

7 GENERAL CONCLUSIONS AND RECOMMENDATIONS

This assessment considered a substantial volume of data to cover a very large area for assessment of the proposed WME. The two areas represent different components of the northern jarrah forest biogeographical sub region with the proposed CBME located in the more mesic south-western portion in State forest, and proposed WMDEC to the central east of the subregion in the drier zone within the highly disturbed agricultural region.

There is a large robust data set for fauna and flora for much of the area contained within the proposed WMDEC and relating to mining operations. Much of this data has been collected from the pre-mining planning stages in 1982, through to monitoring programs and biodiversity surveys carried out over time and into the present. The substantial survey effort in the WMDEC has provided significant information on most threatened species that may exist in the area. The data for the CBME is much less, with only the one systematic fauna survey undertaken in the area in 2000-2001. This is recognised as a gap in data that will require further attention.

Much of the data obtained for the proposed WMDEC and CBME is derived from multi-seasonal systematically designed surveys. This high-level data is generally more than is often available for consideration in environmental impact assessment determinations. This level of scientific robustness can provide a relatively higher level of certainty in the impact risk assessment process although this should be tempered with the knowledge that natural systems are both stochastic and dynamic (i.e., pseudo-random and constantly changing).

This assessment has highlighted that there are several species of national environmental significance that occur at the proposed WMDEC and CBME or in proximity to these areas. Their persistence in highly modified environments suggest a level of adaptability to these conditions and landscapes. The scarcity of records for some of these species, quokka and woylie in particular, reflect their cryptic nature but also a need to undertake further investigations to attempt to determine their distribution and biology across the landscapes. Because of their scarcity in the landscape, surveying for these species is inherently difficult, long-term and logistically costly. However, an attempt has been made to determine if further investigations are required for the threatened species of national environmental significance and, where this is appropriate, it has been indicated under the profile for the species. The undertaking could include:

- For such a large area as WMDEC it is difficult to determine habitat values without on-ground assessments. Such an undertaking would have to be planned over a medium-term period with section of the WMDEC surveyed over time focused on habitat values. This habitat quality assessment, carried out in a standardised systematic manner, is useful in developing habitat quality scales for species and thus provide another management tool. This could be extended to areas not yet surveyed i.e., northern NBGM.
- Similarly, certain areas within WMDEC have not been assessed systematically for biodiversity assemblages. These areas could be surveyed as part of information gathering over time as areas within WMDEC are allocated for development.
- Continued monitoring of fauna is also very important aspect of impact management and assessment. Monitoring of rehabilitation has provided insights into fauna recolonization and habitat use. Standardised monitoring can also be a useful tool in assessing impacts of climate change over the long-term.
- The CBME area, although small is part of a larger contiguous block of native forests. However, there is a gap in the data for the area since 2000-2001 survey. This needs to be remedied by a replicate systematic survey of the area prior to development.

The impact of habitat disturbance is almost always immediate and cumulative on any species. The management of such impacts is reliant on the ability to maintain some level of connectivity in the

landscape to retain the fauna assemblages locally. The connectivity in the landscape must be considered in assessing the quality or value of habitats.

Loss of habitat in the proposed WME is not confined to mine expansion and mine operations, as potential future clearing for agricultural or agroforestry purposes would also contribute to the loss. In a highly fragmented environment, a case can be made that any loss of habitat will have a disproportionate impact on the ecological viability of the area. Therefore, it is not so much a matter of the specific area of habitats lost but the context of the habitats within the landscape. For example, the loss of a few hectares of native remnant habitat may normally not be of concern, but if those few hectares provide a high level of linkage in the fragmented landscape, their ecological value and therefore their loss would be much greater. Within a highly fragmented landscape such as assessed in this report, a major imperative is habitat enhancement as a means of replacement or addition to the existing resource pool of habitats.

Another issue to be incorporated in assessments is the impact of climate change on the ecological processes at the local and regional scale. The exact nature of these changes is difficult to determine, but the changes are likely to manifest themselves over a relatively long period, that may parallel and will exceed the life of the mine. These changes have the potential to alter the long-term viability and sustainability of remnant habitats within the areas and will require a heightened level of adaptability in the management of landscapes.

Fauna species are not constrained by the artificial boundaries such as administrative boundaries or lease boundaries. They will be, however, impacted by “hard” boundaries that are often associated with clearing (either for mining, development or agricultural purposes). The assessment of impacts on the fauna assemblages requires attention, not only to the level of clearing of fauna habitat within the land parcel, but also to the cumulative impact resulting from changes that will or are likely to occur in adjacent areas.

The greater landscape provides suitable habitat for a large variety of volant and non-volant vertebrate fauna. Most have adapted to the fragmented environment and have been recorded in systematic surveys and opportunistically. Breeding records for threatened or listed species within the area include: Carnaby’s black-cockatoo, Baudin’s black-cockatoo, forest red-tailed black-cockatoo, kenngoor and chuditch. The reason many of these species have become conservation significant is because of habitat loss. Future loss would be expected to exacerbate overall ecological viability of these areas.

There are strategies which may be implemented which would mitigate and alleviate the pressures of future developments, and still allow for functional and sustainable diversity of native fauna and fauna habitats within the area. For example, this can include designating permanent refuge areas, progressive and overlapping enhancements of rehabilitation to encourage the return of fauna, management of introduced predators and herbivores, and the enhancement of remnants within agricultural lands to act as refuge and corridors for fauna.

The number of stakeholders covered by the proposed WME complicates the potential to avoid, mitigate and manage impacts and future conservation and rehabilitation strategies. The management of the conservation resources within the WME will require the collaboration of all stakeholders to ensure the sustainability of any plans and actions. Some of the strategies presented here will fall outside the direct scope of South32 control. Some of these measures would require a collaborative approach by South32, the community, NGO’s, local and State governments to achieve them. The benefits of such actions could result, not only in positive ecological outcomes, but also in greater cooperation between stakeholders.

Efforts in mitigation and management will need to incorporate a monitoring program to determine the quality and efficacy of progress. This is a critical component as the monitoring can highlight positive aspects of the landscape management plan but also determine if there are issues with the effective delivery of outcomes that need rectification or modification. Such monitoring programs can be

designed effectively by experienced ecologists and be implemented in the field by community science groups and NGOs as well as professional ecologists. The key to the monitoring program will be coordination with a focus on design, collection, and outcomes.

Rehabilitation can restore some habitat but not within 30 years or more as has been illustrated in studies on mine rehabilitation programs (BIOSTAT Pty Ltd 2015b; Nichols & Grant 2007; Nichols & Nichols 2003; Nichols & Watkins 1984). This lag period will result in a fall in biodiversity with some species locally extirpated if loss of habitat occurs too rapidly. To measure changes in biodiversity, it is important to establish a long-term monitoring program that can assess impacts not only on fauna of conservation significance but other fauna. The focus on biodiversity rather than just specific species is mandatory as all native flora and fauna species make up the habitat and its qualities that support the species of conservation significance.

In conclusion, the overriding issues in the fauna assessment of the proposed WME are:

1. There is adequate robust information to allow more certainty in assessing risk to threatened fauna at the proposed WMDEC.
2. Biodiversity information from CBME will need to be updated. It is recommended that a trapping survey, like the 2000-2001 general biodiversity survey, covering all terrestrial vertebrate fauna groups be undertaken, possibly using the same site locations. Targeted surveys are not designed to determine spatial and seasonal variation in species and would prove inadequate to determine the ecosystem functions of the area. However, targeted searches as part of the biodiversity survey could be incorporated to provide additional information.
3. It is likely the project will be referred on the evidence of information on all three species of black-cockatoo.
4. Certain listed species will need continued monitoring including all three black-cockatoo species, chuditch, woylie, kenngoor, and western ringtail possum. These monitoring programs can be incorporated as part of longer-term management strategies. Targeted populations studies are also recommended as part of the monitoring.
5. Connectivity in a fragmented landscape is critical for the longer-term sustainability of ecosystems. This may require active establishment and maintenance of corridors or protection of existing corridor systems.
6. A broader approach is required to undertake management of landscapes at both sites in the proposed WME. Collaboration with all stakeholders would be required to ensure effective ecological management of the landscape.
7. For highest value outcomes enhancement of habitats should commence early in the planning phase to ensure that they are advanced enough to provide the ecological function of the areas they are to replace.
8. Fauna monitoring is a critical component for collating detailed ecological data that will allow for the avoidance, mitigation and management of impacts on threatened species, ecosystems and other fauna within both areas.
9. General systematic biodiversity surveys are recommended for areas of native forests that have not been surveyed previously to obtain a better understanding of the distribution of fauna in the landscape, e.g., areas in the northern section of NBGM.
10. Climate change is an important consideration in the maintenance and management of ecosystems for the conservation of threatened fauna.

8 REFERENCES

- Abbott, I 2008, 'Historical perspectives of the ecology of some conspicuous vertebrate species in south-west Western Australia', *Conservation Science Western Australia*, vol. 6, no. 3, pp. 1–214.
- Arnold, GW 2003, 'Bird species richness and abundance in wandoo woodland and in tree plantations on farmland at Baker's Hill, Western Australia', *Emu*, vol. 103, no. 3, pp. 259–269.
- Bain, K, Wayne, A & Bencini, R 2014, 'Overcoming the challenges of measuring the abundance of a cryptic macropod: is a qualitative approach good enough?', *Wildlife Research*, vol. 41, no. 1, pp. 84–93.
- Barrett, G, Silcocks, A, Barry, S, Cunningham, R & Poulter, R 2003, *The new atlas of Australian birds*, 2nd edn, Royal Australasian Ornithologists Union (Birds Australia), Hawthorn.
- BIOSTAT Pty Ltd In prep., *Phase 4: Investigations into Fauna at the Saddleback mine, Boddington, Western Australia*, BIOSTAT Pty Ltd, Perth.
- in prep., *The Vertebrate Fauna of Quindanning Timber Reserve 2017-2018*, Unpublished report for South32, Perth.
- 2014, *RCL Expansion: Fauna Assessment*, unpublished report prepared for South32 Worsley Alumina, BIOSTAT Pty Ltd, Perth, p. 90.
- 2015a, *Vegetation Clearing: Fauna Assessment*, unpublished report prepared for South32 Worsley Alumina, BIOSTAT Pty Ltd, Perth, p. 64.
- 2015b, *Vertebrate fauna monitoring, Boddington Bauxite Mine 2014-2015*, Unpublished report prepared for South32 Worsley Alumina, BIOSTAT Pty Ltd, Perth, p. 111.
- 2017, *Mining Extension Areas Associated with the Worsley Alumina Production Increase to 5.1Mtpa - Level 1 Fauna Assessment (1009025-002)*, Unpublished report prepared for South32 Worsley Alumina, BIOSTAT Pty Ltd, Perth, p. 122.
- 2018, *Vertebrate Fauna Monitoring 2017-2018, Saddleback Operations (Draft)*, BIOSTAT Pty Ltd, Perth, p. 70.
- Burbidge, AA 2004, *Threatened animals of Western Australia*, Department of Conservation and Land Management, Kensington.
- Cannella, E, Browne-Cooper, R, Fairbairn, K & Turpin, J 2018, 'Possible sympatry between kenngoor (Phascogale calura) and wambenger (Phascogale tapoatafa wambenger)', *Australian Mammalogy*, viewed 8 October 2018, <<http://www.publish.csiro.au/am/AM18020>>.
- Cannella, EG & Henry, J 2017, 'A case of homing after translocation of chuditch, *Dasyurus geoffroii* (Marsupialia: Dasyuridae)', *Australian Mammalogy*, vol. 39, pp. 118–120.
- Carter, A & Luck, GW 2013, 'Fox baiting in agricultural landscapes: preliminary findings on the importance of bait-site selection', *Wildlife Research*, vol. 40, no. 3, pp. 184–195.
- Churchill, S 2008, *Australian Bats*, 2nd edn, New Holland Publishers (Australia) Pty Ltd, Sydney.

Cochran, WG 2007, *Sampling Techniques*, 3rd edn, Wiley Series in Probability and Statistics, Wiley India Pvt. Ltd.

Comer, S, Danks, A, Burbidge, A & Tiller, C 2010, 'The history and success of Noisy Scrub-bird re-introductions in Western Australia: 1983–2005', in PS Soorae (ed.), *Global Re-Introduction Perspectives: Additional case-studies from around the globe*, IUCN/SSC Re-Introduction Specialist Group, Abu Dhabi, UAE, pp. 187–192.

Commonwealth of Australia 1999, *Environment Protection and Biodiversity Conservation Act 1999*, p. 1078.

Davies Jr., WE & Recher, HF 2012, 'Use by Honeyeaters and Parrots of a Brown Mallet plantation and an arboretum at Dryandra Woodland, Western Australia, at a time of year when few other nectar resources were available', *The Western Australian Naturalist*, vol. 28, no. 2, pp. 69–72.

Department of Environment and Energy 2017, *Revised referral guidelines for three threatened black cockatoo species: Carnaby's Cockatoo (endangered) Calyptorhynchus latirostris, Baudin's Cockatoo (vulnerable) Calyptorhynchus baudinii, Forest Red-Tailed Black-Cockatoo (vulnerable) Calyptorhynchus banksii naso*, Department of Environment and Energy, Canberra, p. 32.

Department of Environment, Water, Heritage and the Arts 2010, *Survey guidelines for Australia's threatened birds*, Guidelines for detecting birds listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*, Department of Environment, Water, Heritage and the Arts, Canberra.

Department of Parks and Wildlife 2013, *Definitions, Categories and Criteria for Threatened and Priority Ecological Communities*, viewed 8 February 2019, <https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/definitions_categories_and_criteria_for_threatened_and_priority_ecological_communities.pdf>.

— 2014, *Western Ringtail Possum (Pseudocheirus occidentalis) recovery plan*, No 58, Wildlife Management Program, Department of Parks and Wildlife, Perth, p. 52.

Department of Sustainability, Environment, Water, Populations and Communities 2012, *EPBC Act referral guidelines for three threatened black cockatoo species: Carnaby's Cockatoo (endangered) Calyptorhynchus latirostris, Baudin's Cockatoo (vulnerable) Calyptorhynchus baudinii, Forest Red-Tailed Black-Cockatoo (vulnerable) Calyptorhynchus banksii naso*, Department of Sustainability, Environment, Water, Populations and Communities, Canberra, p. 26.

Doherty, TS, Wingfield, BN, Stokes, VL, Craig, MD, Lee, JGH, Finn, HC & Calver, MC 2016, 'Successional changes in feeding activity by threatened cockatoos in revegetated mine sites', *Wildlife Research*, vol. 43, no. 2, pp. 93–104.

Gardiner, R, Bain, G, Hamer, R, Jones, ME & Johnson, CN 2018, 'Habitat amount and quality, not patch size, determine persistence of a woodland-dependent mammal in an agricultural landscape', *Landscape Ecology*, vol. 33, no. 11, pp. 1837–1849.

Garnett, ST, Szabo, JK & Dutson, G 2011, *The action plan for Australian birds 2010*, CSIRO Publishing, Collingwood.

Gibbons, P & Lindenmayer, DB 2002, *Tree hollows and Wildlife Conservation in Australia*, CSIRO Publishing, Collingwood.

Glen, AS, Berry, O, Sutherland, DR, Garretson, S, Robinson, T & Tores, PJ de 2009, 'Forensic DNA confirms intraguild killing of a chuditch (*Dasyurus geoffroii*) by a feral cat (*Felis catus*)', *Conservation Genetics*, vol. 11, no. 3, pp. 1099–1101.

Government of Western Australia 1950, *Wildlife Conservation Act 1950*, p. 46.

— 2016, *Biodiversity Conservation Act 2016*, p. 180.

Harper, MJ, McCarthy, MA, van der Ree, R & Fox, JC 2004, 'Overcoming bias in ground-based surveys of hollow-bearing trees using double-sampling', *Forest Ecology and Management*, vol. 190, no. 2–3, pp. 291–300.

Hayward, MW, de Tores, PJ & Banks, PB 2005, 'Habitat use of the Quokka, *Setonix brachyurus* (Macropodidae: Marsupialia), in the northern Jarrah forest of Australia', *Journal of Mammalogy*, vol. 86, no. 4, pp. 683–688.

Hayward, MW, de Tores, PJ, Dillon, MJ & Banks, PB 2007, 'Predicting the occurrence of the quokka, *Setonix brachyurus* (Macropodidae: Marsupialia), in Western Australia's northern jarrah forest', *Wildlife Research*, vol. 34, no. 3, pp. 194–199.

Jackson, S & Groves, C 2015, *Taxonomy of Australian Mammals*, CSIRO Publishing, Melbourne.

Johnstone, RE & Kirkby, T 1999, 'Food of the Forest Red-tailed Black-cockatoo *Calyptorhynchus banksii naso* in south-west Western Australia', *The Western Australian Naturalist*, vol. 22, no. 3, pp. 167–178.

Johnstone, RE, Kirkby, T & Sarti, K 2017, 'The distribution, status movements and diet of the Forest Red-tailed Black Cockatoo in the south-west with emphasis on the greater Perth regions, Western Australia', *The Western Australian Naturalist*, vol. 30, no. 4, pp. 193–219.

Johnstone, RE & Storr, GM 1998, *Handbook of Western Australian Birds*, vol. 1, Non-Passerine (Emu to Dollarbird), WA Museum, Perth.

— 2004, *Handbook of Western Australian birds*, vol. 2, Passerines (Blue-winged Pitta to Goldfinch), Western Australian Museum, Perth.

Kemp, L, Norbury, G, Groenewegen, R & Comer, S 2015, 'The roles of trials and experiments in fauna reintroduction programs', in D Armstrong, M Hayward, D Moro & PJ Seddon (eds), *Advances in Reintroduction Biology of Australian and New Zealand Fauna*, CSIRO Publishing, Melbourne, pp. 73–89.

Le Roux, C 2017, 'Nocturnal roost tree, roost site and landscape characteristics of Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) on the Swan Coastal Plain', Masters Thesis, Edith Cowan University, Perth.

Lee, J, Finn, H & Calver, M 2010a, 'Mine-site revegetation monitoring detects feeding by threatened black-cockatoos within 8 years', *Ecological Management & Restoration*, vol. 11, no. 2, pp. 141–143.

— 2010b, 'Mine-site revegetation monitoring detects feeding by threatened black-cockatoos within 8 years', *Ecological management & restoration*, vol. 11, no. 2, pp. 141–143.

Lee, J, Finn, H & Calver, M 2013, 'Feeding activity of threatened black cockatoos in mine-site rehabilitation in the jarrah forest of south-western Australia', *Australian Journal of Zoology*, vol. 61, no. 2, pp. 119–131.

- Lee, JGH, Finn, HC & Calver, MC 2013, 'Ecology of black cockatoos at a mine-site in the eastern jarrah-marri forest, western Australia.', *Pacific Conservation Biology*, vol. 19, no. 1, pp. 76–90.
- Li, AY, Williams, N, Adams, PJ, Fenwick, S & Hardy, GESJ 2010, 'The spread of *Phytophthora cinnamomi* by feral Pigs', paper presented at 5th IUFRO *Phytophthora* Diseases in Forests and Natural Ecosystems, Auckland and Rotorua, New Zealand.
- Lindenmayer, D 2012, 'Making monitoring up-front and centre in Australian biodiversity conservation', in D Lindenmayer & P Gibbons (eds), *Biodiversity monitoring in Australia*, CSIRO Publishing, Collingwood, pp. 7–13.
- Lindenmayer, D & Likens, G 2018, *Effective Ecological Monitoring*, CSIRO Publishing, Clayton South, Victoria.
- Lindenmayer, DB, Crane, M, Evans, MC, Maron, M, Gibbons, P, Bekessy, S & Blanchard, W 2017, 'The anatomy of a failed offset', *Biological Conservation*, vol. 210, Part A, pp. 286–292.
- Lohr, MT & Davis, RA 2018, 'Anticoagulant rodenticide use, non-target impacts and regulation: A case study from Australia', *Science of The Total Environment*, vol. 634, pp. 1372–1384.
- Marlow, NJ, Thomas, ND, Williams, AAE, Macmahon, B, Lawson, J, Hitchen, Y, Angus, J & Berry, O 2015, 'Lethal 1080 baiting continues to reduce European Red Fox (*Vulpes vulpes*) abundance after more than 25 years of continuous use in south-west Western Australia', *Ecological Management & Restoration*, vol. 16, no. 2, pp. 131–141.
- Maron, M, Dunn, PK, McAlpine, CA & Apan, A 2010, 'Can offsets really compensate for habitat removal? The case of the endangered red-tailed black-cockatoo', *Journal of Applied Ecology*, vol. 47, no. 2, pp. 348–355.
- Maron, M, Hobbs, RJ, Moilanen, A, Matthews, JW, Christie, K, Gardner, TA, Keith, DA, Lindenmayer, DB & McAlpine, CA 2012, 'Faustian bargains? Restoration realities in the context of biodiversity offset policies', *Biological Conservation*, vol. 155, no. 0, pp. 141–148.
- Mattiske Consulting Pty Ltd 2018, *Assessment of Flora and Vegetation within Expansion Survey Areas*, Unpublished report prepared for South32 Worsley Alumina, Mattiske Consulting Pty Ltd, Perth.
- Mawson, PR 1995, 'Observations of nectar feeding by Carnaby's Cockatoo *Calyptorhynchus latirostris*.', *The Western Australian Naturalist*, vol. 20, no. 2, pp. 93–96.
- May, SA & Norton, TW 1996, 'Influence of fragmentation and disturbance on the potential impact of feral predators on native fauna in Australian forest ecosystems', *Wildlife Research*, vol. 23, no. 4, pp. 387–400.
- Mitchell, J, Dorney, W, Mayer, R & McIlroy, J 2008, 'Ecological impacts of feral pig diggings in north Queensland rainforests', *Wildlife Research*, vol. 34, no. 8, pp. 603–608.
- Nichols, OG & Grant, CD 2007, 'Vertebrate fauna recolonization of restored bauxite mines—key findings from almost 30 years of monitoring and research', *Restoration Ecology*, vol. 15, pp. S116–S126.
- Nichols, OG & Nichols, FM 2003, 'Long-term trends in faunal recolonization after bauxite mining in the Jarrah Forest of Southwestern Australia', *Restoration Ecology*, vol. 11, no. 3, pp. 261–272.

Nichols, OG & Watkins, D 1984, 'Bird utilisation of rehabilitated bauxite minesites in Western Australia.', *Biological Conservation*, vol. 30, pp. 109–131.

Ninox Wildlife Consulting 1992, *Phase Three: Vertebrate Fauna Studies, 1991-1992*, Unpublished report for Worsley Alumina Pty Ltd, Perth.

— 1997, *A vertebrate fauna survey of the proposed Northern Saddleback mining area 1996-1997*, Unpublished report prepared for Worsley Alumina Pty Ltd, Perth.

— 1998a, *A vertebrate fauna survey of the proposed Southern Saddleback mining area 1997-1998*, unpublished report prepared for Worsley Alumina Pty Ltd, Unpublished report prepared for Worsley Alumina Pty Ltd, Perth, p. 71.

— 1998b, *Vertebrate fauna of the Overland Conveyor Corridor 1997-1998*, unpublished report prepared for Worsley Alumina Pty Ltd, Ninox Wildlife Consulting, Perth.

— 2002, *The Vertebrate Fauna of Quindanning Timber Reserve*, Unpublished report for Worsley Alumina Pty Ltd, Perth.

— 2003, *The vertebrate fauna of the Boddington Gold Mine*, unpublished report prepared for BGM Management Company Pty Ltd, Ninox Wildlife Consulting, Perth.

— 2004, *A vertebrate fauna survey of the Overland Conveyor Corridor between the Boddington Bauxite Mine and Refinery Lease Area near Collie, Western Australia*, unpublished report prepared for Worsley Alumina Pty Ltd, Ninox Wildlife Consulting, Perth.

— 2006, *Vertebrate fauna monitoring program. Boddington Bauxite Mine*, unpublished report prepared for Worsley Alumina Pty Ltd, Unpublished report prepared for Worsley Alumina Pty Ltd, Albany, p. 27.

— 2007a, *An Assessment of the Presence of the Western Ringtail Possum at the Worsley Alumina Pty Ltd Refinery, near Collie, Western Australia*, unpublished report for Worsley Alumina Pty Ltd, p. 13.

— 2007b, *Vertebrate fauna survey of Marradong Timber Reserve 2006-2007*, Unpublished report prepared for Worsley Alumina Pty Ltd, Perth, p. 41.

— 2010, *A vertebrate fauna survey of the Overland Conveyor Corridor 2009 - 2010*, unpublished report prepared for BHP Billiton Worsley Alumina Pty Ltd, Ninox Wildlife Consulting, Perth, p. 35.

— 2012a, *A vertebrate fauna survey within the Saddleback Treefarms area, Newmont Boddington Gold Mine: an assessment of potential residue disposal areas*, unpublished report prepared for Newmont Boddington Gold, Ninox Wildlife Consulting, Albany, p. 71.

— 2012b, *Monitoring of vertebrate fauna within forest & rehabilitation at the Boddington Bauxite Mine 2009-2011 including comparisons with previous sampling*, Unpublished report for Worsley Alumina Pty Ltd.

— 2012c, *Vertebrate fauna survey of Marradong Timber Reserve 2012*, Unpublished report prepared for BHP Billiton Worsley Alumina Pty Ltd, Perth, p. 55.

— 2012d, *Vertebrate fauna survey within Newmont Boddington Gold Mine: An assessment of potential waste rock disposal areas*, unpublished report prepared for Newmont Boddington Gold, Ninox Wildlife Consulting, Albany, p. 74.

— 2016, *Vertebrate fauna translocation program from the waste rock dump extension area to be developed within Newmont Boddington Gold Mine*, unpublished report prepared for Newmont Boddington Gold, Ninox Wildlife Consulting, Albany, p. 138.

Pruett-Jones, SG, White, CM & Devine, WR 1981, 'Breeding of Peregrine Falcons in Victoria, Australia', *Emu*, vol. 80, pp. 253–269.

Rayner, L, Ellis, M & Taylor, JE 2011, 'Double sampling to assess the accuracy of ground-based surveys of tree hollows in eucalypt woodlands', *Austral Ecology*, vol. 36, no. 3, pp. 252–260.

Redlich, S, Martin, EA, Wende, B & Steffan-Dewenter, I 2018, 'Landscape heterogeneity rather than crop diversity mediates bird diversity in agricultural landscapes', *PLOS ONE*, vol. 13, no. 8, p. e0200438.

Saunders, D 1979, 'The availability of tree hollows for use as nest sites by White-tailed Black Cockatoos', *Wildlife Research*, vol. 6, no. 2, pp. 205–216.

Saunders, DA 1990, 'Problems of survival in an extensively cultivated landscape: the case of Carnaby's cockatoo *Calyptorhynchus funereus latirostris*', *Biological Conservation*, vol. 54, no. 3, pp. 277–290.

Saunders, DA, Mawson, PR & Dawson, R 2014, 'Use of tree hollows by Carnaby's Cockatoo and the fate of large hollow-bearing trees at Coomallo Creek, Western Australia 1969–2013', *Biological Conservation*, vol. 177, pp. 185–193.

Sawatzky, ME, Martin, AE & Fahrig, L 2019, 'Landscape context is more important than wetland buffers for farmland amphibians', *Agriculture, Ecosystems & Environment*, vol. 269, pp. 97–106.

Serena, M & Soderquist, TR 1989, 'Spatial organization of a riparian population of the carnivorous marsupial *Dasyurus geoffroii*', *Journal of Zoology*, vol. 219, no. 3, pp. 373–383.

Shah, B 2006, *Conservation of Carnaby's Black-Cockatoo on the Swan Coastal Plain, Western Australia*, Carnaby's Black-Cockatoo Recovery Project, Birds Australia WA, Perth, p. 74.

Short, J & Hide, A 2012, 'Distribution and status of the red-tailed phascogale (*Phascogale calura*)', *Australian Mammalogy*, vol. 34, no. 1, pp. 88–99.

Short, J, Hide, A & Stone, M 2011, 'Habitat requirements of the endangered red-tailed phascogale, *Phascogale calura*', *Wildlife Research*, vol. 38, no. 5, pp. 359–369.

South32 2017, *Annual Environmental Report FY17*, Worsley Alumina, South32, Perth, p. 123.

— 2018, *Annual Environmental Report FY18*, Worsley Alumina, South32, Perth, p. 86.

Stojanovic, D, Webb, M, Roshier, D, Saunders, D & Heinsohn, R 2012, 'Ground-based survey methods both overestimate and underestimate the abundance of suitable tree-cavities for the endangered Swift Parrot', *Emu*, vol. 112, no. 4, pp. 350–356.

Taylor, DL, Leung, LK-P & Gordon, IJ 2011, 'The impact of feral pigs (*Sus scrofa*) on an Australian lowland tropical rainforest', *Wildlife Research*, vol. 38, no. 5, pp. 437–445.

Thompson, W 2013, *Sampling Rare or Elusive Species: Concepts, Designs, and Techniques for Estimating Population Parameters*, Island Press, Washington, D.C.

Tyler, MJ & Doughty, P 2009, *Field guide to frogs of Western Australia*, 4th edn, Western Australian Museum, Perth.

Tyler, MJ & Knight, F 2011, *Field Guide to the Frogs of Australia*, CSIRO Publishing, Collingwood.

Valentine, L & Stock, W 2008, 'Food resources of Carnaby's Black-cockatoo (*Calyptorhynchus latirostris*) in the Gnangara Sustainability Strategy study area', *ECU Publications Pre. 2011*, Edith Cowan University Research Online, p. 31.

Van Dyck, S, Gynther, I & Baker, A (eds) 2013, *Field companion to the mammals of Australia*, 1st edn, New Holland Publishers, Sydney.

Van Dyck, S & Strahan, R (eds) 2008, *The Mammals of Australia*, 3rd edn, New Holland Publishing Australia Pty Limited, Sydney.

Western Australian Department of Parks and Wildlife 2017, *Numbat (Myrmecobius fasciatus) Recovery Plan*, Wildlife Management Program, Western Australian Department of Parks and Wildlife, Perth.

White, JG, Gubiani, R, Smallman, N, Snell, K & Morton, A 2006, 'Home range, habitat selection and diet of foxes (*Vulpes vulpes*) in a semi-urban riparian environment', *Wildlife Research*, vol. 33, no. 3, pp. 175–180.

Whitford, KR 2001, 'Dimensions of tree hollows used by birds and mammals in the jarrah forest - improving the dimensional description of potentially suitable hollows', *CALM Science*, vol. 3, pp. 499–511.

Wilson, S & Swan, G 2017, *A Complete Guide to Reptiles of Australia*, 5th edn, New Holland Publishers (Australia) Pty Ltd, Sydney.

Woinarski, JCZ, Burbidge, AA & Harrison, PL 2014, *The action plan for Australian mammals 2012*, CSIRO Publishing, Collingwood.

Worsley Alumina Pty Ltd 1985, *Worsley Alumina Project. Flora and Fauna Studies, Phase Two*, Worsley Alumina Pty Ltd, Perth.

— 1999, *Worsley Alumina Boddington Gold Mine Project. Flora and Fauna Studies*, Worsley Alumina Pty Ltd, Perth.

Yeatman, GJ & Groom, CJ 2012, *National recovery plan for the Woylie Bettongia penicillata*, No. 51, Wildlife Management Program, Department of Environment and Conservation, Perth, p. 27.

Appendix 1. Protected Matters Search Tool report



Australian Government

Department of the Environment and Energy

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 17/01/19 22:43:31

[Summary](#)

[Details](#)

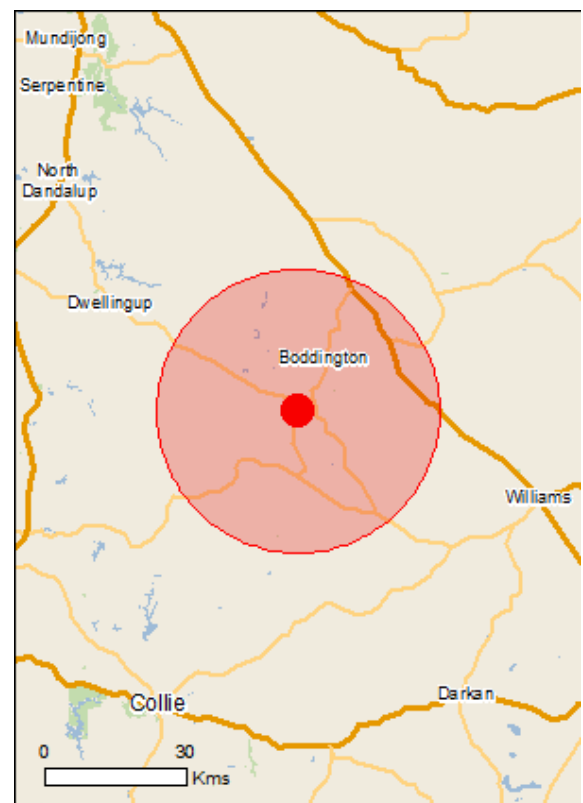
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

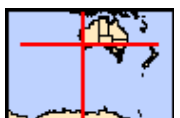
[Acknowledgements](#)



This map may contain data which are
©Commonwealth of Australia
(Geoscience Australia), ©PSMA 2010

[Coordinates](#)

[Buffer: 30.0Km](#)



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	24
Listed Migratory Species:	8

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	15
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	4
Regional Forest Agreements:	1
Invasive Species:	23
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)		[Resource Information]
Name	Proximity	
Peel-yalgorup system	30 - 40km upstream	

Listed Threatened Ecological Communities

 [[Resource Information](#)]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Eucalypt Woodlands of the Western Australian Wheatbelt	Critically Endangered	Community may occur within area

Listed Threatened Species

 [[Resource Information](#)]

Name	Status	Type of Presence
------	--------	------------------

Birds

Atrichornis clamosus		
Noisy Scrub-bird, Tjimiluk [654]	Endangered	Species or species habitat may occur within area

Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area

Calyptorhynchus banksii naso		
Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area

Calyptorhynchus baudinii		
Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Roosting known to occur within area

Calyptorhynchus latirostris		
Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area

Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area

Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Rostratula australis		
Australian Painted-snip, Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area

Mammals

Bettongia penicillata ogilbyi		
Woylie [66844]	Endangered	Species or species habitat known to occur within area

Dasyurus geoffroii		
Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
Myrmecobius fasciatus Numbat [294]	Endangered	Translocated population known to occur within area
Phascogale calura Red-tailed Phascogale, Red-tailed Wambenger, Kenngoor [316]	Vulnerable	Species or species habitat known to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat may occur within area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat likely to occur within area

Other

[Westralunio carteri](#)

Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat known to occur within area
---	------------	---

Plants

[Anthocercis gracilis](#)

Slender Tailflower [11103]	Vulnerable	Species or species habitat may occur within area
----------------------------	------------	--

[Caladenia hopperiana](#)

Quindanning Spider Orchid, Boddington Spider Orchid [88195]	Endangered	Species or species habitat known to occur within area
---	------------	---

[Diuris micrantha](#)

Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
--------------------------	------------	--

[Diuris purdiei](#)

Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat may occur within area
--------------------------------	------------	--

[Eleocharis keigheryi](#)

Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat may occur within area
-------------------------------	------------	--

[Goodenia arthrotricha](#)

[12448]	Endangered	Species or species habitat known to occur within area
---------	------------	---

[Lasiopetalum pterocarpum](#)

Wing-fruited Lasiopetalum [64922]	Endangered	Species or species habitat may occur within area
-----------------------------------	------------	--

[Pultenaea pauciflora](#)

Narrogin Pea [14013]	Vulnerable	Species or species habitat known to occur within area
----------------------	------------	---

[Thelymitra dedmaniarum](#)

Cinnamon Sun Orchid [65105]	Endangered	Species or species habitat may occur within area
-----------------------------	------------	--

Listed Migratory Species

[Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
------	------------	------------------

Migratory Marine Birds

[Apus pacificus](#)

Fork-tailed Swift [678]		Species or species habitat likely to occur within area
-------------------------	--	--

Migratory Terrestrial Species

[Motacilla cinerea](#)

Grey Wagtail [642]		Species or species habitat may occur within area
--------------------	--	--

Name	Threatened	Type of Presence
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat likely to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus		
Osprey [952]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [\[Resource Information \]](#)

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -

Listed Marine Species [\[Resource Information \]](#)

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat likely to occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Lane Poole Reserve	WA
Lane Poole Reserve	WA
Mooradung	WA
Unnamed WA04596	WA

Regional Forest Agreements	[Resource Information]
Note that all areas with completed RFAs have been included.	
Name	State
South West WA RFA	Western Australia

Invasive Species	[Resource Information]
Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.	

Name	Status	Type of Presence
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur

Name	Status	Type of Presence
Passer montanus Eurasian Tree Sparrow [406]		within area Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Mammals		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding		Species or species

Name	Status	Type of Presence
Pine [20780]		habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323] Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-32.88694 116.42205

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- [-Other groups and individuals](#)

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.



Australian Government

Department of the Environment and Energy

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 17/01/19 22:44:46

[Summary](#)

[Details](#)

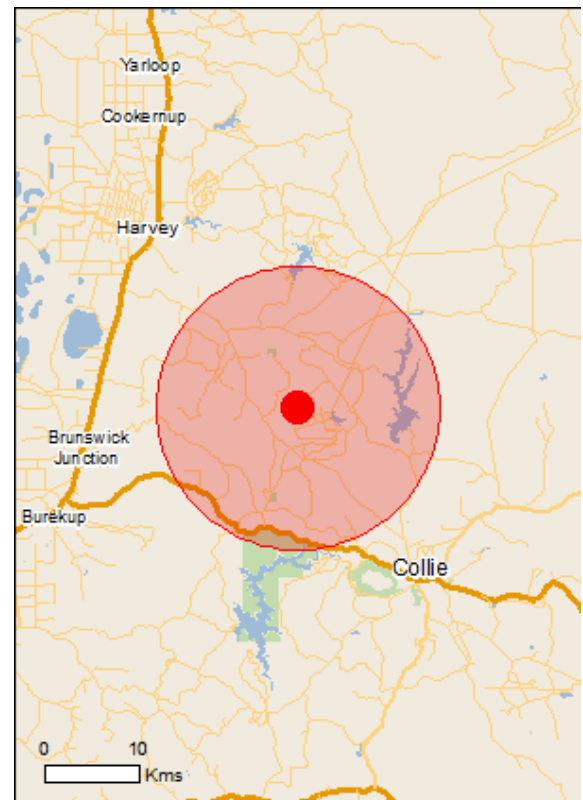
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

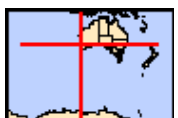
[Acknowledgements](#)



This map may contain data which are
©Commonwealth of Australia
(Geoscience Australia), ©PSMA 2010

[Coordinates](#)

Buffer: 15.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	17
Listed Migratory Species:	8

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	14
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	3
Regional Forest Agreements:	1
Invasive Species:	24
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)		[Resource Information]
Name	Proximity	
Peel-ylgorup system	20 - 30km upstream	

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community may occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
------	--------	------------------

Birds

Botaurus poiciloptilus		
Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area

Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area

Calyptorhynchus banksii naso		
Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area

Calyptorhynchus baudinii		
Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Species or species habitat known to occur within area

Calyptorhynchus latirostris		
Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area

Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area

Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Rostratula australis		
Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area

Fish

Nannatherina balstoni		
Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat likely to occur within area

Mammals

Bettongia penicillata ogilbyi		
Woylie [66844]	Endangered	Species or species

Name	Status	Type of Presence
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	habitat known to occur within area Species or species habitat known to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat known to occur within area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat known to occur within area
Other		
Westralunio carteri Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat known to occur within area
Plants		
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat known to occur within area
Eleocharis keigheryi Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat may occur within area
Grevillea rara Rare Grevillea [64911]	Endangered	Species or species habitat likely to occur within area
Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves		[Resource Information]
Name		State
Falls Brook		WA
Wellington		WA
Westralia		WA

Regional Forest Agreements		[Resource Information]
Note that all areas with completed RFAs have been included.		
Name		State
South West WA RFA		Western Australia

Invasive Species		[Resource Information]
Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.		

Name		Status	Type of Presence
Birds			
Anas platyrhynchos			
Mallard [974]			Species or species habitat likely to occur within area
Columba livia			
Rock Pigeon, Rock Dove, Domestic Pigeon [803]			Species or species habitat likely to occur within area
Passer domesticus			
House Sparrow [405]			Species or species habitat likely to occur within area
Passer montanus			
Eurasian Tree Sparrow [406]			Species or species habitat likely to occur within area
Streptopelia chinensis			
Spotted Turtle-Dove [780]			Species or species habitat likely to occur within area
Streptopelia senegalensis			
Laughing Turtle-dove, Laughing Dove [781]			Species or species habitat likely to occur within area
Mammals			
Canis lupus familiaris			
Domestic Dog [82654]			Species or species habitat likely to occur within area
Felis catus			
Cat, House Cat, Domestic Cat [19]			Species or species habitat likely to occur within area

Name	Status	Type of Presence
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-33.22539 116.04066

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- [-Other groups and individuals](#)

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.