Covalent Lithium

Earl Grey Lithium Project

Terrestrial Fauna Environmental Management Plan

Rev	Originator	Reviewer	Date	Covalent approval	Date
1	L Whitley	K Moyle	6/04/20	A Pate	6/04/20
2	S Puglisi / L Whitley	K Moyle	24/8/20	A Pate	24/8/20
3	L Whitley	L Whitley	16/09/20	A Pate	16/09/20

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Executive Summary

This Terrestrial Fauna Environmental Management Plan (TFEMP) is submitted to meet condition 7 of MS 1118 for the Earl Grey Lithium Project which will be developed by a 50-50 joint venture (JV) between subsidiaries of Wesfarmers Ltd (ASX:WES) and Sociedad Química y Minera de Chile S.A. (SQM:NYSE) (SQM) operating under Covalent Lithium Pty Ltd (Covalent). The following table summarise the purpose of the TFEMP in the context of MS 1118 requirements and the Western Australia Environmental Protection Authority (EPA) objectives (EPA 2016) and the Commonwealth Department of Agriculture, Water and Environment (DAWE) Environmental Management Plan Guidelines (DoE, 2014).

Table ES1.1: Summary and Purpose of the Terrestrial Fauna Environmental Management Plan

Item	Description
Proposal title	Earl Grey Lithium Project.
Proponents name	Covalent Lithium Pty Ltd (Covalent).
Short description of Proposal	The proposal is to develop a pegmatite-hosted lithium deposit at the abandoned Mt Holland Mine Site, located approximately 105 km south-southeast of Southern Cross. The Development Envelope is 1,984 ha. The mining proposal involves a footprint of 667 ha of land, including new clearing of up to 386 ha of native vegetation, for a mine pit, waste rock dump, integrated waste landform, processing plant, airstrip, accommodation village and associated infrastructure.
Purpose of the Environmental Management Plan	This Terrestrial Fauna Environmental Management Plan (TFEMP) is intended to meet the requirements of condition 7 of Ministerial Statement 1118 (MS 1118). The purpose of this TFEMP is to provide a framework to ensure that impacts to chuditch (*Dasyurus geoffroii*), and malleefowl (*Leipoa ocellata*) found to be attributable to the Earl Grey Lithium Project are avoided to the maximum extent practicable and impacts do not compromise the EPA objectives for terrestrial fauna. The TFEMP has also been developed to address the Significant Impact Guidelines 1.1 – Matters of National Environmental Significance.
Key environmental factors	Terrestrial Fauna.
EPA Objective	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.
Key Project Objectives and Management Targets	The key environmental outcome and objective of this TFEMP as per condition 7-1 of MS 1118 is to: • Ensure there is no proposal-related direct or adverse indirect impacts to malleefowl mounds within the exclusion areas. • Ensure there is no removal of active malleefowl mounds within the Development Envelope. • Ensure there is no direct or indirect proposal-related significant adverse impacts to malleefowl and chuditch within the Development Envelope. Management targets of the TFEMP to meet this objective include: • Avoid clearing of vegetation within 100 m of malleefowl mounds. • Avoid removal of any active malleefowl mounds. • Minimise mortality of malleefowl or chuditch from clearing activity, entrapment, vehicle strike or mining related fire. • Minimise decline in population due to predation from introduced predators. • Minimise decline in population due to dust, noise, light, vibration and displacement. • Minimise decline in fauna habitat condition due to change in fire regime.

This TFEMP is designed to be adaptive and will be updated over the life of the Project. As monitoring programs are undertaken, quantifiable environmental criteria will be further defined. Covalent will update this TFEMP in consultation with relevant government departments, as such, this TFEMP remains a working document.

1. Context, Scope and Rationale

The proposed Earl Grey Lithium Project (the Proposal; the Project) is located approximately 105 km south–southeast of Southern Cross, Western Australia in the Shire of Yilgarn. Covalent Lithium Pty Ltd (Covalent), is a joint venture between Wesfarmers Limited (Wesfarmers) and Sociedad Química y Minera (SQM). A large, economic pegmatite–hosted lithium deposit was discovered by Kidman Resources Limited in 2016. The deposit is situated at the previously abandoned Mt Holland Mine Site, which was operated between 1988 and 2001, and comprises open pits, an underground mine, a processing plant, waste rock dumps, tailings storage facilities (TSF) and associated infrastructure. The Mt Holland Mine Site is largely unrehabilitated and currently a liability to the State of Western Australia.

This Terrestrial Fauna Environmental Management Plan (TFEMP) is intended to meet environmental outcomes and objectives of condition 7-1 of Ministerial Statement 1118 (MS 1118) which requires Covalent to:

> *7-1(1) The proponent shall ensure there is no proposal-related direct or adverse indirect impacts to malleefowl mounds within the exclusion areas as shown on Figure 4 and delineated by coordinates in Schedule 2.*
>
> *7-1(2) The proponent shall ensure there is no direct or indirect proposal-related significant adverse impacts to malleefowl and chuditch within the development envelope.*
>
> *7-1(3) The proponent shall ensure there is no removal of active malleefowl mounds within the development envelope.*

The exclusion zones mentioned by condition 7-1(1) are shown by Figure 2.1.

This TFEMP seeks to provide a framework to ensure potential impacts on chuditch (*Dasyurus geoffroii*), and malleefowl (*Leipoa ocellata*) found to be attributable to the Earl Grey Lithium Project (EGLP) are avoided to the maximum extent practicable.

1.1 Proposal

The Project will comprise open cut mining and processing of lithium ore, with transport of a lithium concentrate to a future lithium refinery in Kwinana. Within the Development Envelope (1984 ha), the total Project footprint is 667 ha with the full extent of the Project to be developed progressively over a 40 year period. The location of the Development Envelope and Proposed Layout is shown in Figure 1.1.

The Project has been designed to maximise the use of existing disturbance areas. The Project requires clearing of 386 ha of native vegetation and will use 281 ha of the existing cleared areas. The additional clearing is predominately required for the mine pit, waste landforms and ancillary infrastructure.

1.2 Key Environmental Factors

The Proposal was referred under s 38 of the EP Act on 19 May 2017. The Environmental Protection Authority (EPA) determined the Proposal requires a Public Environmental Review (PER) level of assessment on 14 July 2017. The EPA approved an Environmental Scoping Document (ESD) on 14 December 2017 identifying the preliminary key environmental factors, impacts to be assessed and work required to prepare the Environmental Review Document (ERD).

The ESD identified Terrestrial Fauna as a key preliminary environmental factor.

The Proposal was also referred under the Commonwealth Government *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and received a 'Controlled Action' decision

(2017/7950), which was authorised to be assessed under the WA bilateral assessment process. The EPBC Act requires an assessment as to whether a proposed action is likely to have a significant effect on a matter of national environmental significance (MNES).

The relevant MNES for the TFEMP are:

- Chuditch (*Dasyurus geoffroii*) – Vulnerable
- Malleefowl (*Leipoa ocellata*) – Vulnerable

On 21 February 2020, the delegate for the Federal Minister for Environment approved the proposal subject to the implementation of the conditions detailed by EPBC 2017/7950.

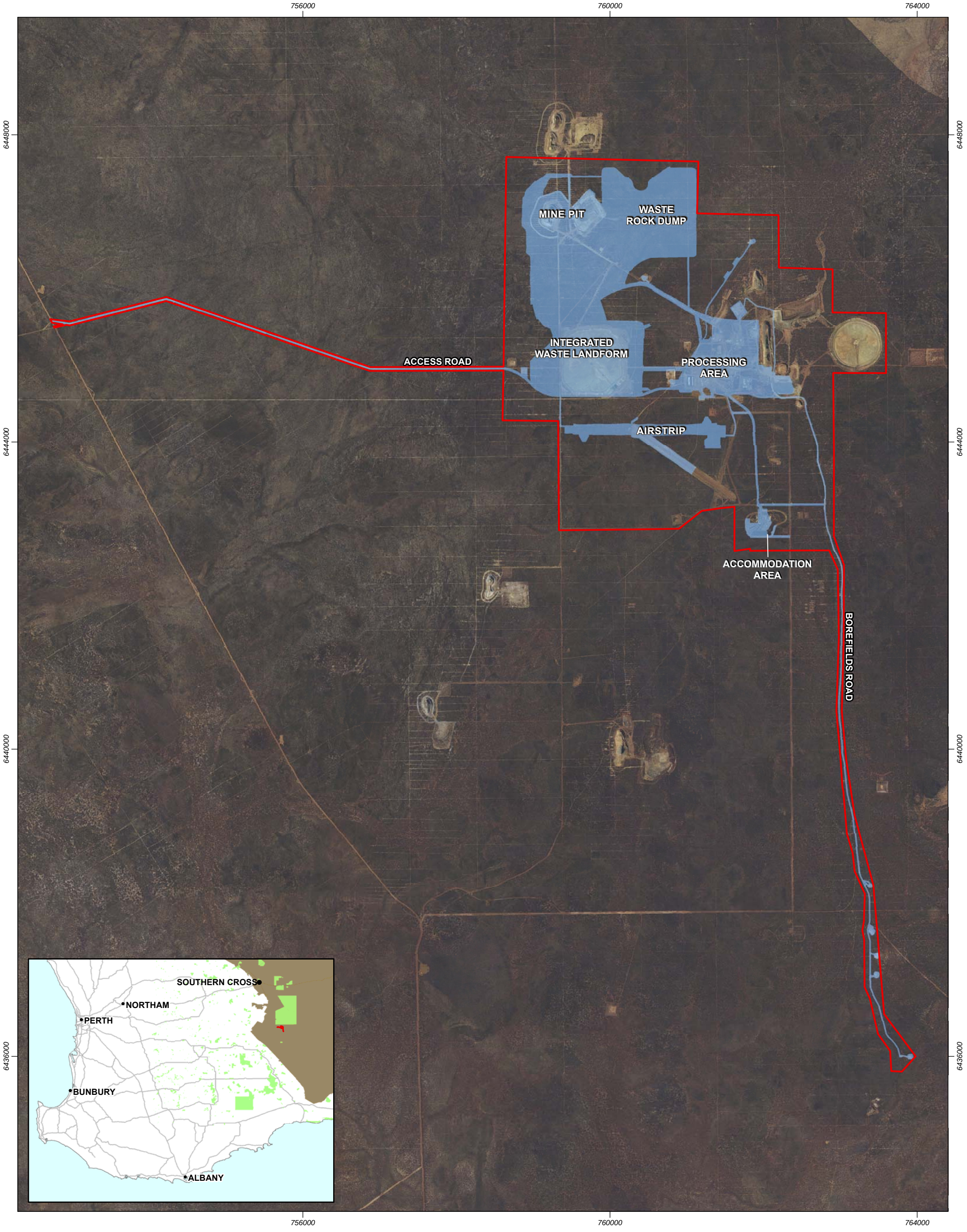

Figure 1.1: Earl Grey Lithium Project Development Envelope and Proposed Layout

N

Scale 1:45,000 at A3

0 500 1,000 m

Coordinate System: GDA 1994 MGA Zone 50

Date: 26/03/2020

Legend

- Development envelope
- Indicative project footprint
- Greater Western Woodland boundary

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Service Layer Credits: SLIP Public Sercives Locate Imagery 2019. Client: Covalent Lithium. Site data, 01/2020. Created by: cthatcher

1.3 Condition Requirements

The condition requirements relevant to meeting the key environmental outcomes and objectives of MS 1118 conditions 7-1 to 7-7 and sections of the TFEMP addressing those conditions is detailed by Table 1.1.

Table 1.1: MS 1118 Conditions and coverage by this plan

No. #	Condition	Plan Section
7-1	The Proponent shall implement the proposal to meet the following environmental outcomes and objectives: (1) The proponent shall ensure there is no proposal-related direct or adverse indirect impacts to malleefowl mounds within the exclusion areas as shown on Figure 4 and delineated by coordinates in Schedule 2; (2) The proponent shall ensure there is no direct or indirect proposal-related significant adverse impacts to malleefowl and chuditch within the development envelope; and (3) The proponent shall ensure there is no removal of active malleefowl mounds within the development envelope.	Section 2
7-2	In order to meet the requirements of condition 7-1, the proponent shall prepare and submit to the CEO a Terrestrial Fauna Environmental Management Plan on advice of the Department of Biodiversity, Conservation and Attractions within six (6) months of this statement being issued.	This Plan
7-3	The proponent shall not commence ground disturbing activities until such a time as the Terrestrial Fauna Environmental Management Plan required by condition 7-2 is approved by the CEO	This Plan
7-4	The Terrestrial Fauna Environmental Management Plan shall: (1) outline how the pre-clearance surveys will be undertaken using LiDAR or similar technology;	Section 2.4.2
	(2) outline the procedure for capture and release of chuditch, and malleefowl if required, prior to clearing of native vegetation;	Section 2.4.2, Table 2.3
	(3) specify trigger criteria that must provide an early warning that the environmental objectives identified in condition 7-1 may not be met;	Table 2.2
	(4) specify threshold criteria to demonstrate compliance with the environmental objectives specified in condition 7-1;	Table 2.2
	(5) specify monitoring to determine if trigger criteria and threshold criteria are exceeded;	Table 2.2, Section 2.4
	(6) specify trigger level actions to be implemented in the event that trigger criteria have been exceeded;	Table 2.2
	(7) specify threshold contingency actions to be implemented in the event that threshold criteria are exceeded; and	Table 2.2
	(8) provide the format and timing for the reporting of monitoring results against trigger criteria and threshold criteria to demonstrate that condition 7-1 has been met over the reporting period in the Compliance Assessment Report required by condition 4-6.	Table 2.2, Section 2.4, Section 2.5
7-5	After receiving notice in writing from the CEO that the Terrestrial Fauna Environmental Management Plan satisfies the requirements of condition 7-4 the proponent shall: (1) implement the provisions of the Terrestrial Fauna Environmental Management Plan; and	As required
	(2) continue to implement the Terrestrial Fauna Environmental Management Plan until the CEO has confirmed by notice in writing that the proponent has demonstrated the objectives specified in conditions 7-1 have been met.	As required
7-6	In the event that monitoring, tests, surveys or investigations indicates exceedance of threshold criteria specified in the Terrestrial Fauna Environmental Management Plan, the proponent shall: (1) report the exceedance in writing to the CEO within seven (7) days of the exceedance being identified;	Table 2.2, Section 2.5, Table 2.6

No. #	Condition	Plan Section
	(2) implement the threshold contingency actions specified in the Terrestrial Fauna Environmental Management Plan within 24 hours of the exceedance being reported as required by condition 7-6(1) and continue implementation of those actions until the CEO has confirmed by notice in writing that it has been demonstrated that the threshold criteria are being met and the implementation of the threshold contingency actions is no longer required;	Table 2.2, Section 2.5, Table 2.6
	(3) investigate to determine the cause of the threshold criteria being exceeded;	Table 2.2, Section 2.5, Table 2.6
	(4) investigate to provide information for the CEO to determine potential environmental harm or alteration of the environment that occurred due to threshold criteria being exceeded; and	Table 2.2, Section 2.5, Table 2.6
	(5) provide a report to the CEO within twenty-one (21) days of the exceedance being reported as required by condition 7-6(1). The report shall include: (a) details of threshold contingency actions implemented; (b) the effectiveness of the threshold contingency actions implemented, against the threshold criteria; (c) the findings of the investigations required by conditions 7-6(3) and 7-6(4); (d) measures to prevent the threshold criteria being exceeded in the future; (e) measures to prevent, control or abate the environmental harm which may have occurred; and (f) justification of the threshold remaining, or being adjusted based on better understanding, demonstrating that objectives will continue to be met.	Table 2.2, Section 2.5, Table 2.6
7-7	The proponent: (1) may review and revise the Terrestrial Fauna Environmental Management Plan, or	As required
	(2) shall review and revise the Terrestrial Fauna Environmental Management Plan as and when directed by the CEO.	As required
7-8	The proponent shall implement the latest revision of the Terrestrial Fauna Environmental Management Plan, which the CEO has confirmed by notice in writing, satisfies the requirements of condition 7-4.	As required

1.4 Rationale and Approach

The Proposal has been designed to avoid impacts to key environmental factors located within the footprint; including the location of malleefowl mounds in relation to key mining infrastructure. Results of baseline surveys and assumptions and uncertainties inform the management approach as summarised further in section 1.4.3.

1.4.1 Survey and study findings

Fauna surveys undertaken between October 2016 and June 2020, as outlined in Table 1.2, have been used to support the assessment of potential impacts of the Proposal on terrestrial fauna.

The surveys were completed in accordance with the standards set out in *Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA 2010), *Environmental Factor Guideline: Terrestrial Fauna* (EPA, 2016c), Survey guidelines for Australia's threatened mammals (Commonwealth Department of the Sustainability, Environment, Water, Population and Communities, 2011) and Survey guidelines for Australia's threatened birds (Commonwealth Department of the Environment, Water, Heritage and the Arts, 2010). The size and shape of the fauna survey areas evolved as the proposed mine footprint was developed and the Development Envelope finalised.

The original survey undertaken in October 2016 focused on the area of the orebody, and further surveys were commissioned in 2016 and 2017 to cover the remainder of the Development Envelope, to investigate chuditch distribution and the full context of fauna habitats within the Development Envelope and surrounding areas. In addition, chuditch and malleefowl surveys were conducted across a wider Regional Survey Area, comprising over 70,000 ha. A summary of the survey methods and findings are summarised in Table 1.2 and discussed in further detail below.

Table 1.2: Terrestrial fauna and habitat surveys

Survey Date	Survey Type and Extent	Survey Details
10 – 15 Oct 2016	Western Wildlife (2017) Reconnaissance survey with targeted searches for malleefowl and chuditch in the Earl Grey study area.	• Literature review and database searches. • Opportunistic records taken. • Habitats recorded and mapped. • **Chuditch**: 12 baited camera traps established for five nights totalling 60 trap nights within the Development Envelope. • **Malleefowl**: 269 km of transects completed by four personnel at 10 m spacing within the Development Envelope.

21 Nov - 4 Dec 2016	Western Wildlife (2017) Detailed survey (trapping and targeted searches), encompassing four study areas, including Early Grey and Irish Breakfast which occur within the Development Envelope. Prince of Wales and Van Uden study areas fall outside the Development Envelope, however, provide further regional context to the fauna and habitat assessment.	• Trapping –12 sites established comprising:
		  • 10 pitfall traps, 10 baited funnel traps, 10 baited Elliott traps and two baited cage traps for eight nights.
		  • each site had 80 pitfall trap–nights, 80 funnel trap–nights, 80 Elliott trap– nights and 16 cage trap–nights.
		  • the survey had 960 trap–nights for pitfalls, funnels and Elliott traps, and 192 trap–nights for cages.
		• Birds: 7 x 20–minute surveys undertaken at each trapping site.
		• Bats: SM2 ultrasonic bat detectors deployed for one night at each trapping site and the camp.
		• Spotlighting: two nights, six people in three teams using road–spotting and head–torching.
		• Opportunistic records taken.
		• Habitats recorded and mapped.
		• **Chuditch**: 45 baited camera traps for four or five trap nights totalling 189 trap nights covering both the Development Envelope and the Regional Survey Area.
		• **Malleefowl**: 306 km of transects completed by six personnel at 10 m spacing. 97 km of transects within Development Envelope and 209 km of transects in Regional Survey Area.

15 Jan – 25 Feb 2017	Western Wildlife (2017). Regional Chuditch survey.	• **Chuditch**: 44 baited camera traps deployed for 13 to 24 nights resulting in 794 trap nights covering both the Development Envelope and the Regional Survey Area. • Vegetation and habitat descriptions taken at camera trap locations. • **Malleefowl**: Opportunistic only.
12 - 21 Sept 2017	Western Wildlife (2017). Opportunistic malleefowl survey (in Development Envelope excluding previously surveyed areas in Oct 2016 and Dec 2016) and chuditch (within Regional Survey Area) survey.	• **Chuditch**: 20 baited camera traps deployed resulting in 350 trap nights covering the Regional Survey Area. • **Malleefowl**: Opportunistic only.
2 – 14 Oct 2017	Western Wildlife (2017). Level 2 (single season) fauna survey with targeted malleefowl survey.	• **Malleefowl**: 801 km of transects completed by two to six personnel at 10 m spacing. 780 km of transects within Development Envelope and 21 km of transects in Regional Survey Area. • **Chuditch:** 15 baited camera traps deployed for five nights resulting in 75 trap nights in the Development Envelope.
25 – 30 Nov 2017	Western Wildlife (2017). Targeted Chuditch (cage trapping) survey.	• **Chuditch**: Cage trapping in the Regional Survey Area timed to avoid the breeding season. Two transects of 50

Survey Date	Survey Type and Extent	Survey Details
		cage traps were established, one to the north and one to the south of the Development Envelope.
19 - 27 Jul 2019	Ecoscape (2019b) 2019 Mt Holland Chuditch Monitoring Survey	• Cage trapping at three grids within the Development Envelope (Impact) and three grids within Jilbadji Nature Reserve (Control). • 120 trap nights completed at both Impact and Control sites. • One capture of female Chuditch recorded at Impact site; no captures at Control site
14 – 18 Oct 2019	Ecoscape (2019a). Targeted search and monitoring by Ecoscape and WA National Malleefowl Recovery Group, previous data check and reconciliation.	• Monitoring of Mallee fowl mounds undertaken in accordance with NMRT guidelines. • Four additional mounds found, three inside the Development Envelope, though outside of the proposed layout, and one outside of the Development Envelope.

15 - 23 June 2020	Ecoscape (2020) 2020 Mt Holland Chuditch Monitoring	• Cage trapping for 2020 Chuditch monitoring, specifically:
		  • Establish and monitor three control sites more than five kilometres outside of the development envelope
		  • Establish and monitor three impact sites within the development envelope
		  • Undertake monitoring within the Chuditch breeding season (May to July).
		  • 120 trap nights completed at both Impact and Control sites.
		• One female Chuditch was recorded during the 2020 survey at control site 58. Mitchell's Hopping-mouse (*Notomys mitchelli*) was also recorded from both the control and impact sites.

1.4.1.1 Malleefowl

Malleefowl were historically common across southern Australia, however, since European settlement populations have reduced and become fragmented. Malleefowl are found in semi-arid to arid shrublands and low woodlands, especially those dominated by mallee and/or acacias and are likely to occur throughout the woodlands and shrublands of the region. Malleefowl have been found to range over one to many square kilometres.

Malleefowl surveys were undertaken on four occasions in the Development Envelope during October 2016, November 2016, September 2017 and October 2017. The October 2016 survey encompassed a large area that included but extended beyond the Development Envelope. Western Wildlife (2017) identified numerous records of malleefowl within 90 km of the Development Envelope through DBCA database searches and sighted malleefowl and recorded active mounds during the survey. The total survey effort for malleefowl included 269 km of intensively searched transects at 10 m spacing. In 2016 the search effort was focused on the location of potential deposits; Earl Grey, Irish Breakfast and Prince of Wales mine sites. In 2017, the survey effort covered the Development Envelope to fully characterise habitat utilisation.

A total of 51 malleefowl mounds were recorded during the Western Wildlife fauna surveys. These mounds included four active, eight recently active and 39 old mounds, with an additional ten instances of mound attempts that were not used for nesting. Of these, two active, four recently active and 31 old mounds were within the Development Envelope, and one recently active mound was found outside the edge of the Development Envelope on the bore fields road (Western Wildlife 2017). Over the course of two years, 12 birds were sighted (or observed on camera traps) in the Development Envelope and six outside of the Development Envelope.

Monitoring for malleefowl undertaken by Ecoscape (2019a) revisited mounds previously identified by Western Wildlife (Western Wildlife 2017). Each mound was assessed, under the guidance of a

National Malleefowl Recovery Group representative, to determine signs of current activity and the term of monitoring which each mound should receive in future monitoring events. At each mound a series of criteria was addressed as stated in The National Malleefowl Monitoring Manual (NMRT 2019). NMRT (2019) does not provide a definition for inactive mounds, although a mound profile is included. As NMRT terminology will be adopted going forward, mounds will no longer be referred to as 'inactive', instead the mound monitoring term will be utilised.

NMRT (2019) methodology outlines that malleefowl mounds should be categorised as follows:

- 'Active' is those mounds that are currently being used by malleefowl as an incubator for their eggs and are likely to contain eggs. These mounds receive an annual monitoring term.
- '5 year' mounds are defined as those that are very degraded and unlikely to be used again by malleefowl; they are regarded as optional for monitoring most years but are expected to be monitored every 5th year in the same way as annual mounds.
- 'Do not monitor' mounds are defined as:
    - Those deemed not to be malleefowl mounds
    - Those which could not be found despite several attempts over two to three seasons to located the mound
    - Those which are known to have been completely destroyed due to land disturbance

Several potential mounds identified in 2016 and 2017 surveys were determined as 'Do not monitor' mounds when revisited in 2019 monitoring. In line with NMRT (2019), these locations were deemed not to be malleefowl mounds, and are omitted from future monitoring in the NMRT database.

A total of 65 malleefowl mounds are identified from the Development Envelope (DE) and surrounds. Of these, 43 mounds were surveyed inside and 22 outside of the Development Envelope. Three mounds located outside of the DE (MM14, MM15, MM20) were not visited due to access and time constraints (Ecoscape, 2019a). One active mound was initially recorded (MM23) within the DE and another active mound was recorded (MM17) outside the DE (Figure 1.2). Camera sightings confirmed the presence of individuals during October and November 2019 at MM23. However, MM23 was re-classified as 'inactive' (Ecoscape 2020) due to a lack of activity from December 2019 onwards (potentially due to egg predation by a feral cat *Felis cattus* observed by a fixed motion-camera recording at this location). The remaining 42 mounds within the DE and 21 mounds outside the DE were either inactive (used within 5 years of this survey) or were long unused. A temporal analysis of malleefowl images determined a population estimate of two breeding pairs, and another three individuals currently inhabiting the DE and the immediate surrounding landscape. Trail cameras identified four different malleefowl mounds were visited by feral cats, which included both active malleefowl mounds.

Malleefowl in the study areas are likely to range over all habitats, favouring patches of shrubland on gravelly sands for mound construction. Although birds may forage in recently burnt habitats, unburnt areas are required for mound construction. Habitat loss, habitat fragmentation and introduced predators are recognised as current threats. Large–scale fires are also likely to impact this species, resulting in loss of leaf–litter to build their mounds.

Table 1.3: 2019 malleefowl mound summary

Monitoring term	Mound Location	
	Within Development Envelope	Outside Development Envelope
Annual	16 (includes 1 active mound)	12 (includes 1 active mound)
5 Year	13	3

Do not monitor	14	7 (includes 3 mounds not visited)
Total	43	22

As per Table 1.3, under the guidance of NMRT representatives and in line with the NMRT (2019) monitoring guidelines and protocols, future monitoring will exclude mounds classified as 'Do not monitor'. Any additional mounds found by chance during monitoring or when ground-truthing LiDAR data, will be monitored using the full NMRT (2019) monitoring criteria.

1.4.1.2 Chuditch

Chuditch is currently restricted to the south-west of Western Australia, with the majority occurring in the Jarrah forest with some wheatbelt/goldfields populations in drier woodlands, heath and mallee shrublands. Until recently, there were only occasional records of chuditch in the wheatbelt and goldfields, with this population estimated at 2,000 mature individuals. However, Western Wildlife (2017) identified numerous records of chuditch within 90 km of the Development Envelope through DBCA database searches. The most recent database records were predominately in Forrestania and mostly in association with the Cosmic Boy Mine approximately 55 km to the south of the Development Envelope (Western Wildlife 2017).

Western Wildlife undertook a targeted Level 2 survey in 2016 to 2017 which included targeted surveys for chuditch (Western Wildlife 2017). The surveys were undertaken over a 12-month period between October 2016 to November 2017 (Table 1.2). Overall, chuditch were recorded on 24 of the 42 camera traps set in the Development Envelope and 29 of the 94 camera traps in the Regional Survey Area. Due to the high mobility of chuditch, the camera traps may be recording individuals at numerous locations, however, this still indicates chuditch are distributed across a large area (Figure 1.3).

In the 2016 surveys, 18 chuditch were trapped (ten adults and eight dispersing young) and chuditch were recorded on 44 of the 101 camera trap locations showing a preference for unburnt habitats. In the 2017 surveys, 10 chuditch were trapped (three adults and seven dispersing young) and chuditch were recorded on 52 of the 136 camera trap locations (Western Wildlife 2017). Results of the November 2017 trapping period undertaken by Western Wildlife are likely to be an overrepresentation of the chuditch population due to the capture of dispersing young and sub-adults. It is difficult to determine sub-adult from a breeding adult at this time and therefore the time of year trapping is performed has a large impact on the results (Ecoscape 2019b).

Over the course of two survey years, 28 chuditch were trapped (13 adults and 15 dispersing young), of which 23 were within the Development Envelope (Western Wildlife 2017). Chuditch were also recorded on 24 of 42 camera traps over the two survey years, showing a preference for unburnt habitats. Factors that may have positively influenced chuditch numbers at Mt Holland include low numbers of feral predators and the presence of long-unburnt habitats to provide shelter and denning sites relative to the surrounding area (Western Wildlife 2017). Individuals are likely to have a core home range of 1,500 ha (males) or 300 – 400 ha (females), though they are highly mobile and likely to range even more widely and the core home–ranges are likely to overlap (Rayner, *et al*, 2011).

Chuditch monitoring was undertaken by Ecoscape (2019b) within the Impact site and Control site within Jilbadji Nature Reserve (Figure 2.3). Impact monitoring sites were positioned based on the proposed project layout and positioned to capture various impacts (for example airstrip, TSF and camp/processing). Impact monitoring sites were not able to be positioned within proximity of the open pit due to space constraints and access issues. Impact trap locations were modified from the 2019 monitoring to increase the collection area by elongating the grids to cover a wider area and remained in a similar general area as for the 2019 monitoring. Furthermore, monitoring locations were placed in positions that could be monitored over consecutive years and were unlikely to be disturbed by future works.

The 2019 chuditch monitoring was the first survey undertaken during the chuditch breeding season within the Development Envelope. Monitoring sites during the 2019 survey occurred both

within and outside the Development Envelope, representing impact and control monitoring sites respectively. Due to no records of chuditch occurring within the control sites in the 2019 monitoring survey (Ecoscape 2019b), it was recommended that new control sites be established in Jilbadji Nature Reserve closer to the Project area in the 2020 chuditch monitoring. The location of the 2019 monitoring sites and new established 2020 sites are shown in Figure 2.3.

One female chuditch was recorded during the 2019 survey at the Impact site and no chuditch were recorded at the Control site within Jilbadji Nature Reserve (Figure 1.3). No records were observed within the impact sites during the 2020 monitoring period. There was one capture of a female Chuditch at the control site. No other impact or control site traps recorded Chuditch. The single capture over 120 trap nights gave a low trap success result of 0.83% (1 capture / 120 control trap nights (30 traps open for four nights)). No data analysis was able to be performed as there was only a single Chuditch capture recorded during the 2020 monitoring. Combined results for 2019 and 2020 are one female capture at the impact site and control site respectively, over the 12 months of monitoring (Ecoscape 2020).

Chuditch are likely to occur in all habitats in the study areas, and may use hollow logs, burrows and old White–browed Babbler nests as den sites, as well as man–made structures such as rocky bund walls. Chuditch have a short life cycle, with males breeding within two years and dying, which results in chuditch population being subject to substantial changes in population numbers over a short time. While the Western Wildlife surveys only covered two years (2016 and 2017), substantial changes in population numbers can be seen. As the vegetation that was previously burnt to the east, north and south of the Development Envelope recovers the chuditch population is expected to return to these areas. Current threats are habitat loss, habitat fragmentation and introduced predators. Large–scale fires also impact this species through loss of den sites and prey.

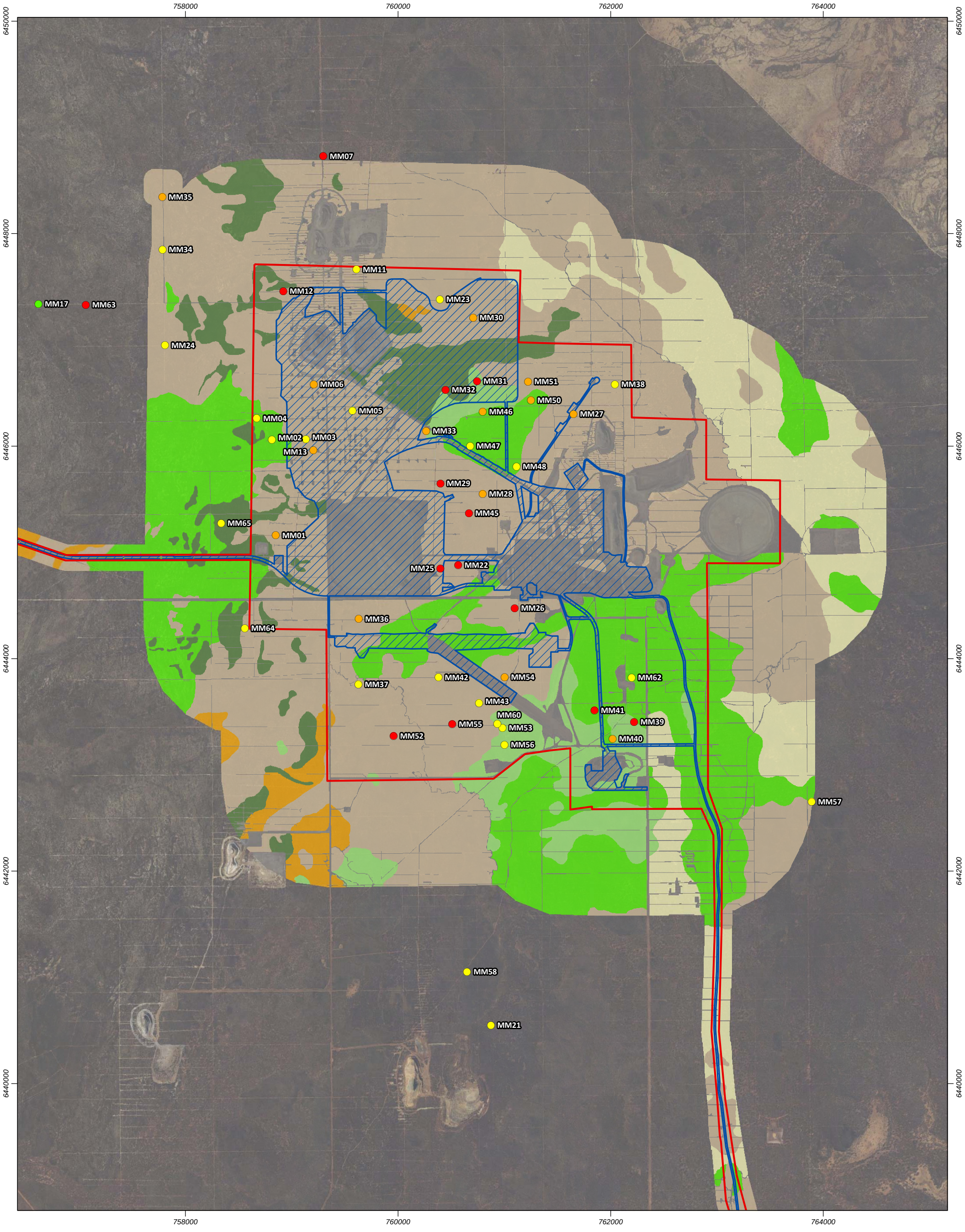

Figure 1.2: Malleefowl records

N

Scale 1:32,500 at A3

0 500 1,000 m

Coordinate System: GDA 1994 MGA Zone 50

Date: 24/08/2020

Legend

- Development envelope
- Indicative project footprint

Fauna habitat

- Mallee woodland on clay loams
- Mallee woodland on sands
- Mallee woodland on sandy clays
- Salmon Gum woodland
- Shrubland on flats
- Shrubland on laterite rises
- Cleared Land

Mallee Fowl mounds

- 5 yearly - Inactive
- Annual – Active
- Annual - Inactive
- Do Not Monitor - Inactive

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752000 754000 756000 758000 760000 762000 764000

6452000 6450000 6448000 6446000 6444000 6442000 6440000 6438000 6436000

Figure 1.3: Chuditch records

N

Scale 1:50,000 at A3

0 500 1,000 m

Coordinate System: GDA 1994 MGA Zone 50

Date: 6/08/2020

Legend

- Development envelope
- Indicative project footprint
- Scats (2017)

Track
- 2016
- 2017

Camera observations
- 2016
- 2017

Trapped
- 2016
- 2017
- 2019
- 2020

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1.4.2 Key assumptions and uncertainties

A number of assumptions and uncertainties based on surveys undertaken to date form the basis of the proposed management approach, as listed below.

1.4.2.1 Assumptions

- It is assumed that by utilising areas of existing disturbance and minimising clearing and implementing progressive rehabilitation throughout the life of the project, the impacts of the Project to conservation significant species will be minimised.
- Surveys to date provide sufficient information to confirm the presence of significant species and suggest a healthy population exists within the Project area and surrounding region.
- The Development Envelope and broader regional area have been adequately surveyed for terrestrial fauna, with surveys undertaken in both 2016 and 2017 comprising a detailed fauna survey, and targeted regional surveys.
- Both malleefowl and chuditch are highly mobile and have been recorded in all habitats, making it difficult to exclude any areas from being potential habitat.

1.4.2.2 Uncertainties

- Chuditch may utilise many shelters within a core range, so the location of shelters and breeding sites within the project area are unknown. The extent to which chuditch may utilise the existing disturbed area for den sites is unknown.
- Potential habitat for malleefowl and breeding mounds may be present throughout the Development Envelope.
- The level of fauna survey varied between different areas; the regional area survey was less intensive than inside the Development Envelope. The regional survey results confirm the presence outside the Development Envelope but may not adequately quantify the regional population.
- The extent to which climatic factors outside of Covalent's control will impact on the health and extent of populations of Conservation Significant Fauna, including malleefowl and chuditch.

1.4.3 Management Approach

Management measures to minimise the intensity of the effect are necessary to ensure the Project will not have a significant detrimental impact on key environmental factors. Specific application of the mitigation hierarchy for the Project is as follows.

1.4.3.1 Impacts

The potential impacts of relevance include:

- Direct impact through further loss and fragmentation of habitat from vegetation clearing.
- Direct impact through mobile equipment strikes resulting in mortality of single individuals.
- Indirect impacts from the formation of pit lakes, including fauna entrapment, poor water quality consumption by fauna and increased predators.
- Indirect impact through displacement by the proposed layout of construction and mining operations and changed fire regimes.
- Indirect impact through entrapment within mine infrastructure and equipment (open pipes, machinery and confined spaces presenting traps).

- Indirect impact from increased introduced predators presence as a result of access into areas from new tracks and roads, and attraction to rubbish tips.
- Indirect impact to fauna and habitat condition from dust, light, noise, vibration.

1.4.3.2 Focus on Avoidance

As described above, fauna surveys have informed the design and layout of mine site infrastructure to ensure direct impacts on malleefowl habitat and active mounds, and chuditch habitat have been avoided where practicable. Based on the current design and available survey information, the proposal will not result in any direct loss of active malleefowl mounds, as described in 1.4.1.1. Environmental criteria and response actions outlined in Section 2.1 will assist in avoiding direct and indirect impacts to the maximum extent practicable.

1.4.3.3 Minimising impact

While active malleefowl mounds will be avoided under the proposal, it should be noted that malleefowl have been recorded as re-using 'annual' and '5 year' mounds, rather than creating new mounds (NMRT 2019). This informs the NMRT (2019) guideline to monitor long, unused mounds every 5 years. Both malleefowl and chuditch utilise habitat across the Development Envelope for breeding and foraging. Both species could be susceptible to direct impacts from vehicle strikes and indirect impacts such as fauna habitat degradation through changed fire regimes and dust, displacement through light, noise and vibration. Applicable management actions and targets to minimise incidental mortality and indirect impacts are proposed in Section 2.2.

1.4.3.4 Remediation actions where impacts cannot be avoided

If incident reports or annual monitoring indicate that incidental mortality from vehicle strikes is an issue of significance, Covalent will consult with DBCA with respect to adaptive management measures and controls that could be implemented to reduce impact to fauna. In addition, other regional actions that would benefit affected species on a regional scale will be considered. This may include supporting research programs into malleefowl and chuditch populations, introduced predator control programs (focusing on fox and cat populations) or habitat conservation.

1.4.3.5 Rationale for choice of provisions

The mitigation hierarchy is based on the objective of avoiding direct impacts and minimising indirect impacts to conservation significant species and their habitat. The positioning of mine site infrastructure within existing disturbed areas and a progressive clearing timeline to develop the mine will minimise the amount of active disturbance present and avoid direct impacts to malleefowl habitat and active mounds, and chuditch habitat.

The management approach is informed by results of baseline surveys and the Project as detailed in EPA Report 1651. The Project will have a relatively small footprint within the bioregion, with greater than 98% of vegetation extent remaining both within and outside of conservation areas. Development of the mine will occur over 40 years and will utilise up to 40% of existing disturbance. Progressive rehabilitation will be undertaken during the life of mine including rehabilitation of existing State liabilities.

Periodic review of the management approach will be undertaken based on monitoring results and incident data. Adaptive management measures will be implemented with a view to achieving continuous improvement into minimising impacts to conservation significant species.

The TFEMP includes both outcome-based and management-based provisions. Outcome-based provisions have been established where the level of impact is known and quantifiable, in this case specifically associated with clearing and impacts to active malleefowl mounds. Movement of malleefowl and chuditch across the region and the short life span of chuditch is likely to result in natural variation of the number of individuals and populations within and surrounding the Development Envelope. In addition, future potential direct impacts from incidental mortality and indirect impacts to populations are unable to be accurately quantified.

2. Management plan provisions

The key objectives of the TFEMP are to meet the condition requirements of MS1118, specifically the objectives and outcomes of condition 7-1

To meet this objective, management provisions have been established for the potential impacts as summarised in Section 1.4.3.

As environmental impacts incorporate both quantifiable and non-quantifiable impacts, outcomes-based and management-based provisions have been included in the TFEMP. Early response triggers for management-based provisions are detailed in Section 3.1.

Outcome-based provisions are performance-based and may be used where the part of the environment is capable of objective measurement and reporting. Therefore, outcome-based provisions have been established to specify triggers and thresholds on direct impacts and to ensure the Project achieves acceptable environmental outcomes.

Management-based provisions relate to management actions and may be used where the part of the environment is not capable of objective measurement and reporting. Therefore, management-based provisions have been established to specify management actions and targets, particularly for indirect impacts that are non-quantifiable. As monitoring is undertaken and additional population data is gathered, the management targets are expected to be reviewed and quantifiable outcome-based provisions established.

2.1 Outcome-based provisions

The primary objective of terrestrial fauna management is to avoid direct and minimise indirect impacts to malleefowl and chuditch individuals and habitat to the maximum extent practicable.

Environmental criteria, including both triggers and thresholds, based on the primary objectives for terrestrial fauna management, are detailed in Table 2.2.

2.1.1 Environmental Criteria justification

Triggers and thresholds by which to measure performance against the environmental objectives of MS1118 condition 7-1 are detailed by Table 2.1.

Table 2.1: Environmental Criteria justification

Environmental Objective	Environmental Criteria	Justification
MS1118 Condition 7-1 (1) – Ensure there is no proposal-related direct or adverse indirect impacts to malleefowl mounds within the exclusion areas (Figure 2.1). MS1118 Condition 7-1 (3) – Ensure there is no removal of active malleefowl mounds within the Development Envelope.	Trigger Criteria: • clearing without an authorised internal permit within the Development Envelope, but outside of the Malleefowl Mound Exclusion Zone (MMEZ). • Unauthorised access by personnel to a MMEZ.	If clearing occurs which has not received an approved internal clearing permit within the Development Envelope, but outside of the MMEZ, it is considered a non-compliance or failure of the procedure which is in place to prevent clearing of the MMEZs. Similarly, if personnel accessed a MMEZ without authorisation, it also represents a failure in the procedure and permit to control access to the area. A spotter is required when authorised (as part of the approved internal clearing permit) clearing occurs within 10 metres of any exclusion zone. This takes into account potential inaccuracy which may arise from GPS navigational systems, line of sight for demarcation barriers and internal reporting requirements.
	Threshold Criteria: • Clearing or disturbance of vegetation up to the MMEZ and / or up to 100 m of any newly identified active Malleefowl mounds.	Avoidance of malleefowl mounds with a buffer of 100 m (MMEZ), would prevent any direct impact or minimise indirect impacts due to the separation distance. The 100 m exclusion area for any newly identified active malleefowl mounds is considered industry standard associated with maintaining adequate surrounding vegetation and minimising indirect impacts (noise, dust and vibrations). The buffer distance is based on similar approved Malleefowl Management Plans and Ministerial Statements within similar vegetation associations.
MS1118 Condition 7-1 (2) The proponent shall ensure there is no direct or indirect proposal-related significant adverse impacts to malleefowl and chuditch within the Development Envelope	Chuditch Trigger Criteria: • A 25% decrease at impact sites in female abundance for two consecutive monitoring events. Malleefowl Trigger Criteria • A 25% decrease in the estimated local population number (based on temporal analysis) over a consecutive two-year period.	Chuditch is subject to natural population fluctuations due to a highly variable breeding cycle. It is therefore proposed to compare abundance of breeding female adults at impact sites within Development Envelope to determine any potential proposal related impacts. Monitoring of malleefowl activity using trail cameras and mound status will be undertaken in conjunction with annual population monitoring as per the NMRT (2019) guidelines. Temporal analysis will be undertaken to determine an estimated local population. A decreasing trend in population numbers may be an indication of malleefowl displacement from the Development Envelope. Should the trigger criteria be breached, temporal analysis will be compared to that of other nearby local populations to determine if the reduction in activity is confined to the Development Envelope and therefore Project related.
	Chuditch Threshold Criteria: • A 50% decrease at impact sites in female abundance for two consecutive monitoring events. Malleefowl Threshold Criteria: • A project related 50% decrease in the estimated local population (based on temporal analysis) over a consecutive two-year period.	

Table 2.2: Terrestrial fauna (Malleefowl and Chuditch) outcome-based provisions

Environmental Objective	Environmental Criteria	Response actions	Monitoring	Reporting
MS1118 condition 7-1 (1) – Ensure there is no proposal related direct or adverse indirect impacts to malleefowl mounds within the exclusion areas (Figure 2.1). MS1118 Condition 7-1(3) – Ensure there is no removal of active malleefowl mounds within the Development Envelope.	Trigger Criteria: • clearing without an authorised internal permit within the Development Envelope, but outside of the Malleefowl Mound Exclusion Zone (MMEZ)	• Report internally as an incident in accordance with internal procedures. • Review management strategies and implement changes to prevent future occurrences which may include the following: • Audit and review of training and staff inductions (ie. Increase in staff training and awareness to include information on MMEZ, legislative requirements, appropriate clearing procedures). • Ground Disturbance Permit competency training. • Review impact of unauthorised clearing and report any noncompliance to DWER within 7 days of identification. • Installation of signage where appropriate. • Review of effectiveness of 10 m trigger response criteria for unauthorised clearing approaching a MMEZ and update FMP appropriately. • Undertake rehabilitation of unauthorised clearing (ie disturbance from vehicle tracks, vegetation clearing) by appropriately qualified personnel as required, in accordance with rehabilitation procedure.	• Internal audit of recorded malleefowl mounds against areas of clearing. • Monitoring of incident reports for over clearing, light and noise disturbance and fire.	• Annual reporting • Clearing Register • Internal clearing permits • Survey data • Incident reports.
	Trigger Criteria: • Unauthorised access by personnel to a MMEZ	• Report internally as an incident in accordance with internal procedures. • Consult with a fauna specialist to review management strategies and implement changes to prevent future occurrences which may include the following: • Review proximity of potential of disturbance to malleefowl mounds within the MMEZ. Should disturbance occur to an active malleefowl mound as a result of unauthorised access, report to DWER within 7 days of identification. • Undertake rehabilitation of unauthorised access (ie disturbance from vehicle tracks) as required in accordance with internal rehabilitation procedures.		
	Threshold Criteria: • Clearing or disturbance of vegetation within 100 m of any newly identified active malleefowl mounds and / or the MMEZs.	• Cease clearing activities. • Undertake investigation to determine source of disturbance. • If disturbance is attributed to Proposal activities, undertake a review of layout to determine if impact can be minimised, development actions to prevent a recurrence and communicate findings to relevant personnel • Suitably qualified fauna specialist to undertake an assessment of impact • If potential impacts to eggs are expected, consultation with DBCA will occur to determine if egg removal is required • Rehabilitation of vegetation disturbance to be considered to re-instate fauna habitat • Any impacts to mounds to be rehabilitated following consultation with DBCA and a suitably qualified fauna specialist • Report as a non-compliance to DWER within 7 days of identification • Investigate and report in accordance with condition 7-6 of MS1118. Report submitted to DWER with remediation actions proposed.		
MS1118 condition 7-1 (2) The proponent shall ensure there is no direct or indirect proposal-related significant adverse impacts to malleefowl and chuditch within the Development Envelope	Chuditch Trigger Criteria: • A 25% decrease at impact sites in female abundance for two consecutive monitoring events. Malleefowl Trigger Criteria • A 25% decrease in the estimated local population number (based on temporal analysis) over a consecutivetwo year period.	• Report internally as an incident. • Review all monitoring data (including control sites) in relation to management measures (Table 2.3) and any other available data such as weather and climate to determine if the decrease is due to proposal related impacts. • Determine whether the changes observed in the impact sites for chuditch are comparable to the observations in the reference sites. • Investigate potential causes for the observed decrease in female chuditch abundance or decrease in local malleefowl population which may include but are not limited to: • seasonal conditions (e.g. rainfall and temperatures) • effectiveness of introduced predator control • changes in mound usage patterns by malleefowl (i.e. use of mounds that are not surveyed) • spatial variation (near-impact areas) versus sites located further from impact • reliability of observations obtained from the sightings register • fauna deaths reported • Seek advice from a suitably qualified fauna specialist as required. • If proposal related impact is suspected, review management measures on advice from a suitably qualified fauna specialist. Management measures may include the following: • Review of annual malleefowl and chuditch monitoring where required • Review and increase effectiveness of pre-clearance monitoring (for example timing/ duration of surveys) • Review and refine remote camera monitoring for introduced predators (foxes and cats).	• Pre-clearance monitoring • Annual monitoring of malleefowl activity using motion sensor cameras • Annual monitoring of malleefowl as per NMRT (2019) guidelines • Annual monitoring of chuditch using cage trapping • Internal audit and monitoring of areas of clearing • Monitoring of incident reports for unauthorised clearing, light and noise disturbance and fire.	• Annual reporting • Weekly reporting when Fauna specialist is on site • Clearing Register • Internal clearing permits • Survey data • Incident reports.

Environmental Objective	Environmental Criteria	Response actions	Monitoring	Reporting
		• A proportionate increase in trapping/ baiting intensity may be required for introduced predator control in areas where increased sightings occur • Increase in the frequency of introduced predator control undertaken may be required • Increase internal audits and inspections for incident reports relating to vehicle interactions, unauthorised clearing, light and noise disturbance and fire. • Fauna death register may require review and locations of deaths examined to identify areas where a decrease in speed limits, alteration to roads and extra signage may be required. • Increase in staff training and awareness to include information on feral species (e.g. impact of feral predators on malleefowl and chuditch populations, no feeding of feral species, reducing availability of food waste to feral animals and all sightings of feral species to be reported).		
	Chuditch Threshold Criteria: • A 50% decrease at impact sites in female abundance for two consecutive monitoring events. Malleefowl Threshold Criteria: • A project related 50% decrease in the estimated local population (based on temporal analysis) over a consecutive two year period.	• Report as a non-compliance to DWER within 7 days of identification • Investigate and report in accordance with condition 7-6 of MS1118. Report submitted to DWER with remediation actions proposed. • Review all monitoring data (including control sites) in relation to management measures (Table 2.3) and any other available data such as weather and climate to determine if the decrease is due to proposal related impacts. • Seek advice from a suitably qualified fauna specialist as required. • If proposal related impact is suspected, increase management measures on advice from a suitably qualified fauna specialist to reduce the exceedance below threshold criteria. Management measures may include but are not limited to the following: • Review of annual malleefowl and chuditch monitoring where required and threshold criteria and early response triggers • Review and increase effectiveness of pre-clearance monitoring (for example timing/ duration of surveys) • Review and refine remote camera monitoring for introduced predators (foxes and cats), for example trapping effort, survey timing and frequency, location and placement of cameras. • A proportionate increase in trapping/ baiting intensity may be required for introduced fauna control coinciding with regional control programs. • Increase in the frequency of introduced predator control undertaken may be required • Increased frequency of internal audits and inspections for incident reports relating to vehicle interactions, unauthorised clearing, light and noise disturbance and fire. • Fauna death register may require review and locations of deaths examined to identify areas where a decrease in speed limits, alteration to roads and extra signage may be required. • Increase in staff training and awareness to include information on feral species (e.g. impact of feral animals on malleefowl and chudditch populations, no feeding of feral species, reducing availability of food waste to feral animals and all sightings of feral species to be reported). • Further regional surveys and monitoring to determine impacts to population		

2.2 Management-based provisions

The following management actions will assist in meeting the trigger and thresholds proposed in the outcome-based provisions (Section 2.1). These actions will be reviewed as part of the monitoring and reporting process and changes made where required.

The management actions detailed in Table 2.3, are summarised as:

- Clearing management
- Malleefowl mound management
- Chuditch habitat and relocation management
- Traffic management
- Fauna entrapment management
- Introduced predator management
- Fire management
- Light, noise and vibration management
- Dust management.

The management targets are:

- Minimise incidental mortality of malleefowl or chuditch from clearing activity, entrapment, vehicle strike or mining related fire.
- Minimise decline in population due to introduced predators.
- minimise decline in population due to the formation of pit lakes, including fauna entrapment, poor water quality consumption by fauna and increased predators.
- Minimise population decline due to entrapment within mine infrastructure and equipment (open pipes, machinery and confined spaces presenting traps).
- Minimise decline in population due to dust, noise, artificial light, vibration and displacement.
- Minimise decline in fauna habitat condition due to dust or changed fire regimes.

Early response triggers have been established for management targets and are detailed in Section 3.1.

Table 2.3: Terrestrial fauna (malleefowl and chuditch) management-based provisions

Environmental objectives	Management Actions	Management targets	Monitoring	Reporting
• MS1118 condition 7-1 (1) – Ensure there is no proposal related direct or adverse indirect impacts to malleefowl mounds within the exclusion areas (Figure 2.1). • MS1118 condition 7-1(3) Ensure there is no removal of active malleefowl mounds within the Development Envelope. • MS1118condition 7-1 (2) The proponent shall ensure there is no direct or indirect proposal-related significant adverse impacts to malleefowl and chuditch within the Development Envelope	Clearing management controls: • Implementation of an internal clearing permit procedure, including onsite demarcation and notification procedures, that limits access to the MMEZs by foot only or only by car where there is an existing track. • MMEZs within close proximity to operational areas to be delineated with flagging tape, signage or similar to alert all personnel of their location. • Inductions of all site personnel to include information on the location of MMEZs, management targets, measures and expectations. • Undertake progressive clearing, minimising the amount of active disturbance present. • Progressively rehabilitate areas as appropriate. • Preferential clearing outside of the egg incubation season (September to February) and potentially the mound building season (June to August). • Clearing of the eight mounds (MM03, MM05, MM06, MM13, MM25, MM30, MM31, MM32) within the Proposed Layout provided in the final approved Covalent Lithium – Earl Grey Lithium Project Response to Submissions (August 2019, Covalent Lithium) will occur between March to May, outside of the mound building, breeding and incubation season (June to February).	• Minimise incidental mortality of Malleefowl and Chuditch from clearing activity, entrapment, vehicle strike.	• Annual monitoring of Malleefowl and Chuditch (section 2.4). • Internal audit of potential entrapment areas, speeding and night driving. • Monitoring of incident reports for Malleefowl and Chuditch predation, vehicle strike, speeding and night driving.	• Annual reporting. • Internal audit reporting for areas of clearing, areas of potential entrapment, speeding and night driving. • Incident reports. • Weekly reporting when Fauna specialist is on site.
	Malleefowl management controls: • All malleefowl sightings, active and inactive mounds will be recorded including date, observer, status of mound/malleefowl and a location description. This information will be assessed as part of annual monitoring. Pre-clearance surveys • Pre-clearance surveys will only be undertaken during the incubation period when mounds are likely to be active from September to February and occur a minimum of two weeks prior to clearing, to identify any malleefowl mounds and determine their status. Outside of this incubation period, annual and 5 year population monitoring will be adequate to determine the presence of mounds and their status. • LiDAR survey of areas planned for clearing will be undertaken to inform pre-clearance surveys annually for the first year during the construction period and any potential mounds checked to determine if they are active, and monitoring term defined. Pre-clearance surveys will be conducted in accordance with the National Malleefowl Mound Monitoring Manual and utilise LiDAR technology (NMRT 2019). • Following the initial one-year period, LiDAR surveys will be undertaken as required depending on the size and scale of the clearing area. If it is more practical and effective to search an area on foot as opposed to LiDAR, 10 m wide transects across the entire area will be employed to determine the presence of mounds and their status. • Pre-clearance surveys will be undertaken as described by section 2.4.2. • Pre-clearance walk throughs will be undertaken to identify and displace fauna prior to clearing. Pre-clearance walk throughs will be undertaken the morning before clearing / disturbance to displace individuals and will include searching and checking refugia sites. In the event malleefowl are found in the area to be cleared and there are no new active mounds, fauna specialists will implement a displacement method to allow the malleefowl to egress on their own but remain within their home range. • Active mounds will be avoided as per MS1118 7-1 (3) and a 100m buffer will be applied to active mounds to be flagged in the field as no–go zones (Figure 2.1). • Suitably qualified fauna personnel will be present during clearing activities, in the unlikely event that malleefowl or fauna are injured during clearing. The person will hold a permit to handle and move conservation significant fauna under the *Biodiversity Conservation Act 2016*, and have access to a care facility that can be used to rehabilitate injured fauna and a procedure in place developed in consultation with DBCA.			
	Chuditch controls: • Clearing will be avoided between the months of September to November where possible to mitigate impacts to denning females. • Vegetation clearing will be undertaken during the day time only, when chuditch are generally less active. Pre-clearance surveys • Pre-clearance surveys will be undertaken as described by section 2.4.2 to record the presence/absence of chuditch in the area to be cleared. • The procedure will involve pre-clearance walk throughs to be undertaken the morning before clearing / disturbance to displace individuals and will include searching and checking refugia sites and trapping for chuditch the night immediately prior to clearing and holding the chuditch for no more than one night. Chuditch will be released into a nearby area from where it was caught following the completion of daytime clearing activities. • Should clearing be undertaken during September to November then the pre-clearance survey procedure for the months of September, October and November will be slightly modified to further mitigate the risk to breeding and denning females.			

Environmental objectives	Management Actions	Management targets	Monitoring	Reporting
	During these months, in the event a female is captured it will be held during the day and released during the evening with a radio collar. The radio-collared female will be tracked to identify the location of the den. Once identified trail cameras will be installed to monitor den activity and an exclusion radius of 100 m applied for clearing activity. The exclusion radius area will not be cleared until such time as it appears the female and young have left the den. A fauna handling procedure will be developed in consultation with DBCA. • Suitably qualified fauna personnel will be present for clearing activities to undertake capture and release activities. The person will hold a permit to handle and move significant fauna under the *Biodiversity Conservation Act 2016*, and have access to a care facility that can be used to rehabilitate injured fauna and a procedure in place developed in consultation with DBCA.			
	Traffic management controls: • Avoid accidental disturbance to fauna and habitat by enforcing strict traffic management rules (e.g. keeping to designated tracks, limited driving between dusk and dawn, driving to road and weather conditions, reduced speed limits within suitable habitat, malleefowl and chuditch signage). • All sightings and interactions with malleefowl and chuditch to be reported to Environmental personnel. • Environmental personnel to identify and establish working relationships with local wildlife carers/vets for injured malleefowl and Chuditch. • Worker awareness training.			

	Fauna entrapment controls:
	• During construction, all construction pipes, culverts, or similar structures stored on–site overnight, will be inspected thoroughly for wildlife by a qualified fauna specialist or properly trained on–site personnel before the pipe is buried, capped, used, or moved.
	• If the inspection indicates presence of conservation significant species inside stored materials or equipment, work on those materials will cease until a suitably qualified fauna specialist determines the appropriate course of action.
	• To prevent pit lake entrapment, a pit lake ramp will be put in place as part of the closure plan. The ramp will enable fauna to exit the pit lake and avoid entrapment.
	• To prevent entrapment of animals, all excavations, steep-walled holes or trenches more than one meter deep will be secured against animal entry at the close of each day, where possible. Any of the following measures may be employed, depending on the size of the hole and method feasibility:
	  • construction holes and trenches will be securely covered (no gaps) with plywood or similar materials at the close of each working day, or any time the opening will be left unattended for more than one hour.
	  • in the absence of covers, the excavation will be provided with escape ramps constructed of earth or untreated wood, sloped no steeper than 2:1, and located no farther than 100 m apart.
	  • in situations where escape ramps are unfeasible, the hole or trench will be surrounded by filter fabric fencing or a similar barrier with the bottom edge buried to prevent entry as appropriate, or
	  • If a trench with a greater distance than 100 m is required to be left open for more than one day, trench inspections shall be undertaken to identify any entrapped fauna and relocation completed. The requirement and specifics (frequency and timing) for trench inspections will be determined by environmental personnel, however inspections after sunrise, before sunset and prior to backfilling may be required.
	• Domestic waste facilities will be fenced, and putrescible waste receptacles will be covered.
	• Containers to have doors closed securely when not in use.
	• Permanent water sources (tanks, ponds and dams) to be fenced and / or have fauna egress mats installed.			

	Introduced predator control management: • Introduced predators identified will be reported to Environmental personnel and recorded to monitor occurrences. • Avoid attraction of introduced predators to the Development Envelope by implementing domestic waste management procedures (e.g. fencing of landfills, regularly covering putrescible waste, secure lids on bins). • Introduced predator control will be undertaken on site in cooperation with regional control programs. • Induct personnel on waste management and introduced predator control measures. • Introduced predator monitoring to be undertaken in accordance with methodology outlined in section 2.4.1. • Predator density by monitoring activity will be monitored and any causal factors identified to ensure appropriate management measures are undertaken. Consideration shall be given to local and regional baiting or a review of food sources at camp or the landfill.	• Minimise decline in population due to predation from introduced predators.	• Introduced predator population monitoring. • Malleefowl and chuditch population monitoring.	• Annual reporting. • Introduced predator control reports. • Incident reports.
	Dust, noise, light and vibration management: • Dust suppression measures that include good house–keeping practices for vehicles, cleared areas, and active stockpiles. • Dust suppression measures such as the use of watercarts will be used during dry and windy conditions, as required. Noise, light and vibration management: • Machinery and equipment will be fitted with noise attenuation measures to meet personnel safety requirements. • Installation of lighting that direct lights toward plant areas to minimise light spill into adjacent vegetated areas.	• Minimise decline in population due to dust, light, noise, vibration and displacement.	• Monitoring of incident reports for light and noise disturbance. • Malleefowl and chuditch population monitoring.	• Annual reporting. • Flora and Vegetation health reporting as per Flora and Vegetation Management Plan.

Environmental objectives	Management Actions	Management targets	Monitoring	Reporting
	• Equipment design will specify compliance with Australian Standard noise limits.		• Dust, Flora and Vegetation health monitoring as per Flora and Vegetation Management Plan.	• Incident reports of speeding. • Incident report of significant dust plumes.
	Fire management: • Implementation of fire management procedures (e.g. maintenance of fire breaks, Hot Work Permit system, firefighting training, Emergency Response Plan). • Firefighting equipment will be located on site and in vehicles. • Lightning protection equipment will be installed as part of Project design where necessary. • Vehicles will not be permitted to leave access tracks or cleared areas. • Coordination with DBCA and Department of Fire and Emergency Services (DFES) to undertake prescribed burns.	• Minimise decline in fauna habitat condition due to changed fire regimes.	• Flora and vegetation health population monitoring as per Flora and Vegetation Management Plan.	• Annual reporting. • Flora and Vegetation health reporting as per Flora and Vegetation Management Plan.

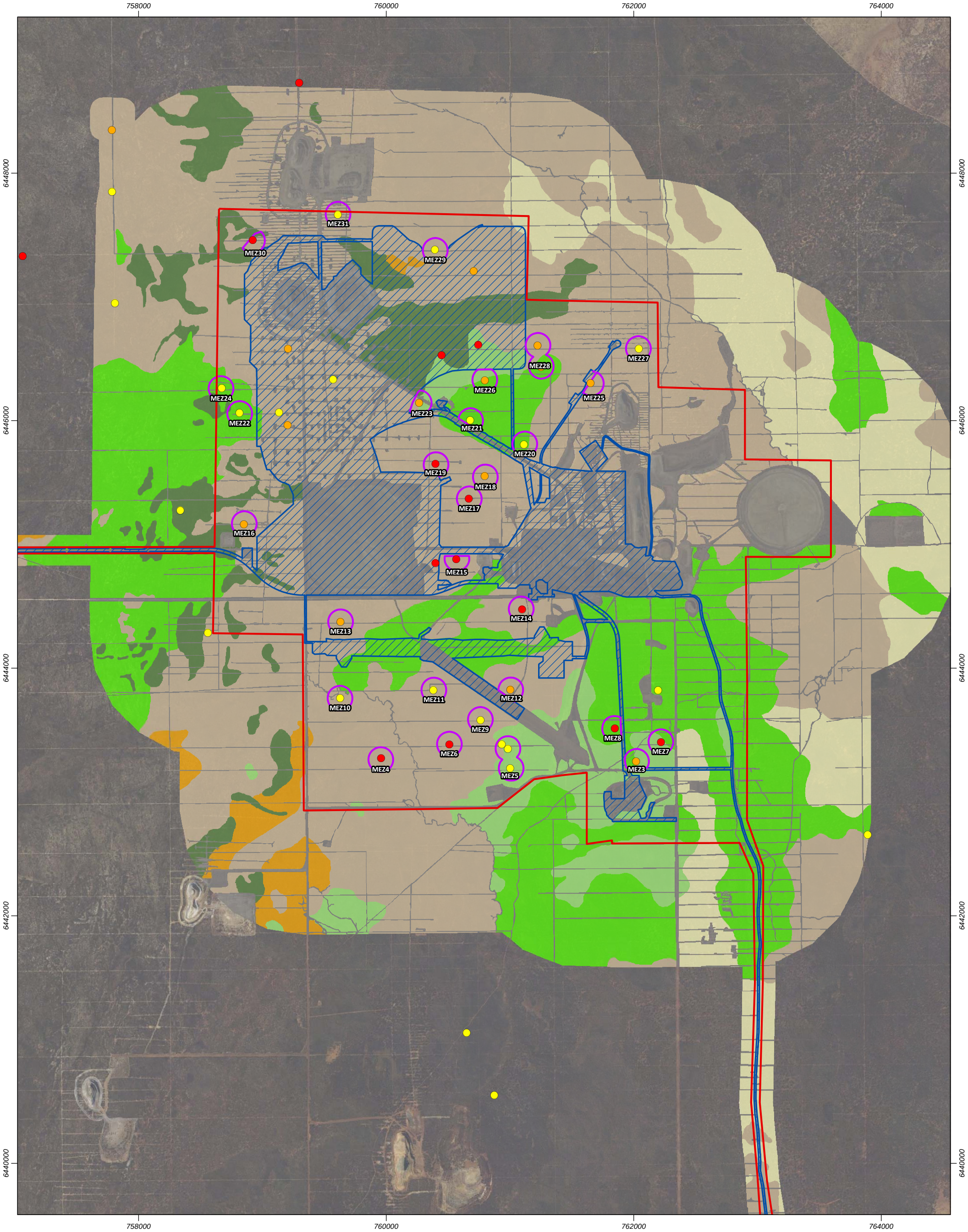

Figure 2.1: Conservation significant fauna exclusion areas

N

Scale 1:28,000 at A3

0 500 1,000 m

Coordinate System: GDA 1994 MGA Zone 50

Date: 24/08/2020

Legend

- Development envelope
- Indicative project footprint
- Malleefowl mound exclusion zones

Fauna habitat

- Mallee woodland on clay loams
- Mallee woodland on sands
- Mallee woodland on sandy clays
- Salmon Gum woodland
- Shrubland on flats
- Shrubland on laterite rises
- Cleared Land
- 5 yearly - Inactive
- Annual - Inactive
- Do Not Monitor - Inactive

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2.3 Implementation

Implementation of the TFEMP will be assisted through an Environmental Management System that will incorporate systems, processes, procedures and work instructions relating to the management, monitoring and reporting components of the TFEMP.

Covalent is committed to conducting its activities at the Earl Grey Lithium Project (the Project) in an ecologically responsible manner. The key personnel involved in implementation of the TFEMP and their roles and responsibilities are listed in Table 2.4.

Table 2.4: Summary of roles and responsibilities relevant to the Earl Grey Lithium Project TFEMP

Role	Responsibility
Covalent	• Covalent have the overall responsibility for implementation of the TFEMP • if any roles are delegated to a contractor or consultant, Covalent has the responsibility to audit compliance and ensure any contingency actions are implemented.
Environmental Manager	• overall accountability for auditing and compliance assessment of the TFEMP during operation to ensure it is maintained and meets objectives and targets • provide technical support to all Project personnel to ensure the TFEMP is implemented correctly and complied with • implement and maintain the TFEMP, review its effectiveness and review the implementation as required • obtain relevant approvals from regulatory agencies for disturbance as required • ensure all personnel involved in the project are inducted and will adhere to the TFEMP requirements • implement monitoring programs and documenting results • liaise with stakeholders and technical experts for advice and resolution of management aspects/objectives as required • review and close out contingency actions as required • report as required to regulating authorities • may delegate all or part responsibility to an appropriately qualified person
Registered Manager	• overall accountability for auditing and compliance assessment with the TFEMP during construction and operations to ensure it is maintained and meets objectives and targets • overall accountability to ensure the TFEMP is implemented, reported and maintained on-site • ensure personnel attend inductions, have sufficient resources and training to meet the requirements of the TFEMP • support the proponent's fauna management initiative and culture • comply with all legal requirements and the requirements of the TFEMP • seek advice from proponent when in doubt about requirements • appoint appropriate consultants to undertake specific activities set out in the TFEMP if required.
All personnel	• must receive induction prior to commencement of work on site • comply with all legal requirements and the requirements of the TFEMP • attend environmental inductions and any other training required • participate in toolbox meetings and encourage personnel to suggest improvements.

2.3.1 Environmental induction

Covalent will require all workers, both during construction and operation of the mine, to attend a worker awareness training/environmental induction covering the following topics.

- Malleefowl and chuditch (e.g. how to identify it, conservation status, the importance of minimising impacts on the species, requirements of personnel including adherence to speed limits and staying on roads as well as locations and incidents, reporting to Environmental personnel)
- information on other potential significant fauna
- information on introduced predators and the impact on malleefowl and chuditch (no feeding of introduced predators and all sightings to be reported)

- information on the prevention and management of fires.

2.3.2 Incidents and corrective actions

Environmental incidents are defined as breaches or non-adherences to objectives and procedures applied to the Project and prescribed in the TFEMP. Environmental incidents are to be reported to the Covalent Environmental Manager by the person responsible for the incident or the first person at the site of an incident.

The Covalent Environmental Manager will assess the type and severity of the incident in accordance with internal procedures. Relevant personnel shall be notified and consulted whether the incident requires notification to regulatory agencies.

2.4 Monitoring

Monitoring will be undertaken in accordance with best practice techniques and the DBCA document, '*Designing a Monitoring Project for Significant Native Species*' (Freegard 2009), which has been referenced for developing the monitoring programs outlined below. Site specific procedures specifying the detail for monitoring of both malleefowl and chuditch will be implemented by a licensed Fauna specialist and in relation to Chuditch, will follow the standard operating procedures for microchipping and wire cage trapping released by DBCA (Appendix A).

The below monitoring methods and principles will be employed for the purpose of meeting the requirements of the TFEMP, including annual population monitoring (Section 2.4.1) and pre-clearance surveys (Section 2.4.2). Table 2.5 and Figure 2.2 provides a summary of the monitoring actions required to implement this TFEMP.

Table 2.5: Monitoring action summary

Monitoring Event	Monitoring Action	Frequency	Responsibility
Annual Population monitoring	• As described by section 2.4.1 (see below)	Annual	Environmental Manager
Pre-Clearance Surveys	• Malleefowl pre-clearance surveys during incubation period of September to February • Chuditch pre-clearance surveys the night immediately prior to ground disturbing activities • As described by section 2.4.2	Ongoing	Environmental Manager
Mortality monitoring	• Monitoring of incident reports for malleefowl and chuditch predation, vehicle strike, speeding and night driving.	Ongoing and annual review	Environmental Manager
Introduced predator monitoring	• Monitoring of the existing introduced predator populations (focussing on the fox and cat populations). This information is intended to provide a baseline for comparison of introduced predator populations over the life of mine. The information will also guide any introduced predator control programs implemented in the Proposal area.	Ongoing and annual review	Environmental Manager
Clearing monitoring	• Monitoring of clearing register for compliance to approvals. • Review of clearing footprint to determine clearing proximity to active malleefowl mounds.	Ongoing and annual review	Environmental Manager
	• Internal audit and inspection of areas of clearing, areas of potential entrapment, speeding and night driving.	Ongoing and annual review	Environmental Manager
Fauna habitat monitoring	• Annual monitoring of vegetation condition as an indicator of fauna habitat quality.	As per Flora Management Plan	Environmental Manager

2.4.1 Annual Population Monitoring

Annual (and 5 year) monitoring of malleefowl will align with the National Malleefowl Monitoring Manual (NMRT 2019) as accepted by DBCA. With regards to chuditch, the proponent consulted with DBCA in July 2019 and the annual monitoring methodology were endorsed. The current monitoring locations for malleefowl and chuditch are displayed in Figure 1.2and Figure 2.3 and includes sites located both within and outside the Development Envelope. The monitoring locations have been established based on previous fauna records and may be revised following the initial monitoring period.

Malleefowl

Annual population monitoring will consist of:

- Twenty trail cameras will be installed at selected malleefowl mounds evenly across the Development Envelope to provide a representative sample of malleefowl activity within this area. The cameras will be installed for the months of October to February during the incubation period (NMRT 2019). The number of sightings will be recorded each year. The total number of sightings for each year will be compared against consecutive years to establish a trend in malleefowl activity and populations. Locations of trail cameras will be determined by site layout and mound status and preference will be given to mounds which have been active within the previous five years.
- The process outlined above will be established within a nearby local population, such as Jilbadji Nature Reserve or outside the Development Envelope for the purpose of comparing camera sighting trends. In the event the threshold criteria outlined by Table 2.1 is breached, this will provide a means of comparison to determine if the declining trend is proposal-related.
- Monitoring occurring between October to February on an annual basis using National Malleefowl Monitoring Manual (NMRT 2019) standards and in consultation with the National Malleefowl Recovery Team (NMRT).
- Monitoring of mounds will record the number of malleefowl mounds (as determined by the National Malleefowl Monitoring Manual - Standards, Protocols and Monitoring Procedures), identify any decline in active mounds and determine the cause.
- A cybertracker software program will be used in annual monitoring. Monitoring data will be submitted to the National Malleefowl Monitoring Database. This data will contribute directly to the long-term malleefowl population trend analysis, as well as the National Malleefowl Recovery Plan.

Camera sightings and malleefowl mound status (active, annual, 5 year, or Do not monitor) will be recorded and assessed qualitatively in line with the monitoring frequency. An estimate of local population number should be made based on number of active mounds, sightings and temporal analysis. This will establish population trends over consecutive years to determine if the proposal is affecting local populations. This is largely the basis for the outcomes-based provisions detailed by Table 2.1.

Chuditch

Annual population monitoring will consist of:

- Twelve trap lines of 1km each will be established inside the Development Envelope with traps installed at the same location each year with 200m spacing between traps (Rayner et al 2011). Fauna specialist will determine appropriate trap sizes, but as per Rayner (2011) may be wire cage traps 220 x 220 x 550 mm.
- Twelve trap lines of 1km each will be established outside the Development Envelope with traps installed at the same location each year with 200m spacing between traps (Rayner et

al 2011). Fauna specialist will determine appropriate trap sizes but as per Rayner (2011) may be wire cage traps 220 x 220 x 550 mm.

- Traps will be baited and monitored for six consecutive nights in June each year (may be reduced in the event of high trapping rates as chuditch can become overly attracted to traps).
- Captured chuditch should have the following recorded; sex, weight, hind foot length (between based of toe to end of heel), head length and pouch status for females. Obvious wounds or injuries will also be recorded. All captures will be PIT tagged (Passive Implant Transponder - microchip) to account for re-captures.
- Tissue samples for DNA analysis and scats will be collected. Tissue samples will be forwarded to DBCA for analysis and scats will be preserved for future diet analysis.
- Chuditch will be held in captivity during the day and released at dusk to nearby habitat from which it was caught.
- Suitable records of population monitoring will be created and stored by the fauna specialist.

Monitoring sites were established both within and outside the Development Envelope, representing impact and control monitoring sites respectively. Due to no records of chuditch occurring within the control sites in the Ecoscape (2019b) monitoring survey, it was recommended that new control sites be established in Jilbadji Nature Reserve closer to the Project area in the 2020 chuditch monitoring. The location of the 2019 and 2020 impact and control monitoring sites are shown in Figure 2.3 With regard to assessing performance against the Environmental Criteria (Table 2.1), capture rates of breeding females will be compared for consecutive years to establish a trend.

Furthermore, for statistical analysis and an understanding of population trends in regard to the response actions of Table 2.2, the capture rate for control and impact sites will be compared each year. Annual monitoring events will also be compared as the data set develops following each annual monitoring event. ANOVA analysis will provide statistical evidence if survey results are significant between the variables chosen for comparison, in this case between impact sites across monitoring events. Further statistical analysis shall be conducted on control sites to determine any adverse impacts to the local population.

Introduced Fauna Monitoring

Annual population monitoring of introduced predators will consist of:

- Recording opportunistic sightings of introduced fauna (feral cats and foxes) through annual reporting, introduced species control reports and incident reports.
- Quantitative and systematic recording of introduced predators to be undertaken during the trail camera monitoring for malleefowl over consecutive years.

Camera sightings will be recorded and assessed qualitatively each year. An estimate of local population number should be made based on number of sightings and temporal analysis (Predator density by monitoring activity). This will establish population trends over consecutive years to determine if the proposal is affecting local introduced predator populations and to establish if there is a correlation in predator density and threatened fauna populations.

2.4.2 Pre-Clearance Survey Monitoring

Prior to vegetation clearing, a pre-clearance survey for both malleefowl and chuditch will be undertaken for the purpose of avoiding impacts to active malleefowl mounds and avoiding potential direct impacts to the population of both species. Separate requirements for both species are broadly outlined below.

Malleefowl

Pre-clearance surveys will only be undertaken during the incubation period when mounds are likely to be active from September to February (NMRT 2019) and occur a minimum of two weeks prior to clearing, to identify any malleefowl mounds and their status in the area to be cleared. Outside of this incubation period, population monitoring will be adequate to determine the presence of mounds and their status.

Within the Development Envelope and across the planned area for vegetation clearing, a LiDAR survey utilising the algorithm developed to identify mounds will be undertaken y for the first year during construction activities.

LiDAR survey of areas planned for clearing will be undertaken to inform pre-clearance surveys annually for the first year during the construction period and any potential mounds checked to determine if they are active.

Following the initial one-year period, LiDAR surveys will be undertaken as required depending on the size and scale of the clearing area. If it is more practical and effective to search an area on foot as opposed to LiDAR, 10 m wide transects across the entire area will be employed to determine the presence of mounds and their status.

If a mound is present, a record of that mound will be made similarly to section 2.4.1. If the mound is active, a buffer of 100 m will be established, and the mound avoided. If at a later date, the mound is found to no longer be active (months later), the 100 m buffer will be removed and the area cleared of vegetation (if still required).

In the event malleefowl are found in the area to be cleared, but there are no active mounds, fauna specialists will be on site to implement a displacement method to allow the malleefowl to egress on their own but remain within their home range.

NMRT (2016) provides some guidance as to the use of LiDAR for surveys. The National Malleefowl Recovery Group or an appropriate fauna specialist may be consulted for technical guidance as required for implementation of the surveys.

Chuditch

Prior to vegetation clearing, the designated clearing area will follow the general procedure for capture and release of chuditch, as follows:

- Trapping will be undertaken for one night immediately prior to vegetation clearing with a total of four traps per hectare relatively evenly distributed (more than double the trapping effort as recommended by DBCA for annual monitoring, section 2.4.1).
- Captured chuditch will have the following recorded; sex, weight, hind foot length (between base of toe to end of heel), head length and pouch status for females will all be recorded. Obvious wounds or injuries. All captures will be PIT tagged (microchip) to account for re-captures.
- Tissue samples for DNA analysis and scats will be collected. Tissue samples will be forwarded to DBCA for analysis and scats will be preserved for future diet analysis.
- Chuditch will be held in captivity for no more than one night and released at dusk into nearby habitat from which it was caught, once vegetation clearing activities for the designated area are complete.

In the event that clearing is undertaken during the months of September, October and November, the procedure will be slightly modified to mitigate any potential risk to breeding and denning females. In the event a lactating female is captured during these months the following procedure will be implemented:

- Upon capture, lactating females will be radio collared and released the evening of capture, and tracked for two days to establish denning site location (due to the relatively flat terrain there is high confidence radio collars will be effective).
- If den site is outside of clearing area, clearing will proceed following one night of trapping.
- If the den is located inside the clearing area, potential dens will have trail cameras deployed to confirm chuditch presence and if confirmed, an exclusion zone of 100 m radius will be employed. Clearing will not commence in this area, until the trail cameras or the radio collar confirms the den has been abandoned.
- In the event the radio collared chuditch and potential den is not located within 48 hours, a further one night of trapping will be implemented at the same sites. If no captures, then clearing will proceed as planned.
- Suitable records of pre-clearance survey results will be created and held by the fauna specialist.

An appropriately qualified displacement zoologist will be on site during clearing activities. Pre-clearance walk throughs to identify and displace fauna prior to clearing will be undertaken. Pre-clearance walk throughs will be undertaken the morning before clearing / disturbance to displace individuals and will include searching and checking refugia sites.

Clearing will be avoided between the months of September to November where possible to mitigate impacts to denning females.

A Chuditch Handling Procedure will be developed by a suitably qualified zoologist in consultation with DBCA to ensure the appropriate capture and release methods are adopted.

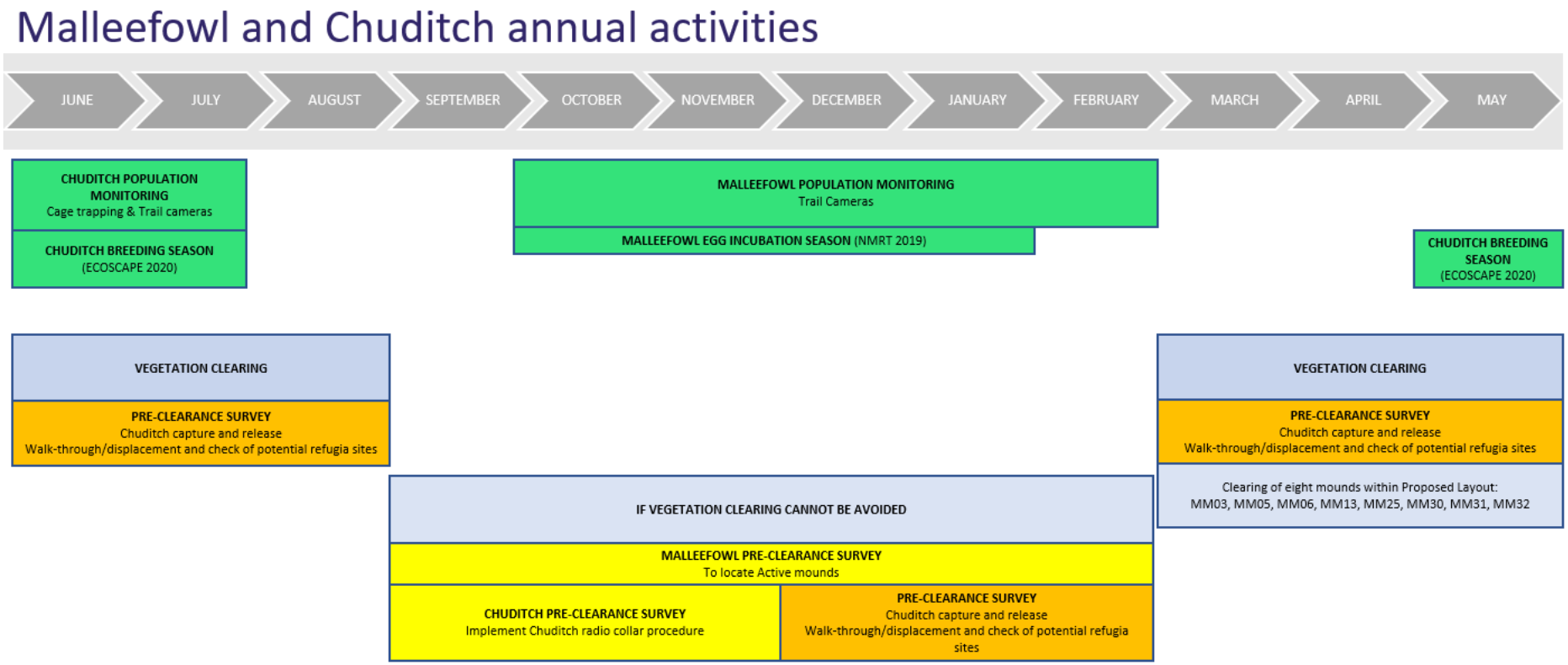

Figure 2.2: Monitoring Summary

745000 750000 755000 760000 765000 770000

6465000 6460000 6455000 6450000 6445000 6440000 6435000

Figure 2.3: Chuditch monitoring locations

N

Scale 1:100,000 at A3

0 1 2 km

Coordinate System: GDA 1994 MGA Zone 50

Date: 6/08/2020

Legend

- Development envelope
- Indicative project footprint

Monitoring locations

- Control (2019)
- Impact (2019)
- Control (2020)
- Impact (2020

covalent LITHIUM

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Service Layer Credits:Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community Client: Covalent Lithium. Created by: hsullivan

2.5 Reporting

The TFEMP sets out the reporting requirements relating to its implementation. Reporting includes:

- preparation annually of a Compliance Assessment Report (CAR) to be submitted to the appropriate regulatory authorities. The CAR will include:
- a summary of compliance requirements
- summary of compliance during the reporting period
- non-compliances and corrective / preventative actions
- compliance assessment table
- documentary evidence
- provision of data (annually) from monitoring programs to relevant regulatory authorities
- in the event a management target is exceeded (or not met), the relevant regulatory authorities will be notified within seven days of identification of the exceedance, including information on remediation actions that have been or will be implemented. The requirements of condition 7-6 of MS1118 will also be implemented and a report submitted to the EPA within 21 days of the exceedance covering:
  - details of contingency actions implemented,
  - effectiveness of the actions against threshold criteria,
  - findings of investigations,
  - measures to prevent a recurrence and prevent, control or abate any impacts, and
  - justification the objective will continue to be met.

Additionally, Table 2.6 outlines proposed internal and external reporting actions specific to notification events outside of the required CAR.

Table 2.6: Fauna reporting actions

Notification Event	Action	Responsibility	Timing
Trigger exceedance	Internal incident report and investigation to prevent a recurrence and reduce the exceedance below trigger criteria.	Environmental Manager	At time of event
Threshold exceedance	Investigate and report as per condition 7-6 of MS1118. Reduce the exceedance below the trigger criteria.	Environmental Manager	Within 7 days of event
Fauna injury or abandonment	The relevant regulatory authorities (DBCA) will be notified annually within the CAR of threatened and specifically protected fauna being injured or abandoned.	Environmental Manager	Annually
Mortality of conservation significant fauna	The relevant regulatory authorities (including DBCA and DAWE) will be notified annually within CAR. Any fauna found deceased, accidentally killed or euthanised due to injury will be offered to the Western Australian Museum as specimens.	Environmental Manager	Annually
Evaluation and revision of the TFEMP	Review and submit to regulator as per condition 7-7(1) of MS1118.	Environmental Manager	As required.

3. Adaptive Management and TFEMP Review

Covalent recognises the dynamic nature of ecosystems and supports adaptive management under this TFEMP. Adaptive management involves:

- implementing mitigation measures
- monitoring and evaluation against management targets (including early response triggers) and environmental criteria (including triggers and thresholds)
- systematically adapting management and mitigation measures and monitoring to meet the environmental objectives.

There remain some uncertainties associated with the Proposal and associated management targets that require ongoing review and consideration. Assumptions and predicted ecosystem responses will be evaluated against collected monitoring data on a recurrent basis, in a process of continual improvement and establishing early response indicators/criteria. Examples of adaptive management throughout operations include:

- the introduction of a different / alternative monitoring initiative to better understand parts of an ecosystem responding differently to that expected
- Evaluation of the monitoring program, data and comparison to baseline data and reference sites on an annual basis to verify whether responses to project activities are the same or similar to predictions
- the identification of more effective trigger criteria or early response triggers in light of more comprehensive monitoring information
- updated modelling and revision of trigger criteria or early response triggers in a system responding differently to that predicted in original modelling
- changes to management actions and targets in response to monitoring data
- Review of management actions as new management measures and technologies become available that may be more effective for terrestrial fauna management
- Assessment of changes which are outside the control of the project and the management measures identified (i.e. a new project within the area or region)
- The trigger criteria for malleefowl and chuditch have been developed with reference to the information available from the baseline monitoring. It is expected that once sufficient monitoring data is collated over time (i.e. 3 years from project commencement) that trigger and threshold criteria for malleefowl and chuditch will be reviewed by an appropriate fauna specialist and revised as necessary, with the fauna management plan updated in consultation with DBCA.

3.1 Early response triggers

Early response triggers have been established for the management-based provisions in Table 2.3 and are detailed in Table 3.1.

Table 3.1: Early response triggers and actions

Management targets	Early response trigger	Early response action	Early response trigger justification
Minimise incidental mortality of malleefowl or chuditch from clearing activity, entrapment, vehicle strike or mining related fire.	25% increase in malleefowl or chuditch sightings within or adjacent to mining activity areas over two consecutive years.	• Report internally that early response trigger has been met in accordance with internal procedures. Due diligence check to ensure the following is adequate: • Internal audit of waste management facilities • Review of traffic management controls to determine management action amendments • Refresher training on malleefowl, chuditch and associated controls and injured animal management. Early response trigger contingency actions may include but are not limited to: • Avoid clearing September to November to mitigate any potential risk to breeding and denning female chuditch. • Near miss of fauna on roads or during clearing and mining activities reported. • Warning signs erected in areas of increased malleefowl or chuditch records • Increase in frequency of internal audits and inspections of vehicle speeds. • Increased presence of malleefowl or chuditch on site discussed in staff induction programs • Staff training and awareness to provide information on malleefowl (e.g. how to identify adults, chicks and mounds, conservation status, the importance of minimising impacts on the species, adherence to speed limits, reporting to Environmental personnel). • Staff training and awareness to include information on the prevention and management of fires. • Domestic waste facilities will be fenced and putrescible wastes will be regularly covered. • Containers to have doors closed securely when not in use.	The potential for population decline due to indirect impacts is currently unknown as impacts to the malleefowl and chuditch populations have not been quantified. As population monitoring data is gathered, trending will indicate any threats and acceptable population changes. This impact is expected to be quantified based on malleefowl and chuditch monitoring as described by section 2.4.1. In the interim, the early response trigger has been established to identify any significant decrease to malleefowl and chuditch populations and provide an indication if the management actions detailed in Table 2.3 require review.

Management targets	Early response trigger	Early response action	Early response trigger justification
Minimise decline in population due to predation from introduced predators.	25% increase in introduced predators (fox or cat) sightings (opportunistic sightings and remote camera) over two consecutive years.	• Report internally that early response trigger has been met in accordance with internal procedures. • Review introduced predators control programme and amend as required. Trigger contingency actions may include but are not limited to the following: • A proportionate increase in trapping/ baiting intensity for introduced predators in areas where increased sightings of foxes and/ or cats have occurred. • If after the two consecutive monitoring events, a threshold exceedance has not been identified, resume standard monitoring. • Installation of signage: Feeding animals prohibited, minimise availability of food waste. • Review and refine remote camera monitoring for introduced predators (foxes and cats) across the DE should it be required. • Staff training and awareness to include information on feral species (e.g. impact of feral animals on malleefowl and chudditch populations, no feeding of feral species, reducing availability of food waste to feral animals and all sightings of feral species to be reported).	The potential for population decline due to indirect impacts is currently unknown as impacts to malleefowl and chuditch populations have not been quantified. As population monitoring data is gathered, trending will indicate any threats and acceptable population changes. This impact is expected to be quantified based on malleefowl and chuditch monitoring as described by section 2.4.1. In the interim, the early response trigger has been established to identify any significant decrease to malleefowl and chuditch populations and provide an indication if the management actions detailed in Table 2.3 require review.
Minimise decline in population due to dust, light, noise, vibration and displacement.	25% decrease in malleefowl or chuditch (camera sightings or trapping results) that are statistically different from previous monitoring results but do not breach trigger criteria as it has not been consecutive for two years.	• Review monitoring program for adequacy: Determine whether the changes observed in the impact sites are comparable to the observations in the reference sites. • Investigate potential causes for population decrease: • Factors that may affect populations of threatened fauna are varied and it is difficult to determine the exact factors as a decline in sightings could be associated with: • seasonal conditions (e.g. rainfall and temperatures)	The potential for population decline due to indirect impacts is currently unknown as impacts to the malleefowl and chuditch populations have not been quantified. As population monitoring data is gathered, trending will indicate any threats and acceptable population changes. This impact is expected to be quantified based on malleefowl and chuditch monitoring as described by section 2.4.1. In the interim, the early response trigger has been established to identify any significant decrease to malleefowl and chuditch populations and provide an

Management targets	Early response trigger	Early response action	Early response trigger justification
		• changes in mound usage patterns by malleefowl (i.e., use of mounds that are not surveyed) • effectiveness of introduced predator control • spatial variation (near-impact areas) versus sites located further from impact); and • reliability of the results obtained from the fauna sightings register • attributable to clearing, construction, operation activities. Where the trigger is attributed to clearing, construction or operational activities, report the exceedance to DWER within 7 days of the exceedance being identified.	indication if the management actions detailed in Table 2.3 require review.

3.2 Benchmarking and Best-Practice

For some environmental factors, environmental outcomes may include compliance with state, national or international standards, guidance or legislation. The Proponent will conduct ongoing benchmarking against best practice options. Adaptive management in this context may include initiatives to implement improvements in technology and emission control technologies to meet best-practice in the relevant industry, proponent-driven improvements in operations, and keeping up to date with improvements in monitoring methods and standards for implementation.

3.3 Plan Revisions

The proponent will amend the TFEMP in accordance with condition 7-7 (1) and (2) of MS1118as required and this may include any adaptive management updates. These amendments will be submitted to the EPA for revision. If the Proponent has gathered sufficient information through research and long-term monitoring to propose revisions to management targets, a formal request for amendment of an approved condition may be submitted to the relevant authority.

4. Stakeholder consultation

4.1 Key Stakeholders

Covalent have undertaken a consultation process with key stakeholders, including:

- State government
- Federal government
- Local government
- Non–government organisations and interest groups.

A comprehensive list of key stakeholders is provided in Table 4.1.

Table 4.1: Key Stakeholders

Stakeholder Group	Stakeholder	Key Interests
State Government	Environmental Protection Authority (EPA)	• Administration of the *Environmental Protection Act 1986* (EP Act) • Part IV (EP Act) Environmental Impact Assessments
	Department of Mines, Industry Regulation and Safety (DMIRS)	• Administration of the *Mining Act 1978* (Mining Act) • Tenement conditions • Mining proposals and programs of work • Mining Rehabilitation Fund (MRF) • Closure and rehabilitation • Safety
	Department of Biodiversity, Conservation and Attractions (DBCA)	• Administration of the *Biodiversity Conservation Act 2016* (BC Act) • Flora, fauna and habitat conservation
	Department of Planning, Lands and Heritage (DPLH)	• Native title and indigenous requirements • Heritage sites
	Department of Fire and Emergency Services (DFES)	• Emergency services • Fire breaks • Fire reduction
	Main Roads Western Australia (MRWA)	• Use of public roads
Federal Government	Department of Agriculture, Water and the Environment (DAWE)	• Administration of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) • Referral and assessment of environmental impact assessments of matters of national environmental significance
Local Government	Shire of Yilgarn and Shire of Kondinin	• Use of public roads and infrastructure
Non–government organisations and interest groups	Conservation Council of Western Australia Wilderness Society National Malleefowl Recovery Team	• Protection of conservation significant species • Potential interest in baseline flora and fauna survey data

4.1.1 Stakeholder Engagement Process

Stakeholder engagement with State Departments and Local Government Authorities commenced in late 2016. The Proponent has since developed and implemented an external stakeholder consultation strategy for ongoing social engagement and community investment. As the joint venture manager, Covalent will be responsible for all engagement moving forward.

The stakeholder consultation strategy has adopted the principles from the Ministerial Council on Mineral and Petroleum Resources (MCMPR) *Principles for Engagement with Communities and Stakeholders* (2005). This includes:

- open and effective communication
- two–way communication
- clear, accurate and relevant information
- timeliness
- transparency, requiring a process for communication and feedback
- collaboration, working cooperatively to seek mutually beneficial outcomes
- inclusiveness, with the aim of recognising, understanding and involving stakeholders early and throughout the process
- integrity, with engagement undertaken in a manner that fosters mutual respect and trust.

The outcomes of the consultation strategy are recorded in the Stakeholder Consultation Register. Consultation to date has comprised predominately of meetings and correspondence with a number of State and Federal Government Departments and Agencies, Local Government Authorities, Traditional Owners and non–government organisations and interest groups.

The Proponent is committed to ongoing stakeholder identification, communication, engagement and consultation through the planning and approval, construction, operational and closure phases of the Project.

Stakeholder Consultation

Stakeholder consultation has been ongoing since late 2016. Key engagement to date is summarised in Section 3.3 of the Environmental Review Document.

5. Definitions

Term	Definition
5 year malleefowl mound	A long, unused mound that is very degraded and unlikely to be used again by malleefowl. They are regarded as option for monitoring most years but are expected to be monitored every fifth year in the same way as annual/regular mounds. A long, unused mound has no obvious signs of malleefowl visitation, and no history of ever being active.
Active malleefowl mound	The classification of malleefowl mound activity is based on the National Malleefowl Monitoring Procedure (NMRT 2019) and as assessed by a suitably qualified fauna specialist. NMRT (2016) defines active as: *'Active mounds are those that are currently being used by malleefowl as an incubator for their eggs, and are likely to contain eggs.'*
Annual malleefowl mound	Annual monitoring term is given to malleefowl mounds that meet NMRT (2019) criteria. In general, a good example of a malleefowl mound that could be utilised by malleefowl in the future. Annual monitoring term is given to any mounds determined as active.
Adverse	Impacts likely to change the conservation status or significantly change the local population numbers of a species.
Direct impact	Impact through loss and fragmentation of habitat from vegetation clearing or vehicle interactions.
Do not monitor 'malleefowl mound'	Deemed not to be a malleefowl mound in line with NMRT (2019) criteria.
Health	Indicator of population numbers which will be further developed as monitoring is undertaken. Malleefowl population health is likely to be associated with occurrence of sightings and malleefowl mound activity levels, whilst chuditch population health is likely to be associated with individual occurrences and population demographics.
Indirect impact	Impact through: • death, injury and displacement from construction and mining operations, vehicle strikes and changed fire regimes. • increased introduced predator presence as a result of increased access into areas from new tracks and roads, and attraction to rubbish tips. • dust, light, noise and vibration during construction and mining operations. • displacement by the proposed layout of construction and mining operations and changed fire regimes.

6. Acronyms and short titles

Abbreviation	Full Description
BC Act	*Biodiversity Conservation Act 2016*
CAR	Compliance Assessment Report
DBCA	Department of Biodiversity, Conservation, and Attractions
DFES	Department of Fire and Emergency Services
EMP	Environmental Management Plan
EPA	Environmental Protection Authority
EP Act	*Environmental Protection Act 1986*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
MMEZ	Malleefowl Mound Exclusion Zone
MCMPR	Ministerial Council on Mineral and Petroleum Resources
MNES	Matter of National environmental significance
NMRT	National Malleefowl Recovery Team
PER	Public Environmental Review
SQM	Sociedad Química y Minera
TSF	Tailings Storage Facility
TFEMP	Terrestrial Fauna Environmental Management Plan
WRD	Waste Rock Dump

7. References

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Appendices

Appendix A Standard operating procedures for cage traps for live capture of terrestrial vertebrates and permanent marking of vertebrates using microchip

Standard Operating Procedure

CAGE TRAPS FOR LIVE CAPTURE OF TERRESTRIAL VERTEBRATES

Animal welfare is the responsibility of all personnel involved in the care and use of animals for scientific purposes.

Personnel involved in an Animal Ethics Committee approved project should read and understand their obligations under the *Australian code for the care and use of animals for scientific purposes.*

Prepared by: Species and Communities Branch, Biodiversity and Conservation Science, Department of Biodiversity, Conservation and Attractions

Prepared for: Animal Ethics Committee

Version 1.2

February 2018

GOVERNMENT OF WESTERN AUSTRALIA

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Department of Biodiversity, Conservation and Attractions (2018). *Standard Operating Procedure: Cage Traps for Live Capture of Terrestrial Vertebrates*. Perth, WA: Department of Biodiversity, Conservation and Attractions.

Disclaimer

The State of Western Australia and its employees do not guarantee that this publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence that may arise from you relying on any information in this publication.

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1.1	23/04/2013	Revision with minor changes	R. Kay	M. Page	July 2015
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Approved by:  Date: February 2018

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Department of Biodiversity, Conservation and Attractions

Contents

1 Purpose

Cage trapping is a common method used for monitoring many species of small to medium-sized mammals. Cage traps usually operate using a treadle plate mechanism, which is set off when an animal steps on the elevated trigger plate and springs the door closed. Cage traps will also catch a range of non-target species including birds and reptiles.

This Standard Operating Procedure (SOP) provides advice on the use of cage traps for non-lethal trapping of terrestrial vertebrate fauna.

2 Scope

This SOP has been written specifically for scientific and education purposes, and endorsed by the Department's Animal Ethics Committee. However, this SOP may also be appropriate for other situations.

This SOP applies to all fauna survey and monitoring activities that may require the use of cage traps undertaken across the State by Department of Biodiversity, Conservation and Attractions (hereafter Department) personnel. It may also be used to guide fauna monitoring activities undertaken by Natural Resource Management groups, consultants, researchers and any other individuals or organisations. All Department personnel involved in the use of cage traps should be familiar with the content of this document.

Projects involving wildlife may require a licence under the provisions of the *Wildlife Conservation Act 1950* and/or the *Biodiversity Conservation Act 2016*. Personnel should consult the Department's Wildlife Licensing Section and Animal Ethics Committee Executive Officer for further guidance. In Western Australia any person using animals for scientific purposes must also be covered by a licence issued under the provisions of the *Animal Welfare Act 2002*, which is administered by the Department of Primary Industries and Regional Development. This SOP complements the *Australian code of practice for the care and use of animals for scientific purposes* (The Code). The Code provides governing principles to guide decisions and actions of personnel involved in the care and use of animals, and contains an introduction to the ethical use of animals in wildlife studies. A copy of The Code may be viewed by visiting the National Health and Medical Research Council website (http://www.nhmrc.gov.au).

3 Animal Welfare Considerations

To reduce the level of impact of cage trapping on the welfare of animals, staff must consider, address and plan for the range of welfare impacts that may be encountered. Strategies to reduce impacts should be identified during the planning stage to ensure that they can be readily implemented during trap set up and trap checking and contingencies for managing welfare issues have been identified. All handlers and volunteers involved in the project should be aware of the range of issues that they may encounter, the options that are available for reducing impacts and improving animal welfare, and the process for managing adverse events.

Department projects involving cage trapping will require approval from the Department's Animal Ethics Committee.

Key animal welfare considerations that should be considered when cage trapping are listed below and highlighted throughout the document.

3.1 Injury and unexpected deaths

If adverse events including injury, unexpected deaths or euthanasia occur then it is essential to consider the possible causes and take action to prevent further incidents. For projects approved by the Department's Animal Ethics Committee, adverse events must be reported in writing to the AEC Executive Officer as soon as possible after the event by completing an *Adverse Events* form. Guidance on field euthanasia procedures is described in the Department SOP for *Humane Killing of Animals under Field Conditions.* Where disease may be suspected, refer to the Department SOP for *Managing Disease Risk in Wildlife Management* for further guidance.

3.2 Level of impact

Potential animal welfare impacts of cage trapping include:

- Capture myopathy (particularly for Macropods)
- Trauma (e.g. head or nose injuries from hitting walls of the trap)
- Smaller non-target species stuck in mesh
- Stress as a result of harsh environmental conditions within the trap (i.e. temperature).
- Distress (caused by confinement, discomfort, social isolation, separation of mother and young, exposure to predators, ants, etc.)
- Predation

If the cage traps are properly monitored and preventative actions are utilised then the impact should be small and only short-term.

4 Approved Trap Types

Large Cage: Galvanised wire mesh cage trap (approx. 45cm x 45cm x 90cm) with a treadle plate release mechanism. Large cages are used primarily for feral cat (*Felis catus*) trapping.

Small Cage: Galvanised wire mesh cage trap (20cm x 20cm x 56cm) with a treadle plate release mechanism. Collapsible forms are available. Used for most medium-sized mammals such as chuditch (*Dasyurus geoffroii*), quenda (*Isoodon obesulus fusciventer*), brushtail possums (*Trichosurus vulpecula*) and woylies (*Bettongia penicillata ogilbyi*). Small cages also catch small Dasyurids and rodents as well as Varanids, large skinks and occasionally birds.

Some old style traps used a trigger mechanism attached to a bait hook hanging from the roof of the trap, which when tugged on, releases the door, or hooks were simply included to keep bait off ground. Traps with hook-release mechanisms are not acceptable. Where traps with bait hooks are still in use, the hook must be completely closed to form a loop so that an animal is unable to get caught on the hook.

Many cage traps used in Western Australia are manufactured by Sheffield Wire Products (Sheffield Rd, Welshpool WA) and so are sometimes referred to as "Sheffields." Cage traps

manufactured with different trigger mechanisms may also be appropriate and their use is not excluded, provided they do not pose additional welfare risks to animals (see reference to 'hooks' above). Projects approved by the Department's Animal Ethics Committee preferring to use alternative cage style traps to those mentioned here may do so if they describe in detail the differences in design and are able to report on the survivorship rates and the welfare impacts.

All traps should be checked for sharp edges, protrusions, or gaps/holes large enough for entrapment of digits/limbs which can cause injury, regardless of age of trap (some new traps can have rough or sharp edges from the milling/cutting process.) Proper function of the doors and trigger mechanisms should also be checked as malfunctioning devices may pose a risk by partially trapping an animal.

The solid nature of cage traps means that animals can injure themselves whilst inside the trap. To minimise these injuries soft trap options have been developed and are covered in the Department SOP for *Soft Cage Traps for Capture of Macropods*. These soft traps are preferred for species that are particularly prone to injury or capture myopathy and have been effectively used for a variety of species including rock-wallabies (*Petrogale lateralis*), tammar wallabies (*Notamacropus eugenii derbianus*) and mala (*Lagorchestes hirsutus*).

Figure 1 A cage trap wit hessian and vegetation cover. Photo: Christine Freegard/DBCA

5 Procedure Outline

5.1 Setting and positioning traps

(a) The location and configuration of trap placement (i.e. transect or grid) as well as the number of traps will be determined by the purpose of the study and should be planned before commencing the survey. Consider the target species' likely use of habitat and home range and welfare implications of trap placement when designing trap configuration and layout.

Example: Transects of 50 small cage traps spaced at 200m intervals (total 10km) have been used as the standard method for monitoring target species under the Western Shield program.

(b) Trap locations must be marked so that no traps are missed when checking or removing them (e.g. with flagging tape which is labelled and using a numbering system which uniquely identifies each trap). A GPS reading for each trap point is strongly recommended. Permanent

monitoring trap sites should also be marked using a permanent marker (e.g. numbered dropper post). The location information for permanent monitoring transects and their trap points should be recorded on datasheets and a database.

(c) If setting traps along roads or vehicle tracks, the traps must be set so that they minimise the impact on the animals. Traps should be placed away from the roadside (generally a distance of 5m or greater on publicly accessible roads and tracks) so that they are not readily visible from the road to avoid public curiosity and possible theft of traps, and to reduce the disturbance on trapped animals from passing vehicles.

(d) Trap placement:

ANIMAL WELFARE: Trap placement can greatly affect animal welfare. Consider the climate of the area you are trapping in and the species biology (e.g. thermoregulation characteristics) when choosing a trap position. Traps need to be placed in suitable locations that provide shelter from the sun and protection from rain to reduce exposure of trapped animals. For example, consideration needs to be given to the movement of the sun (and therefore shade), prevailing winds and drainage in wet conditions. Consider the orientation of the sun and the period of the day when the captured animal will be in the trap.

Thick trap covers that provide protection from the elements and reduce the sense of exposure by the animals are required (refer point (f) below). If the traps are likely to capture species that are prone to panic or stress (e.g. woylies), trap placement should also allow animal handlers to approach the traps without increasing the stress of the animal (e.g. approach trap from the side rather than the front, reduced noise from walking on leaf litter, and minimal talking).

Do not place traps on or in the vicinity of ant nests.

(e) Traps must be set in level positions using natural cover wherever possible. Debris and/or vegetation should be cleared from under the trap to ensure stability and prevent obstructions from stopping the dropping and locking of the trap door. In some areas where the ground is uneven or ground vegetation makes it difficult for the door to close, it may be appropriate to place a short straight stick, no longer than the width of the cage, under the bottom front edge of the trap to lift the bottom lip of the trap mouth just off the ground and provide clearance for the door to close easily. Note that this must be done in a way that won't reduce trap stability and won't create issues for an animal stepping into the trap.

(f) Cage traps must have adequate shelter and protection for the welfare of captured animals. Cage traps should be covered with heavy weight hessian (or similar material with the same protective qualities) to provide captured animals with security and shelter from the elements. Place the hessian over the top of the trap and wrap around to cover exposed sides. The cover needs to be secured to ensure that it cannot be easily removed by an animal and wind cannot blow the hessian off the trap. Options include using a rock or log, nestling the trap into a bush, tucking the edges of the bag under the trap (ensuring the stability of the trap is not impeded) or piling sand on the edges of hessian. Ensure that the trap release mechanism is not impeded by the hessian or method used to secure it.

(g) Before the trap is left, it is important to re-check that the mechanism is working properly, the trap cover is effective and secure, and the trap is positioned to take advantage of shade in the morning. Faulty equipment reduces the opportunity to trap animals and can result in poor data and reduce the value of the trapping effort.

(h) All traps must be accounted for before and after each trapping session.

5.2 Baiting traps

When choosing the type of bait for your traps always consider the target species and possible non-target captures. Bait is intended to lure an animal into the trap and for some species, provides a small amount of food while the animal is trapped.

Small Cage: The standard bait used in small cages is a mixture of peanut paste and rolled oats which is also known as "universal bait" (*Note: sardines may increase the attraction of ants and you may want to consider excluding them from the bait if ants are an issue*). Small cages require a quantity about half to a third of the size of a golf ball. Refer to Appendix II for more information.

Alternative baits such as tuna, sardines, chicken and bacon can be considered when targeting carnivorous mammals such as chuditch. Use of a meat bait may also increase captures of reptiles, particularly varanids and skinks.

If using a meat bait, personnel should maintain good hygiene practises when handling the baits, such as washing and disinfecting their hands after contact with the bait, and avoiding touching their face, mouth and trapping equipment until cleaned. Incorrect handling and hygiene surrounding meat baits can potentially lead to foodborne viruses and infections, such as Salmonella. Gloves can also be worn when preparing or handling meat baits. Gloves should be removed when no longer handling baits to avoid contaminating other equipment.

Other bait types or ingredients may be used if these have been identified as appropriate and approved for use for a particular project and/or species.

Care must be taken when baiting traps to ensure that the bait is placed clear of the treadle plate and does not impede the closing mechanism. To avoid bait rolling underneath the treadle plate and rendering the trap inoperative, it is recommended that universal bait balls are slightly squashed so that they cannot roll under the treadle.

Baits should be replaced when their effectiveness as a lure is reduced (e.g. when the odour of the bait is reduced or gone) or if the bait may impact on an animal's health if consumed (e.g. rancid). Baits should be replaced rather than additional baits placed in the cage – more bait in the cage may increase the probability of the treadle being impeded.

5.3 Checking traps

ANIMAL WELFARE: In determining the duration and frequency of trapping you should consider the purpose of your study and the potential welfare impacts from recapturing animals on multiple occasions (e.g. limitations on feeding, welfare of dependent young). Consider the duration and frequency that will allow the goal of the activity to be achieved with the minimal impact on animals. Some animals become "trap happy" (entering traps on multiple consecutive nights) and this can impact their wellbeing by disrupting behaviours such as normal feeding, foraging, breeding and defending territories. This is particularly relevant to small mammals (e.g. honey possums) which due to their small size, are at risk of death if prevented from feeding. Where honey possums are prevalent, a sugar solution (e.g. Spark liquid) should be available when checking traps.

Avoid trapping in breeding seasons where lactating females may be separated from dependent young or when there is an increased likelihood of injury or separation of

dependent young (e.g. brushtail possums during pouch emergence). However, many species breed throughout the year making it impossible to completely avoid trapping animals at sensitive times. If captured, lactating animals should be released as soon as possible. If the same lactating female is caught on successive nights, consideration should be given to moving or closing the trap.

Avoid trapping or close traps in extreme weather conditions. Plan ahead and monitor long-range and daily weather forecasts.

For programs such as *Western Shield* monitoring it is recommended that traps are set for a minimum of four consecutive nights.

(a) All traps must be accounted for during each day's trapping. Personnel undertaking the trapping should keep tallies of traps to ensure that all are checked. This is the responsibility of the person in charge at the survey location on the day. There is no excuse for leaving traps unchecked.

ANIMAL WELFARE: The timing and frequency of trap checking and clearing should be determined by considering the behaviour and biology of the target species (and potential by-catch species) in association with the environmental conditions at the site. Trap checking timing and frequency should be reviewed and adapted when and if conditions change or adverse events occur. Traps may need to be checked more frequently throughout the day and/or night if prolonged trap confinement or environmental conditions are likely to increase the impact on animal welfare and affect survivorship.

(b) Where nocturnal species are being targeted, traps must be checked early in the morning during the period when temperatures will have minimal effect on the trapped animals (no later than 3 hours after sunrise but as early as possible in high temperature conditions). If checking of traps cannot be completed within this timeframe, trap numbers must be reduced or the number of personnel increased before any further trapping occurs.

(c) Traps must either be closed on checking and re-opened late afternoon, or, if they need to remain open (i.e. targeting diurnal animals), the Animal Ethics application must provide information to show that leaving traps open during the day will not impact animal welfare. Traps remaining open during the day must be in a shaded position, and consideration should be given to more frequent checking throughout the day, particularly in hot weather or if there are non-target captures.

(d) An appropriate handling bag must be carried when approaching a trap to ensure rapid removal of the animal from the trap (see the Department SOP for *Animal Handling and Restraint using Soft Containment*).

(e) Take care when approaching the trap and minimise noise during your approach (reduce noise from walking, leaf crunch, vehicles, talking etc.). A second handling bag may be used to quickly cover the front of the trap (the exposed front of the trap) which may aid in calming agitated trapped animals, particularly woylies.

(f) Bait within each trap should be checked daily and replaced when necessary. Traps without bait reduce the validity of trapping results.

(g) The presence of ants in the trapping area can lead to detrimental impacts on captured animals. A small amount of surface insecticide (e.g. permethrin-based products such as Coopex) can be applied around and below traps to discourage ants. Liquid or spray

insecticides should never be used inside traps, but can be applied around the outside. Extreme care must be taken to ensure that no free standing liquid droplets remain when using liquid-based permethrin as absorption/ingestion can be lethal to frogs and reptiles. Always read the MSDS of chemicals before use. If ants become highly attracted to the trapping area, remove and relocate the traps to a more suitable position. One way to reduce risk of ant infestation is to remove bait each morning, when clearing traps and replace when resetting in afternoon.

ANIMAL WELFARE: If moderate to high numbers of ants are identified at a trap site, or if small numbers of ants cause welfare issues, then the trap must be closed or moved to another location.

(h) Trapping data should be recorded on an appropriate trapping datasheet and in a database.

5.4 Removing animals from traps

All animal handling must be done by (or under the guidance of) trained and competent personnel. Techniques for removing animals from traps vary depending on the species involved and the experience and skills of the animal handler. These notes are provided as a general guide only.

ANIMAL WELFARE: Capture myopathy is a condition associated with the capture and handling of many species of mammals and birds that results in degeneration of skeletal and/or cardiac muscle (Shepherd *et. al.,* 1988). The condition can result in sudden death but death may also occur weeks after capture as a result of complications including abnormalities to posture and gait and increased susceptibility to predation (Abbot *et al*., 2005). Signs and symptoms include a drooping head and neck, laboured breathing, tremors, lethargy and lack of coordination or paralysis.

Prevention of the condition through efforts to minimise stress to animals is better than treatment options. Records of animals suspected to be suffering from capture myopathy need to be provided to the Animal Ethics Committee for annual reporting requirements.

To ensure minimal stress to the animals, animals should only be handled for as long as required to identify them and to collect any necessary measurements (usually no more than five minutes). At a maximum they must be released (or reach alternate end point) within 24 hours of capture.

Ejection of pouch young is common in species of the Potoroidae and Peramelidae families. Persons that may encounter species of these families whilst trapping must be familiar with the Department SOP for *Care of Evicted Pouch Young*. Records need to be kept on orphans, their care and fate for annual reporting requirements for the Department's Animal Ethics Committee approved projects.

(a) Use handling bags appropriate for the species and length of containment as advised in Department SOP for *Animal Handling and Restraint using Soft Containment*.

ANIMAL WELFARE: All handling bags and equipment should be kept clean to minimise risk of disease, contamination, etc. Refer to the Department SOP for *Managing Disease Risk in Wildlife Management* for guidance.

(b) Remove animals from the trap as efficiently as possible.

(c) Keep traps covered as much as possible during removal of the animal to minimise stress.

(d) Small Cage: Animals should be encouraged to enter the handling bag by placing the bag over the end of the trap and manipulating the door to the open position. Lifting small cages with an animal inside should be avoided. Gentle encouragement via blowing on the animal (e.g. short, sharp breaths), using light and dark or positioning of the animal handler's body toward the rear of the trap can help.

(e) Check for dependent young after adult is removed from trap (inside the back of the trap, under hessian and beside the trap).

(f) Particular care should be taken for those species that may eject pouch young.

(g) Venomous or dangerous animals such as snakes should be released with consideration given to the best possible escape route for both animal and personnel. The door can be propped open to allow the animal to leave when the animal is ready.

(h) Captured animals must be released at point of capture (unless the purpose of the trapping is translocation, specimen collection is required or other approved reason). Animals should be released as soon as possible and at an appropriate time of day or night. Animals must be released, or reach an alternate endpoint approved by the Department's Animal Ethics Committee, within 24 hours of capture. Animals should be released into good shelter where necessary and caution taken to reduce exposure to risks such as predation.

(i) Where practical, non-targets, particularly birds, should be assessed for injury.

5.5 Picking up traps

(a) All traps must be counted out upon setting traps and counted in when picking up. Personnel undertaking the trapping should keep tallies of traps to ensure that all are collected and that there are no traps left behind. If traps are not being collected immediately after checking (i.e. traps are not being checked and picked up simultaneously), the traps must be closed on checking and remain closed until they are picked up. This is the responsibility of the person in charge at the survey location on the day. There is no excuse for leaving traps set in the field.

(b) Ensure residual bait is removed from traps and flagging tape is removed from the area.

6 Trap Care and Maintenance

ANIMAL WELFARE: Traps and hessian covers must be cleaned and disinfected after each trapping session. Do not move dirty hessian covers and traps from one working site to another as it poses a disease risk for animal populations. To avoid possible transfer of pathogens use one batch of hessian covers and traps for each site or connected group of sites. Refer to the Department SOP for *Managing Disease Risk in Wildlife Management*.

(a) Traps must be maintained in good working order.

(b) In some instances, particularly traps that have held reptiles or brushtail possums, the trap will require faecal material to be removed within a trapping period. Particular attention should be paid to the release mechanism to ensure it is kept free of bait and scats. Instructions

on cleaning and disinfection of traps are available in the Department SOP for *Managing Disease Risk in Wildlife Management*.

(c) Hessian bags used as trap coverings should also be cleaned and disinfected after each trapping session following the instructions contained in the Department SOP for *Managing Disease Risk in Wildlife Managemen*t.

(d) Do not carry the traps by any of the moving parts and do not put any excessive weight into traps that will be carried.

(e) Any damaged traps requiring attention need to be flagged and labelled in the field when a problem is identified so that it can be attended to and removed from use until repaired.

7 Competencies and Approvals

Department personnel, and other external parties covered by the Department's Animal Ethics Committee, undertaking monitoring projects involving cage traps require approval from the Committee and will need to satisfy the competency requirements detailed in Table 1. This is to ensure that personnel involved have the necessary knowledge and experience to minimise the potential impacts of cage traping on the welfare of the animals. Other groups, organisations or individuals using this SOP to guide their fauna monitoring activities are encouraged to also meet these competency requirements as well as their basic animal welfare legislative obligations.

It should be noted that details such as intensity of the study being undertaken will determine the level of competency required and Table 1 provides advice for basic monitoring only.

Table 1 Competency requirements for Animal Handlers of projects using cage traps to capture fauna

Competency category	Competency requirement	Competency assessment
Wildlife licences	Licence to take fauna for scientific purposes (Reg 17) OR Licence to take fauna for educational or public purposes (Reg 15)	Provide licence number
Formal training *Note: Suitable levels of skills/experience can substitute for formal training requirements*	Department Fauna Management Course or equivalent training	Provide course year
General skills/experience	Relevant knowledge of species biology and ecology	Personnel should be able to correctly identify the likely species to be captured in cage traps for the site/s being studied. This knowledge may be gained through sufficient field experience and/or consultation of field guides and other literature.

Competency category	Competency requirement	Competency assessment
		Estimated total time in field: Min 1 year involved in similar projects.
Fauna survey and capture skills/experience	Experience in setting and use of live traps	Personnel should be confident identifying the best locations to set traps and how to set traps so that the mechanism works and animal welfare is considered at all times. This knowledge may be gained through sufficient field experience and/or consultation of literature. Estimated total time in field: Min 1 year involved in similar projects.
	Training and experience in trap hygiene, disease transmission	Personnel should be familiar with hygiene procedures. This knowledge may be gained through sufficient field experience and/or consultation of literature. Estimated total time in field: Min 1 year involved in similar projects.
Animal handling and processing skills/experience	Experience in handling terrestrial fauna	Personnel should be confident handling and restraining the range of species likely to be captured. This knowledge may be gained through sufficient field experience and/or consultation of literature. Estimated total time in field: Min 2 years involved in similar projects.

8 Occupational Health and Safety

Always carry a first aid kit in your vehicle and be aware of your own safety and the safety of others as well as the animals when handling.

A job safety analysis is recommended prior to undertaking any monitoring which involves hand capture. This safety analysis should include the following considerations.

8.1 Animal bites, stings and scratches

Care should be taken when handling animals to avoid bites, stings or scratches. All inflicted injuries (even superficial ones) should be appropriately treated as soon as possible to ameliorate possible allergic reaction, prevent infection and promote healing.

To improve safety, field personnel should be aware of the treatment for snakebite and carry appropriate pressure bandages. Personnel should also have up-to-date tetanus vaccinations. Department personnel must not capture bats unless fully vaccinated against Australian Bat Lyssavirus.

If Department personnel or volunteers are injured, please refer to the Department's Health and Safety Section's 'Report a Hazard, near-miss or incident' intranet page, which can be

found at http://intranet/csd/People_Services/rm/Pages/ReportingHazards,Near-MissesandIncidents.aspxZoonoses.

8.2 Zoonoses

There are a number of diseases carried by animals, including ticks, that can be transmitted to humans (i.e. zoonoses such as Toxoplasmosis, Leptospirosis, Salmonella). All personnel must take precautions to minimise the risk of disease transmission to protect themselves, their families and wildlife populations.

Advice on minimising disease risk is contained in the Department SOP for *Managing Disease Risk in Wildlife Management*

8.3 Allergies

People with or that develop severe allergies associated with animals or animal materials should consult with their medical practitioner on appropriate precautions and actions for the handling of wildlife. People with nut allergies should demonstrate caution when handling, or in the vicinity of, universal bait.

8.4 Hygeine

Personnel should ensure that they maintain high standards of personal hygiene at all times, particularly in relation to handling bait/food materials. Inappropriate handling of food, especially meat products, can lead to illness and infection in personnel and in animals. Hands, equipment and anything that has come in contact with food items should be thoroughly washed and disinfected.

9 Further Reading

The following SOPs have been mentioned in this advice and it is recommended that they are consulted when proposing to use cage traps:

- Department SOP *Soft Cage Traps for Capture of Macropods*
- Department SOP *Animal Handling and Restraint using Soft Containment*
- Department SOP *Care of Evicted Pouch Young*
- Department SOP *Humane Killing of Animals under Field Conditions*
- Department SOP *First Aid for Animals*
- Department SOP *Managing Disease Risk in Wildlife Management*

For further advice refer also to:

Environmental Protection Authority and Department of Environment and Conservation (2010) *Technical Guide - Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (Eds. B.M. Hyder, J. Dell and M.A Cowan). Perth, Western Australia: EPA and DEC.

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11 Glossary of Terms

Animal handler: A person listed on an application to the Department's Animal Ethics Committee who will be responsible for handling animals during the project.

Cage trap: A trap for the live capture of animals constructed of wire mesh. Cage traps operate by the animal treading on a weight-sensitive trigger plate which causes the door to close and lock.

Appendix I: Universal Bait Recipe

Equipment

- Mixing bowl or bucket
- Mixing spoon (optional: can just use your hands)
- Container with lid to store bait
- Disposable gloves

Ingredients

- 500g Quick cooking oats
- 2 kg (5-6 375g tubs) Smooth peanut butter
- *Optional:* Between 110g (1 tin) and 636g (6-8 tins) Sardines (preferably in oil, or springwater)
- *Optional:* Cooking oil, preferably peanut oil

Note: Avoid using ingredients that contain additives, preservatives or artificial colours and flavours.

Serves: makes enough bait for approximately 100 cage traps for 4 trap nights.

Methodology

1. Ensure staff mixing bait are not allergic to peanuts.
2. Place oats and sardines into clean mixing bowl or bucket and mix so that the sardines are well distributed though the oats.
3. Mix in peanut butter until the oats and sardines are well distributed and the mixture is not too dry or too sticky. Form a ball that is sticky and cohesive. Keep in mind that the mixture will become drier over time as the oats absorb the oil from the peanut butter.
4. Store bait in a sealed container.
5. Clean bait mixing equipment.
6. Add extra peanut butter if mixture becomes too dry. Water or cooking oil can be used if extra peanut butter is not available.

Optional: Bait can be pre-rolled.

Roll bait into balls ready for placing in traps (approx. 20c coin size for cage traps and 10c coin size for box traps). The bait balls can be counted to match the number of traps being set. This will ensure that you have enough bait for all traps being set and will also act as an additional check to ensure all traps have been set and baited.

Animal Welfare

To reduce the risk of impact of the use of universal bait on wildlife ensure that bait is stored for no longer than the specified period of 5 days fresh, or 3 months frozen, to avoid the risk of the components spoiling and unsuitable for consumption. Where possible do not leave bait in open sun. Any old bait should be disposed of after trapping and not frozen for later reuse. Do not use old bait or bait containers that have mouldy bait in them.

Potential animal welfare impacts of mixing universal bait include:

- Food poisoning
- Changing behaviour by providing a food source

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Standard Operating Procedure

PERMANENT MARKING OF VERTEBRATES USING MICROCHIPS

Prepared by: Species and Communities Branch, Science and Conservation, Department of Biodiversity, Conservation and Attractions

Prepared for: Animal Ethics Committee

Version 1.3

October 2017

GOVERNMENT OF WESTERN AUSTRALIA

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1.1	23/04/2013	Revised with minor changes	Rebecca Kay	
1.2	06/09/2015	On advice from G. Kuchling, wording in Table 2 changed (microchip insertion in tortoises changed, marine turtles added)	Mia Podesta	31/12/2015
1.3	22/05/2017	Table 3 changed (endorsements removed as an acceptable competency)	Mia Podesta	
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Approvals

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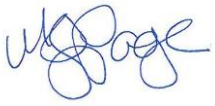
Approved by:  Date: 17/08/2017

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This document has been reviewed and endorsed by the Department's Animal Ethics Committee

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Contents

1 Purpose

Microchipping is a method of permanent identification that remains with the animal for its lifespan.

In fauna monitoring activities, microchips are most commonly used to mark medium to large sized animals being monitored for research purposes and species in which other forms of marking are not practical (e.g. species that burrow and therefore easily lose ear tags). Furred pouch young can be micro-chipped if no other suitable method of marking is available. Microchipping is not suitable for small species with delicate skin such as some rodents, amphibians and invertebrates. Where sufficient to achieve the desired purpose, temporary marking methods should be utilised over permanent methods.

Advantages of using microchips in the identification of animals include their ability to be used on an unlimited number of individual animals and on many different species of mammals, reptiles and birds, providing the microchip to body ratio does not exceed 10%. They can be read through soft/hard tissue, water, glass, thin wood, plastic, handling bags and some metal (e.g. aluminium box traps), although this does vary depending on the type of scanner used. Their very small size and weight means that they do not alter the appearance or behaviour of the animals and they are quick to apply (Mellor *et al.,* 2004)

This standard operating procedure (SOP) provides advice on the safe administration of permanent marking of fauna through the use of passive implant transponders, commonly known as microchips.

2 Scope

This SOP has been written specifically for scientific and education purposes, and endorsed by the Department's Animal Ethics Committee. However, this SOP may also be appropriate for other situations.

This SOP applies to all fauna survey and monitoring activities involving the use of microchips to permanently mark vertebrates, undertaken across the State by Department of Biodiversity, Conservation and Attractions (hereafter Department) personnel. It may also be used to guide fauna monitoring activities undertaken by Natural Resource Management groups, consultants, researchers and any other individuals or organisations. All Department personnel involved in the use of microchips should be familiar with the content of this document.

Projects involving wildlife may require a licence under the provisions of the *Wildlife Conservation Act 1950* and/or the *Biodiversity Conservation Act 2016*. Personnel should consult the Department's Wildlife Licensing Section and Animal Ethics Committee Executive Officer for further guidance. In Western Australia any person using animals for scientific purposes must also be covered by a licence issued under the provisions of the *Animal Welfare Act 2002*, which is administered by the Department of Primary Industries and Regional Development. This SOP complements the *Australian code of practice for the care and use of animals for scientific purposes* (The Code). The Code contains an introduction to the ethical use of animals in wildlife studies and should be referred to for broader issues. A

copy of the code may be viewed by visiting the National Health and Medical Research Council website (http://www.nhmrc.gov.au).

3 Definitions

Animal handler: A person listed on an application to the Department's Animal Ethics Committee who will be responsible for handling animals during the project.

Microchip: A small device about the size of a grain of rice, which is implanted subcutaneously or intra-muscularly into an animal for identification. They generate a low energy radio signal that transmits a unique number when a compatible scanner is passed over the top of it (Sharp *et al.,* 2007).

Permanent marker: A marker designed to stay with an animal for its lifespan (Sharp *et al.,* 2007). They tend to leave marks that are less visible but often involve tissue damage.

4 Procedure Outline

4.1 Equipment required

The following equipment is required when implanting microchips:

- scanner (reader)
- individually packaged microchips (e.g. Trovan ® Passive Implant Transponders)
- applicator/implanter
- topical antiseptic
- gauze swabs or tissues
- tissue glue

Trovan ® and Allflex® microchips and scanners are most commonly used for Department survey and monitoring activities, but there are many other brands of microchips and associated implanting and scanning equipment. Take care to ensure that your scanning equipment can read the microchips being implanted. *Note: The Lid 560 ISO Pocket Read can read ALL ISO and conventional microchips used throughout Australia.* The International Standards Organisation (ISO) has developed the standards ISO 11784 and ISO 11785 to reduce incompatibility issues associated with microchips (WSAVA, 2008). Table 1 lists the microchips in use within Australia.

Table 1 Microchip distributors and brands currently used in Western Australia

Distributor	Brand	Compatible Scanner/Reader
TROVAN	Trovan	AREH5 Portable Reader
Destron-Fearing	Animal Electronic ID System (AEIDS) Lifechip	Pocket Reader Pocket Reader EX
AVID	VMN	Power Tracker II
Allflex	Allflex FDX-B Passive Transponder	Allflex Compact Reader

4.2 Animal handling

(a) Techniques for handling animals vary depending on the species of mammal, reptile or bird involved and the experience and skills of personnel. General advice on handling of animals is contained in the Department SOP for *Hand Restraint of Wildlife*. All handing of animals should be done by (or under the guidance of) experienced personnel.

(b) Use handling bags appropriate for the species and length of containment as advised in the Department SOP for *Animal Handling and Restraint using Soft Containment*.

(c) If an animal is injured during handling/microchipping, treat any superficial wounds with a topical antiseptic (e.g. Betadine). Refer to the Department SOP for *First Aid for Animals*.

(d) If an animal is seriously injured, refer to the flowchart in the Department SOP for *Humane Killing of Animals under Field Conditions* to make the decision on whether or not to euthanase or seek veterinary care.

(e) Captured animals must be released at point of capture (unless the purpose of the trapping is translocation, specimen collection is required or other approved reason). Animals must be released, or reach an alternate endpoint approved by the Department's Animal Ethics Committee, within 24 hours of capture. Animals should be released at a time when they are normally active.

4.3 Inserting the microchip

Microchips are inserted subcutaneously under the skin (generally inserted between the scapula (shoulder blades) of the animal, or intra-muscularly, and are quick to apply and cause only brief pain.

(a) While the animal is in the holding bag or while it is being restrained it should be scanned to ensure that it does not already have a microchip.

Note: As a microchip may migrate it is advisable to scan the whole animal.

(b) All transponder marking must be conducted using sterile equipment.

(c) Turn the scanner on and scan the microchip to ensure it is functioning and that the number of the microchip matches the number shown on the packaging sticker. If the microchip number and sticker match, transfer the sticker onto the animal's record.

(d) Remove the implant needle from its individual sterile packaging and insert the plastic base into the applicator. Secure it by screwing it into the base of the applicator.

(e) Firmly restrain the animal (this is often easier with two people with one person holding head and the other the rump), exposing the implant site and leaving the rest of the body in the handling bag, taking particular care to ensure eyes are covered. Do not continue if the animal becomes distressed as a result of restraint. A squirmy animal while manoeuvring a sharp object can result in injury to both the animal and handler alike.

Recommended implant sites for animal groups are outlined in Table 2.

Table 2 Guide to implantation sites in different animal groups

Animal Group	Implantation Site
Mammals	Subcutaneously in the loose between the scapula (shoulder blades)
Birds	Intramuscularly in the pectoral muscle
Lizards	Subcutaneously in the inguinal region (i.e. on the side of the body just in front of the hind leg) (K. Payne, pers. comm., 2009).
Snakes	Between the scales subcutaneously lateral and cranial to the cloaca (i.e. on the side of the snake just in front of the cloaca) (K. Payne, pers. comm., 2009)
Freshwater turtles and tortoise	Subcutaneously above the tail in a skin fold between the tail and the shell (G. Kuchling, pers. comm., 2015).
Marine turtles	As per the Department SOP for *Marking of Marine Turtles using Flipper and PIT Tags*. Generally in the left shoulder by measuring approximately 2-3 finger widths below the carapace in the right half of the centre section between the neck and flipper.

(f) Once the animal is securely restrained swab the implant site with dilute topical antiseptic (e.g. Betadine®/ethanol), part the fur/feathers/scales to expose the skin at the insertion site. The point of insertion should be 2cm behind where the transponder will be. If an antiseptic swab is not effective at clearing the injection site, hair may be carefully cut away. This may also aid in relocating the injection site should an animal move or flinch between the removal of the syringe and gluing of the site.

(g) Remove the plastic shield from the needle.

(h) Once ready to insert the microchip, tent any loose skin between three fingers, allowing space for entry of the needle and chip.

(i) Firmly insert the needle at the base of the tented skin, facing in a posterior direction on a slight angle trajectory. Pause to allow the animal to relax if it has tensed up, then continue, stopping when the notch in the needle reaches the point of entry into the skin.

Note: New batches of microchips from Microchips Australia do not have the notch on the needle.

The needle needs to be inserted into the subcutaneous space (except birds). If you have difficulty inserting the needle fully you may have the needle too deep and be trying to insert the needle into muscle or you have the needle in too shallow so it is still in the skin layer.

Note: There may also be instances where it may be appropriate to insert the needle towards the animals head. Appropriate techniques may vary slightly between species highlighting the importance of training and experience to administer this procedure.

(j) Rotate the needle 180°, so that the long edge is against the skin allowing the chip to drop out of the needle with greater ease.

(k) Depress the plunger on the applicator, feeling at the end of the needle (through the skin) for the microchip.

(l) Remove the needle gently holding the skin around the needle at the insertion point which helps prevent the microchip from tracking back out with the needle. For mammals and birds ensure there are no fur/feathers within the insertion wound as this can be a source of infection.

Note: If the microchip tracks back out or if the end of the chip is visible at the insertion point it is important to reinsert it by carefully threading the exposed end back up the needle and using the needle to push it further under the skin. Sometimes fingers or forceps are sufficient for this task. (S. Vitali, pers. comm, 2008).

(m) Replace the cover on the needle and dispose of into a sharps container.

(n) Place a drop of tissue glue on the wound to seal it (this is essential with reptiles and in general is a good insurance against the loss of the microchip through the wound). Ensure the wound from the syringe is clear of dirt and hair before it is glued.

(o) Run the scanner over the insertion site to check that the transponder has been correctly applied.

(p) Resecure the animal in the handling bag and allow it to recover before releasing.

4.4 Recording data

Data should be recorded on an appropriate datasheet and database. Microchips are accompanied by several copies of the microchip number (usually 15 digits). To ensure accuracy of recording microchip numbers these should be cut off and stuck onto the data sheets rather than written down.

5 Level of Impact

Potential animal welfare impacts when microchipping animals include:

- Distress (caused by handling, discomfort, social isolation, separation of mother and young)
- Trauma (possible injury to the animal during restraint eg. Scratching itself, biting itself)
- Pain during insertion of microchip (this is usually brief)
- Infection at site of implant insertion
- Incorrect insertion (too deep, into skulls etc.)

If carried out correctly microchipping should be a fast procedure causing limited pain, with no need for either local or general anaesthesia.

It should be noted that whilst these impacts are specifically associated with the procedure of microchipping, an animal may also experience other impacts from associated procedures such as trapping and capture.

6 Ethical Considerations

To reduce the level of impact of microchipping on the welfare of animals there are a number of ethical considerations that should be addressed. Department projects involving

microchipping of vertebrates will require approval from the Department's Animal Ethics Committee.

It should be noted that whilst these ethical considerations are specifically associated with the procedure of microchipping, other ethical considerations need to be taken into account during procedures carried out prior, such as trapping and capture.

6.1 Animal handling

To ensure minimal stress to the animals they should only be handled for as long as required to mark them and to collect any necessary measurements (usually no more than five minutes). They must be released within 24 hours of capture. Improper restraint, especially when dealing with a stressed and frightened animal can lead to major physiological disturbances (hyperthermia, stress, shock capture myopathy). It is preferable that handling be done during the cooler periods of the day (dawn/dusk).

6.2 Pain and infections

Although hygiene is difficult in the field, cleanliness of all surgical techniques is essential to minimise the potential for infection (refer to the Department SOP for *Managing Disease Risk in Wildlife Management*). Appropriate anti-septic and measures of pain minimisation must be used when/if required (refer to the Department SOP for *First Aid for Animals*).

Where the opportunity arises, personnel should check injection sites on animals in the days following the procedure. In addition to identifying the animal upon re-trap, inspect the injection site for signs of infection to verify the procedure is being administered successfully.

6.3 Injury and unexpected deaths

If injury, unexpected deaths or euthanasia occur then it is essential to consider the possible causes and take action to prevent further deaths. For projects approved by the Department's Animal Ethics Committee, adverse events such as injury, unexpected deaths or euthanasia must be reported in writing to the AEC Executive Officer on return to the office (as per 2.2.28 of The Code) by completing an *Adverse Events Form*. Guidance on field euthanasia procedures is described in the Department SOP for *Humane Killing of Animals under Field Conditions.* Where disease may be suspected, refer to the Department SOP for *Managing Disease Risk in Wildlife Management* for further guidance.

7 Competencies and Approvals

Department personnel, and other external parties covered by the Department's Animal Ethics Committee, undertaking monitoring projects involving permanent marking of animals by microchipping require approval from the committee and will need to satisfy the competency requirements detailed in Table 3. This is to ensure that personnel involved have the necessary knowledge and experience to minimise the potential impacts of microchipping on the welfare of the animals. Other groups, organisations or individuals using this SOP to guide their fauna monitoring activities are encouraged to also meet these competency requirements as well as their basic animal welfare legislative obligations.

It should be noted that details such as intensity of the study being undertaken will determine the level of competency required and Table 3 provides advice for basic monitoring only.

Table 3 Competency requirements for Animal Handlers of projects involving permanent marking of vertebrates by microchipping

Competency category	Competency requirement	Competency assessment
Wildlife licences	Licence to take fauna for scientific purposes (Reg 17)	Provide licence number
Formal training *Note: Suitable levels of skills/experience can substitute for formal training requirements*	Department Fauna Management Course or equivalent training	Provide course year
Animal handling and processing skills/experience	Experience in handling target (or similar species) AND Experience and training in inserting PIT tags.	Personnel should be confident at hand restraint of species likely to be encountered when microchipping. The Department's Animal Ethics Committee require that anyone proposing to implant microchips are trained and supervised by a highly experienced staff member or qualified registered veterinarian. A minimum of 5 supervised applications of microchips for each species is recommended. Estimated total time in field: Min 2-5 years involved in similar projects.

8 Occupational Health and Safety

Always carry a first aid kit in your vehicle and be aware of your own safety and the safety of others as well as the animals when handling.

A job safety analysis is recommended prior to undertaking any monitoring which involves hand capture. This safety analysis should include the following considerations.

8.1 Animal bites, stings and scratches

Care should be taken when handling animals to avoid bites, stings or scratches. All inflicted injuries (even superficial ones) should be appropriately treated as soon as possible to ameliorate possible allergic reaction, prevent infection and promote healing.

To improve safety, field personnel should be aware of the treatment for snakebite and carry appropriate pressure bandages. Personnel should also have up-to-date tetanus vaccinations. Department personnel must not capture bats unless fully vaccinated against Australian Bat Lyssavirus.

If Department personnel or volunteers are injured, please refer to the Department's Health and Safety Section's 'Report a Hazard, near-miss or incident' intranet page, which can be found at http://intranet/csd/People_Services/rm/Pages/ReportingHazards,Near-MissesandIncidents.aspxZoonoses.

8.2 Zoonoses

There are a number of diseases carried by animals that can be transmitted to humans (i.e. zoonoses such as Toxoplasmosis, Leptospirosis, Salmonella). All personnel must take precautions to minimise the risk of disease transmission to protect themselves, their families and wildlife populations.

Advice on minimising disease risk is contained in the Department SOP for *Managing Disease Risk in Wildlife Management*

8.3 Allergies

Some personnel may develop allergies when they come in contact with animal materials such as hair and dander. Personnel known to develop allergies should wear gloves when handling animals and long sleeved pants/shirt.

People with severe allergies associated with animals, with immune deficiency diseases or on immunosuppressant therapy should not engage in the handling of wildlife.

8.4 Sharp Equipment

There is a real risk of needle stick injuries to personnel. Needles are designed to be sharp and pierce skin easily. Care must be taken when working around sharp objects. All injuries (even superficial ones) should be appropriately treated as soon as possible to prevent infection and promote healing.

Adequate restraint needs to be used when working with an animal to avoid any sudden movements.

All needles are to be disposed of in a sharps container.

8.5 Chemicals

Only tissue glue is to be used when permanently marking animals with microchips. Super glue is NOT RECOMMENDED. Super glue is ethyl cyanoacrylate which can cause histotoxicity and inflammation as it rapidly breaks down into the by-products of cyanoacetate and formaldehyde (Mobley *et al.,* 2002). Tissue glue is butyl cyanoacrylate which degrades at a slower rate than ethyl cyanoacrylate and releases less toxic by-products into the tissue of the animal (Mobley *et al.,* 2002).

9 Further Reading

The following SOPs have been mentioned in this advice and is recommended that they are also consulted when proposing to use microchips.

- Department SOP *Animal Handling and Restraint using Soft Containment*
- Department SOP *Hand Restraint of Wildlife*
- Department SOP *Humane Killing of Animals under Field Conditions*

- Department SOP *First Aid for Animals*
- Department SOP *Managing Disease Risk in Wildlife Management*

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10.1 Personal Communication

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- Karen Payne (Veterinarian, Perth Zoo), 14 February 2009
- Simone Vitali (Senior Veterinarian, Perth Zoo), 3 October 2008