.	?	No list of species by site. This is often the case for Level 1 surveys where most records are opportunistic rather than systematic, but this survey had 'sampling sites'. No specimens lodged, literature review species list complete and detailed.
Nomenclature:	Fauna names follow recognised lists	✓	Checklists referred to and referenced	✓	Checklists referred to and referenced	✓	Checklists referred to and referenced

Appendix 4. Assessment against the Survey Guidelines for Australia's Threatened Mammals.

✓ = consistent with guideline, × = not consistent with guideline, ? = partially consistent or insufficient detail in report to determine consistency.

Criterion		Ecologia 2014b		Ecologia 2015		Ecologia 2016	
Identify taxa that may occur in the study area							
Characterise study area	Clear study area boundaries	✓	Study area well defined.	✓	Study area well defined.	✓	Study area well defined.
	Detailed map (habitats, important features such as rock outcrops, waterbodies)	✓	Map showing three broad habitat types.	✓	Map showing three broad habitat types.	✓	Map showing three broad habitat types.
Establish the regional context	Establish if habitats rare or common	✓	Habitat determined to be common and not restricted to study area.	✓	Habitat determined to be common and not restricted to study area.	✓	Habitat determined to be common and not restricted to study area.
	Identify presence of critical habitats	✓	Likely habitat determined.	✓	Likely habitat determined.	✓	Likely habitat determined.
	Establish if habitats are permanent or ephemeral	✓	Habitats permanent.	✓	Habitats permanent.	✓	Habitats permanent.
	Consider how the species is likely to use the site.	?	Likely habitat use determined prior to survey - method not stated	?	Likely habitat use determined prior to survey - method not stated	✓	Refers to habitat use results from previous surveys
Identify those threatened mammals that are known to, likely to or may occur in the region	Use of SPRAT database and the protected matters search tool.	✓	Database search conducted.	✓	Database search conducted.	✓	Database search conducted.
	Use of State government databases and/or predictive models	✓	NatureMap and other database searches conducted.	✓	NatureMap and other database searches conducted.	✓	NatureMap and other database searches conducted.
	Use of National/State threatened species recovery plans and teams	✓	Bilby recovery plan referred to.	✓	Bilby recovery plan referred to.	✓	Bilby recovery plan referred to.
	Use of Museum and other specimen collections	✓	WA Museum databases searched as part of NatureMap search.	✓	WA Museum databases searched as part of NatureMap search.	✓	WA Museum databases searched as part of NatureMap search.
	Use of published literature and reference books (e.g. Van Dyck and Strahan 2008)	✓	Use of published literature for species habitat/ecology information.	✓	Use of published literature for species habitat/ecology information.	✓	Use of published literature for species habitat/ecology information.
	Use of unpublished environmental impact reports	✓	Other EIA reports, targeted Bilby surveys referred to.	✓	Other EIA reports, targeted Bilby surveys referred to.	✓	Other EIA reports, targeted Bilby surveys referred to.
	Use of local community groups and researchers	N/A		N/A		N/A	
Prepare a list of threatened taxa that could occur in the study area.	Compare habitat requirements of taxa to habitats/features present in the study area.	✓	Habitat requirements in published literature referred to, and compared to habitats present on site.	✓	Habitat requirements in published literature referred to, and compared to habitats present on site.	✓	Habitat requirements in published literature referred to, and compared to habitats present on site.

Appendix 4 (cont.)

Criterion		Ecologia 2014b		Ecologia 2015		Ecologia 2016	
Determine optimal timing for surveys of target taxa							
Consider time of day, season, changes in abundance between years, sensitivity to impacts from survey methods.		✓	Searches for secondary evidence only.	✓	Searches for secondary evidence only.	✓	Searches for secondary evidence only.
Determine optimal location of surveys							
Habitat stratification	Survey entire site if possible, otherwise use selective sampling/searching.	✓	Selective survey of particular habitat.	✓	Selective survey of particular habitat.	✓	Selective survey of particular habitat.
	If more than one habitat is suitable, use appropriate stratification of sampling sites.	N/A		N/A		N/A	
Targeted searches	Concentrate searches in suitable habitat, if habitat preferences known.	?	Selective survey of particular habitat is stated in methods, but the location/s of the 9hrs 40 minutes of specific Bilby searching is unclear.	✓	Selective survey of particular habitat.	✓	Selective survey of particular habitat.
Establish sampling design and survey effort							
Spatial sampling	Systematic sampling, avoiding local disturbances.	?	Unclear if any systematic approach taken.			✓	Selective survey of particular habitat.
	Appropriate distance between sampling sites, number of sampling units proportional to size of study area.	?	Unclear if any systematic approach taken.	✓	Diurnal search points evenly distributed along haul road route.	✓	Transects evenly spaced through targeted habitat.
Temporal sampling	May be required to detect populations that vary in abundance/distribution, off-study area sampling can be used instead in some cases.	N/A		N/A		N/A	
Select appropriate personnel to conduct surveys							
Competent observers	Familiar with species, adequate training.	✓	Observers listed, unknown familiarity with species, but survey results demonstrate capability of recording the Bilby.	✓	Observers listed, unknown familiarity with species, but survey results demonstrate capability of recording the Bilby.	✓	Observers listed, unknown familiarity with species, but survey results demonstrate capability of recording the Bilby.
Document survey methods and results							
Methods	Personnel involved and their skills	?	Personnel listed, skills are not detailed.	?	Personnel listed, skills are not detailed.	?	Personnel listed, skills are not detailed.

Appendix 4 (cont.)

Criterion		Ecologia 2014b		Ecologia 2015		Ecologia 2016	
Methods	Sampling strategy	?	Unclear if transects or just opportunistic searches carried out, or at which sites/habitats the 9hrs 40 mins searching were carried out.	?	Methods given, but no details on number/location of any transects. No map of transect locations.	✓	Detailed methods given.
	Time of day/dates of sampling	?	Unclear if any systematic approach taken. Dates of field trip given.	✓	Sampling occurred throughout the day (for secondary signs). Survey dates given.	✓	Sampling occurred throughout the day (for secondary signs). Survey dates given.
	Weather conditions	✓	Table of temperature/rainfall given.	×	Not indicated.	×	Not indicated.
	GPS location of sampling sites	?	Locations of camera traps, diurnal searching sites given. Unclear if all diurnal sampling sites were targeted Bilby search areas.	✓	Locations of camera traps, diurnal searching sites given.	✓	Locations of camera traps, map of transects undertaken,
	Maps of study area showing planned infrastructure over aerials or habitat maps	✓	Map shows project footprint with Bilby records.	✓	Map shows project footprint with Bilby records.	✓	Map shows project footprint with scat locations of Bilby individuals identified.
	Map of survey points/GPS tracks	?	Survey points given. Unclear if transects were undertaken.	✓	Map of search points, camera locations.	✓	Map of transects, camera locations.
Results	Information on habitat condition			✓	Map of vegetation condition given.	?	Broad habitat descriptions given, but although a discussion on the impact of fire age was given, no maps or other information was given.
	Document habitat occupied by target taxa/site description	✓	Broad habitat type occupied by Bilbies is described.	✓	Broad habitat type occupied by Bilbies is described.	✓	Broad habitat type occupied by Bilbies is described.
	Presentation of all mammal taxa recorded (as a measure of survey effectiveness/effort)	✓	All mammals observed indicted in an Appendix.	✓	All mammals observed indicted in an Appendix.	×	Only Bilby records presented.
	Photo/records of scats or trace material	✓	Representative photos, list of all scats/evidence.	✓	Representative photos, list of all scats/evidence.	✓	Representative photos, list of all scats/evidence.
	Site photos	?	Representative habitat photos given and photos of trapping sites. No specific Bilby site photos other than representative photos of burrows.	?	Representative habitat photos given and photos of trapping sites. No specific Bilby site photos other than representative photos of burrows.	?	Representative habitat photos given. No specific site photos other than representative photos of burrows.
	Summary table of measurements/observations	✓	All observations listed in a Table.	✓	All observations listed in an Appendix, summarised in text.	✓	All observations listed in an Appendix, summarised in text.
	Photos of mammals	✓	Camera trap photos of Bilby at burrow.	✓	Camera trap photos of Bilby at burrow.	✓	Camera trap photos of Bilby at burrow.

Appendix 4 (cont.)

Criterion		Ecologia 2014b		Ecologia 2015		Ecologia 2016	
Justification	Justification of survey design (opportunistic/systematic/targeted)	✓	Targeting known habitat in study area.	✓	Targeting known habitat in study area.	✓	Refers to previous survey data, appropriate guidelines.
	Justification of timing	×	No, but as Bilbies were recorded, this is not a major factor.	×	No, but as Bilbies were recorded, this is not a major factor.	×	No, but as Bilbies were recorded, this is not a major factor.
Recommended survey methods for Greater Bilby							
Initial detection	daytime searches for potentially suitable habitat resources.	✓	Data collected in previous surveys.	✓	Data collected in previous surveys.	✓	Data collected in previous surveys.
	daytime searches for signs of activity, including burrows, tracks, scats and diggings.	✓	9 hours, 40 mins spent searching for evidence.	✓	Key survey technique, diurnal searches undertaken along length of haul road route.	✓	Key survey technique, transects 500m - 1km apart in all suitable habitat in main study area.
	collection of predator scats, owl casts or remains, targeting predatory bird/mammal nests/dens.	N/A		N/A		N/A	
	soil plot surveys.	N/A		N/A		N/A	
Additional methods	Spotlighting at burrow entrances once species is detected.	✓	Camera traps used to confirm Bilby presence at burrows	✓	Camera traps used to confirm Bilby presence at burrows	✓	Camera traps used to confirm Bilby presence at burrows

Appendix 5. Assessment against the Survey Guidelines for Australia's Threatened Birds.

✓ = consistent with guideline, × = not consistent with guideline, ? = partially consistent or insufficient detail in report to determine consistency.

Criterion		Ecologia 2015 - Level 1 haul rd survey	
Identify taxa that may occur in the study area			
Characterise study area	Clear study area boundaries	✓	Study area well defined.
	Detailed map (habitats, important features such as rock outcrops, waterbodies)	✓	Map showing three broad habitat types.
Establish the regional context	Establish if habitats rare or common	✓	Habitat determined to be common and not restricted to study area.
	Identify presence of critical habitats	✓	Likely habitat determined.
	Establish if habitats are permanent or ephemeral	✓	Habitats permanent.
	Consider how the species is likely to use the site.	?	Likely habitat use determined prior to survey - method not stated
Identify those threatened mammals that are known to, likely to or may occur in the region	Use of SPRAT database and the protected matters search tool.	✓	Database search conducted.
	Use of State government databases and/or predictive models	✓	NatureMap and other database searches conducted.
	Use of National/State threatened species recovery plans and teams	✓	Gouldian Finch recovery plan referred to.
	Use of Museum and other specimen collections	✓	WA Museum databases searched as part of NatureMap search.
	Use of published literature and reference books (e.g. Van Dyck and Strahan 2008)	✓	Use of published literature for species habitat/ecology information.
	Use of unpublished environmental impact reports	✓	Other EIA reports referred to.
	Use of local community groups and researchers	N/A	
Prepare a list of threatened taxa that could occur in the study area.	Compare habitat requirements of taxa to habitats/features present in the study area.	✓	Habitat requirements in published literature referred to, and compared to habitats present on site.
Determine optimal timing for surveys of target taxa			
	Consider time of day, season, changes in abundance between years, sensitivity to impacts from survey methods, weather conditions.	?	Timing of bird point counts and other surveys not stated. Survey undertaken in mid dry season (May), the non-breeding season for Gouldian Finch. Weather conditions during the survey are not stated.
Determine optimal location of surveys			
Habitat stratification	Survey entire site if possible, otherwise use selective sampling/searching.	?	Entire site not searched, unclear if any rationale for where searches were conducted, other than targeted waterhole (dam) search.
	If more than one habitat is suitable, use appropriate stratification of sampling sites.	?	Unknown if this was taken into account.
Targeted searches	Concentrate searches in suitable habitat, if habitat preferences known.	✓	No particular habitat targeted for the most part, searches throughout study area. Targeted search of birds at water in dam.

Appendix 5 (cont.)

Criterion		Ecologia 2015 - Level 1 haul rd survey	
Establish sampling design and survey effort			
Spatial sampling	Systematic sampling, avoiding local disturbances.		
	Appropriate distance between sampling sites, number of sampling units proportional to size of study area.	✓	Diurnal search points evenly distributed along haul road route.
Temporal sampling	May be required to detect populations that vary in abundance/distribution, off-study area sampling can be used instead in some cases.	×	Not considered.
Select appropriate personnel to conduct surveys			
Competent observers	Familiar with species, adequate training.	?	Observers listed, unknown familiarity with species.
Document survey methods and results			
Detailed methods	Personnel involved and their skills	?	Personnel listed, skills are not detailed.
	Sampling strategy including effort (transect duration etc).	?	Methods given, but no details on time of day, duration of surveys.
	Time of day/dates of sampling	✓	Sampling presumed to have occurred throughout the day, no details on bird survey times. Survey dates given.
	Detailed habitat descriptions	✓	Description of each broad habitat given.
	GPS location of sampling sites	✓	Locations of diurnal searching sites, camera site and bird point counts given.
	Maps of study area showing planned infrastructure over aerials or habitat maps	?	Map shows project footprint with habitats, but unclear which habitats if any are suitable for Gouldian Finch.
	Map of survey points/GPS tracks	✓	Map of search points, bird point count, camera location.
	Suitability of the weather during survey.	×	Weather conditions not stated.
Results	Information on habitat condition	✓	Map of vegetation condition given.
	Document habitat occupied by target taxa/site description	?	Broad habitat type occupied by Gouldian Finch is described, but not which habitats in the study area correspond to suitable habitat types. No records of this species made, so no descriptions of observed habitat use.
	Presentation of all bird taxa recorded (as a measure of survey effectiveness/effort)	✓	All species observed indicted in an Appendix.
Justification	Justification of survey design (opportunistic/systematic/targeted)	✓	Targeting known habitat in study area.
	Justification of timing	×	Not specified.
Recommended survey methods for Gouldian Finch			
Targeted searches (12 hrs across 4 days).	Association with breeding Black-faced Woodswallow in the early wet season	N/A	
	Watches at waterholes in the late dry season	✓	Camera trap set at dam. Bird point counts at dam, though timing and duration not specified.
Area searches (20 hrs across 5 days in areas of <50ha)	Area searches in suitable habitat	✓	Searches carried out as part of diurnal searches. No indication of duration/effort/timing.

Appendix 6. Assessment against Guidance Statement 20.

✓ = consistent with guideline, × = not consistent with guideline, ? = partially consistent or insufficient detail in report to determine consistency.

Criterion		Ecologia 2014b - level 2 survey		Ecologia 2014a - targeted SRE survey	
Application of Guidance Statement 20 to Assessments					
SRE taxa considered in fauna survey		✓	SRE invertebrates targeted as part of wider vertebrate and invertebrate fauna survey	✓	SRE invertebrates targeted
Risk assessment - review of likelihood of SRE taxa occurring		✓	Presumed to have been considered, as field survey was undertaken.	✓	Presumed to have been considered, as field survey was undertaken.
Approaches to Survey Design					
Preparation of a scope outlining target taxa, methods, preliminary sampling locations and consulting with DPAW/WA Museum on adequacy of planned survey		?	Unknown if this was undertaken prior to survey.	?	Unknown if this was undertaken prior to survey.
Aim to sample direct impact area and any areas of indirect impact.		✓	Dedicated SRE pitfall sites in impact area only and in only 1 habitat. Vertebrate pitfall sites outside impact area and in all habitats. Opportunistic sampling both inside and outside impact area.	✓	Purpose of previous survey.
Consideration given to sampling similar habitat outside the proposal footprint.		✓	Some vertebrate pitfall sites (used to collect SRE taxa) outside impact area and in all habitats. Opportunistic sampling both inside and outside impact area.	✓	Primary purpose of this survey was to identify SRE taxa outside the proposal footprint.
Sampling considerations					
Where to sample	No prescriptive guidance on habitats to target, suggests sheltered habitats, microhabitats, habitat isolates.	✓	Text suggests that microhabitats targeted for opportunistic sampling.	✓	Text suggests that microhabitats targeted for opportunistic sampling.
When to sample	Depends on taxa, but typically during seasonally wet conditions (Nov - Apr in Kimberley). Sampling can be at other times but suitable searching methods to be used.	?	Phase 1 of sampling in April. Phase 2 undertaken in late dry season.	?	Survey undertaken in May, later than suggested in guidance.
	If not sampling during seasonally wet conditions, discuss limitations in report.	×	Not discussed, though sampling did also occur post-wet in April.	×	Not discussed, though the May survey is not far into the dry season.
How to sample	Wet pit traps (not considered a standard component due to ethical concerns)	N/A		N/A	
	Dry pit traps (of limited use in dry conditions, opportunistic use during vertebrate fauna surveys)	✓	6 SRE trap sites and 4 vertebrate trap sites used to collect SRE taxa. Used in both the post-wet and dry seasons.	✓	10 SRE trap sites, open in May.
	Sieving leaf litter or soil	✓	6 leaf litter samples, all from Pindan habitat. None from other two habitats.	✓	6 leaf litter samples, all from Pindan habitat. None from other two habitats.

Appendix 6 (cont.)

Criterion		Ecologia 2014b - level 2 survey		Ecologia 2014a - targeted SRE survey	
How to sample	Raking through soil, leaf litter and debris	✓	Though not detailed fully in methods, this method was referred to elsewhere in the text.	✓	Though not detailed fully in methods, this method was referred to elsewhere in the text.
	Searching among rock piles	✓	Though not detailed fully in methods, this method was referred to elsewhere in the text.	✓	Though not detailed fully in methods, this method was referred to elsewhere in the text.
	Searching on trees or beneath bark	✓	Though not detailed fully in methods, this method was referred to elsewhere in the text.	✓	Though not detailed fully in methods, this method was referred to elsewhere in the text.
Preservation and lodgement of specimens					
Specimens correctly preserved, labelled and lodged with WA Museum.		✓	Stated that all taxa lodged with WA Museum.	✓	Stated that all taxa lodged with WA Museum.
Specimen identification and analysis					
All potential SRE taxa identified to the lowest taxonomic level possible.		✓	Taxa identified by experts.	✓	Taxa identified by experts.
SRE taxonomic experts consulted.		✓	List of taxonomic experts.	✓	List of taxonomic experts.
Reporting standards					
Methods	Survey techniques described.	?	All methods described, but pitfall trap size and layout for dedicated SRE trapping sites not stated and opportunistic sampling methods vague.	✓	All methods described, but pitfall trap size for SRE trapping sites not stated (though there is a photo of trap layout) and opportunistic sampling methods vague.
	Sampling effort.	?	Overall sampling effort given, but difficult to ascertain the effort for each survey phase (e.g. number of days pit traps open on each survey). Unclear as to when leaf litter collections made. Unclear as to when opportunistic sampling occurred.	✓	Sampling effort (trap nights or minutes spent opportunistically sampling) per site is given.
	Sampling locations.	✓	All sampling locations shown in map and GPS locations in a Table. Descriptions of trapping sites only in Appendix.	✓	All sampling locations shown in map and GPS locations in a Table. Descriptions in Appendix.
	Habitats targeted.	?	Land system listed for each opportunistic sampling site, but unclear which habitats these are. All dedicated SRE pitfall traps and leaf litter collection in Pindan Shrubland habitat only (dominant habitat).	✓	Habitat given for each sampling site.
Limitations	Discussion of any limitations to methods or results (e.g. seasonal factors, level of identification of specimens).	?	List of limitations presented, but no discussion of limitations pertaining to sampling in the dry season (though sampling was also undertaken in the post-wet), limitations pertaining to the lack of information on SRE taxa in the area not discussed.	?	List of limitations presented, but no discussion of limitations pertaining to sampling in the early dry season, limitations pertaining to the lack of information on SRE taxa in the area.

Appendix 6 (cont.)

Criterion		Ecologia 2014b - level 2 survey		Ecologia 2014a - targeted SRE survey	
Results	Quantitative presentation of results.	?	The number of each taxa from each pitfall trapping site is given, but the opportunistically collected taxa are lumped to give number collected in each survey phase, but no numbers of how many in which habitats or inside/outside impact area. These data are presented in a set of Figures showing locations over habitat and proposed impact area, but numbers can only be ascertained from counting the dots on the map/s.	?	The number of each taxa from each pitfall trapping site is given, but the opportunistically collected taxa are lumped.
	Use of current taxonomy and nomenclature (or most recently available names).	✓	Taxonomy/names provided by experts.	✓	Discussed in a general fashion, for each of the three broad habitat types, then specifically for each confirmed or potential SRE taxon.
	Clearly list and discuss taxa collected in each target SRE group.	✓	List of each taxonomic group, number of taxa recorded within it and which are SRE/potential SRE.	✓	List of each taxonomic group, number of taxa recorded within it and which are SRE/potential SRE.
Discussion	The local (proposal area) distribution and abundance of each SRE taxon.	✓	Maps show distribution of records of each taxon	?	Results of previous survey (of taxa in proposal area) not shown on maps. This survey was outside proposal area.
	The wider status of the SRE taxa involved, where known.	✓	Discussed for each confirmed or potential SRE taxon.	✓	Discussed for each confirmed or potential SRE taxon.
	The vegetation types/habitats from which SRE taxa were recorded.	✓	Discussed in a general fashion, for each of the three broad habitat types, then specifically for each confirmed or potential SRE taxon.	✓	Discussed for each confirmed or potential SRE taxon.
	Whether these records appear to partially conform to any identifiable landform features.	✓	Most species not discussed or not noted to be restricted.	✓	Most species not noted to be restricted.
	Use of GIS approaches in studies and reporting.	×	Not used.	×	Not used.

Appendix 7. Assessment against Environmental Assessment Guideline 12.

✓ = consistent with guideline, × = not consistent with guideline, ? = partially consistent or insufficient detail in report to determine consistency.

Criterion		Ecologia 2014b - Level 2 Survey	
Guide to levels of survey			
Consider likely presence of subterranean taxa		✓	Previous survey (Ecologia 2012a) identified the potential presence of subterranean fauna and the need for this survey.
Level 1 survey	Desktop study. Includes a search of regional/site specific habitat data, geological and hydrological information, previous studies in the area, site photos and databases.	✓	Literature review presented, though limited data available for the area. Geological and hydrological information presented for study area.
	Reconnaissance survey to confirm whether habitat is present. Where little data are available, a low intensity survey may be warranted to confirm (or not) presence of subterranean taxa.	✓	Not stated that it is a level 1 survey, but the methods are consistent with this level of survey.
Level 2 survey	Comprehensive survey provides detailed information and requires repeated sampling.	N/A	
	Targeted survey to provide answers to specific questions (e.g. placing samples already collected into context by sampling other parts of the habitat area)	N/A	
Determining survey level			
Determine presence of subterranean fauna habitat	Deep sands/clays or hypersaline groundwater are unlikely to support subterranean fauna. Calcretes, alluvial formations, fractured rock aquifers and karst limestone are known to support stygofauna. Karst, channel iron deposits, banded iron formations alluvium/colluviums in valley fill areas and fractured sandstone are known to support troglofauna.	✓	Subterranean fauna found is discussed in the context of the prevailing geological and hydrological conditions.
Identifying impacts and their likely significance			
Identify potential impacts	Examples of impacts include excavation of rock, groundwater extraction or reinjection, changed surface topography influencing groundwater flows, alterations to groundwater quality (e.g. through leaks), salinisation or vegetation clearing.	×	Not undertaken.
Identify potential significance to subterranean fauna	Impact may depend on project size, duration, level of drawdown on groundwater, proportion of habitat to be impacted.	×	Not undertaken, other than spatial extent of project provided.
Appropriate level of survey			
	Survey level appropriate to the likely impacts and the likelihood of subterranean fauna being present	✓	Level 1 survey sufficient considering geology.

Appendix 7 (cont.)

Criterion		Ecologia 2014b - Level 2 Survey	
Survey design			
Sampling	Surveys led by sufficiently trained/experienced personnel	?	Unknown experience/training of field personnel. In-house identifications for stygofauna. Identifications by external taxonomic experts for troglofauna.
	Accounts for access constraints, environmental conditions, location of existing and proposed boreholes.	✓	Sample sites (boreholes) selected for appropriate groundwater/geological characteristics. Sampling both inside and outside impact area.
	Use of contemporary techniques for sampling subterranean fauna.	✓	Standard methods used for both stygofauna and troglofauna.
	Amount of sampling determined by site characteristics and likely significance of impacts.	✓	Sufficient sampling given site characteristics. Impacts not discussed.
Use of genetics	Use of DNA bar-coding to determine similarity of taxa collected with other regional samples.	N/A	Not undertaken, though recommended to resolve identification issues as the subterranean worms collected are poorly known.
	Use of population genetic analysis of frequencies of different geneotypes (to infer gene-flow).	N/A	Not undertaken, but very few specimens detected.
Use of surrogates	Use of information on one species to infer the likely distribution of a similar (but poorly sampled) species. Can be a biological or physical (habitat) surrogate.	?	Reference to similar habitat occurring in sandstone ranges to east of potential impact area. However, no determination was made of the actual continuity of these habitats, and no mapping carried out.
Specimen vouchering and lodgement			
Specimens, accompanying data and DNA sequences offered to WA Museum.		✓	Samples submitted to WA Museum.
Specimen data submitted to DPAW		?	Unknown, not stated. Likely to have been supplied as part of Reg 17 licence return.
Nomenclature should conform to current published names or the WA Museum alpha-numeric code system.		✓	Specimen names supplied by taxonomic experts.
Interpretation and reporting			
Introduction	Provide background information, project scope (including expected duration and spatial extent).	?	Spatial extent given, but no information on impacts, duration of project.
Methodology	Site selection description	✓	Described in detail. Map of locations. GPS location of each borehole.
	Sampling techniques	✓	Described in detail. Picture of trogofauna trap.
	Survey effort	✓	Survey effort given in a table (number of samples for stygofauna boreholes, dates traps left in situ for troglofauna samples).
	Specimen collection/identification and any molecular analysis	✓	Methods detailed.
	Justification of level of survey used	×	Not given, and level of survey not specifically stated.
	Limitations	✓	List of limitations given, though not specifically for this survey.
	Each persons role in survey, analysis and reporting, plus any specialists and their qualifications and experience.	✓	Given in a Table. List of external taxonomic consultants with specialties.

Appendix 7 (cont.)

Criterion		Ecologia 2014b - Level 2 Survey	
Results	Identification of specimens with their WA Museum registration numbers.	?	Identifications given, WA Museum numbers not given.
	Number of individuals and collection locations.	✓	Given in tables.
	Description of the boreholes sampled.	✓	Summary in main report, description groundwater physio-chemistry in Appendix.
	Compare sampling areas inside and outside the development area.	✓	Limited discussion as very few specimens detected.
	Note any diverse or unique assemblages	N/A	Assemblage not diverse.
	Clear Tables/Figures/Maps	✓	Summary tables and clear maps given.
	Raw data in appendices	×	Description of groundwater physio-chemistry in Appendix. No list of specimens/WA Museum reference numbers.
	Interpretation and analysis of data collected, including explanation for unusual results, discussion of likely proportion of the fauna sampled.	✓	Results linked to geology/hydrology of survey area. Discussion of likelihood of other species occurring.
	Discuss the significance of the predicted impacts on subterranean fauna.	×	No impact assessment undertaken.