



# **Mining Area C – Southern Flank**

## **Response to Submissions**

**November 2017**

**EPA Assessment No. 2085**

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**Document tracking**

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# 1. Introduction

## 1.1 Mining Area C – Southern Flank Proposal

BHP Iron Ore Pty Ltd (BHP) currently operates an iron ore mining operation at Mining Area C (Northern Flank) under Ministerial Statement (MS) 491, located approximately 100 kilometres (km) northwest of Newman township in the Pilbara region of Western Australia. BHP is seeking environmental approval under Part IV of the *Environmental Protection Act 1986* (EP Act) to develop and operate a satellite orebody at Southern Flank as part of its Mining Area C operations, and to expand the scope of disturbance currently approved at the Mining Area C hub under a single ministerial statement and development envelope (the Proposal).

The Proposal will involve conventional open-pit iron ore mining of the mineralised Marra Mamba and Brockman Iron Formation. The bulk of the orebody at Southern Flank lies above the water table but mine dewatering will be required in advance to facilitate dry mining conditions for where ore lies below the water table.

## 1.2 Assessment process

A Referral Form was submitted for the Proposal in accordance with s38 (1) of the EP Act and the Western Australian Environmental Protection Authority's (EPA) General Guide on Referral of Proposals (EPA, 2010). The level of assessment was set as a Public Environmental Review (PER) with a 4-week public review period from 8 May to 6 June, 2017.

## 1.3 Purpose and structure of this document

Six submissions were received during the four week public review period. The submissions were collated by the Office of the EPA (OEPA) with a consolidated summary of the issues provided to the proponent in accordance with Clause 10.2.6 of the *Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2012* (EPA 2012).

Additional comments from EPA Services and other DMA's raised during their review of BHP Billiton Iron Ore responses to public submissions have also been addressed by BHP. This document provides BHP's combined responses to both the summary of issues raised in the submissions and the additional comments.

BHP notes that the Administrative Procedures were superseded by new procedures in 2016, however, as the Proposal was referred prior to the change in procedures, BHP has undertaken assessment as per the Administrative Procedures 2012.

## 1.4 Changes to the Proposal since the release of the PER document

A review of the proposed disturbance and commitments in relation to disturbance was undertaken following comments 51, 12, 9, from DWER (formerly OEPA).

Table 1 outlines the revised proposed clearing following this review. Note that the approved disturbance numbers now account for changes via Attachment 7 of MS 491 which was approved post PER submission via a s45C approval. It has been determined during this disturbance review that the current mine plan and design allows BHP to commit to a reduced disturbance from that outlined in the original Proposal. The revised disturbance is outlined in the table below (Table1).

Table 1- Changes to Disturbance Summary

Element	Current Approval (MS 491)	Proposed Change (May 2017)	Revised Proposed change (September 2017)	Proposed Extent Authorised (May 2017)	Revised Proposed Extent Authorised (September 2017)
Native Vegetation Clearing	Clearing of <b>5,564</b> ha anywhere within a nominal impact assessment area of <b>11,506</b> ha and a Development Envelope of 25,815 ha	The Proposal represents 19,671.2 ha of additional clearing, of which 5,942 ha is within the Mining Area C EMP Revision 6 Impact Assessment Area.  An increase in the Proposed Mining Area C Development Envelope by 10,218 ha.	The Proposal represents <b>16,257</b> ha of additional clearing, of which 5,942 ha is within the Mining Area C EMP Revision 6 Impact Assessment Area.  An increase in the Proposed Mining Area C Development Envelope by 10,218 ha.	Clearing no more than 25,056.2 ha within a 36,032 ha Proposed Mining Area C Development Envelope.	Clearing no more than <b>21 821</b> ha within a 36,033 ha Proposed Mining Area C Development Envelope.

*Items shown in bold indicate the change from the PER. Note clearing has been rounded up to the nearest hectare in the above adjusted figures*

The updated modified indicative additional impact assessment area is shown on Figure 1 in Attachment 1. This figure also shows the original proposed “Additional Indicative Impact Assessment Area”.

As discussed in the PER document, mine design and planning is an iterative process that is informed by many variables such as ongoing exploration and market conditions. Since the time of the PER submission, there have been some minor changes made to the Modified Additional Impact Assessment Area as result of mine design and planning iterations. These changes have been enabled due to the availability of more detailed exploration data and to optimisation of haul road design for the Proposal. Figure 2 in Attachment 1 illustrates these minor changes to the Modified Impact Assessment Area.

These changes have been assessed as minor and therefore do not change the significance of impacts to flora, vegetation, fauna and subterranean fauna as outlined in the Proposal as all EPA objectives for these key factors are still met. No additional conservation significant flora or fauna, restricted subterranean fauna or significant vegetation associations are located in the areas now included to the Modified Additional Impact Assessment Area.

BHP has received approval from the EPA under s43A of the Act for the above changes to the scope of the assessment.

In relation to DWER (EPA Services) comment number 2, the Juna Downs borefield has been identified as a location for managed aquifer recharge and abstraction, to support surplus water management for the current Mining Area C operations and is being developed to replace the existing managed aquifer recharge (MAR) borefield located near to the A deposit at Mining Area C. It therefore does not form part of the Southern Flank Proposal scope.

As part of the Southern Flank PER, the potential cumulative impacts on key environmental factors such as hydrological processes and flora and vegetation were presented for the Juna Downs borefield to ensure cumulative impacts were accurately predicted.

EPA Services have advised (1<sup>st</sup> September 2017) that the Juna Downs borefield can be assessed under Part V of the EP Act. The response to comments in relation to this borefield are consistent with this advice. Should the Southern Flank project be approved, it is likely a new Ministerial Statement be issued superseding Ministerial Statement 491, In this case the Juna Downs Managed Aquifer Recharge area and associated infrastructure will be included in the development envelope.

Following discussions with EPA Services it was agreed that the rail corridor disturbance and characteristics as outlined in Schedule 1 of MS 491 (210 hectares, 35km and 60m) will be included in the final development envelope, noting that this forms part of the current approved project and is not part of this Proposal.

## **2. Response to submissions and comments**

The EPA Services part of the Department of Water and Environmental Regulation (DWER) (formerly OEPA) provided a submission on the Proposal and received submissions from the Department of Parks and Wildlife (DPaW) (now Department of Biodiversity Conservation and Attractions [DBCA]), Department of Mines and Petroleum (DMP) (now Department of Mines, Industry, Regulation and Safety [DMIRS]), Department of Water (DoW) (now Department of Water and Environmental Regulation [DWER]), Main Roads Western Australia (Main Roads WA), Department of Aboriginal Affairs (DAA) (now Department of Planning, Lands and Heritage [DPLH]) and Department of Environment Regulation (DER) (now DWER).

Detailed responses to the summary of public submissions prepared by the EPA Services are provided in Table 2 (for EPA Services comments) and Table 3 (for other decision making authorities (DMA's) comments). Figures and attachments accompanying the responses are provided in the attachments.



Table 2: Response to EPA Services comments

EPA Services comment	Proponent response
<b>Proposal</b>	
<p><i>Proposal Description/Development Envelope - Camp Hill and Juna Downs borefields</i></p> <p>1. It is noted that the Camp Hill and Juna Downs borefields for abstraction and reinjection are located outside of the Mining Area C development envelope (MAC DE) (PER Figure 38). Please provide information on whether these borefields have been constructed and under what licences.</p>	<p>The Juna Downs borefields is proposed as an abstraction (for use during water deficient periods) and as a managed aquifer recharge (MAR) option for the management of surplus water as required to support the existing Mining Area C operations. No reinjection (or abstraction) is currently being undertaken at this borefield location. Prior to the construction and operation of the Juna Downs borefield, approval will be sought under Part V of the EP Act, as per previous correspondence and discussions with the EPA Services. Juna Downs has a current monitoring bore network, with most installed pre-2015. There are a number of existing production bores and investigative MAR bores which were installed in line with the 26D process in accordance with the <i>Rights in Water and Irrigation Act 1914</i> (RIWI Act).</p> <p>No reinjection or abstraction activities are currently being undertaken at the Camp Hill location. Camp Hill has a number of historic monitoring and production holes that were drilled for MAR investigation purposes and for water supply bores. These holes were drilled on tenure to support Mining Area C operations with production bores installed following the 26D process in accordance with the RIWI Act.</p>
<p><i>Proposal Description/Development Envelope - Camp Hill and Juna Downs borefields</i></p> <p>2. As the Camp Hill and Juna Downs borefields form part of the Mining Area C - Northern Flank mine and Southern Flank proposal, figures and shapefiles should be provided illustrating the development envelopes. The EPA Services consider that a s43A amendment to the proposal should be undertaken to include these borefields into the Southern Flank assessment.</p>	<p>BHP does not consider that a s43A amendment is required for the borefields, which is consistent with verbal advice and written advice provided by EPA Services (see Attachment 2). The proposed Camp Hill borefield is presented as an additional option and potential location for any future surplus water management requirements. BHP proposes to defer the approval of the Camp Hill (or other) option at this time until further baseline information is collated for the purpose of undertaking an environmental impact assessment of the proposed activity (and once a potential location is confirmed). Within the vicinity of the proposed Camp Hill borefield, there are regional monitoring bores and test bores. BHP has commenced initial hydrological investigations for MAR in the area to inform future approvals, if required, prior to the construction of the borefield.</p>

EPA Services comment	Proponent response
<b>Flora and Vegetation</b>	
<p><i>Priority Flora</i></p> <p>3. Provide further explanation as to why BHP Billiton does not consider the local and regional impact to Priority flora species to be significant.</p> <p>Impacts to nine Priority flora species are high within the mapped extent of the MAC DE with the highest impact of 100% for 4 species (<i>Acacia bromilowiana</i> (P4), <i>Nicotiana umbratica</i> (P3), <i>Sida</i> sp. Barlee Range (P3) and <i>Triodia</i> sp. Mt. Ella (P3)) and a 93% impact for a P2 <i>Aristida lazaridis</i>. This is based on impacts to individuals rather than populations.</p> <p>Pilbara regional impacts are lower with the highest impact of 44.5% for <i>Eremophila magnifica</i> subsp. <i>magnifica</i> (P4) and 40.8% for the P2 <i>Aristida lazaridis</i>. Impacts to, <i>Sida</i> sp. Barlee Range and <i>Triodia</i> sp. Mt. Ella are 30.8% and 35.3% respectively.</p>	<p>Ten Priority flora species were identified within the Proposed Mining Area C Development Envelope. The environmental impact assessment detailed in the Proposal (Table 18, Pg145) shows that a majority of the known records of these species are located either within the Mining Area C EMP Rev 6 Impact Assessment Area or the Indicative Additional Impact Assessment Area, and therefore have the potential to be impacted from the implementation of the Proposal.</p> <p>When assessing the level of impact to a species it is important to assess the potential impacts at a local and regional level. Although a large portion (and for four species, all) of the records within the Proposed Mining Area C Development Envelope will be potentially impacted, these species are represented beyond the development envelope in the local area and wider regional. Potential impacts to the Priority flora species in question have been assessed (Onshore Environmental, 2017) and based on known records beyond the development envelope Onshore conclude that the Proposal will not result in the contraction to the known range of any species or affect the viability of their regional populations.</p> <p>Additional mapping for the ten Priority flora species has been provided in Attachment 3. This mapping shows the extent of known locations of each species within adjacent BHP tenure, and the distribution of vegetation associations from which the species have been recorded. The mapping shows that additional records for all species in question, with the exception of <i>Nicotiana umbratica</i>, occur within the adjacent tenements. It can also be seen from the mapping that the vegetation associations from which these species occur have been recorded more broadly from mapping completed within BHP's Pilbara tenure. It is considered likely that further records of the Priority flora species would occur in the mapped extent of the associated vegetation unit/s. This demonstrates that on a local scale the potential impacts will not reduce the representation of the Priority flora species in question. With regards to <i>Nicotiana umbratica</i>, this species' is a short-lived herb resulting in it not being frequently recorded; however its known distribution extends from the northern to the southern boundary of the Pilbara region (Onshore Environmental, 2017). It should be noted that the additional mapping largely only extends to the adjacent BHP tenements and records of the species are known beyond the extent of the mapping. The number of Pilbara records for each species is provided in Table 20 of the Proposal (Pg152).</p> <p>A cumulative impact assessment on the ten Priority flora was also undertaken and presented in the Proposal (Table 20, Pg152). This assessment shows potential impact on the species at a regional level and from all BHP</p>

EPA Services comment	Proponent response
	<p>disturbance (not just from the Proposal) and is based on the current best available information of the Priority flora species.</p> <p>BHP has undertaken extensive flora surveys across its tenements in the Pilbara region, and as such has detailed information of species presence within BHP's current disturbance footprint (as used in the cumulative assessment). It is difficult to accurately quantify impacts to Priority flora at a regional level, and the calculated cumulative impacts are expected to be an over-estimate due to the lack of comparable detailed regional data for the species in question (see table below, derived from Attachment 3).</p> <p>In some cases, the species in question (e.g. <i>Aristida jerichoensis</i> var. <i>subspinulifera</i> and <i>Aristida lazaridis</i>) also have known distributions beyond Western Australia, within the Northern Territory, Queensland and/or New South Wales as per the Atlas of Living Australia national biodiversity database (CSIRO, 2017a).</p> <p>When considering all known records of the species, their wider distribution, and the likely occurrence of more individuals from within suitable vegetation associations, impact to the individuals within the Proposed Mining Area C Development Envelope will not result in the contraction to the range of any species or effect the viability of their regional populations. This conclusion is supported by the impact assessment findings for the Proposal (Onshore Environmental, 2017).</p>

EPA Services comment	Proponent response					
	Species	Total Records from within Proposed Impact Areas	Total records Proposed DE	Total records BHP	Total records Naturemap	Total occurrences ALA
	<i>Acacia bromilowiana</i>	1	1	26	40	48
	<i>Aristida jerichoensis</i> var. <i>subspinulifera</i>	15	52	208	35	1,990
	<i>Aristida lazarides</i>	84	94	197	19	147
	<i>Eremophila magnifica</i> subsp. <i>magnifica</i>	39	100	513	38	60
	<i>Grevillea saxicola</i>	0	1	72	37	35
	<i>Nicotiana umbratica</i>	1	1	2	25	50
	<i>Rhagodia</i> sp. Hamersley	105	209	1,280	60	34
	<i>Rostellularia adscendens</i> var. <i>latifolia</i>	20	28	225	35	279
	<i>Sida</i> sp. Barlee Range	7	7	98	45	43
	<i>Triodia</i> sp. Mt Ella	2	2	378	33	24

EPA Services comment	Proponent response
<p><i>Vegetation</i></p> <p>4. Discuss the existing impacts of native vegetation clearing and quantify and discuss the impacts to fauna habitat.</p> <p>A satellite image of the proposal area available on Google Earth (image date 15/12/2015) indicates that a large amount of the proposed Southern Flank development envelope has already been cleared for exploration drill pads. The PER does not appear to discuss the existing impacts and does not quantify the fauna habitat that has already been cleared.</p>	<p>Existing land disturbance is present within the Proposed Mining Area C Development Envelope and considered in the Proposal. The native vegetation clearing undertaken to date is largely attributed to the approved existing mining operation at Mining Area C and ongoing exploration activities.</p> <p>Section 2.5 of the Proposal details existing approvals and operations within the Proposed Mining Area C Development Envelope and immediate surrounds. All existing land disturbance within the Proposed Mining Area C Development Envelope (as at December 2016) is also represented in Figure 7, pg37 of the Proposal.</p> <p>Within Section 11 of the Proposal, existing impacts for the key environmental factor are addressed. Specifically, Section 11.1.3.5 discusses and quantifies the existing impacts for flora and vegetation, and the extent of clearing is illustrated on Figure 16 of the Proposal.</p> <p>Within the PER document, existing impacts for terrestrial fauna are detailed in Section 11.2.3.3 and quantified in Table 27 and Table 28.</p>
<p><i>Vegetation</i></p> <p>5. Two locally significant vegetation units are subject to significant impacts from the proposal:</p> <ul style="list-style-type: none"> <li>• HS AaApr ErjpAmarCocf TwTp (Mulga and Gidgee Woodland)</li> <li>• SP AcaoAa ArobdiaChf (Western Bendee and Mulga Forest).</li> </ul> <p>Based on the consolidated vegetation mapping of all of BHP Billiton's tenements, the proposal would result in the clearing of 73% of the mapped occurrence of Mulga and Gidgee Woodland, and 48.3% of Western Bendee and Mulga Forest. The PER assesses these impacts as "low" however, evidence to support this is required.</p> <p>Mulga and Gidgee Woodland occurs in the eastern part of the disturbance footprint, with small occurrences to the</p>	<p>Additional information and a floristic analysis to determine the conservation significance of the two locally significant vegetation units is provided in Attachment 3 to support the conclusion made within the Proposal. In responding to this query, it is important to provide background information on the development of vegetation association mapping for BHP and more generally.</p> <p>In 2009, BHP developed a standard approach to vegetation mapping and nomenclature, as there was no formal guidance on this available from relevant State government departments. The intent of this was to ensure that each consultant undertaking mapping for BHP used a consistent approach to developing maps and naming conventions. In the absence of State guidance, BHP based the approach on the National Vegetation Information System (NVIS) developed by the Australian Government. Mapping undertaken for BHP is provided at two NVIS levels: Hierarchical Level III (Broad Floristic Formation) and Hierarchical Level V (Association) (see <a href="http://www.environment.gov.au/system/files/pages/06613354-b8a0-4a0e-801e-65b118a89a2f/files/vegetation-attribute-manual-6.pdf">http://www.environment.gov.au/system/files/pages/06613354-b8a0-4a0e-801e-65b118a89a2f/files/vegetation-attribute-manual-6.pdf</a> for more information). The association level maps the dominant growth form, height, cover and species (3 species) for the three traditional strata (Upper, Mid and Ground). Multivariate statistical analysis was done for each of the baseline surveys to determine the 'floristic community type.' This output is defined purely by the floristic composition, and does not account for the vegetation structural attributes, it has no absolute scale (EPA, 2016) and the distribution of floristic community types cannot be mapped accurately on the ground. The multivariate analysis was used as a reference for grouping quadrats for preliminary vegetation mapping, is</p>

EPA Services comment	Proponent response
<p>north and east of the disturbance footprint. Based on the mapped indicative areas of different mine features, it appears that approximately half of the mapped vegetation unit would be cleared for the mine pit and about a quarter for an overburden storage area (OSA). The area that would be cleared for the mine pit has already been disturbed and fragmented by extensive exploration activities.</p> <p>The PER suggests that this vegetation is not distinct from adjacent vegetation other than reflecting a longer time since fire. This reasoning should be expanded upon and substantiated with reference to the floristic analysis. A cumulative impact assessment should then be provided of the vegetation unit that Mulga and Gidgee Woodland is considered to be part of.</p> <p>The assessment by Onshore Environmental (2017a) that clearing of 73% of this vegetation unit as a "low" impact as it is not listed as a priority ecological community, by the Department of Parks and Wildlife, is not adequate as it does not consider the extent of the impacts on the defined vegetation unit. The priority ecological community list is not a comprehensive assessment of the conservation status of all vegetation in the state.</p> <p>Western Bendee and Mulga Forest occurs in the southern part of the disturbance footprint and southeast of the disturbance footprint. Based on the mapped indicative areas of different mine features, it appears that approximately half of the mapped vegetation would be cleared for an OSA.</p>	<p>also utilised to determine if there are any unique or uncommon floristic groups, and can be used to determine similarity to Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) (however it is noted that quadrat data from TECs and PECs in the Pilbara are currently not available for comparison).</p> <p>BHP has reanalysed vegetation quadrat data for a number of large baseline surveys undertaken within the Proposed Mining Area C Development Envelope, and included data from a number of historical surveys that were incorporated into the larger dataset. The resulting database contained information from 1,504 quadrats with a total of 683 flora species represented. The dendrogram provided in Attachment 3 shows that quadrats sampled in the two vegetation associations in question clustered with a number of additional quadrats from other vegetation associations. Eleven of the 15 quadrats sampled in the Mulga – Gidgee woodland formed part of the same floristic group (No. 32) which contained a total of 28 quadrats. The three quadrats within the Western Bendee – Mulga Forest grouped into three separate groups. The reanalysis of the data is consistent with the data analysis undertaken initially for the Southern Flank Baseline Report (Onshore Environmental, 2011).</p> <p>As part of this response, BHP sought a professional opinion on the importance of these two vegetation associations from Dr Darren Brearley from Onshore Environmental and Dr Stephen Van Leeuwen from the Department of Biodiversity Attractions and Conservation:</p> <p>Mulga and Gidgee Woodland was burnt prior to the baseline surveying, and as such is likely mapped as an artefact of the floristic analysis and fire history (Attachment 3). It is not considered to be a significant unit and is typical of a fire degraded Mulga community on lower BIF ranges in the Newman to Karijini area (S. Van Leeuwen pers comm.).</p> <p>The Western Bendee and Mulga Forest community is considered an important community and is of high conservation value principally because of its long-unburnt status (S. Van Leeuwen pers comm.). Based on Stephen Van Leeuwen’s knowledge of the Pilbara, this community is believed to occur west of the Great Northern Highway, from west and south of Coondewanna Flats to West Angelas and east to Wanna Munna. The extent of these communities occur beyond the available mapping for BHP tenure, and therefore data that could be considered in a cumulative impact assessment. Nevertheless, the floristic analysis provided in Attachment 3 shows that representations of this community occur more widely in BHP tenure, and impacts to it are not likely to be significant.</p> <p>All survey work and preparation of EIAs pre-dates the release of the EPA’s guidance in December 2016. BHP received advice from the EPA that due to the ‘near completion of the draft PER document the policies and</p>

EPA Services comment	Proponent response																													
<p>The PER suggests that this vegetation unit is not distinct as BHP Billiton’s Iron Ore’s consolidated mapping contains seven 'closely affiliated' vegetation associations with the same dominant species in the same landscape position, and that similarly dominated vegetation occurs in Karijini NP. This reasoning should be expanded upon and substantiated with reference to the floristic analysis, particularly in relation to understorey species composition. A cumulative impact assessment should then be provided of the vegetation unit that Western Bendee and Mulga Forest is considered to be part of.</p> <p>The reason provided in Onshore Environmental (2017a) for the assessment of 50% clearing of this vegetation unit as a "low" impact was that "valley floor mulga" (of which this vegetation unit is a part), considered an 'Ecosystem at Risk' by Kendrick (2001), is not listed as a priority ecological community by the Department of Parks and Wildlife. This reason is not adequate as it does not consider the extent of the impacts on the vegetation unit. As stated above, the priority ecological community list is not a comprehensive assessment of the conservation status of all vegetation in the state. The EPA's Environmental Factor Guideline Flora and Vegetation provides a range of reasons why vegetation could be considered significant beyond listing as a threatened or priority ecological community.</p>	<p>guidelines should only be applied to the draft document as far as is practicable' (EPA Ref CMS16136/17-000763).</p> <p>BHP has reviewed the Flora and Vegetation EIA against the requirements of the December 2016 Technical Guideline and remapped the vegetation according to the new guide. Section 8.3 of the EPA’s (2016) guidance states: “In areas where no existing regional data is (sic) available, vegetation units should be described at NVIS Level III – Broad Floristic Formation for regional scale and cumulative impact assessment.” As there are no regional data for the Pilbara, BHP has reassessed regional and cumulative impacts at the NVIS Level III - Broad Floristic Formation (BFF) scale.</p> <p>The table below shows the Broad Floristic Formations that occur within the Proposed Mining Area C Development Envelope, with the total area present within BHP Iron Ore’s GIS database, and total area within indicative impact assessment areas assessed under the Mining Area C Revision 6 EMP and the Mining Area C Southern Flank PER. The final column shows proportional cumulative impact of proposed clearing at Mining Area C and Southern Flank. With the exception of two units, all BFFs will have a less than 5% impact. The BFF with the highest proportional impact is the Corymbia Low Woodland, at up to 26% cleared. Note that as this proportional impact is based solely on areas mapped within BHP tenure, the actual proportional impact is likely to be significantly less.</p> <p>The two vegetation units of interest correspond to the following BFFs.</p> <ul style="list-style-type: none"> <li>• HS AaApr ErjpAmarCocf TwTp - Acacia Low Woodland</li> <li>• SP AcaoAa ArobDiaChf - Acacia Low Open Forest</li> </ul> <table border="1" data-bbox="842 1018 2018 1337"> <thead> <tr> <th>Broad Floristic Formation</th> <th>BHP IO (ha)</th> <th>Mining Area C Development Envelope (ha)</th> <th>Mining Area C Revision 6 EMP Indicative Impact Assessment Area (ha)</th> <th>New Modified Indicative Additional Impact Assessment Area (ha)</th> <th>Cumulative proportional impact (South Flank and Mining Area C) (%)</th> </tr> </thead> <tbody> <tr> <td>Acacia High Shrubland</td> <td>7,867</td> <td>41</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Acacia Low Open Forest</td> <td>38,583</td> <td>462</td> <td>26</td> <td>218</td> <td>&lt;1</td> </tr> <tr> <td>Acacia Low Open Woodland</td> <td>23,735</td> <td>1</td> <td>0</td> <td>1</td> <td>&lt;1</td> </tr> </tbody> </table>						Broad Floristic Formation	BHP IO (ha)	Mining Area C Development Envelope (ha)	Mining Area C Revision 6 EMP Indicative Impact Assessment Area (ha)	New Modified Indicative Additional Impact Assessment Area (ha)	Cumulative proportional impact (South Flank and Mining Area C) (%)	Acacia High Shrubland	7,867	41	0	0	0	Acacia Low Open Forest	38,583	462	26	218	<1	Acacia Low Open Woodland	23,735	1	0	1	<1
Broad Floristic Formation	BHP IO (ha)	Mining Area C Development Envelope (ha)	Mining Area C Revision 6 EMP Indicative Impact Assessment Area (ha)	New Modified Indicative Additional Impact Assessment Area (ha)	Cumulative proportional impact (South Flank and Mining Area C) (%)																									
Acacia High Shrubland	7,867	41	0	0	0																									
Acacia Low Open Forest	38,583	462	26	218	<1																									
Acacia Low Open Woodland	23,735	1	0	1	<1																									

EPA Services comment	Proponent response					
	Acacia Low Woodland	18,344	530	0	313	2
	Acacia Open Scrub	8,780	1,763	425	730	13
	Callitris Low Open Forest	583	153	0	15	3
	Corymbia Low Woodland	3,772	15,703	256	714	26
	Eucalyptus Low Open Forest	4,120	49	0	2	<1
	Eucalyptus Low Woodland	1,762	24	7	0	<1
	Petalostylis Shrubland	1,108	155	16	117	12
	Themeda Open Tussock Grassland	1,611	207	0	68	4
	Themeda Tussock Grassland	5,429	768	125	144	5
	Triodia Hummock Grassland	316,239	21,508	59,595	6,244	4
	Triodia Open Hummock Grassland	717,789	3,338	155	1,148	2
<p><i>Camp Hill and Juna Downs borefields</i></p> <p>6. Discuss the impacts to flora and vegetation as a result of the Camp Hill and Juna Downs borefields. Information should be provided on the area and impacts of clearing proposed to establish the borefields and the indirect impacts of drawdown and mounding as a result of abstraction and reinjection. This should include maps showing the proposed location, proximity to the PEC on the Coondewanna Flats, a table quantifying the impacts and a discussion of the impacts on the EPA's objectives for Flora and Vegetation.</p> <p>The PER states that "Any potential impacts to the environment from the Camp Hill borefield has been assessed as part of the development of the Mining Area C EMP Revision 6 for both water supply and managed</p>	<p>Approval is currently being sought for the Juna Downs borefield under Part V of the EP Act as per previous correspondence and discussions with the OEPA (see Proponent response to EPA Services comment no.1 and Attachment 2). Shapefiles for indicative impact areas for the Juna Downs borefield are provided in Attachment 1.</p> <p>Prior to the construction and operation of the Camp Hill borefields (or other option if a more suitable location is identified in the future to support Mining Area C operations), approval will also likely be sought under Part V of the EP Act in consultation with EPA Services, Detailed information and impact assessment for the borefields will therefore be provided during the future Part V assessment process.</p> <p>As there is potential for groundwater mounding from the proposed Juna Downs borefield to interact with the Coondewanna Flats PEC, potential impacts from mounding has been included in the Proposal to ensure cumulative impacts to the PEC have been adequately addressed (refer to Proponent response above against EPA Services comment No.2 for additional information).</p> <p>Onshore Environmental's environmental impact assessment for the Mining Area C EMP Revision 6 (Onshore Environmental, 2015) identified areas of groundwater dependant vegetation (GDV) within the Approved Mining</p>					



EPA Services comment	Proponent response																																												
<p>aquifer recharge (MAR) purposes and subsequently an assessment of a MAR Borefield at Juna Downs has been undertaken." The Mining Area C EMP Revision 6 (EMP Rev 6) states that "A Managed Aquifer Recharge (MAR) trial is currently in operation to reinject surplus water back into the aquifer. This activity is managed under the Mining Area C operating licence." Appendix F of EMP Rev 6 notes that Camp Hill is a potential borefield option. The modelled changes to groundwater levels from the dewatering of the potential Camp Hill borefield and a MAR were discussed in the EMP Rev 6. Impacts to vegetation from changes in groundwater levels at Camp Hill do not appear to have been discussed. Therefore the environmental impacts of dewatering and reinjection on vegetation at Camp Hill and Juna Downs have not been previously considered by the EPA Services and are not presented in the PER.</p>	<p>Area C (Northern Flank) Development Envelope and surrounds (which included the area at the proposed Juna Downs and Camp Hill borefield areas).</p> <p>A summary of impacts relating to clearing of vegetation and flora is provided below (impacts relating to changes in groundwater levels on vegetation and flora were presented in the PER). The additional area to the prescribed premises boundary covered under Environmental Licence L7851/2002/6 is referred to as the Project Area (see new figure Juna Downs Project Area Flora in Attachment 1). The project covers approximately 2,677 ha. The proposed area for clearing for the pipeline is approximately 20 ha within this Project Area. The length of pipeline within the Project Area is approximately 13 km.</p> <p>Thirteen vegetation associations from eight broad floristic formations (BFF) were recorded within the Project Area. Due to the lack of regional vegetation data for the Pilbara, regional and cumulative impacts have been assessed at the BFF level (see Table below). The additional clearing associated with construction of the pipeline will have a negligible regional or cumulative impact on vegetation.</p> <table border="1" data-bbox="844 742 2018 1342"> <thead> <tr> <th>Broad Floristic Formation</th> <th>Area within Project Area (ha)</th> <th>Area within Proposed MAC Development Envelope (ha)</th> <th>Total Area within BHP database (ha)</th> <th>Proportional area (%)</th> </tr> </thead> <tbody> <tr> <td>Acacia Low Open Forest</td> <td>150</td> <td>462</td> <td>38,583</td> <td>2</td> </tr> <tr> <td>Acacia Low Open Woodland</td> <td>891</td> <td>1</td> <td>23,735</td> <td>4</td> </tr> <tr> <td>Acacia Low Woodland</td> <td>46</td> <td>530</td> <td>18,344</td> <td>3</td> </tr> <tr> <td>Eriachne Tussock Grassland</td> <td>8</td> <td>0</td> <td>374</td> <td>2</td> </tr> <tr> <td>Eucalyptus Low Open Forest</td> <td>54</td> <td>49</td> <td>4,120</td> <td>3</td> </tr> <tr> <td>Themeda Open Tussock Grassland</td> <td>&lt;1</td> <td>207</td> <td>1,611</td> <td>13</td> </tr> <tr> <td>Triodia Hummock Grassland</td> <td>324</td> <td>21508</td> <td>31,6239</td> <td>7</td> </tr> </tbody> </table>					Broad Floristic Formation	Area within Project Area (ha)	Area within Proposed MAC Development Envelope (ha)	Total Area within BHP database (ha)	Proportional area (%)	Acacia Low Open Forest	150	462	38,583	2	Acacia Low Open Woodland	891	1	23,735	4	Acacia Low Woodland	46	530	18,344	3	Eriachne Tussock Grassland	8	0	374	2	Eucalyptus Low Open Forest	54	49	4,120	3	Themeda Open Tussock Grassland	<1	207	1,611	13	Triodia Hummock Grassland	324	21508	31,6239	7
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<p><i>Weeli Wolli Spring and Ben's Oasis</i></p> <p>7. Identify monitoring and contingency actions for vegetation health at Weeli Wolli Spring PEC locations, particularly Ben's Oasis.</p> <p>The Central Pilbara Water Resource Management Plan (CPWRMP) reports that predicted cumulative groundwater drawdown from Mining Area C and Hope Downs operations is 3 m-14 m at Weeli Wolli Spring and 2 m-5 m for Ben's Oasis. Monitoring indicates that, as of 2017, there has been a groundwater level drop of -14 m at Bore Hole 15, near the edge of the Weeli Wolli PEC.</p> <p>The CPWRMP states that the cumulative impact would result in decline of groundwater dependent vegetation at both sites. It is unclear whether the loss of surface water into aquifer recharge areas such as Coondewanna Flats has been included in models of groundwater drawdown at Weeli Wolli Spring PEC locations, this should be clarified.</p> <p>The CPWRMP does not currently contain trigger and threshold criteria for the Weeli Wolli Spring PEC locations as "it is impossible to determine accurate trigger and threshold values which attribute to BHP's Billiton Iron Ore's operations alone until Hope Downs closure plans are known."</p> <p>The groundwater model is predicting that Mining Area C could contribute up to 50% of drawdown at Ben's Oasis,</p>	<p>The Central Pilbara Water Resources Management Plan (CPWRMP) is currently in draft form and was submitted with the Proposal (as part of Appendix 7) in order to outline the potential management approach for water impacts in the Central Pilbara catchments.</p> <p>An updated version of the draft CPWRMP has been attached (Attachment 4) that provides more detail on the management framework for how BHP will respond to potential changes in hydrologic processes that support ecological receptors. The updated Plan includes:</p> <ul style="list-style-type: none"> <li>• Commitment to a monitoring strategy for identifying and validating change in hydrologic processes attributable to BHP operations and the proposed trigger response actions (CPWRMP Section 4.2);</li> <li>• Summary of key impact pathways between BHP operations and the water sensitive receptors BHP has identified in the vicinity (CPWRMP Section 4.3);</li> <li>• Commitment to management principles for avoiding, minimising and mitigating potential BHP impacts attributable to BHP operations at these sensitive receptors (CPWRMP Section 4.7); and</li> <li>• Commitment to BHP's approach to mitigation strategies for changes to hydrological processes at a receptor when attributable to a third party activity (CPWRMP Section 4.7).</li> </ul> <p>Section 5.1.2 and the Draft Schedule for Weeli Wolli Creek (schedule 2) of the CPWRMP commits BHP to update triggers and thresholds when the level of scientific knowledge relating to a key environmental or social receptor produces results which justify a change in the current triggers and thresholds or when monitoring results justify a change in the current triggers and thresholds.</p> <p>In relation to the development of triggers and thresholds, BHP does not hold tenure over the area where Bens Oasis is located. BHP have made multiple requests (and will continue to do so) to either access the area to undertake surveys or access data obtained from surveys in the area but to date have been declined this access.</p> <p>It is expected that the EPA Services will include a condition which requires BHP to develop and implement a management plan that provides further detail on monitoring and contingency actions for vegetation health at the Weeli Wolli Spring PEC. Schedule 2 in the CPWRMP (Attachment 4) provides a draft management plan.</p> <p>Catchment loss was not included in regional modelling as BHP considers that a minor change (&lt;1% of the Fortescue Marsh catchment area) in runoff is not material (see Table 55 of the PER).</p>				

EPA Services comment	Proponent response
<p>and 30% at Weeli Wolli Spring. It would therefore be appropriate for contingency actions to be developed, particularly for Ben's Oasis, if there is an observed decline in groundwater dependent vegetation.</p>	<p>It should be noted that Mining Area C may potentially contribute the magnitude of change quoted by the EPA services for Ben's Oasis and Weeli Wolli Spring. However, the absolute change that BHP may contribute is an order of magnitude lower at these receptors than that resulting from RTIO activity prior to Hope Downs Closure. Note that BHP have assumed that RTIO closure activities will follow their published plan and that the plan is successful in returning the aquifer to final state.</p> <p>The prediction of cumulative drawdown at Weeli Wolli Spring in the CPWRMP is based on Bore 18 (located at the spring), not Bore hole 15 (located immediately north-east of Hope Downs). Drawdown predictions at Bore hole 15 range from 25 to 45m peaking in 2026. Current water level data measured at Bore hole 15 are within model predictions.</p> <p>Some additional clarification in regards to Coondewanna Flats is also provided below.</p> <p>The surface water assessment (Appendix 7 – Surface Water EIA; Section 3.4 and Figure A-2) took into account existing catchment modifications such as road and rail infrastructure and culvert locations were used in the supporting modelling work. However the presence of roads and rail culverts was not considered to have a material influence on the assessed catchment change at Coondewanna. Specifically the culverts will regulate flow from the upstream catchment which would reduce peak flow levels but would not change the volume of water reporting to Coondewanna.</p> <p>The Strategic Environmental Assessment (SEA) proposed that 5-20% of catchment disturbance be considered a low level of hydrological change in Pilbara catchments. This is due in part to high variability of interannual rainfall in the region. The Southern Flank PER biodiversity assessment (Appendix 4 – Flora and Veg EIA Southern Flank Part 1, Section 4.3 pp 98) concluded that the cumulative catchment change from MAC combined operations was unlikely reduce biological diversity or ecological integrity of the Coondewanna Flats PEC. While BHP's assessment considers the assessed catchment change to pose a low risk, there is an opportunity to conduct further work to confirm this assessment. This work would also support assessment and inform management of future developments within the catchment as outlined in the SEA. Additional work may include elements such as but not limited to improved rainfall modelling for the Coondewanna catchment, detailed hydrological mapping of the Lake Robinson complex, historical analysis of rainfall and lake filling processes and detailed vegetation mapping around the lake boundary.</p>

EPA Services comment	Proponent response
	<p>Should this further work identify potential for detrimental change at Coondewanna Flats then it will be used as the basis to develop triggers, thresholds and actions to manage potential surface water impacts at Coondewanna Flats. This approach has been included in the updated CPWRMP.</p> <p>BHP is committed to ensure no detrimental impacts to the biological diversity and ecological integrity of the Priority Ecological Communities at Coondewanna Flats. Based on consultation with Departments to date this aligns with their management objectives. Ongoing consultation will be undertaken to ensure alignment is maintained between the Departments management objectives and BHP’s water management approach.</p>
<p><i>Weeds</i></p> <p>8. Further information should be provided on how weed management will be improved to prevent the areas surrounding the current proposal declining in condition as they have around the northern flank development.</p> <p>Vegetation condition in the undeveloped southern half of the Development Envelope was rated as Pristine, Excellent and Very Good. This was in contrast to condition ratings around existing MAC operations in the northern sector where vegetation condition was rated as Very Good, Good or Completely Degraded (Figure 15 of the PER). The lower condition around the existing MAC operations was "largely related to grazing by domestic cattle, hot or frequent fires, and clearing associated with mining and exploration activities" (Onshore Environmental 2011). The proponent should provide further information on how management will be improved to prevent the areas surrounding the current proposal declining in condition as they have around the northern flank development. This is important as the remaining occurrences of Mulga and Gidgee Woodland, one of the vegetation units that will be highly cleared, are</p>	<p>The environmental impact assessment for flora and vegetation showed there is an increased prevalence of weed species within Approved Mining Area C (Northern Flank) Development Envelope. It was also reported that an increase of weed species and their distribution within disturbed sites in the Additional Development Envelope is considered likely (Onshore Environmental, 2017).</p> <p>Areas of decreased vegetation condition are largely associated with operations of the Juna Downs pastoral lease located north north-east of the existing mining operations (Figure 15 of the Proposal). Figure 15 of the Proposal shows the majority of vegetation condition surrounding existing operations in the northern sector as being Good to Excellent. This condition is largely unchanged from pre-mining surveys; with the area to the north-west of the Mining Area C operation mapped as good condition, being surveyed pre-mining by Ecologia Environmental in 1997 and reported as being “generally in reasonable condition” (Ecologia 1998).</p> <p>It is also important to note that the high number of weed records surrounding the Northern Flank, in comparison to the Southern Flank, is considered in part due to the number of targeted weed surveys undertaken at the Mining Area C operations. Identification and mapping of weed species is undertaken during annual weed surveys. The majority of records are associated with cleared areas and are removed when rehabilitation is undertaken. Further, the comparatively low number of weeds outside areas targeted during weed management surveys is compounded by the lack of regional data on weed locations and prevalence. A recent project undertaken by the CSIRO has increased the number of accessible weed records from the Pilbara from 800 to in excess of 500,000 (comprising 125 different weed species) (CSIRO, 2017b).</p> <p>Figure 11 in the Southern Flank baseline flora survey (Onshore Environmental, 2011) shows the distribution of weed species recorded during surveys commissioned by BHP, which primarily occur on BHP tenure (due to the focus of survey work in these areas). Weeds are widespread and common in areas outside active mining areas, as vectors for weed spread in addition to mining activities include cattle and wind. Weeds are by nature</p>

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<p>immediately adjacent to proposed disturbance areas so would be particularly vulnerable to indirect impacts.</p> <p>The PER states that "Existing operations at Mining Area C manage the introduction of weed species through various strategies associated with prevention (quarantine) and control (targeted spray programs and progressive rehabilitation)." However, the Flora and Vegetation Impact Assessment Report (Onshore Environmental 2017a) states that "there is an increased prevalence of weed species within developed project areas at Mining Area C." This is verified by Figure 16 of the PER which shows that weeds are not prevalent in the southern half of the development envelope but are more frequent and of greater species richness around the northern flank development. Onshore Environmental (2017a) goes on to state that "an increase of weed species and distribution within disturbed sites in the Additional Development Envelope is considered likely." This is directly in contradiction to the PER document, which states that "implementation of the proposal is not expected to significantly increase the risk of weed invasion and spread, provided current management processes are maintained."</p>	<p>disturbance colonisers, and therefore increased disturbance will result in an increase in prevalence of weeds widely present in the environment.</p> <p>BHP would like to provide clarification that implementation of the proposal is not expected to significantly increase the risk of weed invasion and spread <b>into areas of undisturbed vegetation</b>, provided current management processes are maintained. Onshore Environmental (2017) states that the "impacts of increased weed spread to native vegetation and flora (including conservation significant species) is not considered significant provided that they are restricted to areas of disturbance". Mining activity will not result in a significant decline in vegetation condition for areas outside of the Proposed Mining Area C Development Envelope. All vegetation clearing is managed by BHP's internal PEHR process, with only essential clearing permitted in approved project areas and not beyond the development envelope boundary.</p> <p>Nevertheless, as a result of the findings from the environmental impact assessments (Onshore Environmental, 2017), BHP is committed to improved weed management at the Mining Area C operations in association with the proposed expansion and reference to weed management has been included into Schedule 2 of the Draft Biodiversity EMP (Attachment 5).</p> <p>A weed management strategy will be developed by applying the risk based approach, and in consideration of the relevant Principles, Priorities and Management Stages identified in the <i>Australian Weed Strategy 2017 – 2027</i> (Department of Agriculture and Water Resources, 2017) and informed by the <i>Environmental Weed Strategy for WA</i> (CALM, 1999).</p> <p>Such management actions may include:</p> <ul style="list-style-type: none"> <li>• Regular weed surveying and spraying</li> <li>• Prior to weed spraying program, areas are identified for spraying based on risk and likelihood for dispersal. These include, rehabilitation area, topsoil stockpiles, creeks, rail corridors and office areas</li> <li>• Weed hygiene certification for surface mobile equipment which requires cleaning and inspection of vehicles prior to entry to site</li> </ul> <p>It is expected that the EPA Services will include a condition which requires BHP to develop and implement a management plan that provides further detail on the monitoring and management actions in relation to biodiversity management. Further detailed management actions and measures will be provided in a Biodiversity Environmental Management Plan developed for the Proposal.</p>

EPA Services comment	Proponent response
	<p>The likely wider occurrence of “Mulga and Gidgee Woodland” and its significance are discussed in detail above (refer to Proponent response above against EPA Services comments no.5 for additional information).</p>
<p><i>Modified Indicative Additional Impact Assessment Area</i></p> <p>9. Provide information on the degree to which the Modified Indicative Additional Impact Assessment Area (Modified IAIAA), if implemented, would alter hydrological and other indirect impacts.</p> <p>The Modified IAIAA has been proposed as a mitigation measure however its implementation has not been committed to. If implemented the potential reduction of direct impacts to flora and vegetation including significant flora and Mulga and Gidgee Woodland, and reduce fragmentation of locally significant vegetation. Information should be provided on the degree to which indirect impacts are altered.</p>	<p>Indirect impacts to flora and vegetation are discussed under Section 11.1.4.2 of the Proposal. Such impacts are not expected to significantly change as a result of implementing the Modified IAIAA, when compared to the assessment of the Indicative Additional Impact Assessment Area. The changes resulting from the Modified IAIAA are largely associated with ground disturbance and direct impacts to flora and vegetation.</p> <p>The result of the Modified IAIAA on surface water catchments was detailed in Table 56 of the PER. If the Modified IAIAA is implemented the overall run-off volumes would remain within regional and seasonal variations for the catchment. The Modified IAIAA, if implemented, is predicted to have no change to potential impacts to groundwater.</p> <p>The groundwater and surface water assessments extended to the catchment boundaries and encompass both the Modified IAIAA and the New Modified IAIAA. As a result both IAIAA footprints are well inside in the surface water and groundwater assessment areas. Changes made within the New Modified IAIAA have not altered the outcomes of the groundwater or surface water assessment.</p>
<p><i>Cumulative impacts</i></p> <p>10. Provide information on the cumulative impacts of developing over 19,000 ha in terms of maintaining landscape and ecosystem processes. Include an explanation of both clearing and surface and groundwater impacts.</p> <p>At over 19,000 ha of clearing this project is the largest area of clearing for a single proposal assessed by the EPA. In 2014, the EPA released s16(e) advice, <i>Cumulative environmental impacts of development in the Pilbara region</i>, outlining its concern that the increasing cumulative impacts of development and land use in the</p>	<p>BHP understands the concerns of the EPA over increasing cumulative impacts in the Pilbara. As a result, BHP has developed a regional approach in consultation with government agencies and the EPA. The Proposal comprises numerous new orebodies at Southern Flank, the existing approved Mining Area C North Flank operations and an area of additional disturbance to the north-west of the approved operations, which will be operating over a 30 year life span. The Proposal enables the assessment of these multiple deposits and existing operations, cumulatively over a large area and long life span, in preference to continuing existing approvals, and developing multiple new and smaller proposals. This has resulted in a proposal that has assessed cumulative impacts within the development envelope over a 30 year period.</p> <p>Each factor has been assessed cumulatively within the development envelope, and where information is available, has considered cumulative impacts from non-BHP mines operating in the Weeli Wolli sub-catchment. The regional management approach is presented in Section 10 of the PER, and cumulative impacts are presented for each factor in relevant subsections in the PER. The management strategies presented in the PER and Draft Biodiversity Environmental Management Plan consider potential impacts from each deposit and will be</p>

EPA Services comment	Proponent response
<p>Pilbara will significantly impact on biodiversity and environmental values (EPA 2014).</p> <p>Mine planning and design at such a large scale should be undertaken with consideration of maintaining landscape and ecosystem processes. In its 2014 strategic advice, the EPA recommended that a more strategic approach is required which identifies and considers cumulative environmental impacts, and outlines strategies to minimise and manage them.</p> <p>The span of the proposal from the Great Northern Highway in the west through to Hope Downs then Weeli Wolli Creek in the east effectively creates a barrier to north-south movement of species across the landscape and may impact on ecosystem processes.</p> <p>In addition to clearing impacts, landscape-scale processes of surface water accumulation and flow will be changed as a result of this and nearby proposals.</p> <p>"The total cumulative area of mine-affected areas and diverted catchments for South Flank, North Flank, Baby Hope, and Hope Downs 1 is approximately 6.9% of the Coondewanna catchment, 7.2% of the Weeli Wolli Creek catchment, and approximately 2% of the Fortescue Marsh catchment" (MWH 2016). It is not clear what proportion of the surface water this represents (i.e. whether there is a linear relationship). This reduction in surface water may reduce the recharge of groundwater.</p>	<p>applied across the Proposed Mining Area C Development Envelope. In the case of water management, this will be applied at a catchment level through the CPWRMP.</p> <p>BHP acknowledges the extent of clearing associated with the Proposal and the importance of managing this through the expected 30 years of the life of the mine. The proposed Closure Plan submitted with the Proposal identifies progressive rehabilitation, adaptively managed during the life of the mine to meet holistic landscape scale outcomes as an important aspect of managing landscape scale ecosystem processes. The Closure Plan identifies the need for a regional approach adaptable over time, as opposed to considering individual mines in isolation. The regional approach, by its very nature, provides an avenue to consider potential post closure cumulative impacts including visual amenity, water, land use, and biodiversity/ecosystem function.</p> <p>BHP are also currently seeking approval of a Strategic Proposal (BHP, 2016a) for its deposits in the Pilbara. Impacts of this Proposal are included in the cumulative impact assessment that was undertaken for the Strategic Proposal at an IBRA scale. The Mining Area C Southern Flank Proposal represents 15% of the total footprint of the Full Development Scenario presented in the Strategic Proposal.</p> <p>In regards to the impact of the proposal on the movement of species and dispersal, BHP Billiton Iron Ore understands that some species survival may be dependent on their ability to move through the landscape taking advantage of resources that are available seasonally in different habitats. Significant barriers to accessing these seasonal resources could result in the collapse of a local population. Other species are highly adapted to local environments and habitats and do not need to move widely through the landscape to survive; these species are less likely to be impacted by barriers to movement.</p> <p>Some taxa share similar ecological characteristics that limit their dispersal, for example burrowing taxa may only leave burrows when juveniles, as a new generation, or when males search for a mate (SRE EIA for the PER - Biologic 2016). Millipedes are an extremely diverse group with many taxa known to be short range endemics (South Flank SRE Survey - Biota 2011) having poor dispersal capabilities due to their slow pace and cryptic habitats. Their survival then, is not dependent on their ability to disperse. Mark Harvey (2002) noted that SRE fauna typically display ecological and life history traits that include poor dispersal powers and confinement to discontinuous habitats.</p> <p>Nine fauna habitats have been mapped within the Proposed Mining Area C Development Envelope (PER Table 24). Two of these habitats have been identified as being important for the dispersal of fauna (Gorge/Gully and Major Drainage Line) and are therefore important corridors of connectivity. Within the Proposed Mining Area C Development Envelope, natural dispersal corridors run in an east-west direction, divided by the Packsaddle,</p>

EPA Services comment	Proponent response
	<p>North Flank and South Flank ranges. BHP has been able to avoid much of this important dispersal habitat. Due to modification of the indicative impact assessment area, potential clearing within Major Drainage lines has been reduced from 21 ha to 0 ha and within Gorge/Gullies from 465 ha to 383 ha.</p> <p>Less significant north-south dispersal corridors will be retained as the opening of deposits is scheduled across the 30 year life of the project. All deposits across the development will not be open at one time, and progressive rehabilitation will be undertaken in those deposits where mining has ceased (as described in the Mine Closure Plan). The nature of deposits across the South Flank range may enable the development of 'land-bridges' across narrow pit voids, that combined with rehabilitation and retained natural habitats between pits, will retain north-south corridors post-closure in these areas. This process is supported by planned in pit waste rock storage of 30% – 50 %</p> <p>BHP is committed to managing habitat connectivity to ensure that populations are not isolated in the long-term as a result of the Proposal. As presented in the PER, Biodiversity EMP and Mine Closure Plan, BHP has committed to the re-establishment of Antichiropus habitat within rehabilitation where practicable (see response to question 19 below). The gradual expansion of invertebrate populations, and the return of fauna species back into rehabilitated areas will be monitored and adaptively managed by BHP through the life of the project.</p> <p>The avoidance of important east-west dispersal corridors, the long timescale of the Proposal combined with, progressive and non-concurrent mining of deposits supported by progressive rehabilitation of closed pits, provides BHP with the opportunity to effectively manage habitat connectivity across the Proposed Mining Area C Development Envelope during and post mining activities.</p> <p>There are few species dependent on regional movement between North and South Flank. Ghost bats and bird species are highly mobile and able to fly between locations, or are likely to utilise major drainage systems as conduits i.e. Weeli Wollie Creek. Small less mobile species are commonly not dependent on seasonal movement, and population connectivity is likely to remain at a generational scale supported by the long timescale of the proposal, the scheduling of operations, and progressive rehabilitation.</p> <p>In the surface water assessment undertaken for the Proposal, a reduction in catchment area has been considered as an equivalent reduction in runoff volume. Using catchment reduction as an equivalent reduction in runoff volume is a conservative approach to surface water impacts. While runoff volumes are considered to be proportional to impact percentage, peak runoff and flood level reduction are not proportional. BHP's Strategic Proposal presented a framework for evaluating changes in surface water catchments based on catchment reduction (Section 10.2.2) where reduction in peak runoff is factored to 0.7 of the percentage catchment</p>



EPA Services comment	Proponent response
	<p>reduction and reduction in flood levels factored to 0.4. For environments such as Coondewanna Flats that are dependent on flooding, these reduction factors suggest that hydrologic impacts to the PEC are likely to be less than the percentage of catchment reduction stated.</p>
<p><i>Rehabilitation</i></p> <p>11. The large scale of the proposal poses significant challenges for rehabilitation, such as seed acquisition and monitoring. Plans to address these challenges should be specifically discussed. The cumulative effects on the broader area in terms of loss of habitat, vegetation and landscape connectivity should be more thoroughly considered including discussions of:</p> <ul style="list-style-type: none"> <li>• progressive rehabilitation</li> <li>• potential staging of development to retain landscape connectivity</li> <li>• completion criteria for the different mine closure domains.</li> </ul> <p>A strategic rehabilitation approach should be implemented, which integrates the re-creation of heterogeneous habitat to support biodiversity and landscape linkages to re-establish ecosystem processes. With a significant distance between remnant vegetation and some parts of the mine area, recolonisation may be unlikely without assistance.</p>	<p>As reported in Section 11.7.6 of the PER document, Southern Flank is not expected to be operational until at least 2020 with mine sequencing and scheduling at preliminary stages and yet to be finalised. Closure and rehabilitation planning, which are embedded in BHP’s Life of Asset and 5 Year Planning processes, will continue throughout the active life of the operation enabling progressive rehabilitation to be identified and undertaken in line with BHP’s normal business planning cycles. An example of a Five Year Rehabilitation plan for Northern Flank is illustrated in Figure 30 (Section 1.36) of the submitted Mine Closure Plan that formed part of the PER document, which outlines areas within the 5 year period that are available for final rehabilitation.</p> <p>Sections 1.15-1.17 of the Mine Closure Plan for Mining Area C (BHP, 2016b) detail how completion criteria will be developed for Southern Flank. At such an early stage of the mine life, the development of draft completion criteria are intended to provide directional guidance for the site. Future revisions of the criteria will focus on using improved knowledge to develop measureable metrics based on site specific data.</p> <p>Section 3.1.4 and Section 5.3 of the Mining Area C Mine Closure Plan (MCP) (Attachment 6) has been updated to align with the pastoralism and or native vegetation post-mining land use set out in BHP’s ‘Public Environmental Review Strategic Proposal (SEA). Also note Section 4.2 Table 8 of the MCP lists the forecast for stakeholder engagement expected to occur over the coming five years which specifically includes further engagement on post-mining land use.</p> <p>Section 5.2 of the MCP provides a clear objective for closure and rehabilitation with supporting closure principles, these provide the foundation for developing site specific completion criteria. Further consultation over the life of the mine will inform further definition of the post-mining land use including completion criteria. Section 5.2 has been updated to more clearly reflect this approach.</p> <p>A rehabilitation schedule for Southern Flank has now been included within the MCP (see Table 34, Section 9.4).</p> <p>BHP has an ongoing research partnership with both the University of Western Australia and the Botanic Gardens and Parks Authority aimed at developing methods to improve rehabilitation outcomes across BHP’s Pilbara mine sites. A large part of the research utilises a Controlled Environment Facility established at the Mount Whaleback</p>

EPA Services comment	Proponent response
	<p>Mine. This facility houses experimental plots that hold a variety of growth media where water can be controlled to simulate a range of rainfall scenarios where rehabilitation challenges can be addressed.</p> <p>BHP has a robust seed acquisition process for sourcing seed within the IBRA region and a 100 km radius of the mine sites. This seed is stored in purpose built storage facilities with a 3 year supply of seed on hand at all times to meet requirements of the 5 year rehabilitation planning process. This approach ensures that supply variations from year to year will have a minimal effect on planned rehabilitation activities.</p> <p>BHP has a long term monitoring program in place with baseline sites, analogue sites and rehabilitation sites up to 20 years old. Additional sites are added to the program as new mining areas are surveyed and developed.</p> <p>BHP recognises the significant challenges with recreating landscape linkages to re-establish ecosystem processes. In addition to land forming and revegetation for post mining land uses, BHP also constructs a range of purpose built habitats across the rehabilitated areas. Current examples are:</p> <ul style="list-style-type: none"> <li>• Ghost Bat Habitats at both Mining Area C and Cattle Gorge.</li> <li>• Terrestrial rock habitats placed across rehabilitated areas.</li> </ul> <p>Both of these habitat types are subject to ongoing research and improvement.</p>
<p><i>Offset</i></p> <p>12. As the proponent is unable to commit to the Modified Indicative Additional Impact Assessment Area offsets will be calculated on clearing of 19,671.2 ha of native vegetation within the Hamersley subregion. Table 13 on page 129 of the PER document shows the following vegetation condition for the Indicative Additional Impact Assessment Area (IAIAA):</p> <ul style="list-style-type: none"> <li>• 727 ha is considered to be in Pristine condition</li> <li>• 9,016 ha is considered to be in Excellent condition</li> </ul>	<p>BHP have committed to a reduced disturbance footprint (see Section 1.4).</p> <p>BHP has identified that vegetation condition mapped for the PER is not as prescribed in Table 2 of the Flora and Vegetation Technical Guidance, revised in December 2016 (EPA 2016). BHP has updated the vegetation condition mapping to align with EPA guidance as depicted in the updated Figure 15 (Attachment 1).</p> <p>The vegetation condition within all existing and potential impact areas is shown in the Table below.</p>

EPA Services comment	Proponent response				
<ul style="list-style-type: none"> <li>658 ha is considered to be in Very Good condition</li> <li>312 ha is considered to be in Good condition</li> <li>28 ha is unmapped.</li> </ul> <p>It is noted that this only totals 10,741 ha rather than the proposed 19,671.2 ha of additional clearing.</p> <p>Clarify the condition of the outstanding 8,930.2 ha of native vegetation.</p>	Vegetation Condition (Hectares)	Area Description			
		Proposed Mining Area C Development Envelope	Indicative Additional Impact Assessment Area	Mining Area C Rev 6 Impact Assessment Area	New Modified Impact Assessment Area
	Excellent	1,190	727	0	721
	Very Good	22,508	9,016	3,292	8,211
	Good	5,936	658	3,344	471
	Poor	773	312	317	312
	Unmapped	145	28	41	22
	Cleared	5482	683	4,419	578
	Total Area	36,034	11,424	11,413	10,315
	Proposal Disturbance	NA	NA	5,942	10,315
	Offsets Proposed		NA	5,942	9,425
	<p>Offsets will apply to an additional of 5,942 hectares within MAC EMP Revision 6 Indicative Impact Assessment boundary, which represents the proposed disturbance above the approved clearing allocation under MS 491. Within the new modified IAIAA, offsets will apply to all vegetation classed as good to excellent vegetation condition or unmapped areas (9,425 Ha), based on the vegetation condition at the time of the assessment. It should be noted for completeness the information on the Indicative Additional Impact Assessment Area has been presented in the table above, but the clearing aligned with this boundary is no longer proposed (see Section 1.4).</p> <p>Noting that vegetation condition has been amended to align with EPA 2016, the total of the good to excellent vegetation condition in the New Modified Indicative Impact Assessment Area has been adjusted to include the area that is unmapped – total vegetation in good to excellent condition is now 9,425 hectares (721+8211+471+22 = 9,425). The remainder of the Proposed Clearing in the New Modified Indicative Impact assessment area is cleared (578 hectares) or is in poor condition (312 hectares).</p> <p>The adjusted Proposed Offsets (including unmapped area) is 15,367 hectares which is inclusive of 5,942 Hectares within the Mining Area C Rev 6 Impact Assessment Area and 9,425 hectares in the new Indicative Modified Impact Assessment Area.</p>				

EPA Services comment	Proponent response
	<p>The proposed offset is less than the total proposed clearing of 16,257 hectares as some of the vegetation is not classed as in good to excellent condition.</p>
<p><i>Offsets</i></p> <p>13. Unless satisfactory information and rationale can be provided to support the proponent's view that a 73% cumulative loss of HS AaApr ErjpAmarCocf TwTp (Mulga and Gidgee Woodland) and a 48.3% cumulative loss of SP AcaoAa ArobDiaChf (Western Bendee and Mulga Forest) is a 'low' impact then an offset may be required.</p>	<p>Based on the additional regional and cumulative information presented in Attachment 3, BHP considers that an offset will not be required in relation to the cumulative loss of HS AaApr ErjpAmarCocf TwTp (Mulga and Gidgee Woodland) and SP AcaoAa ArobDiaChf (Western Bendee and Mulga Forest).</p> <p>Please also refer to Proponent response above against EPA Services comments no.5 for additional information.</p>
<b>Terrestrial Fauna</b>	
<p><i>Camp Hill and Juna Downs borefields</i></p> <p>14. Discuss the impacts to Terrestrial Fauna as a result of the Camp Hill and Juna Downs borefields. Information should be provided on the area and impacts of clearing proposed to establish the borefields and the indirect impacts of drawdown and mounding as a result of abstraction and reinjection. This should include maps showing the proposed location, proximity to the PEC on the Coondewanna Flats, a table quantifying the impacts and a discussion of the impacts on the EPA's objectives for Terrestrial Fauna.</p> <p>The PER states that "Any potential impacts to the environment from the Camp Hill borefield has been assessed as part of the development of the Mining Area C EMP Revision 6 for both water supply and managed aquifer recharge (MAR) purposes and subsequently an assessment of a MAR Borefield at Juna Downs has been</p>	<p>Approval is currently being sought for the Juna Downs borefield under Part V of the EP Act as per previous correspondence and discussions with the OEPA (see Proponent response to EPA Services comment No.1)</p> <p>Prior to the construction and operation of the Camp Hill borefields (or other option if a more suitable location is identified in the future to support Mining Area C operations), approval will also likely be sought under Part V of the EP Act in consultation with EPA services, Detailed information and impact assessment for the borefields will therefore be provided during any proposed the future Part V assessment process.</p> <p>A summary of impacts to terrestrial fauna is provided below (impacts relating to changes in groundwater levels on terrestrial fauna were presented in the PER). The additional area to the prescribed premises boundary covered under Environmental Licence L7851/2002/6 is referred to as the Project Area (see new figure Juna Downs Project Area Fauna in Attachment 1). The project covers approximately 2,677 ha. The proposed area for clearing for the pipeline is approximately 20 ha within this Project Area. The length of pipeline within the Project Area is approximately 13 km.</p> <p>Nine fauna habitats occur within the Project Area (see Table below) also see new figure Juna Downs Project Area Fauna in Attachment 1. The additional clearing associated with construction of the pipeline will have a negligible regional or cumulative impact on fauna habitats.</p>

EPA Services comment	Proponent response				
<p>undertaken." EMP Rev 6 states that "A Managed Aquifer Recharge (MAR) trial is currently in operation to reinject surplus water back into the aquifer. This activity is managed under the Mining Area C operating licence." Appendix F of EMP Rev 6 notes that Camp Hill is a potential borefield option. The modelled changes to groundwater levels from the dewatering of the potential Camp Hill borefield and a MAR were discussed in the EMP Rev 6. Impacts to fauna from changes in groundwater levels at Camp Hill do not appear to have been discussed. Therefore the environmental impacts of dewatering and reinjection on vegetation at Camp Hill and Juna Downs have not been previously considered by the ERA Services and are not presented in the PER.</p>	<b>Fauna habitat type</b>	<b>Area within Project Area (ha)</b>	<b>Area within Proposed MAC Development Envelope (ha)</b>	<b>Total Area within BHP database (ha)</b>	<b>Proportional area (%)</b>
	Drainage Area/ Floodplain	80	2,284	36,863	6
	Gilgai Plain	8	0	2564	<1
	Hardpan Plain	891	13	6,121	15
	Crest/ Slope	306	18,696	191,987	10
	Major Drainage Line	54	63	13,148	<1
	Minor Drainage Line	<1	2,886	11,170	26
	Mulga Woodland	174	1,203	38,525	4
	Sand Plain	170	1,108	54,862	2
	Stony Plain	990	1,607	47,452	5
	<p>One conservation significant species has been recorded in the Project Area; the rainbow bee-eater (<i>Merops ornatus</i>) which is listed as Schedule 5 under the Wildlife Conservation Act 1950. There have been no caves suitable for ghost bat recorded within the Project Area.</p> <p>Three confirmed short-range endemic (SRE) species have been recorded within the Project Area; <i>Conothele MGG282-DNA</i> (3 records from 2 locations), <i>Aganippe sp MYG306-DNA</i> (1 record) and <i>Synothele sp. indet</i> (female; 1 record). The locations of these will be avoided during construction of the pipeline.</p> <p>Indirect impacts potentially occurring from construction of the pipeline are increased dust emissions and introduced weed species. Dust impacts are only likely to occur in the short-term during construction and are</p>				

EPA Services comment	Proponent response
	<p>unlikely to have an impact on surrounding vegetation. Increased spread of weeds may occur into cleared areas; however progressive rehabilitation using removed topsoil will likely reduce this likelihood. Within the Project Area the pipeline will be buried so any fragmentation of habitat will be temporary during construction.</p> <p>Indirect impacts from the project are considered negligible and are consistent with those presented in Section 11.2.4.2 of the PER.</p>
<p><i>Ghost Bat</i></p> <p>15. Provide evidence to support the assumption that bats will move between caves in response to disturbance and will recolonise remaining caves upon closure (PER Section 11.2.5).</p>	<p>There are several studies from within the Pilbara region that demonstrate bats frequently move between caves. Specific examples and references are provided below.</p> <p>Biologic (2017a) <i>Hamersley Subregion Ghost Bat Population and Roost Assessment 2015-2016</i>. Unpublished report for BHP Iron Ore Pty Ltd:</p> <p>This project monitored a number of caves in the Hamersley subregion, particularly in the vicinity of Mining Area C. The methods included the collection of scats and tissue for DNA. One of the caves (M01) was visited on five occasions, with more than 5000 scats collected from the cave. Ghost bats were only observed in the cave on one of these visits (two ghost bats seen), whilst the genetic analysis genotyped 16 individuals. These individuals must sporadically visit cave M01, otherwise they would have been observed on more than one of the sampling occasions.</p> <p>From Armstrong and Anstee (2000) <i>The ghost bat in the Pilbara: 100 years on. Australian Mammalogy</i> 22: 93-101:</p> <p>The presence of small breeding groups in the Hamersley (this paper) and Chichester Ranges (Douglas 1967) negates any suggestions that eastern Pilbara mines are the sole focus of breeding activity within the Pilbara, although the latter is certainly the most important in terms of numbers. The degree of dispersal within the region may be high. Female philopatry and male dispersal is characteristic of this species and the species is characterised by an extremely low diversity of mitochondrial DNA (Worthington-Wilmer <i>et al.</i>, 1994, 1999). Toop (1985) found that while <i>M. gigas</i> aggregated in summer, dispersal and sexual segregation were characteristic in winter. Furthermore, Douglas (1967) reported that although only seven caves examined on Tambrey and Millstream Stations had <i>M. gigas</i> present, most caves in this area showed use by the species in the form of scat piles. This also indicates that <i>M. gigas</i> moves between caves on a regular basis.</p>

EPA Services comment	Proponent response
	<p>Capture and observations from Mt Brockman and West Angelas suggests that small groups may move about within a local area, possibly in response to disturbance, microclimate or social factors. The paucity of recaptures and the presence of new individuals recorded in the same cave (SG1) on different occasions suggest that a small group moves around within the local area.</p> <p>From Threatened Species Scientific Committee (2016) <i>Conservation Advice <u>Macroderma gigas ghost bat</u></i>.</p> <p>Ghost bats move between a number of caves seasonally or as dictated by weather conditions, and require a range of cave sites (Hutson <i>et al.</i>, 2001). Ghost bats disperse widely when not breeding, but concentrate in a relatively few roost sites when breeding.</p> <p>Ghost bats are easily disturbed when roosting. Young may be dislodged by adults in rapid take-offs (J. Toop, unpublished data) and may not return to the roost site (K. Armstrong, pers. comm., cited in Woinarski <i>et al.</i>, 2014). Such susceptibility to disturbance also threatens the viability of roosts with unregulated human visitation, including surveys which target caves and may inadvertently flush individuals into daylight.</p> <p>From Biologic (2014) <i>West Angelas – Deposit B and F Ghost Bat Assessment</i>. Unpublished report for Robe River Joint Venture:</p> <p>Capture and observations from West Angelas suggests that small groups may move about within a local area, and that cave use was intermittent. Possibly in response to disturbance, microclimate or social factors. The paucity of recaptures and the presence of new individuals recorded in the same cave on different occasions suggest that a small group moves around within the local area.</p>
<p><i>Ghost Bat</i></p> <p>16. Management and mitigation should be focused on reducing the impacts to breeding ghost bats and caves. The proposed mitigation includes management actions that may not be appropriate for this species and requires revision:</p> <ul style="list-style-type: none"> <li>Clarify the size of the buffer areas around caves. PER Table 35 &amp; 68 commits to 150 m buffer, but Section 11.2.5 states that there are caves within</li> </ul>	<p>It can be confirmed that all but two caves identified outside of the Modified IAIAA will have a 150 m buffer in place within no disturbance to occur within this buffer. The two caves that fall within 150 m of the Modified IAIAA occur within 60 m of proposed disturbance and within 105 m; both are classified as Low value caves. The former proposed disturbance is a haul road which has been redesigned to avoid direct impacts to the cave, and the maximum possible distance achieved from the redesign of the road was 60 m. The latter is located approximately 105 m from the pit boundary. The close proximity of disturbance may result in these caves not being used by ghost bats during the period of operations in that area, but if so, should be recolonised at the conclusion of local operations. An updated Figure 29 is provided in Attachment 1.</p>

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<p>90 m from proposed impacts. Indicate how the size of the buffer is appropriate to maintain the ghost bats given the caves will be isolated and there will be a significant reduction in the adjacent foraging habitat (see Biologic 2016a Figure 4.5).</p> <ul style="list-style-type: none"> <li>• PER Table 35: provide a reference to illustrate how rehabilitation of <i>Eucalyptus leucophloia</i> trees is relevant or beneficial to ghost bats. This habitat is not listed as important to this species in Appendix 5 (Biologic 2016a; McKenzie 2016).</li> <li>• PER Table 36: The Draft EMP states that it will 'minimise impacts to all known ghost bat cave locations ...', Indicate how this is achievable given the size and nature of the impact.</li> <li>• PER Table 36: Provide proposed trigger and threshold criteria during operations.</li> <li>• PER Table 36: provide proposed monitoring during mining activity to ensure that there are no impacts to remaining caves including those in buffer areas.</li> <li>• PER Table 36: State how the reintroduction of ghost bats from captive population is appropriate and achievable.</li> </ul>	<p>Note that some minor changes have been made to the Modified Additional Impact Assessment Area due to mine design and planning iterations since the time of the PER submission and that this has resulted in two additional low value cave being avoided and one low value caves being impacted (net total of one less cave being impacted).</p> <p>As described in Section 3.6 of the Ghost Bat EIA (Biologic 2016a), ghost bats have a 'sit and inspect' foraging strategy; they hang on a perch where they visually inspect their surroundings for movement. The use of <i>Eucalyptus leucophloia</i> (along with other tall tree species) in rehabilitation would result in suitable vantage points from which ghost bats can forage.</p> <p><b>Buffer size:</b></p> <p>Table 36 of the PER states that BHP will 'minimise impacts to all known ghost bat cave locations and foraging habitat, by avoiding direct impact where practicable and implementing the PEHR process prior to land disturbance.' Proposed impacts to all known ghost bat caves will be minimised initially by avoiding direct impacts where practicable for as long as possible in the progressive mine plan. Where avoidance is not feasible, all land disturbance with the potential to impact known ghost bat caves will be reviewed and approval sought via BHP's PEHR process prior to land disturbance. Only land disturbance deemed necessary will be approved, which may result in additional caves being retained for future use. It should be noted that a number of caves are located within the Modified IAIAA and therefore disturbance or removal of these caves is consider assessed, approved and deemed acceptable through the approval of the Proposal. Therefore the proposed management action in Table 36 of the Proposal is in reference to 'all caves' excluding those approved for disturbance via this approval.</p> <p>BHP has committed to retention of a 150 m buffer. This size is a conservative buffer and was based on recent work undertaken by BHP, Process Minerals and Rio Tinto, as detailed below.</p> <p>In 2014, BHP commissioned TNL consultants to determine the susceptibility of shelters (caves) to blasting impacts. The quantitative assessment utilised a number of different techniques, including vibration monitoring, laser scanning and structural mapping, plus visual observations. The study concluded that for blasting to create fresh fractures in intact block rocks, vibration will need to be at least 320 mm/s, and blasting further than 50 m from a cave is unlikely to show impacts of severe damage.</p> <p>Process Minerals International Poondano Iron Ore Project had a buffer zone in excess of 50 m from a ghost bat cave (Cave 26). Ghost bats were recorded in this cave during 2009 and following the commencement of mining</p>



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	<p>in 2012 they were subsequently recorded in this cave in 2012, 2013, 2014 and 2015 (Process Minerals International, 2013).</p> <p>Bat Call WA (2017) undertook an assessment of ghost bat caves within Rio Tinto’s Robe Valley to determine the impact of ghost bat present and activity. At Mesa A, mining has been in progress since 2010 and operations now cover a majority of the mesa; however the original escarpment on the north side of the mesa has been retained to a width of 50 to 100 m. Caves on this mesa have remained intact; however there are limited signs of ghost bat use (caves determined to be night roosts). An assessment of other mesas where mining has been completed showed that those that have had their perimeters retained will continue to be used by ghost bats, either as nocturnal or diurnal roosts. Bat Call WA (2017) concluded that the retention of a façade greater than 20 m around the mesa perimeter will result in no loss of roosts. Rio Tinto have committed to retain a 40 m mining exclusion zone between the back of each cave the proposed mine pit to protect the integrity of the roost.</p> <p><b>Triggers and thresholds:</b></p> <p>The PER states that “Implementation of the Proposal will likely have a significant impact on the ghost bat at an assemblage level during the period of mining operations. With mitigation, the long-term impact to the ghost bat assemblage within the Proposed Mining Area C Development Envelope is considered to be moderate.” (pg 197). The focus of management by BHP is to therefore ensure that over the long-term (i.e. beyond completion of mining activities) integrity of ghost bat habitat will be retained or rehabilitated to allow ghost bats to return to the area.</p> <p>During the period of operations, BHP will ensure that caves aren’t impacted through retention of buffers around caves. Monitoring of the efficacy of this will be undertaken quarterly via the land disturbance reconciliation process.</p> <p>BHP’s assessment predicts that with mitigation and management, ghost bats will return to the area following the cessation of mining. This is based on limited other studies, including Bat Call WA’s (2017) study that showed of the ten mesas in the Robe Valley where mining has been completed and the mesa façade has been retained, six have shown recent evidence of ghost bat use. If the monitoring post-cessation of mining shows that ghost bats aren’t returning to the area, then the response actions detailed within the PER (Table 36) will be implemented.</p> <p>Trigger and thresholds for the management of ghost bat impacts has been provided in Table 36 of the Proposal. With regards to land disturbance, the threshold is “no unauthorised disturbance beyond the Proposed Mining</p>

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	<p>Area C Development Envelope or within the ghost bat cave buffer zones”. With regards to the local ghost bat population, the following trigger and threshold is detailed in Table 36:</p> <ul style="list-style-type: none"> <li>• Trigger: no sign of ghost bat use in High importance caves or artificial roosts (if applicable) within the Proposed Mining Area C Development Envelope, within 5 years of cessation of operations.</li> <li>• Threshold: no sign of ghost bat use in High importance caves or artificial roosts (if applicable) within the Proposed Mining Area C Development Envelope, within 10 years of cessation of operations.</li> </ul> <p>Further detailed management measures with trigger/thresholds will be formalised through regulation of a Biodiversity Environmental Management Plan via the Ministerial Statement.</p> <p>As stated in Table 36 of the Proposal, quarterly land disturbance reconciliation (hectares and spatial footprint) will be undertaken to monitor effectiveness of the PEHR process and to ensure no unauthorised disturbance occurs. In addition, BHP proposed to undertake visual inspections of all caves that occur within 500 m of active mining operations to ensure that their integrity is maintained. The frequency and exact monitoring of these caves (if techniques additional to visual inspections are done) will be determined in consultation with the Department of Biodiversity Conservation and Attractions, as too frequent visitations have the potential to disturb bats if present at the time of inspection. Further details of the monitoring will be formalised through regulation of a Biodiversity Environmental Management Plan via the Ministerial Statement.</p> <p>Reintroduction of ghost bats would only be considered if natural recruitment back into the area does not occur. Whilst BHP are not aware of any attempts to reintroduce ghost bats into the wild from captive populations, this management option has been proposed and is considered feasible based on studies undertaken at Perth Zoo for reintroduction at Drovers Cave National Park (Claramunt, 2016). Further details on this management option will be investigated and formalised within a Biodiversity Environmental Management Plan via the Ministerial Statement.</p> <p>BHP’s Biodiversity Environmental Management Plan has been updated to include management of ghost bats and is attached to this response (Attachment 5).</p>
<p><i>Ghost Bat</i></p>	<p>Ghost bats are easily disturbed and it is anticipated that bats will move away from caves when clearing occurs nearby due to noise and vibration disturbance. Through consultation with the Department of Biodiversity Conservation and Attractions, if it is deemed necessary to undertake pre-clearance surveys, standard practices</p>

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<p>17. Consideration should be given to pre-clearance surveys for active ghost bat caves, in particular those with breeding females. To reduce the potential loss of individuals, consideration should be given to excluding ghost bats from caves immediately prior to caves being removed or cave removal should be conducted during non-breeding periods. The proponent should seek advice further advice from Department of Biodiversity Conservation and Attractions.</p>	<p>will be employed (e.g. Excluding bats from roosts at night when they are vacant and bats have a greater opportunity to move to new roosts). Details of the exact techniques and timing of pre-clearance surveys will be developed in consultation with the Department of Biodiversity Conservation and Attractions and formalised within a Biodiversity Environmental Management Plan via the Ministerial Statement.</p>
<p><i>Short range endemic (SRE) invertebrate fauna</i></p> <p>18. Additional information is required to support statements made in the PER regarding impacts to SREs, and SRE habitat availability. Provide habitat information for each species, including figures of the locations of SRE species in relation to the IAIAA and extent of habitats.</p> <p>Four confirmed SRE invertebrate species have been recorded within the IAIAA (<i>Antichiropus</i> 'DIP007' (Priority 1 Fauna Wildlife Conservation (Specially Protected Fauna) Notice 2016), <i>Austrothropus</i> 'DIP018', <i>Kwonkan</i> 'MYG339-DNA', <i>Yilgarnia</i> 'MYG197'). All species were also recorded outside the area of impact. <i>Antichiropus</i> 'DIP007', <i>Austrothropus</i> 'DIP018' and <i>Kwonkan</i> 'MYG339-DNA' are known from multiple records across the Southern Flank development envelope. The PER considers impacts to <i>Kwonkan</i> 'MYG339- DNA' and <i>Antichiropus</i> 'DIP007' in detail. To allow adequate assessment of the impacts on these four species provide:</p>	<p>Additional habitat information for <i>Austrothropus</i> 'DIP018' and <i>Yilgarnia</i> 'MYG197' was provided by Biologic (Attachment 7) and is summarised below to support assessment of potential impacts and statements made in the Proposal regarding these species. Figures to support this work and for <i>Kwonkan</i>'MYG339-DNA' are provided in Attachment 7. Figures showing the habitat extent for <i>Antichiropus</i> 'genetics' are provided in the PER (Figures 27 and 29). It is noted that figures showing likely or potential habitat for each of these species are constrained by tenure, as habitat information and results from any SRE surveys on adjacent third party tenure are not available.</p> <p><b><i>Austrothropus</i> 'DIP018'</b> – this species has been recorded at four locations (Figure 1.3 of Attachment 7), of which three are within the Proposed Mining Area C Development Envelope. Three of the four records were on hill crests, and this habitat is likely to be close to, if not the primary habitat for the species, with an adult male, adult female and a juvenile having all been recorded in this habitat. The fourth record (a juvenile) was recorded within drainage habitat and was considered likely to be dispersing.</p> <p>The suitable habitat map (Figure 1.3 of Attachment 7) shows likely primary habitat as the hill crest throughout the Proposed Mining Area C Development Envelope and beyond (only within BHP tenure). Figure 1.3 of Attachment 7 shows the location of A. 'DIP018' known to occur beyond the development envelope at Packsaddle East, and can therefore be regarded as potentially occurring at other hills adjacent to the Proposed Mining Area C Development Envelope. The drainage habitats can be considered likely dispersal habitat for A. 'DIP018' (and therefore gene flow) between the populations at Packsaddle East and Southern Flank.</p> <p><b><i>Yilgarnia</i> 'MYG197'</b> – this species is known from three locations in the Pilbara, including one approximately 25 km south-west of the Proposed Mining Area C Development Envelope (Figure 1.1 of Attachment 7). All three specimens were adult males captured in pit traps while dispersing, and therefore limited habitat information can be taken from the location of the records with regards to primary habitat. Nevertheless, it can be regarded as</p>

EPA Services comment	Proponent response
<ul style="list-style-type: none"> <li>• detailed information on the potential impacts to <i>Austrostrophus</i> 'DIP018' and Yilgarnia 'MYG197'. These two species have been recorded from fewer locations and appear to have distributions that are less widespread than <i>Kwonkan</i> 'MYG339-DNA' and <i>Antichiropus</i> 'DIP007'</li> <li>• figures illustrating the locations of the four species in relation to habitat to support conclusions that impacts to these species are considered to be low due to habitat extent and connectivity outside the IAIAA.</li> </ul>	<p>highly likely that the species occurs extensively throughout the area and between the record to the south-west and the Proposed Mining Area C Development Envelope. In addition it is likely that the species can disperse across a range of habitats, and that barriers to this dispersal are not significant in the landscape.</p>
<p><i>Short range endemic (SRE) invertebrate fauna</i></p> <p>19. The proposed mitigation should be revised to include management actions that are appropriate for the four species (PER Table 37 &amp; 68):</p> <p>a) Provide evidence to demonstrate that rehabilitation using <i>Corymbia hamersleyana</i> is achievable. Rehabilitation of this species is not known to have been undertaken before.</p> <p>b) Provide evidence to support the assumption that SRE species, in particular <i>Antichiropus</i> 'DIP007', will naturally re-establish in rehabilitated vegetation.</p> <p>c) Indicate whether the microhabitats (dense, sheltered leaf litter debris) required for this species can be established in rehabilitated areas or the estimated timeframe for this to be achieved.</p>	<p>(a) <i>Corymbia hamersleyana</i> seeds are readily available and presently used in seed mixes applied during BHP rehabilitation activities. Mature <i>Corymbia hamersleyana</i> trees have been recorded in older rehabilitation at BHP Yarrie (Spectrum Ecology 2017) and Goldsworthy (ENV 2007) sites (Attachment 8).</p> <p>BHP has also sought advice from Dr Todd Erickson, Project Manager – Restoration Seedbank Initiative at the University of Western Australia regarding the likely success of <i>Corymbia hamersleyana</i> in BHP’s rehabilitation. Dr Erickson has provided the following information:</p> <ul style="list-style-type: none"> <li>• <i>Eucalyptus</i> and <i>Corymbia</i> seeds will not have any dormancy that prevents germination.</li> <li>• All seeds from these species are retained in the canopy of the tree in the gum nut/fruits. Upon release they are non-dormant and will germinate readily over a wide temperature range (Erickson <i>et al.</i>, (2016)).</li> <li>• Seedling emergence and establishment is hindered presumably because of the small seeds having less penetrative force to get through hard-setting soils or from depth. The most likely strategy to enhance re-establishment of any of these species would be through growing seedlings up through nursery tubestock/greenstock and planting in the densities required. BHP will utilise tubestock/ greenstock if broad acre seeding does not result in recruitment.</li> </ul> <p>Other recent work from the mid-west at Mt Gibson suggests <i>Eucalyptus</i> seedlings will survive (&gt;90%) in waste rock dump covers systems (Lamoureux <i>et al.</i>, 2016).</p> <p>(b) Whilst there has been no research into the recolonisation of rehabilitated mine sites by millipedes, or any SRE species’ groups, in the Pilbara region, there has been extensive research throughout the 1980s, 1990s and 2000s on recolonisation of rehabilitated mine sites by terrestrial invertebrates (ants, collembola, termites, spiders</p>

EPA Services comment	Proponent response
	<p>and true bugs) in the southwest of Western Australia. This research has indicated that all trophic groups are well represented in post-mining rehabilitated areas (including detritivores, the trophic group that includes millipedes), that there is no difference in species richness for some groups between rehabilitated areas and unmined reference areas, and species composition for most groups improves with rehabilitation age; however, distinct differences remain in species composition, potentially affected by factors such as time, habitat structure, dispersal ability and interspecific interactions between species (Majer et al 2007). The application of this research directly to the arid Pilbara region, and particularly to the successful re-establishment of a specific species, should be taken with some caution; however, it does indicate that post-mining rehabilitation can be successful for many species of terrestrial invertebrates, including detritivores, and that consideration of species specific requirements is important for improving the chances of success.</p> <p>While there is no empirical evidence to support the assumption that <i>Antichiropus</i> 'DIP007' will naturally re-establish within rehabilitated vegetation designed to replicate their known habitat, Wojcieszek, Harvey and Rix (2010) successfully housed and bred the genus in captivity in Western Australia. While the species used in this study was the more common <i>Antichiropus variabilis</i> from the South West of Western Australia, the study provides valuable insight into the husbandry requirements for the genus, and some confidence in the likely success of a breeding and reintroduction program should this be required.</p> <p>(c) Based on our current understanding of the microhabitats required by <i>Antichiropus</i> 'DIP007', it is highly likely that through an appropriately resourced scientific approach the right physical conditions can be recreated to provide suitable microhabitat for <i>A.</i> 'DIP007'. A number of approaches can be investigated, including re-creating habitat within rehabilitated areas and translocating individuals, translocating suitable habitat and individuals into rehabilitated areas and re-creating habitat within rehabilitated areas adjacent to remaining suitable habitat and allowing natural re-colonising to occur.</p> <p>The Biodiversity EMP has been updated to include management provisions of SREs. Section 10.1.3 of the Mine Closure Plan has been updated to detail the appropriate scientific approach for fauna monitoring, frequency of monitoring and key performance indicators. The Mine Closure Plan is submitted as final for EPA approval as part of this response.</p>
<p><i>Short range endemic (SRE) invertebrate fauna</i></p> <p>20. To confirm that <i>Antichiropus</i> 'DIP007' occurs within the habitat retained through mitigation, additional</p>	<p>Additional targeted sampling was undertaken for <i>Antichiropus</i> 'DIP007' between the 15<sup>th</sup> and 24<sup>th</sup> of March 2016 (Biologic, 2016b).</p>

EPA Services comment	Proponent response															
<p>targeted sampling should be undertaken and/or genetic analysis to determine what species the juvenile <i>Antichiropus</i> indet. specimens are.</p> <p>With regards to the mitigation of impacts to the millipede <i>Antichiropus</i> 'DIP007', the PER includes the retention of 2,876 ha of potential habitat, but the species was not recorded within this area during surveys. Millipede species collected in this area were not identified to species as they were juvenile specimens (see Biologic 2016b Figure 4.1).</p>	<p>A genetic analysis has been undertaken by the Western Australian Museum to determine if the juvenile specimens of <i>Antichiropus</i> found within the remaining suitable habitat are <i>A.</i> 'DIP007'. BHP commits to provide these results when work is completed. It should be noted that genetic analysis may not provide a clear delineation of the species, and that some genetic variation will exist within the population, particularly as <i>A.</i> 'DIP007' is a low mobility species and gene flow is likely to be restricted across the population. Careful consideration has been given to the approach taken for the genetic analysis, which is consistent with previous successful genetic work undertaken on other <i>Antichiropus</i> species.</p> <p>Early results from the genetic analysis has confirmed that all juvenile and female specimens, besides one (identified as <i>Antichiropus</i> sp. indet.) that were discussed in the PER are <i>Antichiropus</i> 'DIP007' (Joel Huey Western Australian Museum, pers. comm., 7 November 2017). One Specimen could not be sequenced because of the way it had been preserved. A full genetic report will be provided to EPA following completion of all genetics work (work on other species in the Genus is still outstanding). Please also find attached an updated Figure 27 (Attachment 1) showing the inferred <i>Antichiropus</i> 'DIP007' habitat, the inferred <i>Antichiropus</i> 'DIP007' habitat (Unverified), the location of confirmed and undetermined <i>Antichiropus</i> 'DIP007' records. The following table provides an update to Table 33 of the PER confirming the location of all records of <i>Antichiropus</i> "DIP 007".</p> <table border="1" data-bbox="842 836 2011 1129"> <thead> <tr> <th>Taxon</th> <th>Proposed Mining Area C Development Envelope</th> <th>Within New Modified IAIAA</th> <th>Outside New Modified IAIAA</th> <th>Outside Proposed Mining Area C Development Envelope</th> </tr> </thead> <tbody> <tr> <td><i>Antichiropus</i> 'DIP007'</td> <td>23</td> <td>7</td> <td>15</td> <td>1</td> </tr> <tr> <td><i>Antichiropus</i> sp. indet. 'DIP007'</td> <td>1</td> <td>1</td> <td></td> <td></td> </tr> </tbody> </table> <p>During the targeted survey, habitat assessments were completed throughout the area proposed to be retained of the mapped extent of inferred habitat for <i>A.</i> 'DIP007', to determine the suitability of habitat for this species. The area proposed to be retained is also continuous with the habitat from which this species is known and the mapped extent of inferred habitat. The recent survey efforts resulting in the recording of juvenile specimens of <i>Antichiropus</i> throughout the area proposed to be retained also aids to confirm the suitability of habitat throughout</p>	Taxon	Proposed Mining Area C Development Envelope	Within New Modified IAIAA	Outside New Modified IAIAA	Outside Proposed Mining Area C Development Envelope	<i>Antichiropus</i> 'DIP007'	23	7	15	1	<i>Antichiropus</i> sp. indet. 'DIP007'	1	1		
Taxon	Proposed Mining Area C Development Envelope	Within New Modified IAIAA	Outside New Modified IAIAA	Outside Proposed Mining Area C Development Envelope												
<i>Antichiropus</i> 'DIP007'	23	7	15	1												
<i>Antichiropus</i> sp. indet. 'DIP007'	1	1														

EPA Services comment	Proponent response
	<p>this area. Following the results of the genetic analysis, additional information will be available to help confirm the suitability of this habitat.</p> <p>Details of total area for identified habitat for <i>Antichiropus</i> 'DIP007' are:</p> <ul style="list-style-type: none"> <li>• Total habitat for Antichiropus DIP007 = 7,090 ha (629 ha falls within Baby Hope tenure)</li> <li>• Habitat within the Mining Area C EMP Rev 6 Impact Area = 355 ha</li> <li>• Habitat within the Indicative Additional Impact Assessment Area = 3,861 ha</li> <li>• Habitat within the Modified Indicative Additional Impact Assessment Area = 3,798 ha</li> </ul> <p>Habitat within the New Modified Indicative Additional Impact Assessment Area = 3,794 ha</p>
<p><i>Offsets</i></p> <p>21. The following should be provided:</p> <ul style="list-style-type: none"> <li>• details of the proposed ghost bat offset (what, where, when, how, why)</li> <li>• a summary of whether the proposed offset meets the WA Environmental Offsets Policy (2017) principles</li> <li>• information to determine whether there is a high degree of uncertainty regarding impacts of a project and new science is required to develop better mitigation measure or predictive tools to avoid and minimise the particular type of impact.</li> </ul> <p>The proponent has proposed a research offset to counterbalance the significant residual impacts on the ghost bat. Research projects are generally only appropriate as offsets where there is a high degree of uncertainty regarding impacts of a project and new science is required to develop better mitigation measure</p>	<p>BHP has completed numerous studies over a number of years on ghost bats at the Mining Area C operations and surrounds. As such, BHP has a high degree of certainty regarding the potential loss of roosting habitat for ghost bats. There is however, still uncertainty around the regional population of ghost bat from within the Pilbara region (and beyond), and as such BHP feels the proposal of research to be an appropriate offset.</p> <p>Current studies are already underway (in conjunction with the Department of Biodiversity Conservation and Attractions) and this is providing information regarding the wider use of the landscape and foraging habitats of the ghost bat within the Hamersley sub-region. BHP proposes funding additional studies on ghost bats to further our understanding of the movement and use of habitats by ghost bats in the Hamersley sub-region. This work will be published and will provide information to enable BHP and third party operators in the region to better manage impacts to the species. Further details of the studies will be provided and formalised via a Biodiversity Environmental Management Plan following the receipt of the Ministerial Statement.</p> <p>BHP supports the EPA's intent of highlighting the value of foraging habitat for ghost bats. There is limited information on the use of foraging habitat in the Pilbara by ghost bats, and as such, information for the PER was based on studies undertaken at Pine Creek in the Northern Territory, where the mean size of foraging areas for tagged ghost bats was 61 ha, and tagged bats generally returned to the same areas each night (Tidemann <i>et al.</i>, 1985). These areas were centred, on average, 1.9 km from the day roost, and were not exclusive, as ranges overlapped between several tagged individuals and in one case an area was used by 20 bats (Tidemann, <i>et al.</i>, 1985).</p>

EPA Services comment	Proponent response
<p>or predictive tools to avoid and minimise the particular type of impact.</p> <p>Information has not been provided within the PER document to determine whether this is the case.</p> <p>The Pilbara is mostly Crown land and, as such, traditional land acquisition offsets are not possible in the region. In addition, multiple overlapping tenures including pastoral leases and mineral tenements make it difficult for individual proponents to implement on-ground offset actions to deliver long-term protection of biodiversity. Due to this, the approach to offsets in the Pilbara is applied differently. Rather than proponents proposing land acquisition, on ground management or research offsets, proponents are required to contribute to the Pilbara Strategic Fund.</p> <p>Based on the current information provided in the PER the EPA Services considers that the higher rate of offset contribution (\$1,500 per hectare) be applied for the clearing of foraging habitat and 33 caves for the Ghost Bat, with the remainder at the \$750 per hectare rate.</p>	<p>Studies on foraging habitats undertaken by BHP in the Pilbara have comprised dietary studies and two attempts to satellite track ghost bats. Tracking of a ghost bat in BHP tenure west of Mining Area C suggests that ghost bats may move more than 3 km from a day roost to forage (Biologic, in prep), which is larger than that observed in the Northern Territory. Due to the potentially large area utilised by ghost bats for foraging BHP has committed to undertake further studies on foraging habitats utilised by the ghost bat, which will include satellite tracking of ghost bats to allow for movement over potentially tens of kilometres. This work will complement the landscape scale study currently being undertaken by Biologic in conjunction with the Department of Biodiversity Conservation and Attractions on the use of roosting habitat. All research work will be developed in conjunction with the Department of Biodiversity Conservation and Attractions and the results from these studies will be published.</p> <p>BHP has developed a Ghost Bat Research Plan as a research offset for the project (Attachment 9). This plan has been developed in consultation with the DBCA. BHP believes that a research offset for ghost bats is consistent with the EPA’s Offsets Guidelines and will provide the best outcome for the ghost bats.</p> <p>Further, BHP commits to removing/ replacing up to 50 km where possible of barbed wire fencing in the vicinity of its Mining Area C operations. The fences to be removed will be determined based on information provided by BHP’s consultants regarding known areas where bats have become entangled, the outcomes of the radio-telemetry work (see the Ghost Bat Research Plan), areas where BHP will have the authority to remove/ replace fences (determined by tenure approval) and where not required for cattle containment.</p> <p>BHP understands that the Pilbara Environmental Offsets Fund should be in place by the end of the 2017 calendar year. BHP has been an active participant in the Fund Reference Group and has recently provided feedback in relation to the Special Purpose Statement. We understand that the DWER is working to finalise a standardised Impact Reconciliation Procedure, an Implementation Plan which will select and prioritise offsets for the fund and Contribution Agreements which will set out individual proponent governance arrangements.</p> <p>Following establishment of the Pilbara Environmental Offsets Fund and once appropriate governance arrangements are in place, BHP will seek to meet any other offset obligations through the Fund to the satisfaction of the Director General. If these arrangements are not be in place in time for delivery of these obligations or should the governance arrangements not meet the Company’s requirements, BHP will work with EPA Services (in conjunction with the Commonwealth Department of Environment and Energy where appropriate) to determine appropriate stand-alone offsets for some or all of these obligations in line with the Western Australian Offsets Policy and Guidelines.</p>



EPA Services comment	Proponent response
<b>Subterranean Fauna</b>	
<p><i>Troglofauna</i></p> <p>22. To address habitat continuity and species distribution, figures should be provided that include species records and geological and habitat information for all species predicted as potentially restricted to the impact assessment area.</p> <p>These figures should be presented with boundaries of the impact areas (e.g. mine pits).</p>	<p>The memorandum <i>Additional Habitat Assessment for Five Potentially Restricted Troglofauna Species at South Flank</i> (herein referred to as Additional Habitat Assessment) (BHPBIO 2016c) is attached to this document (Attachment 10). This additional habitat assessment utilises modelled habitat to visualise, in the third dimension, the extent of troglofauna habitat in relation to the Modified Indicative Additional Impact Assessment Area (IAIAA) and indicative pit extent for five troglofauna species regarded as potentially restricted to the pit extent within the IAIAA. Down hole optical televiewer (OTV) imagery was also used to assess smaller scale similarities between troglofauna habitat inside and outside of indicative pit extents.</p>
<p><i>Troglofauna</i></p> <p>23. Provide evidence to support the statements (Benelongia, 2016) that six singleton species are likely to be found outside the impact area based on geology. This evidence should include geological mapping.</p> <p>Of the 20 species that are currently only known from the IAIAA, 11 species are only known from a single bore location. The PER and addendum only considers five of the singleton species in detail. The proponent has determined that the remaining six singleton species are unlikely to be restricted based on the geology of the borehole from which they were collected extending outside of the IAIAA, but no geological mapping has been provided as evidence.</p>	<p>Evidence and supporting information to support the statements made by Bennelongia (2016) that singleton species are likely to be found outside the impact area (i.e. indicative pit extent) based on geology, was provided within the <i>South Flank Troglofauna Habitat Assessment</i> (BHPBIO, 2016d) (which was provided to the EPA Services for their assessment of troglofauna) and is summarised below.</p> <p><b><i>Prethopalpus</i> sp. B24</b> – BHPBIO (2016d) shows that suitable habitat in the form of hardcapped detritals and Mount Newman Member extends continuously, above water table, beyond the indicative pit extent of the IAIAA to the north of the <i>Prethopalpus</i> sp. B24 record.</p> <p><b><i>Philosciidae</i> sp. B15</b> – BHPBIO (2016d) shows that <i>Philosciidae</i> sp. B15 was recorded from detritals (only unit available above water table). Suitable habitat in the form of hardcapped detritals extends continuously above water table to the south of the indicative pit extent of the IAIAA.</p> <p><b><i>Australoschendyla</i> sp. B06</b> - BHPBIO (2016d) shows that <i>Australoschendyla</i> sp. B06 inhabits detritals, which is known to be the most favourable habitat for species of the <i>Australoschendyla</i> genera. The detritals extend extensively to the south of the indicative pit extent of the IAIAA in the vicinity of the <i>Australoschendyla</i> sp. B06 record.</p> <p><b><i>Chilenophilidae</i> sp. B07</b> – BHPBIO (2016d) found that <i>Chilenophilidae</i> sp. B07 is likely to inhabit the detritals, which extend continuously and extensively to the south of the indicative pit extent of the IAIAA.</p>

EPA Services comment	Proponent response
	<p><b>Parajapygidae sp. B25</b> –This species inhabits the detritals, which is the only unit intersected above water table. The detritals extend continuously south of the indicative pit extent of the IAIAA.</p> <p>Following the completion of the <i>Southern Flank Troglafauna Habitat Assessment</i> (BHPBIO, 2016d), upon further review a sixth singleton was discovered; <i>Draculooides</i> sp. B59-DNA was determined to be genetically differentiated. Detailed habitat information for this species was therefore not previously assessed. Geological mapping and habitat assessment for <i>Draculooides</i> sp. B59-DNA has been provided to EPA Services as for their assessment of troglafauna. (BHPBIO, 2017c)</p>
<p><i>Troglafauna</i></p> <p>24. <i>Tyrannochthonius</i> sp. B14 should be discussed in detail similar to <i>Philosciidae</i> sp. B03 in the PER.</p> <p>There is a residual risk to four troglafauna species identified as possibly restricted to the IAIAA and two species with uncertain distributions. Geology, biological surrogates and OTV surveys have been used to infer whether species are predicted as possibly restricted or unlikely to be restricted to the proposed MAC disturbance areas.</p> <p>Evidence provided in the PER does not support the predicted "unlikely to be restricted" status of <i>Tyrannochthonius</i> sp. B14. EPA Services considers that the distribution of species <i>Tyrannochthonius</i> sp. B14 should be considered to be uncertain or possibly restricted, as no geological information is available and other species in this group are known to have small ranges. Therefore <i>Tyrannochthonius</i> sp. B14 should be discussed in detail similar to <i>Philosciidae</i> sp. BOS in the PER.</p>	<p>To support the predicted "unlikely to be restricted" status of <i>Tyrannochthonius</i> sp. B14, a review of available information and a detailed habitat assessment has been completed and has been provided to the EPA Services for their assessment of troglafauna (BHPBIO, 2017c)</p>

EPA Services comment	Proponent response
<p><i>Troglofauna</i></p> <p>25. Geological mapping should be provided to demonstrate the extent of the habitat beyond the IAIAA. PER states that four species (nr <i>Andricophiloscia</i> sp. B16, <i>Prethopalpus</i> sp. B15, <i>Philosciidae</i> sp. BOS and <i>Prethopalpus juianneae</i>) may be "possibly" restricted based on the knowledge and extent of the geology types and habitat that they were collected from. Bennelongia 2017 noted, nr <i>Andricophiloscia</i> sp. B16 was collected from a borehole in the Mount Newman Member that has been predicted to extend north of the proposed pit area with evidence of vugs in these areas that may provide suitable habitat for this species. The Mount Newman Member is also associated with <i>Philosciidae</i> sp. B03 and <i>Prethopalpus juianneae</i>.</p>	<p>Geological mapping and habitat information for the four species in question is in the memorandum <i>Additional Habitat Assessment for Five Potentially Restricted Troglofauna Species at South Flank</i> (BHPBIO 2016c). This document has been attached to this submission (Attachment 10).</p>
<p><i>Troglofauna</i></p> <p>26. PER Figure 33 should be revised to illustrate the boundaries of the IAIAA and Mining Area C impact areas to demonstrate that widespread troglofauna species occur outside the areas of impact.</p>	<p>Figure 33 has been revised as requested and is included in Attachment 1.</p> <p>In addition, Figure 3 (Attachment 1) has been provided that shows the distribution of all <i>Prethopalpus</i> species collected within the Proposed Mining Area C Development Envelope. This map is provided in response to questions raised at the troglofauna habitat presentation on 16 August 2017. As discussed, please note the extent and distribution of <i>Prethopalpus mainii</i> and <i>Prethopalpus</i> sp. indet records throughout Southern Flank and in relation to the locations of <i>Prethopalpus</i> sp. B15 and <i>Prethopalpus juianneae</i>. BHP requested use of the <i>Prethopalpus juianneae</i> specimen to conduct genetic studies and compare resulting sequences against those obtained for <i>Prethopalpus mainii</i>. The Western Australian Museum (WAM) declined access to the specimen given that it is the only specimen of the species. BHP were also unable to access the <i>Prethopalpus</i> sp. indet. specimen from the WAM. Previous attempts to obtain genetic sequences from this specimen were unsuccessful. This <i>Prethopalpus</i> sp. indet record is located to the north-west (outside of the IAIAA) of <i>Prethopalpus</i> sp. B15 and has the potential to be <i>Prethopalpus</i> sp. B15.</p>

EPA Services comment	Proponent response
<p><i>Troglofauna</i></p> <p>27. PER Table 49: Clarify whether <i>Indohya</i> PSE005 has been identified in the IAIAA and modified IAIAA.</p>	<p>BHP can confirm that <i>Indohya</i> PSE005 has been identified in the IAIAA and modified IAIAA, as shown in Table 49 of the Proposal. For further information and descriptions of this species range, see Table 47 in the Proposal.</p> <p>As shown in updated Table 49 (Attachment 1), the updates to the Modified Indicative Additional Impact Assessment Area positively affects two species, <i>Tyrannochthonius</i> sp. B14 and <i>Draculooides</i> sp B15-DNA. Five species records now fall within the Modified Indicative Additional Impact Assessment Area, however all of these are considered unlikely to be restricted to the Assessed Indicative Additional Impact Assessment Area (information on habitat and likely ranges of these species was provided in Table 47 of the Proposal). The updates to the Modified Indicative Additional Impact Assessment Area has not changed the status of the five potentially restricted species at Southern Flank.</p> <p>It is important to reiterate that for troglofauna the Assessed Indicative Additional Impact Assessment Area consisted of indicative pit areas only, whereas the updated Modified Indicative Additional Impact Assessment Area encompasses other disturbance including OSAs and haul roads.</p>
<p><i>Stygofauna</i></p> <p>28. To support statements in the PER that suitable habitat for stygofauna species is likely to extend outside the following information should be provided:</p> <ul style="list-style-type: none"> <li>• Figure 35 should include the boundaries of the Groundwater Assessment Area (GAA) and Revision 6 Groundwater Assessment Area (R6GAA).</li> <li>• Discuss whether the biological surrogates suggested occur sympatrically with the species currently only known from the GAA and R6GAA.</li> </ul>	<p>Figure 35 has been revised and is provided in Attachment 1.</p> <p>The biological surrogates illustrated in Figure 35 of the Proposal coincide with a number (but not all) of the occurrences of species known only from the GAA/R6GAA.</p> <p>It should be noted that the extent to which larger ranges for the species known only from the GAA/R6GAA can be inferred from their co-occurrences with widespread species is somewhat limited because in most cases the factors controlling the ranges of individual species will differ. However, the illustrated distribution of widespread species demonstrates two points (Stuart Halse Bennelongia, via email to BHP):</p> <ol style="list-style-type: none"> <li>1) It suggests that there are few barriers to movement of stygofauna to areas beyond the GAA/R6GAA. This movement probably mostly occurs along creek lines and in areas of calcrete.</li> <li>2) The co-occurrences of species currently only known from the GAA/R6GAA and widespread species suggest there is likely to be suitable habitat for the potentially restricted species outside of the GAA/R6GAA.</li> </ol>

EPA Services comment	Proponent response
<p><i>Stygofauna</i></p> <p>29. A description of the impacts to stygofauna within the areas of groundwater mounding and drawdown associated with the Camp Hill and Juna Downs borefield areas (as per PER Figure 38) is required. This should include maps showing the subterranean fauna and drawdown and mounding contours. A table quantifying the impacts and a discussion of the impacts on the EPA's objectives for Subterranean Fauna.</p> <p>The PER does not consider the impacts from the borefields that may be accessed for processing, construction and dust suppression (see PER Figure 38). The PER states that impacts from the Camp Hill borefield were assessed as part of the MAC Revision 6 proposal, but it is not stated if stygofauna were included in this assessment. A description of the impacts from the Juna Downs borefield was not provided in the EMP Rev 6 or PER.</p>	<p>Prior to the construction and operation of the Juna Downs borefield, approval will be sought under Part V of the EP Act, as per previous correspondence and discussions with the OEPA (refer to Proponent response above against EPA Services comments no.1 for additional information).</p> <p>Mining Area C L7851/2002/6 Licence Amendment Supporting documentation – Juna Downs MAR (November 2016) provides information relating to the direct and indirect impacts to stygofauna resulting from the Juna Downs MAR. This assessment considers it unlikely that the reinjection of surplus water will impact upon stygofauna species. Further information on indirect impacts to stygofauna such as water quality changes is provided in Section 11.3.3.8.1 of the Public Environmental Review document.</p> <p>One stygofauna species (Paramelitidae sp. S4), was considered potentially restricted to the Juna Downs Project Area. This species was also considered restricted to the cumulative Groundwater Assessment Areas defined in the Proposal and was discussed in Section 11.3.3.7.3 of the Public Environmental Review document.</p> <p>The proposed Camp Hill borefield is presented as an additional option and potential location for any future surplus water management requirements. BHP proposes to defer the approval of the Camp Hill (or other) option at this time until further baseline information is collated for the purpose of undertaking an environmental impact assessment of the proposed activity (and once a potential location is confirmed).</p> <p>Water used for processing, construction and dust suppression will be obtained from dewatering activities within the Proposal area. Impacts from dewatering activities were outlined in sections 11.4 and 11.5 of the PER document.</p>
<p><i>Stygofauna</i></p> <p>30. A description of the management and trigger levels for stygofauna monitoring needs to be provided.</p> <p>The management approach for stygofauna outlined in PER Section 11.3.5.1 refers to Tables 57 and 58 of the Hydrological Processes factor. However, these tables do</p>	<p>Coondewanna Flats (CF) is classed as a PEC based on the presence of presence of coolibah and mulga woodland over lignum and tussock grasses (Coondewanna Flats) and coolibah woodlands over lignum over swamp wandiree (Lake Robinson) and there are no restricted stygofauna in the CF area.</p> <p>Table 58 of the PER defines the outcome for Weeli Wolli Breek as “No net-loss of the biological diversity and/or ecological integrity of the Weeli Wolli Spring Priority Ecological Community, as a result of BHP Billiton Iron Ore activities” and identifies the risk as “Weeli Wolli Spring Priority Ecological Community (PEC) has the potential to be impacted from groundwater, resulting in changes in changes to the biological diversity and/or ecological</p>

EPA Services comment	Proponent response
<p>not directly address and do not include any monitoring or trigger criteria for stygofauna.</p>	<p>integrity of the PEC". The "biological diversity and/or ecological integrity" identified in this outcome and risk is inclusive of the protection of the stygofauna species and community within the WWC PEC. The key potential for impacts to stygofauna located with the Weeli Wolli Creek PEC are associated with the level, quantity and quality of groundwater and therefore the proposed triggers, monitoring and management actions proposed in Table 58 account for management of stygofauna within the Weeli Wolli Springs PEC.</p> <p>Based on the fact that of the 53 stygofauna species located in the groundwater assessment areas the impact to all but three species (whose impact is uncertain due to lack of scientific knowledge of the species) is low, it is considered that the impact to stygofauna species as a result of the Proposal is not significant and no further mitigation or offsets are required. As suitable habitat for stygofauna remains outside of the Proposed Mining Area C Development Envelope and Groundwater Assessment Area the impact to stygofauna habitat is not considered significant. The potential impacts to subterranean fauna based on the predicted changes to the Weeli Wolli Creek PEC are not considered significant.</p>
<p><i>Residual impacts</i></p> <p>31. Indicate what if any measures can be undertaken to reduce the uncertainty and any measures that could be taken to avoid or minimise impacts.</p> <p>Uncertainty remains in relation to nine troglofauna and three stygofauna:</p> <p>Troglofauna, IAIAA:</p> <ol style="list-style-type: none"> <li>1. Nr <i>Andricophiloscia</i> sp. B16</li> <li>2. <i>Philosciidae</i> sp. 603</li> <li>3. <i>Prethopalpus julianneae</i></li> <li>4. <i>Prethopalpus</i> sp. B15</li> <li>5. <i>Parajapydidae</i> DPL024</li> <li>6. <i>Tyrannochthonius</i> sp. B14</li> </ol>	<p>To reduce the uncertainty in relation to troglofauna species from within the IAIAA, additional habitat assessment has been completed; refer to memorandum <i>Additional Habitat Assessment for Five Potentially Restricted Troglofauna Species at South Flank</i> (BHPBIO 2016c) which has been provided to the EPA Services' for their assessment of troglofauna. The details of this additional work for five potentially restricted troglofauna species was presented to those in attendance at the 16 August 2017 meeting. Additional habitat information for the sixth troglofauna species is provided in <i>Additional Habitat Assessment for Five Potentially Restricted Troglofauna Species at South Flank</i> (BHPBIO 2016c) which has been provided to the EPA Services' for their assessment of troglofauna (and refer to Proponent response above against EPA Services comments no. 23 for additional information).</p> <p>The three troglofauna species identified in the Mining Area C EMP Revision 6 Impact Assessment Area, and the formed part of the assessment and approval under the EMP Revision 6 for MS 491 in early 2016; and impacts to these species were determined to be acceptable at the time of the assessment.</p> <p>Based on the additional habitat work completed for troglofauna and that the remaining species in question have already been the subject of assessment by BHP as part of the EMP Revision 6 development, BHP considers that no additional measures (to those already reported in the Proposal) are required. If additional actions are deemed necessary, it is proposed that these management provisions will be formalised through the development and implementation of a Biodiversity Environmental Management Plan via the Ministerial Statement.</p>

EPA Services comment	Proponent response
<p>Troglofauna, Mining Area C EMP Revision 6 Impact Assessment Area:</p> <ol style="list-style-type: none"> <li>1. <i>Hanseniella</i> sp. BOS</li> <li>2. <i>Symphyella</i> sp. B03</li> <li>3. <i>Parajapygidae</i> sp. SOS</li> </ol> <p>Stygofauna, R6GAA:</p> <ol style="list-style-type: none"> <li>1. <i>Bathynella</i> sp. 2</li> <li>2. <i>Dussartyclops</i> sp. B10</li> <li>3. <i>Epactophanes</i> sp. B01</li> </ol> <p>In the case that the EPA determines that a significant residual impact remains for the subterranean fauna species that are potentially restricted and that an offset is required, consideration will need to be given to what an adequate offset would entail.</p>	<p>As stated in the Proposal, BHP propose funding additional studies on troglofauna habitats and taxonomy to further understand species and their distribution in the Pilbara. If EPA Services' determines that a significant residual impact remains for the subterranean fauna species, BHP will consider an appropriate offset if required following the completion of the EPA's assessment. Further details on suitable additional studies will be provided and formalised in consultation with the EPA Services via a Biodiversity Environmental Management Plan following approval of the Proposal.</p>
<b>Hydrological Processes</b>	
<p><i>Modelling - Surface Water</i></p> <p>32. Clarify whether the loss of surface water into aquifer recharge areas such as Coondewanna Flats has been included in models of groundwater drawdown at Weeli Wolli Spring PEC locations (including Ben's Oasis).</p>	<p>Disturbance in the Coondewanna and Weeli Wolli catchments and subsequent changes to runoff was not included in regional groundwater modelling. Due to the scale and length (~30 years) of dewatering and resulting mass balance in the aquifer a minor reduction in runoff and recharge volume was not considered material to the modelled dewatering drawdown footprint. Please refer to Appendix 7 of the PER for further details regarding groundwater and surface water modelling.</p>
<p><i>Coondewanna Flats - Surface Water</i></p> <p>33. Provide information in the form to support the PER's claim that a change to the Coondewanna Flats</p>	<p>The ecohydrological model for Coondewanna Flats includes the vegetation assemblage being supported by a large soil moisture reservoir. Soil moisture beneath Coondewanna Flats is maintained by regular flooding events that inundate Lake Robinson, located at the southern end of Coondewanna Flats. When the lake is full a period</p>

EPA Services comment	Proponent response
<p>catchment size is unlikely to impact surface water flow. This information should be supported by figures.</p> <p>34. Indicate the reduction of surface water flow as a result of the loss of 4.7% of the Coondewanna Flats catchment and cumulative catchment loss of 6.9 %. Include an analysis of the impact to the Coondewanna Flats PEC and groundwater recharge.</p> <p>The Coondewanna Flats Ecohydrology Review (AQ2, 2015) Section 5.4, notes that reductions in runoff associated with catchment loss will progressively reduce volumes of surface water. Although the document indicates that surface flow based on a few years of flood monitoring initially appears to come from an area it is not clear where this is in relation to the proposal or PEC and how the proposal would impact it. The PER states that the 6.9% reduction in total catchment size is unlikely to affect the size and frequency of surface water flow reaching the Coondewanna Flats as these come from the north and sit outside the MAC Development Envelope (PER Section 11.1.4.3.4, page 153).</p>	<p>of inundation and seepage recharges the soil profile and underlying aquifer. Lake Robinson is a surface water terminus, located in the south eastern corner of the catchment.</p> <p>The catchment assessment for the proposal shows that a percentage reduction in catchment is likely from the mining works. However that reduction is unlikely to have a material impact on the frequency of flooding at Lake Robinson as this is driven mostly from flood waters that come from the western and northern areas of the catchment, that is from areas within the catchment not impacted by the Proposal</p> <p>Figure 2-1 in the <i>South Flank Surface Water Environmental Impact Assessment</i> (MWH, 2016) shows the shape of the Coondewanna Flats catchment. This figure also shows the BHP changes to this catchment area on the eastern margin of the catchment. Figure 1 in the <i>Coondewanna Flats Ecohydrology Review</i> (AQ2, 2015) shows the catchment drainage lines in more detail. The shape of the catchment and morphology of drainage lines shows that most of the runoff is generated in western sections of the catchment with the majority of floodwater entering Coondewanna Flats coming through the hills to the west and north-west (Homestead Creek). Section 2.3.3.2 of AQ2 (2015) discussed measurement of runoff data and finds a correlation between flooding at Coondewanna and flow in Homestead Creek. Figure 4 shows the location of Homestead Creek, draining the Northwest section of the catchment, and the location of crest gauge SNPH0011. The proposal doesn't impact any areas within the Homestead Creek catchment.</p> <p>In section 10.2.2 of the <i>SEA Ecohydrological Change Assessment</i> (BHPB, 2016e), Pilbara rainfall variability was discussed and based on analysis of historical data, rainfall over a 5 year period was assessed to have a standard deviation of 50% indicating high variability in annual rainfall. A catchment reduction of 6.9% falls inside the range of background climate variability, which means annual rainfall remains the key factor that determines likelihood of flooding at Coondewanna. Due to the high variability it is expected that even with a 6.9% reduction in catchment, future rainfall events will generate runoff volumes that fall within the historic range and no material ecological change will be seen at the receptor.</p>
<p><i>Water balance</i></p> <p>35. Section 6.3 of the Hydrological Impact Assessment (BHP Billiton Iron Ore 2017) states that "Up until 2034, dewatering rates are expected to be either equal to or greater than water demands resulting in a net water surplus." This appears to directly contradict the</p>	<p>An earlier version of the Hydrological Impact Assessment was submitted in error, the current version is included as Attachment 11.</p> <p>The previous version of the Hydrological Impact Assessment stated an incorrect year: The sentence should have read "Up until 2040, dewatering rates are expected to be near to or greater than water demands resulting in a net water surplus in most years" which matches Figure 5 in the previous document (Figure 6 in the updated version).</p>



EPA Services comment	Proponent response
<p>information presented in Figure 5 of the same report. Clarity should be provided around this statement.</p>	<p>The volumes shown in Figure 5 are indicative of volumes required to dewater orebodies across the revised proposal. Surplus volume estimates are strongly influenced by mine plans which are subject to further optimisation. The sequence of pits and mining rates required may be modified when and in what volume such surplus volumes are produced.</p>
<p><i>The Central Pilbara Water Resource Management Plan</i></p> <p>36. Given the assumptions and uncertainties inherent in the ecohydrological model and the potential role of the dolerite dyke, the proposed operation of the MAR close to the limits of the model (within a metre of potential root depth) results in high levels of risk to the Coolibah-Lignum Flats PEC. If the proposal is recommended for approval additional work will be required to:</p> <ul style="list-style-type: none"> <li>• refine the model</li> <li>• initiate monitoring sensitive to early effects of hydrological change</li> <li>• set conservative trigger criteria and detailed contingency actions if the monitoring shows exceedance of triggers based on models.</li> </ul>	<p>The model used to assess change from injection at Coondewanna used all available data to assess change due to injection. Without additional stresses in the aquifer (from drawdown or injection) further refinements or validation of the model would not enhance model predictions. A system of monitoring points have been installed across the area which will provide a better understanding of aquifer response once injection starts.</p> <p>Draft conservative trigger criteria for potential groundwater mounding impacts to Coolibah-Lignum PEC (as part of Coondewanna Flats) vegetation have been established and were included within the Central Pilbara Water Resource Management Plan. The ecological bae for the triggers are described in the <i>Hydrological Impact Assessment and Water Management Summary</i> (see Attachment 11). The triggers, thresholds and corrective actions for potential mounding impacts are detailed in Schedule 1 of the Draft <i>Central Pilbara Water Resource Management Plan</i> and in Table 57 of the PER.</p> <p>BHP considers these triggers to be precautionary and sufficient at this time to manage potential impacts given the ecological function of the receptor and available knowledge of the aquifer. Table 57, pg 285 of the Proposal also outlines triggers, threshold and contingency actions.</p>
<p><i>The Central Pilbara Water Resource Management Plan</i></p> <p>37. Please ensure the PER and CPWRMP are in accord for example the PER states that the average drawdown at Weeli Wolli spring following a period of mitigation by Rio Tinto at Hope Downs 1 is 1.75m and 1 m at Bens Oasis, whereas the CPWRMP states that drawdown at both locations will be less than 1 m.</p>	<p>Acknowledged, it is expected that the EPA will include a condition that requires the development and implementation of a management plan and BHP will update this information to ensure it is accurate and consistent at that time. The correct drawdown for Weeli Wolli is 1.75 m at 2054.</p>

EPA Services comment	Proponent response
<p><i>The Central Pilbara Water Resource Management Plan</i></p> <p>38. The CPWRMP should be updated in line with comments from submissions and in accordance with the Instructions on how to prepare <i>Environmental Protection Act 1986 Part IV Environmental Management Plans</i> (EPA, 2016) rather than EMP 17 (EPA, 2017).</p>	<p>It is expected that the EPA will include a condition that requires the development and implementation of a management plan and BHP will update the Central Pilbara Water Resources Management Plan as per the Instructions on how to prepare <i>Environmental Protection Act 1986 Part IV Environmental Management Plans</i>.</p>
<p><i>The Central Pilbara Water Resource Management Plan</i></p> <p>39. Provide and update Figure 36 that also contains the development envelopes and proposed mine pits so that there is a visual representation of the impact to the dyke separating/slowing the groundwater flow from the Coondewanna Flats to the Weeli Wolli Spring.</p>	<p>Figure 36 has been updated and is provided in Attachment 1. Despite the location of the dyke, the mine sequence indicates that there will be no direct impact to the dyke by BHP operations.</p>
<p><i>Dolerite Dykes - Coondewanna Flats and Weeli Wolli Spring</i></p> <p>40. To minimise impacts of the hydrological regime and increased groundwater abstraction and reinjection, consideration should be given to excluding the mining of the "Highway" deposit dyke.</p> <p>There is a southwest-northeast trending dyke which acts as a partial (low flow) groundwater flow barrier at the eastern end of Coondewanna Flats (AQ2 2015). The dyke passes through the "Highway" deposits, and so may potentially be mined. The removal of this dyke may have unexpected impacts, such as excessive drawdown at Coondewanna Flats, a large increase in the dewatering required for mining the Southern Flank and/or altered flows to Weeli Wolli Spring. It also adds</p>	<p>Please refer to the new figure Highway Deposit in Proximity to the Dyke in Attachment 1 for reference.</p> <p>The dyke is a linear, vertical, regional structure that cuts through the South Flank project area. The dyke runs across the regional dolomite aquifer in the west end of South Flank valley where it creates a 35m difference in groundwater elevation. This difference in level is reflective of a groundwater barrier limiting groundwater flow from the dolomite aquifer beneath Coondewanna into the South Flank valley dolomite aquifer. The dolomite aquifers are the main regional groundwater pathway that connects Coondewanna Flats to Weeli Wolli Spring.</p> <p>This difference in water level on either side of the dyke is also seen in the Marra Mamba geology that hosts the pits in the hills to the north of the valley. While the Marra Mamba units form part of the regional groundwater resource, they are not considered major regional flow pathways for groundwater. These aquifers are often separated from regional aquifer by faults, folds and low permeability geology and can be strongly compartmentalised.</p>

EPA Services comment	Proponent response
<p>increased uncertainty to the groundwater modelling of Coondewanna Flats.</p>	<p>Three pits in the South Flank project area will be developed in proximity to the dyke (Attachment 1). The northernmost of these pits (A) intersects the dyke above water table and therefore won't change the hydraulic behaviour of the dyke.</p> <p>The pit in the centre (B) extends approximately to the water table in the vicinity of the dyke and extends 10m below water table in two small drop cuts on either side of the dyke. This pit is relatively narrow and located approximately 1200m north of the dolomites in the South Flank valley. Due to the limited width and depth of disturbance as well as the distance from the regional aquifer there is a relatively low risk of this activity modifying the regional water regime and impacting water levels at Coondewanna Flats.</p> <p>Due to its location, the pit located in the valley floor (C) has the highest risk of interacting with the dyke in a way that alters the regional groundwater regime. The closest edge of the pit located about 80m west of the dyke and intersects the water table about 250m west of the dyke. Due to the distance from the dyke it is highly unlikely that mining activity in this pit will alter the structure or behaviour of the dyke in the valley.</p>
<p><i>Regional cumulative impacts</i></p> <p>41. Confirm whether model of drawdown at Weeli Wolli (see excerpt from PER below) was unmitigated and did not take into account managed aquifer recharge at Coondewanna Flats.</p> <p>The PER (section 11.4.6, page 278) indicates that "Following closure of Hope Downs (including the aquifer replenishment and mitigation actions outlined in HDMS, 2000) the combined cumulative impacts show a range of 1 to 2.5 m drawdown at Weeli Wolli Spring in 2054 with a median drawdown of 1.75 m. Dewatering at Southern Flank is predicted to contribute between 0.2 and 0.5 m of drawdown at GWB0018 in 2054. The forecast residual drawdown at Weeli Wolli Spring predicted in the Mining Area C EMP Revision 6 model was around 1.6 m at GWB0018 in 2054."</p>	<p>The regional groundwater modelling did not include any mitigating activities from BHP (such as MAR at Coondewanna). The drawdown presented is a conservative worst case that includes third party drawdown and mitigation (based on access to publicly available information at the time of undertaking the modelling for the Proposal).</p>

EPA Services comment	Proponent response
<p><i>Rehabilitation</i></p> <p>42. The PER (Section 11.7.5, Table 66) states that aquifer recovery will be augmented should recovery time post closure be greater than predicted. Clarify the time frames for this proposed rehabilitation action, how this will be achieved post closure and what final groundwater level would be proposed in comparison to the baseline or no development levels.</p>	<p>BHP’s commitment to maintaining ecological function and diversity at key water sensitive receptors extends throughout the period of active mining operations and then into to closure and divestment. Groundwater modelling for closure has been used to identify potential long-term risks to environmental receptors due to extended groundwater recovery timelines. This has informed an early view of the potential scale and location of remedial actions that might be required to maintain ecological function at these receptors. These have been outlined at a high level in the CPWRMP and are expected to be updated over time.</p> <p>The requirement for groundwater recovery will be determined by the risk of impact to environmental values. Where an extended recovery time is shown to be detrimental at a key receptor, recovery times will be reduced. A number of techniques are available for aquifer recovery and include active measures (aquifer injection, pumping into infiltration basins, tree watering) and passive measures (surface water routed to retention and infiltration basins, enhanced recharge). Selection and application of these measures will be detailed in the CPWRMP as per the response to comment 7. Targets for final groundwater levels will be based on the ecological requirement to support function at key receptors.</p> <p>Committing to a particular groundwater recovery approach or specifying final water level at this stage of the project is considered premature due to the uncertainty that remains across the catchment. The uncertainty sits in three domains: potential range of aquifer responses to dewatering, ecological sensitivity to water levels at key receptors and long term effects of third party activity. As uncertainty in these areas reduces over the course of the project, appropriate targets and programs of work can be developed.</p> <p>Consequently BHP commits to the principles of maintaining biological diversity and ecological function and will update water level targets and remedial outcomes as our understanding improves over time.</p>
<p><i>Rehabilitation</i></p> <p>43. Clarify whether a commitment to backfill pit voids will be made or not.</p> <p>44. Provide a detailed risk assessment to demonstrate why a permanent reduction in groundwater levels at Coondewanna Flats and Weeli Wolli Spring is appropriate. Include in this the potential impact to stream</p>	<p>BHP Iron Ore are committed to preventing, minimising or mitigating unacceptable impact of the Southern Flank development including that on Groundwater Dependent Ecosystems.</p> <p>BHP has previously made a commitment to backfill below water table mine voids at Northern Flank to mitigate the risk of long term drawdown at Mining Area C impacting ecohydrological receptors. This commitment remains unchanged with the addition of Southern Flank.</p> <p>BHP considers it appropriate to undertake further work to validate any potential impacts at key receptors as a result of Southern Flank dewatering activity prior to committing to backfill at Southern Flank as a specific control. Consistent with the strategy of adaptive management, ongoing data collection will be used to validate and inform</p>

EPA Services comment	Proponent response
<p>flow at Weeli Wolli Spring from low groundwater levels at Coondewanna Flats.</p> <p>The PER (page 275) notes that "The backfilling of pit voids to above pre-mining water is one option available as part of the mine closure strategy and will be considered where ongoing monitoring is indicating that impacts to water quality or quantity as a result of pit lakes are potentially above those predicted as part of this Proposal". It then states that "The scenario of leaving open voids at A and E Deposits in the Mining Area C current operations post-closure is predicted to lead to a permanent reduction in the groundwater levels at closure, particularly at Coondewanna Flats. However, this risk is mitigated by commitments to backfill pit voids as detailed in the Mining Area C Closure Plan."</p> <p>RPS Hydrogeological Assessment of Mining Area C under taken for the EMP Rev 6, notes that if all of the 14 mine voids are backfilled then:</p> <ul style="list-style-type: none"> <li>• after 300 years groundwater will recover to no development levels at Weeli Wolli Spring area</li> <li>• Coondewanna Flats water levels are up to 2 m below no development levels after 300 years.</li> </ul> <p>If empty voids are left at A and E Deposits then the model predicts:</p> <ul style="list-style-type: none"> <li>• at Weeli Wolli Spring water levels are within 1 m o no development</li> <li>• levels at the cessation of abstraction at MAC</li> <li>• groundwater levels at Coondewanna Flats up to 7 m lower than no development levels</li> </ul>	<p>closure options as knowledge is continually refined. If updated modelling or monitoring of water levels indicate groundwater recovery is likely to have an unacceptable impact on receptors (as a result of the development of Southern Flank), mitigation controls such as backfilling below water table pit voids to above pre-mining watertable or infiltration and injection into the aquifer would be implemented.</p> <p>The Mining Area C Closure Plan, which has been updated to include Southern Flank and will be revised every five years, together with the CPWRMP, will be used to progressively refine the appropriate closure strategy for the mine hub.</p> <p>The PER and supporting studies provided several lines of evidence, supported by field data, that the Coondewanna Flats PEC is primarily supported by surface water flows with a low likelihood of groundwater dependence. As such, a permanent reduction in groundwater beneath Coondewanna Flats is considered to pose little to no risk to the viability of this PEC.</p> <p>For Weeli Wolli Spring, permanent reductions in water level are acknowledged to pose a risk to the viability of the system. As per the Proponent's response to EPA services comment 7, BHP is committed to maintaining viable ecological and hydrological functions at Weeli Wolli Spring. This may be achieved through minimisation and mitigation measures such as tree watering, aquifer recovery, augmented recharge and the implementation of MAR. In relation to potential change at Weeli Wolli Spring this would mean that, where necessary, BHP would carry out additional works within the catchment with the aim of meeting the agreed objectives.</p>

EPA Services comment	Proponent response
<p><i>Post closure groundwater levels</i></p> <p>45. Provide the predicted no development (pre mining) or baseline flow for Weeli Wolli Spring.</p> <p>46. Provide information on the Weeli Wolli Spring flow rates post Hope Downs closure in 2054.</p> <p>47. Provide information on the predicted flow rates post MAC closure and state on what information this is based and the margin of error.</p> <p>48. If the Weeli Wolli spring flow rates do not return to the predicted no development (pre mining) or baseline flow rate, then provide a detailed risk assessment to demonstrate the impacts to the values of the spring and why this is appropriate.</p> <p>49. Indicate whether mitigation measures such as irrigation would be necessary to maintain the values of the spring. If this is the case provide details of the mitigation measures.</p> <p>The impacts to the flow rate of the Weeli Wolli Spring post closure were not apparent in the PER or supporting documentation.</p>	<p>Predicted no development (pre mining) baseline flow for Weeli Wolli Spring is reported in <i>Hydrogeological Assessment for Mining Area C</i> (RPS, 2015) which modelled baseflow for the spring between 6 to 9 ML/d with an average of ~7ML/d. This is based on gauging records from the Weeli Wolli Spring gauging station and the model uses historic rainfall from the period 1972-2012. Determining baseline or pre-mining flow volumes for Weeli Wolli Creek is problematic due to a limited set of measurements (9 years) which include a significant rainfall event (&gt;1:100) over the summer of 1999/2000. The baseline flow numbers are considered to be at the upper end of the historic range.</p> <p>In the <i>Hydrological Impact Assessment and Water Management Summary</i> (Attachment 11) groundwater levels have been used as an indicator of change at Weeli Wolli Spring. The groundwater modelling approach focused on examining the range of potential outcomes given the current range of hydrogeological uncertainty. Due to the scale of the model and the techniques used, it was not considered appropriate to use that model for forecasting spring flow.</p> <p>The previous modelling described in <i>Hydrogeological Assessment for Mining Area C</i> (RPS, 2015), contains forecasts for spring flow resulting from different drawdown scenarios. The Mining Area C High Case and Hope Downs (infilled) scenario shown in Figure 36 is considered equivalent to the P50 scenario described in <i>South Flank Summary of groundwater change assessment</i> (BHP, 2017). Under this scenario from the 2015 model, spring flow is modelled to be 25% lower than the no-development baseline following closure of both Hope Downs and MAC in 2054.</p> <p>As per the proponent response to EPA Services comment 7, BHP has committed to minimising or mitigating impacts at these receptors to maintain ecological function, including surface water availability at Weeli Wolli Spring. This approach assumes that surface water flows at Weeli Wolli Spring remain available at levels that support the pre-impact values of the spring. If ongoing monitoring and modelling for Weeli Wolli Spring shows that this assumption is incorrect, a range of potential mitigation measures is available (see Section 4.6 in updated CPWRMP, provided as Attachment 4) however selection of these measures will be dependent on the timing of BHP mining and third party activity. If required, a detailed risk assessment will be undertaken at this time.</p>
<b>Social Surrounds</b>	
<p><i>Aboriginal Heritage</i></p>	<p>The Banjima are the relevant Native Title Group for the South Flank project area.</p>

EPA Services comment	Proponent response
<p>50. The PER includes baseline flora and vegetation surveys. It is noted that BHP will consult with the relevant native Title Groups in identifying indigenous considerations relevant to these surveys, including bush food and bush medicine as part of ongoing consultation. Please provide information on the involvement that the relevant native Title Groups have had in the collection of baseline survey information.</p>	<p>Between 2013 and 2017 BHP has worked alongside the Banjima during surveys and consultations over the Southern Flank project area amounting to no less than 888 days. These consultations have included discussion on the use of Country, and the impact to traditional land use practices, heritage sites, flora and vegetation. This consultation is formalised at the Banjima Heritage and Environment Subcommittee Meetings, held at least every 6 months, between BHP and Banjima representatives.</p> <p>Consultation determined that ethnobotanical survey was not required specifically of the Southern Flank area, but rather, more generally across the Native Title Claim area. This has resulted in the commitment by BHP to further engage with Traditional Owners to undertake targeted ethnobotanical surveys on Country. BHP has committed to coordinating an ethnobotanical survey, with participation of Banjima representatives, in the latter half of 2017, subject to participant interest and availability.</p> <p>BHP regularly, informally, assists and facilitates the access to, and shares knowledge of, plant locations for Banjima representatives to gather bush medicines and bush food.</p> <p>Prior to the establishment of the Banjima Heritage and Environment Subcommittee Meetings, BHP engaged with Banjima representatives and consultant archaeologists on a monitoring visit which took place at Southern Flank on 2 May 2010.</p> <p>The main objectives of the visit were to:</p> <ul style="list-style-type: none"> <li>• Verify the integrity of heritage sites located in the vicinity of a fauna monitoring program where ground disturbance work had been conducted</li> <li>• Confirm that the Project Environment Aboriginal Heritage Review (PEAHR) conditions were being adhered to by the contractor</li> <li>• Assess the adequacy of heritage site protection measures (fences and hard barricades)</li> <li>• Discuss any issues or concerns relating to the South Flank fauna monitoring program.</li> </ul> <p>The Traditional Owners were encouraged to give feedback and make known any concerns they may have had with any activities which had taken place in the project area.</p>

EPA Services comment	Proponent response
	<p>The Traditional Owners were shown a map and locations of vertebrate fauna trapping sites. The survey techniques that were used to record vertebrate fauna in the area were explained and the team drove in convoy to view the 12 trapping locations within the Southern Flank survey area.</p> <p>The Banjima representatives were given the opportunity to voice any concerns about BHP’s survey program during this baseline survey.</p> <p>The Banjima Traditional Owners were satisfied that the 12 trapping sites have not impacted any known or potential heritage sites in the vicinity of the impact areas.</p> <p>The Banjima Traditional Owners had no further comments to make in regards to the fauna trapping program. The Banjima signed off on the map and monitoring sheet to confirm their understanding of the outcomes of the monitoring exercise.</p>
<b>Other</b>	
<p>51. From spatial data provided the EPA Services considers:</p> <ul style="list-style-type: none"> <li>the size of the Indicative Additional Impact Assessment Area is 11,743.5 ha and the proposed clearing within this is 14,179.2 ha</li> <li>the size of the EMP Rev 6 Impact Assessment Area is 11,413 ha rather than 11,377 ha</li> <li>the PER states that the Modified Indicative Impact Assessment Area may potentially avoid up to 4,107 ha of disturbance (PER, ES-1, Page xi). This would result in clearing being reduced from 19,671.2 to 15,564.2 ha rather than 15,639 ha.</li> </ul> <p>Please confirm that the above is correct or provide the sizes along with updated spatial data.</p>	<p>BHP have made changes to the Proposal since the PER submission which is inclusive of the commitment to reduce additional clearing within the MAC development envelope to 16,257 hectares. BHP can confirm that there is a 3,414 ha reduction in proposed clearing (originally proposed (19,671.2 ha), now proposing (16,257 ha)).</p> <p>Total clearing for the entire MAC development envelope, if the Proposal is approved, will be 21,821 ha rounded up to the nearest hectare (16,257 additional PLUS 5,563.8 ha approved).</p> <p>The size of the EMP Revision 6 Impact Assessment area is 11,413 hectares.</p> <p>Note all figures have been rounded up to the nearest hectare.</p> <p>Please see the Change to proposal section (Section 1.4) which outlines the impact of these adjustment to the native vegetation key characteristics.</p> <p>Figures 1 and 2 in Attachment 1 show these modified areas.</p>



Table 3: Response to public submissions

No.	Submitter	Submission and/or issue	Proponent response
<b>Flora and vegetation</b>			
1	No. 2, Department of Parks and Wildlife (now Department of Biodiversity Conservation and Attractions)	<p><i>PEC - Coondewanna Flats and Weeli Wolli Spring</i></p> <p><b>Summary:</b></p> <p>If the proposal is considered acceptable, condition(s) of approval are applied that requires the potential impacts on conservation significant ecological communities should be avoided, minimised, monitored, managed and mitigated (as appropriate) to ensure their conservation status and long-term viability is not adversely affected (based on appropriate scientific information and investigations), in consultation with the Department of Biodiversity Conservation and Attractions.</p> <p><b>Discussion:</b></p> <p>The proposal appears to involve potential indirect impacts (e.g. hydrological changes from mine dewatering, altered surface and groundwater flows and water diversion activities relating to this proposal) on the priority ecological communities (PEC): Priority 1 Weeli Wolli Springs and Priority 1 and Priority 3 Coolibah Woodlands (Coondewanna Flats) sub types 1 and 2. It should be noted that the Coolibah Woodlands (Coondewanna Flats) PEC is located on the former Juna Downs part pastoral lease, which is a proposed addition to the conservation reserve system.</p> <p>The potential impacts of this proposal, coupled with previously approved mining activities and other surrounding Pilbara mines, should be limited to an agreed level which is based on appropriate scientific information and investigations, to ensure that the</p>	<p>BHP Iron Ore will continue to engage with DBCA, industry experts, regulatory authorities and other stakeholders, when developing and implementing management measures, to ensure that the DWER's objectives for flora and vegetation are met. Management of the Weeli Wolli PEC and Coondewanna Flats PEC will be addressed by the Central Pilbara Water Resource Management Plan (CPWRMP) and the Biodiversity Environmental Management Plan (BEMP). These management plans include triggers, thresholds and specific measures as appropriate.</p> <p>The CPWRMP contains triggers and thresholds that use groundwater levels and vegetation condition as primary measurements. These are considered sufficient to measure and respond to the potential water-related stresses that could impact the PEC. Consequently the CPWRMP will be used as the primary management document for the vegetation community at Coondewanna Flats.</p>

No.	Submitter	Submission and/or issue	Proponent response
		<p>conservation status of the ecological communities is not adversely affected.</p>	
2	<p>No. 4b, Department of Water (now Department of Water and Environmental Regulation)</p>	<p><i>Eucalyptus camaldulensis</i></p> <p><b>Summary:</b></p> <p>1. Site specific evaluations of <i>E. camaldulensis</i> dependence should be undertaken and these communities should be considered groundwater dependent until investigations suggest otherwise. These investigations can be completed as part of the Central Pilbara Water Resource Management Plan (CPWRMP) and discussed in the response to submissions document.</p> <p>2. The CPWRMP (page 24) should commit to ongoing studies investigating the groundwater dependency of <i>E. camaldulensis</i>.</p> <p><b>Discussion:</b></p> <p>The PER states "<i>Eucalyptus camaldulensis</i> and <i>E. victrix</i> are considered to be facultative phreatophyte species". While <i>Eucalyptus camaldulensis</i> communities may adapt to significant groundwater declines, they are unlikely to maintain their ecological function where declines in groundwater and/or surface water flow occur or the rate of decline is excessive.</p> <p>As described, this species will use any available water sources and is able to change between sources - because of this physiology they may only be dependent on groundwater during extended drought periods when rainfall and surface water inputs are minimal. This may be particularly relevant along Weeli Wolli Creek where extensive calcrete has limited the soil profile available to the <i>E. camaldulensis</i>.</p>	<p>Management of the Weeli Wolli PEC, including <i>Eucalyptus camaldulensis</i>, will be addressed by the Central Pilbara Water Resource Management Plan (CPWRMP) and the Biodiversity Environmental Management Plan (BEMP). BHP will work with DBCA, DWER, industry experts, regulatory authorities and other stakeholders as appropriate to determine suitable triggers and thresholds for key components of the PEC. In order to ensure that triggers and thresholds are appropriate for the community, BHP requests from the EPA the results from Hope Downs Management Services (HDMS)' vegetation monitoring programme.</p>

No.	Submitter	Submission and/or issue	Proponent response
		<p>BHP commits to further investigation of vegetation associated with the Coondewanna Flats in the CPWRMP: "Ongoing studies investigating the groundwater dependency of Coondewanna Flats vegetation communities and key tree species, i.e. <i>Eucalyptus victrix</i> (AQ2)" (page 24). This should include reference to <i>E. camaldulensis</i> also, as part of ongoing studies.</p>	
3	<p>No. 4b, Department of Water (now Department of Water and Environmental Regulation)</p>	<p><i>Weeli Wolli Priority ecological community (sedges and herbs)</i></p> <p><b>Summary / Discussion:</b></p> <p>The sedges and herbs of the Weeli Wolli PEC are an important component of this PEC and presumed to be supported by the "very moist sediment" available (pg. 153). The impacts of a 2m drawdown on sediment moisture and sedge and herb components should be discussed and addressed in the response to submissions document and in the CPWRMP.</p>	<p>BHP recognises that the Weeli Wolli PEC comprises a number of components that may be impacted by groundwater drawdown. There is no available baseline information available for the extent, and therefore potential impacts, of these communities, and their extent is likely to change during operations of the Hope Downs 1 mine. BHP requests from the EPA the results from Hope Downs Management Services (HDMS)' groundwater monitoring programme.</p> <p>Management of the Weeli Wolli PEC will be addressed by the Central Pilbara Water Resource Management Plan (CPWRMP) and the Biodiversity Environmental Management Plan (BEMP). BHP will work with DBCA, industry experts, regulatory authorities and other stakeholders as appropriate to determine suitable triggers and thresholds for key components of the PEC, including impacts to <i>M. argentea</i>. In order to ensure that triggers and thresholds are appropriate for the community, BHP requests from the EPA the results from HDMS' vegetation monitoring programme.</p>
4	<p>No. 4b, Department of Water (now Department of Water and Environmental Regulation)</p>	<p><i>Melaleuca argentea</i></p> <p><b>Summary:</b></p> <p>1. Provide an explanation and reference to the &gt;2m drawdown trigger.</p>	<p>Rainfall in the Pilbara is sporadic. Average rainfall at Newman, approx. 90 km SE of Weeli Wolli Creek, is 327.7 mm. According to the Bureau of Meteorology (BoM, 2017), mean rainfall data collected over a 42 year period at Newman Aero ranges between 36.6 mm (1996) and 619.2 mm (1999). Most waterways in the Pilbara are ephemeral and have short-lived, high velocity flows following rainfall. Consequently,</p>

No.	Submitter	Submission and/or issue	Proponent response
		<p>2. A drawdown rate of 0.5 m is recommended in the first year and subsequent declines should be justified by site specific data and observation.</p> <p><b>Discussion:</b></p> <p>Drawdown of &gt; 2 m has been used throughout the PER document as a trigger to define potential risk to <i>Melaleuca argentea</i>. The development of this trigger has not been referenced, nor has drawdown rate been considered. While a drawdown of this magnitude may be tolerated over a number of years, the department has found that a drawdown &gt;0.85 m/year at Harding Dam and &gt;0.5 at Millstream has resulted in <i>M. argentea</i> deaths in similar environments. Based on the above Pilbara evidence, it is considered appropriate that a drawdown rate of 0.5 m in the first year and subsequent declines be justified by site specific data and observation. This information can be provided in the response to submissions document and as part of the CPWRMP document.</p>	<p>the riparian vegetation of the Pilbara has evolved to adjust to the changing availability of water.</p> <p><i>Melaleuca argentea</i> is the only obligate phreatophyte that occurs within the proposed area of groundwater drawdown. In the Pilbara it occurs in areas of high resource heterogeneity, and it therefore has plastic-root levels strategies to maintain high levels of water uptake when water availability changes around the root systems. A study by McLean (2014) showed that root systems under field conditions distribute water from the saturated zone to roots in drier soils in order to maintain fine root function in these drier zones for a period of at least six months. McLean’s (2014) study also investigated a decline in water levels at the Yule River Borefield, where groundwater levels declined by 4.3 m over a 13-month period (in comparison to a 1.5 m decline at the reference site). Mature trees in the impact zone were ‘generally tolerant of the abstraction’, whilst the smaller, younger trees appeared ‘more susceptible to lowering of the water table, most likely due to reduced access to water as a result of their shallower root systems’ (McLean, 2014). McLean (2014) concluded that mature <i>M. argentea</i> trees appear to tolerate groundwater drawdown of ‘at least several metres’ by employing plastic root strategies to access deeper water. On this basis a 2m change in water level was selected as a threshold that would cause impact in mature <i>Melaleuca argentea</i> within the Weeli Wolli PEC.</p> <p>The Weeli Wolli PEC is an altered system that is not exposed to natural fluctuations in groundwater. HDMS commenced discharge into Weeli Wolli Creek in 2006. Flows measured at the Tarina gauging station were presented in the Hydrogeological Assessment for Mining Area C EMP revision 6 (RPS, 2014) and have been used to inform this response. Under natural conditions, <i>Melaleuca argentea</i> at Weeli Wolli Creek would be exposed to extended periods of no surface water flow (e.g. between 1985 and 1994). Following June 2006 there have been no periods of no water flow, with at least three months over</p>

No.	Submitter	Submission and/or issue	Proponent response
			<p>a seven year period where stream discharge volume has exceeded 20,000 mL/month. This discharge has stimulated the recruitment of a number of riparian species, including <i>M. argentea</i>, in the creek channel, where they comprise dense narrow strips fringing the low flow channel (AQ2, 2016).</p> <p>It is not known whether <i>Melaleuca argentea</i> trees within Weeli Wolli Creek have maintained their plasticity in their root systems due to extended periods of abnormally high water availability, and how these trees will respond when water flows are reduced/ ceased at the end of mining operations at Hope Downs 1. Ministerial Statement 584 for the Hope Downs 1 mine includes the following measurement/ compliance criteria:</p> <ul style="list-style-type: none"> <li>No project induced, major long-term adverse effects on the surface and groundwater regimes and any dependent ecological systems.</li> </ul> <p>Management of the Weeli Wolli PEC will be addressed by the Central Pilbara Water Resource Management Plan (CPWRMP) and the Biodiversity Environmental Management Plan (BEMP). BHP will work with DBCA, industry experts, regulatory authorities and other stakeholders as appropriate to determine suitable triggers and thresholds for key components of the PEC, including impacts to <i>M. argentea</i>. In order to ensure that triggers and thresholds are appropriate for the community, BHP requests from the EPA the results from HDMS' vegetation monitoring programme.</p>
5	No. 4b, Department of Water (now Department of Water and	<p><i>Coondewanna Flats</i></p> <p><b>Summary:</b></p>	<p>The project overlays the buffer of the PEC, but there will be no direct impacts to it. Indirect impacts to the PEC, i.e. dust, altered surface water flows, have been addressed in the PER and potential impacts were considered to be low (refer to section s11.1.4.2 and section 11.1.4.3.4 of the PER). Table 57 of the PER outlines the proposed</p>

No.	Submitter	Submission and/or issue	Proponent response
	Environmental Regulation)	<p>1. Clarify the amount of clearing of the Coondewanna Flats PEC that is associated with the MAC-Southern Flank proposal and anticipated cumulatively.</p> <p>2. An assessment of the impacts of dust, sedimentation and other indirect impacts associated with clearing of the PEC should be provided.</p> <p>3. Management of these indirect impacts should be discussed.</p> <p><b>Discussion:</b></p> <p>The current proposal will result in approximately 20% of the perimeter of the Coondewanna PEC being highly disturbed by clearing. Provide an assessment of increased dust, sedimentation and other potential risk associated with clearing to the PEC. The proposed management approach for this disturbance should also be discussed in the response to submissions document and detailed within the CPWRMP.</p>	<p>management measures in relation to disturbance and potential impacts to the Coondewanna Flats PEC.</p>
6	No. 4b, Department of Water (now Department of Water and Environmental Regulation)	<p><i>Coondewanna Flats</i></p> <p><b>Summary:</b></p> <p>The upper and lower drawdown triggers at Coondewanna Flats should be retained until monitoring validates the groundwater use (or otherwise) of the Priority Ecological Community. Vegetation monitoring and contingency actions should be included in the response to submissions document and CPWRMP.</p> <p><b>Discussion:</b></p> <p>Section 11.4.10.2 of the PER - Site specific management approach, indicates that BMP intends to remove the current triggers for Coondewanna Flats - based on investigative studies indicating the Flats are not groundwater dependent. A commitment to groundwater</p>	<p>On the basis of our studies and available evidence, including tree water use data and comparison with analogous communities in the Pilbara our assessment is that the <i>Eucalyptus victrix</i> stands at Coondewanna Flats are reliant on surface water recharge to the local soil profile rather than groundwater. (See Section 11.1.4.3.4 &amp; Appendix 7 - AQ2, (2015) Coondewanna Flats EcoHydrology Review and Conceptual Model) However, BHP will continue to monitor water levels and tree health (i.e. continuation of current studies) at Coondewanna Flats to confirm this assessment. Current trigger levels will be reviewed and presented in the CPWRMP along with mitigation measures and as outlined in the CPWRMP will be reviewed at least annually as part of the annual aquifer review.</p> <p>In the event that this assessment proves incorrect, drawdown mitigation would be required under the CPWRMP. BHP has a number</p>

No.	Submitter	Submission and/or issue	Proponent response
		<p>injection or tree watering is expected if these studies are not justified on the evidence on continued data collection.</p> <p>The removal of these studies is not currently supported and it is pre-emptive to remove the triggers prior to mining and the initial dewatering of Southern Flank. It is recommended that the triggers remain as part of the CPWRMP for a defined period of time or until this assumption can be confirmed.</p>	<p>of plausible management responses available which are discussed in more detail in the CPWRMP. Management measures could involve a number of solutions including groundwater injection near Coondewanna such as the Juna Downs borefield which is currently proposed.</p>
7	<p>No. 2, Department of Parks and Wildlife (now Department of Biodiversity Conservation and Attractions)</p>	<p><i>Priority Flora</i></p> <p><b>Summary:</b></p> <p>Discuss and best practice management measures that will be undertaken to mitigate local impacts to Priority flora.</p> <p><b>Comment:</b></p> <p>The proposal may result in the removal of entire population(s) of the Priority 3 <i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642), Priority 3 <i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739) and Priority 4 <i>Acacia bromilowiana</i>. Although there are numerous records of these species, best practice management is encouraged through:</p> <ul style="list-style-type: none"> <li>• maintaining viable populations by avoiding/minimising impacts where possible</li> <li>• specific mitigation actions (i.e. seed collection for use in rehabilitation) if removal of entire population(s) is unavoidable.</li> </ul>	<p>BHP Iron Ore has a Project Environmental Aboriginal Heritage Review (PEAHR) process to manage the implementation of its environmental obligations prior to and during land disturbance activities. All ground disturbance activities will be required to meet the requirements of the PEAHR process, as well as relevant legislative and regulatory requirements and BHP WAIO’s Sustainable Development Policy. Additionally, the PEAHR process provides a mechanism whereby technical and professional advice can be provided to the business regarding environmental aspects and management issues. The PEAHR system consists of an electronic workflow process linked to a geographical information system. The objectives of the PEAHR process are to:</p> <ul style="list-style-type: none"> <li>• identify the significant environmental, Aboriginal heritage and legal aspects of proposed activities;</li> <li>• ensure that, through appropriate environmental Aboriginal heritage and land access planning and management, BHP WAIO activities comply with all legal and other obligations;</li> <li>• avoid, minimise and mitigate the number and nature of environmental, Aboriginal heritage and land tenure impacts and ensure adequate environmental performance of BHP WAIO operations; and</li> <li>• provide a mechanism for continuous improvement.</li> </ul>

No.	Submitter	Submission and/or issue	Proponent response
			<p>The implementation of the PEHR process will ensure that impact is minimised where possible. BHP WAIO commit to investigating the viability of using <i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642), <i>Triodia</i> sp. Mt Ella (M.E. Trudgen 12739) and <i>Acacia bromilowiana</i> in rehabilitation seed mixes, unless these species are subsequently removed from the Priority flora species listing prior to be impacted by the Proposal.</p>
<b>Subterranean fauna</b>			
8	<p>No. 2, Department of Parks and Wildlife (now Department of Biodiversity Conservation and Attractions)</p>	<p><b>Summary:</b></p> <p>Taxa may be at high risk from development activities and require a level of precautionary protection and an adaptive approach to management until enough information can be gathered to:</p> <ul style="list-style-type: none"> <li>• adequately clarify their distribution and habitat</li> <li>• ensure their long-term survival is not placed at risk by impacting activities.</li> </ul> <p><b>Discussion:</b></p> <p>That during the assessment it is recognised that, based on current information:</p> <ul style="list-style-type: none"> <li>• Forty one of the 126 troglofauna taxa recorded in the development envelope have only been recorded in the proposed impact areas. Due to lack of scientific knowledge, there is uncertainty over the likely range of eight of these taxa.</li> <li>• Ten of the 53 stygofauna taxa recorded in the cumulative groundwater assessment area have only been recorded in areas of cumulative groundwater drawdown. Due to lack of scientific knowledge, there is uncertainty over the likely range of three of these taxa.</li> </ul>	<p><i>Troglofauna:</i> Within the Proposed Mining Area C Development Envelope total survey effort comprises 2,473 traps and 3,020 scrapes. Of the 126 species that have been recorded during surveys, 49 (39%) were only represented by a single animal. Despite numerous attempts to record these species by targeted sampling, they were not recorded. This highlights the difficulty in determining species distribution based solely on sampling, which is compounded by the fact that almost 95% of the recorded species are undescribed (119 species in total).</p> <p>Detailed three dimensional habitat assessments have been undertaken for all species potentially restricted to areas of impact. These habitat assessments suggest that most species (33 of the 41 potentially restricted species) are not restricted to potential areas of impact. There is uncertainty around the remaining eight species due to lack of knowledge about the habitats in which these species occur or if they are actually even true troglofauna species. Given that species records and habitat assessments suggest that 94% of troglofauna species have, or likely have, distributions that extend beyond the proposed impact assessment areas and there are no major geological features likely to restrict distributions of troglofauna, BHP considers the risk that the remaining eight species are restricted to impact areas to be low. Nevertheless, BHP is committed to undertaking further research on troglofauna species to further understand their ecology</p>



No.	Submitter	Submission and/or issue	Proponent response
		<p>It appears that the proposal has the potential to impact on several taxa that have all or most of their known range restricted to proposed impact areas. It is noted that when inferring potential ranges of individual taxa using habitat profiling and mapping, assumptions are made about which potential habitat is actually used by individual taxa. Therefore, in some cases (due to the paucity of information involved with novel and undescribed species and potential habitat specialisation), taxa may be at high risk from development activities and require a level of precautionary protection and an adaptive approach to management until enough information can be gathered to:</p> <ul style="list-style-type: none"> <li>• adequately clarify their distribution and habitat</li> <li>• ensure their long-term survival is not placed at risk by impacting activities.</li> </ul>	<p>and distribution in the Pilbara. BHP has recently engaged Curtin University to undertake a pilot study to determine if environmental DNA (eDNA) can be used to supplement traditional survey methods to determine distribution of troglofauna species and communities. If the pilot is successful, BHP commits to funding additional studies on the use of subterranean fauna eDNA. This work complements existing work funded by BHP being undertaken by the CSIRO in Canberra on stygofauna and troglofauna which is due for completion at the end of 2017.</p> <p>The Draft Biodiversity EMP submitted with the PER included modification of the Indicative Additional Impact Assessment Area to avoid impacts to potentially restricted species, and retention of habitats within pit buffers for six of the eight species for which distribution outside the impact areas remain uncertain. BHP will implement an adaptive management approach for the management of troglofauna considering the results from ongoing work.</p> <p><i>Stygofauna:</i> The three species for which impacts from the Proposal are uncertain are:</p> <ul style="list-style-type: none"> <li>• Nr Epactophenes sp B01</li> <li>• Dussartcyclops sp B01</li> <li>• Bathynella sp 2.</li> </ul> <p>All three species were recorded within areas assessed under Revision 6 of the Mining Area C EMP or previous revisions. Nr Epactophenes sp B01 is known from a single record.</p> <p>The five potentially restricted species at Southern Flank: Prethopalpus sp. B15, Prethopalpus julianneae, Philosciidae sp. B03, nr</p>

No.	Submitter	Submission and/or issue	Proponent response
			<p>Andricophiloscia sp. B16 and Parajapygidae DPL024 were recorded within the pit area of the Indicative Additional Impact Assessment Area and the New Modified Indicative Additional Impact Assessment Area, as shown in the updated Table 49 (Attachment 1).</p> <p>The changes to the Modified Indicative Additional Impact Assessment Area resulted in no net changes to the potential impacts on the five potentially restricted troglofauna species. As discussed in Section 1.4 of the Response to Submissions document, the modifications were driven by the optimisation of the Southern Flank mine plan and design.</p>
<b>Terrestrial Fauna</b>			
9	No. 2, Department of Parks and Wildlife (now Department of Biodiversity Conservation and Attractions)	<p><i>Ghost Bat</i></p> <p><b>Summary:</b></p> <p>If the proposal is considered acceptable, a condition of approval is applied requiring a clear limit for impacts (direct and indirect) is required on <i>Macroderma gigas</i> (ghost bat) individuals, local population and habitat (roosting and foraging) as a result of the implementation of this proposal.</p> <p><b>Discussion:</b></p> <p>Ghost bat is threatened fauna, ranked vulnerable. The estimated ghost bat population for the Hamersley sub region (including the development envelope area) is 300-400 individuals, with an estimated Pilbara population of approximately 1300-2000 individuals. The proponent has indicated that the development envelope area supports a population of approximately 50 individuals.</p> <p>Sixty three caves utilised by ghost bats have been recorded in the development envelope. Twelve caves are located outside the areas of</p>	<p>With implementation of the Modified Additional Impact Assessment Area, the Proposal will impact up to 36 roosts considered suitable for ghost bat roost (14 High value and 22 Low value). Impacts to 18 of these roosts were previously assessed (and approved) under MS491 (EMP Revisions 4-6). BHP acknowledges that the removal of the roosts will have an impact on the ghost bat assemblage during the period of operations, but with mitigation it is considered that the Proposal will be unlikely to have lasting implications for recruitment and genetic continuity in the Hamersley subregion.</p> <p>Estimates of foraging habitat have been made using data on foraging range from studies in the Northern Territory. BHP commits to undertaking ecological studies on the ghost bat in the Hamersley Ranges to inform management of the species within its tenure. BHP utilises an adaptive management framework and information from these studies will be considered during review and update of the Biodiversity EMP as appropriate.</p>

No.	Submitter	Submission and/or issue	Proponent response
		<p>proposed direct impact, with 51 caves occurring either within the approved (18 caves) or proposed (33 caves) impact areas. Twenty two of the 51 caves have been classified in the PER as 'high' value caves (defined as having suitable physical attributes for a day or maternity roost; ghost bats may have been recorded in the roost and scat counts have indicated continual use over a period of years). A subset of these are likely to be used as maternity caves.</p> <p>The PER states that the removal of all 51 caves within the approved and proposed impact areas could result in a reduction of the Hamersley sub region population by a predicted 12 to 17 per cent. While the proponent has stated that the proposal is unlikely to have a significant impact on the ghost bat at a species or a population level, the removal of all 51 caves would likely have a significant impact at a local level.</p> <p>The PER states "<i>... without mitigation it is considered unlikely that the ghost bat would persist within the Proposed Mining Area C development envelope during active mining operations in similar numbers or at air</i> (page 193), with displaced individuals likely to perish or be outcompeted by other groups.</p> <p>It is recognised that the proponent has proposed modification of its impact areas to reduce the total number of caves proposed to be impacted from 51 to 36, and reduced the clearing of ghost bat foraging habitat by 173 hectares (e.g. the overall proposal will likely impact on 14,997 hectares of an estimated 20,920 hectares of foraging habitat within the development envelope). However, the proposed impacts on ghost bat are potentially significant as "...a reduction in [ghost bat] numbers Would be expected as approximately half of the high value caves are planned to be removed and the gap between the east and west caves could reduce the ability of ghost bats to respond to natural or man-made events such as fire, drought and noise" (page 212). It is</p>	

No.	Submitter	Submission and/or issue	Proponent response
		<p>therefore considered important that if the proposal is considered for approval, the specific limit(s) in terms of direct and/or indirect impacts on ghost bat are conditioned to ensure the persistence of the species in the local area.</p>	
10	<p>No. 2, Department of Parks and Wildlife (now Department of Biodiversity Conservation and Attractions)</p>	<p><i>Ghost Bat</i></p> <p><b>Summary:</b></p> <p>If the proposal is considered acceptable, a condition of approval is applied requiring the management of ghost bat to be developed in consultation with the Department of Biodiversity Conservation and Attractions. The proposed measures should be finalised prior to ground disturbing activities so that they include appropriate management and monitoring of ghost bat during construction, operation and decommissioning.</p> <p><b>Discussion:</b></p> <p>It appears that the local ghost bat population could be significantly impacted by the implementation of this proposal, if approved. Therefore, appropriate monitoring, management and mitigation measures should be conditioned for this threatened species. Any management and monitoring program for threatened species should be developed in consultation with the Department of Biodiversity Conservation and Attractions and relevant bat experts and should consider but not be limited to habitat condition monitoring for all foraging and dispersal habitat; cave habitat (including environmental conditions such as humidity); and ultrasonic and infrared monitoring. The early development of an agreed plan and baseline monitoring would ensure that any inter and intra annual variation is adequately documented prior to ground disturbing activities beginning.</p>	<p>BHP will continue to engage with DBCA and relevant experts to ensure that the EPA's objectives for terrestrial fauna are met. Management of the ghost bat will be addressed by the Biodiversity Environmental Management Plan (BEMP). Draft triggers, thresholds and specific measures have been developed and were provided with the PER submission.</p>

No.	Submitter	Submission and/or issue	Proponent response
11	No. 2, Department of Parks and Wildlife (now Department of Biodiversity Conservation and Attractions)	<p><i>Ghost Bat</i></p> <p><b>Summary:</b></p> <p>Parks and Wildlife is provided with the opportunity to comment on possible conservation offset measures aimed at mitigating the residual impacts of the project on ghost bat.</p> <p><b>Discussion:</b></p> <p>It is noted that a series of proposed actions to reduce the proposed residual impacts, through the application of the mitigation hierarchy including offsets, has been prepared by the proponent (Table 67, pages 316-323 in the PER). For example, the proponent has proposed to offset the impacts on the ghost bat by undertaking "Research into ghost bat ecology in the Pilbara" (page 318). As part of mitigating the residual impact to this threatened species, a conservation plan that includes research may have benefit.</p> <p>If there is further consideration or development of offsets for the ghost bat, it is requested that the Department of Biodiversity Conservation and Attractions is consulted as this relates to matters pursuant to the department's <i>Wildlife Conservation Act 1950</i> responsibilities.</p>	<p>BHP has committed to undertaking further research on the ghost bat in the Pilbara. The results of this work will be published in the scientific literature and provided to DBCA. BHP will continue to engage with DBCA and relevant experts to ensure that the EPA's objectives for terrestrial fauna are met.</p>
12	No. 2, Department of Parks and Wildlife (now Department of Biodiversity Conservation and Attractions)	<p><i>Short Range Endemic</i></p> <p><b>Summary:</b></p> <p>Taxa may be at high risk from development activities and require a level of precautionary protection and an adaptive approach to management until enough information can be gathered to:</p> <ul style="list-style-type: none"> <li>• adequately clarify their distribution and habitat</li> </ul>	<p><i>Short-range Endemic taxa:</i> The four confirmed SRE taxa currently only known from impact areas are:</p> <ul style="list-style-type: none"> <li>• <i>Antichiropus</i> DIP006: There is one confirmed record of <i>A. DIP006</i> within the EMP Revision 6 Impact Assessment Area, and a further two juvenile/ female records that are considered likely to be <i>A. DIP006</i> that also occur in the EMP Revision 6 Impact Assessment Area. Biologic (in prep.) has recently (May 2017) recorded an additional 20 records of <i>Antichiropus</i> along Packsaddle Range, and characterised the habitat for the species</li> </ul>

No.	Submitter	Submission and/or issue	Proponent response
		<ul style="list-style-type: none"> <li>ensure their long-term survival is not placed at risk by impacting activities.</li> </ul> <p><b>Discussion:</b></p> <p>That during the assessment it is recognised that, based on current information four confirmed short range endemic taxa are only known from the proposed impact areas.</p> <p>It appears that the proposal has the potential to impact on several taxa that have all or most of their known range restricted to proposed impact areas. It is noted that when inferring potential ranges of individual taxa using habitat profiling and mapping, assumptions are made about which potential habitat is actually Used by individual taxa. Therefore, in some cases (due to the paucity of information involved with novel and undescribed species and potential habitat specialisation), taxa may be at high risk from development activities and require a level of precautionary protection and an adaptive approach to management until enough information can be gathered to:</p> <ul style="list-style-type: none"> <li>adequately clarify their distribution and habitat</li> <li>ensure their long-term survival is not placed at risk by impacting activities.</li> </ul>	<p>to be similar to <i>Antichiropus</i> DIP007. All collections were made at the base of <i>Corymbia hamersleyana</i> (mallee form) along the slopes of Packsaddle Range. This work suggests that <i>A.</i> DIP006 is unlikely to be restricted to proposed impact areas. Preliminary mapping (shown in additional information provided to EPA services as commercial in confidence) shows the likely extent of habitat for this species.</p> <ul style="list-style-type: none"> <li><i>A.</i> DIP007 (Southern Flank): habitat mapping shows extensive areas of suitable habitat outside the proposed impact areas. A genetic analysis is currently being undertaken to determine if the juvenile specimens of <i>Antichiropus</i> found throughout and adjacent to the Proposed Mining Area C Development Envelope are either <i>A.</i> ‘DIP006’ or <i>A.</i> ‘DIP007’. This genetic analysis will be used to complement recent habitat assessments undertaken to produce <i>A.</i> ‘DIP006’ habitat mapping and to refine the current <i>A.</i> ‘DIP007’ habitat mapping, if required. It should be noted that genetic analysis may not provide a clear delineation of the species, and that some genetic variation will exist within the population, particularly as <i>A.</i> ‘DIP006’ and <i>A.</i> ‘DIP007’ are low mobility species and gene flow is likely to be restricted across the populations. Careful consideration has been given to the approach taken for the genetic analysis, which is consistent with previous successful genetic work undertaken on other <i>Antichiropus</i> species</li> <li><i>Chenistonia</i> (<i>Kwonkan</i>) ‘MYG088’ (EMP Rev 6): Following submission of the PER a taxonomic review of the <i>Chenistonia</i> MYG088 specimen has been undertaken and it has been reclassified as <i>Kwonkan</i> MYG088. It is still only known from one record within the Proposed Mining Area C Development Envelope.</li> <li><i>Karaops banyjima</i> (EMP Rev 6): Only known from one record within the EMP Revision 6 Impact Assessment Area; however based on knowledge of habitat preferences for this group, it is considered likely that habitat for this species occurs in multiple</li> </ul>

No.	Submitter	Submission and/or issue	Proponent response
			<p>landform types and occurs beyond the Proposed Mining Area C Development Envelope. The suitable habitat map (Figure 1.6 of Attachment 7) is very conservative at this stage. Also note there are five juvenile <i>Karapos</i> specimens recorded within the Proposed Mining Area C Development Envelope, all outside of indicative impact assessment areas.</p> <p>Management of habitat for <i>Antichiropus</i> 'DIP006', A. 'DIP007' and <i>Kwonkan</i> 'MYG088' was included in the Draft Biodiversity EMP provided with the PER submission.</p>
<b>Hydrological Processes</b>			
13	No.3, Department of Mines and Petroleum (now Department of Mines, Industry, Regulation and Safety)	<p><i>Pebble Mouse Creek</i></p> <p><b>Summary:</b></p> <p>To demonstrate that only stable landforms will remain post closure, the planning and design of long-term constructed landforms should consider rainfall and flood events which are more extreme than the standard 1:100 year ARI events.</p> <p><b>Discussion:</b></p> <p>A concern was raised regarding the proposal to place an Overburden Storage Area (OSA) within the 1:100 year Average Recurrence Interval (ARI) floodplain of Pebble Mouse Creek.</p> <p>To demonstrate that only stable landforms will remain post closure, the planning and design of long-term constructed landforms should</p>	<p>BHP notes the proposed OSA footprint (south-eastern Southern Flank) within the modelled 1:100 year floodplain of Pebble Mouse Creek.</p> <p>Revised mine plans have redesigned (with a smaller footprint) and relocated the OSA so that it now intersects the low flow velocity fringes of the 1:10,000 year flood event. Due to the low flood water velocity modelled in this area long-term landform stability will likely be achieved without rock armouring.</p> <p>Further opportunity exists for additional OSA redesign/relocation to avoid placement within the 1:10,000 year floodplain. This is based on investigations into additional in-pit waste dumping, which can reduce OSA footprint requirements. The current mine plan also indicates no waste will be dumped in this area for &gt; 10 years after mine start-up allowing time to devise a mine planning solution.</p>

No.	Submitter	Submission and/or issue	Proponent response
		<p>consider rainfall and flood events which are more extreme than the standard 1:100 year ARI events that are used for operational planning and design. It is noted that a 1:10,000 ARI flood event has been modelled for the Pebble Mouse Creek, which would be an adequate scale event for determining OSA placement and design.</p> <p>Where OSAs are to be located within the 1:10,000 ARI flood zone for any significant water course, appropriate OSA design should be presented within the Mine Closure Plan to demonstrate the facility will remain stable long-term.</p>	<p>However, should subsequent mine plans still include OSA placement within this area BHP will address closure surface water management and design for this OSA in future updates of the Mine Closure Plan. Table 33, Section 8.5 of the Mining Area C Mine Closure Plan also acknowledges improvement activities to be actioned for surface water hydrology including to ‘develop design principles for structures remaining post-mining that will be exposed to surface drainage.’</p>
14	No. 4a, Department of Water (now Department of Water and Environmental Regulation)	<p><i>Ground water Modelling and Data Collection</i></p> <p><b>Summary:</b></p> <p>Indicate a time frame for data collection and the provision of updated modelling to the EPA that is reasonable and achievable.</p> <p><b>Discussion:</b></p> <p>Modelling predictions are preliminary due to limited data (on hydraulic parameters) and a lower level of confidence in the calibration around Southern Flank - however BHP acknowledges these limitations, and recognises the consequent uncertainties, including the hydrology of any regional connectivity between Coondewanna Flats and Weeli Wolli Spring. It is recommended that the model is updated and recalibrated once further data is collected, and then reviewed as mining progresses.</p>	<p>Noted. BHP timing for data collection to inform subsequent model recalibrations will also depend on accessibility to third-party tenure or data. Development of the conceptual model will be ongoing and numerical model will be updated when information has been gathered to provide a meaningful update. This information will be provided as part of the Annual Aquifer Reviews and Triennial aquifer reviews.</p>
15	No. 4a, Department of Water (now Department of Water and	<p><i>Ground water Modelling and Data Collection - Ben's Oasis</i></p> <p><b>Summary:</b></p>	<p>A number of monitoring holes were installed on BHP tenure in the vicinity of Ben's Oasis in 2016. Baseline groundwater data collection around Ben's Oasis has started and will be ongoing.</p>



No.	Submitter	Submission and/or issue	Proponent response
	Environmental Regulation)	<p>1. Indicate when baseline data collection at Ben's Oasis could commence.</p> <p>2. Indicate when the model could be updated and an impact assessment for Ben's Oasis would be provided.</p> <p>3. Consider how monitoring data collected from the tenure over Ben's Oasis would be made available to regulators and to the tenure holders.</p> <p><b>Discussion:</b></p> <p>The model domain does not include Ben's Oasis - due to a lack of geological knowledge and monitoring data in the area. Considering Ben's Oasis is potentially groundwater dependent (as recognised by BHP in the Strategic Environmental Assessment) hydrological and hydrogeological data collection around Ben's Oasis is essential to update the model and to undertake impact assessment. It is recommended that data collection is undertaken around Ben's Oasis to provide historical baseline data prior to mining at Southern Flank. This data collection should begin as soon as practicable.</p> <p>Given the proposal has potential to impact on Ben's Oasis, which is not on BHP tenure and for which water data is not currently publically available, the proponent should ensure any monitoring data collected off its tenure is made available to regulators and to the tenure holders in the interests of cumulative impact assessment.</p>	<p>Availability of data is a limitation for both assessment and management. BHP remains committed to developing an effective approach to cumulative catchment management. BHP will continue to consult with DWER with respect to any data collected and timing of model updates and assessment with regards to Bens Oasis.</p>
16	No. 4a, Department of Water (now Department of Water and	<p><i>Dolerite Dykes - Coondewanna Flats and Weeli Wolli Spring</i></p> <p><b>Summary:</b></p> <p>1. Demonstrate that mining will not detrimentally effect the Coondewanna Flats and Weeli Wolli Spring hydrological regime.</p>	<p>The identified dyke to the south of Coondewanna Flats will not be removed under the current proposal. Pit designs in the vicinity of the dyke do not intersect the dyke below water table and are not anticipated to change the hydrogeological function of the dyke.</p>

No.	Submitter	Submission and/or issue	Proponent response
	Environmental Regulation)	<p>2. If it cannot be demonstrated that mining of the dykes will not detrimentally effect the hydrological regime then provide measures to avoid, minimise and rehabilitate potential impacts to ensure the continued regime.</p> <p><b>Discussion:</b></p> <p>The hydrogeology of the area is influenced by structural features, including dolerite dykes that potentially act as barriers to groundwater flow. These dykes could result in a series of "hydrogeologically independent" localised groundwater systems, which would need to be managed at a smaller scale.</p> <p>If the dykes are removed, unexpected impacts may occur at sensitive receptors - especially excessive drawdown at Coondewanna Flats and altered flows to Weeli Wolli Spring - if hydraulic connectivity between the two systems is changed. It also adds increased uncertainty to the groundwater modelling of Coondewanna Flats.</p>	<p>Where any future modifications to pit design have potential interactions with the dyke below water table, an assessment will be carried out to identify impacts followed by consultation with relevant agencies prior to implementation.</p> <p>Uncertainty remains about the extent of regionally connectivity between Coondewanna Flats and Weeli Wolli Spring. In the South Flank valley the lack of hydraulic stresses (such as drawdown from dewatering) limits the conclusions that can be drawn about how these systems are connected.</p> <p>The presence and extent of regional connectivity is a key factor in determining the extent of impacts from mining through dykes. To fulfil impact assessment requirements a precautionary approach was taken which assumed connection between these areas. This approach will continue while studies and monitoring programs are carried out to address the uncertainty around regional connection.</p>
17	No. 4a, Department of Water (now Department of Water and Environmental Regulation)	<p><i>Mine Closure - Coondewanna Flats and Weeli Wolli Springs</i></p> <p><b>Summary:</b></p> <p>Modelling of post closure groundwater recovery at Coondewanna and Weeli Wolli springs show potential permanent drawdown impacts when below watertable pit voids remain. Consideration should be given to backfilling.</p> <p><b>Discussion:</b></p> <p>Modelling of post closure groundwater recovery at Coondewanna and Weeli Wolli Springs show potential permanent drawdown impacts when below watertable pit voids remain. BHP has not committed to backfilling below water table pits at southern Flank; the commitment is</p>	<p>Uncertainty remains about the extent of regionally connectivity between Coondewanna Flats and Weeli Wolli spring. In the South Flank valley the lack of hydraulic stresses (such as drawdown from dewatering) limits the conclusions that can be drawn about how these systems are connected.</p> <p>The presence and extent of regional connectivity is a key factor in determining the extent of impacts from pit voids. For the purposes of impact assessment, a precautionary approach was taken that assumed connection between these areas. This approach will continue while studies and monitoring programs are carried out to address the uncertainty around regional connection.</p>

No.	Submitter	Submission and/or issue	Proponent response
		<p>that BHP will consider this as a potential mitigation option if further studies and groundwater modelling validate long term drawdown impacts at these key receptors.</p> <p>Consider whether the potential future impacts on Weeli Wolli Springs and Coondewanna flats necessitate a project commitment by BHP, or a ministerial closure condition relating to pit backfill and mine closure planning.</p>	
<b>Inland Waters Environmental Quality</b>			
18	No. 4a, Department of Water (now Department of Water and Environmental Regulation)	<p><i>Pit Voids</i></p> <p><b>Summary:</b></p> <p>Further work is required to determine the evolution in pit lake salinity and subsequent impact(s) on the regional groundwater system over time.</p> <p><b>Discussion:</b></p> <p>Pit lakes are expected to develop in some pit voids (behaving as groundwater sinks), with resulting brackish to hypersaline groundwater. BHP proposes an adaptive management approach to these voids, including backfilling pit voids as a mitigation measure if the EPA requires.</p> <p>BHP is planning to complete further studies to determine the mine void closure strategy (including considerations of backfilling) to manage these groundwater risks.</p>	<p>Uncertainty in the conceptual groundwater model exists due to complexity with regard to connectivity between below water table pit voids and key ecohydrological receptors, and impacts from existing mines in the area. BHP has committed to undertake ongoing conceptual model development to better inform closure options with regard to pit lakes. Additional study work on the evolution of pit lake salinity over time will also be undertaken.</p> <p>BHP believes it appropriate to undertake this work to validate any pit void impacts at key receptors prior to committing to backfill as a specific control. The Southern Flank PER stated that pit void backfill remains an option if ecohydrological receptors are shown to be at risk. BHP plans to address this issue in subsequent Mine Closure Plans, once a meaningful update to the conceptual groundwater model has been completed.</p> <p>In PER Section 11.7.4.4 BHP states that closure strategy will seek to increase in-pit waste placement, as part of the normal load and haul operations, through ongoing mine plan iterations. Importantly, where possible, waste placement will focus on below water table areas.</p>

No.	Submitter	Submission and/or issue	Proponent response
			BHP has confidence that further study, mine planning and adaptive management practices will result in stable and non-polluting into mine closure.
<b>Social Surroundings</b>			
19	No. 6, Department of Aboriginal Affairs (now Department of Planning, Lands and Heritage)	<i>Aboriginal Heritage</i>  <b>Summary:</b>  Consideration should be given to the Aboriginal Heritage Due Diligence Guidelines when planning specific developments associated with development proposals.	To manage and protect Aboriginal heritage in compliance with the Aboriginal Heritage Act 1972 and the EPBC Act, BHP Iron Ore utilises strict internal processes and procedures ( e.g. PEHR procedure) implemented by dedicated Heritage and GIS teams. The procedure provides a mechanism for the heritage specialists within the Heritage and GIS teams to provide technical and professional advice regarding cultural heritage management of sites These processes are based on guidelines drafted by the Department of Aboriginal Affairs (DAA) and include measures to identify significant heritage sites during planning phases so as to avoid or minimise potential heritage impacts. Within surveyed areas, BHP Iron Ore documents the spatial location of each heritage place and, where practicable, adopts engineering solutions to avoid them. If any heritage site cannot practically be avoided, BHP Iron Ore will consult with the relevant Aboriginal group and seek consent from the Minister under Section 18 of the Aboriginal Heritage Act 1972 prior to undertaking any activities that may disturb the site.
<b>Human Health</b>			
20	No. 1, Main Roads WA	<i>Road Safety</i>  <b>Summary:</b>	Noted. BHP will monitor meteorological forecasts during operations to determine if prevailing weather conditions may cause particulate material to impede the vision of motorists on Great Northern Highway. Operations will be executed in accordance with the mine plan to minimise dust and particulate generation which is produced during

No.	Submitter	Submission and/or issue	Proponent response
		<p>Activities should be restricted to times when the meteorological forecast shows no prevailing conditions which may cause particulate material to impede the vision of motorists on Great Northern Highway.</p> <p><b>Discussion:</b></p> <p>A concern was raised surrounding potential visibility issues stemming from proposed mining operations in the areas shown in Figure 5A of the submitted report. Dust and particulate generation which is produced during blasting / mining operations has been noted as a moderate concern to Great Northern Highway. Close to 500 vehicles per day use this section of Great Northern Highway and a reduction in visibility is a large risk.</p>	<p>blasting / mining operations. However, mining activities will either be reduced in the vicinity of the highway or planned away from the highway as required to minimise potential impacts.</p> <p>Operations will be managed in accordance with the Part V licence conditions.</p> <p>BHP have modified the indicative impact assessment area which has resulted in movement of the overburden storage area (OSA's) away from the Great Northern Highway. This will result in a reduction in potential visibility impacts to the highway (see Figure 6 of the PER).</p>
21	No. 1, Main Roads WA	<p><i>Road Safety</i></p> <p><b>Summary/Discussion:</b></p> <p>Blasting activities, including the imposition of any exclusion zones, should not impede traffic along Great Northern Highway. If there is a requirement for any traffic management along Great Northern Highway related to blasting activities a Blast Management Plan must be agreed in advance by BHP and Main Roads.</p>	<p>Noted. BHP will liaise with Main Roads regarding the preparation and implementation of traffic management measures where required in relation to undertaking blasting activities in the vicinity of the Great Northern Highway.</p>
22	No. 1, Main Roads WA	<p><i>Road Safety</i></p> <p><b>Summary/Discussion:</b></p> <p>At no point during the operations is any water or other material to be discharged into the road reserve.</p>	<p>BHP commits to no water or other material to be purposely discharged into the road reserve, noting that during high rainfall events water and other material may naturally flow into these reserves.</p> <p>Operations will be managed in accordance with the Part V licence conditions.</p>

### **3. Ongoing and additional consultation**

BHP have continued consultation with the EPA with regards troglafauna habitat assessment, clearing and offsets; and in regards to the Juna Downs and Camp hill borefields and in regards to rail characteristic of the current approval. As noted above, BHP have continued consultation with DBCA with regards to vegetation units and Ghost Bat habitat. Other ongoing consultation is noted in the table above.

BHP consulted Stephen van Leeuwen for advice as highlighted in Table 2 and acknowledgement his input in this regard.

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## **5. Attachments**

# **Attachment 1    New and Updated Figures & Tables**

## **Attachment 2 EPA correspondence regarding Juna Downs**

## **Attachment 3 Onshore Environmental Additional Information**

# **Attachment 4 Updated Draft Central Pilbara Water Resource Management Plan**



# **Attachment 5    Draft Biodiversity Management Plan**

## **Attachment 6 Mine Closure Plan**

# **Attachment 7 Short Range Endemic Supporting Information**

# **Attachment 8    Spectrum Ecology and ENV Reports**

## **Attachment 9 Ghost Bat Research Plan**

## **Attachment 10 Additional Southern Flank Troglafauna Habitat Assessment**

# **Attachment 11 Updated Hydrological Impact Assessment**