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BHP Billiton Iron Ore Pty Ltd
ABN 46 008 700 981
225 St Georges Terrace
Perth Western Australia 6000
PO Box 7122 Cloisters Square 6850
Perth Western Australia
Tel +61 8 62244444 Fax +61 8 62244042
bhpbilliton.com

Iron Ore

15 May 2015

Dr Paul Vogel
Chairman
Environmental Protection Authority
Locked Bag 33, Cloisters Square
Perth Western Australia 6850

Attention: Vanessa Angus

Dear Paul,

OREBODY 32 ABOVE WATER TABLE IRON ORE MINE PROJECT, NEWMAN
Referral under Section 38(1) of the *Environmental Protection Act 1986*

BHP Billiton Iron Ore is seeking approval to develop and operate the Orebody 32 deposit, located approximately 10 kilometres north-east of the Newman Township in the Pilbara. The Proposal is known as the Orebody 32 East Above Water Table Mine Project.

Please find enclosed BHP Billiton Iron Ore's referral and supporting documentation, in accordance with Section 38(1) of the *Environmental Protection Act 1986*.

If you have any queries please do not hesitate to contact Mark Garrahy on (08) 6321 2181 or mark.garrahy@bhpbilliton.com. We look forward to working in cooperation with the Environmental Protection Authority on this Proposal.

Yours sincerely,

Gavin Price
Head of Environment

Enclosed:
- Section 38(1) Referral Form
- A copy of the Supporting Environmental Referral Document
- Electronic copies of referral form, the Supporting Environmental Referral Document and the shapefile of the Proposal Development Envelope

GOVERNMENT OF WESTERN AUSTRALIA

Environmental Protection Authority

EPA REFERRAL FORM

Referral of a Proposal to the Environmental Protection Authority under Section 38 of the *Environmental Protection Act 1986*.

PURPOSE OF THIS FORM

Section 38 of the *Environmental Protection Act 1986* (EP Act) makes provision for the referral to the Environmental Protection Authority (EPA) of a proposal (significant proposals, strategic proposals and proposals under an assessed scheme) by a proponent, a decision making authority (DMA), or any other person.

The purpose of this form is to ensure that EPA has sufficient information about a proposal to make a decision about the nature of the proposal and whether or not the proposal should be assessed under Part IV of the EP Act. Information provided in the referral form must be brief (no more than 30 pages), sharp and succinct to achieve the purposes of this form.

This form does not prevent the referrer from providing a supplementary referral report. Should a referrer choose to submit a supplementary referral report please ensure the following.

i. Information is short, sharp and succinct.
ii. Attachments are below eight megabytes (8 MB) as they will be published on the EPA's website (exemptions apply) for public comment. To minimise file size, "flatten" maps and optimise pdf files.
iii. Cross-references are provided in the referral form to the appropriate section/s in the supplementary referral report.

This form is to be used for all proposals[1] which can be referred to the EPA under section 38 of the EP Act; i.e. referrals from: **proponents** of proposals (significant proposals, strategic proposals, derived proposals, proposals under an assessed scheme); **DMAs** (significant proposals); and **third parties** (significant proposals).

This form is divided into several sections, including; Referral requirements and Declaration; Part A - Information of the proposal and proponent; and Part B Environmental Factors. Guidance on successfully completing this form is provided throughout the form and is also available in the EPA's *Environmental Assessment Guideline for Referral of a Proposal under s38 of the EP Act (EAG 16)*.

Send completed forms to
Office of the Environmental Protection Authority
Locked Bag 10, East Perth WA 6892

or

Email: Registrar@epa.wa.gov.au

Enquiries
Office of the Environmental Protection Authority
Locked Bag 10, East Perth WA 6892
Telephone: 6145 0800
Fax: 6145 0895
Email: info@epa.wa.gov.au
Website: www.epa.wa.gov.au

[1] Please note that this form consolidates and replaces the following forms: *Referral of a Proposal by the Proponent to the EPA under section 38(1) of the EP Act*; *Referral of a Proposal by a third party to the EPA under section 38(1) of the EP Act*; and *Referral of a development proposal to the EPA by the decision making authority*.

Referral requirements and Declaration

The following section outlines the referral information required from a proponent, decision making authority and third party.

(a) Proponents

Proponents are expected to complete all sections of the form and provide GIS spatial data to enable the EPA to consider the referral. Spatial GIS data is necessary to inform the EPA's decision.

The EPA expects that a proponent will address Part B of the form as thoroughly as possible to demonstrate whether or not the EPA's objectives for environmental factors can be met.

If insufficient information is provided the EPA will request more information and processing of the referral will commence once the information is provided or the EPA decides to make a precautionary determination on the available information.

Proponent to complete before submitting form	
Completed all the questions in Part A (essential)	☒ Yes ☐ No
Completed all the questions in Part B	☒ Yes ☐ No
Completed all other applicable questions	☒ Yes ☐ No
Included Attachment 1 – any additional document(s) the proponent wishes to provide	☒ Yes ☐ No
Included Attachment 2 – confidential information (if applicable)	☐ Yes ☒ No *not applicable*
Enclosed an electronic copy of all referral information, including spatial data and contextual mapping but clearly separating any confidential information	☒ Yes ☐ No
Completed the Declaration	☒ Yes ☐ No
What is the type of proposal being referred? ** a referred proposal seeking to be declared a derived proposal*	☒ significant ☐ strategic ☐ derived* ☐ under an assessed scheme
Do you consider the proposal requires formal environmental impact assessment?	☒ Yes ☐ No
If yes, what level of assessment? *API = Assessment of Proponent Information* *PER = Public Environmental Review*	☒ API Category A ☐ API Category B ☐ PER

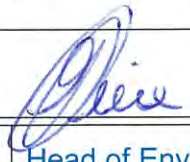
NB: The EPA may apply an Assessment on Proponent Information (API) level of assessment when the proponent has provided sufficient information about:

- the proposal;
- the proposed environmental impacts;
- the proposed management of the environmental impacts; and
- when the proposal is consistent with API criteria outlined in the *Environmental Impact Assessment (Part IV Division 1 and 2) Administrative Procedures 2012*.

If an API A formal level of assessment is considered appropriate, please refer to Environmental Assessment Guideline No. 14 *Preparation for an Assessment on Proponent Information (Category A) Environmental Review Document EAG 14* (EAG14).

Declaration

I, **Gavin Price** declare that I am authorised on behalf of **BHP Billiton Iron Ore Pty Ltd** to submit this form and further declare that the information contained in this form is true and not misleading.

Signature		Name (print)	Gavin Price	
Position	Head of Environment	Organisation	BHP Billiton Iron Ore Pty Ltd	
Email	Gavin.Price@bhpbilliton.com			
Address	Level 39/125	St Georges Terrace		
	Perth		WA	6000
Date	18 May 2015			

(b) Decision-making authority

The EPA expects decision-making authorities to complete applicable sections of Part A of the form and provide the proponent an opportunity to provide additional information in Part B of the form where appropriate.

Wherever possible the DMA should obtain relevant spatial information from the proponent and provide this to the EPA with the referral.

DMA to complete before submitting form	
Completed all the questions in Part A (essential)	☐ Yes ☐ No
Provided Part B to the proponent for completion	☐ Yes ☐ No
Completed all other applicable questions	☐ Yes ☐ No
Included Attachment 1 – any supporting information	☐ Yes ☐ No
Enclosed an electronic copy of all referral information, including spatial data and contextual mapping	☐ Yes ☐ No
Completed the below Declaration	☐ Yes ☐ No
Do you consider the proposal requires formal environmental impact assessment?	☐ Yes ☐ No
What is the type of proposal being referred?	☐ significant proposal ☐ significant proposal under an assessed scheme

Declaration

I, ……, *(full name)* submit this referral to the EPA for consideration of the environmental significance of its impacts.

Signature		Name (print)	
Position		Organisation	
Email			
Address	Street No.	Street Name	
	Suburb	State	Postcode
Date			

(c) Third Party

Third parties are asked to have consideration for the Significance Test outlined in Part A Section 1.5 of this form before referring a significant proposal to the EPA. The EPA will only consider proposals that are likely, if implemented, to have a significant effect on the environment.

Third parties are to provide sufficient information to clearly identify the significant proposal, the proponent, and their reasons for referring the proposal. This can be done by completing as much of Part A of the form as possible, taking into consideration the information available. Third parties may wish to fill in Part B of the form to advance their own views of the significance of the environmental impacts and the need for EPA assessment.

In most cases the EPA will seek additional information from the proponent. This will be to confirm or amend the identity of the proponent, the proposal, and to allow the proponent opportunity to provide its views on the significance of the environmental impacts and the need for EPA assessment.

Third Party to complete before submitting form	
Complete all applicable questions in Part A and B	☐ Yes ☐ No
Completed the Declaration	☐ Yes ☐ No
Do you consider the proposal requires formal environmental impact assessment?	☐ Yes ☐ No

Declaration

I, ……, *(full name)* submit this referral to the EPA for consideration of the environmental significance of its impacts.

Signature		Name (print)		
Email				
Position		Organisation		
Address	Street No.	Street Name		
	Suburb		State	Postcode
Date				

PART A: Information on the proposal and the proponent

All fields of Part A must be completed by the proponent and/or decision-making authority for this document to be processed as a referral. Third party referrers are only expected to fill in the fields they have information for.

1 PROPONENT AND PROPOSAL DESCRIPTION

1.1 The proponent of the proposal

Proponent and/or DMA to complete	
Name of the proponent	BHP Billiton Iron Ore Pty Ltd – acting as manager and agent for the Mount Newman Joint Venture (NJV)
Joint Venture parties (if applicable)	• BHP Billiton Minerals Pty Ltd (ABN 93 008 694 782) 85%; • Mitsui – Itochu Iron Pty Ltd (ABN 84 008 702 761) 10%; and • Itochu Minerals & Energy of Australia Pty (ABN 44 009 256 259) 5%.
Australian Company Number(s) (if applicable)	4600870098
Postal Address *(Where the proponent is a corporation or an association of persons, whether incorporated or not, the postal address is that of the principal place of business or of the principal office in the State)*	125 St Georges Terrace Perth WA 6000
Key proponent contact for the proposal *Please include: name; physical address; phone; and email.*	Mark Garrahy Manager Environment Approvals BHP Billiton Iron Ore Pty Ltd 125 St Georges Terrace PERTH WA 6000 Office Phone Number: 6321 2181 Email: Mark.Garrahy@bhpbilliton.com
Consultant for the proposal (if applicable) *Please include: name; physical address; phone; and email.*	N/A

1.2 Proposal

Proposal is defined under the EP Act to mean a "project, plan, programme policy, operation, undertaking or development or change of land use, or amendment of any of the foregoing, but does not include scheme". Before completing this section please refer to Environmental Protection Bulletin 17 – Strategic and derived proposals (EPB 17) and Environmental Assessment Guideline for Defining the Key Characteristics of a proposal (EAG 1).

Proponent and/or DMA to complete	
Title of the proposal	
What project phase is the proposal at?	☐ Scoping ☐ Feasibility ☑ Detailed design ☐ Other _____

Proponent and/or DMA to complete	
Proposal type *More than one proposal type can be identified, however for filtering purposes it is recommended that only the primary proposal type is identified.*	☐ **Power/Energy Generation** ☐ Hydrocarbon Based – coal ☐ Hydrocarbon Based – gas ☐ Waste to energy ☐ Renewable – wind ☐ Renewable – wave ☐ Renewable – solar ☐ Renewable – geothermal ☑ **Mineral / Resource Extraction** ☐ Exploration – seismic ☐ Exploration – geotechnical ☑ Development ☐ **Oil and Gas Development** ☐ Exploration ☐ Onshore – seismic ☐ Onshore – geotechnical ☐ Onshore – development ☐ Offshore – seismic ☐ Offshore – geotechnical ☐ Offshore – development ☐ **Industrial Development** ☐ Processing ☐ Manufacturing ☐ Beneficiation ☐ **Land Use and Development** ☐ Residential – subdivision ☐ Residential – development ☐ Commercial – subdivision ☐ Commercial – development ☐ Industrial – subdivision ☐ Industrial – development ☐ Agricultural – subdivision ☐ Agricultural – development ☐ Tourism ☐ **Linear Infrastructure** ☐ Rail ☐ Road ☐ Power Transmission ☐ Water Distribution ☐ Gas Distribution ☐ Pipelines ☐ **Water Resource Development** ☐ Desalination ☐ Surface or Groundwater ☐ Drainage ☐ Pipelines

Proponent and/or DMA to complete	
	☐ Managed Aquifer Recharge ☐ **Marine Developments** ☐ Port ☐ Jetties ☐ Marina ☐ Canal ☐ Aquaculture ☐ Dredging *If other, please state below:* ☐ **Other** _____
Proponent and/or DMA to complete	
Description of the proposal – describe the key characteristics of the proposal in accordance with EAG 1.	In summary, the key components of the Proposal are listed below: • campaign open pit mining at a base mining rate of 5 Mtpa; and • associated infrastructure, stockpiles and access roads. The Proposal will involve clearing up to 350 hectares of native vegetation within a Proposal Development Envelope of 414 hectares. The Key Characteristics Table for the proposal is provided in Section 1.3 of the Environmental Referral Document.
Timeframe in which the proposal is to occur (including start and finish dates where applicable).	BHP Billiton Iron Ore is seeking to commence construction in Quarter 4 of the 2015 calendar year.
Details of any staging of the proposal.	N/A
What is the current land use on the property, and the extent (area in hectares) of the property?	The current land use is BHP Billiton Iron Ore exploration activities under approved Native Vegetation Clearing Permits. The underlying tenure is State Agreement Mineral Lease ML244SA, which extends from the Newman Township across the Proposal Development Envelope and out east towards and including Jimblebar.
Have pre-referral discussions taken place with the OEPA? If yes, please provide the case number. If a case number was not provided, please state the date of the meeting and names of attendees.	Yes: • 5 March 2014 (Sally Bowman and Peter Tapsell) • 4 May 2015 (Sally Bowman, Vanessa Angus and John Guld) Case number: CMS15056
DMA (Responsible Authority) to complete	
For a proposal under an assessed scheme (as defined in section 3 of the EP Act, applicable only to the proponent and DMA) provide details (in an	

Proponent and/or DMA to complete	
attachment) as to whether: • *The environmental issues raised by the proposal were assessed in any assessment of the assessed scheme.* • *The proposal complies with the assessed scheme and any environmental conditions in the assessed scheme.*	

1.3 Strategic / derived proposals

Complete this section if the proposal being referred is a strategic proposal or you are seeking the proposal to be declared a derived proposal. Note: Only a proponent may refer a strategic proposal and seek a proposal to be declared a derived proposal.

Proponent to complete	
Is this referred proposal a strategic proposal?	☐ Yes ☒ No
Are you seeking that this proposal be declared a derived proposal?	☐ Yes ☒ No
If you are seeking that this proposal be declared a derived proposal, what is the Ministerial Statement number (MS #) of the associated strategic proposal?	MS #: _____

1.4 Location

Proponents and DMAs must provide spatial data. Please refer to EAG 1 for more detail.

Proponent, DMA and Third Party to complete	
Name of the Local Government Authority in which the proposal is located.	Shire of East Pilbara
Location: a) street address; lot number; suburb; and nearest road intersection; or b) if remote the nearest town; and distance and direction from that town to the proposal site.	Orebody 32 deposit located west of Orebody 24 Mine, and approximately 10 km north-east of the town of Newman
Have maps and figures been included with the referral (consistent with EAG 1 where appropriate)? *The types of maps and figures which need to be provided (depending on the nature of the proposal) include:* • *maps showing the regional location and context of the proposal; and* • *figures illustrating the proposal elements.*	☒ Yes ☐ No
Proponent and DMA to complete	
Have electronic copies of spatial data been included with the referral? ***NB:** Electronic spatial (GIS or CAD) data, geo-referenced and conforming to the following parameters:* • *GIS: polygons representing all activities and named;* • *CAD: simple closed polygons representing all activities and named;* • *datum: GDA94;* • *projection: Geographic (latitude/longitude) or Map Grid of Australia (MGA);* • *format: ESRI geodatabase or shapefile, MapInfo Interchange Format, Microstation or AutoCAD..*	☒ Yes ☐ No

1.5 Significance test and environmental factors

Proponent, DMA and Third Party to complete	
What are the likely significant environmental factors for this proposal?	☐ Benthic Communities and Habitat ☐ Coastal Processes ☐ Marine Environmental Quality ☐ Marine Fauna ☒ Flora and Vegetation ☐ Landforms ☒ Subterranean Fauna (note that Troglofauna was assessed as a preliminary key factor, however following assessment, BHP Billiton Iron Ore is of the view that this factors meets the OEPA objective, and is therefore, not considered significant). ☐ Terrestrial Environmental Quality ☐ Terrestrial Fauna

Proponent, DMA and Third Party to complete	
	☐ Hydrological Processes ☐ Inland Waters Environmental Quality ☐ Air Quality & Atmospheric Gases ☐ Amenity ☐ Heritage ☐ Human Health ☒ Offsets ☒ Rehabilitation and Decommissioning
Having regard to the Significance Test (refer to Section 7 of the *EIA Administrative Procedures 2012*) in what ways do you consider the proposal may have a significant effect on the environment and warrant referral to the EPA?	BHP Billiton Iron Ore has carried out a thorough and comprehensive environmental impact assessment process to review the potential impacts of the Proposal on the environmental values of the area. Following this assessment BHP Billiton Iron Ore is of the opinion that the Proposal meets the requirements of the significance test in relation to assessment due to the potential extent of likely impacts.

1.6 Confidential information

All information will be made publically available unless authorised for exemption under the EP Act or subject to the Freedom of Information Act 1992.

Proponent to complete	
Does the proponent request that the EPA treat any part of the referral information as confidential? *Ensure all confidential information is provided in a separate attachment in hard copy.*	☐ Yes ☒ No

2 REGULATORY CONSIDERATIONS

This section applies to the Local, State and Commonwealth regulatory considerations for the referred proposal.

2.1 Government approvals

2.1.1 State or Local Government approvals

DMA to complete	
What approval(s) is (are) required from you as a decision-making authority?	
Is rezoning of any land required before the proposal can be implemented? If yes, please provide details.	☐ Yes ☐ No

2.1.2 Regulation of aspects of the proposal

Complete the following to the extent possible.

Proponent to complete	
Do you have legal access required for the implementation of all aspects of the proposal? *If yes, provide details of legal access authorisations / agreements / tenure.* *If no, what authorisations / agreements / tenure is required and from whom?*	☒ Yes ☐ No The Proposal is located on Mineral Lease ML244SA, granted pursuant to the *Iron Ore (Mount Newman) Agreement Act 1964*.

Outline both the existing approvals and approvals that will be / are being sought as a part of this proposal.

Proponent to complete			
Aspects* of the proposal	Type of approval	Legislation regulating this activity	Which State agency /entity regulate this activity?
N/A			

**e.g. mining, processing, dredging*

2.1.3 Commonwealth Government *Environment Protection and Biodiversity Conservation Act 1999* approvals

Refer to the assessment bilateral agreement between the Commonwealth of Australia and the State of Western Australia for assistance on this section.

Proponent to complete	
1. Does the proposal involve an action that may be or is a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)?	☐ Yes ☒ No *If no continue to Part A section 2.3.4.*
2. What is the status of the decision on whether or not the action is a controlled action?	☐ Proposal not yet referred ☐ Proposal referred, awaiting decision ☐ Assessed – controlled action ☐ Assessed – not a controlled action
3. If the action has been referred, when was it referred and what is the reference number (Ref #)?	Date: _____ Ref #: _____
4. If the action has been assessed, provide the decision in an attachment. Has an attachment been provided?	☐ Yes ☐ No
5. Do you request this proposal to be assessed under the bilateral agreement?	☐ Yes ☐ No

Complete the following to the extent possible for the Public Comment of EPBC Act referral documentation.

Proponent to complete	
6. Have you invited the public to comment on your referral documentation?	☐ Yes ☐ No
7. How was the invitation published?	☐ newspaper ☐ website
8. Did the invitation include all of the following?	
(a) brief description of the action	☐ Yes ☐ No
(b) the name of the action	☐ Yes ☐ No
(c) the name of the proponent	☐ Yes ☐ No
(d) the location of the action	☐ Yes ☐ No
(e) the matters of national environmental significance that will be or are likely to be significantly impacted	☐ Yes ☐ No
(f) how the relevant documents may be obtained	☐ Yes ☐ No
(g) the deadline for public comments	☐ Yes ☐ No
(h) available for public comment for 14 calendar days	☐ Yes ☐ No
(i) the likely impacts on matters of national environmental significance	☐ Yes ☐ No
(j) any feasible alternatives to the proposed action	☐ Yes ☐ No
(k) possible mitigation measures	☐ Yes ☐ No
9. Were any submissions received during the public comment period?	☐ Yes ☐ No
10. Have public submissions been addressed? If yes provide attachment.	☐ Yes ☐ No

2.1.4 Other Commonwealth Government Approvals

Proponent, DMA and Third Party to complete			
Is approval required from other Commonwealth Government/s for any part of the proposal?		☐ Yes ☐ No *If yes, please complete the table below.*	
Agency / Authority	Approval required	Application lodged?	Agency / Local Authority contact(s) for proposal
		☐ Yes ☐ No	
		☐ Yes ☐ No	

3. SUPPORTING INFORMATION

Please attach copies of any relevant information on the proposal, supporting evidence and / or existing environmental surveys, studies or monitoring information undertaken and list the documents below.

Proponent, DMA and Third Party to complete			
(1)	Orebody 32 East AWT Project Environmental Referral Document	BHP Billiton Iron Ore Pty Ltd	Proposal supporting document which adheres to the EPA's recently released *Environmental Assessment Guideline 14, Preparation of an API-A Environmental Review Document* (EPA, 2015).

PART B: ENVIRONMENTAL FACTORS

The purpose of Part B is to assist the EPA to determine the significance of the likely environmental impacts of the proposal in accordance with the EPA's *Environmental Assessment Guideline for Environmental factors and objectives* (EAG 8) and *Environmental Assessment Guideline for Application of a significant framework in the EIA process* (EAG 9). Referrers completing Part B should refer closely to EAG 8 and EAG 9.

The EPA has prepared *Referral of a Proposal under s38 of the EP Act EAG No.16 - Appendix A* (Appendix A) to assist in identifying factors and completing the below table. Further guidance can be found in the guidance and policy documents cited in Appendix A under each factor.

How to complete Part B
For each environmental factor, that is likely to be significantly impacted by the implementation of the proposal, make a copy of the table below and insert a summary of the relevant information relating to the proposal. The table can be broken down into more than one table per factor, if the need arises. For example the hydrological processes factor can be presented in two separate tables, one for surface water and one for groundwater, or similarly one for construction and one for operations.

For complex proposals a supplementary referral report can be provided in addition to the referral form. If this option is chosen the table must still be completed (summaries are acceptable) to assist the Office of the EPA with statistical reporting and filtering proposals for processing.

Proponents expecting an API level of assessment must provide information in accordance with the EPA's *Environmental Assessment Guideline for Preparation of an API-A environmental review document* (EAG 14).

For each of the significant environmental factors, complete the following table (Questions 1 – 10).

POTENTIAL KEY FACTOR – FLORA AND VEGETATION		
1	Factor, *as defined in EAG 8*	Flora and Vegetation
2	EPA Objective, *as defined in EAG 8*	To maintain representation, diversity, viability and ecological function at the species, population and community level
3	Guidance - what established policies, guidelines, and standards apply to this factor in relation to the proposal?	Position Statement No. 2, Environmental Protection of Native Vegetation in Western Australia: Clearing of native vegetation with particular reference to agricultural areas (EPA 2000a); Position Statement No. 3, Terrestrial Biological Surveys as an element of Biodiversity Protection (EPA 2002a); Guidance Statement No. 51, Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in WA (EPA 2004a) Checklist for Documents Submitted for EIA on Marine and Terrestrial Biodiversity (EPA 2010b).

POTENTIAL KEY FACTOR – FLORA AND VEGETATION		
4	Consultation - outline the need for consultation and the outcomes of any consultation in relation to the potential environmental impacts, including: • *anticipated level of public interest in the impact;* • *consultation with regulatory agencies; and* • *consultation with community.*	BHP Billiton Iron Ore has consulted with the Office of Environmental Protection Authority (OEPA) regarding the proposed clearing of vegetation in 'Good-to-Excellent' condition. BHP Billiton Iron Ore has also consulted with the Department of Parks and Wildlife (DPaW) regarding this factor. The DPaW has reviewed the Proposal and advised it does not need to provide comments.
5	Baseline information - describe the relevant characteristics of the receiving environment. *This may include: regional context; known environmental values, current quality, sensitivity to impact, and current level of cumulative impacts.*	Details are provided in Table 9 of the Referral supporting document.
6	Impact assessment - describe the potential impact/s that may occur to the environmental factor as a result of implementing the proposal.	Details are provided in Table 9 of the Referral supporting document.
7	Mitigation measures - what measures are proposed to mitigate the potential environmental impacts? The following should be addressed: • *Avoidance - avoiding the adverse environmental impact altogether;* • *Minimisation - limiting the degree or magnitude of the adverse impact;* • *Rehabilitate – restoring the maximum environmental value that is reasonably practicable; and* • *Offsets – actions that provide environmental benefits to counterbalance significant residual environmental impacts or risks of a project or activity.*	Details are provided in Table 9 of the Referral supporting document.

POTENTIAL KEY FACTOR – FLORA AND VEGETATION		
8	Residual impacts – review the residual impacts against the EPA objectives. *It is understood that the extent of any significant residual impacts may be hard to quantify at the referral stage. Referrers are asked to provide, as far as practicable, a discussion on the likely residual impacts and form a conclusion on whether the EPA's objective for this factor would be met if residual impacts remain. This will require:* • *quantifying the predicted impacts (extent, duration, etc.) acknowledging any uncertainty in predictions;* • *putting the impacts into a regional or local context, incorporating knowable cumulative impacts; and* • *comparison against any established environmental policies, guidelines, and standards.*	Details are provided in Table 9 of the Referral supporting document.
9	EPA's Objective – from your perspective and based on your review, which option applies to the proposal in relation to this factor? *Refer to EAG 9*	☒ *meets the EPA's objective* ☐ *may meet the EPA's objective* ☐ *is unlikely to meet the EPA's objective*
10	Describe any assumptions critical to your conclusion (in Question 9). *e.g. particular mitigation measures or regulatory conditions.*	Implementation conditions are suggested in Appendix M of the Referral supporting document.

POTENTIAL KEY FACTOR – SUBTERRENEAN FAUNA		
1	Factor, *as defined in EAG 8*	*Subterranean Fauna (Troglofauna)*
2	EPA Objective, *as defined in EAG 8*	*To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.*
3	Guidance - what established policies, guidelines, and standards apply to this factor in relation to the proposal?	EPA Position Statement No. 3, Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA, 2002a). EPA Guidance No. 56, Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia (EPA, 2004b).

POTENTIAL KEY FACTOR – SUBTERRENEAN FAUNA		
4	Consultation - outline the need for consultation and the outcomes of any consultation in relation to the potential environmental impacts, including: • *anticipated level of public interest in the impact;* • *consultation with regulatory agencies; and* • *consultation with community.*	BHP Billiton Iron Ore has carried out a thorough impact assessment and has assessed Subterranean Fauna (troglofauna) as a preliminary key factor in the referral supporting document, however, does not consider that Subterranean Fauna is a key factor and does not warrant specific conditioning. BHP Billiton Iron Ore has also consulted with the DPaW regarding troglofauna and the DPaW has chosen not to provide any comments with regards to this factor.
5	Baseline information - describe the relevant characteristics of the receiving environment. *This may include: regional context; known environmental values, current quality, sensitivity to impact, and current level of cumulative impacts.*	Details are provided in Table 10 of the Referral supporting document.
6	Impact assessment - describe the potential impact/s that may occur to the environmental factor as a result of implementing the proposal.	Details are provided in Table 10 of the Referral supporting document.
7	Mitigation measures - what measures are proposed to mitigate the potential environmental impacts? The following should be addressed: • *Avoidance - avoiding the adverse environmental impact altogether;* • *Minimisation - limiting the degree or magnitude of the adverse impact;* • *Rehabilitate – restoring the maximum environmental value that is reasonably practicable; and* • *Offsets – actions that provide environmental benefits to counterbalance significant residual environmental impacts or risks of a project or activity.*	Details are provided in Table 10 of the Referral supporting document.

POTENTIAL KEY FACTOR – SUBTERRENEAN FAUNA		
8	Residual impacts – review the residual impacts against the EPA objectives. *It is understood that the extent of any significant residual impacts may be hard to quantify at the referral stage. Referrers are asked to provide, as far as practicable, a discussion on the likely residual impacts and form a conclusion on whether the EPA's objective for this factor would be met if residual impacts remain. This will require:* • *quantifying the predicted impacts (extent, duration, etc.) acknowledging any uncertainty in predictions;* • *putting the impacts into a regional or local context, incorporating knowable cumulative impacts; and* • *comparison against any established environmental policies, guidelines, and standards.*	Details are provided in Table 10 of the Referral supporting document.
9	EPA's Objective – from your perspective and based on your review, which option applies to the proposal in relation to this factor? *Refer to EAG 9*	☒ *meets the EPA's objective* ☐ *may meet the EPA's objective* ☐ *is unlikely to meet the EPA's objective*
10	Describe any assumptions critical to your conclusion (in Question 9). *e.g. particular mitigation measures or regulatory conditions.*	Implementation conditions are suggested in Appendix M of the Referral supporting document.

POTENTIAL KEY FACTOR – OFFSETS		
1	Factor, *as defined in EAG 8*	Offsets
2	EPA Objective, *as defined in EAG 8*	To counterbalance any significant residual environmental impacts or uncertainty through the application of offsets
3	Guidance - what established policies, guidelines, and standards apply to this factor in relation to the proposal?	WA Environmental Offsets Policy 2011 WA Environmental Offsets Guidelines Environmental Protection Bulletin No. 1 - Environmental Offsets – Biodiversity WA environmental offsets template

POTENTIAL KEY FACTOR – OFFSETS		
4	Consultation - outline the need for consultation and the outcomes of any consultation in relation to the potential environmental impacts, including: • *anticipated level of public interest in the impact;* • *consultation with regulatory agencies; and* • *consultation with community.*	BHP Billiton Iron Ore has reviewed the recently published *WA Environmental Offsets Guidelines* (WA Government, 2014) and completed the *Offsets Form* as part of this Proposal. BHP Billiton Iron Ore will address offsets in accordance with the *Offsets Guidelines* (WA Government, 2014 – or its revisions).
5	Baseline information - describe the relevant characteristics of the receiving environment. *This may include: regional context; known environmental values, current quality, sensitivity to impact, and current level of cumulative impacts.*	Details are provided in Table 11 of the Referral supporting document.
6	Impact assessment - describe the potential impact/s that may occur to the environmental factor as a result of implementing the proposal.	Details are provided in Table 11 of the Referral supporting document.
7	Mitigation measures - what measures are proposed to mitigate the potential environmental impacts? The following should be addressed: • *Avoidance - avoiding the adverse environmental impact altogether;* • *Minimisation - limiting the degree or magnitude of the adverse impact;* • *Rehabilitate – restoring the maximum environmental value that is reasonably practicable; and* • *Offsets – actions that provide environmental benefits to counterbalance significant residual environmental impacts or risks of a project or activity.*	Details are provided in Table 11 of the Referral supporting document.

POTENTIAL KEY FACTOR – OFFSETS		
8	Residual impacts – review the residual impacts against the EPA objectives. *It is understood that the extent of any significant residual impacts may be hard to quantify at the referral stage. Referrers are asked to provide, as far as practicable, a discussion on the likely residual impacts and form a conclusion on whether the EPA's objective for this factor would be met if residual impacts remain. This will require:* • *quantifying the predicted impacts (extent, duration, etc.) acknowledging any uncertainty in predictions;* • *putting the impacts into a regional or local context, incorporating knowable cumulative impacts; and* • *comparison against any established environmental policies, guidelines, and standards.*	Details are provided in Table 11 of the Referral supporting document.
9	EPA's Objective – from your perspective and based on your review, which option applies to the proposal in relation to this factor? *Refer to EAG 9*	☒ *meets the EPA's objective* ☐ *may meet the EPA's objective* ☐ *is unlikely to meet the EPA's objective*
10	Describe any assumptions critical to your conclusion (in Question 9). *e.g. particular mitigation measures or regulatory conditions.*	Implementation conditions are suggested in Appendix M of the Referral supporting document.

POTENTIAL KEY FACTOR – REHABILITATION AND DECOMMISSIONING		
1	Factor, *as defined in EAG 8*	Rehabilitation and decommissioning
2	EPA Objective, *as defined in EAG 8*	To ensure that premises are decommissioned and rehabilitated in an ecologically sustainable manner.
3	Guidance - what established policies, guidelines, and standards apply to this factor in relation to the proposal?	EPA Guidance Statement No. 6 Rehabilitation of Terrestrial Ecosystems (EPA, 2006a) Guidelines for Preparing Mine Closure Plans (DMP and EPA, 2015) Leading Practice Sustainable Development Program for the Mining Industry - Managing Acid and Metalliferous Drainage (DITR, 2007) EPA involvement in mine closure, (EPA, 2013e)

POTENTIAL KEY FACTOR – REHABILITATION AND DECOMMISSIONING		
4	Consultation - outline the need for consultation and the outcomes of any consultation in relation to the potential environmental impacts, including: • *anticipated level of public interest in the impact;* • *consultation with regulatory agencies; and* • *consultation with community.*	BHP Billiton Iron Ore has consulted with the Department of Mines and Petroleum (DMP) regarding closure and rehabilitation for the wider Eastern Ridge Hub in January 2015. BHP Billiton Iron Ore has since provided a copy of the draft referral package to the DMP for review as part of the pre-consultation process for this Proposal. BHP Billiton Iron Ore is committed to ongoing consultation with the DMP throughout this Proposal assessment process.
5	Baseline information - describe the relevant characteristics of the receiving environment. *This may include: regional context; known environmental values, current quality, sensitivity to impact, and current level of cumulative impacts.*	Details are provided in Table 12 of the Referral supporting document.
6	Impact assessment - describe the potential impact/s that may occur to the environmental factor as a result of implementing the proposal.	Details are provided in Table 12 of the Referral supporting document.
7	Mitigation measures - what measures are proposed to mitigate the potential environmental impacts? The following should be addressed: • *Avoidance - avoiding the adverse environmental impact altogether;* • *Minimisation - limiting the degree or magnitude of the adverse impact;* • *Rehabilitate – restoring the maximum environmental value that is reasonably practicable; and* • *Offsets – actions that provide environmental benefits to counterbalance significant residual environmental impacts or risks of a project or activity.*	Details are provided in Table 12 of the Referral supporting document.

POTENTIAL KEY FACTOR – REHABILITATION AND DECOMMISSIONING		
8	Residual impacts – review the residual impacts against the EPA objectives. *It is understood that the extent of any significant residual impacts may be hard to quantify at the referral stage. Referrers are asked to provide, as far as practicable, a discussion on the likely residual impacts and form a conclusion on whether the EPA's objective for this factor would be met if residual impacts remain. This will require:* • *quantifying the predicted impacts (extent, duration, etc.) acknowledging any uncertainty in predictions;* • *putting the impacts into a regional or local context, incorporating knowable cumulative impacts; and* • *comparison against any established environmental policies, guidelines, and standards.*	Details are provided in Table 12 of the Referral supporting document.
9	EPA's Objective – from your perspective and based on your review, which option applies to the proposal in relation to this factor? *Refer to EAG 9*	☒ *meets the EPA's objective* ☐ *may meet the EPA's objective* ☐ *is unlikely to meet the EPA's objective*
10	Describe any assumptions critical to your conclusion (in Question 9) *e.g. particular mitigation measures or regulatory conditions.*	Implementation conditions are suggested in Appendix M of the Referral supporting document.

In circumstances where there was some uncertainty on the level of significance of a particular factor it is recommended that a brief summary (no longer than 1 - 2 paragraphs) is provided on the steps taken to determine why a factor was not considered to be significant.

Orebody 32 East AWT

bhpbilliton
resourcing the future

Proposal – Orebody 32 East Above Water Table Mine Project

Environmental Referral Document
May 2015

Document tracking

Item	Detail
Project name	Revised Proposal – Orebody 32 East Above Water Table Mine Project
Saved location of document	G:\AssetDev\Environmental Approvals (beta)\06 Sustaining Tonnes
Prepared by	BHP Billiton Iron Ore Environmental Approvals Team – Sonya Brunt
Reviewed by	BHP Billiton Iron Ore – Renelle Thorpe
Approved for release by	BHP Billiton Iron Ore – Mark Garrahy
Status/version number	Final Version 0
Date saved	27/05/2015

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Abbreviations, acronyms and definitions

Abbreviation/Acronym	Full Title
AER	Annual Environmental Report
AHA	*Aboriginal Heritage Act 1972*
AMD	Acid and Metalliferous Drainage
ANC	Acid Neutral Capacity
BIF	Banded Iron Formation
AWT	Above water table
DEC	Department of Environment and Conservation
DER	Department of Environment Regulation
Development Envelope	The boundary of the Proposal – as per the requirements of the Environmental Protection Authority's Environmental Assessment Guideline 1 – Defining the Key Characteristics of a Proposal (EPA, 2012).
DMP	Department of Mines and Petroleum
DoH	Department of Health
DoW	Department of Water
DPaW	Department of Parks and Wildlife
DRF	Declared Rare Flora
DSD	Department of State Development
EAG	Environmental Assessment Guideline
EIA	Environmental Impact Assessment
EP Act	*Environmental Protection Act 1986*
EPA	Environmental Protection Authority
ERD	Environmental Referral Document
ESD	Ecologically Sustainable Development
GDV	Groundwater dependent vegetation
GL/a	Gigalitres per annum
GWL	Groundwater well licence
ha	Hectares
IBRA	Interim Biogeographic Regionalisation for Australia
Indicative Disturbance Boundary or Maximum Disturbance Boundary	Historic reference to a disturbance area used by BHP Billiton Iron Ore in all Part IV projects prior to the release of EPA EAG 1 (EPA, 2012). It is also the terminology used to carry out environmental impact assessment studies prior to determining a final Proposal Development Envelope.
km	kilometre
km^2	square kilometre
m	metres
mbgl	metres below ground level
mg/L	milligrams per Litre
ML/d	Megalitres per day
Mt	Million tonnes

Abbreviation/Acronym	Full Title
Mtpa	Million tonnes per annum
Newman State Agreement	Iron Ore (Mount Newman) Agreement Act 1964
NJV	Mount Newman Joint Venture
NVCP	Native Vegetation Clearing Permit
OEPA	Office of the Environmental Protection Authority
OSA	Overburden Storage Area
PAF	Potentially acid forming
PEAHR	Project Environment and Aboriginal Heritage Review
PEC	Priority Ecological Community
RIWI Act	Rights in Water and Irrigation Act 1914
TEC	Threatened Ecological Community

1. Proponent and key proposal characteristics

1.1 Proposal overview

BHP Billiton Iron Ore Pty Ltd (BHP Billiton Iron Ore) is seeking approval to develop and mine a new deposit, referred to as Orebody 32 East (the Proposal). The Proposal will involve conventional open pit iron ore mining of the mineralised Marra Mamba Iron Formation. The orebody lies above the water table (AWT). Ore mined at the deposit will be transported to existing ore processing infrastructure at the adjacent mining operations for processing and transport via existing infrastructure.

The Proposal area is located approximately ten kilometres (km) north-east of Newman Township and immediately west of the existing Orebody 24 Mine and Orebody 25 Mine, which are part of what is known as the BHP Billiton Iron Ore Eastern Ridge Hub, in the Pilbara region of Western Australia (WA) (Figure 1).

A Referral Form has been prepared for the Proposal in accordance with Section 38(1) of the *Environmental Protection Act 1986* (EP Act) and the Western Australian Environmental Protection Authority's (EPA) *Environmental Assessment Guideline (EAG) 16 for Referral of a proposal under s38 of the EP Act* (EPA 2015a).

The purpose of this Environmental Referral Document (ERD) is to provide supporting information to the EPA in order to determine the Level of Assessment (LOA) and assist the EPA in assessing the potential impact associated with the development and operation of the Proposal. BHP Billiton Iron Ore has evaluated the characteristics of this Proposal and considers that this Proposal falls into the LOA category of 'Assessment on Proponent Information' (API-A). This document has been prepared in accordance with the EPA's *Environmental Assessment Guideline (EAG) 14 for Preparation of an API – Category A Environmental Review Document* (EPA 2015b) and provides information regarding the potential factors which have been determined through risk assessments and a range of technical studies, which have been carried out to address potential impacts for each of the relevant environmental factors.

1.2 The proponent

The proponent for the proposal is:

BHP Billiton Iron Ore Pty Ltd
ABN: 46 008 700 981
125 St Georges Terrace
Perth WA 6000

BHP Billiton Iron Ore is the authorised manager and agent of the project for the Newman Joint Venture (NJV), which is comprised of the companies listed below with their respective interests:

- BHP Billiton Minerals Pty Ltd (ABN 93 008 694 782) 85%;
- Mitsui – Itochu Iron Pty Ltd (ABN 84 008 702 761) 10%; and
- Itochu Minerals & Energy of Australia Pty (ABN 44 009 256 259) 5%.

BHP Billiton Iron Ore is authorised as the manager and agent of the proponents to submit this Proposal and execute the works as approved. All references to BHP Billiton Iron Ore are references to it acting in that capacity. Refer to the letter in Appendix A, which confirms BHP Billiton Iron Ore has the authority to act for the NJV.

The key contact for this proposal is:

Mark Garrahy
Manager Environment Approvals
Phone: 6321 2183
Email: Mark.Garrahy@bhpbilliton.com

768447 778447 788447 798447 808447

7429837

7419837

7409837

PORT HEDLAND

NEWMAN

OREBODY 32

OREBODY 24

OREBODY 23

OREBODY 25

Marble Bar Rd

MT WHALEBACK

NEWMAN

OREBODY 18

JIMBLEBAR/WHEELARA HILL

0 2 4 6 8

Kilometers

bhpbilliton

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PROPOSAL LOCATION

SCALE (A3): 1:125,000	DATUM: GDA94/MGA 50	FIGURE 1
Prepared: Env Approvals	Revision: 0	
Centre: Perth	Date: 12 May 2015	Dwg:STER_OB32_0001_RevA_0

1.3 Key proposal characteristics

This ERD supports a referral to access and mine a new iron ore deposit (the Proposal). The proposed key characteristics are provided in Table 1 and illustrated in Figure 2.

Table 1: Key proposal characteristics

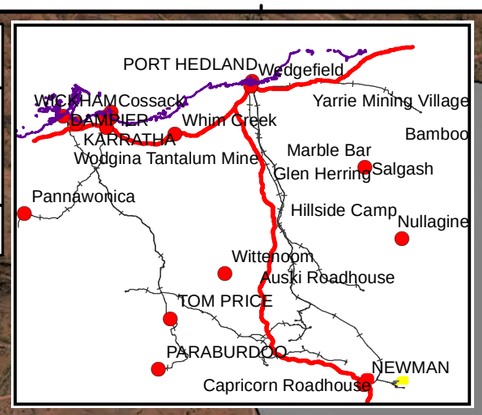
Summary of proposal		
Proposal Title	Orebody 32 East Above Water Table Mine Project	
Proponent Name	BHP Billiton Iron Ore Pty Ltd	
Short Description	BHP Billiton Iron Ore is proposing to develop the Orebody 32 East above water table mine deposit located west of Orebody 24 Mine, and approximately 10 km north-east of the town of Newman in the Pilbara Region.	
Physical elements		
Element	**Location**	**Proposed Extent**
1.Orebody 32 East AWT Mine	Figure 2	Clearing of no more than 220 ha within a 414 ha development envelope
2.Orebody 32 East AWT OSAs, stockpiles and other associated infrastructure	Figure 2	Clearing of no more than 130 ha within a 414 ha development envelope
Operational elements		
Element	**Location**	**Proposed Extent**
3. Ore mining rate	Figure 2	5 Mtpa

Description of clearing

OSA, infrastructure and ancilliary	130 ha
Pit area	220 ha
Total:	350 ha

Legend

- Orebody 32 Development Envelope
- Existing Haul Road and Trial Pit area
- Indicative future OSA area
- OB32 Indicative future pit



0 0.2 0.4 0.6 0.8
Kilometers

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ENVIRONMENTAL APPROVALS
BHPBILLITON IRON ORE

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Orebody 32
Iron Ore Mine Project
Proposal Development Envelope (in accordance with EAG 1)

SCALE (A3): 1:12,000	DATUM: GDA94/MGA 50	**FIGURE 2**
Prepared: Env Approvals	Revision:0	
Centre: Perth	Date: 26 May 2015	Dwg:OB32_002_RevA_0

Existing Haul Road and Trial Pit Area (cleared under NVCP 6234/1) This area will become part of the future pit area

Indicative future OSA area

Indicative future mine pit area

Orebody 24 Approved Part IV Boundary (MS 834)

Orebody 25 Approved Part IV Boundary (MS 712)

781422 782422 783422 784422
7421539 7420539 7419539 7418539

2. General description of proposal

2.1 Description

2.1.1 Proposal location and development envelope

The Proposal is located approximately 10 km north-east of Newman Township and immediately west of the existing Orebody 24 Mine in the Pilbara region of WA (Figure 1). The Proposal is to develop the Orebody 32 pit to provide ore for processing at the existing Ore Handling Plants at the Eastern Ridge Hub (Orebody 24 and Orebody 25). Figure 2 illustrates the Proposal Development Envelope boundary as well as the adjacent operations at Eastern Ridge, including:

- Orebody 24 Development Envelope (historically referred to within BHP Billiton Ore as a Maximum Disturbance Boundary). This Development Envelope encompasses the existing Orebody 24 operations as approved under Ministerial Statement (MS) 834; and
- Orebody 25 Development Envelope. This Development Envelope encompasses the existing Orebody 25 operations as approved under MS712.

2.1.2 Proposal components and disturbance

The key components of the Proposal are:

- campaign open pit mining at a base mining rate of 5 Mtpa; and
- associated infrastructure, stockpiles and access roads.

Figure 2 provides an indicative layout of the Proposal components.

Area of disturbance

Within the Proposal Development Envelope, up to 350 ha of land clearing will be required. Of this, up to 220 ha will be cleared for the open pit with the remaining 130 ha cleared for roads and other associated infrastructure (for example, laydown areas, overburden storage areas (OSAs) and other stockpiles).

No additional clearing is required within the adjacent Orebody 24 (MS834) and Orebody 25 (MS712) operations to support the Proposal.

Mining method

The Proposal involves campaign mining of iron ore and overburden through conventional open cut mining methods. Campaign mining involves drilling, blasting and categorisation of blasted material into iron ore or waste rock. Approximately 40 million tonnes (Mt) of iron ore in total is expected to be mined under the Proposal.

Ore processing and transport

The Proposal will be supported by infrastructure and facilities at the existing operations at Orebody 24 and Orebody 25. Ore mined from the Proposal will be transported via road to the existing ore handling facilities at either Orebody 24 or Orebody 25 and then either railed to the Mount Whaleback Mine where it will be blended with ore produced by the Newman Joint Venture or railed directly to Port Hedland. This is consistent with BHP Billiton Iron Ore's approach to minimise land clearing across all of its operations by exploring resources immediately adjacent to existing operations.

Overburden management

Overburden will be managed in accordance with the mine plan. The preference will be to stockpile in previously approved OSAs at Orebody 24 in the first instance. The least preferred and last case option is to create OSAs within the Proposal Development Envelope. Topsoil, where recoverable, will be removed and placed into stockpile areas either within approved stockpile locations at Orebody 24 or within the Proposal area for later use in rehabilitation. The final locations of topsoil stockpiles will be determined when on-site clearing commences.

Water supply

It is anticipated that water will only be required for dust suppression purposes. Water trucks will be filled from the existing facilities at adjacent operations.

Transport

Access to the Proposal Development Envelope area will be via the existing Orebody 24 road network. A light vehicle road and haul road have been constructed under an existing Native Vegetation Clearing Permit (NVCP) (CPS6234/1) for a trial pit which ties into the existing Orebody 24 road network. This road will be used during mining of the Proposal to allow access to the deposit, haulage of ore to the Orebody 24 or Orebody 25 ore handling plants, and haulage of waste to previously approved OSAs at Orebody 24.

2.1.3 Existing operations

The Proposal lies immediately adjacent to existing operations at Orebody 24 and Orebody 25, referred to as the Eastern Ridge Hub (Figure 2).

Orebody 24

The original proposal to develop mining operations at Orebody 24 was submitted as an Environmental Protection Statement (EPS) in March 2010 with approval for the proposal granted on 8 July 2010 as MS834.

Since the original approval was granted, one modification has been assessed and approved under Section 45C of the EP Act in 2011. The approval history is described in Table 2 and is included in MS834.

Table 2: Approval History of Orebody 24

Date	Approval	Approval scope
March 2010	Referral under Part IV EP Act	BHP Billiton Iron Ore referred the proposal to mine ore at Orebody 24 to the EPA, with the level of assessment set as EPS.
July 2010	Ministerial Statement	Minister for Environment issued conditions and proponent environmental management commitments for the Orebody 24/25 Upgrade Project.
October 2011	Application under Section 45C of the EP Act	BHP Billiton Iron Ore submits an application under Section 45C for modifications to the Orebody 24/25 Upgrade Project.
November 2011	Approval granted under Section 45C	The EPA approved the change to the proposal which authorised the following activities: • Increased ore processing rate to up to 18 Mtpa • Increase to the Maximum Disturbance Boundary (now Development Envelope) and area (ha) to be cleared to enable a rail spur, train load-out facility and on-site ore handling plant. • Removal of Power from the Key Characteristics table as it is not environmentally relevant.

Current mining operations at Orebody 24 are conducted in accordance with the *Iron Ore (Mount Newman) Agreement Act 1964*, and current MS834 implementation.

Orebody 25

The initial proposal to mine at Orebody 25 was made in 1988, and approved by the EPA in the same year. Since the original approval there have been a number of revisions to the proposal that have been assessed and approved as described in Table 3.

Table 3: Approval History of Orebody 25

Date	Approval	Approval scope
1988	Referral under Part IV EP Act.	Mining of detrital ore at Orebody 25 to a rate of up to 1 Mtpa.
1993	Informal review with public advice.	Bedrock mining in Pit 2.
1995	Referral under Part IV EP Act.	Extend mining at Orebody 25 and to develop the Pit 1 and Pit 3 deposits.
2006	Referral and EPS (MS712).	Extend mining at Orebody 25. The proposal involved increasing the ore production rate from 7 Mtpa to 8 Mtpa; extension of Pit 1 outside the previously approved disturbance areas; extensions to existing approved OSAs and low grade ore stockpiles; progressive development of new OSAs and placement of overburden in existing and new mined-out pits, OSAs and mine infrastructure; and increasing ore transport from 11 trains per week to approximately 13 trains per week.
2007	Part V Licence Amendment.	Increase mining rate from 8 Mtpa to 10 Mtpa.
2008	S45C (Attachment 1 to MS712).	Mine ore and waste rock below the groundwater table in a portion of Pit 1.
2009	S45C (Attachment 2 to MS712).	Mine a portion of Pit 1 (Pit 1 East) below the groundwater table, extend the depth of approved Pit 3, and make minor extensions to the approved Pit 3 boundary to the north, south and west.
2012	S45C (Attachment 3 to MS712).	Increase disturbance area from 650 ha to 800 ha and extend the Development Envelope.

2.1.4 Part V approvals – Environmental Protection Act – Native Vegetation Clearing Permits

BHP Billiton Iron Ore currently holds two NVCPs over parts of the Development Envelope for mineral exploration, a trial pit and associated activities (Figure 3). The permits have been issued by the Department of Mines and Petroleum (DMP). The details of these two permits are summarised in Figure 3 and Table 4.

BHP Billiton Iron Ore intends to relinquish the total amount of clearing carried out to date under these two NVCPs within the Development Envelope and instead, include this clearing into the proposed clearing allocation under this Proposal. BHP Billiton Iron Ore has taken a conservative approach and carried out a review of the vegetation condition of the Proposal area based on flora and vegetation surveys which were carried out prior to clearing activities commencing in the Proposal area. Therefore, BHP Billiton Iron Ore proposes that the requirements to rehabilitate the disturbance associated with the two NVCPs will be addressed through mine closure planning for this Proposal and also through application of the *Offsets Guideline* (WA Government, 2014) which is further addressed in Table 9 and Table 11.

Table 4: BHP Billiton Iron Ore current NVCPs

Permit number	Purpose	Area of clearing approved (ha)	Total amount cleared within Development Envelope to end of FY14	Area remaining	Expiry date
CPS 6234/1	Orebody 32 Trial Pit Disturbance	30	12.76	17.24	30 November 2024
CPS 2779/2 superseded by CPS 4768/4	Exploration and Borrow Pit Disturbance	290	87.06*	202.94	30 November 2022
	Total	**310**	**99.82**	**220.18**	

*Approximately 20 hectares of this cleared amount is related to historic borrow pits within the Development Envelope and has been rehabilitated at the time of this Proposal. These are as labelled in Figure 3.

2.1.5 Future operations

BHP Billiton Iron Ore is seeking approval to access the Orebody 32 deposit under this Proposal as a short-term strategy to meet business requirements during 2015/2016. Given that this Proposal will eventuate in a third Ministerial Statement (in addition to Orebody 24 (MS834) and Orebody 25 (MS712)), at the time of writing, it is the business preference that a Revised Proposal be submitted within the year to consolidate and supersede all Ministerial Statements with one new Ministerial Statement issued for the Eastern Ridge Hub. The Revised Proposal will include future proposed expansions to current operations at the Eastern Ridge Hub, replace historic conditions with modernised conditions and be in line with BHP Billiton Iron Ore plans to simplify reporting requirements and improve the way it does business across all of its Pilbara operations.

Additional information on BHP Billiton Iron Ore's management system is provided at Appendix B.

781313 781813 782313 782813 783313 783813 784313 784813

7420927 7420427 7419927 7419427 7418927 7418427

Historic Borrow Pit since rehabilitated

Historic Borrow Pit since rehabilitated

0 0.25 0.5 0.75 1
Kilometers

Legend

- CPS 6234/1 OB32 Trial Pit Disturbance (12.76 hectares)
- CPS 2779/3 and CPS 4768/4 Exploration and Borrow Pit Disturbance (87.06 hectares)
- Orebody 32 Development Envelope

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Orebody 32
Iron Ore Mine Project
Existing Disturbance within the Proposal Development Envelope

SCALE (A3): 1:10,000	DATUM: GDA94/MGA 50	**FIGURE 3**
Prepared: Env Approvals	Revision:0	
Centre: Perth	Date: 25 May 2015	Dwg:OB32_003_RevA_0

2.2 Proposal tenure

The Proposal is located on Mineral Lease ML244SA (ML244SA), granted pursuant to the *Iron Ore (Mount Newman) Agreement Act 1964* (Newman Agreement Act). The Proposal area is zoned "Rural" under the Shire of East Pilbara Town Planning Scheme No. 4 (Department of Planning, 2005). Figure 4 illustrates the tenure of the Proposal and surrounds.

740838 745838 750838 755838 760838 765838 770838 775838 780838 785838 790838 795838 800838 805838 810838 815838 820838 825838 830838 835838

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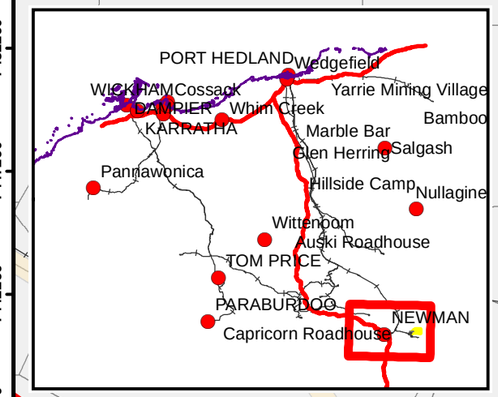

Legend

- Orebody 32 Development Envelope
- BHP Billiton Iron Ore Tenure
- Non BHP Billiton Iron Ore Tenure

NEWMAN

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Orebody 32
Iron Ore Mine Project
Tenure of the Proposal and Surrounds

SCALE (A3): 1:250,000	DATUM: GDA94/MGA 50	**FIGURE 4**
Prepared: Env Approvals	Revision:0	
Centre: Perth	Date: 26 May 2015	Dwg:OB32_004_RevA_0

0 4.5 9 13.5 18
Kilometers

3. Stakeholder consultation

BHP Billiton Iron Ore's commitment to community engagement is articulated in the company's Code of Business Conduct, whereby:

> *Our aim is to be the company of choice, valued and respected by the communities in which we operate. We do this by engaging regularly, openly and honestly with people affected by our operations, and by taking their views and concerns into account in our decision-making.*

To support this commitment, BHP Billiton Iron Ore has comprehensive company standards and dedicated resources to ensure our activities are underpinned by continuous community engagement and feedback.

BHP Billiton Iron Ore has identified stakeholders with diverse interests in this Proposal. Based on an analysis of the Proposal location, effected land users and potential impacts and risks, BHP Billiton Iron Ore has commenced consultation with the stakeholders as outlined in Table 5.

Table 5: Details of stakeholder consultation

Stakeholder	Date	Topic/Issue Raised	Proponent Response/outcome
Office of the Environmental Protection Authority (OEPA)	Meeting on 5 March 2014. Sally Bowman and Peter Tapsell (OEPA). Sally Pickard and Sonya Brunt (BHP Billiton Iron Ore).	BHP Billiton Iron Ore provided an overview of the business requirement to access Orebody 32 in 2015 and increase ore production at Orebody 24. Discussions focused on scope, studies underway, anticipated key environmental factors and approvals pathways, i.e. a new Referral application for a stand-alone deposit or a Revised Proposal incorporating adjacent Orebody 24.	It was agreed that BHP Billiton Iron Ore submit a Revised Proposal to the Orebody 24/25 Upgrade Project (MS834).
	Meeting on 4 May 2015. Sally Bowman, Vanessa Angus and John Guld (OEPA). Renelle Thorpe and Sonya Brunt (BHP Billiton Iron Ore).	BHP Billiton Iron Ore provided an update on the proposed Orebody 32 Referral, the preliminary results of baseline surveys and environmental impact assessment studies and recent opportunities to reduce the scope of the Proposal. There was also discussion of the potential for ore to be processed at either of the adjacent Orebody 24 or Orebody 25 operations.	It was agreed that this Proposal be submitted as a new Proposal and not a revised Proposal. It was also noted that a Revised Proposal for the Eastern Ridge Hub would be submitted within 12 months with the intention to simplify approvals within this region through superseding historic Ministerial Statements and creating one new Ministerial Statement with modernised conditions for the entire Eastern Ridge Hub.
DoW	BHP Billiton Iron Ore coordinated a site visit on 7-9 July 2014 to visit a number of its Pilbara operations. Gary Humphreys, Penny Wallace-Bell, Tasnim Poligadu and Hermes Medina (DoW). Blair Douglas, Peta Barnes and Sally Pickard (BHP Billiton Iron Ore).	BHP Billiton Iron Ore's proposed Eastern Pilbara Water Resource Management Plan, operation and management of Ophthalmia Dam and general discussions regarding future plans for potable water management across the region.	The DoW was supportive of BHP Billiton Iron Ore's approach towards water management.

Stakeholder	Date	Topic/Issue Raised	Proponent Response/outcome
	Phone call on 12 May 2014 followed up by formal submission to the DoW via email on 15 May 2015. Email addressed to Gary Humphreys and Penny Wallace-Bell (DoW). Email sent from Blair Douglas (BHP Billiton Iron Ore).	Documents provided included a technical environmental impact assessment study addressing hydrological aspects of the Orebody 32 Proposal as well as an updated version of the Newman Potable Water Protection Plan (BHP Billiton Iron Ore, 2015) and a Surface Water Environmental Impact Assessment (RPS Aquaterra, 2015).	No written comments have been received to date, however, BHP Billiton Iron Ore will liaise with the DoW throughout this assessment process and answer any questions or provide further clarification if requested by the DoW.
DMP	Discussion on 3 December 2014 with the DMP. Danielle Risbey (DMP). Tara Read and Stephen White (BHP Billiton Iron Ore).	This meeting focused on rehabilitation across all current and future BHP Billiton Iron Ore hubs. There was discussion of progress to date on achievements and challenges in the development of Ecological Completion Criteria and alignment on a new target date for defining agreed draft criteria, possibly 2020.	BHP Billiton Iron Ore committed to reporting progress in the BHP Billiton Iron Ore Annual Environmental Review documents on an annual basis.
	Written correspondence to the DMP. Letter signed by Chris Dark – BHP Billiton Iron Ore General Manager of Eastern Ridge Mine Hub. Letter addressed to: Mr Anthony Sutton – Director of Assessment and Compliance of the OEPA on 5 January 2015 (Refer to Appendix C).	The correspondence outlined BHP Billiton Iron Ore's intent to develop a new consolidated Mine Closure Plan for the Eastern Ridge Hub (including Orebody 32) during 2015.	This approach was discussed further with the DMP during the meeting of 29 January 2015 (refer to next line item).

Stakeholder	Date	Topic/Issue Raised	Proponent Response/outcome
	Presentation meeting on 29 January 2015 at DMP East Perth offices. Rebecca Wright, Brad Smith, Tara Read and Sally Pickard (BHP Billiton Iron Ore). Danielle Risbey and Mariana De-Moraes (DMP).	This meeting provided the DMP with a general update on closure planning across the business, including Eastern Ridge. BHP Billiton Iron Ore noted that the current Decommissioning and Rehabilitation Plan applicable to Orebodies 24 and 25 is scheduled to be updated in 2015, however, a new consolidated Mine Closure Plan for the wider Eastern Ridge Hub (including the Orebody 32 deposit) was the preferred way forwarding for managing closure.	The DMP was supportive of BHP Billiton Iron Ore's approach towards creating a new consolidated Mine Closure Plan to supersede the current plan (and include Orebody 32).
	Email correspondence to the DMP dated 22 May 2015. Email from: Sonya Brunt (BHP Billiton Iron Ore) Email addressed to: Danielle Risbey and Matt Boardman (DMP)	The purpose of this consultation was to advise that BHP Billiton Ore intend to refer a Proposal to the EPA. An overview of the mine closure strategy was presented.	No specific written comments have been received to date, however, BHP Billiton Iron Ore will assist DMP throughout this assessment process and answer any questions or provide further clarification if requested by DMP.
Department of Parks and Wildlife (DPaW)	Phone call, followed up with email correspondence on 12 May 2015 to DPaW. Email from George Watson (BHP Billiton Iron Ore). Email addressed to Murray Baker and Sandra Thomas (DPaW).	The purpose of this consultation was to advise that BHP Billiton Ore intend to refer a Proposal to the EPA. An overview of biological survey results and environmental impact assessments were also provided.	The DPaW responded via email on 20 May 2015 advising that: *"No comment is provided on Parks and Wildlife's Conservation and Land Management Act 1984 responsibilities as the proposal is not located on existing or proposed Parks and Wildlife-managed lands."* Furthermore, based on the information provided to DPaW, *"…it appears unlikely that the proposal will impact on conservation significant flora, vegetation and fauna values".* The DPaW also advised that it would welcome further involvement, *"if through the assessment/investigations for this proposal, BHP Billiton identifies significant issues with conservation significant values that warrant specific*

Stakeholder	Date	Topic/Issue Raised	Proponent Response/outcome
			consultation."
Department of State Development (DSD)	Regular discussions have occurred regarding this Proposal since 2014. Greg Dellar (BHP Billiton Iron Ore). Paul Platt (DSD).	This Proposal has been the subject of discussions with DSD at regular monthly meetings since August 2014. A formal Notice of Proposal under the *Iron Ore (Mount Newman) Agreement Act 1964* was submitted to the Premier on 19 December 2014.	The DSD is currently providing assistance and support to BHP Billiton Iron Ore with regard to the Notice of Proposal process and the State Agreement.

Table 6: Details of other relevant stakeholder consultation, subject to other regulatory processes

Stakeholder	Date	Topic/Issue Raised	Proponent Response/outcome
Context regarding ongoing discussions on drinking water across the wider region: BHP Billiton has developed a revised Drinking Water Source Protection Plan for the Priority 1 Newman Public Drinking Water Source Area (PDWSA). The plan covers both the Ophthalmia Borefield and also the new Homestead borefield, which is located north-west of this Proposal area. Both borefields are designated drinking water borefields and managed in accordance with the Source Plan and the Australian Drinking Water Guidelines (ADWG, 2011). A number of smaller borefields in the Newman area have been decommissioned over the past three years following implementation of a risk based approach and identified potential land use conflicts. In addition, BHP Billiton is constructing a new water treatment plant in Newman to mitigate any residual risks and deliver water within ADWG. The implementation of a risk based approach for drinking water and the development of the water treatment plant and Homestead borefield has been discussed with the Department of Water Drinking Water Branch and the Pilbara Region management and hydrogeological technical teams. The discussions have also extended to the Water Corporation and Department of Health (DoH) over the past two years. The following outlines the specific consultation details concerning future developments in the PDWSA:			
DoW	Meeting on 11 November 2014 with DoW representatives. Nigel Mantle, Steven Watson and Penny Wallace-Bell (DoW). Blair Douglas (BHP Billiton Iron Ore).	A discussion regarding potable water management in the Newman area.	This meeting was part of ongoing consultation with stakeholders regarding BHP Billiton Iron Ore's approach towards integrated water management in the Newman area.
DoH	Meeting on 8 May 2015 with DoH representatives. Brian Labza and Richard Theobolt (DoH). Clarrie Hall, Ronnie McLean, Christien Ehrhardt and Sean McGrath (BHP Billiton Iron Ore).	A discussion regarding BHP Billiton Iron Ore's approach to water source protection in Newman and the updated version of the Newman Potable Water Source Protection Plan (BHP Billiton Iron Ore, 2015).	The DoH has provided in-principal support towards BHP Billiton Iron Ore's approach to water source protection in Newman, subject to final review of the latest updated version of the Newman Potable Water Source Protection Plan (BHP Billiton Iron Ore, 2015 (Revision 3)).
Water Corporation	Meeting on 27 November 2014 with Water Corporation representatives. David Juers, Paul Vanderval and Andrew Bath (Water Corporation). Blair Douglas (BHP Billiton Iron Ore).	A discussion regarding future works including this Proposal, which are proposed with the PDWSA. This discussion also outlined BHP Billiton Iron Ore's risk-based approach to managing the potential threats to land use conflicts.	This meeting was part of ongoing consultation with stakeholders regarding BHP Billiton Iron Ore's approach towards integrated water management in the Newman area.

4. Environmental studies and survey effort

BHP Billiton Iron Ore undertakes a program of regular baseline surveys across our deposits so that current environmental data is available for impact assessment and approval applications as the need arises. Table 7 details the studies, investigations and surveys undertaken to date across the Development Envelope, the study area covered, the guidelines referred to and any limitations of the study.

To support environmental approval applications, an EIA report is prepared for each environmental factor, which consolidates the current survey data (surveys undertaken within 5 years) and assesses the impacts of the Proposal. These are the only documents which are provided as an Appendix to this Referral (Appendices D-I).

Table 7: Environmental studies and surveys

Factor	Consultant	Survey/Investigation Name	Study area, type and timing	Study standard/guidance and limitations	Appendix
Flora and Vegetation	Onshore Environmental Consultants	Orebody 32 East Flora and Vegetation Impact Assessment (2015)	Orebody 32 development envelope and surrounds. Desktop review and impact assessment.	EPA Position Statement No 2. EPA Position Statement No 3. EPA Guidance Statement No 51.	Appendix D A figure illustrating all previous flora and vegetation surveys within and/or surrounding the Development Envelope is at Figure 5.
	ENV. Australia	Eastern Ridge (OB23/24/25) Flora and Vegetation Assessment (2012)	Orebodies 23, 24, 25, 28 and 32 and surrounds (88.31 km^2). Desktop review and field survey (April and July 2011). Included a review of all previous survey data. Refer to Figure 5 for survey boundaries.	EPA Position Statement No 2. EPA Position Statement No 3. EPA Guidance Statement No 51. Single season Level 2 survey. Limitations: restricted/no access to some areas.	
	Onshore Environmental Consultants	Biological Survey. Myopic Exploration Leases (2009)	Orebodies 26, 28, 32 and 33 (3,815.5 ha). Desktop review and field survey (June 2009). Refer to Figure 5 for survey boundaries.	EPA Position Statement No 2. EPA Position Statement No 3. EPA Guidance Statement No 51. Single season Level 2 survey.	
	GHD	Report for Myopic Project area, Newman. Flora and Fauna Assessment (2008)	Orebodies 26, 28, 32 and 33 and surrounds (3,600 ha). Desktop review and field survey (May and June 2008). Refer to Figure 5 for survey boundaries.	EPA Guidance Statement No 51. Single season Level 2 survey. Limitations: single season survey, lower than average rainfall over the wet season.	

Factor	Consultant	Survey/Investigation Name	Study area, type and timing	Study standard/guidance and limitations	Appendix
	ENV. Australia	OB24 Flora and Fauna Assessment Phase II (2006)	Orebody 24 area and surrounds (52 km^2). Desktop review and field survey (March and April 2006). Refer to Figure 5 for survey boundaries.	EPA Position Statement No 2. EPA Position Statement No 3. EPA Guidance Statement No 51. Consultation with EPA and CALM (now DPAW). Single season Level 2 survey.	
	ecologia Environment	Orebody 24 Expansion Biological Survey (2004)	Orebody 24 area and surrounds (52 km^2). Desktop review and field survey (May 2004), DRF and priority flora survey (August 2004). Refer to Figure 5 for survey boundaries.	EPA Guidance Statement No 51. Single season Level 2 survey and targeted survey.	
	Biota Environmental Sciences	Baseline Biological & Soil Surveys and Mapping for ML244SA West of the Fortescue River (2001)	ML244SA west of the Fortescue River (includes Orebodies 23, 24, 25, 32 and Mount Whaleback). Desktop review and field survey (September and October 2000). Refer to Figure 5 for survey boundaries.	No specific guidance available at time of survey. Limitation: no significant rainfall in 5 months preceding survey resulting in limited ephemeral flora collected, recent fire, lack of aerial photography coverage.	
Terrestrial Fauna	Astron Environmental Services	Orebody 32 East Vertebrate Fauna Environmental Impact Assessment (2015)	Orebody 32 development envelope and surrounds.	EPA Position Statement No 3. EPA Guidance Statement No 56.	Appendix E
	Biologic Environmental Survey	Orebody 32 Short Range Endemic Invertebrate Fauna Environmental Impact Assessment (2015)	Orebody 32 development envelope and surrounds.	EPA Position Statement No 3. EPA Guidance Statement No 56.	Appendix F

Factor	Consultant	Survey/Investigation Name	Study area, type and timing	Study standard/guidance and limitations	Appendix
	ENV. Australia	Eastern Ridge (OB23/24/25) Fauna Assessment (2011)	Orebodies 23, 24, 25, 28 and 32 and surrounds (88.31 km^2). Desktop review and field survey (May 2011).	EPA Position Statement No 3. EPA Guidance Statement No 56. Level 1 survey. Limitations: restricted/no access to some areas.	
	Onshore Environmental Consultants and Biological Consultants	Biological Survey. Myopic Exploration Leases (2009)	Orebodies 26, 28, 32 and 33 (3,815.5 ha). Desktop review and field survey (June 2009).	EPA Position Statement No 3. EPA Guidance Statement No 56. Level 1 survey. Limitations: only opportunistic records (no trapping), cool temperatures.	
	GHD	Report for Myopic Project area, Newman. Flora and Fauna Assessment (2008)	Orebodies 26, 28, 32 and 33 and surrounds (3,600 ha). Desktop review and field survey (May and June 2008).	EPA Guidance Statement No 56. Level 1 survey. Limitations: only opportunistic records (no trapping), lower than average rainfall over the wet season.	
	ENV. Australia	OB24 Flora and Fauna Assessment Phase II (2006)	Orebody 24 area and surrounds (52 km^2). Desktop review and field survey (March and April 2006).	EPA Position Statement No 3. EPA Guidance Statement No 56. Consultation with EPA and CALM (now Parks and Wildlife). Single season Level 1 Fauna survey. Limitations: cool temperatures.	

Factor	Consultant	Survey/Investigation Name	Study area, type and timing	Study standard/guidance and limitations	Appendix
	ecologia Environment	Orebody 24 Expansion Biological Survey (2004)	Orebody 24 area and surrounds (52 km^2). Desktop review and field survey (May 2004).	EPA Guidance Statement No 56. Single season Level 2 survey and targeted survey. Limitation: cool temperatures.	
	Biota Environmental Sciences	Baseline Biological & Soil Surveys and Mapping for ML244SA West of the Fortescue River (2001)	ML244SA west of the Fortescue River (includes Orebodies 23, 24, 25, 32 and Mount Whaleback). Desktop review and field survey (September and October 2000).	No specific guidance available at time of survey. Limitation: only opportunistic records (no trapping).	
	Biologic Environmental Survey	Orebody 24/25 Short-range Endemic Invertebrate Survey (2014)	Eastern Ridge Mine Hub area (Orebodies 23, 24, 25, 32 and surrounds). Desktop review, habitat assessment and field survey (April and August 2013).	EPA Position Statement No 3. EPA Guidance Statement No 56. EPA Guidance Statement No 20. Two season targeted survey. Limitations: fire and limited access to some northern areas.	
	Outback Ecology	Orebody 24/25 Upgrade Terrestrial Invertebrate Short-range Endemic Assessment (2008)	Orebody 24 area and surrounds. Desktop review and field survey (April and June 2008).	EPA Position Statement No 3. EPA Guidance Statement No 56. Consultants with DEC (now DPaW), UWA and the Western Australian Museum. Two-season trapping survey and targeted searches. Limitation: some limited access.	

Factor	Consultant	Survey/Investigation Name	Study area, type and timing	Study standard/guidance and limitations	Appendix
	ENV. Australia	Short-range Endemic Study Pseudoscorpions (Chelicerata: Arachnida) (2008)	Orebody 24 and Orebody 25. Targeted field survey (March 2008).	No specific standard/guideline mentioned. Targeted searches. Limitations: searches only conducted for Pseudoscorpions.	
Subterranean Fauna	Bennelongia Environmental Consultants	Orebody 32 Troglofauna Environmental Impact Assessment (2015)	Orebody 32 development envelope and surrounds.	EPA Environmental Assessment Guideline 12. EPA Guidance Statement No. 54a.	Appendix G Supplementary information on potential habitat and surrogacy is provided at Appendix H
	Bennelongia Environmental Consultants	Orebody 32 Baseline Subterranean Survey (2015)	Orebody 32 Development Envelope and surrounds. One sample round (November 2014).	EPA Environmental Assessment Guideline 12. EPA Guidance Statement No. 54a.	
	Bennelongia Environmental Consultants	Subterranean Fauna Survey at Orebody 24 (2013)	Orebody 24 area and surrounds. Two rounds of sampling (April and July 2013).	EPA Environmental Assessment Guideline 12. EPA Guidance Statement No. 54a.	

Factor	Consultant	Survey/Investigation Name	Study area, type and timing	Study standard/guidance and limitations	Appendix
Surface Water and Hydrological Processes	RPS Aquaterra	Orebody 32 Surface Water Impact Assessment (2015)	Orebody 32 and surrounds.	Water Quality Protection Guidelines – Mining and Mineral processing. *Environmental and water assessments relating to mining and mining-related activities in the Fortescue Marsh management area* – Section 16e advice (EPA, 2013d). Limitation: This report was carried out based on the mine plan at the time the report was commissioned. As the mine plan evolves, surface water infrastructure will be revised and updated as required.	Appendix I

Factor	Consultant	Survey/Investigation Name	Study area, type and timing	Study standard/guidance and limitations	Appendix
Decommissioning and Rehabilitation	ERK Consultants	Orebody 32 Preliminary Acid Mine Drainage Risk Assessment (2015)	Orebody 32 and surrounds.	Commonwealth Department of Industry, Tourism and Resources [DITR] (2007) *Leading Practice Sustainable Development Program for the Mining Industry - Managing Acid and Metalliferous Drainage* International Network for Acid Prevention (2012) *Global Acid Rock Drainage Guide* (GARD Guide) Australian and New Zealand Environment Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (2000), Australian Water Guidelines for Fresh and Marine Waters and its updates	Appendix J

Legend

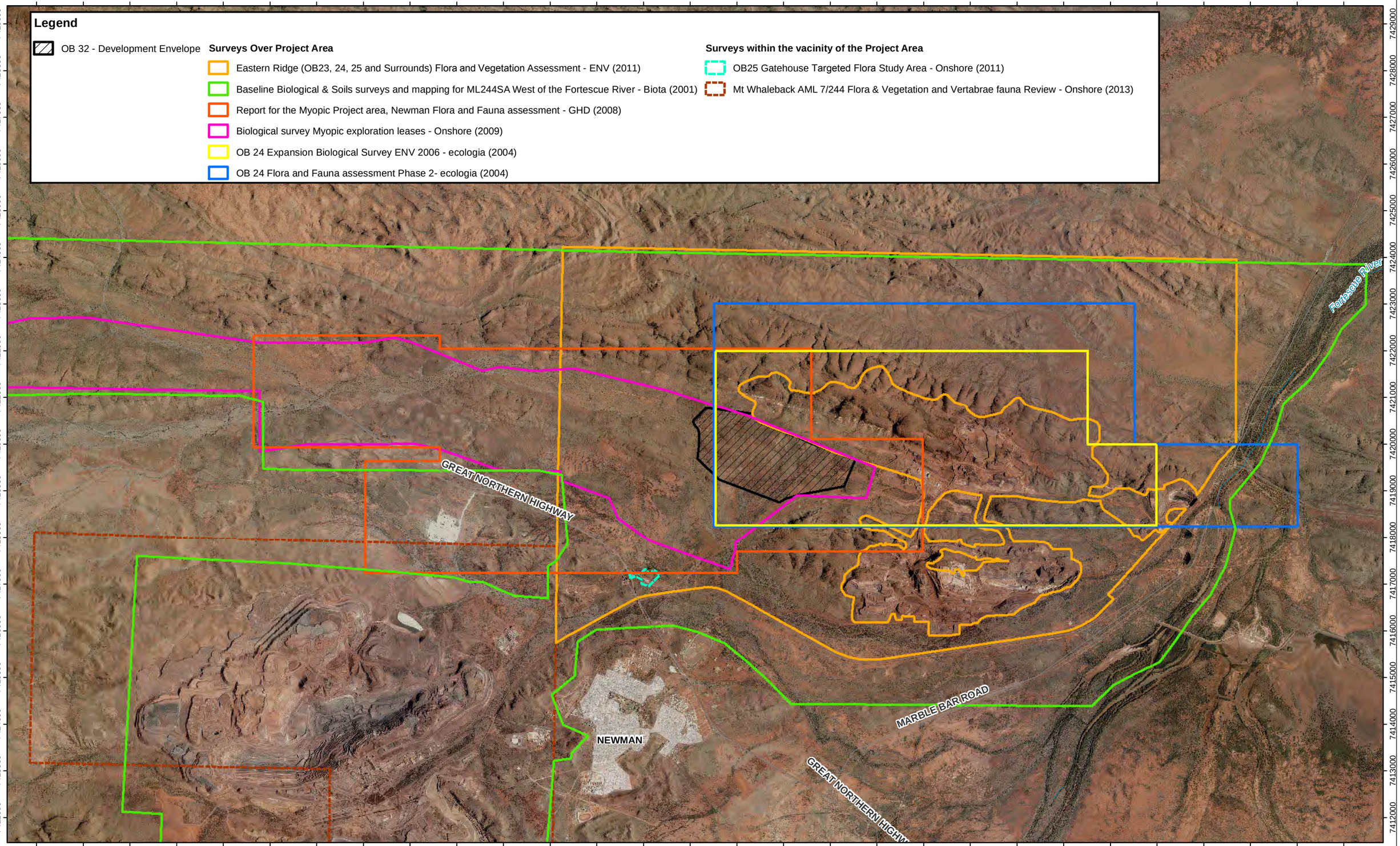
OB 32 - Development Envelope

Surveys Over Project Area

- Eastern Ridge (OB23, 24, 25 and Surrounds) Flora and Vegetation Assessment - ENV (2011)
- Baseline Biological & Soils surveys and mapping for ML244SA West of the Fortescue River - Biota (2001)
- Report for the Myopic Project area, Newman Flora and Fauna assessment - GHD (2008)
- Biological survey Myopic exploration leases - Onshore (2009)
- OB 24 Expansion Biological Survey ENV 2006 - ecologia (2004)
- OB 24 Flora and Fauna assessment Phase 2- ecologia (2004)

Surveys within the vacinity of the Project Area

- OB25 Gatehouse Targeted Flora Study Area - Onshore (2011)
- Mt Whaleback AML 7/244 Flora & Vegetation and Vertabrae fauna Review - Onshore (2013)



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7429000 7428000 7427000 7426000 7425000 7424000 7423000 7422000 7421000 7420000 7419000 7418000 7417000 7416000 7415000 7414000 7413000 7412000

ONSHORE ENVIRONMENTAL

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Drawn by: GSM	Requested by: GSM	GSM Reference: OB32_Survey_areas	

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Meters
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Datum: GDA94
Projection: MGA Zone 50

BHPBIO

OREBODY 32 EAST AWT
Previous flora and vegetation surveys within the vicinity of the OB32 East AWT project area

GRIFFIN SPATIAL & MAPPING
PO Box 7215
Eaton WA 6232
admin@griffinspatial.com.au
+61 8 9725 3213

5. Assessment of preliminary key environmental factors

5.1 Preliminary key environmental factors

To identify the likely preliminary key environmental factors, BHP Billiton Iron Ore undertook a preliminary risk assessment. Following this, environmental impact studies were commenced to quantify the potential environmental impacts and determine the significance of the environmental factors identified in the preliminary risk assessment against the EPA Significance Framework (EPA, 2013b). Following the completion of these studies the results of the preliminary risk assessment were reviewed and the potential key environmental factors, as defined in EAG 8 (EPA, 2013a), determined on the basis of the environmental impact studies. A summary of the preliminary key environmental factors applicable to this proposal is provided in Table 8.

Table 8: Preliminary key environmental factors

Environmental Factor	Environmental Aspect	Impact
Flora and Vegetation	Clearing of 350 hectares of vegetation in 'Good-to-Excellent' condition.	Reduction in flora and vegetation species density and diversity in the Hamersley IBRA sub-region. Spread/introduction of weeds.
Subterranean Fauna (Troglofauna)	Mine pit excavation.	Reduction in habitat for Troglofauna.
Offsets	Clearing of 350 hectares of vegetation in 'Good-to-Excellent' condition (as per Flora and Vegetation preliminary key factor).	Reduction in flora and vegetation species density and diversity in the Hamersley IBRA sub-region (as per Flora and Vegetation preliminary key factor).
Rehabilitation and Decommissioning	Creation of a mine pit post-closure.	Potential pit void post closure.

Other environmental factors include:

- landforms;
- terrestrial environmental quality;
- terrestrial fauna (terrestrial vertebrate fauna and invertebrate short-range endemic fauna);
- inland waters environmental quality;
- hydrological processes;
- air quality and atmospheric gases;
- amenity;
- heritage; and
- human health.

These are addressed in Section 6, Table 13.

5.2 Assessment of preliminary key environmental factors

The preliminary key environmental factors identified in Table 8 are discussed in detail in Table 9. For each preliminary key environmental factor the following information is provided:

- context, including a concise description of the relevant environmental values and policy context;
- the inherent significant impacts resulting from implementation of the proposal;
- environmental aspects that may cause significant impacts;
- a description of ongoing mitigation for each significant impact;

- the regulation process required to make sure adequate mitigation occurs; and
- a statement of the outcome and justification to demonstrate that the EPA's objective would be achieved.

Table 9: Assessment of preliminary key environmental factors – Flora and Vegetation

Inherent Impact	Environmental Aspect	Mitigation actions to address residual impacts	Proposed regulatory mechanisms for ensuring mitigation	Outcome to demonstrate the Proposal meets EPA objective
Vegetation and Flora – To maintain representation, diversity, viability and ecological function at the species, population and community level.				
Context • The Proposal is seeking a total of 350 ha of native vegetation clearing within a defined Development Envelope. • No Threatened Flora, Priority flora, TECs or PECs within the Development Envelope. • Five Priority flora taxa within a 2 km radius of the development envelope. • One minor range extension (less than 50 km) within the development envelope (outside the indicative pit area) (Figure 6). • Six introduced weed species within the development envelope (Figure 7). • Seven vegetation associations within the development envelope. • Vegetation has been rated 'Good to Excellent' condition based on pre-exploration baseline surveys (Figure 8). *Relevant policies, standards and guidelines* • Position Statement No. 2, Environmental Protection of Native Vegetation in Western Australia: Clearing of native vegetation with particular reference to agricultural areas (EPA, 2000a). • Position Statement No. 3, Terrestrial Biological Surveys as an element of Biodiversity Protection (EPA, 2002a). • Guidance Statement No. 51, Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in WA (EPA, 2004a). • Checklist for Documents Submitted for EIA on Marine and Terrestrial Biodiversity (EPA, 2010b). **Impacts** *(details provided in Appendix D – Onshore Environmental Consultants, 2015)* • Direct impact from clearing up to 350 ha of native vegetation. • Spread or introduction of weed species. • Minor increases to dust levels.	• Clearing of vegetation in 'Good to Excellent' condition. • Introduction or spread of weeds through machinery, vehicles and land clearing. • Increased levels of dust.	Avoid/Minimise The use of existing ore processing infrastructure and facilities at adjacent Orebody 24 and Orebody 25 is consistent with BHP Billiton Iron Ore's approach to minimise land clearing across all of its operations by exploring resources immediately adjacent to existing operations. This has enabled BHP Billiton Iron Ore to minimise the amount of native vegetation required under this Proposal. The use of existing approved OSAs in the first instance at adjacent Orebody 24 will also contribute towards a small footprint overall for the Proposal. The Proposal will implement standard BHP Billiton Iron Ore operational dust controls such as use of water carts along roads and other high-traffic areas. In addition, the area of native vegetation that is cleared, and the duration for which cleared areas are left open before being rehabilitated or otherwise stabilised will be minimised. Vehicles and machinery mobilising to site are also required to be clean on entry. This requirement assists in reducing the introduction or spread of weeds. Rehabilitate • Rehabilitation of areas disturbed when no longer required or at closure. Offset • Financial contribution to offset 350 ha of clearing required for clearing 'Good to Excellent' vegetation (based on pre-exploration baseline surveys and inclusion of clearing allocations under approved NVCPs).	Implement the BHP Billiton Iron Ore Regional Land and Biodiversity Management Plan (BHP Billiton Iron Ore, 2015 – Refer Appendix K). This management plan has recently been appended to Orebody 31 Iron Ore Project Proposal, which was formally referred to the OEPA in April 2015 as part of the business approach towards managing operations at the Regional level. This Proposal further supports this approach in rolling out the management plan across operational areas. BHP Billiton Iron Ore is also committing to financial offsets to address residual impacts for each hectare of 'Good-to-Excellent' vegetation cleared as part of this Proposal (Refer to Offsets Factor).	**This factor is considered a preliminary key environmental factor.** Native vegetation clearing is estimated at 350 ha within a Development Envelope of 414 ha. BHP Billiton Iron Ore is confident that with the implementation of the Regional Land and Biodiversity Management Plan, including dust and weed controls and application of an offset for the 'Good to Excellent' vegetation, the EPA objective can be met. None of the vegetation associations proposed to be impacted are considered conservation significant at the Commonwealth or State level. The Development Envelope contains no Threatened Flora, Priority Flora, TECs or PECs and all taxa have been recorded in adjacent tenements or throughout the Pilbara.

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7418841

Homestead Creek

Legend

- Orebody 32 Development Envelope
- Orebody 32 Indicative Mine Pit Area
- Orebody 24
- Orebody 25
- Watercourse

Species

- Aristida jerichoensis var subspinulifera
- Eremophila magnifica var. velutina
- Brunosia sp. Long hairs (D.E. Symon 2440)
- Goodenia nuda
- Isotropis parviflora
- Range Extension - Diplatia grandibractea

bhpbilliton

ENVIRONMENTAL APPROVALS
BHPBILLITON IRON ORE

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Orebody 32
Iron Ore Mine Project
Significant Flora

SCALE (A3): 1:14,783	DATUM: GDA94/MGA 50	**FIGURE 6**
Prepared: Env Approvals	Revision: 0	
Centre: Perth	Date: 12 May 2015	Dwg:STER_OB32_006_RevA_0

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Kilometers

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Homestead Creek

Legend

- Orebody 32 Development Envelope
- Orebody 32 Indicative Mine Pit Area
- Orebody 24
- Orebody 25
- Watercourse

Weed Species

- Bidens bipinnata
- Cenchrus ciliaris
- Cenchrus setaceus
- Flaveria trinervia
- Malvastrum americanum
- Setaria verticillata

0 0.25 0.5 0.75 1

Kilometers

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ENVIRONMENTAL APPROVALS
BHPBILLITON IRON ORE

N

Orebody 32
Iron Ore Mine Project
Weed Records

SCALE (A3): 1:14,783	DATUM: GDA94/MGA 50	**FIGURE 7**
Prepared: Env Approvals	Revision: 0	
Centre: Perth	Date: 12 May 2015	Dwg:OB32_007_RevA_0

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Homestead Creek

Legend

- Orebody 32 Indicative Mine Pit Area
- Orebody 32 Development Envelope
- Orebody 24
- Orebody 25
- Watercourse

Vegetation Condition

- Very Good
- Excellent to Very Good
- Excellent

bhpbilliton

ENVIRONMENTAL APPROVALS
BHPBILLITON IRON ORE

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Orebody 32
Iron Ore Mine Project
Vegetation Condition

SCALE (A3): 1:14,783	DATUM: GDA94/MGA 50	**FIGURE 8**
Prepared: Env Approvals	Revision: 0	
Centre: Perth	Date: 12 May 2015	Dwg:OB32_008_RevA_0

0 0.25 0.5 0.75 1
Kilometers

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Table 10: Assessment of preliminary key environmental factors – Subterranean Fauna (Troglofauna)

Inherent Impact	Environmental Aspect	Mitigation actions to address residual impacts	Proposed regulatory mechanisms for ensuring mitigation	Outcome to demonstrate the Proposal meets EPA objective
Subterranean Fauna (Troglofauna) – To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.				
Context • Troglofauna survey within the Development Envelope area was carried out according to EPA guidelines. • Fifteen species of troglofauna have been collected within the Development Envelope area. • Of the 15 species, three are known only from the indicative mine pit area. These are *Palpigradi* sp. B17, nr *Andricophiloscia* sp. B17 and Pauropodidae sp. B32 (Figure 9). • *Palpigradi* sp. B17 consisted of seven individuals collected from two drill holes on the northern side of the indicative pit area. • Of the two remaining species recorded only within the indicative pit area, two specimens of nr *Andricophiloscia* sp. B17 and a singleton record of Pauropodidae sp. B32, were recorded from the same drill hole in the south-eastern part of the indicative pit area. • Investigations indicate good habitat connectivity between the indicative pit area and surrounding areas, and no geological barriers to cause a localised species to be considered restricted to the indicative mine pit area. • Ranges and known habitat of surrogate species suggests that the three species known only from the indicative pit area are considered likely to have ranges that extend outside into surrounding areas. • The Development Envelope suggests similar troglofauna community to those previously identified in the Ophthalmia Range. • Overall, there appears to be little risk to the persistence of troglofauna in the region. *Relevant policies, standards and guidelines* • Position Statement No. 3, Terrestrial Biological Surveys as an element of Biodiversity Protection (EPA, 2002a); • Environmental Assessment Guideline 12 for Consideration of subterranean fauna in environmental impact assessment in Western Australia (EPA, 2013c); • Checklist for Documents Submitted for EIA on Marine and Terrestrial Biodiversity (EPA, 2010b); and • Draft Guidance No. 54a, Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia (EPA, 2007a). **Impacts** *(details provided in Appendix G and H – Bennelongia, 2015)* • Potential impacts to the three species recorded only within the indicative pit area from the removal of habitat through pit excavation.	• Pit excavation.	The seven individuals of *Palpigradi* sp. B17 were recorded from two drill holes on the northern side of the indicative pit shell. Two individuals of nr *Andricophiloscia* sp. B17 and a single record of Pauropodidae sp. B32 were recorded from a single bore hole. BHP Billiton Iron Ore is of the view that the potential impacts to troglofauna from the implementation of the Proposal are not significant for the following reasons. • Ranges and known habitat of surrogate species recorded from the same drill hole suggests that the three species known only from the indicative pit area are considered likely to have ranges that extend outside into surrounding areas. • Based on geological information, the preferred habitat for these species is considered to be Tertiary detritals. Given that Tertiary detritals is widespread in the surrounding area, it is likely that these three species have moderately widespread local occurrence. • Investigations indicate good habitat connectivity between the indicative mine pit and surrounding areas and no geological barriers to cause a localised species to be restricted to the indicative mine pit. • All three species are considered likely to have ranges extending outside the mine pit because a high proportion of the other localised species have ranges that extend into surrounding areas. When biological (surrogate) and geological (habitat) information is considered, the likely conclusion is that the three species occur beyond the indicative mine pit area Additional information illustrating the potential extent of Tertiary Detritals (likely Troglofauna Habitat) and additional information and figures indicating the known range of surrogate species is available at Appendix H.	Based on this assessment, BHP Billiton Iron Ore is of the view that potential impacts to troglofauna species will not be significant and not warrant conditioning.	**This factor was considered a preliminary key environmental factor in relation to troglofauna based on data collected during baseline surveys.** **Following further assessment and a review of biological (surrogate) and geological (habitat) information, is considered likely that the three species occur beyond the indicative mine pit. Based on this, BHP Billiton Iron Ore considers the Proposal meets the EPA's objective for this factor and no longer considers this to be a key environmental factor.** All troglofauna species, which have been recorded in the Development Envelope, either have been recorded elsewhere or are likely to have ranges which extend beyond the area of impact (the pit).

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Legend

- Orebody 32 Development Envelope
- Orebody 32 Indicative Mine Pit Area
- Orebody 24
- Orebody 25

Species

- Palpigradi sp. B17
- Pauropodidae sp. B32
- nr Andricophiloscia sp. B17

bhpbilliton

ENVIRONMENTAL APPROVALS
BHPBILLITON IRON ORE

N

Orebody 32
Iron Ore Mine Project
Troglofauna restricted to the indicative mine pit area

SCALE (A3): 1:14,783	DATUM: GDA94/MGA 50	**FIGURE 9**
Prepared: Env Approvals	Revision: 0	
Centre: Perth	Date: 12 May 2015	Dwg:OB32_009_RevA_0

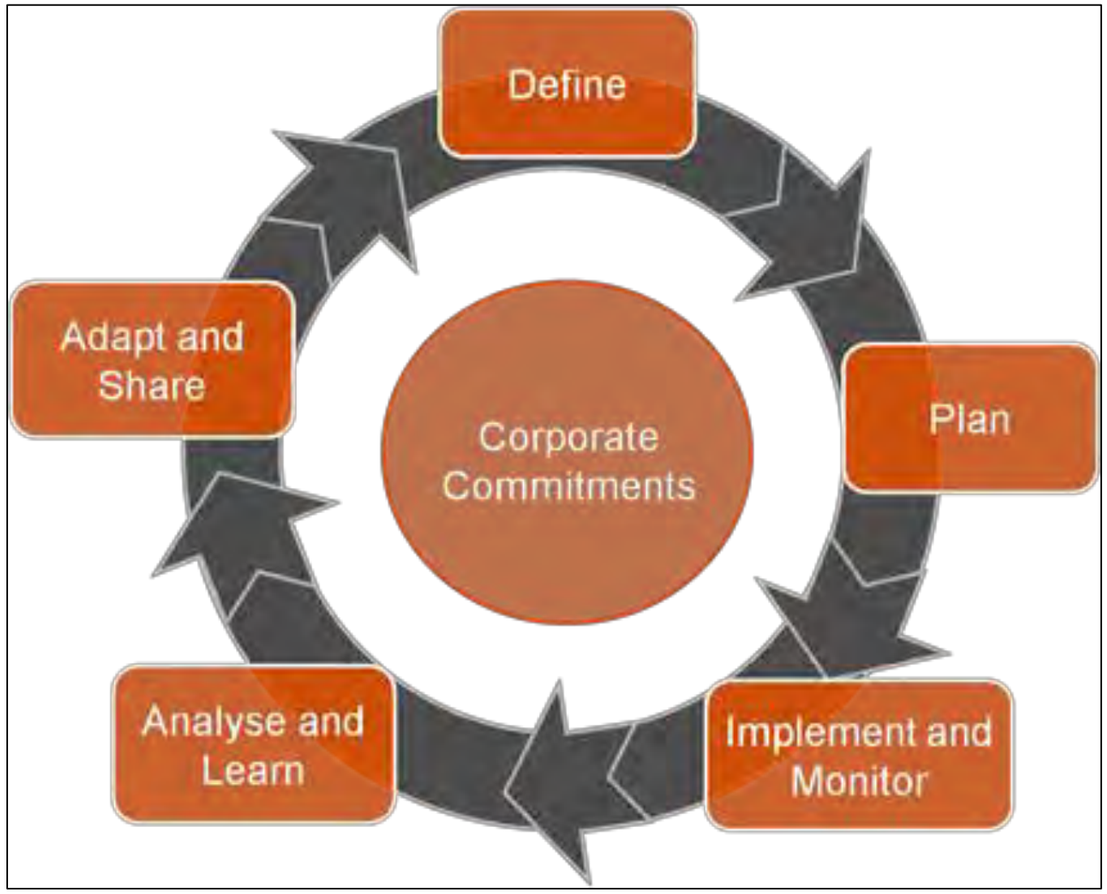
0 0.25 0.5 0.75 1
Kilometers

Table 11: Assessment of preliminary key environmental factors – Offsets

Inherent Impact	Environmental Aspect	Mitigation actions to address residual impacts	Proposed regulatory mechanisms for ensuring mitigation	Outcome to demonstrate the Proposal meets EPA objective
Offsets – To counterbalance any significant residual environmental impacts or uncertainty through the application of offsets				
Context • The Proposal is seeking a total of 350 ha of native vegetation clearing within a defined Development Envelope. • The vegetation condition is considered 'Good-to-Excellent', based on pre-exploration baseline surveys. *Relevant policies, standards and guidelines* • WA Environmental Offsets Policy 2011 • WA Environmental Offsets Guidelines • Environmental Protection Bulletin No. 1 - Environmental Offsets – Biodiversity • WA environmental offsets template **Impacts** • Direct impact to 350 ha of 'Good-to-Excellent' vegetation within the Pilbara's Hamersley IBRA sub-region.	• Clearing of vegetation in 'Good-to-Excellent' condition.	Offsets are proposed to address all outstanding residual impacts remaining after all other mitigation actions listed in this ERD have been implemented.	BHP Billiton Iron Ore is committing to financial offsets for in accordance with the *Offsets Guideline* (WA Government, 2014). A completed Offsets Form and supporting documentation is at Appendix L.	**This factor is considered a key environmental factor.**

Table 12: Assessment of preliminary key environmental factors – Rehabilitation and Decommissioning

Inherent Impact	Environmental Aspect	Mitigation actions to address residual impacts	Proposed regulatory mechanisms for ensuring mitigation	Outcome to demonstrate the Proposal meets EPA objective
Rehabilitation and Decommissioning – To ensure that premises are decommissioned and rehabilitated in an ecologically sustainable manner.				
Context • Adjacent orebodies 24 and 25 are currently subject to a Decommissioning and Rehabilitation Plan which is scheduled to be updated this calendar year (2015). • Ongoing discussions with the DMP over the past 12 months have focused on BHP Billiton Iron Ore's preferred hub-based approach towards managing closure, of which the Orebody 32 deposit will be included. • In January 2015, the DMP and BHP Billiton Iron Ore concurred that instead of updating the historic existing Decommissioning and Rehabilitation Management Plan applicable to orebodies 24 and 25, a new Mine Closure Plan would be developed and implemented for the greater Eastern Ridge Hub. • A number of scenarios are currently being considered as part of a proposed Mine Closure Plan for the Eastern Ridge Hub. **Impacts** • This Proposal is considered low-risk for closure and rehabilitation. Final land use, land management, safety landform and sustainability aspects can be managed through standard BHP Billiton Iron Ore management practices for closure. • Based on the Preliminary Acid and Metalliferous Drainage (AMD) Risk Assessment (SRK, 2015) carried out, the majority of material to be encountered during mining AWT has a low to negligible potential to generate acidity during operations. No instances of sulphur exposures on the pit wall, which exceeded a 0.1% threshold, were identified. • Given that the Proposal is AWT mine, no impact on groundwater quantity/level is anticipated and no permanent standing water is expected. • Based upon the local topography and previous assessments for Eastern Ridge, the Homestead Creek flood regime is unlikely to be impacted by the Closure landforms (including mine void). • Flora and vegetation are addressed in Table 9.	• Alteration of landforms to create a pit.	The Proposal will be integrated into the proposed Mine Closure Plan for Eastern Ridge, incorporating adjacent Orebody 24 and Orebody 25. The WAIO Closure and Rehabilitation Principles will be applied to the Proposal through the following specific strategies: • Final land-use: Base case of low intensity grazing will be adopted for planning purposes, final use will be determined through stakeholder consultation for the Eastern Ridge Hub. • Land management: Integrated across the Eastern Ridge hub. • Safety: Access to unsafe areas will be impeded through construction of safety bunds in accordance with industry standards. • Landforms: Mine waste (overburden) will be transported to OB24 and integrated into OB24 closure landforms (including pit backfill to achieve closure objectives). Some minor OSA's may be required at OB32 as a last case scenario. Pit walls will be left as run of mine where geo-technically stable. Pit walls and OSAs will be re-profiled as necessary to achieve closure objectives. • Mine Planning: Integrated waste strategy across eastern ridge hub to optimise closure landform outcomes, minimise footprint and facilitate progressive rehabilitation. • Sustainability: Rehabilitation to be undertaken in accordance with BHP Billiton Iron Ore's Rehabilitation Standard (informed by the Land and Biodiversity Management Plan). Flora and vegetation mitigation through rehabilitation is addressed in Table 9. • Water: Closure floodplain engineering assessment for Homestead Creek with design and implementation of engineering controls if required to meet closure objectives. AMD risk management will be carried out in accordance with the WAIO AMD Management Standard including; waste characterisation, modelling and management of PAF in specifically design PAF OSAs (if required). • Decommissioning: Utilisation of existing infrastructure at Orebody 24 and Orebody 25, avoiding Proposal-specific decommissioning requirements. • Contaminated sites: All chemicals, hydrocarbons, explosives and other hazardous substances and dangerous goods will be stored at existing facilities at adjacent Orebody 24 or Orebody 25. Any spills occurring within the Proposal Development Envelope to be managed during the life of mine in accordance with BHP Billiton Iron Ore. BHP Billiton Iron Ore has adopted an Adaptive Management Approach (AMA) to closure management across all of its operations, including Eastern Ridge (Figure 10). The AMA aims to reduce impact by embedding a cycle of monitoring, reporting and implementing change where required. It allows an evaluation of the mitigation controls so that they are progressively improved and refined, or alternative solutions adopted, to achieve the desired environmental outcomes. BHP Billiton Iron Ore's AMA is underpinned by its corporate commitments, which collectively articulate and mandate the Company's core values and minimum performance standards for environmental management and sustainability. For example, as part of the AMA ongoing waste rock characterisation and modelling will further inform waste management and closure landform designs for OB32. This may lead (although unlikely) to identification of PAF materials, if this occurs examples of some of the control activities which could be implemented include: • Construction of PAF OSAs in accordance with leading practice to minimise AMD generation and discharge. Verification of OSA compliance to 'as dumped' design. • Blending PAF material with neutralising material prior to disposal, in order to neutralise the stored acidity upon re-wetting. • Optimise mine pit design including opportunities to minimise residual PAF material in pit walls. • Collect and treat AMD run-off or seepage, if required (e.g. lime addition). AMA will be incorporated into the proposed Eastern Ridge Mine Closure Plan to be developed over the next 12 months.	BHP Billiton Iron Ore proposes to develop and implement a Mine Closure Plan for the Eastern Ridge Mine Hub during 2015.	**This factor is considered a key environmental factor.** BHP Billiton Iron Ore is obliged under its the tenure requirements of the Mining Lease, issued under the *Iron Ore (Mount Newman) Agreement Act 1964* ensure that premises are closed, decommissioned and rehabilitated in an manner consistent with current government standards and without unacceptable liability to the State. To support this, a Mine Closure Plan is being developed to consolidate existing management plans applicable to adjacent mines and to also incorporate this Proposal.



The five key steps of BHP Billiton Iron Ore's adaptive management approach are as follows:

1 Define: Conduct baseline and impact assessments (including cumulative impact assessments where required) to understand how the proposed operation or expansion may impact sensitive receptors. Define management outcomes consistent with regulatory and internal requirements and set performance criteria to ensure these outcomes are met.

2 Plan: Develop management plans (site specific or air shed) that describe how the performance criteria will be met through the application of the management hierarchy, monitoring and reporting measures.

3 Implement and Monitor: Implement management measures and monitor against performance criteria during construction and operations. Conduct internal audits to verify management measures are being implemented in line with regulatory and internal standards.

4 Analyse and Learn: Use monitoring data to verify models and validate assumptions and identify relevant internal and external changes (e.g., change in regulatory requirements or advancements in technology) and address where applicable. Assess data and information acquired to ensure that management measures and performance criteria remain appropriate over the life of the operation.

5 Adapt and Share: Report management performance and relevant metrics according to external and internal reporting requirements (e.g., Annual Environmental Reporting, BHP Billiton's Annual Sustainability Report). Where shortcomings and/or improvement opportunities in the management approach are identified, adapt the management approach. Implement and communicate the changes with a view to share learnings externally and contribute to improvements across industry.

Figure 10: BHP Billiton Iron Ore's Adaptive Management Approach

6. Other environmental factors

An assessment of those environmental factors not considered to be key environmental factors is provided in Table 13. This summary table provides the following information:

- environmental factor / EPA objective;
- a description of the activity and potential impact;
- relevant aspect of the proposal;
- mitigation actions to address residual impacts; and
- proposed mechanism for mitigation.

Table 13: Assessment of other environmental factors

Potential Impact	Aspect	Mitigation actions to address residual impacts	Proponent's proposed mechanism for ensuring mitigation
Landforms *To maintain the variety, integrity, ecological functions and environmental values of landforms.*			
Modification of landforms. The Proposal area is located within one soil type: • *"Fa13 – Ranges of banded jaspilite (BIF) and chert along with shales. Soils with predominantly physical limitations (shallow skeletal soils), Low A1 horizon organic content"* The following land systems are located within the Development Envelope: • Newman Land System; • Boolgeeda Land System; and • River Land System.	Alteration of landform through the creation of pits.	Rehabilitating mine landforms when they are no longer required. Conserving topsoil resources where practicable Various options are being further explored to reduce the impact of the Proposal existing landforms, including using overburden to backfill depleted pits within the wider hub as they become available. Where this is not possible, waste will be hauled to existing approved OSAs at Orebody 24, prior to creating new OSAs within the Development Envelope. Any required new OSAs will be designed to physically interface appropriately with adjacent features, considering visual impact, waste characterisation, natural hydrological linkages and ensuring surface landform stability.	As previously mentioned, BHP Billiton Iron Ore is currently developing a hub-based consolidated Mine Closure Plan for the Eastern Ridge Hub, including the Orebody 32 deposit.

Potential Impact	Aspect	Mitigation actions to address residual impacts	Proponent's proposed mechanism for ensuring mitigation
Terrestrial Environmental Quality *To maintain the quality of land and soils so that the environmental values, both ecological and social, are protected.*			
Potential to contaminate land and soils with waste materials and dangerous goods, if not managed appropriately.	Mobile plant and equipment.	Servicing of mobile plant and machinery will be undertaken at existing facilities at Orebody 24 and 25.	Condition 5 of MS 834 (Environmental Management Plan) will apply to mobile plant and equipment at Orebody 24 and 25.
	Waste disposal.	No wastes will be disposed of at Orebody 32. All waste will be taken to waste management facilities at Orebody 24 or 25.	
A Preliminary AMD Risk Assessment (SRK, 2015) has been carried out and the majority of material to be encountered during mining above the water table has a low to negligible potential to generate acidity during operations. The AMD Risk Assessment has shown no instances of sulphur exposures on the pit wall which exceeded a 0.1% threshold.	Mine pit excavation (operational activity)	Ongoing waste rock characterisation modelling and inclusion in mine planning designs and schedules will occur to validate the Preliminary AMD Risk Assessment (SRK, 2015) and enable identification of PAF material in mined waste and pit walls and segregation of PAF overburden.	Implement existing PAF management strategies if new or unknown materials are encountered during operations.

Potential Impact	Aspect	Mitigation actions to address residual impacts	Proponent's proposed mechanism for ensuring mitigation
Terrestrial Fauna (terrestrial vertebrate fauna and invertebrate short-range endemic fauna) *To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.*			
Potential impact to fauna habitat, which may lead to a decline in species representation. Possible direct mortality, fauna entrapment and vehicle strikes during clearing and operations. Indirect impacts may include habitat fragmentation and barriers to movement, habitat degradation, behavioural impacts Introduction of new (feral) species. For further information, please refer to Appendix E – Astron Environmental Services, 2015 and Appendix F – Biologic Environmental Survey, 2015.	Clearing of up to 350 ha of potential fauna habitat. Creation of conditions attractive to feral animals.	Utilisation of existing OSAs and ore handling plants at adjacent Orebody 24 and Orebody 25 has considerably reduced the amount of potential habitat to be cleared for the Proposal.	BHP Billiton Iron Ore will manage this factor as part of standard Pilbara-wide Health, Safety and Environment Management System. Given that the four vertebrate fauna habitat types recorded within the Development Envelope are typical and well represented in the region, the impact of clearing within the Development Envelope is unlikely to have any impact on an ecosystem of high functional value or that is regionally significant. All potential Short-range Endemic invertebrate fauna species are known to occur beyond the Development Envelope, and are known from a range of habitat zones which have been shown to extend beyond the Development Envelope.

Potential Impact	Aspect	Mitigation actions to address residual impacts	Proponent's proposed mechanism for ensuring mitigation
Inland Waters Environmental Quality *To maintain the quality of groundwater and surface water, sediment and biota so that the environmental values, both ecological and social, are protected.*			
The Proposal will potentially mobilise sediment to natural drainage systems. Potential impacts on natural surface water quality. For further information, please refer to Appendix I (RPS Aquaterra, 2015).	Mobile plant and equipment. Ground disturbance and clearing.	Sediment basins will be used to control surface water sediment and will be constructed downslope of all disturbed ground within the Development Envelope	No significant changes to surface water drainage or quality are anticipated as a result of the Proposal.
Two potable water bores to the north-east of the Proposal area have recently been decommissioned. This Proposal is AWT; therefore, no surplus water discharge is proposed.	Mining activities within the vicinity of a potable drinking water borefield.	In consultation with the DoW over the past 12 months, BHP Billiton Iron Ore has decommissioned the two eastern-most potable water bores and updated the Newman Potable Water Resource Protection Plan (BHP Billiton Iron Ore, 2015). This updated plan has been submitted to the DoW in May 2015.	Changes to drinking water protection measures can be dealt with via alternative regulatory processes in consultation with the Department of Water, the Water Corporation and the Newman Water Catchment Working Group.

Potential Impact	Aspect	Mitigation actions to address residual impacts	Proponent's proposed mechanism for ensuring mitigation
Hydrological Processes *To maintain the hydrological regimes of groundwater and surface water so that existing and potential uses, including ecosystem maintenance, are protected.*			
Interruptions in natural surface water flow patterns have potential to increase or decrease surface water run-off in the local environment if not appropriately managed. Given that the Proposal is AWT, potential impacts to groundwater regimes and regional aquifers are anticipated to be negligible.	Ground disturbance and clearing.	The Development Envelope has been designed 50m back at its closest point to avoid impacting the flow of Homestead Creek. Surface water structures will be built within the Development Envelope to appropriate levels to ensure Homestead Creek and significant tributaries are not impacted by the mine. To ensure structural integrity, appropriate side slopes and construction methods will be adopted to minimise erosion. Local sediment ponds will be built downstream of OSA's to capture sediment before runoff is discharged into Homestead Creek. Bunds will be constructed taking into consideration hydraulic modelling undertaken for the project (RPS, 2014). The hydraulic model is informed by topographical data obtained from available LIDAR surveys to produce water surface profiles to estimate pre-development and post-development ARI flood extents. This modelling information is used to inform bund construction and sediment basin requirements. As the pit design is refined the hydraulic model will be updated accordingly and therefore bund construction and sediment basin requirements will also be updated.	No diversions to nearby Homestead Creek are proposed under this Proposal. It is not considered that additional approvals such as Beds and Banks under the *Rights in Water and Irrigation Act 1914* are required given that the Proposal is not anticipated to significantly impact the natural flow of Homestead Creek and the Creek is outside of the Proposal Development Envelope boundary. Following construction and implementation of suitable bunding informed by site-specific hydraulic modelling, it is not anticipated that the hydrological regimes of surface water and the nearby Homestead Creek will be significantly impacted.

Potential Impact	Aspect	Mitigation actions to address residual impacts	Proponent's proposed mechanism for ensuring mitigation
Air Quality and Atmospheric Gases *To maintain air quality for the protection of the environment and human health and amenity, and to minimise the emission of greenhouse and other atmospheric gases through the application of best practice.*			
Based on in-isolation modelling, there is minimal increase in dust emissions and no exceedances are anticipated*. *Based on a campaign mining approach, air quality and atmospheric gases have already been assessed as part of adjacent approved orebodies 24 and 25. Therefore, the in-isolation modelling for this Proposal only involves land clearing, blasting and haulage of the ore to adjacent operations, which result in negligible impacts.	Land clearing. Excavation and blasting of open pit and hauling ore to processing plants at adjacent operations.	The area of native vegetation that is cleared, and the duration for which cleared areas are left open before being rehabilitated or otherwise stabilised will be minimised. Roads and active work areas will be watered or alternative dust control measures applied to minimise dust generation.	DER Licence L6942/1997/12 which is applicable to the ore processing infrastructure at adjacent orebodies 24 and 25. National Environmental Protection (Ambient Air Quality) Measure.
Amenity *To ensure that impacts to amenity are reduced as low as reasonably practicable.*			
Potential for minor reduction in visual amenity*. * Note that the Proposal indicative pit is relatively small (only 220 ha) and that based on a campaign mining approach, the waste will be hauled to approved existing OSA locations at adjacent Orebody 24 in the first instance. No processing or other large infrastructure is proposed under this Proposal.	Mine pit excavation. Mine pit blasting.	Proposal components located to minimise visibility from Newman or Great Northern Highway as far as practicable. Cleared areas rehabilitated when they are not required. Dust control measures above implemented.	This Proposal will haul waste in the first instance to existing approved OSA locations within the MS834 which have previously been approved under MS834.
Heritage *To ensure that historical and cultural associations, and natural heritage, are not adversely affected.*			
The Proposal will require the clearing of native vegetation clearing and will involve land disturbance.	Mine pit excavation. Access and haul roads.	Identified heritage sites are avoided where practicable through design, planning and engineering solutions.	Heritage sites to be managed in compliance with section 18 of the *Aboriginal Heritage Act 1972*.

Potential Impact	Aspect	Mitigation actions to address residual impacts	Proponent's proposed mechanism for ensuring mitigation
Human Health *To ensure that human health is not adversely affected.*			
Based on in-isolation modelling, there is minimal increase in noise emissions and no exceedances are anticipated*. *Based on a campaign mining approach, noise impacts have already been modelled as part of adjacent orebodies 24 and 25. Therefore, the in-isolation modelling for this Proposal only involves land clearing, blasting and haulage of the ore to adjacent operations, which result in negligible impacts.	Ore and waste rock haulage. Mine pit excavation and blasting.	Dust control measures identified above.	DER Licence L6942/1997/12. Environmental Protection (Noise) Regulations 1997. National Environmental Protection (Ambient Air Quality) Measure.

7. Principles of the Environmental Protection Act

The concept of sustainable development came to prominence at the World Commission on Environment and Development (1987), in the report entitled Our Common Future, which defined sustainable development as:

> *Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.*

In recognition of the importance of sustainable development, the Commonwealth Government developed a National Strategy for Ecologically Sustainable Development (Commonwealth of Australia, 1992) that defines Ecologically Sustainable Development (ESD) as:

> *…using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased.*

The principles of ESD are incorporated into the *Environmental Protection Act 1986* and the EPA's Position Statement No. 7 - Principles of Environmental Protection (EPA, 2004d). These principles are:

- the precautionary principle;
- the principle of intergenerational equity;
- the principle of the conservation of biological diversity and ecological integrity;
- principles in relation to improved valuation, pricing and incentive mechanisms; and
- the principle of waste minimisation.

Table 14 provides a summary of how BHP Billiton Iron Ore has considered the principles of ESD for the Proposal.

Table 14: Consideration of principles of the Environmental Protection Act

Principle	Description in Environmental Protection Act 1986	Relevant Yes/No	If Yes, Consideration
Precautionary Principle	Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, decisions should be guided by: • careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and • an assessment of the risk-weighted consequences of various options.	Yes	Biological surveys have been carried out. Specialist technical impact assessments have been carried out to assess potential impacts and propose potential management strategies.
Intergenerational Equity	The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.	Yes	BHP Billiton Iron Ore has prepared a credible environmental impact assessment to inform the public debate about whether and how the Proposal should proceed. Technical studies and modelling have been carried out to inform this impact assessment.
Conservation of Biological Diversity and Ecological Integrity	Conservation of biological diversity and ecological integrity should be a fundamental consideration.	Yes	Baseline biological surveys have been completed. Technical impact assessments have been completed. Standard industry management measures can be used or adapted to mitigate biodiversity and ecological impacts associated with implementation of the Proposal.
Improved Valuation, Pricing and Incentive Mechanisms	Environmental factors should be included in the valuation of assets and services. The polluter pays principle - those who generate pollution and waste should bear the cost of containment, avoidance or abatement. The users of goods and services should pay prices based on the full life cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any wastes. Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solutions and responses to environmental problems.	Yes	Environmental factors have been considered throughout the development of this Referral. Specialist technical studies have been carried out to inform detailed impact evaluations and management measures which aim to minimise pollution and waste.

Principle	Description in Environmental Protection Act 1986	Relevant Yes/No	If Yes, Consideration
Waste Minimisation	All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.	Yes	Standard waste management measures are a key element for the implementation of this Proposal. It is standard practice for BHP Billiton Iron Ore to apply the waste management hierarchy to all sites and this will be the case in relation to this Proposal (i.e. avoidance, reuse, recycling, recovery of energy, treatment, containment and disposal).

8. Conclusion

8.1 Proponent's conclusion

This ERD has provided supporting information to the EPA in order to determine the Level of Assessment. This document has provided information about the existing environment and potential impacts of implementation of the Proposal. This ERD has also explained BHP Billiton Iron Ore's new regional management approach of potential impacts for each of the EPA's environmental factors. BHP Billiton Iron Ore has suggested implementation conditions to address those factors which may be considered potential key factors at Appendix M.

The Proposal has been designed to utilise existing infrastructure at adjacent orebodies 24 and 25 as part of BHP Billiton Iron Ore's approach towards exploring deposits adjacent to existing operations and minimising environmental footprints. This Proposal is considered relatively small with only 350 ha of native vegetation proposed, AWT mining only and no creek diversions.

The identified preliminary key environmental factors can be adequately managed to meet the EPA's objective, provided the proposed management plans are implemented and an offset is applied to counterbalance the potentially significant residual environmental impact resulting from clearing of good-to-excellent vegetation in the Pilbara.

BHP Billiton Iron Ore considers that the information and assessment presented in this ERD has adequately identified and addressed environmental aspects and issues relevant to the Proposal, and is adequate to enable the EPA to set the LOA category at 'Assessment on Proponent Information'.

8.2 Application of the significance framework

BHP Billiton Iron Ore has applied the significance framework detailed in EPA Environmental Assessment Guideline 9 during the assessment of this proposal. Figure 11 provides a conceptual illustration of how the significance framework has been applied by BHP Billiton Iron, indicating the level of uncertainty remaining and the mitigation measures to be adopted. This conceptual illustration is intended to provide the EPA with confidence that the objective for each preliminary key environmental factor will be met.

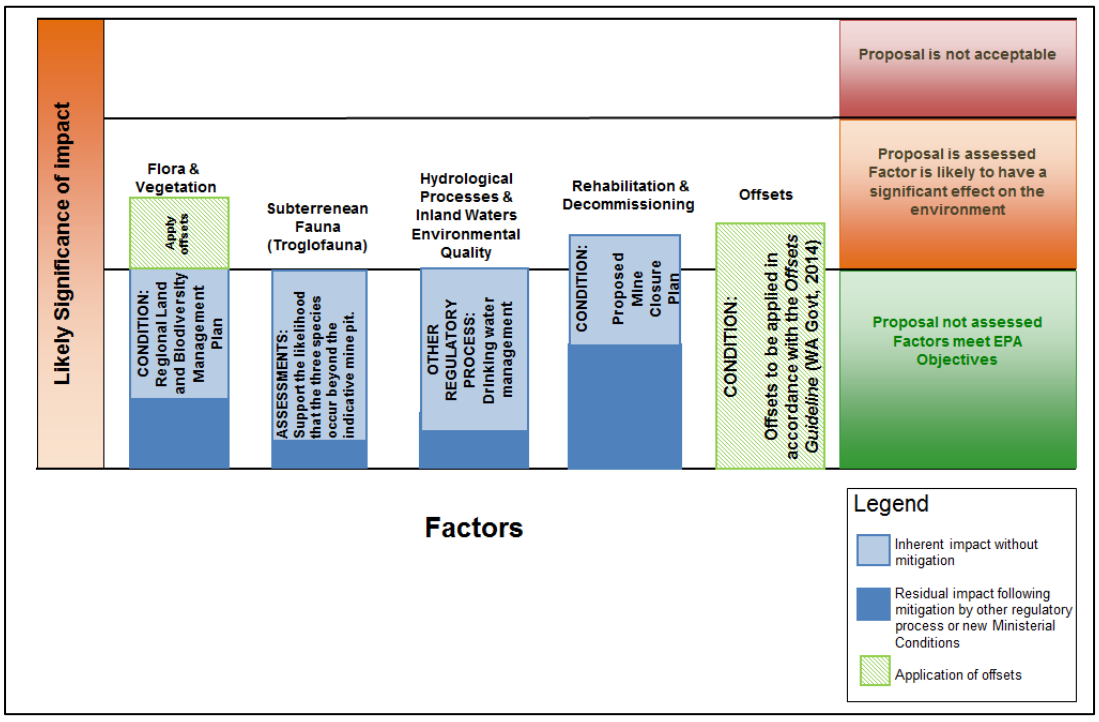


Figure 11: Conceptual application of the EPA's significance framework

9. References

Astron (2015) Orebody 32 East Vertebrate Fauna Environmental Impact Assessment. Report prepared for BHP Billiton Iron Ore Pty Ltd.

Bennelongia (2015a) *Orebody 32 East Troglofauna Environmental Impact Assessment.* Report prepared for BHP Billiton Iron Ore Pty Ltd.

Bennelongia (2015b) *Orebody 32 Baseline Subterranean Survey.* Report prepared for BHP Billiton Iron Ore Pty Ltd.

Bennelongia (2014) *Orebody 24 Baseline Subterranean Survey.* Report prepared for BHP Billiton Iron Ore Pty Ltd.

BHP Billiton Iron Ore (2015a) *Draft Regional Land and Biodiversity Management Plan*. BHP Billiton Iron Ore, Perth Western Australia

BHP Billiton Iron Ore (2015b) *Draft Eastern Pilbara Water Resource Management Plan*. BHP Billiton Iron Ore Pty Ltd, Perth, Western Australia

BHP Billiton Iron Ore (2013a) *BHP Billiton Iron Ore Sustainability Policy.* BHP Billiton Iron Ore, Perth, Western Australia

BHP Billiton Iron Ore (2013b) Our BHP Billiton Iron Ore Charter. BHP Billiton Iron Ore, Perth, Western Australia

BHP Billiton Iron Ore (2014a) *Group Level Document .009 (Environment).* BHP Billiton Iron Ore, Perth, Western Australia

BHP Billiton Iron Ore (2010) Orebody 24/25 Upgrade Project Environmental Protection Statement. BHP Billiton, Perth, Australia

Biologic (2015) *Orebody 32 East Short Range Endemic Invertebrate Fauna Survey.* Report prepared for BHP Billiton Iron Ore Pty Ltd.

Biologic (2014) Biologic Environmental Survey. Orebody 24-25 Short-range Endemic Invertebrate Survey. Report to BHP Billiton Iron Ore. Perth.

Biota Environmental Sciences (2001) *Baseline Biological and Soil Surveys and Mapping for ML244SA West of the Fortescue River.* Report prepared for BHP Billiton Iron Ore.

Department of Planning (2005) Shire of East Pilbara Town Planning Scheme No. 4 – District Zoning Scheme.

Department of Mines and Petroleum and Environmental Protection Authority (2015) *Guidelines for Preparing Mine Closure Plans.* Revised in May 2015.

Ecologia Environment (2004) *OB24 Expansion Biological Survey.* Report prepared for BHP Billiton Iron Ore.

ENV Australia (2012) *Eastern Ridge (OB 23/24/25) Flora and Vegetation Report.* Report prepared for BHP Billiton Iron Ore.

ENV Australia (2011) *Eastern Ridge (OB23/24/25) Fauna Assessment*. Report prepared for BHP Billiton Iron Ore.

ENV Australia (2006) *OB24 Flora and Fauna Assessment Phase II.* Report prepared for BHP Billiton Iron Ore.

ENV (2008) OB24-OB25 Short-Range Endemic Study Pseudoscorpions (Chelicerata: Arachnida). Report prepared for BHP Billiton Iron Ore.

Environmental Protection Authority (2015a) *Environmental Assessment Guideline 16 for Referral of a proposal under s38 of the Environmental Protection Act 1986*. January 2015.

Environmental Protection Authority (2015b) *Environmental Assessment Guideline 14 for Preparation of an API – Category A Environmental Review Document.* January 2015.

Environmental Protection Authority (2014) *Environmental Assessment Guideline 13 for Consideration of environmental impacts from noise.* September 2014

Environmental Protection Authority (2013a) *Environmental Assessment Guideline 8 for Environmental Factors and Objectives.* June 2013 – recently updated in January 2015

Environmental Protection Authority (2013b) *Environmental Assessment Guideline 9 for Application of a significance framework in the environmental impact assessment process (focusing on key environmental factors).* June 2013

Environmental Protection Authority (2013c) *Environmental Assessment Guideline 12 for Consideration of Subterranean fauna in environmental impact assessment in Western Australia*.

Environmental Protection Authority (2013d) *Environmental and water assessments relating to mining and mining-related activities in the Fortescue Marsh management area*. Advice of the Environmental Protection Authority to the Minister for Environment under Section 16(e) of the *Environmental Protection Act 1986*

Environmental Protection Authority (2013e) Environmental Protection Bulletin No.19 EPA involvement in mine closure. July 2013

Environmental Protection Authority (2012) *Environmental Assessment Guideline 1 – Defining the Key Characteristics of a Proposal.* May 2012

Environmental Protection Authority (2010a) *General Guide on Referral of Proposals to the Environmental Protection Authority under Section 38 of the Environmental Protection Act 1986.* Environmental Protection Authority.

Environmental Protection Authority (2010b) Environmental Protection Bulletin No. 1 - Environmental Offsets – Biodiversity

Environmental Protection Authority (2009a) *Sampling for Short-range Endemic Invertebrate Fauna for Environmental Impact Assessment in WA, Guidance Statement No. 20*

Environmental Protection Authority (2008a) *Environmental Guidance for Planning and Development, Guidance Statement No. 33*

Environmental Protection Authority (2007a) Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia, Draft Guidance Statement No. 54a

Environmental Protection Authority (2006a) *Rehabilitation of Terrestrial Ecosystems. Guidance Statement No. 6*

Environmental Protection Authority (2004a) *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia, Guidance Statement No. 51*.

Environmental Protection Authority (2004b) *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia, Guidance Statement No. 56*

Environmental Protection Authority (2004c) Assessment of Aboriginal Heritage, Guidance Statement No. 41

Environmental Protection Authority (2002a) *Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement No. 3*

Environmental Protection Authority (2002b) *Minimising Greenhouse Gas Emissions, Guidance Statement No. 12*

Environmental Protection Authority (2000a) *Environmental Protection of Native Vegetation: Clearing of native vegetation with particular reference to agricultural areas*. Guidance Statement No. 2

GHD (2008) *Report for Myopic Project Area, Newman Flora and Fauna Assessment.* Report prepared for BHP Billiton Iron Ore.

Ministerial Statement of Approval No. 834 Orebody 24/25 Upgrade Project

Ministerial Statement of Approval No. 712 Orebody 24 Project

Onshore Environmental Consultants (2015) *Orebody 32 East Flora and Vegetation Environmental Impact Assessment Study.* Report prepared for BHP Billiton Iron Ore.

Onshore and Biologic 2009, 'Biological Survey Myopic Exploration Leases'. Report prepared for BHP Billiton Iron Ore.

Onshore Environmental (2009) *Biological Survey Myopic Exploration Leases.* Report prepared for BHP Billiton Iron Ore.

Outback Ecology (2008) Orebody 24-25 Upgrade Terrestrial Invertebrate Short-range Endemic Assessment. Report to BHP Billiton Iron Ore Pty Ltd.

RPS Aquaterra (2015) Orebody 32 East Surface Water Impact Assessment. Report prepared for BHP Billiton Iron Ore Pty Ltd.

RPS Aquaterra (2014) Orebody 32 East Surface Water – Selection Phase Study. Report prepared for BHP Billiton Iron Ore Pty Ltd.

SRK (2015) *Orebody 32E Preliminary Acid Mine Drainage Risk Assessment.* Report prepared for BHP Billiton Iron Ore Pty Ltd.

Standards Australia (2004) *Environmental management systems – requirements with guidance for use.* Standards Australia/Standards New Zealand, Sydney, Australia

Appendices

Iron Ore

BHP Billiton Iron Ore Pty Ltd
ABN 46 008 700 981
125 St Georges Terrace
Perth WA 6000 Australia
PO Box 7122 Cloisters Square
Perth WA 6850 Australia
Tel +61 8 63210000 Fax +61 8 63229978
bhpbilliton.com

24 September 2014

The Hon. Colin Barnett, MLA
Premier: Minister for State Development; Science
1 Parliament Place
WEST PERTH WA 6005

Dear Premier

PROPOSALS AND APPROVALS LODGED BY BHP BILLITON IRON ORE PTY LTD

BHP Billiton Iron Ore Pty Ltd confirms the capacity in, and authority under which it lodged proposals or seeking approvals for the following:

- Mount Newman Joint Venture operating under the *Iron Ore (Mount Newman) Agreement Act 1964*;
- Mount Goldsworthy Mining Associates Joint Venture operating under the *Iron Ore (Mount Goldsworthy) Agreement Act 1964* and the *Iron Ore (Goldsworthy-Nimingarra) Agreement Act 1972*;
- BHP Iron Ore (Jimblebar) Pty Ltd operating under the *Iron Ore (McCamey's Monster) Agreement Authorization Act 1972*;
- Yandi Joint Venture operating under the *Iron Ore (Marillana Creek) Agreement Act 1991*;
- BHP Billiton Direct Reduced Iron Pty Ltd;
- BHP Billiton Minerals Pty Ltd; and
- United Iron Pty Ltd.

In each case, BHP Billiton Iron Ore Pty Ltd confirms that it is the manager and agent of the participants and that it is authorised to undertake such business as is necessary or advisable for the efficient and economic operations of the participants under their respective State Agreements. This includes the preparation and lodging of development proposal documents under the above State Agreements on behalf of the participants.

You will be aware that historically, BHP Billiton Iron Ore Pty Ltd has prepared and lodged proposal documents under the above State Agreements and various approvals. In many cases, this has been since the inception of the State Agreements in question.

We trust that this satisfies the Department's query.

Yours sincerely,

M. Beck

Margaret Beck
Vice President Finance
BHP BILLITON IRON ORE

BHP Billiton Iron Ore management approach

1.1 Environmental management overview

BHP Billiton has developed a *Company Charter and Sustainable Development* Policy for its operations. The *Company Charter and Sustainable Development Policy* (BHP Billiton Iron Ore, 2013a) are guiding resources for maintaining an emphasis on health, safety, environment and community and clarifying a broader commitment to aspects of sustainability including biodiversity, human rights, ethical business practices and economic contributions at all BHP Billiton sites. To interpret and support the Company Charter and BHP Billiton Iron Ore's Sustainable Development Policy, BHP Billiton Iron Ore has developed an Environmental Governance Hierarchy, an Environmental Management System and is currently developing a series of Regional Management Strategies.

1.2 Environment Governance Hierarchy

BHP Billiton Iron Ore now operates under an Environmental Governance Hierarchy (Figure 1). The Environment Governance Hierarchy provides the processes and practices that enable BHP Billiton Iron Ore to achieve its environmental objectives, reduce its environmental impacts and increase its operating efficiency. It enables environmental legal compliance to be undertaken and audited and provides for continual improvement in environmental performance.

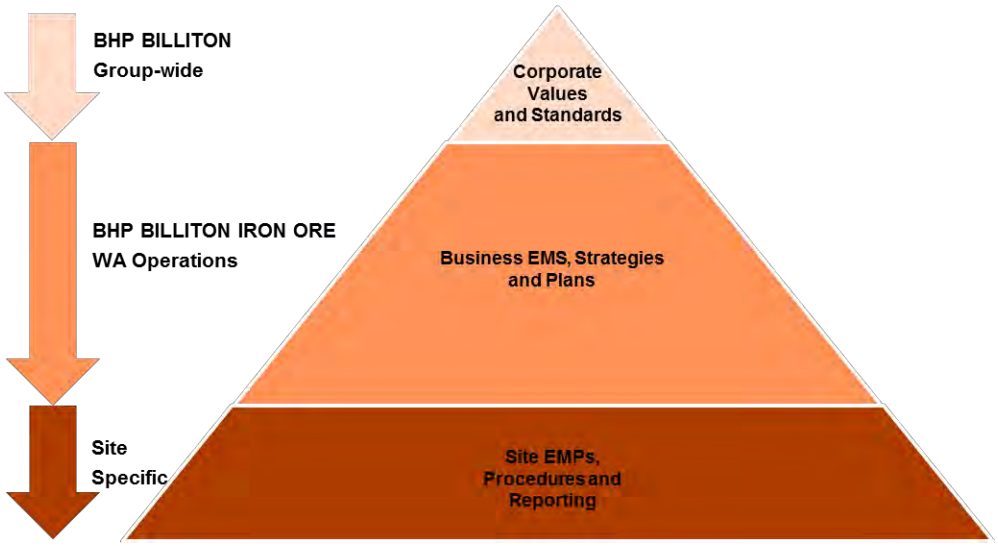


Figure 1: BHP Billiton Iron Ore Environmental Governance Hierarchy

As shown in Figure 1, BHP Billiton Iron Ore's environment governance hierarchy is broadly comprised of three tiers, representative of BHP Billiton Iron Ore's different levels of management – BHP Billiton (corporate level), BHP Billiton Iron Ore (Business Unit level) and site specific (operations level) – and reflective of BHP Billiton's top-down approach to environmental management across the Group.

At the corporate, or Group level, the fundamental values that underpin all aspects of BHP Billiton's activities are enshrined within BHP Billiton's Corporate Charter – *Our BHP Billiton Charter* (BHP Billiton, 2013b) – which are translated into measureable minimum performance standards in BHP Billiton's Group Level documents (GLDs). These standards are mandated across all BHP Billiton Business Units (including BHP Billiton Iron Ore) and form the foundation for developing and implementing environmental management systems at the Business Unit level. BHP Billiton's GLD.009

(Environment) (BHP Billiton, 2014a) is the key reference for environmental management across the Group.

At the Business Unit level, BHP Billiton Iron Ore's environmental management system, environment strategy and regional plans collectively describe the environmental outcomes BHP Billiton Iron Ore is committed to for the Pilbara region and the mechanisms through which BHP Billiton Iron Ore will meet these outcomes consistent with the GLDs and other internal and external requirements. BHP Billiton Iron Ore's Business Level Documents (BLDs) and Sustainability Policy are critical environmental governance documents, which translate the general Group-wide GLD standards into overarching requirements that are relevant and specific to BHP Billiton Iron Ore's operations.

BHP Billiton Iron Ore's Annual Environmental Report (AER) is the Company's primary document for reporting its overall annual environmental compliance performance. In addition to compliance reporting, BHP Billiton reports its Group-wide sustainability performance in the BHP Billiton Annual Sustainability Report.

1.3 Environmental Management System

The BHP Billiton Iron Ore Environmental Management Framework provides the processes and practices that enable the business to achieve its environmental objectives, reduce its environmental impacts and increase its operating efficiency. The Environmental Management Framework enables environment legal compliance to be easily undertaken and audited and provides for continual improvement in environmental performance.

A key component of the environmental management framework is the environmental management system, which is certified to Australian and New Zealand Standard AS/NZS ISO 14001 (Standards Australia, 2004) and is aligned with BHP Billiton's Corporate Charter.

1.4 Western Australia Iron Ore Environment Strategy and Regional Plans

BHP Billiton Iron Ore has developed standard business approaches to manage key environmental aspects. These standard business approaches form elements of the Western Australian Iron Ore Environment Strategy, the elements are:

- Pilbara Water Resource Management Strategy;
- Land And Biodiversity Strategy;
- Air Quality Strategy; and
- Western Australian Iron Ore Closure and Rehabilitation Strategy.

These documents describe how BHP Billiton Iron Ore will manage the changes resulting from BHP Billiton Iron Ore mining in the Pilbara region on the key receiving receptors (environment, social and third-party operations). The documents that demonstrate these approaches will be included in the BHP Billiton Iron Ore Pilbara Expansion Public Environmental Review Strategic Proposal submission in 2015. These standard business approaches have guided the development of management measures associated with this Proposal.

1.4.1 Regional Management Plans

To detail and implement the standard business approaches described in the Western Australia Iron Ore Environment Strategy, BHP Billiton Iron Ore has drafted regional management plans to support these key areas. The management plans applicable to the implementation of the Proposal are:

- Draft BHP Billiton Iron Ore Regional Land and Biodiversity Management Plan – Flora and Vegetation; and

- Draft BHP Billiton Iron Ore Eastern Pilbara Water Resource Management Plan.

1.4.2 Site Specific Environment Management Plans

Site-specific management, monitoring and reporting is undertaken in a manner consistent with the above strategy, and in accordance with internal and external requirements, via a site-based Environmental Management Plan (EMP), procedures and registers.

1.4.3 Project Environmental and Aboriginal Heritage Reviews

To support these management documents BHP Billiton Iron Ore has an internal Project Environmental and Aboriginal Heritage Review (PEAHR) Procedure. The purpose of the procedure is to manage implementation of environmental, Aboriginal heritage, land tenure and legal commitments prior to and during land disturbance. All ground disturbance activities will meet the requirements of the PEAHR procedure, all relevant legislative and regulatory requirements, the BHP Billiton Iron Ore's Sustainable Development Policy, industry standards, and codes of practice.

Iron Ore

bhpbilliton
resourcing the future

BHP Billiton Iron Ore Pty Ltd
ABN 46 008 700 981
125 St Georges Terrace
Perth WA 6000 Australia
PO Box 7122 Cloisters Square
Perth WA 6850 Australia
Tel +61 8 6321 0000 Fax +61 8 6322 9978
bhpbilliton.com

6 January 2014

Anthony Sutton
Director Assessment and Compliance
Office of the Environmental Protection Authority
Locked bag 33
Cloisters Square
PERTH WA 6850

RE: Orebody 24/25 Decommissioning and Rehabilitation Plan Update

Dear Anthony,

Condition 9-1 of Ministerial Statement 834 requires BHP Billiton Iron Ore to 'implement the proposal in accordance with the Decommissioning and Rehabilitation Plan provided as Appendix B of Orebody 24/25 Upgrade Project Environment Protection Statement or subsequent revisions'. BHP Billiton Iron Ore submitted Revision 2 of the Decommissioning and Rehabilitation Plan in January 2010.

Condition 9-2 of Ministerial Statement 834 states 'the proponent shall review and revise the Decommissioning and Rehabilitation Plan required by condition 9-1 at intervals not exceeding 5 years'. This 5 yearly review is required in January 2015.

BHP Billiton Iron Ore requests approval to delay submission of the Decommissioning and Rehabilitation Plan for the Eastern Ridge Operations to allow integration with additional projects that the business proposes to seek approval for in 2015 and a planned revised proposal for the site. It is anticipated the updated Decommissioning and Rehabilitation Plan will be available and submitted in December 2015. Additionally the updated Plan will be prepared in accordance with the revised Mine Closure Planning Guidelines, when released. During this interim period BHP Billiton Iron Ore will continue to operate utilising the existing Decommissioning and Rehabilitation Plan.

If you require further information or clarification, please contact Brendan May (Senior Environment Advisor) on (08) 9154 8510 or brendan.may@bhpbilliton.com.

Yours sincerely

J Dippenaar

pp **Chris Dark**
General Manager – Eastern Ridge

Orebody 32 East

Flora and Vegetation Impact Assessment

Prepared for BHP Billiton Iron Ore Pty Ltd
April 2015

Document Status						
Rev No.	**Authors**	**Reviewer/s**	**Date**	**Approved for Issue**		
				Name	**Distributed To**	**Date**
1	D.Brearley, J.Waters	D.Brearley	05/02/15	D.Brearley	L.Boulden, S.Pickard, B.Menezies	10/02/15
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3	D.Brearley	S.Brunt, S.Pickard, B.Menezies	31/03/15	D.Brearley	S.Brunt, S.Pickard, B.Menezies	07/04/15
4	D.Brearley	E.Drain	28/04/15	D.Brearley	S.Brunt, S.Pickard, B.Menezies	30/04/15

Onshore Environmental Consultants Pty Ltd
ACN 095 837 120
PO Box 227
YALLINGUP WA 6282
Telephone / Fax (08) 9756 6206
E-mail: onshoreenv@westnet.com.au

EXECUTIVE SUMMARY

BHP Billiton Iron Ore Pty Ltd (BHP Billiton Iron Ore) is preparing referrals to the Environmental Protection Authority (EPA) under Section 38 of the *Environmental Protection Act 1986* (EP Act) to commence above water table (AWT) mining at Orebody 32 East. Onshore Environmental Consultants Pty Ltd (Onshore Environmental) was commissioned by BHP Billiton Iron Ore to undertake an impact assessment of the proposed development on flora and vegetation.

There are at least 25 previous flora and vegetation surveys that have been completed within a 25 km radius of the Development Envelope, including six surveys that overlap all or parts of the Development Envelope. The most recent survey was completed between April and July 2011 at Eastern Ridge (OB 23/24/25) (ENV Australia 2012).

Based on collated results from previous flora and vegetation surveys intersecting the Development Envelope, no plant taxon gazetted as Threatened Flora (T) pursuant to subsection (2) of Section 23F of the *Wildlife Conservation Act 1950* (WC Act) or listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) has been recorded from the Development Envelope. In addition, none of the flora recorded from the Development Envelope are listed as Priority flora by the Department of Parks and Wildlife (Western Australian Herbarium 2015).

There were six introduced (weed) species recorded as scattered individuals on footslopes, plains and drainage lines within the Development Envelope; **Bidens bipinnata*, **Cenchrus ciliaris, *Cenchrus setaceus, *Flaveria trinervia, *Malvastrum americanum* and **Setaria verticillata.* None of these taxa are listed as Declared Pests under the *Biosecurity and Agriculture Management Act 2007* (BAM Act). Existing management strategies being successfully implemented at surrounding BHP Billiton Iron Ore operations would be extended to the Orebody 32 East AWT operations to minimise any potential impacts.

Vegetation within the Development Envelope has been mapped as seven vegetation associations from three broad floristic formations. None of the vegetation associations are Federal or State listed Threatened Ecological Communities (TECs) or State listed Priority Ecological Communities (PECs), and all are well represented within the Pilbara bioregion.

Vegetation condition within the Development Envelope was predominantly rated as excellent, with localised lower lying areas impacted by grazing rated as excellent to very good or very good.

Two vegetation associations occurring on hill crests, hill slopes and breakaway slopes support *Acacia aptaneura* (Mulga) as a part of the shrub component. While Mulga vegetation occurring on floodplains in the Pilbara can be at risk from alteration to surface water flows, the two vegetation associations supporting Mulga in the Development Envelope are not determined to be at risk due their elevated position in the landscape.

At July 2011 fire age within the Development Envelope was rated as moderate (3-5 years) to old (≥6 years). Fire is a natural occurrence within the Pilbara, and the increased risk posed by mine development at the site is manageable and not considered a significant risk.

There is a minor risk of vegetation decline resulting from increased levels of airborne dust along the edge of unsealed roads and tracks supporting large volumes of traffic. This can be effectively managed by implementing proven dust control measures currently being implemented at surrounding BHP Billiton Iron Ore operations.

ABBREVIATIONS

Abbreviation	Definition
AWT	Above Water Table
BAM Act	*Biosecurity and Agriculture Management Act (2007)*
bgl	below ground level
BHP Billiton Iron Ore	BHP Billiton Iron Ore Pty Ltd
BoM	Bureau of Meteorology
CID	channel iron deposit
DEWHA	Department of the Environment, Water, Heritage and the Arts
DoE	Department of Environment
DPaW	Department of Parks and Wildlife
EC	electrical conductivity
EIA	environmental impact assessment
EP Act	*Environmental Protection Act (1986)*
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act (1999)*
EPS	Environmental Protection Statement
ha	hectares
HV	heavy vehicle
IBRA	Interim Biogeographic Regionalisation for Australia
IUCN	International Union for Conservation of Nature
KCT	Key Characteristics Table
km	kilometre
LOM	Life of Mine
LV	light vehicle
m	metre
MS	Ministerial Statement of Approval
Mt	million tonnes
Mtpa	million tonnes per annum
OB	Orebody
OSAs	Overburden Storage Areas
P1	Priority 1
P2	Priority 2
P3	Priority 3
P4	Priority 4
PECs	Priority Ecological Communities
SRE	short-range endemic
T	Threatened Flora
TECs	Threatened Ecological Communities
WA	Western Australia
WAH	Western Australian Herbarium
WC Act	*Wildlife Conservation Act (1950)*

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1 INTRODUCTION

1.1 Preamble

Onshore Environmental was commissioned by BHP Billiton Iron Ore to undertake a flora and vegetation impact assessment to assess potential impacts of the proposed above water table (AWT) mining at Orebody 32 East (Figure 1). The purpose of the impact assessment was to provide a project specific assessment of the potential impacts of the proposed development on flora and vegetation.

The Orebody 32 East AWT project is located approximately five kilometres (km) north-east of Newman in the Pilbara region of Western Australia (Figure 1). It is situated immediately to the west of BHP Billiton Iron Ore's existing Orebody 24 mining operations on Mineral Lease ML244SA, which is subject to the *Iron Ore (Mount Newman) Agreement Act 1964* (Newman Agreement Act).

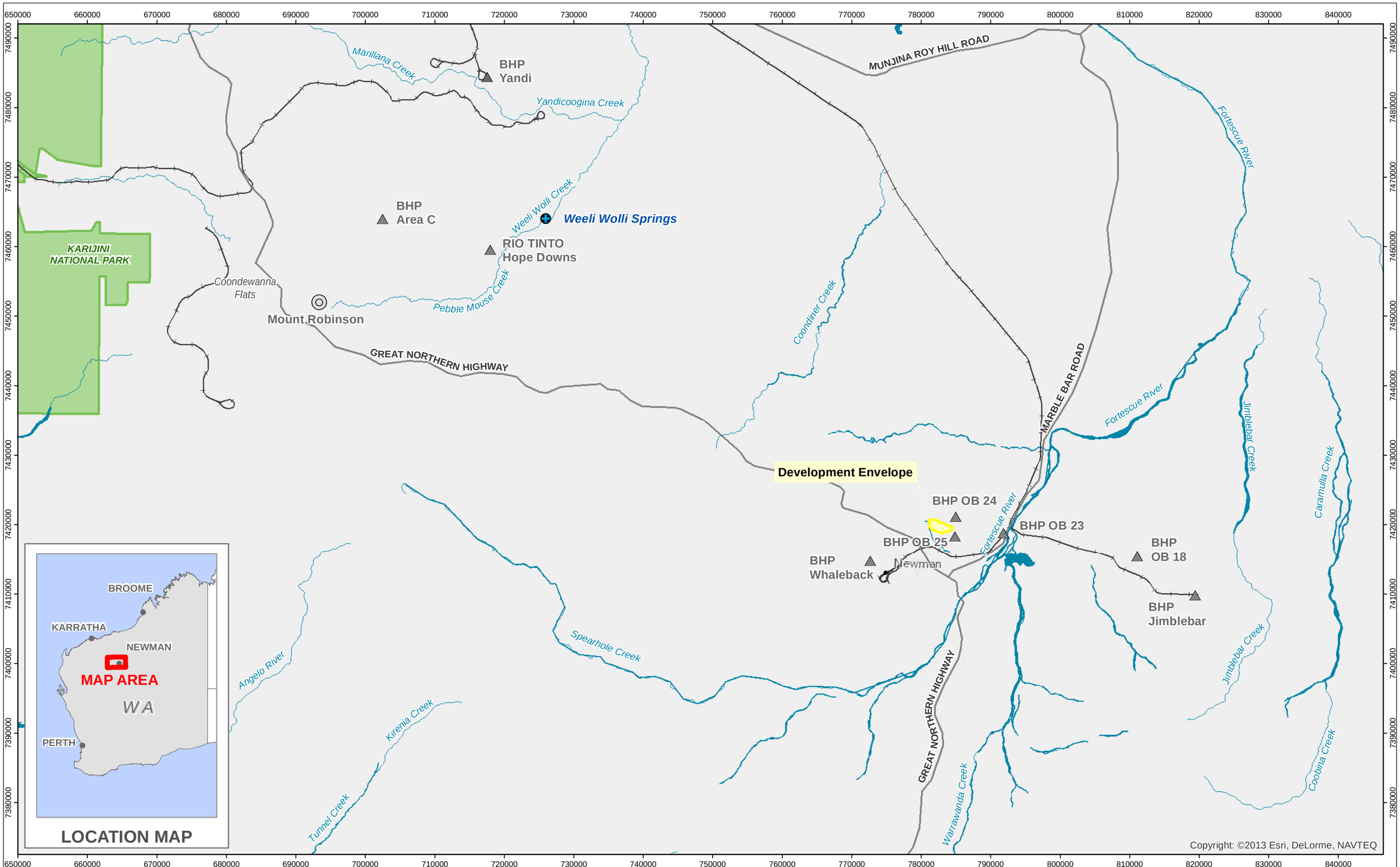
BHP Billiton Iron Ore currently operates a number of iron ore mines and associated rail and port infrastructure within the Pilbara region of Western Australia. Current mining operations situated in close proximity to Orebody 32 East AWT include:

- Orebodies 23, 24 and 25, located approximately 8 km north-east of Newman Township;
- Newman Joint Venture Hub, located approximately 2 km west of Newman Township, which consists of Mount Whaleback and Orebodies 29, 30 and 35; and
- Orebody 18, located approximately 25 km east of Newman Township.

The closest operations to Orebody 32 East AWT are Orebodies 23, 24 and 25 (Figure 1).

1.2 Project Description

BHP Billiton Iron Ore is proposing to commence pre-strip mining at Orebody 32 East AWT in June 2015 and sustainable recovery of high-grade ore is scheduled for November 2015 onwards. Ore from Orebody 32 East AWT will supplement the feed and production of ore from BHP Billiton Iron Ore's existing Eastern Pilbara operations (in particular the Ore Handling Plant (OHP) at Orebody 24). Resource drilling completed to date has identified approximately 40 million tonnes (Mt) of AWT ore available at Orebody 32 East.



ONSHORE ENVIRONMENTAL

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BHPBIO

OREBODY 32 EAST AWT REGIONAL LOCATION

Figure 1

Legend

- OB 32 - Development Envelope
- Nature Conservation Reserve
- Watercourses
- Roads
- Railways

GRIFFIN SPATIAL & MAPPING
PO Box 7215
Eaton WA 6232
admin@griffinspatial.com.au
+61 8 9725 3213

2 EXISTING ENVIRONMENT

2.1 Climate

The Pilbara region is characterised by an arid-tropical climate resulting from the influence of tropical maritime and tropical continental air masses producing predominantly summer rainfall. Cyclones can occur during this period, bringing heavy rain and causing potential destruction to coastal and inland towns.

The nearest Bureau of Meteorology (BoM) weather station to the Orebody 32 East AWT Development Envelope is located approximately 12 km south-southeast at the Newman Airfield. Additional meteorological data is available from a former BoM weather station at Newman that was operational for 38 years between 1965 and 2003. Both of these weather stations have statistical records of temperature, rainfall, relative humidity and wind speed and direction for periods of greater than ten years.

Regional temperatures are warmest from October through to April, with average monthly maximum temperatures at both stations exceeding 30°C during this period. Temperatures are coolest from May to September with average monthly minimum temperatures below 12°C. The average daily maximum temperature in January is approximately 39°C, while average daily minimum temperatures reach as low as 5.7°C in July.

The total annual average precipitation is approximately 310 mm at Newman and 316 mm at Newman Airfield (BoM 2015). The majority of precipitation occurs between December and March, peaking in February with a monthly average of approximately 81 mm. The months of September and October exhibit the driest conditions with average rainfall less than 4 mm.

The Wittenoom BoM station is located approximately 190 km north-west of Newman and is the closest station that records evaporation. Annual average evaporation for Wittenoom is 3,142 mm per year, which exceeds annual rainfall by as much as 2,500 mm per year.

2.2 Biogeographic Regions

The latest version of the Interim Biogeographic Regionalisation for Australia (IBRA7) divides Australia into 89 bioregions based on climate, geology, landform, native vegetation and species information (DoE 2012) and includes 419 sub-regions. The bioregions and sub-regions are the reporting unit for assessing the status of native ecosystems and their level of protection in the National Reserve System.

The Orebody 32 East AWT Development Envelope is located in the Pilbara bioregion which consists of four sub-regions: Chichester, Fortescue, Hamersley and Roebourne. The Development Envelope is located in the Hamersley sub-region (PIL3), which is described as a mountainous area of Proterozoic sedimentary ranges and plateaux, dissected by gorges (basalt, shale and dolerite) (Kendrick 2001). It contains Mulga low woodland over bunch grasses on fine textured soils in valley floors, and *Eucalyptus leucophloia* over *Triodia brizoides* on skeletal soils of the ranges.

2.3 Existing Land Use

The current land use surrounding the Orebody 32 East AWT Development Envelope is predominantly mineral exploration, iron ore mining and dry land agriculture, specifically pastoralism, cattle grazing and rangelands. Conservation lands amount to less than ten percent of the total area of the Pilbara Bioregion, with the major reserve being Karijini National Park (approximately 120 km to the north-west), supplemented by lesser conservation estates such as Cane River and Meentheena Conservation Parks. Wetlands of National Significance include the permanent pools of Millstream-Chichester and Karijini National Parks and the Fortescue Marsh (approximately 80 km to the north).

2.4 Landforms

The Orebody 32 East AWT Development Envelope is located at the southern end of the Hamersley Plateau. The Hamersley Plateau is characterised by long strike ridges rising 300 m or more above valley floors and flats. Other characteristic landforms of the general area include stony plains and some alluvial plains and sandplains (Tille 2007). The entire region contains mainly rounded ranges and hills in contrast to the characteristic ‘mesa form’ hills that are located further north. A rounded ridge occurs through the central and western sector of the Development Envelope, draining onto sloping plains to the north and south. The ephemeral drainage line Homestead Creek fringes the western boundary of the Development Envelope.

2.5 Soils

The following soil type occurs within the Development Envelope [Australian Soil Resource Information System (ASRIS) 2014]:

- Fa13 - Ranges of banded jaspilite and chert along with shales, dolomites, and iron ore formations; some areas of ferruginous duricrust as well as occasional narrow winding valley plains and steeply dissected pediments. This unit is largely associated with the Hamersley and Ophthalmia Ranges. The soils are frequently stony and shallow and there are extensive areas without soil cover: chief soils are shallow stony earthy loams (Um5.51) along with some (Uc5.11) soils on the steeper slopes. Associated are (Dr2.33, Dr2.32) soils on the limited areas of dissected pediments, while (Um5.52) and (Uf6.71) soils occur on the valley plains.

2.6 Geology

The Pilbara region makes up a portion of the Western Shield and consists of pre-Cambrian, Proterozoic and Archaean rocks. The area contains some of the earth’s oldest rock formations, thought to be around 3.5 billion years old (ANRA 2008). Important mineral reserves, including iron ore, which is prevalent in the Pilbara, are associated with these rock formations.

The Pilbara Craton lies beneath the Proterozoic rocks of the Hamersley and Bangemall Basins. The Hamersley Basin covers the majority of the southern part of the Pilbara Craton and is separated into three stratigraphic groups; the Fortescue, Hamersley and Turee Creek rock groups. The Fortescue Group consists mainly of basalt with beds of siltstone, mudstone, shale, dolomite and jaspilite. These rocks

form the Chichester Plateau, which lies beneath the Hamersley Plateau. The Turee Creek Group consists of interbedded mudstone, siltstone, sandstone, conglomerate and carbonate. These rocks are the youngest of the three groups and are exposed mainly in the Ashburton Valley.

The Hamersley Group is the most relevant to the Development Envelope as it contains both the Brockman Iron Formation and the Marra Mamba Iron Formation, which together provide most of the major iron ore deposits in the Pilbara (O'Brien and Associates 1992). This group forms the Hamersley Range and Plateau and consists of jaspilite and dolomite. The jaspilite produces deposits of haematite and limonite, which are mined for iron ore.

The main geological unit within the Development Envelope is the Marra Mamba Formation. This formation is described by Tyler *et al.* (1991) as chert, ferruginous chert and banded iron-formation with minor shale. The Orebody 32 East AWT Development Envelope is situated to the north of the Homestead Fault and in its western parts lies adjacent to the Brockman Iron Formation of Homestead Ridge. The main enrichment occurs within the Mount Newman Member, which forms a tight, southward dipping recumbent anticlinal structure. The local footwall is Paraburdoo Member dolomite.

2.7 Surface Water Hydrology

Most creeks within the Pilbara are ephemeral with surface water only present following heavy rains as a result of storms or cyclones during the summer months. The Orebody 32 East AWT Development Envelope is located in close proximity to Homestead Creek an ephemeral drainage line which occurs as a tributary of the larger Fortescue River. Homestead Creek runs south, then east, adjacent to the Orebody 32 East AWT Development Envelope and Orebody 25 Development Envelope, to join the Fortescue River just north of Ophthalmia Dam. The Fortescue River then flows north for approximately 80 km into the Fortescue Marsh.

2.8 Flora and Vegetation

The Orebody 32 East AWT Development Envelope is located within the Hamersley Botanical District, which is part of the Eremaean Province (Beard 1990). It is dominated by tree and shrub - steppe communities consisting mainly of *Eucalyptus* and *Acacia* species. *Triodia pungens* and *Triodia wiseana* and some Mulga occur within valley areas and short grass plains occur on alluvia.

The original vegetation mapping was undertaken by Beard (1975) and refined by Shepherd *et al.* (2002). There were two vegetation associations described from the Development Envelope (Table 1, Figure 2). While the Pre-European extent for each vegetation association is approximately 100 percent, less than ten percent of each association occurs within formal or informal reserves (Table 1).

Table 1 Pre-European extent of vegetation associations occurring within the Development Envelope (Shepherd *et al.* 2002).

Vegetation Sub-Association	Pre-Euro. Extent Remaining	Extent within tenement boundary (ha)	% remaining IUCN Class I-IV Reserves
Hamersley 82: Hummock grasslands, low tree steppe; Snappy gum over *Triodia wiseana*	2,290,910 (100 %)	380.60	8.9
Hamersley 18: Low woodland; mulga (*Acacia aneura*)	24,659,110 (99.9%)	32.99	2

In recent years there has been numerous small-scale surveys completed throughout the Pilbara, predominantly associated with mining approvals. A literature review confirmed six previous flora and vegetation surveys covering at least part of the Development Envelope were completed between 2000 and 2011. An additional 19 baseline surveys have been completed at surrounding BHP Billiton Iron Ore tenements.

2.9 Land Systems

The Department of Agriculture has conducted inventory and condition surveys of the Pilbara (van Vreeswyk *et al.* 2004) using an integrated survey method involving the land system approach to rangeland description evaluation. The primary objective of the surveys was to provide comprehensive descriptions and mapping of the biophysical resources of the region as well as an evaluation on the condition of soils and vegetation. The mapping is based on patterns in topography, soils and vegetation.

A total of 102 land systems were defined in the Pilbara at a scale of 1:250,000 (van Vreeswyk *et al.* 2004), with three land systems occurring within the tenement boundary (Table 2, Figure 3). All three land systems are well represented in the Pilbara covering between 2.3 percent and 8.0 percent of the Pilbara bioregion.

Table 2 Land systems occurring within the Development Envelope (descriptions from van Vreeswyk *et al.* 2004).

Land System	Distribution in the Pilbara	Area in Development Envelope (km²)	Area in Pilbara (km²)	% of Pilbara in DE
Boolgeeda: Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands and mulga shrublands	Wide, common	1.43	7,748	0.018
Newman: Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands	Southern half, very common	2.69	14,580	0.018
River: Active flood plains and major rivers supporting grassy eucalypt woodlands, tussock grasslands and soft spinifex grasslands.	Wide, common	0.023	4,088	0.001

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7422000 7421000 7420000 7419000 7418000 7417000

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ONSHORE ENVIRONMENTAL

Figure:	2	Date:	15 Jan. 2015
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N

0 250 500 750 1,000 1,250

Meters
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Projection: MGA Zone 50

BHPBIO

OREBODY 32 EAST AWT
Vegetation within the Development Envelope, as mapped by Beard (1975)

FIGURE 2

Legend

OB 32 - Development Envelope

Pre-European Vegetation (Beard 1975)

System, Vegetation Association

HAMMERSLEY, 18

HAMMERSLEY, 82

GRIFFIN SPATIAL & MAPPING
PO Box 7215
Eaton WA 6232
admin@griffinspatial.com.au
+61 8 9725 3213

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Figure:	3	Date:	15 Jan. 2015
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Meters
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Datum: GDA94
Projection: MGA Zone 50

BHPBIO

OREBODY 32 EAST AWT
Land Systems within the Development Envelope, as mapped by Van Vreeswyk *et al.* (2004)

FIGURE 3

Legend

- OB 32 - Development Envelope

Land Systems

Mapping Unit, Land Systems

- RGEBGD, Boolgeeda Land System
- RGEELI, Elimunna Land System
- RGEMCK, McKay Land System
- RGENEW, Newman Land System
- RGERIV, River Land System
- RGEROC, Rocklea Land System
- RGEWNM, Wannamunna Land System

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PO Box 7215
Eaton WA 6232
admin@griffinspatial.com.au
+61 8 9725 3213

3 REVIEW OF BASELINE REPORTS

There are at least 25 previous flora and vegetation surveys that have been completed within a 25 km radius of the Orebody 32 East AWT Development Envelope, including six surveys that intersect the Development Envelope. Table 3 summarises findings of the literature review, tabulating timing, survey intensity, and the main results including total flora, conservation significant flora and introduced weeds. Previous survey areas surrounding the Development Envelope include Orebody 25, Orebody 23 and Orebody 24 (both within a 2 km radius), Mt Whaleback (approximately 5 km to the south-west) and Orebody 18 (approximately 20 km to the east).

None of the significant flora points recorded from the previous surveys occur within the Development Envelope.

Table 3 Summary of results from previous flora and vegetation surveys within, or in close proximity to, the Development Envelope.

Report	Proximity to Orebody 32 East AWT Project	Survey Timing & Intensity	Vegetation Associations & Landform	Floristics	Significant Flora
Surveys within or partly within the Development Envelope (DE)					
ENV Australia (2012) Eastern Ridge (OB 23/24/25) Flora and Vegetation Report	Overlaps the DE and includes OB23, OB24 and OB25	8-19th April, 29-31st July 2011 Good-average seasonal conditions	13 vegetation associations	422 taxa from 52 families and 170 genera 18 weed species: **Cenchrus ciliaris, *Cenchrus setiger, *Acetosa vesicaria, *Aerva javanica, *Vachellia farnesiana, *Tamarix aphylla, *Cynodon dactylon, *Lactuca serriola, *Malvastrum americanum, *Solanum nigrum, *Symphyotrichum squamatum, *Echinochloa colona, *Agave americana, *Cyperus involucratus, *Setaria verticillata, *Bidens bipinnata, *Cucumis melo* subsp. *agrestis, *Flaveria trinervia*	*Calotis latiuscula* (Priority 3), *Aristida jerichoensis* var. *subspinulifera* (Priority 1), *Goodenia nuda* (Priority 4), *Eremophila magnifica* subsp. *velutina* (Priority 3), *Isotropis parviflora* (Priority 2)
Onshore Environmental (2009) Biological Survey Myopic Exploration Leases	Overlaps the DE – only targeted searches were conducted in the area that overlaps the current DE	8th-14th June 2009 15-18th June 2009 Good seasonal conditions	17 vegetation associations	274 taxa from 48 families and 123 genera. Eight weed species: **Bidens bipinnata, *Cenchrus ciliaris, *Cenchrus setiger, *Malvastrum americanum, *Setaria verticillata, *Solanum nigrum, *Stylosanthes hamata, *Tribulus terrestris*	*Aristida lazaridis* (Priority 2), *Goodenia nuda* (Priority 4), *Lepidium catapycnon* (Threatened)
GHD (2008) Report for Myopic Project Area, Newman Flora and Fauna Assessment	Overlaps the DE and extends to the west	26th May – 4th June 2008 Poor seasonal conditions	9 vegetation types	321 taxa from 52 families Thirteen weed species: **Cenchrus ciliaris, *Cynodon dactylon, *Vachellia farnesiana, *Malvastrum americanum, *Citrullus* sp., **Merremia dissecta, *Cylindropuntia* sp., **Aerva javanica, ?*Arundo donax, *Cenchrus setaceus, *Acetosa vesicaria, *Tamarix aphylla*, **Tribulus terrestris*	*Brunonia* sp. Long Hairs (DE Symon 2440) (Priority 1)

Report	Proximity to Orebody 32 East AWT Project	Survey Timing & Intensity	Vegetation Associations & Landform	Floristics	Significant Flora
ENV Australia (2006a) OB24 Flora and Fauna Assessment Phase II	Overlaps the DE and extends to the north and east	16th March - 10th April 2006 Good seasonal conditions	6 vegetation associations	413 taxa from 53 families and 156 genera Eight weed species: **Acetosa vesicaria, *Bidens bipinnata, *Cenchrus ciliaris, *Cynodon dactylon, *Echinochloa colona, *Malvastrum americanum, *Setaria verticillata, *Solanum nigrum*	*Eremophila magnifica* subsp. *velutina* (Priority 3), *Gymnanthera cunninghamii* (Priority 3)
Ecologia Environmental (2004) OB24 Expansion Biological Survey	Overlaps the DE and extends to the west	14th-27th May 2004, 5th-9th August 2004 Good seasonal conditions	6 vegetation types based on topographic features	258 taxa from 45 families and 108 genera Four weed species: **Acetosa vesicaria, *Bidens bipinnata, *Cenchrus ciliaris, *Malvastrum americanum*	None
Biota Environmental Sciences (2001) Baseline Biological and Soil Surveys and Mapping for ML244SA West of the Fortescue River	Overlaps the DE - the entire ML244SA mining lease was surveyed	28th September - 8th October 2000 Poor seasonal conditions	27 vegetation types	380 taxa from 98 families and 168 genera Fourteen weed species*: *Acetosa vesicaria, *Cenchrus ciliaris, *Cenchrus echinatus* (OB23), **Cenchrus setiger* (Whaleback), **Cynodon dactylon, *Sisymbrium erysimoides, *Malvastrum americanum* (OB30, OB35, OB23, Whaleback), **Solanum nigrum* (Whaleback), **Argemone ochroleuca* (Whaleback), **Bidens bipinnata* (OB30/35, Whaleback), **Conyza bonariensis* (Whaleback), **Hypochaeris glabra* (Whaleback), **Helichrysum luteoalbum, *Sonchus oleraceus* (OB23, Whaleback, OB25)	*Eremophila magnifica*[1], *Lepidium catapycnon* (Threatened)

[1] subspecies not recorded, could be either *Eremophila magnifica* subsp. *magnifica* (Priority 4) or *Eremophila magnifica* subsp. *velutina* (Priority 3)

Report	Proximity to Orebody 32 East AWT Project	Survey Timing & Intensity	Vegetation Associations & Landform	Floristics	Significant Flora
Surveys at OB23, OB24 and OB25					
Onshore Environmental (2013a) Targeted Flora and Vegetation Survey Orebody 24	Adjacent to the DE to the north	5-14th June 2013 Targeted Survey	Not assessed	Not assessed	*Goodenia nuda* (Priority 4)
Onshore Environmental (2012) Targeted Significant Flora Survey and Vegetation Mapping of Homestead Creek	Adjacent to the DE to the south	4th-8th July 2012, 23rd July - 1st August 2012 Targeted survey and vegetation mapping Average seasonal conditions	7 vegetation associations	Two weed species: **Cenchrus ciliaris, *Cenchrus setiger*	*Eremophila magnifica* subsp. *velutina* (Priority 3)
BHP Billiton Iron Ore (2011) OB25 Gatehouse Vegetation and Flora Survey	3km south-west of the DE	5th January 2011	3 vegetation associations	87 taxa and 22 families Seven weed species: **Cenchrus ciliaris, *Cenchrus setiger, *Malvastrum americanum, *Vachellia farnesiana, *Cucumis melo* subsp. *agrestis, *Conyza bonariensis, *Symphyotrichum squamatum*	*Rhagodia* sp. Hamersely (M. Trudgen 17794) (Priority 3)[2]

[2] Likley to be a mis-identification, Onshore Environmental (2011) searched this area and determined there were no *Rhagodia* sp. Hamersley present

Report	Proximity to Orebody 32 East AWT Project	Survey Timing & Intensity	Vegetation Associations & Landform	Floristics	Significant Flora
Onshore Environmental (2011) Targeted Survey for Rhagodia sp. Hamersley (Priority 3) OB25 Gatehouse	3km south-west of the DE	6th March 2011 Targeted survey	Not assessed	Not assessed	None
ENV Australia (2009) Orebody 25 to Newman Flora and Vegetation Assessment	Between Mt Whaleback to OB25 closest point is 1.5km south	14-17th July 2009 Poor seasonal conditions	-	Seven weed species*: *Acetosa vesicaria, *Bidens bipinnata, *Cenchrus ciliaris, *Cynodon dactylon, *Enteropogon ramosus, *Malvastrum americanum, *Setaria verticillata*	*Rostellularia adscendens* var*. ?latifolia* (Could not be identified to variant level, possibly a Priority 3 species)
ENV Australia (2007) RGP4 Orebody 25 Rail Spur Siding Declared Rare and Priority Flora Survey	~2km south	27th November - 1st December 2006 Targeted survey Poor seasonal conditions	-	One weed species: **Cenchrus ciliaris*	None
Ecologia Environment (2005) Orebody 25 Biological Review and Environmental Impact Assessment	Adjacent to the project to the south	September 2005 Desktop Survey	12 vegetation associations	Three weed species; **Acetosa vesicaria, *Cenchrus ciliaris, *Sonchus oleraceus*	*Eremophila magnifica*[3]

[3] The subspecies is not provided in the report and could be either *Eremophila magnifica* subsp. *magnifica* (Priority 4) or *Eremophila magnifica* subsp. *velutina* (Priority 3)

Report	Proximity to Orebody 32 East AWT Project	Survey Timing & Intensity	Vegetation Associations & Landform	Floristics	Significant Flora
Ecologia Environmental (2004) Orebodies 18, 23 and 25 Flora and Fauna Review	Adjacent to the DE and OB18 approx. 25km to the east	May 2004 Desktop survey	11 vegetation associations	Five weed species; **Sonchus oleraceus* (OB18, OB 23, OB 25), **Acetosa vesicaria* (OB 18,OB 23, OB 25), **Bidens bipinnata* (OB18), **Cenchrus ciliaris* (OB23), **Cenchrus echinatus* (OB23)	*Rhodanthe frenchii* (Priority 2, OB18), *Eremophila magnifica* (OB25)
BHP Billiton Iron Ore Environment Department (2000) Orebody 25 Priority Flora Species Survey	Adjacent to the DE to the south	June 2000 Targeted survey Good seasonal conditions	-	One weed species recorded; **Acetosa vesicaria*	*Eremophila magnifica*[4]
Ecologia Environment (1998) Orebody 23 Extension Biological Assessment Survey	~7km east	17-22nd June 1997 Excellent seasonal conditions	7 vegetation types	304 taxa from 47 families and 128 genera Four weed species recorded; **Acetosa vesicaria, *Cenchrus ciliaris, *Cenchrus echinatus, *Sonchus oleraceus*	None
Ecologia Environment (1995) Orebody 25 Biological Assessment Survey	Adjacent to the DE to the south	6th-15th June 1995	4 vegetation types	211 taxa from 41 families and 93 genera	*Eremophila magnifica*[5]

[4] The subspecies is not provided in the report and could be either *Eremophila magnifica* subsp. *magnifica* (Priority 4) or *Eremophila magnifica* subsp. *velutina* (Priority 3)

[5] The subspecies is not provided in the report and could be either *Eremophila magnifica* subsp. *magnifica* (Priority 4) or *Eremophila magnifica* subsp. *velutina* (Priority 3)

Report	Proximity to Orebody 32 East AWT Project	Survey Timing & Intensity	Vegetation Associations & Landform	Floristics	Significant Flora
Surveys at Whaleback, OB29, OB30 and OB35					
Onshore Environmental (2014a) Mt Whaleback OB29/30/25 Targeted Flora Survey Assessment	~5km to the west-south west	16th-23rd February 2014 Targeted survey Excellent seasonal conditions	Not assessed	Not assessed	*Lepidium catapycnon* (Threatened), *Calotis latiuscula* (Priority 3), *Gymnanthera cunninghamii* (Priority 3), *Eremophila magnifica* subsp. *magnifica* (Priority 4), *Goodenia nuda* (Priority 4)
Onshore Environmental & Biologic Environmental Surveys (2009) Flora and Vegetation Survey and Fauna Mt Whaleback Mine Site	~8 km to the south west	22nd -25th June 2009	9 vegetation associations	201 plant taxa from 40 families and 100 genera 15 weed species: **Aerva javanica, *Argemone ochroleuca, *Bidens bipinnata, *Cenchrus ciliaris, *Cenchrus setigera, *Chloris barbata, *Cucumis melo, *Cynodon dactylon, *Echinochloa colona, *Malvastrum americanum, *Setaria verticillata, *Sisymbrium orientale, *Solanum nigrum, *Sonchus oleraceus, *Vachellia farnesiana*	None

Report	Proximity to Orebody 32 East AWT Project	Survey Timing & Intensity	Vegetation Associations & Landform	Floristics	Significant Flora
ENV Australia (2006b) Mt Whaleback Flora and Vegetation Assessment – Phase 3 Summary Report	~8 km to the south west	2-13th August 2006, 20th September 2006 Average seasonal conditions	9 vegetation types	240 taxa Seven weed species: **Aerva javanica, *Acetosa vesicaria, *Bidens bipinnata, *Cenchrus ciliaris, *Malvastrum americanum, *Solanum nigrum, *Librium orientale*	*Lepidium catapycnon* (Threatened)
Additional survey areas within 25km radius of the Development Envelope					
Onshore Environmental (2014b) Western Ridge Flora and Vegetation and Vertebrate Fauna Survey	~11km south west	21st -24th June 12 quadrats Good seasonal conditions	17 vegetation associations	194 plant taxa from 34 families and 89 genera Seven introduced weed species: **Aerva javanica, *Bidens bipinnata, *Cenchrus ciliaris, *Cenchrus setiger, *Malvastrum americanum, *Setaria verticillata, *Vachellia farnesiana*	*Aristida jerichoensis* var. *subspinulifera* (Priority 1), *Calotis latiuscula* (Priority 3)
Onshore Environmental (2013b) Orebody 19 Level 2 Flora and Vegetation Survey	~20km east	19th-27th March 2013, 9th-22nd September 2013 Good seasonal conditions	22 vegetation associations	276 plant taxa from 40 families and 110 genera Species representation was greatest among the Fabaceae (68 taxa), Poaceae (42 taxa) and Malvaceae (33 taxa) families. Three introduced weed species: **Bidens bipinnata, *Cenchrus ciliaris, *Portulaca oleracea*[6]	*Isotropis parviflora* (Priority 2), *Triodia* sp. Mt Ella (M.E. Trudgen 12739) (Priority 3)

[6] No longer considered a weed species for the Pilbara

Report	Proximity to Orebody 32 East AWT Project	Survey Timing & Intensity	Vegetation Associations & Landform	Floristics	Significant Flora
ENV Australia (2009) Homestead Creek Culvert Flora and Vegetation Assessment	~6km east south east of the DE	14th July 2009	3 vegetation associations	80 taxa from 24 families and 53 genera, six weed species: **Cenchrus ciliaris, *Echinochloa colona, *Enteropogon ramosus, *Malvastrum americanum, *Setaria verticillata, *Vachellia farnesiana*	None
Ecologia (2004) Eastern Ophthalmia Range Biological Survey	~10km east of the DE	18th March-7th April 2004 Good seasonal conditions	8 vegetation associations	248 taxa from 41 families and 94 genera. The most speciose families were Poaceae (33 taxa), Mimosaceae (27 taxa) and Malvaceae (22 taxa). Two weed species: **Cenchrus ciliaris, *Bidens bipinnata*	*Isotropis winneckei*[7] (Priority 1)

[7] Unlikley to be this species probably *Isotropis parvifolia* (Priority 2)

4 METHODOLOGY

4.1 Legislation and Guidance Statement

The previous flora and vegetation surveys completed within the Development Envelope and surrounds were carried out in a manner that was compliant with Environmental Protection Authority (EPA) requirements for the environmental surveying and reporting of flora and vegetation in Western Australia:

- Environmental Protection of Native Vegetation in Western Australia: Clearing of Native Vegetation with Particular Reference to Agricultural Areas. Position Statement No. 2 (EPA 2000);
- Terrestrial Biological Surveys as an Element of Environmental Protection. Position Statement No. 3 (EPA 2002); and
- EPA Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia No. 51 (EPA 2004).

The most recent survey of Eastern Ridge (Orebodies 23, 24 and 25) by ENV Australia (2012) was also conducted in accordance with BHP Billiton Iron Ore's Guidance for Flora and Vegetation Surveys in the Pilbara (BHP Billiton Iron Ore 2010).

4.2 Desktop Searches

Desktop searches of three databases were completed for information relating to significant flora (DPaW 2014a, see Appendix 1), TECs and PECs (DPaW 2014b) previously collected or described within, or in close proximity to, the Development Envelope. For this report a database search covering the entire Development Envelope was completed. The search was extended beyond the immediate envelope to place flora values into a local and regional context. The search co-ordinate used was a 50 km radius around the point location 782618 mE 7419843 mN (50K GDA94). The State database search investigated three DPaW databases (DPaW 2014a):

1. The Threatened (Declared Rare) Flora Database;
2. The Threatened (Declared Rare) and Priority Flora List; and
3. The Western Australian Herbarium (WAH) Specimen Database for Priority flora species opportunistically collected in the area of interest.

A search of the EPBC Act Protected Matters database was undertaken [Department of Environment (DoE) 2015, see Appendix 2], as well as a search of the International Union for Conservation of Nature (IUCN) database (IUCN 2015). A comprehensive literature review of surveys previously completed within or in close proximity to the tenement boundary was also undertaken.

4.3 Field Survey Methodology

4.3.1 Timing and Personnel

There are six flora and vegetation surveys that have previously been completed within, or partly within, the Development Envelope between October 2000 and July

2011, with survey effort spread across a variety of seasons (Table 4). The surveys are described further in Section 3.

The most recent Level 2 flora and vegetation survey at Orebody 32 East AWT was completed by ENV Australia (2012) under good to average seasonal conditions and included a review of all previous survey data.

Table 4 Summary of previous flora and vegetation surveys completed within, or partly within, the Development Envelope.

Report	Survey Field Date	Survey Intensity
ENV Australia (2012) Eastern Ridge (OB23/24/25) Flora and Vegetation Report	8-19th April, 29-31st July 2011	51 quadrats
Onshore Environmental (2009) Biological Survey Myopic Exploration Leases	8th-14th June 2009 15-18th June 2009	74 quadrats Targeted searches only within the DE
GHD (2008) Report for Myopic Project Area, Newman Flora and Fauna Assessment	26th May – 4th June 2008	119 quadrats
ENV Australia (2006a) OB24 Flora and Fauna Assessment Phase II	16th March – 10th April 2006 Good seasonal conditions	48 quadrats
Ecologia Environmental (2004) OB24 Expansion Biological Survey	14th-27th May 2004, 5th-9th August 2004	50 quadrats
Biota Environmental Sciences (2001) Baseline Biological and Soil Surveys and Mapping for ML244SA West of the Fortescue River	28th September- 8th October 2000	60 quadrats

4.3.2 Sampling of Study Sites

Field surveys completed within the Development Envelope involved systematic sampling using quadrats. Although a number of different consultancy groups have completed the previous flora and vegetation surveys the methodology implemented is relatively consistent.

Quadrats were generally 50 m by 50 m in dimensions or an equivalent area (2,500 m^2) along narrow associations such as minor drainage lines. This area is standard for the Pilbara bioregion. Quadrats for the Ecologia Environment (2004) survey of Orebody 24 were 100 m by 100 m or equivalent area. The survey of ML244SA by Biota (2001) employed different sampling methods using additional line and belt transects to provide information on cover and the shrub and tree component. In most surveys, relevé vegetation descriptions were made to increase the accuracy of vegetation mapping and where conservation significant flora were recorded. Targeted searches were completed in areas supporting significant plant taxa, or within habitats where it was anticipated significant flora may occur.

The sampling sites were assessed to provide a list of the total flora occurring within the area and a description of the vegetation structure. Data collected covered a range of environmental parameters including:

- Landform and habitat;
- Aspect;
- Soil colour and soil type;
- Rock type;

- Slope (angle);
- Percentage of bare ground, logs, twigs and leaves;
- Vegetation condition;
- Disturbance (caused by fire, clearing, grazing etc.);
- Age since fire;
- Broad floristic formation;
- Vegetation association description; and
- Height and percentage ground cover provided by individual plant taxa.

Other parameters recorded for each study site were:

- Study site number and date of assessment;
- Names of the botanists undertaking the assessment;
- Location (waypoint) – GPS coordinate (GDA94) using a handheld GPS; and
- Photograph number.

4.3.3 Weed Survey and Mapping

The location of introduced weed species within the Development Envelope was identified from previous flora and vegetation surveys. Introduced weed species were recorded from formal quadrats assessed within the Development Envelope and surrounds. Opportunistic collections were also made while moving between study sites and targeted weed searches were completed in high moisture habitats, including drainage lines and floodplains.

4.3.4 Vegetation Association Mapping

Onshore Environmental has previously completed consolidated mapping of BHP Billiton Iron Ore leases including the central, eastern and mainline rail tenements of the Pilbara (Onshore Environmental 2014c). A total of 162 baseline flora and vegetation surveys commissioned by BHP Billiton Iron Ore at its Pilbara based tenements between 2004 and 2013 were reviewed by Onshore Environmental as part of the consolidation of regional vegetation mapping.

The six previous flora and vegetation surveys intersecting the Development Envelope have all included a vegetation mapping component. During the consolidated mapping project, Onshore Environmental rated the integrity of vegetation association mapping datasets overlapping the Development Envelope and selected the most recent dataset (ENV Australia 2012) for incorporation into the consolidated database as ‘fine scale’ mapping. The consolidated mapping dataset (Onshore Environmental 2014c) was utilised for the Orebody 32 East AWT impact assessment.

The vegetation mapping utilised high-resolution aerial photography of the entire study area at a scale of 1:20,000, with definition of vegetation polygons based on contrasting shading patterns. Ground-truthing of the study area was completed during the survey with vegetation descriptions made within selected vegetation polygons to confirm dominant structural layers and associated plant taxa.

Description of vegetation structure follows the height, life form and density classes of Specht (1970) as modified by Alpin (1979) and Trudgen (2009) (see Appendix 3). This is largely a structural classification suitable for broader scale mapping, but taking all ecologically significant strata into account. Vegetation condition for each of the sampling sites was determined using a recognised rating scale (based on Keighery 1994, see Appendix 4).

4.3.5 Field Survey Constraints

The EPA Guidance Statement No. 51 for Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2004) list twelve potential constraints that field surveys may encounter. These constraints are addressed in Table 5.

Table 5 Relevance of constraints, as identified by EPA (2004), to the flora and vegetation survey.

Constraint	Relevance
Scope	The scope of work for baseline flora and vegetation surveys was established by BHP Billiton Iron Ore in compliance with relevant EPA Guidance Statements.
Proportion of flora collected and identified	Given that six flora and vegetation assessments have been conducted within the Development Envelope it is anticipated that a large proportion of the total flora present is likely to have been recorded. The previous surveys have been completed over a range of seasons allowing for the collection of ephemeral plant taxa.
Sources of information	A total of six previous flora and vegetation surveys have been completed within all, or part of, the Development Envelope. Numerous additional surveys (at least 19) have been undertaken in close proximity, providing an extensive local database.
The proportion of the task achieved and further work which might be needed	There has been a high level of survey intensity over an extended period (2000 to 2011) within the Development Envelope. All required tasks relating to compliance with Level 2 flora and vegetation survey have been achieved and there are no recommendations for any further work.
Timing / weather / season / cycle	The previous baseline flora and vegetation surveys have been completed at different times of the year, with four of the six surveys completed under good seasonal conditions.
Disturbances, e.g. fire, flood	Minor disturbances related to fire, mine exploration and grazing by domestic stock were noted within the tenement boundary, but did not impact on survey results.
Intensity	None of the previous baseline surveys have been concentrated specifically on the Development Envelope, but instead incorporating wider project areas. However, the larger project areas have been completed at survey intensity that is expected for the Pilbara bioregion, with vegetation mapping at a scale of 1:20,000.
Completeness	All required tasks associated with a multi-season Level 2 flora and vegetation survey have been completed within the Development Envelope.
Resources	Appropriate resources have been applied to the baseline and targeted surveys and there were no limitations to survey outcomes identified.
Access problems	The entire Development Envelope is accessible on foot walking from established exploration tracks.
Availability of contextual information	A total of 25 flora and vegetation surveys have previously been completed within a 25 km radius of the Development Envelope, with six surveys occurring all or partly within the envelope, providing an extensive local database.
Experience levels	No constraints relating to the experience of personnel were identified from previous surveys of the Development Envelope.

4.3.6 Assessment of Conservation Significance

The conservation significance of flora and ecological communities are classified on a Commonwealth, State and Local level on the basis of various Acts and Agreements (EPA Guidance Statement No. 51, EPA 2004), including:

Commonwealth Level:

- EPBC Act: DoE lists Threatened Flora and Ecological Communities, which are determined by the Threatened Species Scientific Committee according to criteria set out in the Act. The Act lists flora that are considered to be of conservation significance under one of six categories (Appendix 2).

State Level:

- WC Act: At a State level native flora species are protected under the WC Act - Wildlife Conservation (Rare Flora) Notice. A number of plant species are assigned an additional level of conservation significance based on a limited number of known populations and the perceived threats to these locations. Species of the highest conservation significance are gazetted Threatened Flora (T) under subsection 2 of section 23F of the Act. It is an offence to take or damage Threatened flora without Ministerial approval. Section 23F of the Act defines 'to take' as "to gather, pick, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means".
- DPaW Priority list: DPaW produces a list of Priority species and ecological communities (PECs) that have not been assigned statutory protection under the WC Act. Priority Flora are under consideration for declaration as 'Rare Flora', classified as in urgent need of further survey (Priority One to Three), require monitoring every 5-10 years (Priority Four) or require a specific conservation program to prevent the taxon becoming threatened within five years (Priority 5), see Appendix 1. The list of PECs identifies those that need further investigation before nomination for TEC status.

Local Level:

- Species may be considered of local conservation significance because of their patterns of distribution and abundance. Although not formally protected by legislation, such species are acknowledged to be in decline as a result of threatening processes, primarily habitat loss through land clearing.

5 RESULTS

5.1 Desktop Review

5.1.1 Threatened Flora listed under the EPBC Act

A search of the EPBC Act Protected Matters database was undertaken within a 50 km radius of the Development Envelope (DoE 2015). The database search listed two Threatened Flora or their habitat as likely to occur within the search area; *Lepidium catapycnon* (Hamersley Lepidium) and *Pityrodia augustensis* (Mt Augustus Foxglove).

5.1.2 Threatened Flora listed under the IUCN Red List database

There were no Threatened Flora records identified from a search of the International Union for Conservation of Nature (IUCN) database (IUCN 2015).

5.1.3 Threatened Flora listed under the WA Wildlife Conservation (Rare Flora) Notice

The DPaW search identified one Threatened Flora taxon occurring within a 50 km radius of the Development Envelope, *Lepidium catapycnon* (Table 6).

5.1.4 Priority Flora recognised by the DPaW

The DPaW database search (DPaW 2014a) identified 23 Priority flora taxa as potentially occurring within a 50 km search radius of the Development Envelope. Priority flora taxa recorded during the database search are listed in Table 6, along with a general habitat description and the likelihood of habitat occurring within the Development Envelope.

Table 6 Significant flora taxa previously recorded from the Newman area; taken from Federal and State database searches, literature review and local knowledge.

Taxon	Cons. Code	Life Form	Habitat Preference	Suitable Habitat Present	Likelihood in the Development Envelope
Acacia bromilowiana	P4	Perennial	Red skeletal stony loam, laterite, banded ironstone, basalt. Rocky hills, breakaways, scree slopes, gorges, creek beds.	Yes	Possible
Acacia subtiliformis	P3	Perennial	Rocky calcrete plateaus.	No	Unlikely
Amaranthus centralis	P3	Annual	River banks. Sand plains. Mulga woodlands.	No	Unlikely
Aristida jerichoensis var. *subspinulifera*	P1	Perennial	Hard pan plains.	Yes	Possible

Taxon	Cons. Code	Life Form	Habitat Preference	Suitable Habitat Present	Likelihood in the Development Envelope
Brachyscome sp. Wanna Munna Flats (S. van Leeuwen 4662)	P1	Annual	Clayey loams and loamy plains.	No	Unlikely
Brunonia sp. Long Hairs (D.E Symon 2440)	P1	Annual	Floodplains. Rangelands.	Yes	Possible
Calotis latiuscula	P3	Perennial	Sand, loam. Rocky hillsides, floodplains, rocky creeks or river beds.	Yes	Possible
Crotalaria smithiana	P3	Annual	Regeneration site on floodplain	No	Unlikely
Dampiera metallorum	P3	Perennial	Skeletal red-brown gravelly soil over banded ironstone. Steep slopes, summits of hills.	No	Unlikely
Eremophila magnifica subsp*. magnifica*	P4	Perennial	Skeletal soils over ironstone. Rocky Screes.	Yes	Likely
Eremophila magnifica subsp*. velutina*	P3	Perennial	Skeletal soils over ironstone. Summits.	Yes	Likely
Eremophila rigida	P3	Perennial	Hard pan plains.	No	Unlikely
Eremophila sp. West Angelas (S van Leeuwen 4068)	P1	Perennial	High in the landscape. Rocky hill summits.	No	Unlikely
Euphorbia inappendiculata var. *inappendiculata*	P2	Annual	Broken rocky scree slopes.	Yes	Possible
Goodenia sp. East Pilbara (A.A. Mitchell PRP 727)	P3	Biennial	Low undulating plain, swampy plains.	No	Unlikely
Goodenia nuda	P4	Annual	Plains and floodplains.	Yes	Likely
Gymnanthera cunninghamii	P3	Perennial	Sandy soils.	No	Unlikely
Indigofera sp. Gilesii (M.E. Trudgen 15869)	P3	Perennial	Pebbly loam amongst boulders and outcrops. Hills	Yes	Possible
Isotropis parviflora	P2	Annual	Rocky hills	Yes	Likely
Lepidium catapycnon	T	Perennial	Skeletal soils. Hillsides	Yes	Possible
Oxalis sp. Pilbara (M. E Trudgen 12725)	P2	Annual	Gullies. Base of cliffs. Shady areas associated with high ironstone cliffs	Yes	Possible
Rhagodia sp. Hamersley (M. Trudgen 17794)	P3	Perennial	Clay plains. Mulga woodlands	No	Unlikely

Taxon	Cons. Code	Life Form	Habitat Preference	Suitable Habitat Present	Likelihood in the Development Envelope
Rostellularia adscendens var. *latifolia* (R.Br.) R.M.Barker	P3	Annual	Ironstone soils. Near creeks, rocky hills	Yes	Possible
Themeda sp. Hamersley Station (M.E. Trudgen 11431)	P3	Perennial	Clay pan, grass plain	No	Unlikely

1 Number of records from the Western Australian Herbarium (WAH 2014)
2 Closest records from DPaW flora database search results (DPaW 2014)
3 Likely - suitable habitat, close (<10 km) records and/or field survey completed in sub-optimal season, suggest species is likely to occur;
Possible - sub-optimal habitat, close (<10 km) records and/or field survey completed in sub-optimal season, suggests species possibly occurs; and
Unlikely - lack of suitable habitat, no records (<50 km) and/or field survey completed in optimal season, suggest species is unlikely to occur.

5.1.5 TECs listed under State and Federal Legislation

A search of the DPaW communities database (DPaW 2014b) confirmed there was one TEC record within a 50 km radius of the study area; the Ethel Gorge Aquifer Stygobiont Community TEC (Figure 4). It is listed as Endangered under the EPBC Act Protected Matters Database (DoE 2014). The TEC is a subterranean community and has no relationship with flora and vegetation and will not be discussed further.

5.1.6 PECs recognised by DPaW

A search of the State communities database (DPaW 2014c) confirmed that one PEC was located approximately 40 km north of the study area (Figure 4). The Priority 3iii PEC ‘Vegetation of sand dunes of the Hamersley Range/Fortescue Valley’ (previously 'Fortescue Valley Sand Dunes') is described as red linear sand dune communities that lie on the Divide Land system at the junction of the Hamersley Range and Fortescue Valley. A small number are vegetated with *Acacia dictyophleba* scattered tall shrubs over *Crotalaria cunninghamii*, *Trichodesma zeylanicum* var. *grandiflorum* open shrubland. They are regionally rare, small and fragile and highly susceptible to threatening processes such as weed invasion, especially buffel grass, and erosion (DPaW 2014c).

While sandplains have been recorded in the western sector of the Development Envelope, it is unlikely that this landform includes dunes supporting the PEC.

660000 670000 680000 690000 700000 710000 720000 730000 740000 750000 760000 770000 780000 790000 800000 810000 820000 830000 840000

7490000 7480000 7470000 7460000 7450000 7440000 7430000 7420000 7410000 7400000 7390000 7380000

Marillana Creek
Yandicoogina Creek
Weeli Wolli Creek
Pebble Mouse Creek
GREAT NORTHERN HIGHWAY
MUNJINA ROY HILL ROAD
Fortescue River
Goondlnar Creek
MARBLE BAR ROAD
Fortescue River
Jimblebar Creek
Caramulla Creek
Development Envelope
NEWMAN
Fortescue River
Jimblebar Creek
Spearhole Creek
Angelo River
Angelo River
Kirenla Creek
GREAT NORTHERN HIGHWAY
Warrawanda Creek
Coobina Creek
Tunnel Creek

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

660000 670000 680000 690000 700000 710000 720000 730000 740000 750000 760000 770000 780000 790000 800000 810000 820000 830000 840000

ONSHORE ENVIRONMENTAL

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Orebody 32 East AWT
Location of TECs and PECs within a 50 km radius of the Development Envelope

Figure 4

Legend

OB 32 - Development Envelope

PEC Locations

Ethel Gorge aquifer stygobiont community

Fortescue Valley Sand Dunes

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Eaton WA 6232
admin@griffinspatial.com.au
+61 8 9725 3213

5.2 Conservation Significant Flora

5.2.1 Threatened Flora listed under the WC Act and EPBC Act

No plant taxon gazetted as Threatened Flora (T) pursuant to subsection (2) of Section 23F of the WC Act or listed under the EPBC Act was recorded from within the Development Envelope.

5.2.2 Priority Flora

Six previous baseline flora and vegetation surveys intersecting all or part of the Development Envelope did not record any Priority flora taxa from within the Development Envelope. However, five Priority flora taxa have previously been recorded from a 2 km radius around the Development Envelope; *Aristida jerichoensis* var*. subspinulifera* (Priority 1), *Brunonia* sp. Long Hairs (D.E Symon 2440) (Priority 1), *Isotropis parviflora* (Priority 2), *Eremophila magnifica* subsp*. velutina* (Priority 3) and *Goodenia nuda* (Priority 4) (Figure 5). While suitable habitat for Priority flora does exist within the Development Envelope (Table 6), any occurrences should have been recorded during the previous survey work completed.

5.2.3 Flora of Interest

Previous baseline surveys incorporating the Development Envelope have identified seven plant taxa that represent range extensions. Six of the seven taxa were recorded from outside the Development Envelope; *Abutilon cryptopetalum, Dysphania saxatilis, Schoenoplectus subulatus, Ventilago viminalis,* **Symphyotrichum squamatum* and *Lactuca serriola.* At February 2015 only **Symphyotrichum squamatum* and *Lactuca serriola* (less than 50 km to the east of existing populations) and *Dysphania saxatilis* (less than 100 km to the north and east of existing populations) are considered to be minor range extensions.

The range extension from within the Development Envelope is *Diplatia grandibractea,* a mistletoe growing as an aerial hemiparasitic shrub on *Eucalyptus* trees. It was recorded from a single location within the Development Envelope (Figure 5) where it provided less than one percent cover. It represents a minor range extension of less than 50 km to the south-east of the existing known population range.

780000 781000 782000 783000 784000 785000

7421000 7420000 7419000 7418000

Legend

- OB 32 - Development Envelope
- Indicative Pit Area

Significant Flora

- *Aristida jerichoensis* var. *subspinulifera*(A.j)
- *Brunonia* sp. Long hairs (D.E. Symon 2440) (B.l)
- *Eremophila magnifica* var. *velutina* (E.m)
- *Goodenia nuda* (G.n)
- *Isotropis parviflora* (I.p)

Range Extension

- *Diplatia grandibractea* (D.g)

G.n
G.n
I.p
D.g
30m Buffer
50m Buffer
B.l
Homestead Creek
A.j
E.m
E.m
E.m
E.m
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OREBODY 32 EAST AWT SIGNIFICANT FLORA SURROUNDING PROJECT AREA

FIGURE 5

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Eaton WA 6232
admin@griffinspatial.com.au
+61 8 9725 3213

5.3 Introduced Flora

A total of six introduced weed species have been recorded within the Development Envelope during previous baseline surveys: **Bidens bipinnata* (Beggar's Ticks), **Cenchrus ciliaris* (Buffel Grass), **Cenchrus setaceus* (Fountain Grass), **Flaveria trinervia* (Speedy Weed) **Malvastrum americanum* (Spiked Malvastrum) and **Setaria verticillata* (Whorled Pigeon Grass) (Table 7, Figure 6, Appendix 5). None of these taxa are listed as a Declared Pest under the BAM Act.

It is noted that records for **Cenchrus setaceus* (Fountain Grass) within the Development Envelope by GHD (2008) is likely to a misidentification for **Cenchrus ciliaris* (Buffel Grass). **Cenchrus setaceus* occurs predominantly within the south-west sector of the Western Australia, with a single record from the coast near Port Hedland. The original identification has been maintained for the purpose of the impact assessment report.

Table 7 Introduced weed species recorded from the Development Envelope.

Taxon (Common Name)	Photograph	Description	Occurrence within Development Envelope	Survey(s)
**Bidens bipinnata* (Beggar's Ticks)		Erect annual herb with deeply lobed bipinnate leaves, flowering heads in terminal panicles, and black fruits with barbed awns at one end. Is widespread north of Kalbarri.	Occurs as scattered plants from ten locations within the Development Envelope (Figure 6). Ground cover was generally less than two percent cover.	ENV Australia (2012), GHD (2008)
**Cenchrus ciliaris* (Buffel Grass)		Tufted perennial grass originating from the Middle East as a fodder species by pastoralists. It grows in dense tussocks up to 1 m tall and typically occurs in monospecific stands on loamy plains and creekline levee banks. It is an aggressive colonising species that has become well established throughout the Pilbara, Gascoyne and Murchison regions of Western Australia, and is continuing to spread in the south west (Hussey *et al.* 1997).	Recorded extensively within the Development Envelope mainly from footslopes in the south-east sector (Figure 6). Generally occurring as scattered plants at each location.	ENV Australia (2012, 2006a)

Taxon (Common Name)	Photograph	Description	Occurrence within Development Envelope	Survey(s)
**Cenchrus setaceus* (Fountain Grass)		Perennial tussock grass that has been recorded across Australia and is a declared plant in South Australia.	Recorded from two locations within the Development Envelope as scattered plants (less than two percent cover).	GHD (2008)
**Flaveria trinervia* (Speedy Weed)		An erect glabrous annual herb to 0.8 m in height, producing yellow flowers; older stems are terete and often a distinctive red or purple colour. It occurs on clay or loam soils most often near watercourses and is distributed from Kununurra and Isdell River southwards throughout the Pilbara and along the coast to Carnarvon. It also occurs in the Northern Territory, Queensland, South Australia and New South Wales (Hussey *et al.* 1997).	Recorded from one location in the north-east sector of the Development Envelope.	ENV Australia (2012)

Taxon (Common Name)	Photograph	Description	Occurrence within Development Envelope	Survey(s)
**Malvastrum americanum* (Spiked Malvastrum)		Erect perennial herb or shrub, ranging from 0.5 m to 1.3 m in height. It grows in a variety of soil types on stony ridges and hill sides, flood plains and along drainage lines.	Recorded as scattered plants (less than two percent cover) from three locations within the Development Envelope.	ENV Australia (2012)

Taxon (Common Name)	Photograph	Description	Occurrence within Development Envelope	Survey(s)
**Setaria verticillata* (Whorled Pigeon Grass)		A loosely tufted annual grass-like herb, growing between 0.1 metres and 1.3 metres in height and flowering from December to June. It grows in a variety of soils including sand, clay and loam and has spread over much of Western Australia.	Recorded from two locations within the eastern sector of the Development Envelope, occurring as scattered plants (less than two percent cover).	ENV Australia (2012)

780000 781000 782000 783000 784000 785000

7421000 7420000 7419000 7418000

30m Buffer

50m Buffer

Homestead Creek

C.c B.p C.s M.a S.v F.t

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OREBODY 32 EAST AWT LOCATION OF INTRODUCED FLORA

FIGURE 6

ONSHORE ENVIRONMENTAL

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Legend

- OB 32 - Development Envelope
- Indicative Pit Area

Introduced Flora

- *Bidens bipinnata* (B.p)
- *Cenchrus ciliaris* (C.c)
- *Cenchrus setaceus* (C.s)
- *Flaveria trinervia* (F.t)
- *Malvastrum americanum* (M.a)
- *Setaria verticillata* (S.v)

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5.4 Threatened Ecological Communities

No TECs were recorded from within the Development Envelope. The nearest known TEC is the Endangered 'Ethel Gorge aquifer stygobiont community'. This TEC is a subterranean community and therefore has no relationship to flora and vegetation.

5.5 Priority Ecological Communities

None of the vegetation associations mapped from the Development Envelope were found to have affiliations with any PECs documented within the Pilbara.

5.6 Vegetation

Vegetation mapping for the Development Envelope was collated and standardised by Onshore Environmental as part of the consolidated mapping of BHP Billiton Iron Ore's Pilbara tenements. The vegetation polygon detail was sourced from the '*Eastern Ridge (OB23/24/25) Flora and Vegetation Assessment*' (ENV Australia 2012). The consolidated mapping defined seven vegetation associations from three broad floristic formations occurring within the Development Envelope (Table 8, Figure 7).

Table 8 Vegetation associations occurring within the Development Envelope (as per the consolidated mapping, Onshore Environmental 2014c).

Vegetation Map Code	BFF	Vegetation Association
MI AmoAanPl ChEl TtAin	*Acacia* Shrubland	Shrubland of *Acacia monticola, Acacia ancistrocarpa* and *Petalostylis labicheoides* with Scattered Low Trees of *Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* over Open Tussock Grassland of *Themeda triandra* and *Aristida inaequiglumis* on red loamy sand on minor drainage lines
HC TpTs El AaAkAsi	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia pungens* and *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835) with Scattered Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* over Scattered Tall Shrubs of *Acacia aptaneura, Acacia kempeana* and *Acacia sibirica* on red brown loam on hill crests, hill slopes and breakaway slopes
HC TwTbrTp ElCh AmaGwAb	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia wiseana, Triodia brizoides* and *Triodia pungens* with Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* over High Open Shrubland of *Acacia maitlandii, Grevillea wickhamii* subsp. *hispidula* and *Acacia bivenosa* on red brown sandy loam on hill crests and upper hill slopes
HS TsTwTp ElCh AhiAad	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835), *Triodia wiseana* and *Triodia pungens* with Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* over Low Open Shrubland of *Acacia hilliana* and *Acacia adoxa* var. *adoxa* on red brown sandy loam on hill slopes

Vegetation Map Code	BFF	Vegetation Association
HS Tw ElChHc AanAbAa	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia wiseana* with Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia, Corymbia hamersleyana* and *Hakea chordophylla* and Open Shrubland of *Acacia ancistrocarpa, Acacia bivenosa* and *Acacia aptaneura* on red sandy loam on hill slopes
SA Tb ChEg SpBeKp	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia basedowii* with Low Open Woodland of *Corymbia hamersleyana* and *Eucalyptus gamophylla* over Low Open Shrubland of *Scaevola parvifolia, Bonamia erecta* and *Kennedia prorepens* on red loamy sand on sand plains
ME TtEaEte ApyAtpPl EVCh	*Themeda* Tussock Grassland	Tussock Grassland of *Themeda triandra, Eulalia aurea* and *Eriachne tenuiculmis* with High Shrubland of *Acacia pyrifolia* var. *pyrifolia, Acacia tumida* var. *pilbarensis* and *Petalostylis labicheoides* and Open Woodland of *Eucalyptus victrix* and *Corymbia hamersleyana* on red brown silty loam on medium drainage lines and flood plains

781000 782000 783000 784000 785000 786000

7421000 7420000 7419000 7418000

30m Buffer

50m Buffer

Homestead Creek

Legend

OB 32 - Development Envelope

Indicative Pit Area

Vegetation Types

***Acacia* Shrubland**

MI AmoAanPl ChEl TtAin — Shrubland of *Acacia monticola*, *Acacia ancistrocarpa* and *Petalostylis labicheoides* with Scattered Low Trees of *Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* over Open Tussock Grassland of *Themeda triandra* and *Aristida inaequilatera* on red loamy sand on minor drainage lines

***Themeda* Tussock Grassland**

ME TtEaEte ApyAtpPl EvCh — Tussock Grassland of *Themeda triandra, Eulalia aurea* and *Eriachne tenuiculmis* with High Shrubland of *Acacia pyrifolia* var. *pyrifolia, Acacia tumida* var. *pilbarensis* and *Petalostylis labicheoides* and Open Woodland of *Eucalyptus victrix* and *Corymbia hamersleyana* on red brown silty loam on medium drainage lines and flood plains

***Triodia* Hummock Grassland**

HC TpTs El AaAkAsi — Hummock Grassland of *Triodia pungens* and *Triodia* sp. Shovelanna Hill with Scattered Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* over Scattered Tall Shrubs of *Acacia aptaneura, Acacia kempeana* and *Acacia sibirica* on red brown loam on hill crests, hill slopes and breakaway slopes

HC TwTbrTp ElCh AmaGwAb — Hummock Grassland of Triodia wiseana, Triodia brizoides and Triodia pungens with Low Open Woodland of Eucalyptus leucophloia subsp. leucophloia and Corymbia hamersleyana over High Open Shrubland of Acacia maitlandii, Grevillea wickhamii subsp. hispidula and Acacia bivenosa on red brown sandy loam on hill crests and upper hill slopes

HS TsTwTp ElCh AhiAad — Hummock Grassland of *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835), *Triodia wiseana* and *Triodia pungens* with Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* over Low Open Shrubland of *Acacia hilliana* and *Acacia adoxa* var. *adoxa* on red brown sandy loam on hill slopes

HS Tw ElChHc AanAbAa — Hummock Grassland of *Triodia wiseana* with Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia, Corymbia hamersleyana* and *Hakea chordophylla* and Open Shrubland of *Acacia ancistrocarpa, Acacia bivenosa* and *Acacia aptaneura* on red sandy loam on hill slopes

SA Tb ChEg SpBeKp — Hummock Grassland of *Triodia basedowii* with Low Open Woodland of *Corymbia hamersleyana* and *Eucalyptus gamophylla* over Low Open Shrubland of *Scaevola parvifolia, Bonamia erecta* and *Kennedia prorepens* on red loamy sand on sand plains

781000 782000 783000 784000 785000 786000

7418000

ONSHORE ENVIRONMENTAL

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OREBODY 32 EAST AWT VEGETATION ASSOCIATION MAP

FIGURE 7

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Eaton WA 6232

admin@griffinspatial.com.au

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5.7 Vegetation Condition

Vegetation condition within the Development Envelope ranged from excellent to very good (Figure 8). Four vegetation associations associated with hill crests and hill slopes were rated in excellent condition. The minor drainage lines within the Development Envelope were rated in excellent to very good condition, while sand plains and medium drainage lines were rated as very good condition. The drainage lines and sand plain associations are positioned lower in the landscape and subject to higher levels of grazing by domestic stock, with associated issues such as surface erosion and the introduction of weeds reducing vegetation condition.

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7419000

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30m Buffer

50m Buffer

Homestead Creek

BHPBIO

OREBODY 32 EAST AWT VEGETATION CONDITION

FIGURE 8

ONSHORE ENVIRONMENTAL

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Datum: GDA94
Projection: MGA Zone 50

Legend

- OB 32 - Development Envelope
- Indicative Pit Area

Vegetation Condition

- Very Good
- Excellent to Very Good
- Excellent

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5.8 Significance of Vegetation

A list of ecosystems considered to be 'at risk' within each IBRA subregion was identified during the biodiversity audit of Western Australia's biogeographical subregions (McKenzie *et al.* 2003). According to the audit, the Development Envelope occurs within the Pilbara 3 - Hamersley Subregion. Kendrick (2001) lists the following communities within the Hamersley Subregion as being 'Ecosystems at risk':

- Grove-intergrade Mulga communities, eastern Hamersley Range;
- Valley floor mulga;
- Lower slopes mulga;
- Marillana Station dunefields, adjacent to the Hancock Ranges (dunes support some desert fauna elements such as *Ningui ridei* and *Ctenotus quattuordecimlineatus*);
- Coolibah Swamp, Mount Bruce, Karijini National Park;
- Munjina Claypan and associated mulga community;
- Hilltop floras, Hamersley Range;
- All major ephemeral water courses;
- Wetland community, Weeli Wolli Spring;
- Wetland community, Palm Spring, Duck Creek;
- Stygofauna communities, OB23;
- Other stygofauna associated with aquifers near mining below water table;
- Lake Robinson-Coondewanna Flats;
- West Angelas Cracking-Clays; and
- Coolibah-Lignum Flats.

None of the above ecosystems are analogous to vegetation associations occurring within the Development Envelope.

Beard (1975) vegetation associations within each subregion were ranked as Low, Medium or High priority for reservation in the conservation estate (Kendrick 2001). The two Beard associations represented within the Development Envelope Hamersley 18 and Hamersley 82 (Figure 2) were rated as being of medium and low reservation priority respectively (Kendrick 2001).

6 EVALUATION OF THE POTENTIAL IMPACTS

The following potential flora and vegetation impacts have been identified within the Development Envelope:

- Direct removal of vegetation during clearing and earthworks;
- Alteration to the volume of surface water flows;
- Altering the frequency or intensity of wildfire;
- Increased diversity and cover of introduced (weed) species; and
- Increased levels of airborne dust reducing leaf transpiration and causing vegetation decline.

These potential impacts are addressed below.

6.1 Direct Clearing

6.1.1 Vegetation

The Development Envelope is located within the Hamersley Botanical District within the Pilbara IBRA region, which is part of the Eremaean Province (Beard 1990). Broad scale vegetation mapping undertaken by Beard (1975) and refined by Shepherd *et al.* (2002) show two vegetation complexes occurring within the Development Envelope; Hamersley 82 and Hamersley 18 (Figure 2). The Pre-European extent remaining for each these vegetation complexes is estimated at close to 100 percent, or 2,290,910 ha (100 percent) and 24,659,110 ha (99.9 percent) respectively (Table 1). At a regional scale the area of each vegetation complex within the Development Envelope is 380.60 ha and 81.53 ha, representing 0.01 percent and 0.0003 percent of the total extent respectively. The regional impact from direct clearing within the Development Envelope will be insignificant.

Based on fine-scale consolidated vegetation mapping of BHP Billiton Iron Ore's Pilbara tenements (Onshore Environmental 2014c) seven vegetation associations occur within the Development Envelope (Table 9). Clearing of vegetation within the Development Envelope will represent disturbance to less than one percent of the total representation within the consolidated mapping database for four of the seven associations, and 1.7 percent, 1.8 percent and 10.3 percent for the remaing three vegetation associations (Table 9). The proportion of each vegetation association cleared within the Indicative Pit Area is less in comparison to the Development Envelope (Table 9).

It is determined that direct clearing within the Development Envelope will not have any significant impact on the representation of the seven vegetation associations.

Table 9 Representation of seven vegetation associations occurring within the Development Envelope, and Indicative Pit Area (from Onshore Environmental 2014c). NOTE: Percentage values in brackets represent proportion of the vegetation association within the consolidated mappimg database.

Vegetation Map Code	BFF	Vegetation Association	Area (ha)		
			Consolidated Mapping Database	Development Envelope	Indicative Pit Area
MI AmoAanPl ChEl TtAin	*Acacia* Shrubland	Shrubland of *Acacia monticola, Acacia ancistrocarpa* and *Petalostylis labicheoides* with Scattered Low Trees of *Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* over Open Tussock Grassland of *Themeda triandra* and *Aristida inaequiglumis* on red loamy sand on minor drainage lines	609.40	11.01 (1.81%)	6.41 (1.05%)
HC TpTs El AaAkAsi	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia pungens* and *Triodia* sp. Shovelanna Hill with Scattered Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* over Scattered Tall Shrubs of *Acacia aptaneura, Acacia kempeana* and *Acacia sibirica* on red brown loam on hill crests, hill slopes and breakaway slopes	952.34	98.30 (10.32%)	41.98 (4.41%)
HC TwTbrTp ElCh AmaGwAb	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia wiseana, Triodia brizoides* and *Triodia pungens* with Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* over High Open Shrubland of *Acacia maitlandii, Grevillea wickhamii* subsp. *hispidula* and *Acacia bivenosa* on red brown sandy loam on hill crests and upper hill slopes	9,186.80	157.10 (1.71%)	38.82 (0.42%)
HS TsTwTp ElCh AhiAad	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835), *Triodia wiseana* and *Triodia pungens* with Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* over Low Open Shrubland of *Acacia hilliana* and *Acacia adoxa* var. *adoxa* on red brown sandy loam on hill slopes	42,184.16	108.40 (0.26%)	73.39 (0.17%)
HS Tw ElChHc AanAbAa	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia wiseana* with Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia, Corymbia hamersleyana* and *Hakea chordophylla* and Open Shrubland of *Acacia ancistrocarpa, Acacia bivenosa* and *Acacia aptaneura* on red sandy loam on hill slopes	3,631.58	0.09 (0.002%)	0.09 (0.002%)

Vegetation Map Code	BFF	Vegetation Association	Area (ha)		
			Consolidated Mapping Database	Development Envelope	Indicative Pit Area
SA Tb ChEg SpBeKp	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia basedowii* with Low Open Woodland of *Corymbia hamersleyana* and *Eucalyptus gamophylla* over Low Open Shrubland of *Scaevola parvifolia, Bonamia erecta* and *Kennedia prorepens* on red loamy sand on sand plains	5,954.30	55.25 (0.93%)	53.28 (0.89%)
ME TtEaEte ApyAtpPl EVCh	*Themeda* Tussock Grassland	Tussock Grassland of *Themeda triandra, Eulalia aurea* and *Eriachne tenuiculmis* with High Shrubland of *Acacia pyrifolia* var. *pyrifolia, Acacia tumida* var. *pilbarensis* and *Petalostylis labicheoides* and Open Woodland of *Eucalyptus victrix* and *Corymbia hamersleyana* on red brown silty loam on medium drainage lines and flood plains	1,032.77	8.13 (0.79%)	4.30 (0.42%)

Vegetation condition within the Development Envelope was predominantly rated as excellent (350.96 ha or 84.9 percent), with smaller areas rated as excellent to very good (11.0 ha or 2.7 percent) or very good (51.64 ha or 12.5 percent) (Table 10). Vegetation is predominantly associated with uplands supporting non-palatable plant taxa that are subject to low grazing pressure by domestic stock in the area. This is the major factor contributing to the high proportion of better condition vegetation relative to the wider region.

For the Indicative Pit Area vegetation condition was predominantly rated as excellent (154.3 ha or 76.6 percent), with a smaller proportion rated as excellent to very good (6.4 ha or 3.2 percent) or very good (40.76 ha or 20.2 percent) (Table 10).

Table 10 Representation of vegetation condition categories within the Development Envelope and Indicative Pit Area.

Vegetation Condition	Area within Development Envelope (ha)	Area within Indicative Pit Area (ha)
Pristine	0	0
Excellent	350.96 (84.9%)	154.28 (76.6%)
Excellent –Very Good	11.00 (2.7%)	6.41 (3.2%)
Very Good	51.64 (12.5%)	40.76 (20.2%)
Good	0	0
Degraded	0	0
Completely Degraded	0	0
Total	413.57	201.46

6.1.2 Flora

There was no Threatened Flora or Priority flora recorded from within the Development Envelope. One plant taxa occurring from a single point location within the Development Envelope was determined to represent a minor range extension of less than 50 km; *Diplatia grandibractea*.

Diplatia grandibractea has a current distribution extending for approximately 250 km between Newman and Pannawonica in the Pilbara bioregion, and is also scattered throughout the Kimberley bioregion. Due to the wide distribution of this sepcies it is determined that direct clearing of one plant within the Development Envelope will not have any impact on this species.

6.2 Alteration to Surface Water Flows

Surface water drainage occurs in a general westerly direction across the Development Envelope and into Homestead Creek, an ephemeral drainage line fringing the western boundary. The majority of the Development Envelope consists of undulating hills supporting four of seven vegetation associations that will remain unaffected by any alteration to surface water flows. Similarly the sandplain vegetation association occurring in the western sector of the Development Envelope and fringing Homestead Creek supports vegetation that is unlikely to be impacted by changes to surface water flows.

Two vegetation associations occurring on hill crests, hill slopes and breakaway slopes support *Acacia aptaneura* (Mulga) as a part of the shrub component. While

Mulga vegetation occurring on floodplains in the Pilbara can be at risk from alteration to surface water flows, the two vegetation associations supporting Mulga in the Development Envelope are not determined to be at risk due their elevated position in the landscape.

Two vegetation associations occur along minor and medium drainage lines that capture and redirect surface water flows across the Development Envelope and into Homestead Creek. Any change to surface water flows along the minor drainage lines is unlikely to impact on vegetation, given that they are primarily xerophytic species that are adapted to the prevailing low rainfall and extended dry periods. The medium drainage lines support larger trees of *Eucalyptus victrix* (Coolibah) forming Open Woodland with *Corymbia hamersleyana.* Given the low density of trees within medium drainage lines it is expected that vegetation should be resilient to any alteration to surface water flows. *Eucalyptus victrix* is also recognised as a facultative phreatophyte with the ability to utilise water sourced directly from the watertable during extended dry periods.

It is determined that alteration to surface water flows is unlikely to have any significant impact on vegetation health within the Development Envelope.

6.3 Fire

Fire age within the Development Envelope at July 2011 was rated as moderate (3-5 years) to old (≥6 years) (ENV Australia 2012). Fire is a common disturbance that occurs throughout the Pilbara, and the seven vegetation associations represented within the Development Envelope are not fire-sensitive.

Fire within the Development Envelope is determined to manageable and is unlikely to pose any significant risk to vegetation.

6.4 Introduced (Weed) Species

There are six introduced (weed) species that have been recorded as scattered plants providing less than two percent ground cover within the Development Envelope; **Bidens bipinnata*, **Cenchrus ciliaris, *Cenchrus setaceus, *Flaveria trinervia, *Malvastrum americanum* and **Setaria verticillata*. None of these taxa are listed as Declared Pests under the BAM Act.

Clearing of native vegetation and increased vehicular access has the potential to introduce and/or spread weed species within the Development Envelope. An increased weed loading would compete with native vegetation and potentially reduce species diversity and even alter vegetation structure in the longer term. Existing management strategies used at surrounding BHP Billiton Iron Ore operations are important tools for reducing weed risks.

General and species-specific weed management, hygiene and monitoring would be undertaken in accordance with BHP Billiton Iron Ore's existing weed management procedures. Management measures that would be undertaken to minimise the potential for the spread of weed species would include the following:

- Mobile machinery and equipment would be brought to site in a clean state;

- Regular inspections for the presence of weeds within areas of disturbance would be conducted (particularly in high moisture environments such as drainage lines, floodplains and valleys); and
- Seasonal weed control programmes would be implemented as necessary.

6.5 Dust

Vegetation can be impacted by increased levels of airborne dust in instances where leaf transpiration is impeded. This could occur along unsealed roads and tracks supporting large volumes of traffic, and is pronounced during dry seasonal conditions. Dust control measures such as road watering, use of sprays on the main ore transfer points, and progressive rehabilitation of disturbed areas would be used to minimise dust generation from the site.

Given the absence of significant flora within the Development Envelope, the potential impact of increased levels of airbourne dust is not considered to be a significant risk.

7 SUMMARY

Key findings from the Orebody 32 East AWT flora and vegetation impact assessment are listed below:

- No plant taxon gazetted as Threatened Flora (T) pursuant to subsection (2) of Section 23F of the WC Act or listed under the EPBC Act was recorded from within the Development Envelope;
- No Priority flora taxa were recorded from within the Development Envelope;
- One plant taxon from within the Development Envelope *(Diplatia grandibractea)* represents a minor range extension of less than 50 km south-east of the existing known population range;
- Six introduced weed species occur within the Development Envelope; **Bidens bipinnata* (Beggar's Ticks), **Cenchrus ciliaris* (Buffel Grass), **Cenchrus setaceus* (Fountain Grass), **Flaveria trinervia* (Speedy Weed) **Malvastrum americanum* (Spiked Malvastrum) and **Setaria verticillata* (Whorled Pigeon Grass). None of the weed taxa are listed as a Declared Pest under the BAM Act;
- Based on fine-scale consolidated vegetation mapping of BHP Billiton Iron Ore's Pilbara tenements (Onshore Environmental 2014c) seven vegetation associations from three broad floristic formations occur within the Development Envelope;
- The vegetation associations are not affiliated with either Federal and State listed TECs, or State listed PECs for the Pilbara;
- Vegetation condition within the Development Envelope ranged from excellent to very good;
- Vegetation within the Development Envelope has previously been rated as medium to low reservation priority by Kendrick (2001), and is not affiliated to any of the 'Ecosystems at risk' identified during the biodiversity audit of Western Australia's biogeographical subregions (McKenzie *et al.* 2003);
- Clearing of vegetation within the Development Envelope will represent disturbance to less than one percent of the total representation within the consolidated mapping database for four of the seven associations, and 1.7 percent, 1.8 percent and 10.3 percent for the remaing three vegetation associations;
- It is determined that direct clearing within the Development Envelope will not have any significant impact on the regional representation of the seven vegetation associations, nor will there be any impact on conservation significant flora or flora species of interest;
- The majority of the Development Envelope consists of undulating hills that will remain unaffected by any alteration to surface water flows;
- While Mulga vegetation occurring on floodplains in the Pilbara can be at risk from alteration to surface water flows, the two vegetation associations supporting Mulga within the Development Envelope are not determined to be at risk due their elevated position in the landscape;
- Fire is a common disturbance that occurs throughout the Pilbara, and the seven vegetation associations represented within the Development Envelope are not fire-sensitive. Fire within the Development Envelope is determined to manageable and is unlikely to pose any significant risk to vegetation;
- Clearing of native vegetation and increased vehicular access has the potential to introduce and/or spread weed species within the Development

Envelope. The implementation of existing management strategies used at surrounding BHP Billiton Iron Ore operations will be implemented to minimise the potential for introduction and spread of weed species within the Development Envelope; and

- Given the absence of significant flora within the Development Envelope, the potential impact of increased levels of airbourne dust is not considered to be a significant risk.

8 STUDY TEAM

The Orebody 32 East AWT flora and vegetation impact assessment was planned, co-ordinated and executed by the following personnel:

Onshore Environmental Consultants P/L
ABN 41 095 837 120
PO Box 227
YALLINGUP WA 6282
pf 08 9756 6206 m0427 339 842
Email onshoreenv@westnet.com.au

Project Staff

Dr Darren Brearley	PhD	Project Manager
Ms Jessica Waters	Bsc	Botanist
Mr Todd Griffin		GIS Specialist

9 REFERENCES

Aplin T.E.H. (1979). The Flora. Chapter 3 in O'Brien, B.J. (ed.) (1979). Environment and Science. University of Western Australia Press.

Australian Soil Resource Information System (ASRIS) (2014) Available at http://www.asris.csiro.au/mapping

Beard J. S. (1990) *Plant Life of Western Australia*. Kangaroo Press, Perth.

Beard, J. S. (1975). Pilbara. Explanatory Notes and Map Sheet 5, 1:1 000 000 series Vegetation Survey of Western Australia. University of Western Australia Press: Nedlands.

BHP Billiton Iron Ore (2010) *Guidance for Vegetation and Flora Surveys in the Pilbara Region*. Unpublished guidance statement prepared by BHP Billiton Iron Ore.

BHP Billiton Iron Ore (2011) *OB25 Gatehouse Vegetation and Flora Survey.* Report prepared for BHP Billiton Iron Ore.

BHP Iron Ore Environment Department (2000*) Orebody 25 Priority Flora Species Survey*. Report prepared for BHP Billiton Iron Ore.

Biota Environmental Sciences (2001) *Baseline Biological and Soil Surveys and Mapping for ML244SA West of the Fortescue River.* Report prepared for BHP Billiton Iron Ore.

Bureau of Meteorology (2015), Climate Statistics for Australian Locations: Newman.

Department of Environment (DoE) (2012) Interim Biogeographic Regionalisation for Australia, Revision 7. Online at: http://www.environment. gov.au/parks/nrs/science/bioregion-framework/ibra/ index.html#ibra

Department of Environment (DoE) (2015) Interactive Environmental Database Reporting Tool Search. www.environment.gov.au

Department of Parks and Wildlife (DPaW) (2014a) Threatened and Priority Flora Database Search.

Department of Parks and Wildlife (DPaW) (2014b) *List of Threatened Ecological Communities on the Department of Parks and Wildlife's Threatened Ecological Community (TEC) Database endorsed by the Minister for the Environment.* WA Threatened Species and Communities Unit, Department of Parks and Wildlife.

Department of Parks and Wildlife (DPaW) (2014c) *List of Priority Ecological Communities on the Department of Parks and Wildlife's PEC Database endorsed by the Minister for the Environment.* WA Threatened Species and Communities Unit, Department of Parks and Wildlife.

Ecologia Environment (1995) *Orebody 25 Biological Assessment Survey*. Report prepared for BHP Billiton Iron Ore.

Ecologia Environment (1998) *Orebody 23 Extension Biological Assessment Survey*. Report prepared for BHP Billiton Iron Ore.

Ecologia Environment (2004a) *Orebodies 18, 23 and 25 Flora and Fauna Review.* Report prepared for BHP Billiton Iron Ore.

Ecologia Environment (2004) *Eastern Ophthalmia Range Biological Survey.* Report prepared for BHP Billiton Iron Ore.

Ecologia Environment (2004) *OB24 Expansion Biological Survey.* Report prepared for BHP Billiton Iron Ore.

Ecologia Environment (2005) *Orebody 25 Biological Review and Environmental Impact Assessment.* Report prepared for BHP Billiton Iron Ore.

ENV Australia (2006a) *OB24 Flora and Fauna Assessment Phase II.* Report prepared for BHP Billiton Iron Ore.

ENV Australia (2006b) *Mt Whaleback Flora and Vegetation Assessment – Phase 3 Summary Report.* Report prepared for BHP Billiton Iron Ore.

ENV Australia (2007) *RGP4 Orebody 25 Rail Spur Siding Declared Rare and Priority Flora Survey.* Report prepared for BHP Billiton Iron Ore.

ENV Australia (2009a) *Orebody 25 to Newman Flora and Vegetation Assessment.* Report prepared for BHP Billiton Iron Ore.

ENV Australia (2009b) *Homestead Creek Culvert Flora and Vegetation Assessment.* Report prepared for BHP Billiton Iron Ore.

ENV Australia (2012) *Eastern Ridge (OB 23/24/25) Flora and Vegetation Report.* Report prepared for BHP Billiton Iron Ore.

Environmental Protection Authority (EPA) (2000) Environmental Protection of Native Vegetation in Western Australia: Clearing of Native Vegetation with Particular Reference to Agricultural Areas, Position Statement No. 2, EPA, Perth.

Environmental Protection Authority (EPA) (2002) Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement No. 3, EPA, Perth.

Environmental Protection Authority (EPA) (2004) EPA Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia, No. 51, EPA, Perth.

GHD (2008) *Report for Myopic Project Area, Newman Flora and Fauna Assessment.* Report prepared for BHP Billiton Iron Ore.

Hussey, B. M. J., Keighery, G. J., Cousens, R. D., Dodd, J. and Lloyd, S. G. (1997) *Western Weeds*. The Plant Protection Society of Western Australia and Agriculture Western Australia. Kensington, W.A.

International Union for Conservation of Nature (IUCN) (2015) Interactive Environmental Database Reporting Tool Search, performed February 2014. www.iucn.org

Keighery, B. J. (1994) Bushland Plant Survey: a Guide to Plant Community Survey for the Community. Wildflower Society of WA (Inc.), Nedlands, Western Australia.

Kendrick (2001) Bioregion: Pilbara 3 Subregion (PIL3). Department of Conservation and Land Management, Perth.

McKenzie, NL, May, JE and McKenna, S (2003) *Bioregional Summary of the 2002 Biodiversity Audit for Western Australia*, The National Land and Water Resources Audit and the Western Australian Department of Conservation and Land Management, Perth, Western Australia.

O'Brien, B.J. and Associates Pty. Ltd. (1992) Marandoo Iron ore Mine and Central Pilbara Railway. Environmental Review and Management Programme. Report to Hamersley Iron Pty. Ltd.

Onshore Environmental (2009) *Biological Survey Myopic Exploration Leases.* Report prepared for BHP Billiton Iron Ore.

Onshore Environmental (2011*) Targeted Survey for Rhagodia sp. Hamersley (Priority 3) OB25 Gatehouse*. Report prepared for BHP Billiton Iron Ore.

Onshore Environmental (2012) *Targeted Significant Flora Survey and Vegetation Mapping of Homestead Creek.* Report prepared for BHP Billiton Iron Ore.

Onshore Environmental (2013a) *Targeted Flora and Vegetation Survey Orebody 24.* Report prepared for BHP Billiton Iron Ore.

Onshore Environmental (2013b) *OB19 Level 2 Flora and Vegetation Survey.* Report prepared for BHP Billiton Iron Ore.

Onshore Environmental (2014a) *Mt Whaleback OB29/30/25 Targeted Flora Survey Assessment.* Report prepared for BHP Billiton Iron Ore.

Onshore Environmental (2014b) *Western Ridge Flora and Vegetation and Vertebrate Fauna Survey.* Report prepared for BHP Billiton Iron Ore.

Onshore Environmental (2014c) Consolidation of Regional Vegetation Mapping BHP Billiton Iron Ore Pilbara Tenure. Prepared for BHP BIllition Iron Ore.

Onshore Environmental & Biologic Environmental Surveys (2009) *Flora and Vegetation Survey and Fauna Mt Whaleback Mine Site.* Report prepared for BHP Billiton Iron Ore.

Shepherd, D.P., Beeston, G.R., and Hopkins, A.J.M. (2002) Native Vegetation in Western Australia. Technical Report 249. Department of Agriculture, Western Australia, South Perth.

Specht R.L. (1970) Vegetation. In The Australian Environment. 4th edn (Ed. G.W. Leeper). Melbourne.

Tille, P. (2007) Soil-lanscapes of Western Australia's rangelands and arid interior. Resouce management technical report 313. Department of Agriculture and Food.

Trudgen, M.E. (2009) BHP Billiton Iron Ore – Vegetation classification system for utilisation in the Pilbara Bioregion. Professional advice provided to BHP Billiton Iron Ore.

Tyler IM, Hunter WM & Williams IR (1991) Geological Survey of Western Australia 1:250000 Geological Series – Explanatory Notes Newman, Perth Western Australia

van Vreeswyk *et. al.* (2004) An inventory and condition survey of the Pilbara region, Western Australia. Western Australian Department of Agriculture Technical Bulletin No. 92.

Western Australian Herbarium (WAH) (2015) *Florabase – Information on the Western Australian flora.* Department of Parks and Wildlife. Online: *http://florabase.dpaw.wa.gov.au* [February 2015].