Black-footed Tree-rat (*Mesembriomys gouldii gouldii*) Offset Plan for the Lee Point Development (EPBC 2015/7591)

Defence Housing Australia

4 elements

DECLARATION OF ACCURACY

In making this declaration, I:

- am aware that section 491 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) makes it an offence in certain circumstances to knowingly provide false or misleading information or documents to specified persons who are known to be performing a duty or carrying out a function under the EPBC Act or the *Environment Protection and Biodiversity Conservation Regulations 2000* (EPBC Regulations). The offence is punishable on conviction of imprisonment or a fine, or both.
- am authorised to bind **Defence Housing Australia** to this declaration and have no knowledge of that authorisation being revoked at the time of making this declaration.

Signature

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Full name (please print)

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Organisation (please print)

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Revision History

Version	Purpose	Issued by	Date	Reviewer	Date
1	Draft	Patrick Tomkins	28/03/2025	Mellissa Brown	29/03/2025
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1.0 Introduction

1.1 Purpose of the Document

Four Elements Consulting was commissioned by Defence Housing Australia (DHA) to prepare a document outlining strategies to offset impacts of the Lee Point Master-planned Urban Development (the Project) on the nationally significant black-footed tree-rat (*Mesombriomys gouldii gouldii*), which is listed as Endangered under the *Environment Protection and Biodiversity Act 1999* (EPBC Act). Offsets for the black-footed tree-rat are required under the project's EPBC Act approval (EPBC 2015/7591), which is detailed in **Section 1.1.2** below.

1.1.1 Impacts Requiring Offsets

The project was subject to an Environmental Impact Statement (EIS) process in 2017, which confirmed presence of the black-footed tree-rat at Muirhead North and concluded that 17.5 ha of suitable habitat was present for the species within the disturbance footprint. This area was reduced to 10 ha when the project was granted EPBC approval in 2019. Thus, this Black-footed Tree-rat Offset Plan will outline a strategic framework to offset the loss of 10 ha of black-footed tree-rat habitat at Muirhead North.

1.1.2 Meeting the Project's EPBC Act Approval Conditions

The project's EPBC Act approval conditions state that offsets must be provided for the loss of black-footed tree-rat habitat at Muirhead North. Condition 8 a) of the EPBC Act approval states that a framework for the delivery of offsets (i.e., an offset plan) must be submitted to the Minister for approval within 12 months of commencement of the action at Muirhead North. Condition 8 b) states that when this offset plan has been approved, detailed management plans for each approved offset project must be developed and submitted to the minister. This document addresses Condition 8 a) of the project's EPBC Act approval only, with condition 8 b) to be addressed once this document is approved by the minister. These conditions are outlined in **Table 1** below.

Table 1 Lee Point Master-planned Urban Development EPBC Approval – Condition 8

Biodiversity Offset Condition	Location in this Document
8. To offset the loss of 10 ha of **Black-footed Tree-rat** habitat from **Muirhead North**, within 12 months of **commencement** of the action at **Muirhead North** the approval holder must submit a Black-footed Tree Rat Offset Plan to the **department** for the **Minister**'s approval. The approval holder must not undertake the action at **Muirhead North** for more than 24 months from the date of **commencement** of the action	**Entire document.**

unless the **Minister** has approved the Black-footed Tree Rat Offset Plan in writing, and the provisions of condition 2A and 8B have been met.	
a) The Black-footed Tree-rat Offset Plan must provide a framework for how the **clearance** of **Black-footed Tree-rat** habitat will be offset, and must: i. Include a review of relevant **approved conservation advices, recovery plans and threat abatement plans**;	**Section 3**
ii. Identify threats to **Black-footed Tree-rat**, and potential recovery actions and research opportunities; and	**Section 3**
iii. Specify a process for developing Black-footed Tree Rat Offset Projects, and a staged process for submitting proposed Black-footed Tree Rat Offset Projects and milestones for completion of Black-footed Tree Rat Offset Projects to the **Department** for approval by the **Minister**.	**Section 5**
b) Offset Projects submitted to the Department for approval in accordance with Condition 8(a)iii must: i. specify the location and nature of Offset Project activities; ii. include project goal/s, budget and a detailed Black-footed Tree Rat Offset Project description, including timeframes for the elements of the Black-footed Tree Rat Offset Project, and reporting and publishing of the Black-footed Tree Rat Offset Project results; iii. demonstrate how the Black-footed Tree Rat Offset Project is consistent with the Black-footed Tree Rat Offset Plan; iv. describe advice obtained to develop the Black-footed Tree Rat Offset Project; v. explain how the Black-footed Tree Rat Offset Project complies with the principles of the **EPBC Act Environmental Offsets Policy** and, if relevant, provide details of how the Black-footed Tree Rat Offset Project meets the criteria for research and educational programs identified in Appendix A of the **EPBC Act Environmental Offsets Policy**; and	**To be addressed in future documents.**

vi. identify and manage risks associated with implementing the Black-footed Tree Rat Offsets Project. The approval holder must not implement any Black-footed Tree Rat Offset Project until it has been approved in writing by the **Minister**. Each approved Black-footed Tree Rat Offset Project must be implemented. The approval holder must expend an amount equivalent to at least $78,750 (excluding GST) on implementation of the Black-footed Tree Rat Offset Projects approved in accordance with Condition 8(a) and 8(b).	

This document outlines strategies to offset impacts to the black-footed tree-rat at Muirhead North only. Impacts to the species from the 2CRU development will be offset according to condition 7 of the project's EPBC approval, which is outside the scope of this document.

1.2 Document Structure

This Black-footed Tree-rat Offset Plan is structured as follows:

- **Section 1** – Introduction
- **Section 2** – Overview of the project and species description
- **Section 3** – Threats facing the black-footed tree-rat and potential management strategies
- **Section 4** – Development of offset plan
- **Section 5** – Proposed offset projects
- **Section 6** - References

2.0 Project Overview

2.1 Project description

Defence Housing Australia is proposing an urban development (the Lee Point Master-planned Urban Development) on the outskirts of Darwin, which will establish a residential, tourism, community and commercial precinct in the suburb of Nightcliff. The 132.5 ha project site is bisected by Lee Point Road and comprises a former Department of Defence installation (referred to as the 2CRU site) on the western side, and a vacant parcel of crown land on the eastern side (referred to as Muirhead North). The project will provide affordable housing for both Defence families and for members of the public, as well as establish a tourism and community hub featuring restaurants, cafes, hotels, self-contained apartments, and retail shops. The project will also provide

serviced allotments to the NT Government for essential community infrastructure, including a childcare centre, primary school, and sporting oval.

The project's proximity to popular public spaces at Lee Point and the Casuarina Coastal Reserve will ensure high traffic throughout the year, generating economic stimulus for a Darwin economy that is currently in decline after recent downturns in the mining and fossil fuel industries. In total, the project will contribute an estimated $350 million to the local economy, providing full time employment for up to 964 workers in the construction industry, 117 full-time and part-time employees in the hospitality industry, and 40 full-time employees in education. Furthermore, the project will prioritise training and employment opportunities for traditional owners, fostering economic participation and long-term benefits for the local community.

2.1.1 Relevant stakeholders

The project will proceed via an arrangement between the two major stakeholders – DHA, who are the landowners of 2CRU, and the Northern Territory Government, who is the controlling agency at Muirhead North via the Northern Territory Department of Infrastructure, Planning and Logistics (DIPL). In addition to the primary stakeholders, there are several key agency stakeholders involved with the project. These include:

- The Larrakia people - the traditional owners of the project site represented through the Larrakia Development Corporation and the Larrakia National Aboriginal Corporation.
- The City of Darwin - the relevant local government body.
- Northern Territory Parks and Wildlife Commission - the agency responsible for the Casuarina Coastal Reserve.

2.2 Species Description

2.2.1 Conservation Status

The black-footed tree-rat is listed as Endangered under both the EPBC Act and the *Territory Parks and Wildlife Conservation Act 1976*. At present, no Recovery Plan exists for the species. However, the Conservation Advice for the Kimberley and mainland Northern Territory subspecies of the black-footed tree-rat provides sufficient direction to implement priority actions for the species and mitigate against key threats.

2.2.2 Habitat and Distribution

The black-footed tree-rat is restricted to forests and woodlands in coastal regions of the Kimberley and the Northern Territory (Friend & Calaby, 1995; Rankmore, 2003). It prefers woodland dominated by *Eucalyptus miniata* (Darwin Woollybutt) and *Eucalyptus tetrodonta* (Darwin Stringybark), particularly in areas with a well-

developed shrubby understorey (Friend, 1987; Friend & Taylor, 1985). These habitats are typically characterised by large-diameter trees, indicative of low fire frequency and intensity.

The black-footed tree-rat (*Mesembriomys gouldii*) comprises three subspecies with disjunct distributions - *M. g. rattoides* is found along the eastern and western coastal regions of Cape York Peninsula, *M. g. melvillensis* is restricted to Melville Island, and *M. g. gouldii* is distributed patchily across the Kimberley and the Top End. Historical records indicate a contraction of the species' range, particularly from Eastern Arnhem Land and the Gulf of Carpentaria (Friend & Calaby, 1995).

Multiple studies have documented a decline in population size across key regions in the black-footed tree-rat's distribution. For example, recent surveys have revealed very low numbers of black-footed tree-rats in Kakadu National Park, where the species was considered relatively common 30-40 years ago (Woinarski et al., 2010). Similar declines have been observed across the broader Top End region (Ziembicki et al., 2013) and on Melville Island (Davies et al., 2018a). However, the species appears to remain relatively abundant in the Darwin region, with studies recording stable numbers between 2001 and 2014 (Stokeld & Gillespie, 2015).

2.2.3 Ecology

The black-footed tree-rat is a large, nocturnal rodent weighing between 500 and 900 g. It is characterised by a robust body with grey fur, large black feet and ears, and a distinctive, elongated tail (30-40 cm) that terminates in a brush of white hairs. The species exhibits both arboreal and terrestrial foraging behaviours and is highly mobile, with an average home range of 67 ha in unfragmented forest and 27 ha in fragmented habitats (Rankmore, 2006). It is known to travel up to 2 km in a single night whilst foraging and is primarily frugivorous, consuming a range of fleshy and hard fruit seeds, with a strong preference for *Pandanus spiralis* fruit (Friend & Calaby, 1995). Its diet is supplemented with invertebrates, flowers, and grasses depending on seasonal availability (Morton, 1992; Rankmore, 2006; Rankmore & Friend, 2008).

The black-footed tree-rat is nocturnal, sheltering preferentially in tree hollows during the day. In areas where hollows are scarce, the species is known to nest in large *Pandanus spp.* (Pittman, 2003). Historically considered a solitary species (Friend, 1987), emerging evidence suggests that the black-footed tree-rat may exhibit more gregarious behaviours. A recent radio-tracking study reported that a significant proportion of retrieved collars had been chewed by other black-footed tree-rats (Rankmore pers. comm. as cited in EcOz, 2017). Additionally, recent camera-trapping studies have frequently documented multiple individuals at bait stations, further supporting the hypothesis of social tendencies within the species (Brydie Hill, Flora and Fauna Branch of the NT Department of Land and Resource Management, pers. comm. as cited in EcOz, 2017).

The black-footed tree-rat reproduces throughout the year, with peak breeding activity occurring during the late dry season (typically August–September) (Friend, 1987; Rankmore, 2006). They become sexually mature at approximately 80 days, with females reproducing every nine months. The species has a gestation period of 43–

44 days, producing litters of one to three offspring, with juveniles weaned at around one month of age (Crichton, 1969; Friend, 1987).

3.0 Threats and Management Strategies

A combination of factors has contributed to the contraction and fragmentation of black-footed tree-rat populations across their range. These threats, as well as appropriate management strategies, are detailed in the Black-footed Tree-rat Conservation Advice and are outlined in **Table 2** and **Table 3** below. Other relevant documents considered when determining threats to the black-footed tree rat and potential mitigation strategies include:

- *Threat abatement plan for predation by feral cats 2024* (DCCEEW, 2024)
- *Threat abatement plan to reduce the impacts on northern Australia's biodiversity by the five listed grasses* (DSEWPC, 2012)
- *Threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads* (DSEWPC, 2011)

Table 2 Threats to the Black-footed Tree-rat

Threat	Consequence Rating	Evidence	Relevance to Greater Darwin Population
Inappropriate fire regimes (frequent, high-intensity, extensive fires)	Severe	Fire frequency is an important predictor of black-footed tree-rat abundance (Davies et al., 2018b). There is strong evidence that frequent, high-intensity fires reduce habitat quality for the black-footed tree-rat by decreasing food availability and the number of suitable hollows (e.g., Penton et al., 2020; Penton et al., 2021a; Penton et al., 2021b). Inappropriate fire regimes are also known to exacerbate predation pressures on small mammals (Leahy et al., 2015), particularly from feral cats (McGregor et al., 2014; 2015; 2016).	**High.** Intense, high-frequency fires are a known threat to ecological values in the greater Darwin region.
Predation by feral cats	Severe (if confirmed)	This has not been demonstrated but is highly likely. Feral cats are widespread across northern Australia and have been implicated in the decline of mammal populations throughout the black-footed tree-rat's range (e.g., Davies et al., 2018a; Fisher et al., 2014; Frank et al., 2014). A recent review of all known feral cat predation records in Australia identified 151 species of native Australian mammal, with medium-large rodents considered most at risk of predation (Woolley et al., 2019). Several species that are comparable in size and behaviour to the black-footed tree-rat were confirmed as prey for feral cats, including congener the golden-backed tree-rat (*Mesembriomys macrurus*).	**High.** Feral cats are common in the greater Darwin area and are likely to be impacting black-footed tree-rat populations.

Habitat loss and fragmentation	Severe	The large tracts of tall, open Eucalypt woodland required by this species (Rankmore, 2006) are increasingly at threat from localised developments, particularly from the horticulture and mining sectors (TSSC, 2015). Urbanisation and expansion in the Darwin region are increasingly constricting and fragmenting remaining black-footed tree-rat habitat (S. Ward, pers. comm. as cited in TSSC, 2015).	**High.** Black-footed tree-rat populations in the Darwin region are becoming increasingly fragmented as urbanisation encroaches on the species' remaining habitat.
Habitat change due to exotic invasive grasses	Severe	This has not been demonstrated but is likely. Invasive grasses are spreading throughout the black-footed tree-rat's range (e.g., DEPWS, 2024; Kean & Price 2003) and are known to increase fuel loads, resulting in more frequent and higher intensity fires, which are known to be detrimental to the species. Invasive grass infestations are also likely to impede the black-footed tree-rat's ability to forage (TSSC, 2015).	**High.** Invasive grasses are present throughout the greater Darwin region and are likely to be impacting black-footed tree-rat habitat quality by reducing food availability, impeding foraging behaviours, and contributing to detrimental fire regimes.
Predation by wild dogs/dingoes	Moderate	This has not been demonstrated but is plausible. Wild dogs/dingoes are common throughout the black-footed tree-rat's range (ALA, n.d.) and are known to predate upon similar mammalian species.	**Medium.** Wild dogs are known to occur throughout the greater Darwin region, but their impact on the black-footed tree-rat is likely to be minor. Direct predation of feral dogs on black-footed tree-rats has not been demonstrated, and wild dog/dingo presence may provide indirect benefits to black-footed tree-rats be suppressing the activity of feral cats (Kennedy et al., 2012).
Habitat degradation and resource depletion due to livestock and feral herbivores	Minor	This has not been demonstrated but is possible. Feral herbivores exacerbate invasive grass and weed incursion (Hogan & Phillips, 2011), which can impact vegetation structure and may, in turn, alter fire regimes.	**Medium.** Feral herbivores occur throughout the greater Darwin region, but their impact on black-footed tree-rat populations is likely to be minor.
Poisoning by cane toads	Unknown	This has not been demonstrated but is possible. The decline of black-footed tree-rats in the Top End coincided with cane toad colonisation (TSSC, 2015), suggesting a possible correlation.	**Low.** Evidence suggests that impacts from cane toads are greatest at the invasion front, with these effects diminishing over time as wildlife adapts to their presence (DCCEEW, 2010). Given

		Impacts to the black-footed tree-rat may be indirect (e.g., cane toad-related decreases in python and monitor populations resulting in more feral cats).	that cane toads have been present in the Darwin region for 20 years, and there is no evidence linking their colonisation to declines in black-footed tree-rat populations across their range, the impact of cane toads on black-footed tree-rats in the Darwin region is likely to be low.

Table 3 Management Strategies for the Black-footed Tree-rat

Management Strategy Theme	Specific Actions	Priority	Relevance to Darwin Population
Active mitigation of threats	Develop or maintain regimes that reduce frequency and intensity of fire	High	**High.** Frequent, high-intensity fires are a major threat to biodiversity throughout the Darwin region. The implementation of appropriate fire regimes will improve habitat quality for the black-footed tree-rat and reduce the risk of catastrophic fire events.
	Implement cost-effective control measures to reduce the abundance or impacts of feral cats	High	**High.** Feral cats are prevalent throughout the greater Darwin region and are likely to be impacting black-footed tree-rat populations.
	Maintain habitat patch integrity and increase connectivity, especially in regions subject to clearing and intensification of land use	Medium-high	**High.** As urbanisation of the Darwin region continues, maintenance of habitat patch quality and connectivity is of vital importance.
	Seek to constrain further encroachments of invasive pasture grasses	Medium-high	**High.** Invasive grass control will lessen fuel loads and, in turn, reduce the likelihood of frequent, high-intensity fires. Reduction in invasive grass infestations is also likely to increase foraging opportunities for the black-footed tree-rat.
Captive breeding	Enhance captive breeding program	Medium-high	**Low.** Black-footed tree-rat populations in the Darwin region appear to be relatively stable (Stokeld & Gillespie, 2017; von Takach et al., 2023) and would benefit more from threat mitigation as opposed to re-population.
Translocation	May be required in the Kimberley	Low-medium	**Low.** Black-footed tree-rat populations in the Darwin region appear to be relatively stable (Stokeld & Gillespie, 2017; von Takach et al., 2023) and would benefit more from threat mitigation as opposed to re-population.

Monitoring	Implement monitoring program linked to assessment of management effectiveness	High	**High.** The black-footed tree-rat population in the Darwin region remains poorly understood. An effective monitoring program will help inform management practices in the future.
Community engagement	Involve Indigenous ranger groups in survey, monitoring and management	Medium	**High.** Indigenous ranger involvement is likely to benefit both the environment and the local community.
	Increase the profile of the species in the Darwin peri-urban area to advocate for its protection	Medium	**Medium.** Recent media attention for the project has increased the profile of the black-footed tree-rat in the Darwin region, which is likely to increase as the project progresses. Increased awareness and community engagement will contribute to positive conservation outcomes for the species.
Habitat mapping	In the Northern Territory, particularly around Darwin, identify and map the highest quality habitat for this subspecies (including the maintenance of required connectivity) for consideration and protection under development pressure.	Medium-high	**High.** Habitat mapping in the Darwin area is important for the maintenance of patch integrity and connectivity as urbanisation in the region increases.

3.1 Relevance to the Darwin Region

The Black-footed Tree-rat Conservation Advice identifies four threats with a consequence rating of severe that are all highly relevant to the greater Darwin population – habitat loss and fragmentation, inappropriate fire regimes, exotic grass incursion and feral cats (**Table 2**). These threats are discussed below.

3.1.1 Habitat Loss and Fragmentation

Rapid urbanisation in the greater Darwin area poses a significant threat to biodiversity. As Darwin's population grows and anthropogenic transformation of the landscape intensifies, once continuous expanses of native vegetation are becoming increasingly fragmented (Fischer et al., 2021), creating isolated patches of remnant bushland surrounded by a matrix of modified habitats. A number of threatened species, including the black-footed tree-rat, are dependent on these fragmented patches for survival (Griffiths et al., 2002), meaning their retention and management are vital for the preservation of biodiversity in the greater Darwin region.

Patch size is an important factor when considering the biodiversity value of fragmented habitat. It is widely accepted in the literature that species richness is positively correlated with patch size, as larger patches allow for greater habitat diversity (e.g., Angold et al., 2006; Larence et al., 2018; Szangolies et al., 2022). Larger patches are also less influenced by external forces (Saunders et al., 1991), meaning they are more resistant to edge effects and thus more stable (Rankmore, 2006). In northern Australia, where fire plays a major role in the landscape, patch size is even more important as small fragments (e.g., <1 ha) cannot support a diverse fire regime, meaning they become more homogenous as time since isolation increases (Andersen et al., 2012; Driscoll et al., 2021; Rankmore, 2006).

Patch size requirements vary greatly between species (Arroyo-Rodriguez et al., 2020; Johst et al., 2011). Although empirical data on minimum patch size requirements for the black-footed tree-rat is lacking, inferences can be drawn from the species' ecology. Specifically, the black-footed tree-rat is highly mobile, has a relatively large home range (Rankmore, 2006; Rankmore & Friend, 2008), and utilises large tracts of intact forest when foraging (Griffiths et al., 2002; Kerle et al., 2024). A study that radio-tracked black-footed tree-rats in the greater Darwin region found that individuals travelled up to 18 ha over a three-month period (Griffiths et al., 2002), indicating a strong dependence on large, intact woodland patches. This suggests that larger patches (e.g., >20 ha) are more valuable to the species than multiple, smaller habitat fragments.

3.1.2 Inappropriate Fire Regimes

The alteration of fire regimes across northern Australia is well documented in the literature (e.g., Bowman, 2003; Enright & Thomas, 2008; Russell-Smith et al., 2003). The breakdown of traditional burning practices has led to more frequent, high intensity fires (Mariani et al., 2022), which are further exacerbated by factors such as exotic

grass invasion (Setterfield et al., 2010) and climate change (Canadell et al., 2021). This increase in the frequency of high intensity fires has been implicated in the decline of several mammal species across northern Australia (e.g., Davies et al., 2018b; Price et al., 2005; Woinarski et al., 2001) including the black-footed tree-rat (Davies et al., 2018b).

Several studies have identified fire frequency and intensity as a significant predictor of black-footed tree-rat abundance. Kerle et al. (2024) found that in the Kimberley, black-footed tree-rats preferred areas that were structurally diverse and protected from fire, while Davies et al. (2018b) observed an increase in black-footed tree-rat abundance in plots that were burnt less frequently. These findings can be explained by the species' habitat requirements, which are dependent upon longer fire intervals and reduced fire intensity. Specifically, the black-footed tree-rat prefers mature forest with a well-developed understorey (Davies et al., 2018a; Kerle et al., 2024), utilising hollows for day-time refuges and nesting (Griffiths et al., 2002; Wooley et al., 2024). Penton et al. (2020; 2021) found that black-footed tree-rats prefer mature den trees with large den cavities, while Wooley et al. (2024) demonstrated that hollows are a critical limiting resource for the species in areas that burn frequently. Intense, more frequent fires are also likely to reduce food resources for the species and increase susceptibility to feral cats (McGregor, 2017).

Altered fire regimes in the Darwin region pose a significant threat to the black-footed tree-rat. Due to its proximity to a major population centre, bushland in the greater Darwin region experiences frequent, deliberate burning (NAFI, 2025). This rise in fire frequency, combined with the increase in fuel loads associated with the proliferation of exotic grasses in the region (Keane & Price, 2002), highlights the increasing threat that fire poses to black-footed tree-rats in the greater Darwin area.

3.1.3 Invasive Grasses

Exotic grass invasion is a major threat to biodiversity across northern Australia (Cook & Grice, 2013; Gallagher & Leishman, 2015; Godfree et al., 2017; Rossiter-Rachor et al., 2023). Invasive grasses alter habitat structure, composition, and quality (D'antonio & Vitousek, 1992), which in turn impacts resource availability and disturbance regimes, often with far-reaching ecosystem-level consequences (Gordon, 1998). There are numerous exotic grass species currently invading northern Australia, and there is a plethora of literature documenting their adverse environmental impacts (e.g., Grice et al., 2013; Lonsdale, 1994; Rossiter et al., 2003; van Klinken et al., 2015; van Klinken & Friedel, 2018).

Of particular concern in Australia's northern savannah are transforming grasses such as gamba grass (*Andropogon gayanus*). Gamba grass outcompetes native grasses (Rossiter-Rachor et al., 2009), forming a monoculture that increases fuel loads and results in more frequent, high-intensity fires (Setterfield et al., 2010). One study attempted to quantify the impact of gamba grass on fire regimes in northern Australia, finding that areas dominated by gamba grass experienced fires eight times more intense than those recorded in native grass

savannahs at the same time of year (Rossiter et al., 2003). Recent surveys in the greater Darwin area revealed a significant increase in gamba grass infestations, with an estimated 532,900 ha in the Darwin and Katherine regions affected (Northern Territory Government, 2024). This highlights the urgent need for effective management strategies in the region.

Exotic grass invasion poses a significant threat to the black-footed tree-rat. Invasive grasses contribute to more frequent, higher-intensity fires, which is consistently identified in the literature as the major threatening process for the species (Davies et al., 2018b; Kerle et al., 2024; Neave et al., 2024; Wooley et al., 2024). Invasive grasses outcompete native grasses and shrubs, reducing structural diversity and woodland complexity, which is likely to impact food availability (Grice et al., 2013) and impede black-footed tree-rat foraging behaviours. Accordingly, it is demonstrated throughout the literature that black-footed tree-rats prefer habitats with a well-developed shrubby understorey (Friend, 1987; Friend & Taylor, 1985). In recent studies, Davies et al. (2018) found that shrub density was a significant, positive predictor of site-occupancy for the black-footed tree-rat, and Kerle et al. (2024) demonstrated a preference for areas of high structural diversity. This suggests that exotic monocultures of invasive grasses may be detrimental to the species, regardless of their impact on fire regimes.

3.1.4 Feral Cats

Feral cats are a driving force behind the collapse of mammalian populations across northern Australia (Davies et al., 2017; Dickman 1996; Murphy et al., 2019; Tuft et al., 2021; Woinarski et al., 2011). They exert direct pressure on species through predation, and influence populations indirectly by compounding the impacts of other threats (Doherty et al., 2017). Feral cats are abundant throughout the greater Darwin region and represent a significant threat to the black-footed tree-rat. Although there is limited evidence demonstrating direct predation of cats on black-footed tree-rats, feral cats are generalists and are known to predate upon many similar species, including congener the golden-backed tree-rat (Woolley et al., 2019). This lack of direct evidence does not suggest an absence of predator-prey interactions between the species, but rather a lack of sufficient research into the impacts of feral cats on black-footed tree-rat populations.

The impact of feral cats in the Darwin region is likely exacerbated by other threats, including invasive grass incursion and altered fire regimes. In a study conducted by Neave et al. (2024), the impact of feral cats was found to be greatest in areas that were frequently burnt. This aligns with previous work suggesting that frequent, high intensity fire driven by invasive grass incursion can exacerbate the impact of feral cats in northern Australian savannahs (Leahy et al., 2015; McGregor et al., 2014, 2015). The synergistic effects of feral cats, altered fire regimes, and native grass incursion highlight the need for a wholistic approach when developing management actions in the greater Darwin region.

3.2 Management Strategies Relevant to the Darwin Region

To mitigate the threats outlined above, the conservation advice identifies several high and medium-high priority management strategies that are highly relevant to the greater Darwin population of black-footed tree-rats - fire management, maintenance of habitat patch integrity and connectivity, feral cat control, invasive grass management, habitat mapping, and implementation of a monitoring program (**Table 3**). These management strategies are discussed below.

3.2.1 Maintenance of Patch Integrity and Connectivity

As urbanisation in the Darwin region intensifies and habitats become more fragmented, the maintenance of patch integrity becomes increasingly important. Threats such as weeds and feral animals are more prevalent closer to population centres (Gallagher & Leishman, 2015), meaning active management of patches in these areas is necessary for the maintenance of ecosystem functions. As discussed above, patch size is an important factor when assessing the value of habitat, with larger patches generally supporting greater biodiversity than smaller patches. Larger patches are also more resistant to the effects of fire, highlighting the importance of prioritising the protection of continuous tracts of habitat over multiple, smaller patches.

The impacts of habitat fragmentation can be mitigated by maintaining connectivity between habitat patches. This can be achieved through habitat corridors, which maintain or re-establish a link between two or more historically contiguous patches of habitat (Hobbs, 1992). Habitat corridors are beneficial in fragmented landscapes as they increase the amount of habitat available to species (Saunders & Hobbs, 1991), facilitate movement and dispersal between otherwise isolated populations (Saunders et al., 1991), and help to maintain ecosystem functions (Saunders & Hobbs, 1991). The benefit of habitat corridors is well established in the literature, and there is a plethora of research documenting their successful implementation in wildlife conservation (e.g., Brooker et al., 1999; Christie & Knowles, 2015; Gilbert-Norton et al., 2010).

The protection of larger habitat patches (i.e., >20 ha) and the maintenance of connectivity is particularly important for the black-footed tree-rat. The species has a relatively large home range and prefers expansive, intact tracts of mature forest (Rankmore, 2006; Davies et al., 2018b), meaning it may be more susceptible to the impacts of habitat fragmentation. This is particularly relevant to the greater Darwin population, where increased urbanisation is resulting in smaller, more fragmented patches of habitat, suggesting that management strategies in the region should prioritise protection of large, contiguous patches that preserve connectivity.

3.2.2 Fire Management

Fire management is one of the few tools available for conservation at the landscape scale (Davies et al., 2018). It is applied throughout northern Australia to conserve biodiversity, with the patch mosaic burning paradigm most often utilised. This burning strategy attempts to establish and maintain a fine-scale, heterogenous mosaic

of varying fire histories (Parr & Anderson, 2006), with the goal of increasing the amount of long unburnt vegetation (Woinarski & Winderlich, 2014). Recent research suggests that fire management could benefit from a more tailored approach (Davies et al., 2018), with the success of management strategies increasing if they are developed in consideration of local environmental conditions and adapted to individual species.

Inappropriate fire regimes are having a detrimental impact on ecosystems in the greater Darwin area (Fischer et al., 2023; Price & Baker, 2007) and are likely to be impacting black-footed tree-rat populations. More frequent, high intensity fires are a key threat to the species, meaning effective fire management is crucial to the black-footed tree-rat's ongoing perseverance in the Darwin region. This can be best achieved through a fire management strategy that is tailored to the Darwin region and developed in consideration of black-footed tree-rat ecology.

3.2.3 Invasive Grass Management

Invasive grass management in northern Australia is guided by the *Threat abatement plan to reduce the impacts on northern Australia's biodiversity by the five listed grasses* (DSEWPC, 2012). This plan states that weed management is based on the principles of prevention, eradication, containment and asset protection, which establishes a hierarchy for weed management. Preventing the establishment of invasive plant species is the most cost-effective approach to weed management and should be the goal of all management programs. In areas with small or newly established infestations, the goal should be aggressive suppression with the aim of eradication. In cases where eradication is not feasible or economically viable, containment efforts should focus on limiting the spread of the invasive grasses and reducing their impact on unaffected areas. And finally, for core or large infestations, management should prioritise the identification and protection of key assets.

Invasion by invasive grasses is a major threat to biodiversity in the Darwin region. Gamba grass is of particular concern and must be managed according to the strategies outlined in the Management Plan for Gamba Grass 2020-2030 (DEPWS, 2020), which is a statutory document designated under Section 10 of the *Weeds Management Act 2001*. Proliferation of gamba grass and other exotic species is likely to be impacting local black-footed tree-rat populations, meaning invasive grass management is vital to the preservation of habitat for the species in the greater Darwin area.

3.2.4 Feral Cat Control

Feral cat control in Australia is guided by the *Threat abatement plan for predation by feral cats 2024*, which outlines methods for both the direct and indirect control of feral cats. Direct control methods are exclusion via purpose-built fenced areas, poisoning, and trapping and shooting, while indirect methods include management of fire and grazing, and manipulation of species interactions.

Feral cats are a major threat to biodiversity in the greater Darwin area and are likely to be impacting the black-footed tree-rat. A reduction in feral cat numbers will directly benefit the species by reducing predation pressures. Further, inappropriate fire regimes, invasive grass incursion and feral cats are likely to be having synergistic effects, meaning black-footed tree-rat habitat cannot be managed successfully unless all three threats are addressed.

3.2.5 Habitat Mapping

Habitat mapping is an essential tool in wildlife management. It ensures informed decision-making during the development process and facilitates the protection of high value threatened species habitat. Habitat mapping is particularly important in urban areas, where connectivity between habitat patches is of greater importance (LaPoint et al., 2015), and small habitat patches can hold disproportionate value for threatened species (Bierwagen, 2007).

In the Darwin region, black-footed tree-rat populations occur in increasingly fragmented habitats. Mapping of black-footed tree-rat habitat in the area would facilitate decision-making during the development process, allowing for the protection of high value habitat and the maintenance of connectivity between habitat patches.

3.2.6 Monitoring Program

The literature documenting the importance of monitoring in conservation is vast (Lindenmayer & Lykens, 2010). It is widely accepted in the scientific community that effective management goes beyond implementation and is fundamentally linked to well-designed monitoring and evaluation systems (Hockings, 2003; Stem et al., 2002; Woodhill, 2000). Monitoring allows for evaluation of a management strategy's efficacy, serving as an early warning system for potential problems and facilitating development of remedial ideas (Hatry, 1999; Stem et al., 2002). Effective monitoring programs provide public and internal accountability and are vital for informed decision-making (Buckley et al., 2008).

Monitoring black-footed tree-rat populations in the greater Darwin area is essential for effective management. Small, fragmented habitat patches are more susceptible to external forces than large, contiguous tracts of bushland (Saunders et al., 1991), increasing the importance of monitoring in urban areas. Monitoring is necessary to ensure management strategies are achieving their desired outcomes, ensuring accountability and allowing for remedial action if conservation goals are not being achieved. Conservation outcomes benefit from monitoring multiple variables, including population density, population movements, and food availability, as well as monitoring of threats such as predator presence, fire history, and weed presence.

4.0 Development of Offset Plan

As discussed above, the Black-footed Tree-rat Conservation Advice identifies four severe, high-priority threats for the species – habitat loss and fragmentation, inappropriate fire regimes, exotic grass invasion, and predation by feral cats. This plan aims to mitigate these threats in the greater Darwin area through implementation of the management strategies identified in the conservation advice, thus achieving a conservation gain for the species.

4.1 Consistency with the EPBC ACT Offsets Policy

Appendix A details how the biodiversity offsets proposed for the project meet the requirements of the EPBC Act Offsets Policy (Department of Sustainability, Environment, Water, Population and Communities – DSEWPaC 2012). A complete offsets policy assessment will occur when individual offset projects are submitted under condition 8 b) of the project's EPBC approval. These projects will be developed in accordance with the EPBC Act Offsets Policy.

4.2 Consultation

This offset plan was developed in consultation with the Northern Territory Department of Lands, Planning and Environment (DLPE – formerly DEPWS Flora and Fauna Division).

5.0 Proposed Offset Projects

The EPBC Act approval for the project states that offsets must be provided for the black-footed tree-rat to achieve a conservation gain for the species. The offset programs proposed in this document were developed in consideration of the Northern Territory Government's Strategic Conservation Planning for the Greater Darwin Region, which aims to assess and manage cumulative impacts of development on biodiversity values. Following consultation with the Northern Territory Department of Lands, Planning and Environment, a multifaceted approach was identified as the most effective strategy to meet the offset requirements for this project. This approach consists of both direct and indirect offsets which, when implemented collectively, are expected to achieve a positive conservation outcome for the black-footed tree-rat. These offset projects are outlined below.

5.1 Direct Offsets

In accordance with the EPBC Act Environmental Offsets Policy, this offset plan is built around the delivery of direct offsets for the black-footed tree-rat. Specifically, DHA will secure a minimum of 40 ha of black-footed tree-rat habitat in the greater Darwin region to directly offset the loss of 10 ha of habitat at Muirhead North. This area will comprise a single, continuous patch of vacant, crown lease land that preserves connectivity in the region (i.e., within 50km of Darwin's city centre). DHA aims to have this area protected in perpetuity via

proclamation of a reserve pursuant to the *Crown Lands Act 1992*. Once created, Section 79 of the Crown Lands Act states that protection can only be revoked by a decision of the Legislative Assembly of the NT. Implementation of protection through this mechanism will provide the highest level of protection for black-footed tree-rat habitat while allowing for continued use of the area for the mutual benefit of the community and the environment.

5.1.1 Offset Area Suitability

The conservation advice for the species identifies preferred habitat as lowland open forests and woodland dominated by *Eucalyptus miniata* and *E. tetrodonta* with a relatively dense, shrubby understorey. Areas that meet these criteria will be identified via a desktop assessment and surveyed to ground-truth vegetation communities and determine suitability as an offset. Specifically, habitat quality assessments will be conducted within potential offset areas using the following key habitat criteria:

- Denning/refuge site availability (i.e., density of large trees, hollows, and mature *Pandanus* sp.)
- Food resource availability (i.e., density of known food plants)
- Ground cover composition/density
- Disturbance (e.g., grazing, fire, weed incursion)

Habitat quality scores will be derived from these key criteria to determine suitability for the black-footed tree-rat. Detailed habitat assessment methodology will be provided when condition 8 b) of the project's EPBC approval is met (i.e., in future documents). To achieve a conservation gain for the species, the offset area will be managed using a combination of strategies (i.e., 'offset projects') that will improve habitat quality and maintain black-footed tree-rat habitat in perpetuity. These offset projects are outlined below.

5.1.2 Fire Management

The conservation advice identifies inappropriate fire regimes as a severe, high priority threat for the black-footed tree-rat. To mitigate impacts of fire on black-footed tree-rat populations in the greater Darwin area, targeted fire management strategies will be implemented within the proposed offset area to improve habitat quality for the species and protect it from catastrophic fire events. Active fire management is a requirement for landowners under Northern Territory legislation (*Bushfires Management Act 2016, Fire Emergency Act 1996*), and the management strategies employed at the proposed offset area will meet these requirements while simultaneously benefiting black-footed tree-rat populations.

In accordance with Condition 8 b) of the project's EPBC approval conditions, a detailed Bushfire Management Plan will be developed once this offset plan is approved by the minister. This plan will provide all details relevant to implementation of the Bushfire Management Plan, including project goals, budget, and timeframes, as well

as detail the process for monitoring, reporting, and publishing of offset project outcomes. In summary, the Bushfire Management Plan will:

- Outline methods for assessing fire history in the proposed offset area.
- Outline methods for maintenance of fire breaks.
- Devise an appropriate burning regime that is tailored to local conditions and black-footed tree-rat habitat requirements.
- Describe the training and resources required for implementation of the Bushfire Management Plan.

5.1.2.1 Development of Bushfire Management Plan

The Bushfire Management Plan will be developed via a collaborative process involving multiple stakeholders. 4 Elements Consulting will coordinate development of the project, which will be implemented by local consultants with demonstrated experience in fire management in the greater Darwin region. During the planning phase, 4 Elements Consulting will engage with experts from the Darwin Centre for Bushfire Research (DCBR) at Charles Darwin University and Flare Wildlife Research, as well as specialists in black-footed tree-rat ecology, to ensure that the Bushfire Management Plan is informed by current scientific knowledge and is appropriately tailored to address the specific habitat requirements of the species. Experts that will be contacted during development of the Bushfire Management Plan include (but are not limited to):

- Professor Jeremy Russell-Smith - bushfire management expert (Professor of Research, Darwin Centre for Bushfire Research)
- Professor Trent Penman - bushfire management expert (Team Leader, Flare Wildlife Research)
- Dr Brooke Rankmore - black-footed tree-rat expert (CEO of AMRRIC – Animal Management in Rural and Remote Indigenous Communities)
- Professor John Woinarksi - black-footed tree-rat expert (NESP Research Professor, Charles Darwin University)
- Brydie Hill (Threatened Species Scientist, NT DLPE)
- Larrakia Development Corporation and the Larrakia National Aboriginal Corporation

Acacia Land Management, who currently implement fire management strategies at Lee Point, will be engaged to conduct the Bushfire Management Plan at the Offset Area. The plan will be coordinated by 4 Elements Consulting and implemented in collaboration with Larrakia rangers.

5.1.2.2 Timeframe

Implementation of the Bushfire Management Plan will occur over a 10-year period. The project will be subject to a biennial review process to ensure conservation outcomes are being achieved. Milestones for the project are outlined in **Table 4** below.

Table 4 Timeframe For Bushfire Management Plan Milestones

Year	Milestones
0-3 months	▪ Secure Offset Area ▪ Consult with experts in the field ▪ Engage Larrakia Development Corporation and the Larrakia National Aboriginal Corporation ▪ Conduct desktop and field assessment of fire history in offset area ▪ Devise appropriate burning regime ▪ Finalise Bushfire Management Plan
1	▪ Maintain fire breaks ▪ Training and capacity-building for Larrakia Rangers ▪ Begin implementation of burning regime
2	▪ Conduct review of Bushfire Management Plan
4	▪ Conduct review of Bushfire Management Plan
6	▪ Conduct review of Bushfire Management Plan
8	▪ Conduct review of Bushfire Management Plan
2-10	▪ Implement burning regime and maintain fire breaks ▪ Provide annual monitoring report

5.1.3 Weed Management

The conservation advice identifies exotic grass invasion as a severe, high-priority threat for the black-footed tree-rat. To mitigate impacts of invasive grasses on black-footed tree-rat populations in the greater Darwin area, targeted weed management strategies will be implemented within the proposed offset area to limit the spread of exotic grasses, with a particular emphasis on "high priority weeds" (e.g., transforming grasses such as gamba grass). Active weed management is a requirement for landowners under Northern Territory legislation (*Weeds Management Act 2001*), with management strategies guided by the *Threat abatement plan to reduce the impacts on northern Australia's biodiversity by the five listed grasses* (DSEWPC, 2012), the Darwin Regional Weeds Strategy 2020-2026 (DEPWS, 2021), and the Management Plan for Gamba Grass 2020-2030 (DEPWS, 2024). Strategies employed at the proposed offset area will be developed in consideration of these documents to ensure they meet state legislative requirements while also benefiting local black-footed tree-rat populations.

In accordance with Condition 8 b) of the project's EPBC approval conditions, a detailed Weed Management Plan will be developed once this offset plan is approved by the minister. This plan will provide all details relevant to

implementation of the Weed Management Plan, including project goals, budget, and timeframes, as well as detail the process for monitoring, reporting, and publishing of offset project outcomes. In summary, the Weed Management Plan will:

- Define high priority weeds (e.g., transforming grasses) for the purpose of the Weed Management Plan.
- Outline methods for mapping of current infestations of weeds in the proposed offset area, focusing on high priority weeds.
- Outline measures to prevent the introduction of weeds and control, reduce or eradicate existing weeds.
- Detail methods for monitoring weed infestations.
- Describe the training and resources required for implementation of the Weed Management Plan.

5.1.3.1 Development of Weed Management Plan

The Weed Management Plan will be developed via a collaborative process involving multiple stakeholders. 4 Elements Consulting will coordinate development of the project, which will be implemented by local consultants with demonstrated experience in weed management in the greater Darwin region. During the planning phase, 4 Elements Consulting will engage with invasive grass experts from Charles Darwin University, as well as specialists in black-footed tree-rat ecology, to ensure that the Weed Management Plan is informed by current scientific knowledge and is appropriately tailored to address the specific habitat requirements of the species. Experts that will be contacted during development of the Weed Management Plan include (but are not limited to):

- Dr Natalie Rossiter-Rachor - invasive grass expert (Senior Lecturer in Ecology, Charles Darwin University)
- Dr Brooke Rankmore - black-footed tree-rat expert (CEO of AMRRIC – Animal Management in Rural and Remote Indigenous Communities)
- Professor John Woinarksi - black-footed tree-rat expert (NESP Research Professor, Charles Darwin University)
- Brydie Hill (Threatened Species Scientist, NT DLPE)
- Larrakia Development Corporation and the Larrakia National Aboriginal Corporation

Acacia Land Management, who currently implement weed management strategies at Lee Point, will be engaged to conduct the Weed Management Plan at the Offset Area. The plan will be coordinated by 4 Elements Consulting and implemented in collaboration with Larrakia rangers.

5.1.3.2 Timeframe

Implementation of the Weed Management Plan will occur over a 10-year period. The project will be subject to a biennial review process to ensure conservation outcomes are being achieved. Milestones for the project are outlined in **Table 5** below.

Table 5 Timeframe For Weed Management Plan Milestones

Year	Milestones
0-3 months	▪ Secure Offset Area ▪ Consult with experts in the field ▪ Engage Larrakia Development Corporation and the Larrakia National Aboriginal Corporation ▪ Finalise Weed Management Plan
1	▪ Map current weed infestations ▪ Training and capacity-building for Larrakia Rangers ▪ Begin implementation of weed management strategies
2	▪ Conduct review of Weed Management Plan
4	▪ Conduct review of Weed Management Plan
6	▪ Conduct review of Weed Management Plan
8	▪ Conduct review of Weed Management Plan
2-10	▪ Implement weed management strategies ▪ Provide annual monitoring report

5.1.4 Feral Cat Management

The conservation advice identifies predation by feral cats as a severe, high-priority threat for the black-footed tree-rat. To mitigate impacts of feral cats on black-footed tree-rat populations in the greater Darwin area, targeted feral cat management will be implemented within the proposed offset area to reduce predation pressure on the species. Management strategies will be guided by the *Threat abatement plan for predation by feral cats 2024* (DCCEEW, 2024), with emphasis on feral cat control through innovative techniques.

In accordance with Condition 8 b) of the project's EPBC approval conditions, a detailed Feral Cat Management Plan will be developed once this offset plan is approved by the minister. This plan will provide all details relevant to implementation of the Feral Cat Management Plan, including project goals, budget, and timeframes, as well as detail the process for monitoring, reporting, and publishing of offset project outcomes. In summary, the Feral Cat Management Plan will:

- Outline methods for monitoring of feral cat populations within the proposed offset area.
- Devise appropriate measures to control feral cat numbers within the proposed offset area.
- Describe the training and resources required for implementation of the Feral Cat Management Plan.

5.1.4.1 Development of Feral Cat Management Plan

The Feral Cat Management Plan will be developed via a collaborative process involving multiple stakeholders. 4 Elements Consulting will coordinate development of the project, which will be implemented by local consultants

with demonstrated experience in feral animal management in the greater Darwin region. During the planning phase, 4 Elements Consulting will engage with feral cat experts from Charles Darwin University to ensure that the Feral Cat Management Plan is informed by current scientific literature and developed in consideration of local environmental conditions. Experts that will be contacted during development of the Feral Cat Management Plan include (but are not limited to):

- Professor Sarah Legge – feral cat management expert (Research Professor Conservation Management, Charles Darwin University)
- Professor John Woinarksi - feral cat and black-footed tree-rat expert (NESP Research Professor, Charles Darwin University)
- Dr Brooke Rankmore - black-footed tree-rat expert (CEO of AMRRIC – Animal Management in Rural and Remote Indigenous Communities)
- Brydie Hill (Threatened Species Scientist, NT DLPE)
- Larrakia Development Corporation and the Larrakia National Aboriginal Corporation

Local consultants will be engaged to implement the Feral Cat Management Plan once a methodology has been determined. DHA will seek advice on suitable local consultants during the consultation process.

5.1.4.2 Timeframe

Implementation of the Feral Cat Management Plan will occur over a 10-year period. The project will be subject to a biennial review process to ensure conservation outcomes are being achieved. Milestones for the project are outlined in **Table 6** below.

Table 6 Timeframe For Feral Cat Management Plan Milestones

Year	Milestones
0-3 months	▪ Secure Offset Area ▪ Consult with experts in the field ▪ Engage Larrakia Development Corporation and the Larrakia National Aboriginal Corporation ▪ Trial feral cat management strategies to determine efficacy ▪ Finalise Feral Cat Management Plan
1	▪ Training and capacity-building for Larrakia Rangers ▪ Begin implementation of feral cat control strategies
2	▪ Conduct review of Feral Cat Management Plan
4	▪ Conduct review of Feral Cat Management Plan
6	▪ Conduct review of Feral Cat Management Plan
8	▪ Conduct review of Feral Cat Management Plan
2-10	▪ Implement feral cat control strategies

	▪ Provide annual monitoring report

5.2 Indirect Offsets

The EPBC Act Environmental Offsets Policy states that indirect offsets can form up to 10% of an offset proposal. To supplement the direct offsets outlined above, DHA proposes funding for a research project to improve our understanding of black-footed tree-rat populations in the greater Darwin area and to ensure that conservation outcomes in the proposed offset area are achieved. This research project is outlined below.

5.2.1 Research Project

The conservation advice identifies monitoring and habitat mapping as high and medium-high priority management actions for the species, respectively. Accordingly, DHA proposes funding for a research project designed to improve our understanding of habitat requirements, landscape use, and population viability of black-footed tree-rats in the greater Darwin area, as well as investigate the efficacy of the management strategies outlined above. The goals of this research project are:

- Conduct a meta-population analysis of the black-footed tree-rat in the greater Darwin region.
- Improve our understanding of black-footed tree-rat habitat requirements in the greater Darwin region through habitat assessments and mapping.
- Conduct a study investigating the efficacy of conservation management strategies by comparing the offset area (i.e., the treatment) to the surround landscape (i.e., the control). This will include:
    - Monitoring black-footed tree-rat densities in the proposed offset area and comparing them to the surrounding landscape.
    - Monitoring feral cat numbers in the proposed offset area and comparing them to the surrounding landscape.
    - Monitoring invasive grass incursions in the proposed offset area and comparing them to the surrounding landscape.
    - Conducting habitat assessments in the proposed offset area using key variables (e.g., food availability, den/refuge availability etc) and comparing them to the surrounding landscape.

In accordance with Condition 8 b) of the project's EPBC approval conditions, a detailed Research Project Proposal will be developed once this offset plan is approved by the minister. This document will provide all details relevant to implementation of the Research Project, including project goals, budget, and timeframes, as well as detail the process for monitoring, reporting, and publishing of research project outcomes.

5.2.1.1 Development of Research Project

DHA aims for this research project to be developed and implemented by researchers at Charles Darwin University (CDU), with fieldwork supplemented by suitably qualified consultants if necessary. Preliminary discussions with CDU have begun, with early suggestions centred around this proposal forming part of a PhD project.

5.2.1.2 Timeframe

The Research Project will continue for a 5-year period. Milestones for the project are outlined in **Table 7** below.

Table 7 Timeframe For Research Project Milestones

Year	Milestones
0-3 months	▪ Engage researchers at CDU ▪ Engage Larrakia Development Corporation and the Larrakia National Aboriginal Corporation ▪ In-depth Literature review
1	▪ Meta-population analysis ▪ Begin habitat assessments in the greater Darwin region ▪ Begin monitoring program
2	▪ Provide habitat mapping ▪ Implement monitoring program ▪ Provide annual monitoring program report
3	▪ Implement monitoring program ▪ Provide annual monitoring program report
4	▪ Implement monitoring program ▪ Provide annual monitoring program report
5	▪ Implement monitoring program ▪ Provide report synthesising project findings

5.3 Delivery of Offset Projects

Once this offset plan is approved, DHA will submit each individual Management Plan and the Research Project Proposal to the Department for review to satisfy Condition 8 b) of the project's EPBC approval conditions. DHA proposes that each offset project is submitted as a revision of this document (i.e., each project will be submitted as an appendix to this Black-footed Tree-rat Offset Plan). Offset projects will be submitted individually with this offset plan as they are developed.

DHA aims to implement each offset project within 12 months of approval of this offset plan. This will be achieved by adhering to the timeline outlined it **Table 8** below, which will commence when this offset plan is approved (i.e., day 0).

Table 8 Timeframe For Delivery of Offsets

Project Stage	Time Allocated
Development of offset projects (including expert consultation)	3 months
Departmental review	3-6months
Revisions and resubmission to the Department	3 months
Commencement date	12 months after approval of offset plan

5.4 Adaptive Management

DHA acknowledges that offset projects must be adaptable to changing circumstances. Situations that may require adaptation of offset projects include:

- Disconnect between theory and application. The efficacy of an offset program cannot be fully evaluated until it is implemented, meaning theoretical planning often requires real-world adjustment. While the offset strategies outlined in this offset plan are known to be effective in achieving conservation outcomes, their success cannot be guaranteed. Accordingly, the biennial review will identify if conservation outcomes are not being achieved, allowing for offset projects to be altered if necessary.
- Advancements in knowledge. The offset projects will be developed with expert consultation and built around current scientific literature. However, if new research emerges during implementation of the offset programs that may improve conservation outcomes, the projects will be modified. For example, if a new feral cat control technique is developed during the first year of the project's implementation, this will be identified in the offset project's biennial review and, if feasible, incorporated into the project the following year.

If the biennial review identifies changes that should be made to offset projects to achieve better conservation outcomes, an amended offset project plan will be submitted to the Department for review. If approved, these changes will be implemented immediately. The offset projects will also be held accountable by the research project, which will monitor their efficacy by comparing variables in the offset area to the surrounding landscape.

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Appendix A Consistency of Offset Plan with EPBC Act Offsets Policy

Requirement of EPBC Act Offsets Policy	Consistency of Offset Plan
Offsets must deliver an overall conservation outcome that improves or maintains the viability of the protected matter	This will be achieved by improving our understanding of black-footed tree-rat populations in the greater Darwin area, as well as improving the quality of available habitat for the species and protecting it in perpetuity. **Section 3** outlines threats and abatement strategies identified in the conservation advice that are relevant to the species in the greater Darwin area, while **Section 5** explains how these threats will be addressed by this Offset Plan.
Suitable offsets must be built around direct offsets but may include other compensatory measures	**Section 5** describes the proposed offset program, which is built around direct offsets.
Suitable offsets must be in proportion to the level of statutory protection that applies to the protected matter	This is determined by the project's EPBC Act approval, which states that: "The approval holder must expend an amount equivalent to at least $78,750 (excluding GST) on implementation of the Black-footed Tree Rat Offset Projects approved in accordance with Condition 8(a) and 8(b)." The amount spent by DHA will exceed this dollar amount.
Suitable offsets must be of a size and scale proportionate to the residual impacts on the protected matter	DHA will secure a minimum of 40 ha of black-footed tree-rat habitat as an offset, which will be managed in perpetuity, as well as fund a research project to improve understanding of the species in the area.
Suitable offsets must effectively account for and manage the risks of the offset not succeeding	Offset projects will be subject to a biennial review. If this review identifies changes that should be made to the project to improve conservation outcomes, an amended offset project plan will be submitted to the Department for approval.
Suitable offsets must be additional to what is already required, determined by law or planning	The offsets outlined in this plan are additional to the duty of care required by DHA under environmental planning laws at all levels of government.

regulations, or agreed to under other schemes or programs	
Suitable offsets must be efficient, effective, timely, transparent, scientifically robust and reasonable	Offsets will be efficient and timely as they will adhere to the strict timelines outlined above. DHA understands that development at Muirhead North cannot proceed until offset plans are established, which will expediate their approval and implementation. They will be effective as they have been developed in consideration of the black-footed tree-rat conservation advice, as well as relevant abatement plans, recovery plans, and scientific literature. The offset projects must supply yearly monitoring reports and will undergo biennial review, ensuring transparency. They are scientifically robust and reasonable as they will be developed in consultation with experts in the field and built around current scientific literature.
Suitable offsets must have transparent government arrangements including being able to be readily measured, monitored, audited and reported	All offset projects will be transparent, measurable and monitored. They will be available to government auditing at all stages of delivery.