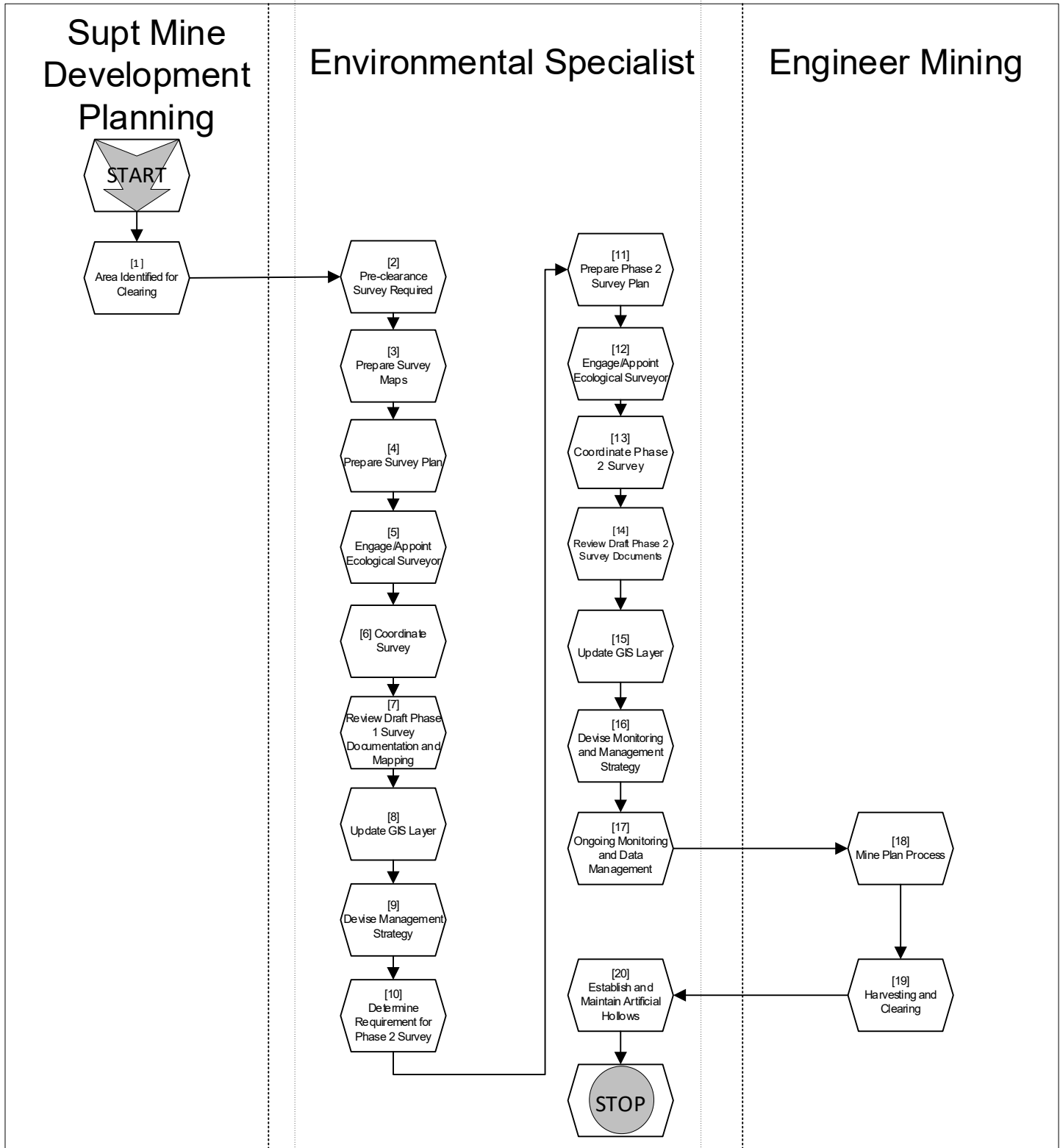


Threatened Species Pre-Clearance Survey and Management



Worsley Alumina



1 PURPOSE

Intent

The intent of this process is to ensure that mine pre-clearance Threatened species surveys are conducted in a consistent manner, with adequate survey effort and methods in line with the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), *Biodiversity Conservation Act 2016* (WA) (BC Act), *Environmental Protection Act 1986* (EP Act) and Department of Biodiversity, Conservation and Attractions (DBCA) recommendations.

Threatened fauna are considered umbrella species of biodiversity value indicative of a functioning ecosystem and fauna values within an area. Although some species are generalist in habitat requirement, the majority of the Threatened species have restricted, specific or critical habitat requirements.

This procedure identifies Threatened fauna species likely to occur within current and future operational areas and defines the pre-clearance survey methodology to be used to ensure the most effective opportunity of identifying significant habitat, habitat features or presence of individuals of Threatened species prior to habitat disturbance taking place. Pre-clearance surveys are required to identify areas of habitat considered to be high value or where risk of mortality or injury of individuals may occur. The surveys are required to be integrated into planning processes to ensure consideration and appropriate management of identified areas occurs prior to and during harvesting, clearing and mining operations.

Results/Benefits

Process outcomes are:

- Pre-clearance Threatened fauna surveys are conducted in a consistent manner across South32 Worsley Alumina Pty Ltd (Worsley) sites and in accordance with best practice, Environmental Protection Authority (EPA) guidance and DBCA recommendations.
- Areas of important habitat for Threatened species are mapped to ensure consideration during planning processes and development of appropriate management strategies.
- Investigation, review and management of breeding habitat (nesting, denning), roosting and refuge for Threatened fauna species prior to clearing and mining activity. In particular, those Threatened species that are unlikely to disperse in response to habitat modification (harvest, disturbance) and clearing activities.
- Survey methodology and data collection are conducted in sufficient detail to provide supplementary information to inform impact assessment.
- Application of the mitigation hierarchy (avoid, minimise, rehabilitate, offset) to manage high value habitat (in particular breeding habitat and habitat features) and manage habitat for Threatened species prior to development activity.
- Minimise the likelihood of mortality or injury of Threatened fauna species impacted by clearing operations.
- Where identified and available to do so, conservation significant fauna species will be encouraged to disperse or be captured and relocated to minimise risk of future mortality or injury.
- Inform mine planning scheduling of harvesting and clearing activities.
- Records of Threatened fauna are retained for integration into the existing spatial biodiversity database.
- All fauna incidents, relocations and significant survey findings and reported in the AER.
- Salvage of suitable habitat trees and forest residue as construction materials for rehabilitation constructed fauna habitats.

Threatened Species Pre-Clearance Survey and Management



Worsley Alumina

2 SCOPE

Scope Overview

The scope of this document includes:

- All Worsley activities requiring disturbance of remnant native vegetation.
- Exploration is excluded from this scope as exploration is considered to be low impact and does not involve removal or disturbance of key Threatened fauna habitat features (i.e. PHT, hollow logs, grasstree skirts etc.).

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3 ACCOUNTABILITIES

Superintendent Mine Development Planning

- Coordinate development and submission of the 10 Year Mine Plan, which includes mining areas planned for clearing within 3 years plus indicative clearing areas in the next 4 to 10 years.

Engineer Mining

- Include proposed 10 Year Mine Plan clearing layers in ArcGIS library.
- Liaise with site Environmental Specialist regarding mine planning requirements; including areas planned to be cleared to support the mine plan in the next 3 years, and indicative areas expected to be cleared within ten years.
- Ensure identified Black Cockatoo trees and key breeding habitat (nesting, denning), roosting and refuge habitat features are displayed in pit disturbance plans.
- Maintain mapping layers for Protection Commitments and Protected Areas in Mine Planning software.

Draftsperson Design Services

- Identify and include Refinery clearing areas (non-mining related) in annual forecast clearing for the State Forest Clearing Compensation process.

Environmental Specialist

- Review 10 Year Mine Plan and Refinery clearing requirements, as identified in the Annual State Forest Clearing Compensation process, and determine requirement for and level of Threatened fauna pre-clearance surveys.
- When assessing Clearing Permit Applications, include determination of requirement for and level of Threatened fauna pre-clearance surveys. Where required, include pre-clearance surveys in approval conditions.
- Ensure appropriate terrestrial vertebrate licences are obtained for all fauna spotters (BC Act). Review requirement for ethics approval for pre-clearance surveys.
- Prepare Threatened fauna pre-clearance survey maps.
- Review Threatened fauna survey reports and analyse data.

Threatened Species Pre-Clearance Survey and Management



Worsley Alumina

Environmental Specialist

- Conduct required pre-clearance surveys and management activities of proposed disturbance locations or engage and supervise an appropriately qualified consultant.
- Update GIS layers and mapping of high value habitat, habitat features for Threatened fauna and identify suitable salvageable forest material for use in constructed fauna habitats in rehabilitation.
- Apply hierarchy of control and define process for allocation of protection status.
- Recommend areas for protection following the Biodiversity and Forest Management Plan (01012523) and Protected Areas Plan (01013619).
- Ongoing liaison with Mine Planning.
- Consult with DBCA and other stakeholders as required.
- Ensure site inductions include information regarding approval processes for clearing of native vegetation.

Principal Approvals

- Identify and recommend areas for Protection following completion of baseline flora and fauna surveys.
- Develop and maintain Protected and Protection Commitment mapping layers.

Principal Biodiversity Offsets

- Provide number and location of Black Cockatoo artificial hollows installed each financial year to Environmental Specialist for inclusion in the Annual Environmental Report.

All Employees and Contractors

- Request approval for miscellaneous native vegetation clearing requirements (other than mining related) from the Environmental Specialist using the Clearing Permit Application Form (00112965).

4 THREATENED FAUNA PRE-CLEARANCE SURVEY AND MANAGEMENT

4.1 LEGISLATION AND STATUTORY REQUIREMENTS

EPBC Act 1999 (Cth)

The EPBC Act (Commonwealth) provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places – recognised under the Act as Matters of National Environmental Significance (MNES). Under the EPBC Act, any actions that will have or are likely to have a significant impact on a listed Threatened species must be referred to the Federal Environment Minister for a decision on whether assessment and approval is required.

The Worsley Mine Expansion Revised Proposal (the Revised Proposal) was referred under the EPBC Act as it was identified that the proposal had the potential to significantly impact on several listed Threatened fauna species.

Biodiversity Conservation Act 2016 (WA)

The Biodiversity Conservation Act 2016 (WA) (BC Act) provides for the protection of wildlife and its habitat in Western Australia, specifically those species that are identified as under threat of extinction, rare and/or to be afforded special protection. Of the fauna recorded within the region that Worsley operates, the same species listed as Threatened under the EPBC Act are also listed as Threatened under the BC Act. The only exception is the Red-tailed Phascogale (*Phascogale calura*), which is listed as Conservation Dependent.

The BC Act also protects other species, such as those listed as conservation dependent or other specially protected species. The BC Act comes into effect if there is direct disturbance impact to any of the listed species (i.e. disturbing an inhabited Black Cockatoo breeding hollow).

EP Act 1986 (WA)

The EP Act provides for the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment.

The Act is managed and reviewed by the EPA who supplies notification for the appropriate level of government to grant approvals for disturbance activities of major works programs. Guidelines provided for EP Act approval are supplied typically through an Environmental Review Document (e.g. Environmental Review and Management Plan, Consultative Environmental Review, Public Environmental Review, ERD).

IUCN Red List

The International Union for the Conservation of Nature (IUCN) Red List of Threatened Species is widely recognised as the most comprehensive, objective global approach for evaluating the conservation status of plant and animal species. Each Threatened fauna species has an additional ranking under the World Conservation Union criteria.

4.2 REGULATORY AND CORPORATE REQUIREMENTS

Alumina Refinery (Worsley) Agreement Act 1973

Clause 5A(2) of the *Alumina Refinery (Worsley) Agreement Act 1973* (WA) requires that Worsley '...carry out continuous investigations and research (including monitoring and the study of sample areas) to ascertain the effectiveness of the measures they are taking pursuant to the approved environmental review and management programme for the protection and management of the environment'.

Ministerial Statement 719 (MS719)

Proponent Commitment 6 of MS719 requires that a Biodiversity and Forest Management Plan be in place for all activities inside the Primary Bauxite Area (PBA). The Biodiversity and Forest Management Plan (01012523) includes:

- A program of baseline flora and fauna surveys before mining to determine;
 - The occurrence and extent of vegetation communities;
 - The occurrence and extent of forest disease; and
 - Occurrence and abundance of vertebrate fauna, significant Short Range Endemic and other significant invertebrate taxa;
- Seasonal flora and fauna surveys in adjoining mining areas;
- Weed and feral animal control programs;
- Forest hygiene procedures;
- Identification of areas of potentially high conservation value;
- Control measures to ensure that the biodiversity and sustainability of these areas will not be substantially adversely affected by mining and bauxite conveyors; and
- Creation of wildlife corridors and establishment of fauna habitat zones in consultation with the State.

In addition to the above, a number of biodiversity related conditions exist under Part B of MS719. These must be complied with prior to completing any disturbance outside of the PBA.

4.3 THREATENED FAUNA

Threatened Fauna

The following list of Threatened fauna species (annotated with Federal and State conservation status accurate as at July 2021) are considered under this procedure:

- Carnaby's Black Cockatoo *Zanda latirostris* (Endangered EPBC Act and BC Act)
- Baudin's Black Cockatoo *Zanda baudinii* (Endangered EPBC Act and BC Act)
- Forest Red-tailed Black Cockatoo (FRBC) *Calyptorhynchus banksia naso* (Vulnerable EPBC Act and BC Act)

- Chuditch *Dasyurus geoffroii* (Vulnerable EPBC Act and BC Act)
- Woylie *Bettongia penicillata ogilbyi* (Endangered EPBC Act, Critically Endangered BC Act)
- Red Tailed Phascogale *calura* (Vulnerable EPBC Act, Conservation Dependent BC Act)
- Western Ringtail Possum *Pseudocheirus occidentalis* (Critically Endangered EPBC Act and BC Act)
- Numbat *Myrmecobius fasciatus* (Endangered EPBC Act and BC Act)
- Quokka *Setonix brachyurus* (Vulnerable EPBC Act and BC Act)
- Malleefowl *Leipoa ocellata* (Vulnerable EPBC Act and BC Act)
- Peregrine Falcon *Falco peregrinus* (Specially Protected BC Act)

These Threatened species have been identified through the Worsley Mining Extension Revised Proposal (the Revised Proposal) Environmental Impact Assessment process as species requiring special consideration under State and Federal requirements.

Ecological Requirements

Importantly the focus for pre-clearance is the consideration of habitat features that the species are reliant on for breeding, roosting, denning and refuge.

Detailed information on species ecological requirements is included within the Threatened Species Management Plan (200000338).

4.4 THREATENED FAUNA PRE-CLEARANCE HABITAT SURVEY METHODOLOGY

4.4.1 Phase 1 Habitat Assessment

Background Information

- A review of Threatened fauna species (EPBC Act and BC Act listed) recommended survey methodology and advice, including EPBC SPRAT (Species Profiles and Threats) database profiles for federally listed Threatened species, EPA Technical guidance statements (2004, 2016, 2020), EPA Species Recovery Plans and consultation with fauna experts, have supported the development of species and habitat survey methodology. This review has also defined fauna habitat types within Worsley operational areas, species habitat suitability and likelihood of occurrence within the pre-clearance mining areas.
- Guidelines and species profiles, for example, the EPBC SPRAT profiles for the three Black Cockatoo species (DoE, 2021 a, b, c) recommend habitat assessment as the primary technique that should be used to determine use of an area by Black Cockatoos. A similar process has been applied for potential occurrence of other Threatened species. Appendix 1: Survey Methodology Guidance summarises the aims, timing and standardised method for undertaking habitat assessment.
- Habitat assessments have been completed for the PAA as part of the Revised Proposal EIA process. Habitat assessments will still be required for any future mining areas and will include the following:
 - Desktop assessment - historical data including vegetation complex mapping, basic (low-intensity survey, i.e. Level 1) fauna habitat mapping and analysis of DBCA / Landsat satellite imagery.
 - Baseline assessment of the extent, type and quality of the vegetation present.
 - Baseline broadscale fauna habitat mapping for Threatened species.
 - Detailed habitat mapping for Black Cockatoos - i.e. designating habitat as potential breeding, roosting or foraging habitat (refer to DSEWPac (2012) for habitat assessment methodology).



Note

- Reconnaissance.
- Identifying and recording Potential Habitat Trees (PHTs) including: location, tree DBH, tree height, tree condition, presence of hollows (including orientation and approx. diameter), evidence of use.
- Record other habitat features of potential high value (breeding habitat (nesting, denning), roosting and refuge) for other Threatened species, for example, rocky outcrops, breakaways and overhangs, hollows and dreys as well as old growth forest where forest meets the DBCA criteria.
- In addition to searching for suitable breeding hollows, in potential Black Cockatoo breeding habitat, measurements of the DBH of trees in a patch of woodland via transect monitoring supports tree and habitat demographics assessment, determining if the habitat could be considered breeding habitat.

Habitat Trees

'Potential Habitat Trees' (PHTs) refer to:

- Large hollow-bearing trees, generally within woodlands or forests that are suitable for Black Cockatoo breeding (Figure 1), or
- Significant trees utilised by Black Cockatoos as night roosting sites.

The DSEWPaC (2012) provides the following DBH guide for likely habitat trees for Black Cockatoos:

- General guide > 500mm.
- Exception of Salmon Gum and Wandoo, > 300mm.

Whilst Black Cockatoo species are the primary users of PHTs other Threatened species such as Chuditch may also make use of these habitat features.

Any PHT that is identified to be in use or recently used by Black Cockatoos or other Threatened species is labelled as a 'Confirmed Habitat Tree'. For a full list of ratings and descriptions refer to Appendix 1.



Figure 1: Examples of 'Potential Habitat Trees'.

 **Note**

Trees of suitable DBH (as outlined above) are considered to be of sufficient age to begin to form hollows and hollow entrances with a diameter greater than 100mm as required for Black Cockatoos. In the Northern Jarrah Forest, Marri and Wandoo are the dominant tree species with hollow bearing potential, accounting for >90% of trees with confirmed breeding hollows (pers. comms. Tony Kirkby).

 **Note**

Fauna and specifically nesting Black Cockatoos respond to disturbance around the tree that they occupy. DSEWPaC (2012) recommend rubbing (hitting) a stick against a PHT to identify the presence of nesting Black Cockatoos. This is a simple method that can be used to verify habitat tree status, however, should not be relied upon as the only method of designating status. Other Threatened species may also respond to this technique, however visual inspection is recommended.

Habitat Features

'Habitat Features' refer to specific features that offer potentially suitable breeding habitat (nesting, denning), roosting and refuge habitat for Threatened fauna species. 'Habitat features' include:

- high quality hollows;
- ground logs with suitable hollows;
- dreys;
- burrows;
- significant rocky outcrops;
- breakaways; and
- Overhangs and caves

Any 'habitat features' identified to be in use or recently used by Threatened fauna is labelled as a 'Confirmed Habitat Feature'.

Field Identification Protocol

Standard protocols must be used for identification and monitoring of identified PHTs and 'Confirmed Habitat Trees' as follows:

- Record GPS coordinates (GDA 1994).
- Trees must be marked as follows:
 - PHT: use double band of flagging tape (green and blue).
 - Confirmed Habitat Tree: use triple band of flagging tape (green, blue and orange). In addition to flagging, white spray paint is used to mark a 'H' on the tree trunk with an arrow pointing to the hollow entrance, this allows for longevity of field markings.

- Record required information on GIS data collection application including location of the tree, approximate height, maturity, tree condition, DBH, photos, orientation and height of any hollows.

Other 'Habitat Features' or 'Confirmed Habitat Features' should have the following information recorded for future use:

- GPS coordinates of feature (GDA 1994);
- Description of feature, location and any signs of current or historic use;
- Photos of habitat feature;
- Orientation (where applicable); and
- Any other information considered important in understanding the value of the habitat feature.

Confirmed Habitat Trees and Confirmed Habitat Features must be included on Clearing Plans to ensure proper consideration in Mine Planning processes.

Broad Habitat Assessment

The following information is required if a broad habitat assessment is necessary prior to significant alteration to future mining areas:

- Review of fauna technical reports, studies and database searches.
- 'Habitat Trees' appropriately demarcated in the field using standardised protocols for future identification and reference.
- Inclusion of assessed information into broad-scale habitat mapping to quantify the amount of habitat suitable for Threatened species within the development area and its significance within the local and regional area. This should compare vegetation types and condition and note the distance, size and connectivity of remnant habitat patches in breeding areas.
- Specific areas of habitat considered of high conservation value for Black Cockatoos or other Threatened fauna species (may warrant further detailed survey/assessment).
- GIS habitat mapping information defining:
 - Threatened species likelihood of occurrence assessment.
 - Habitat suitable for Black Cockatoo - breeding, roosting and/or foraging.
 - Transects in differing habitat types mapping PHTs, 'Confirmed Habitat Trees', potential 'Habitat Features' and 'Confirmed Habitat Features'.

4.4.2 Phase 2: Targeted Surveys

Phase 2 targeted surveys refer to surveys for:

- Breeding Black Cockatoos and 'habitat trees';
- Black Cockatoo night roosting habitat and 'habitat trees'; and
- Breeding (denning and nesting), roosting and refuge habitat for Threatened fauna species.

Phase 2 targeted surveys are required where the identified confirmed and high potential features cannot be immediately allocated as Protected under the assessment process outlined in section 4.5.

4.4.3 Breeding Black Cockatoos

Habitat Tree Status

PHTs and potentially significant breeding habitat identified, demarcated and mapped during the Phase 1 Habitat Assessment require further assessment for potential to support breeding birds.

Phase 2 assessment requires visual investigation of any potential hollows. Investigation is undertaken from the ground using binoculars by an experienced Black Cockatoo and ecological surveyor. Experience for identification of potential hollows is gained by field time with dedicated fauna consultants and / or personnel who have previously conducted surveys of this type, and visual inspections of confirmed Black Cockatoo hollows.

Additionally, the use of a pole-mounted camera allows internal and external investigation of the hollow with live-feed recordable imagery. This method permits an assessment of the suitability of a hollow to be used by Black Cockatoos for breeding. This method may identify eggs or nestlings inside the hollow thereby confirming the breeding habitat status of the tree. Additionally, this may identify evidence of historical use and assess the potential for a hollow to be used in the future.

Where possible, each identified location will be monitored over multiple breeding seasons to determine level of use.

Unmanned aerial vehicles (or drone) may be used to conduct an exterior assessment if the pole camera is not of a sufficient length to reach the hollow.

Appendix 1 summarises the aims, timing and survey effort required to undertake breeding bird surveys in line with recommended EPBC guidelines.

Active nests are located most easily at dusk, when the male returns to the nest with food for the incubating or brooding female (DEHWA, 2012). Breeding birds tend to forage near the nest during the breeding season and foraging birds during the breeding season may indicate nearby breeding habitat.

Surveys should note the distance, size and connectivity of remnant habitat patches in breeding areas (e.g. from satellite images).



Note

Outputs from Survey

The Phase 2 Targeted Survey for 'habitat trees' should provide the following information:

- Refined area of breeding bird habitat.
- Number of birds and species identified during the survey.
- Photos/video evidence of hollow investigations.
- Identification of all of the trees surveyed including:
 - GPS coordinates (GDA 1994);
 - tree species with photographic log;
 - designated 'habitat tree' status (i.e. Confirmed or Potential Habitat Tree);
 - tree quality;
 - approximate DBH;
 - hollow height and orientation;
 - Recommendations of designated protective status (refer to Section 4.5); and
 - Any further action i.e. requirement (if any) for further mitigation or monitoring.

Following the completion of the annual breeding survey, the Black Cockatoo habitat and 'Habitat Tree' GIS layers must be updated by the Environmental Specialist and must reflect Confirmed and High Potential habitat trees and recommended protective status. GIS layers and tree labels are captured via ArcGIS collector and associated ArcGIS online systems, with outputs provided to Mine Planning for allocation of scheduling and, where required, modifications to plan to allow avoidance.

The identification of multiple 'Confirmed Habitat Trees' within a localised area will be viewed as a high conservation value area that requires consideration for Protection from disturbance activities (Section 4.5).

All Confirmed and High Potential Habitat Trees must be added to the "PROTECTED" layer in accordance with the Protected Area Plan (01013619) through completion of a Recommendation for Area Protection Form (00112994).

4.4.4 Black Cockatoo Night Roosting Habitat

Habitat Trees

Black Cockatoo night roosting PHTs identified during the Phase 1 Habitat Assessment require further survey to investigate their use by Black Cockatoos.

Survey methods described in Appendix 1 are to be performed during the breeding and non-breeding seasons to provide a snap-shot of indicative population estimates of Black Cockatoos utilising the site, how the site is used throughout the year, proximity to foraging and breeding habitat and an indication of the significance of the night roost site for Black Cockatoos locally and regionally.

Appendix 1 summarises the aims, timing and survey effort required to undertake roosting bird surveys in line with recommended EPBC guidelines.

Outputs from Survey

The Phase 2 Targeted Survey for night roosting habitat should provide the following information:

- Presence / absence of roost site habitat trees;
- Refined area of night roost habitat;
- Numbers of birds or species identified during the breeding and non-breeding seasons, species dependent - providing an indication of local population estimates;
- Identification of all confirmed night roost habitat trees surveyed (Refer section 4.4.1) including recommendation of designated protected status (refer to Section 4.5);
- Local and regional significance of night roosting habitat trees; and
- Any further action i.e. requirement (if any) for further monitoring.

Following the completion of the survey, GIS layers must be updated to reflect identified night roosting habitat and habitat trees and recommended protective status.

4.4.5 Black Cockatoo Foraging Habitat

Background

Surveys for Black Cockatoo foraging habitat should be undertaken in any remnant vegetation containing proteaceous heath / woodland, eucalypt woodlands or forest (particularly Marri and Jarrah forest) and in areas that may be dominated by Pine trees (Pinus spp).

Phase 2 targeted survey and refinement of Black Cockatoo foraging habitat (refer to DSEWPac (2012)) is required to identify the significance of foraging habitat, with particular focus given to high quality habitat that may be of high importance to Black Cockatoos locally and regionally. This will inform the designated protected status that should be applied to that habitat.

Appendix 1 summarises the aims, timing and survey effort required to undertake foraging Black Cockatoo surveys in line with recommended EPBC guidelines. Given the completion of surveys as part of the Revised Proposal, this work is considered complete for the WMDE but will be required for future mining areas.

Outputs from Survey

The Phase 2 Targeted Survey for foraging Black Cockatoo and foraging Black Cockatoo habitat should provide the following information:

- Confirmed presence/absence of foraging Black Cockatoo and foraging habitat.
- Refined foraging habitat mapping and identification of foraging habitat considered of high importance to the species locally and regionally.

- Numbers of Black Cockatoo and species identified during the breeding and non-breeding seasons - indication of population estimates.
 - Any further action i.e. requirement (if any) for further monitoring.
- Following the completion of the foraging survey the Black Cockatoo habitat GIS layer must be updated to reflect identified confirmed and potential habitat and its recommended protective status (refer to Section 4.5).

4.4.6 Other Threatened Species

Background

Phase 2 surveys for other Threatened fauna species should be conducted in proposed clearing areas within the 'species likelihood of occurrence' offering suitable habitat for the specific Threatened species. 'Likelihood of occurrence' has been determined by fauna specialists familiar with the area, the particular species and with local, regional and historical context. Surveys primarily target 'habitat features' potentially used for breeding (denning, nesting), roosting and refuge habitat, which for many of the arboreal or predominantly arboreal species may include habitat trees with hollow requirement characteristics similar to those for Black Cockatoo. Typically, these surveys can be undertaken in parallel with the Black Cockatoo habitat assessments.

Phase 2 targeted surveys delineate habitat features and where identified, field signs of the species. Further targeted monitoring assessments (e.g., multi-seasonal trapping, camera trapping) may be initiated to confirm the presence of Threatened species as some are cryptic, highly mobile and territorial. These surveys will be conducted where pre-clearance surveys identify likely signs of occupation but are unable to confirm presence. Targeted surveys will be designed by appropriately qualified personnel or consultants to maximise the potential of detection and capture for the target species.

A summary of the pre-clearance survey methodology required for each Threatened fauna species currently identified as potentially occurring within Worsley operational areas is provided in Table 4-1. Pre-clearance survey methods and activities will be reviewed under an adaptive management process considering improvements in methods, techniques and best practice.

Outputs from Survey

The Phase 2 Targeted Survey for other Threatened species should provide the following information:

- Threatened species confirmed presence / likely absence.
- Refined 'likelihood of occurrence' and suitable habitat mapping for the species.
- Updated habitat mapping and identification of 'habitat features' considered significant and of value to the species.
- Where possible, species and numbers of individuals identified during the breeding and non-breeding seasons - indication of population estimates.
- Any further action i.e. requirement (if any) for further monitoring or alternative mitigation (i.e. staged harvest and clearing, trap and release requirements).

Following the completion of the survey, a GIS layer is to be generated and updated to reflect:

- Refined species 'likelihood of occurrence' and habitat suitability mapping; and
- Identification of potential habitat features and confirmed habitat features and recommended protective status (following current practices for protection processes as described in Section 4.5).

4.5 PROTECTION OF THREATENED FAUNA HABITAT

4.5.1 Designated Protected Status

Mitigation Hierarchy and Assessment of Protection Status

Allocation of priority status for the protection of habitat, 'habitat features' and 'habitat trees' is to follow the South32 Environment Standard hierarchy of control as follows:

- **Protect** – Tree/s or habitat not to be removed. Examples may include; 'habitat trees' supporting Confirmed Black Cockatoo hollows, confirmed breeding 'habitat features' for Chuditch, Western Ring-tailed Possum etc., specific areas of habitat supporting multiple 'habitat trees' that have been identified as Confirmed Black Cockatoo hollows, or high potential Black Cockatoo hollows, areas identified as providing multiple confirmed 'habitat trees' and confirmed 'habitat features' for multiple Threatened species, local and regionally significant night roosts.
- **Avoid** – Mitigation and management actions should prioritise impact avoidance over impact reduction measures. Where possible, avoid breeding sites, potential and confirmed 'habitat features' or 'habitat trees' (avoid development of the area or develop in the area while protecting the habitat or 'habitat tree' with an appropriate development buffer and consider timing to avoid peak Black Cockatoo and other Threatened species breeding/activity periods).
- **Minimise** – Minimise the removal of Threatened species breeding (nesting and denning), roosting and/or refuge habitat.
- **Compensatory action** – Compensatory actions are as agreed under Worsley regulatory environmental approvals. Where the removal of a confirmed 'habitat tree' or habitat considered of significance to Threatened species is unavoidable, appropriate compensatory actions will be required.

In order to make an informed decision with input from Mine Planning and Environmental Specialists with regard to the significance and / or protected status of 'habitat features' and 'habitat trees', assessment must apply consideration for each individual feature on a 'case by case' basis. This must be done in accordance with conditions and commitments included in current environmental approval instruments and Environmental Management Plans. Considerations must include:

- Where in the landscape the feature is, compared to that of other confirmed breeding (nesting and denning), roosting, refuge habitat and remnant habitat.
- Potential group breeding locations (i.e. areas supporting >4 Rank 1 and / or Rank 2 breeding trees within a 100m radius) for Forest Red-tailed Black Cockatoos must be Protected in accordance with the PAP;
- The significance of the habitat, 'habitat feature' or 'habitat tree' at a local and regional level;
- Recommendations from fauna experts / specialists;
- Breeding / roosting status of the 'habitat feature' or 'habitat tree' i.e. confirmed, high potential, actively used;
- Condition of the 'habitat feature' or 'habitat tree';
- Location within the proposed disturbance boundary i.e. edge vs centre of pit, possibility of realignment (e.g. haul roads), topography of the area etc; and
- Mineral value – grade of ore to be lost, depth, quantity (tonnage).

Where protection or avoidance is able to be applied consideration must be given to protecting / avoiding adjacent remnant vegetation to maintain connectivity to foraging habitat in accordance with the PAP.

Habitat Feature and Habitat Tree Status Allocation

Potential and confirmed 'habitat features' or potential 'habitat trees' are assigned 'Monitor' status where decision on development is pending or where status is unconfirmed.

The Black Cockatoo Hollow Protection Commitment requires that at least 95% of all Confirmed Habitat Trees or High Potential Habitat Trees supporting Black Cockatoo Hollows (representing Rank 1 or Rank 2 trees under the assessment categories utilised by Bamford Consulting and trees scoring 8-10 under assessment categories applied by Phoenix Consulting) will be protected from disturbance with a buffer applied from the base of the tree to ensure the tree and its intrinsic values are preserved. This Protection Commitment and associated buffer allocation are managed in accordance with the Protected Areas Plan (01013619) (PAP).

Where no alternative to removal of a high potential or confirmed 'habitat feature' or potential 'habitat tree' can be identified, the feature or tree should be assigned 'Controlled-Fell' status. This implies that the feature or tree will require monitoring again prior to disturbance (where possible, during 2 breeding seasons prior to clearing) and again immediately before disturbance to determine whether the tree or feature is actively in use.

Where a feature or tree is identified to be in use, the tree must be assigned 'Keep' status and monitored until use ceases, as required by the BC Act for Disturbance of Fauna. Once the feature or tree has been vacated, it triggers the mitigation hierarchy and assessment process again.

Once a feature or tree has been removed for mining requirements, the feature or tree is then assigned a 'Removed' status. GIS information is retained for understanding of total disturbance of 'habitat features' and potential / confirmed 'habitat trees'.

Compensatory Actions – Black Cockatoos

Where Confirmed or High Potential Habitat Trees for Black Cockatoos cannot be protected, Black Cockatoo artificial hollows will be installed. The installation of artificial Black Cockatoo hollows will require the location, number, positioning and monitoring to be aligned with Offset Implementation Plan No. 4 - Black Cockatoo Artificial Breeding Hollows (200000544) (OIP4).

Under OIP4 removal of a single Confirmed or High Potential Habitat Tree (once the tree has been vacated), requires the compensation action of installing 3 artificial hollows. Establishment locations are selected that would best replace or improve areas identified as breeding habitat or close to other confirmed breeding hollows, developed under consultation with DBCA, WA Museum and fauna experts. Locations must consider:

- Avoidance of areas that may be disturbed for future mining (requires consultation with Mine Planning);
- The location of other confirmed hollows;
- Commitments made under the Biodiversity Offset Plan and OIP4;
- Habitat considered of high value to Black Cockatoos for breeding (i.e. Wandoo);
- Availability of water sources (drinking resource) within a 1km radius;
- Any known roosting sites; and
- Access for maintenance.

Locations of all artificial hollows must be captured via GIS once established and monitoring for use must be completed annually during the peak Black Cockatoo breeding period. Artificial hollows will also require inspections and maintenance to provide the best available conditions for use (as described in OIP4). Monitoring and inspection notes are collected via GIS.

- The number and location of Black Cockatoo artificial hollows installed each financial year must be reported in the Annual Environmental Report (AER).

4.6 ADDITIONAL PRE-CLEARANCE MANAGEMENT ACTIVITIES

Overview

Where potential or confirmed habitat features for Threatened species are included in planned disturbance areas, additional management activities are required to ensure that the potential for impacting any Threatened fauna is minimised.

It should be noted that the pre-clearance management activities have a separate purpose to Pre-clearance surveys. Pre-clearance surveys have the intent of identifying high potential habitat and habitat features that may be utilised by Threatened fauna with the purpose of defining areas for

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avoidance. The Management activities outlined here are designed to minimise the likelihood of impacts on Threatened fauna during disturbance activities.

A series of pre-clearance management activities are outlined in detail below. These management activities will be applied as shown in Table 4-1. Additional management measures may be applied under advisement from expert consultants or following consultation with relevant government regulators.

Destructive Searches

Destructive searches may be implemented for confirmed and high potential habitat features. Destructive searches are completed following harvesting activities and prior to remaining forest resource removal. Firstly, the habitat features are inspected for occupation. If the habitat feature is occupied, then safe removal or relocation of any animals to a suitable nearby location will be completed by appropriately qualified personnel.

Once verified to be unoccupied and as a final investigation of the habitat feature, the habitat feature under investigation will be destructively searched and finally destroyed to prevent the return of any fauna prior to clearing taking place.

Where possible, destructive searches will be completed by hand. For larger features mechanical destruction will be required. Where possible, habitat features (i.e. hollow logs) will be retained for use as fauna habitat in rehabilitation in accordance with the BFMP.

Habitat Modification

Where Wandoo, Allocasuarina and grasstree dominated habitat are required to be cleared, habitat modification should be completed during or closely following harvesting to minimise the likelihood of repopulation by fauna prior to clearing.

Fauna Spotters

The Fauna Spotter's role is to manage any fauna that may be present within the disturbance area. This activity is prioritised to monitor:

- controlled felling of previously identified PHTs,
- disturbance of any remaining high potential and confirmed habitat features and
- disturbance of areas identified as having high potential to support Threatened species.

The Fauna Spotter will remain for the duration of clearing operations to monitor for fauna presence and movement. If any fauna is encountered, it will be checked by the Fauna Spotter for injuries, and if deemed suitable, will be relocated to a suitable nearby location. If the fauna is injured or unsuited for release it will be taken to an appropriately licensed wildlife carer or veterinarian for care in accordance with the Fauna Management - Animal Handling Procedure (00113130).

A licence under the BC Act is required where fauna is to be physically captured, such as for their relocation. Where the fauna to be taken is threatened fauna, a section 40 authorisation to take threatened fauna is required under the BC Act.

All Fauna Spotters must be verified to hold appropriate qualifications prior to commencing work.

Clearing Method

Where possible, clearing will be completed on a clearing front towards Protected Areas, ecological linkages and remnant habitat to encourage dispersal of mobile fauna into surrounding vegetation without the stress and mortality risk associated with trapping, relocation and/or translocation.

Fauna Relocation

Worsley does not currently implement broadscale fauna trapping and relocation as part of its Pre-Clearance processes, favouring monitoring for natural dispersal and habitat modification encouraging dispersal to adjacent and protected habitat.

Translocations often observe higher mortality rates in the initial weeks following release due to predation, starvation, disease, interception with roads, cardiac pathology, reduced reproduction and dispersal from release site. Chronic stress does not directly cause a translocation to fail, however it increases the vulnerability of individual animals to these factors that contribute to translocation failure.

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Therefore, animal stress should be accommodated within translocation planning and procedures (Dickens et al. 2010).

Detailed consultation with DBCA is required to determine whether a translocation program would be suitable for any threatened species present within planned operational areas. This consultation will be completed in accordance with the TSMP.

Buffers for active Black Cockatoo Breeding Hollows

Where disturbance activities must proceed during the known occupation of a Black Cockatoo Breeding Hollow a 250 m buffer will be applied to the base of the tree containing the active hollow to minimise potential impacts on breeding success. Once the hollow has been vacated this buffer will revert to the Protected Area buffer applied in accordance with the PAP.

4.7 PRE-CLEARANCE PHASE 2 SURVEY AND MANAGEMENT REQUIREMENTS BY SPECIES

Summary

Table 4-1 provides a summary of the pre-clearance surveys and management measures used by Worsley to ensure that impacts on Threatened species are minimised during land disturbance activities. This information should be used to guide the development of Pre-Clearance Survey Plans and in planning for additional controls to be implemented for subsequent disturbance activities.

The pre-clearance surveys and management approach adopted for each Threatened species must be reviewed for effectiveness on a regular basis (at least 3 yearly) and adapted as required to ensure that impacts on Threatened fauna are minimised in line with industry best practice.

Species	Critical Habitat Features	Survey Timing	Pre-Clearance Monitoring and Management Activities
<p><i>Caladenia hopperiana</i> (Quindanning Spider Orchid), <i>Diuris micranta</i> (Dwarf Bee Orchid), <i>Pultenaea pauciflora</i> (Narrogin Pea) and <i>Caladenia caesarea</i> subsp. <i>Mooradung</i></p>	Vegetation types A, M, Y in low lying areas of the landscape	Spring (Sep-Oct)	<ul style="list-style-type: none"> Targeted searches for Threatened flora species in likely habitat (inside and within 200 m of proposed clearing) prior to harvesting. Protection of any identified individuals with application of a 50 m buffer in accordance with the PAP.
<p><i>Calyptorhynchus banksii naso</i> (FRTBC), <i>Zanda latirostris</i> (Carnaby's Cockatoo) and <i>Zanda baudinii</i> (Baudin's Cockatoo)</p>	PHTs	<p>Targeted searches for PHTs – unrestricted</p> <p>Confirmed Habitat Trees will be monitored during the peak breeding season:</p> <ul style="list-style-type: none"> Carnaby's - Sept-Nov FRTBC - April-June and Aug-Nov Baudin's - Oct-Jan (RLA) 	<ul style="list-style-type: none"> Targeted searches for PHTs. Protection of 'confirmed' and 'high potential' PHTs in accordance with the Black Cockatoo Hollow Protection Commitment. 'Confirmed' and 'high potential' PHTs are monitored for multiple seasons where possible i.e. up to 2 years prior to disturbance (2 days of monitoring at monthly intervals during breeding season). Signs of activity must also be recorded including foraging debris (noting in particular the markings on marri nuts to support species identification) and pruning debris. 'Confirmed' Habitat Trees must be verified as not-occupied prior to controlled felling.

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Table 4-1: Phase 2 Threatened Species Pre-Clearance Survey and Management Summary

Species	Critical Habitat Features	Survey Timing	Pre-Clearance Monitoring and Management Activities
			<ul style="list-style-type: none"> Confirmed Habitat Trees for Baudin's Cockatoo, must be Protected in accordance with the PAP. Should clearing be required to occur in proximity to an active Black Cockatoo Breeding Hollow a temporary 250 m mining exclusion zone must be applied (i.e. no ground disturbing activities or clearing) until the hollow has been verified as vacated.
<i>Dasyurus geoffroii</i> Chuditch	PHTs, hollows, denning features (hollow logs, rocks, overhangs, caves, breakaways etc)	March – August Note: Breeding occurs April-July	<ul style="list-style-type: none"> Targeted searches for PHTs and critical habitat features up to 2 years prior to disturbance. Assume presence of species for 'Confirmed' Habitat Trees and / or 'Confirmed' Habitat Features. Features are flagged (with a buffer allocated in accordance with the PAP) and recorded on clearing plans. Harvesting and habitat disturbance is undertaken while avoiding the 'Confirmed' feature and buffer (encouraging dispersal). Destructive searches of any habitat features present with a fauna spotter / specialist to encourage dispersal and / or capture / release ensuring no individuals are present prior to clearing. Complete standard clearing for the remainder of the pit on a clearing front towards remnant habitat.
<i>Bettongia penicillata ogilbyi</i> Woylie	Large intact areas of variable vegetation	March – August Note: No specific breeding period, breed every 3-4 months	<ul style="list-style-type: none"> No specific habitat features are defined for this species; however, signs of activity are assessed and recorded during pre-clearance surveys (e.g. nest building, recent foraging activity). Further targeted surveys (e.g., camera trapping) may be initiated to confirm presence of species as outlined in Section 4.4.6. Harvesting and habitat disturbance are undertaken while avoiding any areas supporting evidence of nest building and recent foraging activity (encouraging dispersal). Where presence is confirmed, complete a destructive search of verified habitat with a fauna spotter / specialist to encourage dispersal and / or capture / release and ensure no individuals are present. Complete clearing of the remainder of the pit on a clearing front towards remnant habitat.

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Table 4-1: Phase 2 Threatened Species Pre-Clearance Survey and Management Summary

Species	Critical Habitat Features	Survey Timing	Pre-Clearance Monitoring and Management Activities
<i>Phascogale calura</i> Red Tailed Phascogale Kenngoor	Allocasuarina stands Tree hollows Grass tree skirts	June – August Note: breeding known to occur in July	<ul style="list-style-type: none"> Investigate options for capture and relocation for this species with DBCA given relatively small home range and dispersal potential. Where Wandoo or Allocasuarina with grasstree dominated habitat are being cleared, undertake the harvesting and habitat disturbance to include habitat modification of these habitat types with a Fauna Spotter present. Complete clearing of the remainder of the pit on a clearing front towards Protected Areas, ecological linkages and remnant habitat. Adaptive management for pre-clearance for the species upon review of initial clearance activities.
<i>Pseudocheirus occidentalis</i> Western Ringtail Possum Ngwayir	PHTs Dreys	March – August Note: breeding occurs in April-May and September-October	<ul style="list-style-type: none"> Targeted searches for PHTs (as per Black Cockatoos) and dreys / habitat features. Monitor 'Confirmed' Habitat Features for 2 weeks prior to harvesting. Ensure a Fauna Spotter is present during clearing activities.
<i>Setonix brachyurus</i> Quokka	Often associated with riparian vegetation, dense vegetation and mid slopes.	March – August Note: Breeding occurs throughout the year on the mainland	<ul style="list-style-type: none"> No specific habitat features are defined for this species however, signs of activity are assessed and recorded during pre-clearance surveys (runnels, scats, tracks). Further targeted surveys (e.g., camera trapping) may be initiated to confirm presence of species as outlined in Section 4.4.6. Undertake harvesting and habitat disturbance while avoiding any areas supporting evidence of quokka activity (runnels, scats, tracks) with a focus on dense vegetation and riparian buffer habitat. Fauna Spotter to be present during clearing activities for areas of preferred habitat types within the RLA.
<i>Myrmecobius fasciatus</i> Numbat Noombat	Hollow logs Termites	March- August (cooler months when they are more active throughout the day) Note: Breeding occurs December -January	<ul style="list-style-type: none"> Targeted searches for preferred habitat (hollow logs) and signs of activity (recent foraging activity and scats). Further targeted surveys (e.g., camera trapping) may be initiated to confirm presence of species as outlined in Section 4.4.6. Where presence is confirmed or considered likely, complete investigation of habitat features with a fauna spotter / specialist to encourage dispersal and / or capture / release and ensure no individuals are present. Where possible retain suitable logs, for rehabilitation fauna habitat.

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Table 4-1: Phase 2 Threatened Species Pre-Clearance Survey and Management Summary			
Species	Critical Habitat Features	Survey Timing	Pre-Clearance Monitoring and Management Activities
			<ul style="list-style-type: none"> Undertake harvesting and habitat disturbance while avoiding any potential habitat features, logs and hollows suitable for the species Complete clearing of the remainder of the pit on a clearing front towards remnant habitat.
<i>Leipoa ocellata</i> Malleefowl	Mounds	N/A	<ul style="list-style-type: none"> Targeted searches for mallee fowl mounds. If identified, verify status (active vs inactive). Where found to be inactive estimate time (years) since last use.
<i>Falco peregrinus</i> Peregrine Falcon	Nests	Spring	<ul style="list-style-type: none"> Targeted searches for active nests. Active nests must be avoided with a 30m buffer applied from the base of the tree. Trees must be monitored annually for use. If tree is not used over 2 consecutive breeding seasons it may be removed through controlled felling.

4.8 GIS DATA MANAGEMENT

The results of the Phase 1 Habitat Assessment mapping and Phase 2 Targeted Surveys are to be documented in GIS format using standardised naming and symbology conventions. This will capture baseline Black Cockatoo and Threatened species habitat data and allow tracking of the designated protected status of Black Cockatoo and Threatened species 'habitat trees' and 'habitat features'. To ensure appropriate management of Black Cockatoo and Threatened species habitat, tracking of the priority status of 'habitat features' and 'habitat trees' is to be regularly updated within dedicated GIS Layers available for use by Mine Planning. Regular consultation between Environmental personnel and Mine Planning is essential to ensure GIS layers are accurately maintained.

4.9 THREATENED FAUNA PRE-CLEARANCE SURVEY

4.9.1 Process Steps

[1] Area Identified for Clearing

The Superintendent Mine Development Planning compiles the Annual Bauxite Operations Plan (10 Year Mine Plan) which is submitted annually to the Worsley Environmental Management Liaison Group (EMLG) for review. The Plan includes clearing identified in the 2 year forecast and the Life of Operations Plan clearing.

[2] Pre-clearance Survey Required

Pre-clearance survey requirement is identified by the Environment team in accordance with Section 4.4 of this procedure.

[3] Prepare Survey Maps

The Environment Specialist creates pre-clearance survey maps using relevant shapefiles in ArcGIS provided by Mine Planning and from historical biodiversity data (vegetation complex mapping, Level 1 and Level 2 fauna habitat mapping).

[4] Prepare Survey Plan

The Environmental Specialist will determine:

- The location of surveys required for Phase 1 habitat assessment;

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- Access to study areas; and
- A suitable provision for buffers to study areas, if required.

This will form the basis of the Pre-Clearance Survey Plan.

[5] Engage/Appoint Ecological Surveyor

The Environment Specialist will engage an ecological surveyor or appropriately qualified and experienced environmental employee to complete the works identified within the Pre-Clearance Survey Plan.

[6] Coordinate Survey

The Environment Specialist will coordinate the required survey. This includes:

- Ensuring all work is conducted in accordance with site requirements;
- Providing maps and other material support onsite;
- Ensuring access to mining areas in collaboration with Mining Execution and Mine Services Supervisors; and
- Ensuring GIS applications are field ready and accessible.

[7] Review Draft Phase 1 Survey Documentation and Mapping

Draft documentation and mapping are submitted to the Environment Specialist by the ecological surveyor.

The Environment Specialist, and the Environmental Supervisor will review draft documents and provide comments to the ecological surveyor prior to the issue of final documentation.

The final drafts must be provided as two electronic versions (Adobe and Microsoft Word) with all raw data, maps and appendices included. GIS shape files in GDA 1994 MGA z50 must also be provided.

[8] Update GIS Layer

The Environment Specialist will update the GIS layers with updated locations of pre-clearance surveys undertaken, designated 'habitat feature' and 'habitat tree' status and the location of any new (or altered) confirmed and potential 'habitat features' or 'habitat trees'.

The Environment Specialist will advise Mine Planning when the GIS layers has been updated to ensure that layers in Vulcan are also updated for use by Mine Planning.

[9] Devise Management Strategy

The Environment Specialist, with the support of Mine Planning, follows the Mitigation Hierarchy and Assessment of Protection Status process and develops a strategy for the management of each identified potential or confirmed 'habitat feature' or 'habitat tree'. Any Confirmed or High Potential Habitat Trees or Habitat Features requiring Protection must be managed in accordance with the Protected Areas Plan (01013619) and associated GIS layers will require update. All changes must be communicated to applicable internal stakeholders.

[10] Determine Requirement for Phase 2 Survey

Environmental Specialist to determine requirement and scope of the Phase 2 targeted survey and monitoring.

[11] Prepare Phase 2 Survey Plan

Environment Specialist will determine:

- The location of surveys required for the Phase 2 targeted survey;
- Access to study areas; and
- A suitable provision for additional unplanned work to be undertaken if required.

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[12] Engage/Appoint Ecological Surveyor

The Environment Specialist may engage an ecological surveyor or appropriately qualified and experienced Environment Specialist for the relevant work.

[13] Coordinate Phase 2 Survey

The Environment Specialist will coordinate the required pre-clearance survey. Refer to Step 6 for details on the requirements of this step.

[14] Review Draft Phase 2 Survey Documents

Draft documents are submitted to the Environment Specialist by the ecological surveyor. The Environment Specialist and the Environmental Supervisor may review draft reports and provide comments to the ecological surveyor prior to the issue of final documents. The final documents must be provided as two electronic versions (Adobe and Microsoft Word) with all raw data, maps and appendices included. GIS shape files in GDA 1994 MGA z50 must also be provided.

[15] Update GIS Layer

The Environment Specialist will update the pre-clearance GIS layers, with updated locations of pre-clearance surveys undertaken, designated habitat status, the location of any new or altered confirmed and potential 'habitat features' or 'habitat trees', and any areas that may require protection via the Protected Areas Procedure (01013619). The Environment Specialist will advise Mine Planning when the pre-clearance GIS layers have been updated to ensure that layers in Vulcan are also updated for use by Mine Planning.

[16] Devise Monitoring and Management Strategy

Environment Specialist to determine requirement of any further high value habitat, 'habitat feature' and 'habitat tree' monitoring. Management strategy to be devised considering:

- Threatened species habitat identified in the Phase 1 assessment;
- The location of potential and confirmed 'habitat features', 'habitat trees' and habitat considered of high conservation value for Threatened fauna species; and
- Mine development requirements.

Environment Specialist, with support of Mine Planning, must develop a strategy for the management of each confirmed Threatened species habitat.

[17] Ongoing Monitoring and Data Management

Ongoing monitoring and update of the status of priority Threatened fauna habitat, potential and confirmed 'habitat features' and 'habitat trees' by the Environment Specialist. Habitat that requires deferment from mining (become a Protected Area) will follow the Protected Areas Procedure (01013619) and will be updated in GIS layers with any changes communicated to internal stakeholders. Any confirmed habitat features identified must undergo an investigation and / or destructive search process during any disturbance processes. The Environmental Specialist or other qualified fauna specialist as appointed by the Environmental Specialist must act as the fauna spotter and document any outcomes.

[18] Mine Plan Process

Clearing must take into consideration Protected Areas. All potential and confirmed habitat identified during this process that is considered protectable will be added to the Protected Areas GIS layers and communicated to internal stakeholders. This will ensure clearing is planned with due consideration. Flagging and signage in the field will assist to protect the areas during operations.

[19] Harvesting and Clearing

Harvesting carried out to encourage dispersal of fauna from disturbed areas prior to clearing. Harvesting process to include any additional management activities required for threatened species as outlined in Table 4-1.

Clearing of approved areas proceeds in accordance with the Mine Plan employing additional management measures required for threatened species as outlined in Table 4-1. Any trees flagged as a PHT or Confirmed Habitat Tree that are removed during the clearing process must be removed through controlled felling with a fauna monitor present. Where the habitat values of the tree are maintained following felling the material must be retained for use in rehabilitation.

[20] Establish and Maintain Artificial Hollows

The Environmental Specialist must apply the Offset Implementation Plan No. 4 - Black Cockatoo Artificial Breeding Hollows (200000544) and available 10 Year Mine Plan data to establish artificial hollows for any removed Confirmed Black Cockatoo Habitat Trees.

Artificial hollows will require annual inspections and maintenance to provide the best available conditions for use as instructed under the Worsley Black Cockatoo Artificial Hollow Plan.

5 DEFINITIONS, TERMS AND ABBREVIATIONS

Term	Description
ArcGIS	Geographic information system used by the Environmental and Mine Planning departments.
BBM	Boddington Bauxite Mine
BC Act	Biodiversity Conservation Act 2016
Confirmed Habitat Tree	A potential habitat tree which has: Adult on nest, chick in nest. (Refer Appendix 1 Table 8-2)
DAWE	Department of Agriculture, Water and the Environment (formerly Department of the Environment and Energy (DoEE)), Commonwealth Government.
DBCA	Department of Biodiversity, Conservation and Attractions
DBH	Diameter at breast height
Destructive Search	To search through a specific habitat immediately prior to the habitat being removed.
DoEE	Department of the Environment and Energy
EP Act	Environmental Protection Act 1986
EPBC Act	Environmental Protection and Biodiversity Conservation Act 1999
FRTBC	Forest Red-Tailed Black Cockatoo
Habitat feature	<p>Specific features that offer potentially suitable breeding habitat (nesting, denning), roosting and refuge for Threatened fauna species. 'Habitat features' include:</p> <ul style="list-style-type: none"> • high quality hollows; • ground logs with suitable hollows; • dreys; • burrows; • significant rocky outcrops; • breakaway; and • caves and overhangs. • Any 'habitat features' identified to be in use or recently used by Threatened fauna is then labelled as a 'Confirmed Habitat Feature'.

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Habitat tree	<ul style="list-style-type: none"> Large hollow-bearing trees, generally within woodlands or forests that are suitable for Black Cockatoo breeding, Significant trees utilised by Black Cockatoos as night roosting sites, or Confirmed significant trees that have been utilised by other threatened or priority species
High Potential Habitat Tree	A potential habitat tree which has: Moderate to high confidence in evidence of use. Likely chewing at hollow entrance. Hollow attributes suitable for black cockatoo breeding. Pole camera/drone to confirm. (Refer Appendix 1 Table 8-2)
IUCN	International Union for the Conservation of Nature
MS719	Ministerial Statement 719
OIP	Offset Implementation Plan
PBA	Primary Bauxite Area
RLA	Refinery Lease Area
SPRAT Profile	Species Profile and Threats Database Profile
Worsley	Worsley Alumina Pty Ltd

6 REFERENCES

	Alumina Refinery (Worsley) Agreement Act 1973 (WA)
	Biodiversity Conservation Act 2016 (WA)
	Environment Protection and Biodiversity Conservation Act 1999 (Cth)
	Ministerial Statement 719
	DBCA (2017) [online] Western Ringtail Possum <i>Pseudocheirus occidentalis</i> , Fauna Profile.
	DEHWA (2010) [online] Survey Guidelines for Australia's Threatened Birds. EPBC Act survey guidelines. Accessed 10 February 2015.
	Dickens et al. (2010). Conservator guidelines for the translocation of native flora and fauna in the ACT - supporting information
	DSEWPaC (2012) [online] Revised draft referral guideline for three threatened Black Cockatoo species: Carnaby's Cockatoo (Endangered) <i>Calyptorhynchus latirostris</i> , Baudin's Cockatoo (Vulnerable) <i>Calyptorhynchus baudinii</i> , Forest Red-tailed Black Cockatoo (Vulnerable) <i>Calyptorhynchus banksii naso</i> .
	DSEWPaC (2011) [online] Survey guidelines for Australia's Threatened mammals. Accessed 5 January 2020.
	DoE (2021a) [online] <i>Calyptorhynchus banksii naso</i> in Species Profile and Threats Database. Department of the Environment, Canberra Available from: https://www.environment.gov.au/sprat Accessed January 2021.
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	DoE (2017). Revised referral guidelines for three threatened black cockatoo species: Carnaby's Cockatoo (endangered) <i>Calyptorhynchus latirostris</i> , Baudin's Cockatoo (vulnerable) <i>Calyptorhynchus baudinii</i> , Forest Red-Tailed Black-Cockatoo (vulnerable) <i>Calyptorhynchus banksii naso</i> , Department of Environment, Canberra.

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	DPaW (2017) Numbat (<i>Myrmecobius fasciatus</i>) Recovery Plan
	DSEWPaC (2012) [online] Referral guidelines for three species of Western Australian Black Cockatoos: Carnaby's cockatoo, Baudin's cockatoo and Forest red-tailed Black Cockatoo. DSEWPaC, Canberra.
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	IUCN Red List of Threatened Species
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	Johnstone, R E; Kirkby, T; and Sarti, K. (2013) The breeding biology of the Forest Red-tailed Black Cockatoo <i>Calyptorhynchus banksii naso</i> Gould in south-western Australia. I. Characteristics of nest trees and nest hollows. <i>Pacific Conservation Biology</i> 19: 121 – 142. Surrey Beatty & Sons, Sydney.
	Johnstone, R E; Storr, G M (1998) Handbook of Western Australian Birds. Volume I – Non-passerines (Emu to Dollarbird). Western Australian Museum, Perth.
	Murdoch (2019) Black Cockatoo Tracking and Ecology Project, 2018 Summary Data.
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	Project Number website. Available from: www.numbat.org.au/thenumbat . Accessed 1 July 2021.
	Short, J, Hide, A & Stone, M 2011, 'Habitat requirements of the endangered red-tailed phascogale, <i>Phascogale calura</i> ', <i>Wildlife Research</i> , vol. 38, no. 5, pp. 359–369.
	Western Australian Environmental Protection (Clearing of Native Vegetation) Regulations 2004
00112994	Recommendation for Area Protection Form
00113130	Fauna Management - Animal Handling Procedure
01012523	Biodiversity and Forest Management Plan
01013619	Protected Areas Plan
200000544	Offset Implementation Plan No. 4 - Black Cockatoo Artificial Breeding Hollows

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7 DOCUMENT CONTROL

Endorsement Circulation

Role	Name	Endorsed	Date
Environment Specialist	Paul Bullock	✓	07.03.2024
Environmental Supervisor	Craig Kimpton	✓	07.03.2024
Lead Design and Land Management	Rochelle Jones	✓	08.03.2024

Approval Circulation

Role	Name	Approved	Date
Manager Environment Heritage & Approvals	Claire Reid	✓	07.03.2024
Manager Production Planning	Cameron McKean	✓	08.03.2024

8 APPENDICES

8.1 APPENDIX 1: SURVEY METHODOLOGY GUIDANCE

8.1.1 Black Cockatoos

Table 8-1: Black Cockatoo Survey Methodology Guidance

Survey Method	Habitat Assessment	Targeted Habitat Trees (Breeding Habitat)	Targeted Habitat Trees (Night Roosting)	Surveys for foraging birds and/or habitat
Aim	<ol style="list-style-type: none"> 1) Identify habitat suitable for Black Cockatoos 2) Record the presence and extent of breeding, foraging and roosting habitat (including contiguous offsite areas). 3) Map the extent, type and quality of the vegetation present. 4) Identify and record 'habitat trees' and potential to support Black Cockatoos 	<ol style="list-style-type: none"> 1) Identify likelihood of 'Potential Habitat Tree(s)' supporting breeding Black Cockatoos. 2) To detect Black Cockatoos, especially (but not exclusively) nesting females to confirm that breeding is taking place on the site. 3) Assess tree hollows for their future potential to support Black Cockatoo breeding. 	<ol style="list-style-type: none"> 1) Search for evidence that a roost site occurs and is utilised by Black Cockatoos. The presence of cockatoo droppings and feathers, or 'chewed' Banksia cones or Marri nuts, can indicate feeding by Black Cockatoos with indicative species bite patterns. 2) Detect Black Cockatoos roosting at the site. 3) Estimate the number of birds using the roost. 	<ol style="list-style-type: none"> 1) To detect Black Cockatoo foraging habitat. 2) Record the presence and extent of foraging habitat (including contiguous offsite areas). 3) Identify conservation significant areas. 4) Estimate the number of birds using the site.
Timing	Habitat assessment may be performed at any time of the year. Ideally surveys should be complete at least 2 years prior to any clearing to allow survey of potential 'habitat trees' over at least two breeding seasons.	Preliminary hollow assessment can be undertaken at any time of the year. Breeding surveys to be conducted during the peak breeding period.*	Daytime surveys can occur any time of the year. Dawn visits should be made at all likely roost sites in both breeding* and non-breeding season	One survey in winter. Two further surveys in spring. In Marri habitats, the preferred time to survey for Black Cockatoo foraging is December to April (three surveys conducted during this period (DoE, 2015b).
Effort	As required to adequately survey, with sufficiently close transects, covering the entire development area.	Survey effort is required for at least two suitable days, at approximately monthly intervals.	A minimum of two dawn surveys per season, at approximately monthly intervals over at least one hour during breeding and non-breeding seasons.	Survey effort as per habitat assessment. Requires a total of three surveys with two hour visits in both the morning and evening.
Methods	<ol style="list-style-type: none"> 1) Desktop assessment 2) Reconnaissance – assess habitat via vehicle track and walking transects giving coverage of the entire survey area. 3) Map the survey area according to Black Cockatoo habitat use. 4) Search and record evidence of Black Cockatoo feeding, breeding, roosting and identification of individuals/groups. 5) Identify habitat considered to be of high conservation significance to Black Cockatoos and 'Potential Habitat Trees' following assessment protocol (Section 4.4.1). 	<ol style="list-style-type: none"> 1) Visual assessment of potential breeding hollows externally i.e. evidence of chewing around entrance. 2) Identify the presence of Black Cockatoos at any potential hollows. 3) Visual camera assessment – use of pole-mounted camera (refer to Section 4.4.1). Document hollow attributes - dimensions, evidence of breeding. 4) For hollows that are considered suitable or show evidence of previous breeding, undertake survey to identify use of the hollow at monthly intervals during the peak breeding season 	<ol style="list-style-type: none"> 1) Visit site at least 30 minutes before sunrise. Record Black Cockatoo calls until at least 30 minutes after sunrise in order to estimate the number of birds as they leave the roost. 2) Counts are best made by standing under a flight path (e.g. a road, track or open area that the birds cross) and looking towards the roost against an open skyline. 3) Subsequent visits may be required to count the birds as they leave the roost. Roost sites may also be located by following birds returning to the roost in the evening. 	<p>Refer to habitat assessment method for survey and mapping of Black Cockatoo foraging habitat.</p> <p>Foraging bird surveys:</p> <ol style="list-style-type: none"> 1) 20 minute targeted searches of food resource areas. 2) Systematic area and transect searches combined with point surveys providing adequate coverage of the survey area. Area searches 20 minutes covering 2ha areas. Transects by vehicle and by foot for 20 minute periods. 20 minute point surveys.

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*Peak breeding – Carnaby Black Cockatoo – September to November, Baudin Black Cockatoo - October to January and FRTBC – April to June and August to November

Table 8-2: Black Cockatoo pre-clearance survey potential habitat tree rating system (Phoenix, 2021).

Rating	Potential	Description
10	Confirmed	Adult on nest, chick in nest.
9	Extremely high	Extremely high potential. High confidence in evidence of use i.e. visible fresh chewing around and at entrance to hollow, smooth entrance into hollow, scat line inside hollow, mulch material in base of hollow. Hollow attributes suitable for black cockatoo breeding i.e. entrance greater than 10cm diameter, depth of hollow greater than 80cm. If above criteria met then pole camera/drone used to confirm. Specific images to be sent to experts and where confirmed as a black cockatoo hollow, the rating is elevated to 10.
8	High	Moderate to high confidence in evidence of use. Likely chewing at hollow entrance. Hollow attributes suitable for black cockatoo breeding. Pole camera/drone to confirm.
7	Moderate-High	Possible chewing at hollow entrance. Hollow attributes suitable for black cockatoo breeding. Pole camera/drone to confirm.
6	Moderate	Hollow entrance and attributes suitable for BC breeding. Pole camera/drone to confirm.
5	Moderate	Hollow entrance and attributes on the limits of what may be considered suitable for BC breeding. Pole camera/drone to confirm. Pole camera/drone - Not possible to view inside hollow. Too high (usually >20 - 25m) or not possible to view hollow.
4	Low to Moderate	No visible evidence of chewing or breeding activity. Hollow entrance suitable. Depth questionable. Pole camera/drone to confirm.
3	Low	Hollows present, however, likely unsuitable by location, type or size. DBH moderate to high.
2	Low	Hollows present, however, likely unsuitable by location, type or size. DBH moderate.
1	Low	Hollows present, however, likely unsuitable by location, type or size. DBH low.
0	None	No breeding potential at the time of survey.

8.1.2 Other Avian Species

Table 8-3: Other Avian Species survey methods

Survey Method	Habitat Assessment
Aim	<ol style="list-style-type: none"> 1) Identify habitat potential for survey 2) Record the presence and extent of breeding locations (including contiguous offsite areas). 3) Map the extent, type and quality of the vegetation present. 4) Identify and record 'habitat trees' with potential to support significant avian species (other than Black Cockatoos).
Timing	<p>Habitat assessment may be performed at any time of the year.</p> <p>Time of year may influence breeding timeframes and species identification and interaction.</p>
Effort	<p>As required to adequately survey, covering the entire proposed disturbance area.</p> <p>Examine for breeding locations depending on the targeted species.</p> <p>Review potential breeding habitat feature and immediate surrounds for evidence of use or activity</p>
Methods	<ol style="list-style-type: none"> 1) Opportunistic search during other field based targeted surveys. Noting large nests, platforms and bird activity, 2) Identify habitat considered to be of high conservation significance and 'Potential Habitat Trees' following assessment protocol (Section 4.1.4).

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8.1.3 Mammal Species

Table 8-4: Mammal survey methods

Survey Method	Habitat Assessment
Aim	<ol style="list-style-type: none"> 1) Identify habitat potential for survey 2) Record the presence and extent of breeding locations (including contiguous offsite areas). 3) Map the extent, type and quality of the vegetation present. 4) Identify and record 'habitat trees' or 'habitat features' with potential to support significant mammal species.
Timing	<p>Habitat assessment may be performed at any time of the year.</p> <p>Where undertaken during breeding periods for the species, this may increase detection likelihood, species identification and interaction.</p>
Effort	<p>As required to adequately survey, covering the entire proposed pre-clearance area.</p> <p>Examining for 'habitat trees' and 'habitat features' suitable for the targeted species.</p>
Methods	<ol style="list-style-type: none"> 1) Opportunistic search during other field based targeted surveys. Noting 'habitat features' and mature trees with suitable hollows for potential use by medium to large mammal species, 2) Identify habitat considered to be of high conservation value and potential 'habitat trees' following assessment protocol (Section 4.1.4).