

Final Report

Kangaroo Management Plan, 188a O'Herns Road, Epping, Victoria

Prepared for

Development Victoria

December 2023



Ecology and Heritage Partners Pty Ltd

MELBOURNE: 292 Mt Alexander Road, Ascot Vale VIC 3032 GEELONG: 230 Latrobe Terrace, Geelong West VIC 3218 BRISBANE: Level 22, 127 Creek Street, Brisbane QLD 4000 ADELAIDE: 78 Edmund Avenue, Unley SA 5061 CANBERRA: 19-23 Moor Street, Turner ACT 2612 SYDNEY: Level 5, 616 Harris Street, Ultimo NSW 2007 www.ehpartners.com.au | 1300 839 325





DOCUMENT CONTROL

Assessment type	Kangaroo Management Plan
Address	188a O'Herns Road, Epping, Victoria
Project number 17618	
Project manager	Jeremy Coyne (Natural Heritage Team Leader / Associate Zoologist)
Report reviewers Jeremy Coyne (Natural Heritage Team Leader / Associate Zoologist), Aaron Organ (Director / Principal Ecologist)	
Other EHP staff Amelia Weight (Field Ecologist), Lauren Sandy (Field Ecologist)	
Mapping Monique Elsley (GIS Coordinator)	
File name 17618_EHP_MASTER_ KMP_188aOHernsRd_Epping_Final_11122023	
Client Development Victoria	
Bioregion Victorian Volcanic Plain	
Catchment Management Authority	Melbourne Water
Council	City of Whittlesea

VERSION CONTROL

Report versions	Comments	Comments made by:	Date submitted
Draft	Report sent to the client for review		25/09/2023
Final	Development Victoria	JC	11/12/2023

Ecology and Heritage Partners acknowledge the Traditional Owners of the country we live and work on, and we pay our respect to Elders past, present and emerging.

Copyright © Ecology and Heritage Partners Pty Ltd

This document is subject to copyright and may only be used for the purposes for which it was commissioned. The use or copying of this document in whole or part without the permission of Ecology and Heritage Partners Pty Ltd is an infringement of copyright.

Disclaimer

Although Ecology and Heritage Partners Pty Ltd have taken all the necessary steps to ensure that an accurate document has been prepared, the company accepts no liability for any damages or loss incurred as a result of reliance placed upon the report and its contents.



FULL KANGAROO MANAGEMENT PLAN

188a O'Herns Road, Epping

Date 08/12/2023

This full Kangaroo Management Plan (KMP) has been prepared on behalf of Development Victoria by Ecology and Heritage Partners. It provides details of the planned management of Eastern Grey Kangaroos (EGK) at 188a O'Herns Road, Epping.

CLIENT DETAILS

Company name: Development Victoria

Contact number: 03 8317 3400

Email: aurora@development.vic.gov.au

CONSULTANT

Company name: Ecology and Heritage Partners

Contact number: 1300 839 325

Email: admin@ehpartners.com.au

SITE INDUCTION

Does the site induction for construction workers cover this KMP, and what to do if they find evidence of kangaroos in the construction area? Yes



SITE INDUCTION

Site inductions are to be provided to the Project Manager or other relevant persons responsible for the implementation of this Plan by a suitably qualified Ecologist. The general site induction for all staff on site must communicate the basic responsibilities under the KMP (Appendix 1) and can be delivered by the Project Manager or other persons responsible for the implementation of this plan who has been inducted to this plan by an Ecologist. The KMP site induction must cover the following details:

No.	Induction Requirement	Required details
1	A brief overview	 KMP Rationale – why a KMP is necessary, and the objectives of a successful KMP (Section 1.3) including: Reducing the risk of negative interaction between humans and EGK; Reducing impacts to natural areas, conservation reserves and other threatened species. Population survey results (likely locations of EGK during construction) (Section 5) Kangaroo populations were observed throughout the development site; While no EGK were observed moving in and out of the development site into adjacent areas, substantial evidence (scat, tracks and fence breaks) in the local area suggests that they sometimes leave the development site; and, The development site comprises a largely urbanised environment and is not considered to be primary suitable habitat for EGK. What to do if you find a kangaroo in a construction area (Further detail and a printout for office/site display can be found in Appendix 1): Let the kangaroo leave of its own accord and do not herd the kangaroo; Try to identify where the kangaroo entered the construction area. Temporarily widening the entry point might encourage the kangaroo to leave through it. If the kangaroo to the Ecologist; If there are things attracting kangaroos in the construction area, contact the Ecologist immediately about amending the site's kangaroo management plan to possibly remove the attractants; If a kangaroo is injured or killed the Department of Energy, Environment and Climate Action must be notified; and, All people must obey standard construction area speed limits.
2	A detailed overview of the Action Plan (Section 9) of the following report. The attached tables in the following sections can be used as a guide, and can be provided to workers if required, to encourage thorough understanding of the responsibilities of workers during construction	 Management/preventative actions as detailed in Section 9; The workers' roles in implementing actions detailed in Section 9, including reporting kangaroo sightings and follow stop work procedures; Implement and/or follow regular monitoring procedures detailed in Section 9.4; and, For more complex actions (such as fencing), the information in Section 9 will be used by relevant project managers and officers to prepare specific instructions for workers on the requirements of tasks and/or outcomes including kangaroo exclusion fencing.



CONTENTS

1	INT	RODUCTION	8
	1.1	Background	8
	1.2	Study Area	8
	1.3	Kangaroo Management Rationale	9
	1.3.2	1 Human: Eastern Grey Kangaroo Interactions	9
	1.3.2	2 Animal Welfare Considerations	9
	1.4	Plan Goals1	.0
2	EAS	STERN GREY KANGAROO ECOLOGY1	1
3	SUR	RVEY METHODOLOGY 1	2
	3.1	Development Site 1	.2
	3.1.2	1 Habitat Assessment 1	.2
	3.1.2	2 Population Density Assessment 1	.2
	3.1.3	3 Monitoring Surveys 1	.2
	3.2	Eastern Corridor1	.3
	3.2.2	1 Habitat Assessment 1	.3
	3.2.2	2 Population Presence/Absence Assessment 1	.3
	3.3	Recipient Site	.3
	3.3.2	1 Habitat and Population Presence/Absence Assessment 1	.3
	3.3.2	2 Remote Camera Deployment 1	.3
4	POF	PULATION SURVEY RESULTS 1	4
	4.1	Home Range and Refuge Habitat1	.4
	4.2	Kangaroo Observations1	.4
	4.3	Monitoring Results1	.5
	4.4	Patterns of Movement1	.6
	4.5	Protective Habitat 1	.9
	4.6	Watering Points 1	9
	4.7	Remote Camera Survey1	.9
	4.8	Residential Areas1	.9
	4.9	Threatened Species and Ecological Communities 2	1



www.ehpartners.com.au

	4.10	Land	dscape Features and Major Hazards	21
	4.11	Reci	pient Site	21
	4.11	.1	Protective habitat and available resources	22
	4.11	.2	Sustainable Population Limit	23
	4.11	.3	Hazards	24
5	STA	GED	FENCING PLAN	25
6	ASS	ESSN	MENT OF OTHER MANAGEMENT OPTIONS	29
	6.1	Mar	nagement Overview	29
	6.2	Des	ktop Review of Current Industry Practice	29
	6.3	Asse	essment of Management Options	29
7	MA	NAG	SEMENT OPTIONS – PHASE 1	33
	7.1	Deco	ommissioning of Resources	33
	7.1.1	1	Requirements, Risks and Considerations	33
	7.1.2	2	Animal Welfare	34
	7.1.3	3	Conclusion	34
	7.2	Line	ar Corridors	35
	7.2.1	1	Requirements, Risks and Considerations	35
	7.2.2	2	Controlled Herding	35
	7.2.3	3	Animal Welfare	37
	7.2.4	1	Case Studies	37
	7.2.5	5	Conclusion	38
8	MA	NAG	SEMENT OPTIONS – PHASE 2	39
	8.1	Tran	nslocation	39
	8.1.1	1	Requirements, Risks and Considerations	39
	8.1.2	2	Suitable Release Site	39
	8.1.3	3	Animal Welfare	39
	8.1.4	1	Case Studies	40
	8.1.5	5	Conclusion	41
	8.2	Euth	nanasia	41
	8.2.1	1	Requirements, Risks and Considerations	41



www.ehpartners.com.au

	8.2.2	Animal welfare	
	8.2.3	Case studies	
	8.2.4	Disposal of Kangaroo Carcasses	;
	8.2.5	Conclusion	;
9	ACTION	PLAN	
	9.1 Prev	entative Actions	
	9.2 Site	User and Public Education	
	9.3 Ada	otive Management	
	9.4 Mor	itoring	,
	9.4.1 D	uring Staged Fencing	,
	9.4.2	Following Staged Fencing	,
	9.4.3 R	eporting	,
	9.5 Resp	oonse to Future Kangaroo Presence)
	9.5.1	Contingencies)
R	EFERENCES	5	
F	IGURES		
A	PPENDIX 1	INFORMATION SHEET: KANGAROOS IN ACTIVE CONSTRUCTION SITES	



1 INTRODUCTION

1.1 Background

Habitat for Eastern Grey Kangaroo *Macropus giganteus* (EGK [Plate 1]) is being reduced with the loss of grassland, grassy woodland and farmland as a result of urban development. If poorly managed, development in and around the habitat of EGK can land-lock populations or force them to leave their home range in ways that endanger their welfare or lead to adverse human interactions.

This Kangaroo Management Plan (KMP) has been prepared to minimise risks to EGK, people and the broader environment that may occur as a result of unmitigated development within the home ranges of EGK. It provides a long-term, adaptable plan aimed at minimising risks over the life of development at the subject site.

The study area comprises the property at 188a O'Herns Road, Epping, Victoria (the development site), as well as the surrounding roads and the proposed recipient site to the west of Cotters Road (Figure 1). Habitat within the development site and surrounding residential areas consists of largely urbanised environment and is not considered to be primary suitable habitat for EGK (Plate 2-13). A seemingly separate population of EGK have been observed using the proposed recipient site to the west of Cotters Road, which is a larger and more resource-rich area than the development site. Scat, tracks and fence breaches along Cotters Road suggest some movement of EGK from the development site into the proposed recipient site (Plate 14-19). Evidence found in the landscaped electrical easement to the east of the development site (herein described as the eastern corridor) suggests that EGK are also moving east, though less frequently and in fewer numbers (Figure 2; Plate 13).

1.2 Study Area

The broader study area encompasses the development site, the proposed recipient site and a section of the eastern corridor that extends east from the northeast corner of the development site (Figure 1). Covering approximately 94.3ha hectares, the study area stretches from Hume Freeway in the west, through to residential areas east of Edgars Road. The study area is bordered by the Hume Freeway to the west, residential streets to the north, with O'Herns Road forming the southern boundary. The land is predominantly characterised by modified grassland with sparse, scattered shrubs and trees, intersected by a moderate speed, high traffic road (Edgars Road).

The development site is located at 188a O'Herns Road, Epping, Victoria, approximately 21km north-northeast of Melbourne CBD within the municipality of City of Whittlesea. The site is bordered by Cotters Road to the west, Rockfield Street and residential housing to the north, residential housing to the east and O'Herns Road to the south. Covering approximately 21 hectares, the development site comprises highly modified and degraded land with patches of internal and external fencing in varying degrees of integrity (Plate 16 - 19). The site exhibits minor undulations throughout with invasive graminoids, herbs and small woody shrubs making up much of the ground layer. Scattered, sparse clumps of larger shrubs and juvenile trees exist in parts of the site and EGK have been observed sheltering in these throughout the day. A large section to the west of Edgars Road appears to have been recently scalped with minimal emerging growth present. A recent extension of Edgars Road has divided the development site in two. This Plan will refer to land to the east of Edgars Road as



the eastern section and that to the west of Edgars Road as the western section of the development site. This stretch of Edgars Road has been observed to experience a high volume of traffic throughout the day, particularly at peak times.

The eastern section of the development site contains two potential water sources. A rain garden has been installed to the east of Edgars Road as part of the upcoming development and was holding water at the time of survey (Plate 20). While this could be seen as a potential resource for the resident EGK population, no evidence of use was observed, with no tracks or scats present in the direct vicinity. The second water source is an ephemeral drainage line in the northeast corner of the development site (Plate 12). The presence of tracks and scat surrounding this water source suggests occasional use by resident EGK, however this drainage line is predominantly ephemeral in nature, and has remained dry during all follow-up monitoring conducted at the site. No water sources are present in the western section.

Approximately 50ha of grassland lies to the west of Cotters Road that could serve as a potential recipient site for the EGK population currently inhabiting the development site. The recipient site is already home to at least 10 EGK which are utilising Edgars Creek as a reliable source of water (Plate 21-22). We understand that the grassland within the site is home to the EPBC Act listed Golden Sun Moth *Synemon plana* and is also mapped as containing a small patch of the endangered Plains Grassland Ecological Vegetation Community (EVC).

According to the Department of Energy, Environment and Climate Action (DEECA) NatureKit Tool (DEECA 2023) the development site is in the Victorian Volcanic Plain bioregion, within the City of Whittlesea municipality.

1.3 Kangaroo Management Rationale

1.3.1 Human: Eastern Grey Kangaroo Interactions

The development site is surrounded by residential areas and busy roads. Development of the site may result in adverse interactions between humans and EGK. One of the goals of this KMP is to reduce the likelihood and the severity of these interactions. These negative interactions may include:

- Collisions between vehicles and EGK;
- Attacks on EGK by unrestrained dogs; and,
- Very occasional reported 'attacks' by EGK on humans.

These interactions may occur due to:

- Resident EGK within the broader region moving throughout the landscape to and from surrounding connective habitat; and,
- Likelihood that the resident EGK population have become desensitised to human activity.

1.3.2 Animal Welfare Considerations

Primarily, the objective of a KMP is to ensure the safety and welfare of EGK throughout the development process. As a result of the development and the increase in the human population surrounding the development site, there are a range of potential impacts to the welfare of EGK (Herbert, 2004; Coulson, 2007), including:



- Injury and mortality associated with fence and vehicle collisions; and,
- Increased interactions with humans (i.e. EGK becoming dependent, desensitised and possibly aggressive).

1.4 Plan Goals

The goals of this KMP are to minimise risks to animal welfare, public safety and the environment through a staged fencing plan and other initial and responsive management actions, including controlled herding. Responsive management actions within this KMP aim to provide clear instructions and contingencies to respond to any foreseeable issue arising from the implementation of the staged fencing and controlled herding, plan and subsequent alteration of EGK home range and movement patterns.

This KMP is based on a consideration of the lifetime, and end-point, of the development. By the end-point of development there will be no EGKs on the site. However, a population of EGK will likely remain active throughout the surrounding landscape. As such, this plan must address mitigation efforts with an end goal to maintain safe conditions for both EGKs and humans in the local vicinity.

In order to assess the ongoing health and sustainability of the EGK population, this KMP provides detailed monitoring efforts to be implemented during, and following completion of the project. Monitoring will be undertaken to determine the success and effectiveness of the controls and management strategies implemented as part of this KMP.

This KMP acknowledges that EGK management should be responsive to the changing needs and behaviour of the EGK population.



2 EASTERN GREY KANGAROO ECOLOGY

EGK live in mobs of 10 or more with a home range extending up to five kilometres. Males grow larger than females typically weighing up to 66 kilograms, with a body length of up to 1.3 metres and a tail length up to one metre. Females can weigh up to 37 kilograms and have a body length of up to one metre and tail up to 0.84 metres. Male EGK stand around 1.5 metres tall (Burrell 2015, DSE 2010) (Plate 1).

EGK are found in a wide range of habitats from semi-arid Mallee scrub through to woodland, forest and farmland. EGK are herbivorous, predominantly eating grasses, although they can also eat a range of other plants. They favour the protein rich young green grass shoots as dry grass is difficult for them to digest (Burrell 2015). A summary of EGK ecology is outlined below (Table 1).



Plate 1. Eastern Grey Kangaroo (Ecology and Heritage Partners Pty Ltd 2013)

Feature	Description	
Distribution	Wide distribution from North Queensland to Tasmania	
Home Range	Sex-biased, smaller range for females	
Sexual maturity	Males approximately 4 years old Females approximately 1.5 years old	
Reproductive cycle	Seasonal breeding: Most young born in summer with pulse of emergent pouch young in spring. Oestrus cycle 46 days Gestation 36 days First pouch exit at 283 days (or 9 months) Permanent pouch exit at 319 days (or 10 months) Weaning typically 540 days (or 18 months – sub adult)	
Mortality	Mortality is mainly due to lack of nutrition, predation (including human actions that reduce population numbers) and disease High mortality of young prior to breeding age, especially for males Few males more than 10 years old in wild	
Fecundity	Data shows very high levels of fecundity even at high population densities and low <i>per capita</i> food availability	

Table 1 Summary of EGK Ecology.

Source: Territory and Municipal Services (2010).



3 SURVEY METHODOLOGY

Surveys were undertaken by qualified Zoologists experienced in EGK surveys. The survey methods followed DEECA's *Interim advice for consultants on the contents of a Kangaroo Management Plan* (DELWP 2015).

3.1 Development Site

3.1.1 Habitat Assessment

A habitat assessment was undertaken in conjunction with presence/absence surveys, to determine habitat and resource availability (including watering points) within the development site. Areas of potentially suitable habitat in adjacent properties were also considered as part of the habitat assessment, which took place on 5 September 2023 (Table 2).

3.1.2 Population Density Assessment

Population density assessments were undertaken using a Direct Observation Count. The Direct Observation Count is the simplest method of estimating absolute abundance of EGK per hectare on medium sized sites (Territory and Municipal Services 2010). Surveys were conducted over four half-days with the hours of observation including dawn to daylight or late afternoon to dusk when EGK are more active. Surveys involved walking through the development site and surrounding areas and included visual observations for EGK as well as searches for scats, tracks, fur caught in fences and other evidence (i.e. roadkill).

The population density assessments took place between 5 and 9 September 2023 (Table 2).

3.1.3 Monitoring Surveys

Monitoring surveys of the resident population of EGK were undertaken during the staged fencing deployment to record their behaviour and any changes in the resident EGK population size (i.e. if the EGK were showing signs of stress or moving into alternative habitat in the surrounding area). Additional assessments of the EGK were undertaken by an Ecologist following staged fencing being erected, to observe the behaviour and population of EGK on site.

For each monitoring survey, the Ecologist recorded the following factors.

- An assessment of the resident EGK's health (i.e. identified any signs of emaciation, disease, lameness, etc.);
- Any evident sign that any EGK is diseased or lame;
- Any evidence of increased vehicle collisions or EGK carcasses on surrounding roads;
- Whether exclusion fencing is avoiding land-locking EGKs (and, if relevant, any change in the degree of land-locking since the last assessment);
- Check electronic Variable Message Sign (VMS) boards are operational;
- Assessment of compliance with any relevant approved KMP; and,



• Any notable information.

3.2 Eastern Corridor

3.2.1 Habitat Assessment

A habitat assessment was undertaken in conjunction with presence/absence surveys, to determine habitat and resource availability (including watering points and potential movement corridors) within the eastern corridor. Areas of potentially suitable habitat with connectivity to the eastern corridor were assessed for their potential to provide a way for EGK to move east into the small patch of woodland surrounding Epping Stadium. Hazards and obstructions to EGK movement were also determined within this area during the habitat assessment, which took place on 5 September 2023.

3.2.2 Population Presence/Absence Assessment

Population Presence/Absence assessments were undertaken throughout the broader study area (Figure 3). Surveys were conducted over four half-days and involved walking or driving throughout the study area and included visual observations for EGK as well as searches for scats, tracks, fur caught in fences and other evidence (i.e. roadkill). Areas of protective habitat in adjacent properties (within approximately one kilometre of the study area) were visually surveyed using binoculars.

3.3 Recipient Site

3.3.1 Habitat and Population Presence/Absence Assessment

While the recipient site has not been extensively traversed or surveyed, visual surveys using binoculars were undertaken from several vantage points to conduct a preliminary assessment of habitat suitability and EGK presence/absence. Water sources were assessed to determine current utilisation levels and access points connecting the recipient site to the development site were investigated for EGK signs.

A high-level estimate of the current population and carrying capacity of the area was made.

3.3.2 Remote Camera Deployment

Two Reconyx hyperfire infrared camera were deployed on 7 September for a single night along Cotters Road to monitor EGK movement between the development and recipient sites (Plate 23).



4 POPULATION SURVEY RESULTS

4.1 Home Range and Refuge Habitat

EGK home range encompasses the entire development site, as well as surrounding areas including the eastern corridor and grassland to the west. The development area and recipient site are surrounded on all boundaries by residential development and major roads (Hume Freeway to the west and O'Herns Road to the south). As such, the population of EGK within these areas can be considered landlocked, as they do not have unimpeded access to the broader landscape.

Movement from the eastern corridor into the development site is unrestricted. Evidence of EGK movement was observed in the initial 200m stretch of this corridor. Since the initial habitat and population surveys were completed in September 2023 (Table 2), staged fencing has been erected around the entire western section of the development site (including along Edgars Road and Cotters Road) to reduce the risk of vehicle collisions. Fencing stages two and three have also been implemented (Figure 4), further reducing the available range for EGK to the northern section of the development area, west of Edgars Road. Two exit point have been provided along Cotters Road to allow egress of EGK to the West (Plate 17-19), where more suitable habitat and available resources including Edgars Creek and open grassland are present (the proposed recipient site) (Figure 2).

Tracks, scats and fur were observed at the exit points, indicating movement of EGK across Cotters Road into the recipient site. While not appearing to be of high quality, this grassland site is considered adequate habitat for sustaining the resident population of EGK. Several EGK have been observed to the west of the development area within 100 meters of Cotters Road, further supporting the likelihood that EGK use this area as a movement corridor.

There are no additional reserves, parks or open spaces directly connected with the development site which could be considered major sources of refuge and habitat for EGK populations.

4.2 Kangaroo Observations

A total of four visits to the development site to search for EGK were completed prior to staged fencing being implemented. Up to 30 EGK were observed in the broader study area during population density surveys (Table 2 & 2A). The EGK population inhabiting the development site was deemed moderately healthy with a relatively complex age structure. Mature adults (male and female) were accompanied by several recently weaned young.

During surveys, EGKs were skittish and actively moved away from surveyors, which suggests high sensitivity to human presence. EGK have been observed avoiding site assessors without any encouragement from 50 to 100 meters. This suggests that they will be receptive to herding operations and may only need minimal disturbance to encourage them through the proposed movement corridor into the recipient site.

Observation numbers did not fluctuate significantly over the four surveys suggesting that this population is relatively static and not moving freely into and out of the development site (Figure 3). However, EGK sign (scats and tracks) found at access points along Cotters Road does suggest some migration between these areas.



Table 2. EGK Survey Results – Within Development Site.

Date	Time	EGK Observed
5 September 2023	15:00 - 18:00	10
6 September 2023	05:45 - 08:30	22
7 September 2023	16:30 - 18:40	20
9 September 2023	05:30 - 08:00	20

Table 3A. EGK Survey Results – Within Recipient Site.

Date	Time	EGK Observed
5 September 2023	15:00 - 18:00	5
6 September 2023	05:45 - 08:30	5
7 September 2023	16:30 - 18:40	9
9 September 2023	05:30 - 08:00	8

4.3 Monitoring Results

In accordance with the requirements of the KMP, monitoring survey of the resident EGK population occurred during staged fencing deployment between 15 September – 25 October 2023. The staged fencing deployment was then halted at Stage 3, leaving the site accessible to EGK through a break on the eastern perimeter along Cotters Road. From 25 October, monitoring surveys were adapted to assess the number and health of the remaining EGK within the development area. These monitoring surveys included multiple dawn, dusk surveys to gain a better understanding the EGK movement patterns at different times of the day. The number of resident EGK within the development area is outlined in Table 2B.

Table 2B. EGK Monitoring Results.

*Additional monitoring surveys not required by the Kangaroo Management Plan.

Date	Fencing Stage	EGK Observed	Observer
15 September 2023	Stage 1*	19	LS
28 September 2023	Stage 1*	22	AW
6 October 2023	Stage 1	20	AW
11 October 2023	Stage 2*	22	AW
20 October 2023	Stage 2	16	LS
25 October 2023	Stage 3	22	LS
31 October 2023	Stage 3*	20	LS
20 November 2023	Stage 3*	19	JC
28 November 2023	Stage 3*	16	JC
29 November 2023	Stage 3*	20	JC



4.4 Patterns of Movement

EGK were predominantly observed grazing and resting in the western section of the development site (Plate 2). In the early mornings a small number (3 or 4) were observed moving east from the internally fenced area in the site's southwest corner to join the remaining ~15 EGK grazing around the long grass and scattered shrubs in the northern half of the western section (Plate 4 - 5). On multiple occasions, it appeared that the entire population were congregated around the shrubs in the northern half of the western.

Prior to fencing being deployed, between 5 and 7 individuals could often be found in the eastern section of the development site, grazing in the long grass nearby the rain garden (Plate 3). Movement between that area and the small patch of large trees in the southeast was observed. Three EGKs were observed crossing Edgars Road (west to east) on one occasion. No other movement between sections or outside of the development site was observed during the survey period.

Assessments of movement patterns were also undertaken using scat, tracks and signs observed within the development site and broader study area. Some evidence suggests movement of EGK within the first 200m of the abutting eastern corridor (Plate 13). Tracks and scat at several points along Edgars Road suggests relatively frequent movement between the eastern and western sections of the development site (Plate 9 - 11). EGK have been observed to move freely throughout the western section. Tracks, scat, and fur around the Cotters Road fence breaks indicate some movement of EGKs between the development site and the grassland to the west (proposed recipient site). However, the frequency of this movement pattern is uncertain as no fresh scats or tracks were discovered over the survey period. Those found were likely made in the days prior to the initial survey.

There was little fluctuation in numbers between dawn and dusk surveys. The population appears to predominantly remain in the development site. Any movement in and out of the site was not consistent nor predictable.

Two Reconyx hyper fire infrared cameras were deployed on Thursday 7 September to monitor the Cotters Road fence breaks overnight. No EGK movement was captured.

It should be noted that at least one EGK present within the development site exhibited signs of poor health during surveys, and four deceased EGK were found (Plate 8). Three of the carcasses were significantly decayed while one large male appeared to be recently deceased with suggestions of a head wound that had since been scavenged.

Staged fencing has restricted EGK range to the western section of the development site. However, during follow up monitoring there have been several instances where fencing has been tampered with and opened, presumably by members of the public. Fence breaks have subsequently allowed EGK to access previously fenced stages and Edgars Road. This is likely to have resulted in at least one EGK fatality, with an additional carcass being observed during follow up monitoring on Edgars Road, close to the fence break.

www.ehpartners.com.au





Plate 2. EGK amongst scattered shrubs in western section. Ecology and Heritage Partners 07/09/2023.



Plate 3. EGK feeding in eastern section of the development site. Ecology and Heritage Partners 07/09/2023.



Plate 4. Internally fenced southwest section. EGK visible to the east. Ecology and Heritage Partners 05/09/2023.



Plate 5. Internal fencing in southwest of the development site. Ecology and Heritage Partners 05/09/2023.



Plate 6. EGK scat in southwest of the development site. Ecology and Heritage Partners 05/09/2023.



Plate 7. Evidence of EGK movement throughout western section of the development site. Ecology and Heritage Partners 05/09/2023.





Plate 8. Individual appearing to be in poor health within the development site. Ecology and Heritage Partners 05/09/2023.



Plate 10. EGK scat on western edge of Edgars Road. Ecology and Heritage Partners 05/09/2023.



Plate 9. EGK tracks in western section showing movement toward Edgars Road. Ecology and Heritage Partners 05/09/2023.



Plate 11. EGK track in north-eastern development site showing movement across Edgars Road. Ecology and Heritage Partners 05/09/2023.



Plate 12. Ephemeral water source in north-east of the development site. Ecology and Heritage Partners 05/09/2023.



Plate 13. Evidence of EGK movement into eastern corridor. Ecology and Heritage Partners 05/09/2023.

4.5 Protective Habitat

Scattered shrubs and long grass provide moderate protective habitat for EGK in the western section of the development site. A small number of large trees in the southeast could provide some protection but did not appear to be frequented by EGK.

4.6 Watering Points

The eastern section of the development site contains two water sources. A rain garden has been installed alongside Edgars Road as part of the upcoming development and was holding water at the time of survey. While this could be seen as a seasonal resource for the resident EGK population, no evidence of use was detected. The second water source is a drainage line in the northeast corner of the development site. The presence of tracks and scat surrounding this water source suggests occasional use by resident EGK, however the drainage line is predominantly ephemeral in nature, and has remained dry during all follow-up monitoring conducted at the site. No water sources were found in the western section. The proposed recipient site is home to a stretch of Edgars Creek which was flowing at the time of survey and exhibiting signs of frequent EGK use. The semi-permanent nature of this creek would prove a reliable water source year round with minimal human-EGK disturbance (Plate 21).

4.7 Remote Camera Survey

Two Reconyx hyperfire infrared cameras were deployed on 7 September for a single night along Cotters Road to monitor EGK movement between the development and recipient sites. No fauna captures were obtained.

Camera number	EGK Observed on camera	Time Observed	EGK Direction of Movement	Other
1	0	-	-	0
2	0	-	-	0

Table 3. EGK Remote Camera Survey Results.

4.8 Residential Areas

EGK fatalities have been reported along the new section of Edgars Road that bisects the recipient site north to south. W5-29 kangaroo warning signs have been installed along Edgars Road to warn drivers of increased EGK movement in the area. Since surveys have been completed, two electronic VMS boards have been placed at locations along Cotters Road as an additional measure to reduce the risk of vehicle collisions with EGK (Figure 4). These signs have been checked and confirmed to be operational during all follow up monitoring at the site.





Plate 14. Evidence of EGK movement throughout western section and deteriorated fencing. Ecology and Heritage Partners 05/09/2023.



Plate 15. EGK tracks and scat along Cotters Road fence line. Ecology and Heritage Partners 05/09/2023.



Plate 16. Potential evidence of EGK movement along Cotters Road. Ecology and Heritage Partners 05/09/2023.



Plate 18. Fence break on eastern side of Cotters Road. Ecology and Heritage Partners 05/09/2023.



Plate 17. Fence break on eastern edge of Cotters Road. Ecology and Heritage Partners 05/09/2023.



Plate 19. Fence break on western side of Cotters Road, looking towards recipient site. Ecology and Heritage Partners 05/09/2023.



4.9 Threatened Species and Ecological Communities

DEECA's Biodiversity Conservation Strategy for Melbourne's Growth Corridors (BCS) has determined the location and size of conservation areas designed for protecting specific threatened species and communities. If a KMP proposes to in situ manage the EGKs in a conservation area, it must be clear that the management objectives for the area will not be compromised, including that grazing by EGKs will not affect threatened values (DELWP 2015).

No BCS conservation areas are present within, or adjacent to the study area. It is understood that the neighbouring property to the west contains suitable habitat and previous records of the EPBC Act-listed Golden Sun Moth and is mapped as containing a small patch of the endangered Plains Grassland Ecological Vegetation Community (EVC) in the northwest corner. However, given the relatively small population of EGK in the broader study area, the in-situ management of EGK through the application of this KMP is unlikely to negatively affect the surrounding habitat of threatened species or ecological communities through overgrazing or the displacement of resident EGK populations.

4.10 Landscape Features and Major Hazards

Slow to moderate speed roads with high traffic activity (50-60 km/h) exist as hazards between the development site and nearby suitable EGK habitat (grassland to the west of Cotters Road). A recent extension of Edgars Road has divided the development site in two. Edgars road is a moderate speed road, and based on observations during site assessments, traffic density is very high especially during peak times, creating a significant hazard to EGK within the development site.

Deteriorating fencing is a common feature throughout much of the site, where the risk to EGK moving through the landscape is magnified. However, staged fencing has restricted EGK range to the northern section of the site, west of Edgards Road (Figure 4).

Residential development surrounds the site, however behaviour witnessed during the survey suggests that this population are still sensitive to human presence. There are no further hazards (i.e. quarries) present within or adjacent to the site.

4.11 Recipient Site

The following information has been gathered from desktop assessments as well as four broad visual inspections of the area using binoculars from a several vantagepoints.

The proposed recipient site is a modified grassland covering approximately 50ha to the west of Cotters Road. A population of at least 10 EGK were observed using the site over the four survey days. The site is bordered by the Hume Freeway to the west, O'Herns Road to the south, residential developments to the north and northeast, and Cotters Road to the east. An electrical easement bisects the site east-west. The site is home to the EPBC Act listed golden sun moth and is mapped as containing a small patch of the endangered Plains Grassland Ecological Vegetation Community (EVC) in the northwest corner. The EPBC Act listed growling grass frog has been recorded in the surrounding landscape and suitable habitat for this species was identified along Edgars Creek during site inspections.



While the site in question does not appear to contain high quality EGK habitat, surrounding developments have rendered this the only feasible option for relocation of this population. Large areas of open grassland are present within the site which is adequate habitat for sustaining a population of EGKs, however there have been no detailed studies conducted to establish the carrying capacity and existing populations of terrestrial herbivores within the proposed recipient site.

4.11.1 Protective habitat and available resources

Edgars Creek runs north-south along the eastern section of the recipient site (Figure 2). The creek was flowing at the time of the surveys, and it can be assumed that the semi-permanent nature of this creek makes it likely to provide a reliable water source and is likely to attract EGKs into the recipient site. Low lying "gilgai" (potential water holding) areas are present throughout the recipient site, which may provide additional seasonal water sources.

Trees and scattered shrubs offer potential protective habitat for EGKs in the recipient site (Figure 2), as well as undulating areas around Edgars Creek, all of which combine to provide shade, safe refuge from predators and windbreaks for EGKs to rest during extreme weather. Trees are present as scattered paddock trees, planted windrows and a woodland area.



Plate 20. New rain catchment in eastern development site. Appears to be unused by EGK Ecology and Heritage Partners 05/09/2023.



Plate 21. Section of Edgars Creek. Water source within recipient site and suitable habitat for Growling Grass Frog. Ecology and Heritage Partners 05/09/2023.

www.ehpartners.com.au







Plate 22. Evidence of EGK utilisation of Edgars Creek Plate 23. Location of remote camera on western side of water source. Ecology and Heritage Partners Cotters Road. Ecology and Heritage Partners 07/09/2023. 05/09/2023.

4.11.2 Sustainable Population Limit

As per the Translocation Policy for isolated wild EGK populations in Victoria (DELWP 2015), this recipient site was assessed using a sustainable population limit, rather than other density models (e.g. carrying capacity). A sustainable population limit is an estimate of the number of EGKs an area can sustain without supplementary feeding and watering, whilst meeting management objectives for animal welfare, human safety and environmental protection within the area (DELWP 2015). DEECA recommends a density of 1.5 EGKs / ha (150 per km²) within grassland and grassy woodland ecosystems, and a density of 0.6 - 1.0 EGKs / ha (60–100 per km²) within Melbourne's growth corridors (DELWP 2015).

It is important to note that a thorough feasibility assessment of the recipient site has not been conducted. The following calculations are a rough estimate based on population data gathered via visual surveys using binoculars being undertaken from a several vantagepoints.

The site appears to already support a small population of EGK. Between five and nine individuals were observed during each survey. Using the approximate site area of 50 hectares, it can be estimated that the recommended density of EGKs in this site (which lies within Melbourne's growth corridors) is $30(0.6 \times 50 =$ 30).

The population of EGK within the development site is estimated to be 22. Relocation of this population into the already inhabited recipient site would bring the overall population to at least 31 and would exceed the sustainable population limit of this site.

A thorough feasibility survey including presence/absence population counts would be necessary to accurately determine the recommended density of the recipient site and thus the sustainable population limit. However, it should be noted that resources available within the development site are currently very limited, with areas of scalped ground, and protective habitat limited to one small patch of shrubs. As such, the proposed recipient site is considered a more suitable location for resident EGK, given the availability of water and grazing resources, reduced hazards including roads and likelihood of EGK-human interaction, and availability of protective habitat in this area.



4.11.3 Hazards

Hume Freeway is located approximately 0.9 kilometres to the west of the development area, forming the entire western border of the recipient site. This high-speed road poses a collision risk for both EGK and humans, and the presence of more expansive grassland to the west may encourage movement of EGKs across the freeway. However, installation of approximately 1.3 kilometres of permanent kangaroo proof fencing along the entirety of the western boundary is not considered to be practical or a cost-effective measure to manage risk of EGK collision. Given the resident population of EGK within the study area can currently move freely through the landscape to the west, it is considered unlikely that relocation of the resident EGKs a short distance into the recipient site will significantly increase collision risk along Hume Freeway. Further, the significant risk, and recent instances of EGK collision along Edgards Road should be addressed as a priority in terms of EGK collision risk reduction.

The site is bordered to the east by Cotters Road, a low to moderate speed though highly frequented road. Following herding actions being implemented, permanent kangaroo-proof fencing must be erected and maintained along the western side of Cotters Road to reduce the risk of collision.



STAGED FENCING PLAN 5

The aim of staged fencing with regard to this KMP is to avoid land-locking EGK within the development site and execute a gradual relocation into the proposed recipient site, away from Edgars Road, thus avoiding further EGK vehicle collisions.

The development site has been fenced in three stages (Plate 24 & 25). Detail regarding the fencing stages is provided in Table 5, Figure 4 and the following sections. Once a fencing stage was established, a one-week period passed before integrating the subsequent fencing stage. Once the boundary of subsequent stages are fenced, any internal fencing between the stages can be removed.

A suitably qualified Ecologist was on site on the day of deployment of each fencing stage to observe the behaviour of the EGKs (Table 2B).

Details of monitoring requirements and procedure are provided in section 9.4.

Table 4. Fence Staging Schedule.

Stage	Fencing Timing
Population density assessment	Complete
Fencing Stage 1	Complete
Fencing Stage 2	Complete
Fencing Stage 3	Complete



boundary of stage 1. Ecology and Heritage Partners 11/10/2023.



Plate 24. Staged fencing being erected along northern Plate 25. Staged fencing being erected along northern boundary of stage 1. Ecology and Heritage Partners 11/10/2023.



Table 5. Fence Staging Details and Fencing Requirements.

Fencing Stages	Stage Details and Fencing Requirements
Baseline population density assessment	Prior to the commencement of Stage 1 fencing, a suitably qualified Ecologist will conduct a baseline population density assessment of the development site, to determine the abundance of EGK's within the area. This will be conducted the morning of the planned deployment of stage 1 fencing, to determine how many EGK are onsite the day of fencing deployment and observe their behaviour and movement patterns.
1	This stage requires traffic control to block access to Edgars Road for the duration of the fencing operation. Blockades (either human or structural) must be deployed at the northern and southern ends of the road to prevent EGK exiting at any of these points and entering the surrounding residential area. This stage comprises fencing the boundary of the western half of the development site (between Cotters Road and Edgars Road) to contain all EGK within that section. EGK have been observed to congregate in this section, particularly at dawn, as such it is recommended that this stage be executed at dawn. Once contained, the entire perimeter of this section must be fenced before roads are reopened. Land-Locking Risk: High. Fencing Requirements: Stage 1 must be fenced around entire boundary using kangaroo proof fencing (as defined in DELWP 2015, p. 26).
2	Once the recipient site and resident EGK population have been assessed by a suitably qualified Ecologist, and it has been deemed appropriate to do so, all western boundaries of the recipient site (excluding the movement corridor and access point along Cotters Road) must be fenced with permanent kangaroo proof fencing (as defined in DELWP 2015, p. 26) (Figure 4). This will prevent the relocated EGK population from entering the surrounding residential areas in an attempt to re-enter the development site. A suitably qualified Ecologist must be present to monitor EGK behaviour during this process. The excluded section along Cotters Road will act as the access point for EGK during the final stage of this relocation plan. This stretch should be cleared of all fencing and any surrounding hazards removed to encourage movement and allow safe passage of EGK into the recipient site. Land-Locking Risk : High. Fencing Requirements: Permanent kangaroo proof fencing along the western boundary of the recipient site (excluding the movement corridor and access point along Cotters Road) with kangaroo proof fencing (as defined in DELWP 2015, p. 26).



Fencing Stages	Stage Details and Fencing Requirements
	This stage comprises the western section of the development site, located between west of Edgard Road and Cotters Road (Figure 4). EGK are known to be present on site and must be allowed to disperse to the north and west into subsequent stages and the recipient site west of Cotters Road. A suitably qualified Ecologist or wildlife spotter must be on site on the day of deployment of each fencing stage to observe the behaviour of the EGKs. If EGKs are observed to be agitated or stressed at any time during fence deployment, work must cease until the EGKs have calmed down and Ecologist gives the all-
3	Following the completion of staged fencing, controlled herding will commence as per section 7.2.2. Prior to herding proceeding, temporary fencing will be erected across Cotters Road once traffic management has closed the road, to allow a safe exit point to cross the road into the proposed recipient site. Once fencing is complete within each stage and it is determined safe to do so by the Ecologist, fencing across Cotters Road can be removed, and traffic management can allow the road to re-open.
	Controlled herding out of the stage must follow the procedure covered in section 7.2.2 and may only be undertake once an authority to control wildlife permit ATCW has been granted by DEECA, and once all fencing and herding plans have been actioned (see section 6.1).
	Fencing Requirements: Stages must be fenced around entire boundary. Fences at each stage must be deployed sequentially with a one-week gap between the installation of each fencing stage.



The land surrounding the development site is occupied by residential plots and roads that experience high rates of traffic (Edgars Road and O'Herns Road). EGK management must be responsive to the changing needs and behaviours of this EGK population.

This plan reduces the likelihood of EGK accessing the construction area and road reserve at Edgars Road. This reduces the collision risk and risk of further landlocking within the development area. However, once construction commences the area must be searched each day before the commencement of works to determine if EGK are present. If EGK are found in the construction area or in an area at risk of land-locking, DEECA must be contacted immediately to determine an appropriate course of action. Temporary fencing must be established as an adaptive management measure if necessary due to the appearance of EGK in construction areas or in areas at risk of land-locking.

Actions such as herding or scaring EGK out of the development site must not be undertaken unless part of a planned and permitted direct management action, as this can stress and confuse EGKs making them behave erratically and move in unpredictable directions to busy roads nearby or residential lots. This can create hazards resulting in severe injury to EGKs and people.



6 ASSESSMENT OF OTHER MANAGEMENT OPTIONS

6.1 Management Overview

This section assesses the suitability of other allowable management options as ways to prevent EGK from using the site. Possible management options, including non-lethal options, are developed and considered by reviewing current industry best practice, research on latest methods and through consultation with State Government agencies and other organisations.

The management options reviewed include:

- Direct management (fertility control, herding and lethal methods); and,
- Indirect management (habitat manipulation).

Indirect management of the EGK population is the desired approach within regard to EGK management. If alternate measures or controls are necessary, an ATCW is required under the *Wildlife Act 1975*. It is understood that an ATCW application will be submitted in conjunction with the this KMP to facilitate active herding of EGK into the proposed recipient site. Lethal control will be avoided and is considered an undesirable approach given the high profile nature of the project.

6.2 Desktop Review of Current Industry Practice

A desktop review was undertaken to ensure the most up to date information and existing technical knowledge on current industry practice of the management of EGK was reviewed in the assessment of management options. This involved a review of:

- Published EGK research and State management documents (TAMS 2009; Pople and Grigg 1999);
- Current environmental resource management guidelines (Allan and Stansky 2009);
- Update on Situation Analysis Report: Current state of scientific knowledge on EGK in the environment, including ecological and economic impact and effect of culling. Report to the EGK Management Advisory Committee (Olsen and Low 2006); and,
- RSPCA Policies and Position Papers (RSPCA 2014).

6.3 Assessment of Management Options

Each identified management option was assessed against the various criteria outlined below. With each option the following questions were asked:

In order to sustainably manage the EGK population, is the option:

- Fit for purpose (i.e. will it fulfil intention and specification)?
- Supported by government agencies (DEECA)?
- Supported by animal welfare groups (RSPCA)?



- Scientifically proven and commercially available?
- Practical?
- Known to be humane, safe and without impacts to non-target individuals or populations?



A detailed analysis of options and their suitability for any population of EGK potentially using the study area is shown in Table 6.6. Any option which failed more than one of the assessment criteria was not considered further.

Option	Description	Fit for purpose	Supported by Gov. Agencies	Supported by RSPCA	Proven and available	Practical	Animal Welfare
No Management							
No management	EGK population left to self-regulate	×	×	×	×	×	×
	Direct Management						
Surgical sterilisation	Tubal-ligation or ovariectomy - females. Vasectomy or castration - males.	×	✓	✓	✓	×	×
Immuno- contraception	Vector carries agent that initiates auto- immune response rendering animal sterile.	×	×	✓	×	×	✓
Chemical castration	Injection of toxin that causes castration of males or atrophy of the testes.	~	×	✓	×	×	✓
Chemo-sterilant	Injection of the chemical which eliminates primordial and primary follicles.	×	×	✓	×	×	✓
Contraceptive implants	Peptide hormone implants.	×	~	✓	\checkmark	×	✓
Contraceptive implants	Steroid hormone implants.	×	✓	✓	✓	×	✓
Euthanasia injection	Capture of animals via darting and euthanasia by lethal injection.	×	✓	×	✓	×	×
Shooting	Shooting to reduce population size by licensed operators following approved guidelines.	×	✓	✓	✓	✓	✓
Translocation	Capturing animals via darting then transporting to another area.	×	×	×	×	×	×



Option	Description	Fit for purpose	Supported by Gov. Agencies	Supported by RSPCA	Proven and available	Practical	Animal Welfare
Relocation	Herding animals out of a particular area to another	~	~	×	√	√	×
Poisoning	Poison added to supplementary feed for the population	×	×	×	×	×	×
		Complement	tary Management				
Decommissioning dams	Decommissioning dams outside conservation areas, in areas of future development.	×	✓	✓	×	v	4
Removal of food	Scrape/cut grassy areas to remove EGK food sources outside of conservation areas	✓	✓	✓	✓	✓	~
Revegetation	Revegetating areas of grassland to woodland.	✓	✓	✓	✓	✓	~
Removing fencing in specific areas	Remove fencing in areas to encourage emigration.	✓	✓	✓	✓	✓	~
Temporary exclusion fencing	Use of fencing with kangaroo-proof features (as defined in DELWP 2015, p. 26) to exclude EGK from hazardous areas	✓	✓	✓	✓	1	1
Permanent fencing	Erecting fencing with kangaroo-proof features (as defined in DELWP 2015, p. 26) to contain or exclude kangaroos to/from a particular area indefinitely	√	√	×	√	1	4
Signs along roads	Increased use of signs along surrounding public roads and internal roads.	✓	✓	✓	✓	¥	¥
Site user education	Information for site inductions and education material relating for all site users.	✓	✓	✓	~	✓	~



7 MANAGEMENT OPTIONS – PHASE 1

7.1 Decommissioning of Resources

7.1.1 Requirements, Risks and Considerations

Decommissioning of resources is an effective and non-invasive way to discourage EGKs from moving into an area or returning to their former home range. This management option is supported and encouraged by DEECA (DELWP 2015).

This management option involves the removal or decommissioning of resources that are used by EGK in order to encourage movement out of an area. Resource removal is focused on the removal of water points, food resources and protective habitat. If a population of EGK is identified to be land locked during pre-development surveys, resource removal should not occur as EGK will not be able to disperse from the area and there will be an increased risk to both human safety and animal welfare if forced to move into more urbanised areas in search of resources.

The decommissioning of resources across the development site (i.e. palatable grasses, protective habitat and water sources) would typically be considered in conjunction with exclusion/kangaroo-proof fencing as part of a staged development in order to remove attractants within areas to be developed and encourage EGK to move towards other resources in undeveloped areas.

The below sections outline the requirements, risks and considerations for the decommissioning of resources to be considered a viable option for EGK management, and whether or not these have been met.

Removal of food sources

EGK predominately feed on green annual grasses with moderate amounts of forb and shrub material (Davis et al. 2008; Pahl 2019). The development site comprises areas of both open grassland and highly modified land and consists of mixed grassland containing native and invasive species, both of which are considered palatable and likely to be utilised as a food source by EGK. EGKs will not graze in an area where the edible grasses and herbs have been completely removed.

When used in conjunction with removal of water points and protective habitat, the removal of palatable grasses and herbs may encourage EGK to move on from the area and reduce the immediate risk of land-locking. Where possible, removal of food resources within each development stage should involve complete removal, as slashing or mowing can be ineffective and often spreads highly invasive weeds. Regrowth of food resources will need to be closely monitored as young shoots may attract EGK back into an area.

Prior to fencing being erected around each development stage, all grass within that stage should be slashed/scraped to remove all available food sources. Grassland slashing/scraping should be undertaken one to two days before fences are installed within each stage. This will further encourage EGK to vacate each stage before fencing occurs.

Removal of Protective Habitat

Protective habitat includes areas such as patches of trees and windrows where EGK can shelter, rest and are safe from human disturbances. If there is protective habitat within one (1) kilometre, EGK are more likely to



be found in that area (DELWP 2015b). Protective habitat such as trees and shrubs should be removed to encourage EGK movement out of the area.

There is no significant native vegetation within the development site which has been identified as 'to be retained' for conservation purposes. Scattered shrubs exist throughout the site, which may provide limited protective habitat for EGK (Plate 7 & 14).

If permitted, removal of scattered shrubs should be undertaken within each development stage prior to fencing being erected around that stage, to encourage EGK movement out of the area.

7.1.2 Animal Welfare

Removal of Food

When food resource removal begins there will likely be an increase in grazing pressure on remaining areas, which can result in an increase in competition between individual EGK and welfare issues. These changes, as a result of development and increase human population within the area, can lead to a range of potential impacts to the welfare of EGK (Olsen and Low 2006), including:

- Starvation due to lack of food resources (i.e. removal of grassland habitats);
- Stress-related illness and disease;
- Exposure to disease, including Phalaris poisoning;
- Malnutrition causing parasite infestations;
- Injury and mortality associated with fence and vehicle collisions; and,
- Increased interactions with humans (i.e. EGK becoming dependent and possibly aggressive).

The population of EGK within the development site were not identified as land locked during pre-development surveys. EGK will be able to disperse from the development site in search of more resources once removal of food resources occurs within each stage, and there is therefore a low risk of EGK suffering any ill-effects of this management option.

Removal of Protective Habitat

Shade provides protection against adverse weather, including severe heat during the day or cold temperatures at night. A lack of suitable shade may affect EGK ability to control heat load and balance energy and water budgets, and may therefore result in the animal experiencing dehydration, heat stress or hypothermia in young (Roberts 2016). A lack of protective habitat is also likely to leave EGK exposed and vulnerable to predators, such as Red Foxes, and may therefore result in higher stress levels and/or injury as a result of attacks.

7.1.3 Conclusion

EGK are expected to move out of the development site as access to available resources (food and shelter) are removed, with movement expected to occur westward towards the proposed recipient site. Based on the literature outlined above, the development site conditions, animal welfare considerations and proposed mitigation techniques, available resources within the surrounding area, including the availability of a suitable



release site, decommissioning of resources is considered **a suitable management action** for the population of EGK within the development site.

7.2 Linear Corridors

7.2.1 Requirements, Risks and Considerations

Providing a linear corridor for EGK to move into adjacent habitat is only considered to be a potential option if there is a safe pathway for EGK movement. Residential housing, low-traffic streets and moderate traffic roads encompass the development site, presenting a risk to both EGK welfare and human safety to allow the EGK to cross the road as part of a staged development plan.

The areas surrounding the development site contain a number of linear corridors, open spaces and parks that may facilitate the movement of EGK out of the development site and into the broader landscape while construction is occurring. Whilst not designed for EGK movement, they may be used by EGK as development progresses throughout the development site and available habitat/open space is reduced. These linear corridors are likely to facilitate potential migration of EGK out of the development site.

Clear fence breaks on the western boundary of the development site, in addition to the presence of scat and tracks, suggest this population regularly access and exit the site across Cotters Road to move throughout the surrounding landscape. There is evidence that this population of EGK are utilising an electrical easement to the north west of the development site as a movement corridor. This movement corridor does not bisect any main roads. Cotters Road intersect the movement corridor (Figure 2), and EGKs would be required to cross this low-traffic street in order to access the recipient site. Enacting this management option would involve the implementation of reduced speed limits and kangaroo warning signs within the local area. Electronic warning signs have been installed along Cotters Road to alert drivers of potential EGK collisions, and will remain in place until controlled herding is implemented and the site confirmed to be free of any remaining EGK.

7.2.2 Controlled Herding

Controlled herding is the non-lethal, human-induced movement of EGK out of a certain area. This requires the creation of fenced corridors to provide a predictable pathway through which EGKs can move.

Following the installation of fencing around Stage 3, EGK have remained within the development site for a period of five (5) weeks as of the date of this report. It is therefore recommended that the known movement corridor along the electrical easement be utilised as a passage for the purpose of herding EGK out of the development site and into the recipient site. When combined with staged and permanent fencing and resource decommissioning, this management option will ensure any remaining EGK access this movement corridor to vacate the development site, reducing the risk of future EGK collisions along Edgars Road. This management option will also avoid the need for the culling of EGKs, ensure that animals are relocated out of the development site within a shorter timeframe than passive dispersal, and will ensure that the animals are relocated to a safer and more appropriate, pre-determined area with available resources to sustain them.

Temporary fencing is recommended to be erected across Cotters Road prior to herding commencing. This additional fence will encourage EGK's through the intended movement corridor into the neighbouring recipient site. Prior to herding commencing, permanent kangaroo proof fencing must be erected along the western side of Cotters Road and along Rockfield Street to the west of the intersection with Cotters Road, to



prevent EGK returning to the development area after herding is complete (Figure 4). Temporary fencing will be erected at the exit point and across Cotters Road, which will be lined with hessian or shade cloth across the movement corridor, and at least thirty meters either side of the exit point to increase their visibility and significantly reduce the likelihood of EGKs sustaining injuries during the herding process. A suitable qualified Ecologist will be on site during the herding operation, and communicate with the herding team via two-way radio. If EGK show signs of distress during herding, the Ecologist will instruct the herding team to stop moving and remain still until further notice and when EGK have calmed down.

Based on the methods outlined in Colgan et al. 2019, controlled herding should involve:

- Cotters Road must be temporarily closed to all traffic during the herding process;
- Herding will commence at dawn, when EGKs are most active and human activity is minimised;
- A line of 10 personnel (herders) spaced a maximum of 10 metres apart, will enter the development site from O'Herns Road, and move to the North through each subsequent stage to ensure no EGK are remaining in previously fences stages (Figure 4), and ensuring to close all fences behind them;
- Herding must occur at a slow walking pace, with herders making mild noises and speaking in calm voices to alert EGK to their presence, ensuring not to startle them;
- All personnel will be utilising two-way radio communication, with herders frequently updating other personnel, including traffic management personnel on Cotters Road regarding EGK herding progress;
- Herders will then move towards fencing stage 3, and enter stage 3 at the north east corner of stage 2;
- Herders will be space along the eastern boundary of stage 3, and move in a westerly direction towards the fence break on Cotters road, with the space between personnel decreasing as herding progresses towards the exit point;
- The line of movement will encourage EGK to move at a slow pace towards and along fence lines, towards the exit point;
- EGK must be counted as they pass through the exit point, to ensure all individuals vacate the development area;
- Herding by vehicle must not be undertaken to avoid undue distress to the animals;
- Herding events may be cancelled or discontinued at the discretion of the Ecologist and due to unfavourable weather conditions (e.g. heavy rain) or in the event that EGK begin showing signs of distress.

All herding personnel will be equipped with two-way radios and have constant, reliable communication with one another throughout the entirety of the herding process. Should any issue arise during this process, the herding personnel will notify all other personnel involved and the herding process should be halted.

Should any EGK remain in the development site for more than 3 hours following herding efforts, DEECA must be notified, and a qualified Veterinarian notified to determine an appropriate Course of action.

It is difficult to herd EGKs along predetermined pathways as EGK tend to scatter in an uncontrolled manner into non-preferred areas (MPA 2014), however this risk is reduced given the electrical easement is a known movement corridor, and will be fully fenced prior to herding being undertaken.

Controlled herding will only be considered if an Authority to Control Wildlife Permit is granted, and if EGK remain in the development site after all other management options have been exercised. If controlled herding is deemed necessary, it is likely that EGK will move through the corridor after the initial stages of herding commence, with minimal herding pressure required overall.



Consent must be obtained from all landholders whose private land may be traversed by EGKs during the herding event. The proponent has obtained approval from one of the two landowners to the west, and attempted to contact the second landowner to inform them of the intent to herd, however do date no response has been received. EGK have been observed within this property during follow up monitoring, and there are no significant barriers to EGK egress into this area from the development area and broader landscape to the west. As such, herding of 22 EGK from the development area through private property into the recipient site to the west will not introduce EGK into an area they are not currently present.

7.2.3 Animal Welfare

Controlled Herding

Herding along fenced corridors where animals are essentially captive requires animal husbandry standards to be met, and thus it is recommended that a qualified wildlife Veterinarian provides supervision throughout the entire herding process. Herding is non-lethal, but it can significantly stress EGKs. It can also result in injury, death or the ejecting of pouch young if stress turns to panic and EGKs behave erratically. Fences across Cotters Road and around the exit point should be lined with hessian or shade cloth to increase their visibility and significantly reduce the likelihood of EGKs sustaining injuries during the herding process. Herders will maintain a safe distance and display an outwardly calm, quiet demeaner in order to reduce the likelihood of EGK feeling threatened by herders and experiencing subsequent stress and panic. If EGKs display any signs of distress, herders will stop walking and wait for advice from the Ecologist before herding is resumed.

Controlled herding may only be effective over a short time scale, as EGK have a strong attachment to their home range and may attempt to return to their territory following herding from the site (MPA 2014; DELWP 2015). Combining herding with use of permanent exclusion fencing will improve its efficacy by creating a barrier to prevent EGK from returning onto the land (MPA 2014). Additionally, EGKs that are herded into unfamiliar territory may face territorial disputes with other EGKs, but it is unlikely that this EGK population will encounter unfamiliar EGK in a property that is directly adjacent to the development site, where these EGK are known to visit.

7.2.4 Case Studies

There are limited studies that describe the EGK management method of controlled herding via linear corridors, and thus there is limited experience on which to draw. It is a relatively understudied management option with a high potential for success, if the known risks are avoided and minimised where possible (Colgan 2019; Higginbottom and Page 2010).

A study by Colgan (2019) found that utilising a herding and capture method to relocate and sterilise a large population of EGKs, resulted in a largely successful outcome with low overall mortality rates. Free ranging EGKs and Red Kangaroos were herded into purpose-built capture yards, before being darted with a projectile syringe. Herding large groups of kangaroos was necessary in order to vacate areas before construction commenced, and to move the animals into safe locations for darting. Despite repeated, large-scale herding events, there were rarely any kangaroo deaths due to post-capture myopathy (Colgan 2019). This infers that on-foot herding techniques can successfully be conducted in such a way that minimises EGK levels of fear, anxiety and prolonged exertion (Shepherd NC. 1981; Vogelnest and Portas 2008).

EGKs tend to travel along fence lines when herded (Colgan 2019). In order for herding and relocation to be effective, fences must be specifically designed to prevent EGK collisions (Jackson 2003). Although fence-



related musculoskeletal injuries were the main cause of EGK mortality in this study, this fatal outcome was significantly reduced following the introduction of fences lined with weed matting and shade cloth to increase fence visibility (Colgan 2019). Additional measures included the padding of fenceposts, construction of fence arms to funnel EGKs through gates, constructing of a soft-barrier hessian fence 100 metres inside the fence line, and hessian placed at strategic points where the fence was difficult to see (Colgan). Active pursuit of animals should also be restricted to cool weather to minimise the occurrence of myopathy (Jackson 2003).

Where many translocations fail due to the highly invasive darting procedures and lengthy transportation processes which cause stress related illnesses and mortalities (Clayton *et al.* in 2014; Fischer and Lindenmayer 2000; DELWP 2025), the process of herding EGK a short distance within their natural range as per the current management plan is considerably less invasive. If the same precautions known to aid translocation success, as outlined in Section 8.1.4 are undertaken in regard to linear corridors and controlled herding, it is likely that these management options could be implemented successfully (Higginbottom and Page 2010).

7.2.5 Conclusion

Extensive site assessments have confirmed that EGK use the neighbouring site to the west as a movement corridor, and EGK movement through this area will replicate the population's current pattern of movement. It is therefore expected that this linear corridor will be effectively used by EGKs.

Herding EGK through a fenced movement corridor across Cotters road is considered **the preferred management action** in this instance given EGK have not left the development site following staged fencing and resource removal. Kangaroo proof fencing will be required along all boundaries of the development site. The fencing across Cotters Road and around the exit point must be hessian lined to minimise disturbance of the EGK and block their line of site to any humans or vehicles. Careful planning and consideration will be required to successfully encourage EGKs to leave the development site along the corridor provided, and all hazards to EGK movement such as machinery, fencing, and scattered equipment and rubbish must be removed from within and around the movement corridor prior to herding commencing. The implementation of controlled herding will only be considered as an additional management option if EGK fail to leave the development site of their own accord after the implementation of resource decommissioning and staged fencing. Controlled herding out of the stage may only be undertake once an ATCW permit has been granted by DEECA, and once all fencing and herding plans have been actioned.



8 MANAGEMENT OPTIONS – PHASE 2

8.1 Translocation

8.1.1 Requirements, Risks and Considerations

Translocation of kangaroos is a supported management option by DEECA when certain conditions are met. These conditions include the mob to be translocated being a small, isolated population of 50 EGKs or fewer, and the presence of a suitable release site within close proximity to the source site (DELWP 2018). The below sections outline the requirements, risks and considerations for translocation to be considered a viable option for EGK management, and whether or not these have been met.

With respect to the information given above in Section 7, the use of linear corridors and herding is a preferred management action, with translocation considered to be a suitable management action if herding efforts fail.

8.1.2 Suitable Release Site

EGK display a strong site fidelity and their home range typically extends approximately five to 10 kilometres. For translocation to be a viable option, measures must be put into place to manage this behaviour such as providing barriers to prevent return (Priddel *et al.* 1998). It should be noted that even with these measures in place, there is a high likelihood of EGKs returning.

For translocation to be a viable option, the release site therefore needs to be a minimum of 10 kilometres away to discourage EGK from attempting to return to the original site or measures must be put into place to prevent return. Such movement would include potentially crossing major roads and travelling through developed and developing areas, increasing the likelihood of negative human-EGK interactions such as collisions with vehicles. As the conditions for translocation also include the requirement to have the suitable release site within "close proximity" as well as containing similar, continuous habitat from the source site, this further narrows the availability of a suitable release site.

Within a 15 kilometre radius of the development site, the majority of the land is either already developed for residential purposes or being used for farming. Much of this land contains human-made hazards such as fencing, roads, residential and commercial development

The release site also needs to be able to support the translocated EGK without any negative impacts on biodiversity or other animals already utilising this habitat.

With these factors in mind, the requirement of a suitable release site has not been met.

8.1.3 Animal Welfare

There are significant impacts to animal welfare when considering translocation as a management option. The translocation of EGKs involves capturing, sedating, handling and transporting individuals and is often not considered to be a viable option due to the level of stress and mortality associated with the process (DELWP 2015). The stress of being chased and captured, being handled, or struggling to escape traps or nets means that EGK are susceptible to capture myopathy, which causes paralysis and heart failure. EGK have reduced



ability to thermoregulate whilst sedated; capture myopathy can also result from this inability to thermoregulate whilst sedated.

The Victorian Government acknowledges that there may be some limited circumstances under which translocation may be appropriate and feasible, such as for small effectively isolated populations when suitable habitat is nearby and if all the requirements outlined in the Translocation policy for isolated wild EGK populations in Victoria have been met (DELWP 2018).

According to Griffith *et al.* 1989, the success of animal translocation relies on four major factors; reproduction rate, survival rate, genetic variability, and the number of founders, which is dependent on the number released as well as post-release survival and dispersal. As noted by Dickens *et al.* 2010, the physiological stress induced by translocation impacts on three of these factors. Dickens *et al.* suggest that the chronic stress caused by translocation can be reduced by decreasing the number and magnitude of exposures to stressors associated with the translocation process. Doing so includes reducing the novelty of release habitat by releasing the animal within the core habitat range. However, this has already been addressed as not a viable option due to EGK strong site fidelity, and the danger associated with EGK trying to return to their source site. Another method of stress reduction suggests that the tranquilization period where the animal is entirely unconscious allows for a reduced stress level due to the animal being unaware of capture and handling (as opposed to capturing and handling the EGK whilst conscious). However, as detailed above, EGK lack the ability to thermoregulate and therefore are in an increased state of vulnerability during tranquilization which may in turn increase stress levels once the animal has regained consciousness.

Dickens *et al* also reports that the genetic variability of translocated populations may suffer as a result of selective mortality from stress exposure. Due to the fact that the mob of EGK in question constitutes a possible 20+ individuals, there exists the potential for stress induced mortality to reduce the genetic variation of the mob. In addition to this, mortality can be as high as 10% just from the use of a dart rifle, while the use of other capture methods such as nets, trap yards or oral drugs can also result in EGK mortality, as well as mortality sustained during translocation from hypothermia, dehydration and physical injury (Australian Veterinary Association 2009).

Due to the mob consisting of \sim 20 individuals, and the risks of myopathy and the question of whether the stress induced by translocation and release is **not justified**.

8.1.4 Case Studies

Case studies on the translocation of animals show varying results in their effectiveness and survival rate. A literary review by Fischer and Lindenmayer (2000) found that, of the 180 case studies reviewed, translocations that aimed to solve human-animal conflicts generally failed, and re-introduction success was found when the source population was wild and a large number of animals was released (*n* >100). Further, a detailed review of relevant literature and expert advice conducted by the Kangaroo Impacts Management Advisory Group (KIMAG), established by DEECA to provide independent, evidence-based advice to enhance DEECA's approach to EGK management across the State, in 2017, concluded that translocation of EGK should not be a supported management option due to animal welfare and biodiversity concerns (DELWP 2017). A meta-analysis by Clayton *et al.* in 2014 found that of the 109 case studies reviewed, presence or absence data were available for only 72, firstly highlighting the difficulty of monitoring mammals post-translocation to identify whether translocation has been successful or not. Of these 72 studies, the authors found 39% of them had failed against their presence/absence criteria.

Other studies have found varying success rates. For example, Garlick and Austen (2010) provide the results of a translocation program and post-release monitoring of 87 wild and semi-wild EGK. The results from the translocation of these kangaroos to two separate release sites show a high survival rate overall (97%), however the study does not detail the location of the source populations, nor the location of the release sites. Although not explicitly stated, the release sites within this study are referred to as "release site enclosures" suggesting that the release sites were encompassed or fenced, potentially reducing the mortality rate by predators, vehicular collision, negative human interactions or dog attacks; significant factors which need to be taken into account when translocating kangaroos to release sites that are not enclosed. It should also be noted that many of the kangaroos used in this study were treated or reared at a wildlife recovery centre and it is stated within the paper that the kangaroos at release Site 2 approached the person carrying out the monitoring surveys and were fed by hand when called.

Higginbottom *et al.* 2010 notes that monitoring of translocated EGK in the Gold Coast was partially successful with many individuals surviving more than one year post-translocation. However, the authors note that translocation survival is only viable when necessary site criteria are met. These criteria are stated by Higginbottom as being "geographically close to the source site, being large, containing similar habitat to the source site, meeting habitat requirements of the translocated species, having appropriate land tenure, being well connected to other areas of suitable habitat, including minimal roads and other barriers to natural movement, imposing minimal threats from anthropogenic sources and containing resident populations below carrying capacity" (Higginbottom 2004, as cited in Higginbottom 2010). Using these criteria the authors were able to identify just one suitable release site, and further state that this site ended up not being as suitable in practice as it was in theory, as fencing of the area did not inhibit the individuals from dispersing towards busy roads and residential developments.

8.1.5 Conclusion

Although protected under the *Wildlife Act 1975* and the *Prevention of Cruelty to Animals Act 1986*, EGK are not a threatened species. Based on the literature outlined above, the study area conditions, mob characteristics animal welfare considerations and the presence of a suitable release site, translocation is **not** a suitable management action for the EGK on this occasion. -

8.2 Euthanasia

8.2.1 Requirements, Risks and Considerations

Euthanasia is not a preferred management option and is considered to be a last resort. However, there are circumstances in which it is necessary. This includes instances where the EGK are landlocked by development and/or roads, the land is not suitable for in situ management of the population (DELWP 2015, p. 30) and relocation of the EGK is not considered a suitable option.

With respect to the information given above in Section 8.1, the use of linear corridors and herding is deemed to be a suitable management action. Therefore, euthanising EGK is considered to **not be a suitable management action unless all other methods are exhausted**. This conclusion has been reached for the following reasons:



- The presence of a linear movement corridor to the west of the development site may enable EGK to safely move into the recipient site;
- The preparation, submission and approval by DEECA of an application for Authority to Control Wildlife (ATCW) must be completed before any euthanasia of EGK is undertaken;

The following animal welfare principles must be applied with respect to euthanasia:

- The euthanasia of kangaroos must only be included in the KMP after a rigorous assessment of all management options, as documented in Sections 6, 7 and 8 of this KMP;
- DEECA must authorise any euthanasia. An ATCW permit outlines the conditions and requirements for euthanasia, including the number of kangaroos to be euthanised, the euthanasia technique, firearm standards and timelines. The landowner must submit a full KMP, approved by the relevant authority, with the ATCW permit application;
- Kangaroos can only be euthanised by a licensed shooter / darter. If an ATCW permit application is approved, DEECA can recommend a shooter / darter to undertake the culling;
- Euthanasia must be done humanely, in accordance with the National code of practice for the humane destruction of kangaroos and wallabies for non-commercial purposes;
- To keep a kangaroo population within its sustainable limit, a landowner / manager must take a proactive approach that ensures minimal ongoing culling of EGKs. They should prevent population levels reaching crisis point, to need a large cull; and,
- Dogs must not be used to kill, injure or pursue EGKs.

8.2.2 Animal welfare

When considering the 'Five Domains Model' (Mellor 2017) modified by Sharp and Saunders (2011) to compare and select optimum management options which consider the physical and functional well-being of a EGK, Stephens 2021 found that the animal welfare impacts vary depending on management techniques, with lethal management methods when compliant with relevant code of practice, having generally lower impacts on EGK wellbeing than non-lethal methods. Specifically, commercial harvesting conducted by professional shooters has higher acceptability in terms of welfare in comparison to non-commercial culling due to competency of shooters involved and poor adoption of mandatory codes a concern (Sinclair *et al.* 2019).

Welfare costs include deliberate and indirect harm to dependent young (a by-product of the commercial kill), and a number of unintended harms to adult EGKs such as disrupting social stability and evolutionary potential of individuals (Ben-Ami et al. 2023).

8.2.3 Case studies

It should be noted that justification for lethal control of wildlife in a conservation setting is often viewed with differential attitudes and perceptions (Eeden *et al.* 2019). Case studies on the use of lethal methods to control EGK populations show varying levels of effectiveness and attitudes from the general public, especially in high profile cases. Social pressures in these circumstances vary from financial, social and emotional costs (Fletcher 2007) due to human wildlife conflict, to a wildlife protection and care perspective (Ben Ami 2009).

A case study by Kerle 2019 which examined the use of culling to control EGK at Mount Panorama, Bathurst NSW, in order to mitigate increasing concerns of collision with race cars during the Bathurst 1000 race, found that these management actions caused a significant negative media response and condemnation from both Australian and International animal rights groups (Kerle 2019). Bathurst Regional council had been placed under increasing pressure to find a solution for the population of EGK on Mount Panorama, and approved the culling of 140 EGK as a solution.

Culling of EGKs for maintenance of biodiversity was conducted in Canberra's Nature Parks in 2013. Culling was carried out across seven reserves; Mulligan's Flat Woodland Sanctuary, Goorooyaroo Nature Reserve, Mullangarri Nature Reserve, Mount Painter Nature Reserve, Mount Pinnacle Nature Reserve, Kama Nature Reserve and Callum Brae Nature Reserve. This conservation cull was carried out with intent to strictly adhere to the standards outlined in the National code of Practice for the Humane Shooting of EGKs and Wallabies for Non-Commercial Purposes. This report also included an independent audit undertaken by the Chief Veterinary Officer of ACT and the RSPCA. A high degree of compliance was found during this audit, with 100% of carcasses inspected being shot in the field killed with a single shot to the brain or to the base of the skull (Animal Welfare and compliance assessment of the 2013 Australian Capital Territory Kangaroo Conservation Cull 2013).

In other scenarios, concern has been expressed by animal rights groups such as the RSPCA Australia that there is minimal research on the most humane way to euthanise joeys (RSPCA Australia 2002). Specific concerns that young-at-foot may flee from the shooter once their mother is shot, resulting in the animal being orphaned and likely to succumb to predation, dehydration or starvation (RSPCA Australia 2002). In a study conducted by Sharp et al. 2023, euthanasia methods of 14 kangaroo harvesters across 15 different nights were observed to collect information on the euthanasia of EGK young during harvesting operations (RIRDC 2014). This study highlights the concerns in regard to the difficulties in euthanising young-at-foot, and the possible lack of compliance when euthanising pouched young (National Code of Practice).

8.2.4 Disposal of Kangaroo Carcasses

Where EGKs have been euthanised, the shooter and/or a qualified Veterinarian will be able to advise on, and possibly undertake, the disposal of EGK carcasses. The preferred method of disposal is to send the carcasses to an appropriate license landfill (DELWP 2015, p. 31). If this is not possible, a limited number of carcasses can be buried on private property only if the burial pit does not adversely affect the land, surface ground water or the air by creating odours. Specific requirements pertaining to the burial of kangaroo carcasses can be found within the Guide to Preparing a Kangaroo Management Plan for Melbourne's Growth Corridors (DELWP 2015).

8.2.5 Conclusion

Although protected under the *Wildlife Act 1975* and the *Prevention of Cruelty to Animals Act 1986,* EGK are not a threatened species. Based on the literature outlined above, concerns with both public opinion and effectiveness of culling of EGK young-at-foot **euthanasia should be treated as a last resort if all methods above fail.**



9 ACTION PLAN

9.1 Preventative Actions

Drawing on the options assessment and supporting information in Section 6, the activities and responsibilities for undertaking management actions are detailed in Table 7. This information is to be referenced throughout the life of this KMP to record progress and detail the outcomes of all implemented actions.

Preventative actions to be undertaken include:

- Staged fencing (Figure 4): The site will be fenced through a staged approach to limit the risk of land-locking and EGK collision along Edgars Road;
- Temporary exclusion fencing: Use of fencing with kangaroo proof features to exclude EGK from the road reserve. According to DELWP (2015) Kangaroo exclusion fencing for kangaroos must:
 - o be chain-link (cyclone) fencing or deer mesh (also known as K wire)
 - o not be ring-lock-style fencing (which is an entanglement hazard)
 - o be high-tensile, heavy galvanised wire
 - o be at least 1.9 m high (deer mesh is produced in this size)
 - o have no barbs
 - o have no loose or open wires
 - be completely free of holes and gaps in, and under, the fence to stop the kangaroos trying to escape, and to stop them being injured.
- The scraping/cutting of grassy areas, to remove food sources if EGK are found during staged fencing or construction; and,
- Establishment of signs along roads: Increased use of signs along surrounding public roads and internal roads.

9.2 Site User and Public Education

Information for site inductions and education material relating to all site users is provided on page 4 of this KMP and in Appendix 3. Site inductions are to be provided to the Project Manager or other relevant persons responsible for the implementation of this KMP by a suitably qualified Ecologist.

9.3 Adaptive Management

Adaptive management measures can be implemented in response to changing conditions at the site. In the event that EGK appear on site in construction areas or areas at risk of land-locking, temporary exclusion fencing must be erected to exclude EGK from entering these areas.



9.4 Monitoring

9.4.1 During Staged Fencing

Monitoring of EGK populations within the construction area and surrounding habitat is a key element of any KMP. The aim of undertaking regular monitoring is to determine the success and effectiveness of the controls and management strategies implemented as part of this KMP.

A suitably qualified Ecologist or wildlife spotter must be on site during deployment of any staged fencing to observe the behaviour of the EGKs. If EGKs are observed to be agitated or stressed at any time during fence deployment, work must cease until the EGKs have calmed down and Ecologist gives the all-clear to proceed.

Development Victoria is responsible for arranging an Ecologist to conduct a formal site visit, for monitoring purposes on a weekly basis to coincide with the deployment of each fencing stage in the staged fencing plan.

9.4.2 Following Staged Fencing

Once staged fencing has been completed as per section 5, Development Victoria is responsible for arranging an Ecologist to conduct a monthly site visit for monitoring purposes for twelve months after works are completed. These surveys will occur in the three hours immediately following dawn or immediately preceding dusk to maximise the likelihood of detection EGK. During the visits, the Ecologist must determine whether EGKs are using the survey area or not, using the same method that was implemented when undertaking the original presence/absence survey. If EGKs are present, the Ecologist will make note of:

- The total number of EGKs;
- Any evident sign that any EGK is diseased or lame;
- Any evidence of increased vehicle collisions or EGK carcasses on surrounding roads;
- Whether staged fencing is avoiding land-locking EGKs (and, if relevant, any change in the degree of land-locking since the last assessment);
- Assessment of compliance with any relevant approved KMP; and,
- Any notable information.

Failure to notify DEECA to the presence of any landlocked, sick or injured EGK, and address the management of a local EGK population may result in risks to animal welfare and public safety. Failing to notify DEECA may be considered wilful negligence in the event that an animal experiences, or is likely to experience injury, pain or suffering.

DEECA Authorised Officers have the power to investigate potential breaches of the *Wildlife Act 1975* or the *Prevention of Cruelty to Animals Act 1986*.

All relevant construction personnel will be briefed regarding the monitoring and reporting requirements as part of the site induction.



9.4.3 Reporting

After completing each monitoring activity, an Ecologist must report on the progress of the implementation of the KMP. This report should include:

- A brief statement (1–2 pages) summarising progress to date and the success or failure of actions, drawing on the information in Table 7; and,
- An updated Table 7, which is the record of management actions and how they are progressing.

A review of the KMP will be undertaken as part of the EGK monitoring report background review. This review will consider all aspects of the KMP in regards of EGK on site and the surrounding area and incorporate comments and feedback from the client. This review will include information from:

- The monitoring report;
- Discussion with DEECA staff;
- New published information on EGK ecology; and,
- New techniques for monitoring and managing EGK.

Any recommended updates to the KMP will be discussed with Development Victoria representatives, and any agreed updates will be incorporated into a revised KMP.

If the monitoring determines that the KMP is not meeting its goals, management options and actions must be reassessed in consultation with the client, and revise and submit a new table of actions to the client within one month of determining the KMP is not meeting its goals.

DEECA may at any time intervene in the implementation of the KMP if it considers there is a risk to animal welfare, public safety or significant native vegetation or threatened species.

9.5 Response to Future Kangaroo Presence

In the event, after construction has commenced, EGK become land-locked within the site, DEECA must be notified. A suitably qualified Ecologist must provide instruction regarding the available options including appropriate management actions in this plan, to be approved by DEECA. In this instance, this KMP must be updated using the expertise of a qualified ecological consultant and must be re-submitted to DEECA for approval.

9.5.1 Contingencies

Temporary exclusion fencing, road blocks and escape routes must be used as an adaptive measure should EGK be observed either within or on roads surrounding the development site. A suitably qualified Ecologist will be on site prior to fencing being deployed, and photos and details regarding the location, number of EGK and health and condition of the animals will be recorded. At no stage will EGK be herded or scared out of the area, and EGKs must be left to leave the stage of their own accord.

Location and positioning of temporary fencing and escape routes will depend on a number of factors, however the overall approach will be consistent with the plan goals and the aim of encouraging EGK migration towards recipient site. By further subdividing a fencing stage, EGK present in the area will be restricted to a smaller



www.ehpartners.com.au

portion of the stage which includes a temporary escape route, thus encouraging them to move out of the development site of their own accord. Should the EGK remain in the stage for more than 24 hours following temporary fencing and escape routes being completed, DEECA must be notified and a suitably qualified Veterinarian must be engaged to attend site to assess the situation, particularly the health and welfare of the animal/s on site. If the EGK is deemed by the Veterinarian injured or in considerably poor health, or will not leave by itself, the Veterinarian or a wildlife rescue agency such as those listed in Appendix 1, will be engaged to determine an appropriate Course of action. This may include humanly euthanising an animal if severely injured.



Table 7. Initial Action Plan.

	Action	Steps	Deadline	Performance Indicator	Responsible Person	Date Completed	Did the action work?	Comments / follow-on action
1.	Determine if EGK are present in construction areas	Search the construction area for EGK	Each day before the commencement of construction	No EGK within construction area(s)	Developer	05/09/2023	No	EGK remain within the site, and EGK collisions on Edgards Road required further action to avoid any repeat
2.	Staging Temporary exclusion fencing	Install kangaroo-proof fencing (as defined in DELWP 2015, p. 26) prior to the commencement of construction in each stage. An inspection will be carried out the day after fencing is installed to ensure no EGK are trapped in the area. Fencing design must consider EGK welfare.	Prior to the commencement of construction.	No EGK within construction area(s)	Developer	25/10/2023	Yes	Staged fencing was completed and now successfully restricts EGK access to the road reserve. Given EGK remain within Stage 3, controlled herding is recommended to relocate EGK into the proposed recipient site
3.	Removal of food	Scrape/cut grassy areas to remove food sources (outside of conservation areas) if EGK are found during Action 2	Immediately, if EGK are found during Action 2	No EGK within construction area(s)	Developer	October 2023	No	EGK remain within stage 3 following slashing being completed
4.	Implement site user education	Include information on EGK in site inductions. All site workers are to participate in an environmental induction.	At each development stage and as required	No incidents between site workers and EGK	Developer	05/09/2023	Yes	All personnel inducted prior to staged fencing



www.ehpartners.com.au

Ac	tion	Steps	Deadline	Performance Indicator	Responsible Person	Date Completed	Did the action work?	Comments / follow-on action
1.	Review of KMP	Consider all aspects of the KMP in regard to EGK on site, and other relevant information Any updates to the KMP to be agreed to by DEECA, and completed within three weeks of the review	Weekly during deployment of staged fencing. Then monthly during construction and for twelve months following completion of construction	DEECA satisfied with updated KMP.	Developer	30/11/2023	ТВС	Following a review and update of the KMP, recommended action includes controlled herding of EGK out of the site, as per procedure outlined in section 7.2.2
2.	Further resource removal	Scrape/cut grassy areas to which continue to encourage EGK (excluding conservation areas)	Immediately, if EGK are found during site inspections	No further EGK entering construction area	Developer			



REFERENCES

- Allan, C. and Stankey, G. 2009. Adaptive Environmental Management: A Practitioner's Guide. Pp. 368. Springer and CSIRO Publishing: Dordrecht, Netherlands and Collingwood, Australia.
- ARI 2007. Ecological Burning in Box-Ironbark Forests Phase 1 Literature Review [www Document]. URL: https://www.nccma.vic.gov.au/sites/default/files/publications/nccma-25583-ecological_burning_in_boxironbark_-_lit_review.pdf. Arthur Rylah Institute for Environmental Research, Department of Sustainability and Environment, Victoria.
- Armstrong, D. and Sneddon, P. 2008. Directions in reintroduction biology. Trends in Ecology and Evolution 23, 20-25.
- Ben-Ami, D., Boom, K., Boronyak, L., Townend, C., Ramp, D., Croft, D.B. And Bekoff, M. 2023. The welfare ethics of the commercial killing of free ranging kangaroos: an evaluation of the benefits and costs of the industry. Animal Welfare 23, 1-10.
- Burrell, S. 2015. *Eastern Grey Kangaroo*, Australian Museum. Available at: http://australianmuseum.net.au/eastern-grey-kangaroo
- Clayton, J. A., Pavey, C. R., Vernes, K., and Tighe, M. 2014. Review and analysis of Australian macropods translocations 1969 2006. Mammal Review.
- Coetsee, A., Harley, D., Lynch, M., Coulson, G., Milliano, J., Cooper, M., and Groenewegen, R. 2016. Radiotransmitter attachment methods for monitoring the endangered eastern barred bandicoot (*Perameles gunnii*). Australian Mammalogy 38, 221-231
- Coulson, G. 2007. Exploding Kangaroos: assessing problems and setting targets in Pest or guest: the zoology of overabundance. Ed. Lunney, D., Eby, P., Hutchings, P. and Burgin, S. Royal zoological society of New South Wales, New South Wales.
- Coulson, G., Cripps, J., and Wilson, M. 2014. Hopping down the Main Street: Eastern Grey Kangaroos at Home in an Urban Matrix. Animals 2, 272-291.
- DELWP 2015. Guide to preparing a kangaroo management plan for Melbourne's growth corridors. Victorian Department of Environment, Land, Water and Planning.
- DELWP 2017. *Managing Kangaroo Impacts in Victoria: Report of the Kangaroo Impacts Management Advisory Group (KIMAG) to DELWP,* Melbourne, The State of Victoria Department of Environment, Land, Water and Planning.
- DELWP 2018. Translocation policy for isolated wild Eastern Grey Kangaroo populations in Victoria. Victorian Department of Environment, Land, Water and Planning.
- DELWP 2022. Native Vegetation Information Management (NVIM) Tool. Native Vegetation Information Management (NVIM) Tool. https://nvim.delwp.vic.gov.au/. Victorian Department of Environment, Land, Water and Planning.



- Dennis, T., and Shah, S. 2012. Assessing Acute Effects of Trapping, Handling, and Tagging on the Behaviour of Wildlife Using GPS telemetry: A Case Study of the Common Brushtail Possum. Journal of Applied Animal Welfare Science **15**: 189-207.
- Dickens, M. J., Delehanty, D. J. and Romero, L. M., 2010. Stress: An inevitable component of animal translocation. Biological Conservation **143**: 1329-1341.
- DSE 2010. Our Wildlife Factsheet. No. 6. Eastern Grey Kangaroo. East Melbourne, Victoria: Department of Sustainability and Environment.
- Eeden, L., Newsome, T., Crowther, M., Dickman, and C., Bruskotter, J. 2019. Diverse public perceptions of species' status and management align with conflicting conservation frameworks. Biological Conservation 242, 108416.
- Fischer, J. and Lindenmayer D. B. 2000. As assessment of the published results of animal relocations.
- Fletcher, D. 2007. Managing Eastern Grey Kangaroos Macropus giganteus in the Australian Capital Territory: reducing the overabundance – of opinion. pp117-128 in Pest or Guest: the zoology of overabundance eds D. Lunney, P. Eby, P. Hutchings & S. Burgin. Royal Zoological Society of New South Wales, Mosman. NSW Australia.
- Garlick, S. and Austen, R. 2010. Kangaroo translocation: program efficiency and welfare goals. Paper to the National Wildlife Rehabilitation Conference, Adelaide, 22-24 June 2010.
- Griffith, B., Scott, J. M., Carpenter, J. W. and Reed, C., 1989. Translocation as a species conservation tool status and strategy. Science **245**: 477-480.
- Henderson, T., Vernes, K., Kortner, G., and Rajaratnam, R. 2018. Using GPS technology to understand spatial and temporal activity of kangaroos in a peri-urban environment Animals 2018. 97.
- Herbert, C. A. 2004. Long-acting contraceptives: A new tool to manage overabundant kangaroo populations in nature reserves and urban areas. Australian Mammalogy **26**: 67-74.
- Higginbottom, K. 2010. Monitoring the fate of translocated eastern grey kangaroos at the Gold Coast. In Macropods: The Biology of Kangaroos, Wallabies and Rat-Kangaroos; Coulson, G., Eldridge, M., Eds.; CSIRO: Melbourne, Australia; pp. 341–348.
- Jackson SM. 2003. Macropods. In: Jackson SM, editor. Australian mammals: biology and captive management. CSIRO Publishing, Collingwood, Victoria; pp 245–296.
- Kerle, A. 2019. The Eastern Grey Kangaroo: A Modern Conservation Dilemma. Australian Zoologist 40, 102-117.
- LLS 2020. Options for integrated kangaroo management in the Western region. A practical guide for active management. Kangaroo Management Taskforce, Local Land Services. New South Wales Government.
- Mayberry, C. 2011. Management of isolated populations of western grey kangaroos (Macropus fuliginosus ocydromus) through fertility control, in south-western Australia. Unpublished thesis. The Unoversity of Western Australia.
- MPA 2014. Clarification Matters Amendments to the Wyndham Planning Scheme. Metropolitan Planning Authority, Melbourne, Victoria.



- Olsen, P. and Low, T. 2006. Update on Situation Analysis Report: Current state of scientific knowledge on Kangaroos in the environment, including ecological and economic impact and effect of culling. Prepared for the Kangaroo Advisory Panel. March 2006.
- Parks Victoria 2007. Greater Bendigo National Park Management Plan [www Document]. URL: file:///C:/Users/shill/Downloads/Greater%20Bendigo%20National%20Park%20-%20Management%20Plan%20-%202007.pdf. Parks Victoria, Melbourne.
- Parks Victoria 2023. Greater Bendigo National Park [www Document]. URL: https://www.parks.vic.gov.au/places-to-see/parks/greater-bendigo-national-park. Parks Victoria, Melbourne.
- Pople, A., and Grigg, C. G. 1999. Commercial harvesting of Kangaroos in Australia. Environment Australia, August 1999. Department of Zoology, University of Queensland.
- Povh, L., Willers, and N., Fleming, P. 2022. Set free; an evaluation of two break-away mechanisms for tracking collars. CSIRO Publishing.
- Pridell, D., Shepherd, N., and Ellis, M. 1998. Homing by the red kangaroo, Macropus rufus (Marsupialia: Macropodidae). Australian Mammalogy **11**: 171-172.
- Roberts J.A., Coulson G., Munn A.J., Kearney M.R. 2016. A continent-wide analysis of the shade requirements of red and western grey kangaroos. Temperature (Austin). 2016 Apr **5;3(2)**: 340-353.
- RSPCA 2014. Policies. RSPCA Australia: Deakin West ACT.
- RSPCA Australia. 2002. Kangaroo Shooting Code Compliance: A survey of the extent of compliance with the requirements of the Code of Practice. Available from: http://155.187.2.69/biodiversity/wildlife-trade/publications/kangarooreport/introduction.html
- Sharp, T., and McLeod, S.R. 2023. Kangaroo Harvesters and the euthanasia of orphaned young-at-foot: applying the theory of planned behaviour to an animal welfare issue. Animal Welfare 25, 39-54.
- Shepherd NC. 1981. Capture myopathy in the red kangaroo (Macropus rufus). In: Fowler ME, editor. Wildlife diseases of the pacific basin and other countries. Wildlife Disease Association, Sydney;239–247.
- Sinclair K., Curtis A. L., Hacker R. B. and Atkinson T. 2019. Stakeholder judgements of the social acceptability of control practices for kangaroos, unmanaged goats and feral pigs in the south-eastern rangelands of Australia. *The Rangeland Journal* **41**: 485–496.
- Taylor 1980. Distribution of Feeding Activity of the Eastern Grey Kangaroo, Macropus giganteus, in Coastal Lowland of South-East Queensland. Wildlife Research, 7(3), 317.
- Territory and Municipal Services 2010. ACT Kangaroo Management Plan. Pp. 194. Parks, Conservation and Lands, Territory and Municipal Services: Canberra, Australia.
- Vogelnest L, and Portas T. 2008. Macropods. In: Vogelnest L, Woods R, editors. Medicine of Australian mammals. CSIRO Publishing, Collingwood;133–225.



www.ehpartners.com.au

FIGURES









Aerial source: Nearmap 2023



APPENDIX 1 INFORMATION SHEET: KANGAROOS IN ACTIVE CONSTRUCTION SITES

If you see a kangaroo in the construction area...

- Report seeing a kangaroo to the Ecologist (1300 839 325) who will advise you on what necessary steps to take.
- Let the kangaroo leave of its own accord.
- Don't herd the kangaroo: it is an offence under the *Wildlife Act 1975*. Herding can stress and confuse a kangaroo, and make it behave erratically. This can result in the kangaroo, and people, being injured.
- Try to identify where the kangaroo entered the construction area. Temporarily widening the entry point might encourage the kangaroo to leave through it. If the kangaroo leaves, securely close off the entry point as soon as possible.
- If there are things attracting kangaroos (such as food, shade, water and habitat) in the construction area, contact the Ecologist immediately about amending the site's Kangaroo Management Plan to possibly remove the attractants.
- If the kangaroo is injured, or will not leave by itself, contact one of these agencies for advice:
 - Wildlife Rescue and Information Network (0419 356 433)
 - Bendigo Animal Hospital ((03)5443-3322)
 - o Wildlife Victoria (1300 094 535)
- All people must obey standard construction area speed limits.
- If a kangaroo is injured or killed in a construction area covered by a Kangaroo Management Plan, the Department of Energy, Environment and Climate Action must be notified as soon as possible on 136 186.