Targeted Fauna Surveys: East of Aberline, Warrnambool

Report prepared for the Victorian Planning Authority

6 August 2025

Document Information

Assessment:	Targeted Fauna Surveys: East of Aberline
Project #:	25-011
Prepared by:	Jonathan Salisbury, Jake Urlus
Prepared for:	Victorian Planning Authority
Distribution:	Kelvin Li, VPA Jeff Tait, VPA
File:	Targeted Fauna Surveys_East of Aberline_final_TactEcol_06Aug25

Document History

Version:	Changes:	Author:	Date:
Draft	Draft report	J. Salisbury, J. Urlus	21 May 2025
Final	Final report, address comments by VPA	J. Urlus	6 August 2025

Cover photo: J. Salisbury 2025

Disclaimer:

TactEcol Consulting Pty Ltd have taken all necessary steps to ensure this document is accurate and accords with relevant federal, state and local legislation, as well as industry best practice. The company accepts no liability for any damages or loss incurred as a result of reliance placed upon the report content or for any purpose other than that for which it was intended.

Contents

Document Information **2**
Document History 2
Tables 3
Figures 3
Plates 4
Executive Summary **6**
1. Introduction **7**
1.1. Background 7
1.2. Objectives 7
1.3. Study area 7
2. Methodology **9**
2.1. Desktop review 9
2.2. Site inspection 9
2.3. Target fauna species 9
2.4. Targeted fauna surveys 14
2.5. Prevaling conditions 18
2.6. Limitations 19
3. Results **21**
3.1. Site inspection 21
3.2. Flora and fauna species 24
4. Discussion and Recommendations **27**
4.1. Contemporary habitat quality 27
4.2. Target species 29
4.3. Recommendations 30
References **32**
Appendix 1 Observed fauna species **34**
Appendix 2 Growling Grass Frog survey data **36**
Appendix 3 Southern Toadlet survey data **39**
Appendix 4 Artificial refuge survey data **42**
Appendix 5 Elliot trapping survey data **46**

Tables

Table 1 Growling Grass Frog habitat assessment variables recorded during the site surveys 14

Figures

Figure 1 Extent of study area and accessed areas for the East of Aberline project 8
Figure 2 Locations of targeted fauna surveys at the within the East of Aberline study area. 18
Figure 3 Historical average and current season monthly temperatures in Warrnambool (airport) during the targeted fauna survey period 19

Figure 4 Historical average and current season monthly rainfall in Warrnambool (airport) during the targeted fauna survey period 19

Plates

Plate 1 Growling Grass Frog Litoria raniformis (Source: J. Salisbury 2023) 11
Plate 2 Southern Toadlet Pseudophryne semimarmorata (J. Urlus, 2008) 12
Plate 3 Swamp Skink Lissolepis coventryi (Source: J. Urlus 2015) 13
Plate 4 Glossy Grass Skink Pseudemoia rawlinsonii (J. Urlus 2008) 14
Plate 5 Roof tiles deployed in a grid as artificial refuge for survey of threatened reptiles west of Horne Rd, for the East of Aberline project 16
Plate 6 Elliot trap deployed sheltered under vegetation during reptile surveys for the East of Aberline project 17
Plate 7 Small pools of water in Russell Creek during the initial inspection 21
Plate 8 Russell Creek was largely dry during fauna surveys 22
Plate 9 A larger pool remains in Russell Creek under the Horne Road bridge 22
Plate 10 A fenced area directly east of the Horne Road bridge on Russell Creek has excluded cattle and resulted in an area with dense (mostly exotic) graminoids and grasses 23
Plate 11 Many of the dams inspected on existing farms within the East of Aberline study area were dry 23
Plate 12 Southern Grass Skink Pseudemoia entrecasteauxii captured during artificial refuge surveys in the East of Aberline study area. 25
Plate 13 Eastern Blue-tongued Lizard Tiliqua scincoides scincoides captured in an Elliot trap within the East of Aberline study area. 26
Plate 14 Photographs from 2017 of wetlands present within Tozer Reserve (sourced from Ecology & Heritage Partners 2018) 27
Plate 15 Area in northern half of Tozer Reserve which presumably formerly supported ephemeral wetland habitat 28
Plate 16 Area in northern half of Tozer Reserve which presumably formerly supported ephemeral wetland habitat 28
Plate 17 Swamp Skink Lissolepis coventryi detected within E. Johnson Reserve, Warrnambool on 12 March 2025 29

Acknowledgements

- Jeff Tait Victorian Planning Authority
- Kelvin Li Victorian Planning Authority

Executive Summary

TactEcol Consulting Pty Ltd (TactEcol) was commissioned by the Victorian Planning Authority in October 2024 to undertake targeted fauna surveys in a study area near Aberline Road, Warrnambool, Victoria. This site currently consists predominantly of pastures containing cattle, and also includes some existing dwellings, civil infrastructure and nature reserves. We understand the intent is to rezone the majority of the land from Farming Zone (FZ) to Urban Growth Zone (UGZ) for housing and urban development.

The current targeted surveys were informed by an 'existing conditions' assessment by Ecology & Heritage Partners (EHP; 2024), which comprised a desktop investigation and site-based native vegetation and habitat assessment. The targeted surveys detailed in this document aim to determine whether several key identified threatened species are present within the area east of Aberline Road proposed for rezoning, and if so, what the potential impact on the species may be and propose mitigation methods.

The study site is approximately 408 ha in size and comprises a large area of pastoral and public use land to the east of Aberline Road, Warrnambool, Victoria. Tozer Reserve, a committee-managed flora and fauna reserve, exists in the centre of the study area, stretching north-south between Russell Creek and Wangoom Road. West and south of the site is largely medium-density residential estates, while north and east are mostly pastoral farms, with some light industrial usage to the southeast.

The initial target species for the project were the following threatened species:

- Growling Grass Frog *Litoria raniformis*
- Swamp Skink *Lissolepis coventryi*
- Southern Toadlet *Pseudophryne semimarmorata*.

A summary inspection of existing available information and databases upon initiation suggested that the threatened Glossy Grass Skink *Pseudumoia rawlinsonii* could also occur within the site. Following discussions with VPA and DEECA, this species was added to the target species list for the project.

An in-person site inspection was conducted by two experienced ecologists on 19 December 2024, at properties for which access had been provided by the landowner, to assess habitat and inform survey locations Following the site inspection, targeted surveys were undertaken, utilising the following survey techniques:

- Artificial refuge surveys
- Elliot trapping
- Call playback/spotlighting.

In general, the habitat available within the study area for the target species was of low to moderate quality. The majority of the study area was pastoral, with cattle present on many property parcels. Vegetation was almost exclusively grazed exotic grass in the paddocks, with some sporadic native grasses and sedges/rushes. Russell Creek was observed to be heavily degraded in most sections, with substantial evidence of cattle access. Most of the length of Russell Creek was dry, as were the majority of dams and wetlands within the study area.

None of the target species were detected within the study area during the targeted surveys. We note that the survey period was exceptionally dry, being under drought conditions, and this somewhat limits the confidence in the lack of detection of any of the species, particularly the two amphibians, equating to true absence.

A number of recommendations are made to protect and enhance fauna habitat at the site, and to mitigate potential impacts from the rezoning and associated development activities.

1. Introduction

1.1. Background

TactEcol Consulting Pty Ltd (TactEcol) was commissioned by the Victorian Planning Authority in October 2024 to undertake targeted fauna surveys in a study area near Aberline Road, Warrnambool, Victoria. This site currently consists predominantly of pastures containing cattle, and also includes some existing dwellings, civil infrastructure and nature reserves. We understand the intent is to rezone the majority of the land from Farming Zone (FZ) to Urban Growth Zone (UGZ) for housing and urban development.

The current targeted surveys were informed by an 'existing conditions' assessment by Ecology & Heritage Partners (EHP; 2024), which comprised a desktop investigation and site-based native vegetation and habitat assessment. Targeted surveys for fauna (specifically the Growling Grass Frog *Litoria raniformis* and Swamp Skink *Lissolepis coventryi*) were recommended by EHP as part of the 2024 assessment, and formed the basis of this current project.

This document presents the findings of the targeted fauna surveys, discusses the potential for impacts upon them, and makes recommendations with respect to these findings.

1.2. Objectives

The targeted surveys detailed in this document aim to determine whether several key identified threatened species are present within the area east of Aberline Road proposed for rezoning, and if so, what the potential impact on the species may be and propose mitigation methods.

Specific objectives for the assessments were as follows:

- Undertake targeted surveys for the Growling Grass Frog, Swamp Skink, Southern Toadlet *Pseudophryne semimarmorata* and Glossy Grass Skink *Pseudemoia rawlinsonii*, to determine the presence or likely absence of each species
- Determine the potential impacts for threatened species of future development resulting from the proposed rezoning
- Develop a report (this document) outlining the methodology and results of the targeted surveys, and the potential ecological impacts and legislative implications for the study area.

1.3. Study area

The study site is approximately 408 ha in size and comprises a large area of pastoral and public use land to the east of Aberline Road, Warrnambool, Victoria. It is currently a combination of Farming Zone (FZ), Public Use Zone (PUZ1) and Transport Zone (TRZ3). The study area is part of the Victorian Volcanic Plains bioregion, Glenelg-Hopkins Catchment Management Authority, and the Warrnambool City Council municipal area.

Roads bound the study area to the north (Wangoom Road), west (Aberline Road) and partially in the south (Boiling Down Road), while Horne Rd bounds some of the eastern extent. Tozer Reserve, a committee-managed flora and fauna reserve, exists in the centre of the study area, stretching north-south between Russell Creek and Wangoom Road.

West and south of the site is largely medium-density residential estates, while north and east are mostly pastoral farms, with some light industrial usage to the southeast.

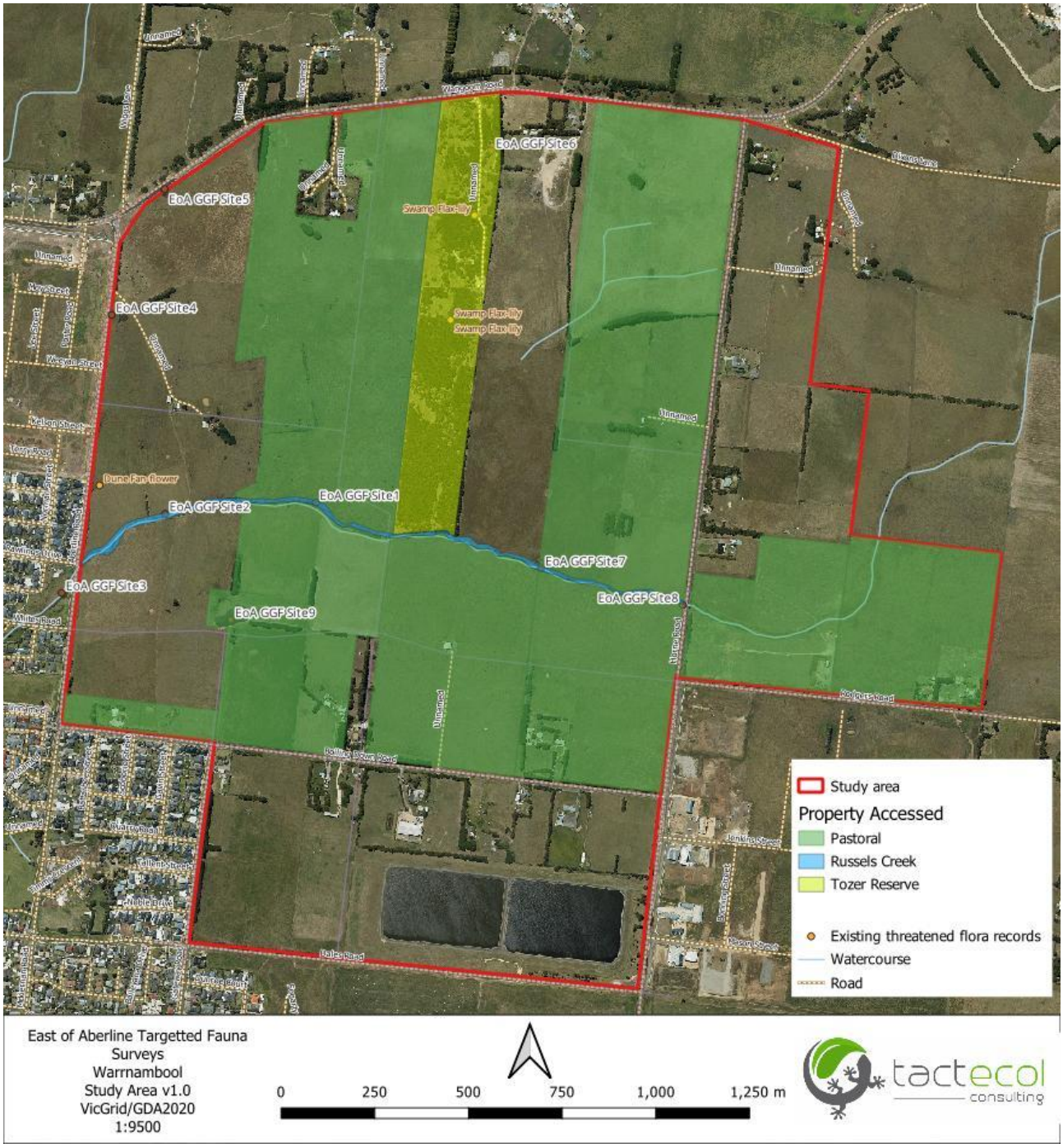

Figure 1 Extent of study area and accessed areas for the East of Aberline project

2. Methodology

2.1. Desktop review

Although a desktop assessment had been done by Ecology and Heritage Partners (2024) and was not within the scope of this project, a summary inspection of existing available information and databases (e.g. Victorian Biodiversity Atlas (VBA), NatureKit) upon initiation suggested that the threatened Glossy Grass Skink could occur within the site, and should be addressed along with the other target fauna. Glossy Grass Skink is listed as Vulnerable under the *Flora and Fauna Guarantee Act 1988* (FFG Act), and was not addressed in the existing ecological conditions report (EHP 2024). Following discussions with VPA and DEECA, this species was added to the target species list for the project (refer Section 2.).

2.2. Site inspection

An in-person site inspection was conducted by two experienced ecologists on 19 December 2024. All parcels for which access had been permitted (i.e. those property owners had previously consented to VPA enquires and were able to be contacted by TactEcol to confirm access) were inspected on foot (Figure 1). The ecological team assessed the available habitat for suitability and relative quality for the target threatened species, and noted potential locations for targeted surveys.

2.3. Target fauna species

2.3.1. Growling Grass Frog *Litoria raniformis*

The Growling Grass Frog (Plate 1) is a relatively large and mobile amphibian that inhabits a diverse range of wetlands such as swamps, marshes, slow flowing rivers/streams, lakes, drainage lines and artificial waterbodies (e.g. farm dams, reservoirs, and former quarry pits). The species generally breeds in permanent or near-permanent waterbodies, but has also been recorded breeding in ephemeral waterbodies, when they hold sufficient water during the breeding season (Heard et al. 2014; Ecology Australia 2016; J. Urlus; unpub. data).

Several key habitat attributes significantly influence the presence and/or breeding success of the Growling Grass Frog, including:

- Connectivity to occupied sites
- Hydroperiod (i.e. water permanence)
- Cover of aquatic vegetation
- Water quality, particularly salinity
- Terrestrial vegetation, including overshading by trees and shrubs, and
- Presence of predatory fish (Heard et al. 2010; Heard and Scroggie 2009; Ecology Australia 2017).

Larger and more permanent waterbodies are more likely to be occupied and sustain populations over a longer period (Hamer et al. 2016). The Growling Grass Frog is a highly aquatic frog. As such, the drying out of waterbodies can increase the chance of local extinctions (Heard et al. 2008); however, periodic drying out of wetlands can also be potentially beneficial through reducing impacts from predatory fish and/or amphibian chytrid fungus *Batrachochytrium dendrobatidis*, which has caused the decline of amphibians worldwide, including the Growling Grass Frog (Clemann and Gillespie 2012). Recruitment of Growling Grass Frog can be pronounced in ephemeral wetlands that hold water for at least three months during the breeding season (November to March) (J. Urlus, unpub. data).

The cover of aquatic vegetation has a strong positive relationship with habitat occupancy (Heard et al. 2014), with the species showing marked preferential use of submerged and floating vegetation during nocturnal activity

(Heard et al. 2008), while emergent vegetation provides sheltered perching sites for basking during the day and for ambushing prey. These plants also provide important microhabitat for aquatic larvae and are likely to serve as a refuge from predatory fish (Webb and Joss 1997; Heard et al. 2008).

Several studies have demonstrated that connectivity is a critical factor for the ongoing persistence of Growling Grass Frog populations (e.g. Heard et al. 2008; Heard et al. 2014; Hale et al. 2013; Ecology Australia 2017). The likelihood of a site being colonised by the species is strongly linked to connectivity, specifically the number of suitable wetlands near the site (e.g. within 1,000 m). This connectivity is essential as the species has been shown to operate under a 'metapopulation' paradigm, where sites vary in occupancy year to year, driven by local conditions and the processes of localised extinction and colonisation (Heard et al. 2014)

The Growling Grass Frog spends the non-breeding season (approximately May to September) sheltering in terrestrial environments (e.g. rocks, fallen timber, soil cracks or dense ground vegetation), some distance from water (Wassens et al. 2008). Terrestrial habitat surrounding waterbodies is important not only for providing shelter, foraging habitat and over-wintering refuge, but also to provide a buffer from surrounding land uses (existing and future).

The presence of predatory fish, such as Eastern Gambusia *Gambusia holbrooki*, has been implicated in the decline of Growling Grass Frogs and the closely related Green and Golden Bell Frog *Litoria aurea* (Morgan and Buttemer 1996; Pyke 2002). Although the Growling Grass Frog was formerly widespread across south-eastern Australia, including Tasmania (Ashworth 1998), since European settlement, and most notably over the past three decades, the species has declined markedly across much of this former range (Ashworth 1998; Clemann and Gillespie 2012). This is particularly evident in south and central Victoria, where populations have experienced widespread declines and local extinctions (Mahoney 1999; Pyke 2002). Consequently, the Growling Grass Frog is listed as Vulnerable under both the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Victorian FFG Act.

Several waterbodies potentially provide habitat for Growling Grass Frogs within the study area (Figure 2), including:

- Various existing dams on properties
- Russell Creek
- Apparent ephemeral wetlands in Tozer Reserve

The dams and other permanent or semi-permanent waterbodies throughout the study area potentially offer breeding habitat, while Russell Creek (when flowing) could provide breeding habitat as well as facilitate movement and dispersal through and beyond the study area. It is important to note that this species can move extensively across terrestrial areas between wetland habitats, and such movements are important in recolonisation of wetlands under suitable conditions. Growling Grass Frogs appear to have been detected in the northern portion of Tozer Reserve during previous survey efforts (Landtech 2014; quoted in EHP 2024); however, these records do not appear in the VBA.

Plate 1 Growling Grass Frog Litoria raniformis *(Source: J. Salisbury 2023)*

2.3.2. Southern Toadlet *Pseudophryne semimarmorata*

The Southern Toadlet is listed as Endangered in Victoria under the FFG Act. This species occurs in southern Victoria from East Gippsland to across the border in South Australia, as well as in Tasmania. Many historical sites for this species have been re-surveyed in recent years, with the species appearing to be absent from many of them (C. Cleeland, pers. comm.).

Southern Toadlet occurs in high moisture environments at low altitudes, but not necessarily near waterbodies or other permanent water. It can occur in a variety of vegetation types, from forest to grassland and heathland. Breeding occurs in autumn, when eggs are laid in small burrows created by males, which flood after rainfall. Because breeding can occur in ephemeral drainage lines, pools and depressions, this species can be distributed throughout suitable vegetation and is not restricted by proximity to standing or permanent water. This species walks rather than hops, and operates at very small spatial scales; a home range can be as little as 5 m from a breeding site, where it returns to season after season (C. Cleeland, pers. comm.). This very small spatial scale at which it operates, and high site fidelity, makes the species very prone to impacts from habitat disturbance or clearance.

Portions of Tozer Reserve and potentially some areas of Russell Creek represent plausible Southern Toadlet habitat. The Existing Conditions ecological report (EHP 2024) suggests that Southern Toadlets were detected in the northern half of Tozer Reserve in 2014 (Landtech 2014; quoted); however, as with Growling Grass Frog, these records are not in relevant databases, and we have been unable to determine the locations or confirm the records.

Plate 2 Southern Toadlet Pseudophryne semimarmorata (J. Urlus, 2008)

2.3.3. Swamp Skink *Lissolepis coventryi*

The Swamp Skink (Plate 3) has a predominantly coastal distribution across southern Victoria, reaching into adjoining southern coastlines of South Australia and New South Wales (Cogger 2014). Dorsal scales are olive-brown in colour with a black anterior margin and two black dorso-lateral stripes from the nape to tail base (Robertson and Coventry 2019). A medium-sized skink, the Swamp Skink has a snout-vent length of c. 100 mm and a tail reaching 150% of the body length (Cogger 2014).

Swamp Skinks typically inhabit densely vegetated wetlands (both freshwater and saltmarsh habitats) including low-lying marshes, swampy heaths, paperbark swamps, as well as surrounding vegetation (Clemann 2000; Cogger 2014; Smales 1981). These lizards are cryptic and can inhabit populated areas yet remain undetected. This species is highly dependent on wetlands, marshes, and surrounding vegetation; with the structure of the vegetation, rather than its composition, generally being of greatest importance. This species requires low, dense vegetation in damp, humid areas, and is excluded from any areas where a dense overstorey or canopy blocks sunlight from reaching the lower strata.

The dominant plant species in freshwater habitats commonly includes reeds, sedges, and tussocks, with Paperbarks and Tea-trees often scattered throughout or on the margins of wetland habitat. In saltmarsh habitats, dominant species typically include Beaded Glasswort, saltbush, rushes, and tussock grasses (Clemann 2004). The Swamp Skink can commonly be found in or adjacent to dense sedges and tussock life-form vegetation (such as species of *Gahnia*, *Poa*, *Baumea*) up to 1.5 m in height, which provides shelter and protection from predators (Smales 1981). Other habitat requirements of this species include mats of dead vegetation or logs or fallen branches which can provide perches for basking. As structure is a more important determinant of habitat suitability than composition, 'intact native vegetation' is not necessarily required and skinks can make use of introduced species such as Kikuyu grass; populations have been found persisting in heavily modified remnant vegetation (e.g. median strips, unmanaged reserves) in urban environments, and significantly degraded pastures in rural areas.

Several areas of plausible Swamp Skink habitat exist within the study area, predominantly the riparian areas along Russell Creek where native graminoids persist, and some areas of Tozer Reserve. The Existing Ecological Conditions report (EHP 2024) suggests that Swamp Skinks were detected in the northern half of Tozer Reserve in 2014 (Landtech 2014; quoted); again, these records are not in the public databases and we have been unable to determine the locations or confirm these records.

Plate 3 Swamp Skink Lissolepis coventryi *(Source: J. Urlus 2015)*

2.3.4. Glossy Grass Skink *Pseudemoia rawlinsonii*

The Glossy Grass Skink occurs in a patchy distribution in New South Wales, Victoria, South Australia and Tasmania. The species occurs predominantly in and around wetlands and swamps, including brackish areas and drainage lines (Robertson and Coventry 2019). This wet habitat can occur in a variety of surrounding vegetation types, intact and modified, from woodlands to heathlands, coastal scrub and saltmarsh, and paddocks (Cogger 2014). Occupied habitats tend to support dense ground layer vegetation, particularly sedges, rushes and grasses. Matted, high cover vegetation provides favourable thermal conditions to these lizards, where the high-volume of biomass and structure remains cooler during the higher temperatures of summer days, whilst retaining heat at night (Farquhar et al. 2024). This preference for dense vegetation, combined with its cryptic nature, mean that the species is rarely seen outside of targeted searches and surveys.

Little is known about Glossy Grass Skinks with respect to real distributions and their ability to disperse and colonise (data on the species is deficient in general); however, evidence suggests that disturbance to vegetation structure (e.g., grazing, mowing) is a significant predictor of absence, even when proximate (e.g. within dispersal distance) to known populations (Farquhar et al. 2024; Farquhar et al. 2023). Nonetheless, populations are often found persisting in remnant suitable habitat in cleared agricultural areas.

There is a substantial overlap in habitat niche between Glossy Grass Skink and the threatened Swamp Skink, and as for the latter species it appears that the structure of vegetation, rather than its composition or origin (i.e. native or exotic), is more important for the Glossy Grass Skink. The Glossy Grass Skink is listed as Endangered within Victoria under the FFG Act.

Glossy Grass Skinks have not been detected in the study area previously, but the site does exist within the range of the species. Survey effort for Glossy Grass Skink has significant overlap with that for Swamp Skinks, as they often occupy similar and adjacent habitats, and in consultation with DEECA and the VPA, this species was added to the target species list, for survey by artificial refuges (see below).

Plate 4 Glossy Grass Skink Pseudemoia rawlinsonii *(J. Urlus 2008)*

2.4. Targeted fauna surveys

2.4.1. Growling Grass Frog Surveys

Ten sites within or adjacent to the East of Aberline study area were surveyed on 19 December 2024, 25 March 2025 and 26 March 2025. Surveys at each site were undertaken by two zoologists experienced in surveying for Growling Grass Frog and occurred at night, between approximately 9 pm and 2 am. The following survey method was used:

1. Quiet listening for frog calls for approximately five minutes
2. After quiet listening, Growling Grass Frog call-playback was undertaken at every site
3. After quiet listening and call-playback, active searching by spotlights was undertaken using head-mounted torches to scan the waterbodies and all dry land within approximately 15 m of the water's edge. Spotlighting is used to detect Growling Grass Frog from their eye-shine or body shape. Spotlight searching was undertaken for up to 30 person-minutes per site.

Three nocturnal surveys were undertaken at each site regardless of whether Growling Grass Frog were detected during the first survey. All vertebrate fauna detected were recorded, with GPS waypoints taken of any Growling Grass Frog recorded (+/- 5 m accuracy).

Habitat descriptions were also recorded during the site surveys, including the site variables listed in the table below (Table 1). These variables were recorded at every site irrespective of Growling Grass Frog detection.

Survey sites were selected along Russell Creek, within Tozer Reserve, and at various dams within the study area. Dams on properties for which property owners were not able to be contacted, but the dams were adjacent to public roads, were surveyed 'over-the-fence' without entering the property.

Table 1 Growling Grass Frog habitat assessment variables recorded during the site surveys

Assessment category	Variables
Site Details	Site ID; Location; Site Area; Mean Depth; Maximum Depth; Site Type.
Growling Grass Frog Detection	Adult Frogs – Aural; Adult Frogs – Visual; Tadpoles and Metamorphs – Visual; Count (Total).
Weather	Ambient Air Temperature; Relative Humidity; Cloud Cover; Rain Intensity; Wind Velocity; Moon Glow

Assessment category	Variables
Hydrology	Hydroperiod; Dry at any Time,
Water Properties	Salinity; Water Temperature
Aquatic Vegetation	Emergent Vegetation Cover; Submerged Vegetation Cover; Floating Vegetation Cover
Dry Land Cover / Fringing Vegetation	Emergent Vegetation Cover (Bankside); Dense Exotic Grass Cover; Sparse Exotic Grass Cover; Native Grass Cover; Bare-ground Cover; Rock Cover; Litter Cover; Fringing Vegetation Cover

2.4.2. Artificial refuge surveys (Swamp Skink & Glossy Grass Skink)

Evidence suggests that employment of more than one suitable survey technique for Swamp Skinks *Lissolepis coventryi* within a discreet location materially increases likelihood of detection if present (Urlus et al. 2018). Methods with reasonable potential to result in detections of Swamp Skinks include artificial refuge surveys, Elliot trapping, and camera trapping. Under these guidelines, this project employed a combination of artificial refuge surveys and Elliot trapping to survey for the species Skinks. Although active search may result in detection of the species if present, it is not generally considered a cost-effective method due to the elusiveness of individuals.

Artificial refuges can survey areas of potential habitat for the presence of target species through the provision of refuge and thermoregulatory habitat that is then subsequently inspected for the species' presence. This can be effective for a number of ectothermic ('cold-blooded') species as well as some small mammals, and avoids disturbance to natural habitat features such as rocks, logs, vegetation and leaf litter. Roofing tiles—either cement or terracotta—are portable, thermally favourable for reptiles, non-reactive and economically efficient artificial refugia, with a demonstrated history of successfully surveying for a number of threatened reptile species, including Swamp Skinks (Michael et al. 2012; Urlus et al. 2018). In most cases, tiles are deployed in a grid pattern and left to integrate into the habitat ('weather in') for a period of time prior to surveying. Surveyors then check each tile in a grid methodically, searching for any reptiles basking on top of each tile before carefully inspecting underneath the tile, for any fauna underneath. Tiles are removed when the surveys are completed.

Four grids of 50 tiles each (i.e. 200 tiles) were deployed across the study area in potential Swamp Skink and Glossy Grass Skink habitat on 20 December 2024 (Plate 5). One grid was deployed in Tozer Reserve, and three along Russell Creek (Figure 2). Each grid was either a 5 x 10 tile arrangement or 16-17 x 3, with 5 m between tiles (e.g. approximately 20 m x 45 m or 10 m x 80 m). Tiles were left to 'weather in' for approximately one month, before surveys commenced. Each of the four tile grids was surveyed four times over the 2024-25 summer period, commencing on 21 January 2025 with subsequent checks on 10 February, 13 February and 26 February.

Tile grids were surveyed by systematically approaching each tile, observing for fauna basking on the tile, and then lifting one edge of the tile to reveal any animals sheltering beneath. Hand capture was attempted once safety was assessed (e.g. certainty that the animal was not a snake). All detections were recorded to species level (where possible). Captured reptiles were assessed for pertinent information (e.g. life stage) and photographed. After each survey, the tile was replaced in position. Tiles were removed during the final check, on 26 February 2025.

Plate 5 Roof tiles deployed in a grid as artificial refuge for survey of threatened reptiles west of Horne Rd, for the East of Aberline project.

2.4.3. Elliot trapping (Swamp Skink)

Elliot traps are small aluminium foldable boxes with spring-loaded doors. Typically, Elliot traps are deployed with a bait (suitable for the target species) inside designed to entice fauna into the trap, whereupon the weight of the animal triggers the spring-loaded door, trapping it inside. Elliots traps are relatively labour-intensive, particularly in summer where they must be checked multiple times per day for animal welfare reasons; however, a multiple technique approach to surveys, including more active techniques like Elliot traps, has been shown to be required to have confidence in the absence of Swamp Skinks at a site (Urlus et al. 2018)

Elliot trapping was undertaken within the site between 10 February and 13 February 2025. 120 Elliot traps were deployed within suitable habitat at the site, in three clusters of 40 traps each (Figure 2). Elliot traps were deployed within or under dense vegetation such as shrubs, tussock grasses or other graminoids to prevent direct exposure to sunlight (Plate 6).

Traps were baited with a mixture that included oats, peanut butter, golden syrup and sardines with sardine oil. Elliot traps were checked 11 times over four days (e.g., twice on day of deployment, then three times each day for three days before being collected). Elliot traps were deactivated (door closed) after the final check of the day, to prevent animals being trapped overnight, and re-armed in the early morning of the following day. All triggered traps were inspected for occupants, which were identified, recorded and photographed before being let go within 2 m of the point of capture. The protocol for venomous snakes in Elliott traps is to remove the release pin so as to fully open the trap on the ground and not need to handle the snake; however, no snakes were encountered in traps during the surveys.

Plate 6 Elliot trap deployed sheltered under vegetation during reptile surveys for the East of Aberline project

2.4.4. Southern Toadlet surveys

Three nights of nocturnal survey of the areas of potentially suitable habitat for Southern Toadlet were undertaken, on 25 March, 26 March and 8 May 2025. No surveys were undertaken during April due to the lack of rainfall and the resulting dryness of wetland habitats (see Limitations below). Surveys occurred for a period of approximately four to five hours each night, commencing shortly after dusk. Ten sites were selected, along Russell Creek and within Tozer Reserve. Targeted surveys of this nature have been shown to be effective if undertaken at the correct time of year (Mar-May), due to the relatively high detectability of this species under suitable calling conditions, where there is a greater than 90% chance of detecting males calling within two minutes (C. Cleeland, unpub. data; Howard et al. 2010).

The peak calling period for Southern Toadlets is in autumn following rainfall events, typically from Mar to late May, prior to minimum overnight temperatures dropping below approximately 100C (Yoni Tiljak; Honours thesis, LaTrobe University). Weather conditions during the surveys were suitable, with a minimum overnight temperature at the site of 13°C, low winds and high humidity. Approximately 15 mm of rainfall occurred in the week preceding the March surveys (BoM 2024); rainfall was then very low throughout April, and the final survey occurred following approximately 5 mm of rain in early May.

The survey locations of Southern Toadlet surveys included standalone sites, as well as some more ephemeral sites also identified for Growling Grass Frog surveys (Figure 2). The survey largely comprised listening for calling males and active searching of potential habitat by spotlight, focusing on areas of litter and refuge from which toadlets generally call. Although typically not a chorusing species, call-playback was also used at several locations within each site to attempt to elicit calling by males. Pre-recorded calls of the Southern Toadlet were broadcast, at up to approximately 110% of natural call volume, for two minutes using a megaphone; call-playback was followed by several minutes of quiet listening for a response.

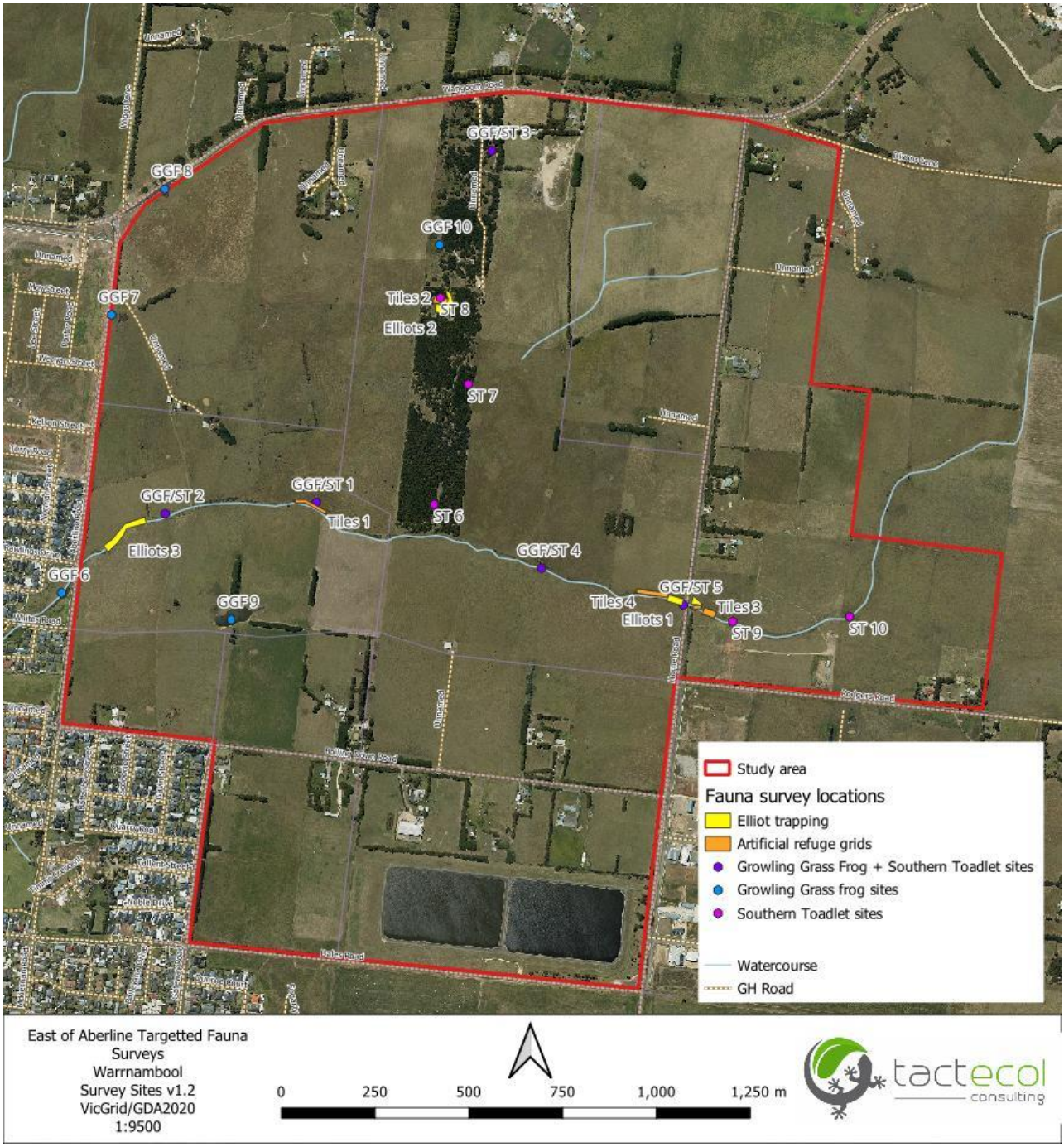

Figure 2 Locations of targeted fauna surveys at the within the East of Aberline study area.

2.5. Prevaling conditions

Prevailing conditions during the surveys were, except for December 2024, substantially warmer and drier than average (Figures 3-4; BoM 2025, Warrnambool Airport). January 2025 through April 2025 (and into May) were exceptionally dry—rainfall was only between approximately 25% to 50% of average rainfall throughout this period (Figure 4).

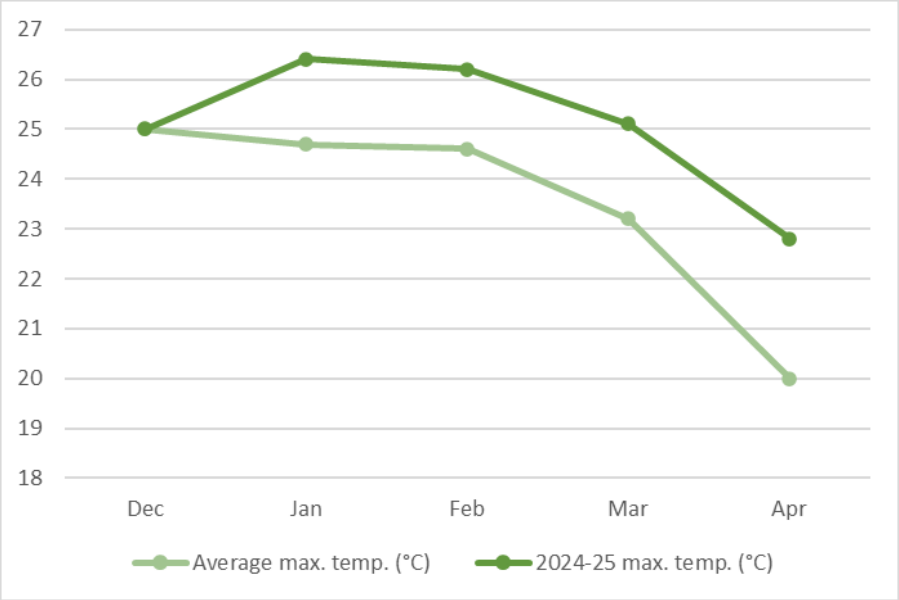

Figure 3 Historical average and current season monthly temperatures in Warrnambool (airport) during the targeted fauna survey period

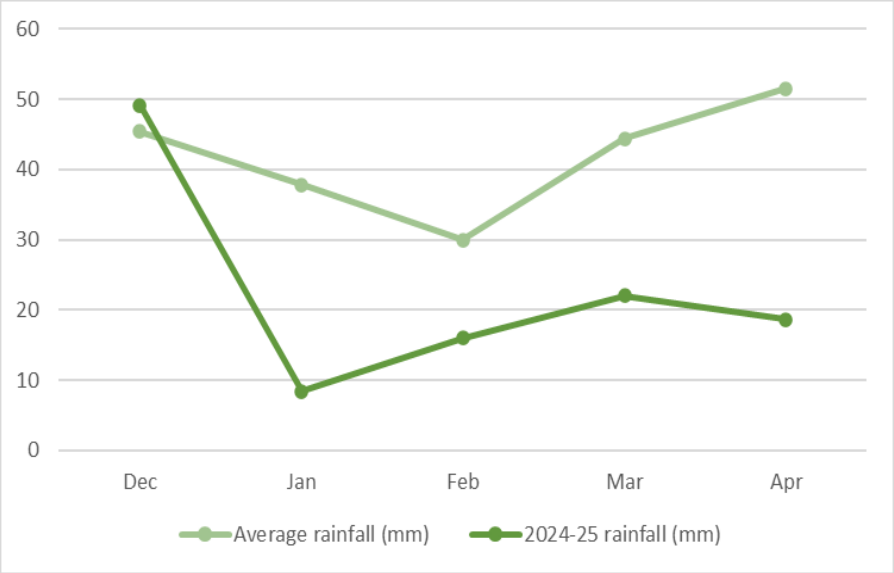

Figure 4 Historical average and current season monthly rainfall in Warrnambool (airport) during the targeted fauna survey period

2.6. Limitations

The results presented in this report are indicative of the environmental conditions at the time of assessment. Site conditions, including the presence or absence of significant species, and the type and quality of habitats have the potential to change over time.

We note the atypical prevailing weather conditions throughout most of the survey period. Whilst the higher than average temperatures are generally favourable for activity and detection of reptiles and amphibians, the significant dryness in the region—specifically, drought conditions, that have broken regional records for low rainfall—is likely to have significantly affected the activity and detectability of amphibians, and potentially reptiles, in the study area. Accordingly, the apparent absence of target amphibians, and possibly reptiles, may be partially a factor of the

highly unusual prevailing conditions, rather than true absence. It is possible that species considered absent could be recorded within the study area under more typical or favourable conditions in future; i.e. detectability may increase, or recolonisation may occur.

The entirety of the study area was not accessible for survey effort or inspection. At the time of works, approximately half the study area (Figure 1) was inspected. TactEcol was provided with a map of properties where the landowner had previously consented to the VPA to allow survey effort within the property, and a contact list for these property owners. Not all of these owners were able to be contacted and/or consented to access. Although most of the land which contained potential habitat for the target species was accessed, much of the inaccessible land was not able to be inspected, even through an 'over-the-fence' approach, and as such we cannot rule out the possibility that some of the study area contains suitable habitat for the target species, and hence could potentially support threatened species. For example, the property along Wangoom Rd in the north, directly on the eastern border of Tozer Reserve, appears to support areas of dense graminoids; however, we were unable to get in contact with the landowner for access.

3. Results

3.1. Site inspection

In general, the habitat available within the study area for the target species was of low to moderate quality. The majority of the study area that was available for inspection is pastoral, with cattle present on many property parcels. Vegetation is almost exclusively grazed exotic grass in these paddocks, with some sporadic native grasses and sedges/rushes, e.g. *Juncus* spp., remaining in lower areas or drainage lines.

Russell Creek is heavily degraded in most sections, with substantial evidence of cattle access. Only the western and eastern (Plates 7 to 9) extents of the creek within the study area have retained a material cover of native graminoids, with the centre section almost completely devoid of native species. Most of the length of Russell Creek was dry, with only some small pools present upon initial inspection. On subsequent visits the creek was completely dry (Plate 8) with the exception of a larger isolated pool under the Horne Road bridge (Plate 9). A small, fenced portion of the riparian area of Russell Creek, directly east of the Horne Road bridge, has been protected from cattle usage and contains dense vegetation (Plate 10).

Most of the dams scattered around the properties were dry (Plate 11), although the larger dam in the south-west on crown land contained some water (but no vegetative cover).

Plate 7 Small pools of water in Russell Creek during the initial inspection

Plate 8 Russell Creek was largely dry during fauna surveys

Plate 9 A larger pool remains in Russell Creek under the Horne Road bridge

Plate 10 A fenced area directly east of the Horne Road bridge on Russell Creek has excluded cattle and resulted in an area with dense (mostly exotic) graminoids and grasses

Plate 11 Many of the dams inspected on existing farms within the East of Aberline study area were dry

3.2. Flora and fauna species

3.2.1. Fauna species

A total of 38 fauna species were observed or detected within the study area during the current assessment, either incidentally or during targeted survey work. These comprised 32 native species (84%), and six introduced species (16%). The 38 species recorded at the study area consisted of 25 bird species, five mammal species, five reptile species and three amphibian species. No threatened fauna species were detected during surveys.

A full list of fauna species recorded at the study area is provided in Appendix 1.

3.2.2. Growling Grass Frog surveys

Growling Grass Frogs were not detected during three nights of survey effort. Several common frog species were detected at the survey sites, including Spotted Marsh Frog *Limnodynastes tasmaniensis*, Southern Brown Tree Frog *Litoria ewingii* and Common Eastern Froglet *Crinea signifera*. An Eastern Long-necked Turtle *Chelodina longicollis* was also detected at one site

We note that the failure to detect the Growling Grass Frog during the targeted surveys does not necessarily equate to its absence. Apart from the drought-like conditions and not being able to access the entire study area, this species is also known to occur in landscapes under a 'metapopulation' paradigm, whereby sub-populations go extinct under certain conditions, and then re-colonise those areas under favourable conditions (Heard et al. 2013). The waterbodies within the site, particularly the storm water drain in the west, have extensive potential ephemeral connectivity with other significant bodies both up and downstream—many of which have existing GGF records. Hence, the status of this species in the study area should be considered to be 'likely absent' currently, but with the potential to occur/re-colonise over the long-term, particularly under favourable conditions.

3.2.3. Artificial refuge surveys

Neither target species, Swamp Skink or Glossy Grass Skink, was detected during artificial refuge surveys. Several non-threatened species were detected, including the Common Garden Skink *Lampropholis guichenoti*, Southern Grass Skink *Pseudemoia entrecasteauxii* (Plate 12) and Lowlands Coppperhead *Austrelaps superbus*. Several skinks were detected utilising tiles but were not able to be identified past genus level as they were not able to be captured; none of these were considered likely to potentially be the target species.

Full details for the artificial refuge surveys are provided in Appendix 4.

Plate 12 Southern Grass Skink Pseudemoia entrecasteauxii *captured during artificial refuge surveys in the East of Aberline study area.*

3.2.4. Elliot trapping

No Swamp Skinks were detected whilst Elliot trapping. Only three fauna species were detected during Elliot trapping: Common Garden Skink, Eastern Blue-tongued Lizard *Tiliqua scincoides scincoides* (Plate 13) and House Mouse *Mus musculus*.

Plate 13 *Eastern Blue-tongued Lizard* Tiliqua scincoides scincoides captured in an Elliot trap within the East of Aberline study area.

3.2.5. Southern Toadlet surveys

Southern Toadlets were not recorded within the study area, over three nights of survey effort at ten locations within Tozer Reserve and along Russell Creek.

Targeted surveys at these sites returned two common amphibian species; Southern Brown Tree Frog and Common Eastern Froglet. Further details of the Southern Toadlet surveys are provided in Appendix 3.

4. Discussion and Recommendations

4.1. Contemporary habitat quality

Comparison of previously recorded images of Tozer Reserve from 2017 (Plate 14; EHP 2018), to the existing state of the reserve suggests that the condition of the wetlands (and reserve in general) has substantially declined; how much of this is due to the current drought versus other trends is not clear. Where previously some areas in the east of the reserve appear to contain water and significant native graminoid cover (Plate 14), the current state shows a distinct lack of water (and evidence that the sites have not contained water in a significant time; e.g. extensive Blackberry **Rubus fruticosis* spp. agg. cover), apparent declines in the cover of native vegetation, and colonisation/expansion by exotic grasses and noxious weeds (Plates 15 and 16).

Whether this apparent decline is a result of drought, lack of maintenance or other factors we do not speculate, nonetheless, the functional outcome is that the habitat quality in Tozer Reserve has apparently declined so much that it is possible that the species targeted in this study that appear to have been detected in 2014 (Swamp Skink, Southern Toadlet and Growling Grass Frog; Landtech 2014, in EHP 2024) may have become extirpated (locally extinct) in the study area.

Plate 14 Photographs from 2017 of wetlands present within Tozer Reserve (sourced from Ecology & Heritage Partners 2018)

Plate 15 Area in northern half of Tozer Reserve which presumably formerly supported ephemeral wetland habitat.

Plate 16 Area in northern half of Tozer Reserve which presumably formerly supported ephemeral wetland habitat.

4.2. Target species

Three nights of survey effort with no detections suggests that Growling Grass Frogs do not currently occur within the study area; however, we note the limitations inherent to this conclusion, particularly the extensive dryness/drought during most of the survey period. Public databases (VBA, NatureKit, Atlas of Living Australia) suggest the species has not been detected in the greater Warrnambool area since 2000. We note that surveys by Landtech (2014; in EHP 2024) suggest they were present within Tozer Reserve as recently as 2014. Assuming the Growling Grass Frog does persist within the broader landscape, there is potential for it to recolonise Russell Creek, Tozers Reserve and/or other waterbodies within the study area under suitable conditions, given the metapopulation paradigm this species operates under, and its ability to disperse across hundreds of metres of dry land (e.g. Heard et al. 2010). This possibility may be more likely if protection and enhancement of the habitat in Russell Creek occurs, as this waterway corridor may provide a key connective pathway for the dispersal of the species across the landscape.

TactEcol ecologists did incidentally detect Swamp Skinks in E. Johnson Reserve, Warrnambool (Plate 17) during the survey period (12 March 2025), which is approximately 5.6 km from Tozer Reserve. This provides evidence that Swamp Skinks were active and detectable whilst surveys were being undertaken within the survey area. The lack of detection, despite using two survey methods suggests that Swamp Skinks are likely absent from the site. While Swamp Skinks were apparently present in the study area in 2014 (Landtech; in EHP 2024), the lack of detections currently suggest that the species no longer occurs in the study area. This appears to have potentially occurred through loss or degradation of habitat; Swamp Skinks are sensitive to changes in vegetation structure and assemblage. Agricultural use and disturbance, drought and lack of vegetation management and weed control may have contributed to this outcome. We note that Swamp Skinks have a very small home range and are likely slow to disperse between adjacent habitats, particularly where these are disjunct.

Plate 17 Swamp Skink Lissolepis coventryi *detected within E. Johnson Reserve, Warrnambool on 12 March 2025*

The Glossy Grass Skink was also not detected, and is considered unlikely to occur in the study area presently. As described previously, several *Pseudemoia* sp. skinks were detected during artificial refuge surveys but were not able to be identified to species level as they were not captured. These are likely to comprise the similar-sized congeneric Southern Grass Skink; however, we note that the potential for one of these *Pseudemoia* sp. to be Glossy Grass Skink cannot be ruled out. Like Swamp Skink, the Glossy Grass Skink operates at a very small spatial scale, and hence the possibility of recolonisation (if absent), especially across barriers to movement, is considered low.

Southern Toadlets were not detected during surveys and are considered unlikely to occur within the study area currently. Southern Toadlets are largely sedentary, being slow to disperse and having high site fidelity, and likely rely on flooding events washing tadpoles into lower order waterways or wetlands for any significant dispersal. As such, populations of this species are particularly sensitive to impacts and disturbance to microhabitat. The apparent decline in habitat quality within Tozer Reserve—where the species was apparently previously detected (Landtech 2014; in EHP 2024)—and the lack of current detections does suggest that they have been extirpated in the study area. However, we note the dry weather during the survey period, and the potential for *Psedophryne* species to persist despite unfavourable seasons (*sensu* De Angelis & Cleeland 2019), and hence the small but not insignificant chance that the species may persist within the study area.

Notwithstanding the above clarifications and nuances, we consider that all of the target species have, in general, a low likelihood of occurrence within the study area currently.

4.3. Recommendations

We make the following recommendations with regard to the proposed clearance of vegetation and habitat within the study area, and the management of retained vegetation:

- Establish and maintain a riparian buffer along the entire length of Russell Creek; we suggest this would ideally have a minimum total width of 30 m (i.e. 15 m each side). This creek may represent an important east-west movement corridor for native fauna, potentially including threatened species present within the greater landscape. This buffer should exclude stock (e.g. fencing) and other disturbances, and be enhanced and revegetated in line with indigenous Ecological Vegetation Classes—we recommend that this revegetation generally avoids the planting of trees and woody shrubs growing to over 2 m, which are known to be negatively correlated with the presence or relative abundance of most of the target species (i.e. through overshading and reducing insolation).
  - We recommend considering the creation of some in-stream wetlands as part of establishing the Russell Creek riparian corridor, which would fill under average and/or high-flow conditions. Such ephemeral or semi-permanent wetlands can provide important habitat for amphibians, including supporting significant breeding habitat for the Growling Grass Frog (Ecology Australia 2017; J. Urlus unpub. data).
  - Where consistent with planning objectives for the precinct, we recommend retaining dams and other wetlands in the landscape and enhancing habitat values for native fauna, particularly the Growling Grass Frog. Retained wetlands should be managed according to the principles outlined in Heard et al. (2010), *Guidelines for managing the endangered Growling Grass Frog in urbanising landscapes*. We also note the Habitat Design Standards for this species (DELWP 2017); these were developed as part of the Melbourne Strategic Assessment program, but they hold relevance for managing Growling Grass Frog habitat more broadly.
- Maintain and enhance the ecological values of Tozer Reserve. This may require a material investment in weed control, revegetation and potentially reinstating wetlands and hydrological regimes, as noxious weeds and exotic grasses currently dominate much of the area. However, we note that this reserve is one of the largest, and only, remaining sizeable wooded non-coastal reserves in the entire region, and hence it holds substantial ecological value, and potential.
- For conservation areas and retained habitat, e.g. Tozer Reserve, Russell Creek corridor, we recommend the development of an Environmental Management Plan, outlining the objectives, management measures and performance criteria, and monitoring approach, to ensure that ecological values are protected and enhanced following the rezoning, and subsequent development, of the precinct.
  - In particular, we note that the quality of habitat for target fauna species in the study area generally is being impacted by the invasion of weedy species, particularly blackberries. As part of the Environmental Management Plan, we recommend that a weed management approach is developed and implemented, to eliminate or reduce the cover of exotic species within the study area, especially highly invasive species. Ideally weed management in conservation areas and fauna habitat areas would commence within the medium term.

- The measures to minimise direct and indirect (e.g. noise, dust, light, pollution, waterway sedimentation) impacts to flora and fauna during future construction works and the associated vegetation removal should be detailed in a Construction Environment Management Plan (CEMP).
- An appropriately qualified and permitted zoologist should undertake a pre-clearance assessment (e.g. for the presence of native fauna, potential nesting habitat etc.) prior to areas of vegetation (native or exotic) supporting potential fauna habitat being cleared. Where there is evidence of occupation and/or nesting by native species, the zoologist should be on hand to inspect the areas supporting potential fauna habitat as it is cleared, and to salvage and relocate any resident fauna, as well as in the event of injury to fauna during clearance works.
- Consider periodic monitoring for the target species, under more suitable prevailing conditions, to determine their presence/absence and potential recolonisation of the site.

References

Ashworth JM (1998). An Appraisal of the Conservation Status of *Litoria raniformis* (Keferstein) in Tasmania. Unpublished Masters Thesis, University of Tasmania, Hobart

Clemann N (2000). Survival in the Suburbs. The (re)discovery of the threatened Swamp Skink *Egernia coventryi* east of Melbourne, with comments on the failure of Elliott traps in a survey for this species. *The Victorian Naturalist* **117 (5)**: 180–183.

Clemann N (2004). *Tamarisk Creek Wetland: Survey for Growling Grass Frogs* Litoria raniformis *and Swamp Skink* Egernia coventryi*.* Arthur Rylah Institute for Environmental Research: Heidelberg

Clemann N, Gillespie G (2012). *National Recovery Plan for the Southern Bell Frog Litoria raniformis*. Department of Sustainability and Environment, Melbourne.

Cogger HG (2014). '*Reptiles & Amphibians of Australia*.' 7th edn. CSIRO Publishing: Collingwood.

De Angelis D, Cleeland C (2019). Observations of recruitment failure and success in relation to rainfall for an isolated population of the Southern Toadlet *Pseudophryne semimarmorata*. *The Victorian Naturalist*;**136(3)**;112-116.

DEPI (2013). *Sub-regional Species Strategy for Growling Grass Frog.* Victorian Government Department of Environment and Primary Industries (DEPI). Available: https://www.vgls.vic.gov.au/client/en_AU/search/asset/1299261/0

Ecology Australia (2010:2016). *Annual Growling Grass Frog monitoring at the Western Treatment Plant, Werribee.* Unpublished reports prepared for Melbourne Water by Ecology Australia, Fairfield.

Ecology Australia (2017). *Frog Conceptual Model Project: Modelling and Final Report.* Unpublished report prepared for Melbourne Water by Urlus J, Quin D, Bird T. (Ecology Australia, Fairfield).

EHP (2018). Flora and Fauna Assessment: Aberline to Horne Growth Corridor. Unpublished report by Ecology & Heritage Partners, Ascot Vale, Victoria.

EHP (2024). Existing Ecological Conditions: East of Aberline Growth Corridor, Warrnambool, Victoria. Unpublished report by Ecology & Heritage Partners, Ascot Vale, Victoria.

Farquhar JE, Carlesso A, Pili A, Gale N, Chapple DG (2023). Capturing uncatalogued distribution records to improve conservation assessments of data-deficient species: a case study using the glossy grass skink. *Animal Conservation* **27(1)**: 124-137.

Farquhar JE, Wotherspoon L, Porter H, Chapple DG (2024). Habitat loss and degradation reduce the abundance of the glossy grass skink, *Pseudemoia rawlinsoni*. *Wildlife Research* **51(3)**.

Hale JM, Heard GW, Smith KL, Parris KM, Austin JJ, Kearney M, Melville J. (2013). Structure and fragmentation of growling grass frog metapopulations. *Conservation Genetics* **14**; 313-322.

Hamer A, Heard GW, Urlus J, Ricciardello J, Schmidt B, Quin D, Steele WK (2016). Manipulating wetland hydroperiod to improve occupancy rates by an endangered amphibian: modelling management scenarios. *Journal of Applied Ecology* **53**; 1842-1851.

Heard GW, Robertson P, Scroggie MP (2008). Microhabitat preferences of the endangered Growling Grass Frog *Litoria raniformis* in southern Victoria*. Australian Zoologist* **34(3)**; 414-425.

Heard GW, Scroggie MP, Clemann N (2010). *Guidelines for managing the endangered Growling Grass Frog in urbanising landscapes*. Report prepared for Victorian Department of Sustainability and Environment. (Arthur Rylah Institute for Environmental Research, Heidelberg).

Heard GW, Scroggie MP, Clemann N, Ramsay DSL (2014). Wetland characteristics influence disease risk for a threatened amphibian. *Ecological Applications* **24(4)**; 650-662.

Landtech Consulting (2014). *Tozer Reserve Fauna Survey 2014/15*. Unpublished report prepared for Tozer Reserve Committee and Warrnambool City Council. Warrnambool, Victoria.

Mahony M (1999). Review of the declines and disappearances within the bell frog species group (Litoria aurea species group) in Australia. In: *Declines and Disappearances of Australian Frogs*. 81-93.

Michael DR, Cunningham RB, Donnelly CF, Lindenmayer DB (2012). Comparative use of active searches and artificial refuges to survey reptiles in temperate eucalypt woodlands. *Wildlife Research* **39(2)**;149-162.

Morgan LA, Buttemer WA (1996). Predation by the non-native fish *Gambusia holbrooki* on small *Litoria aurea* and *L. dentata* tadpoles. *Australian Zoologist* **30(2)**;143-149.

Pyke G (2002). A review of the biology of the southern bell frog *Litoria raniformis* (Anura: Hylidae). *Australian Zoologist* **32(1)**; 32-48.

Robertson P, Coventry J (2019). *Reptiles of Victoria: A Guide to Identification and Ecology*. CSIRO Publishing, Clayton South, Victoria.

Smales I (1981). The Herpetofauna of Yellingbo State Faunal Reserve. *The Victorian Naturalist* **98**; 234–246.

Urlus J, McCutcheon C, Gilmore D, McMahon J (2014). The effect of camera trap type on the probability of detecting different size classes of Australian mammals. In: *Camera Trapping, Wildlife Management and Research* (Eds Meek P, Fleming P).

Urlus J, Humphrey J, De Angelis D (2018). Surveying Swamp Skinks. *Transects: Ecological Consultants Association of Victoria* **2**; 3-6.

Wassens S, Watts RJ, Jansen A, Roshier D (2008). Movement patterns of southern bell frogs (*Litoria raniformis*) in response to flooding. *Wildlife Research* **35(1)**; 50-58.

Webb C, Joss J (1997). Does predation by the fish *Gambusia holbrooki* (Atheriniformes: Poeciliidae) contribute to declining frog populations? *Australian Zoologist* **30**; 316–323.

Appendix 1 Observed fauna species

Table A1. 1 Fauna species detected during inspection and fauna surveys within the East of Aberline study area

Category	Scientific name	Common name	Status	Origin
Bird	*Acanthiza pusilla*	Brown Thornbill		
Bird	*Accipiter fasciatus*	Brown Goshawk		
Bird	*Aquila audax*	Wedge-tailed Eagle		
Reptile	*Austrelaps superbus*	Lowlands Copperhead		
Bird	*Anthochaera carunculata*	Red Wattlebird		
Bird	*Cacatua galerita*	Sulphur-crested Cockatoo		
Reptile	*Chelodina longicollis*	Eastern Long-necked Turtle		
Bird	*Corvus mellori*	Little Raven		
Bird	*Cracticus torquatus*	Grey Butcherbird		
Amphibian	*Crinia signifera*	Common Eastern Froglet		
Bird	*Colluricincla harmonica*	Grey Shrikethrush		
Bird	*Cormobates leucophaea*	White-throated Treecreeper		
Bird	*Cracticus torquatus*	Grey Butcherbird		
Bird	*Elanus axillaris*	Black-shouldered Kite		
Bird	*Grallina cyanoleuca*	Magpie-lark		
Bird	*Gymnorhina tibicen*	Australian Magpie		
Bird	*Hirundo neoxena*	Welcome Swallow		
Reptile	*Lampropholis guichenoti*	Common Garden Skink		
Mammal	*Lepus europaeus*	European Brown Hare		*
Amphibian	*Limnodynastes tasmaniensis*	Spotted Marsh Frog		
Amphibian	*Litoria ewingii*	Southern Brown Tree Frog		
Bird	*Malurus cyaneus*	Superb Fairywren		
Mammal	*Mus musculus*	Field Mouse		*
Mammal	*Oryctolagus cuniculus*	European Rabbit		*
Bird	*Pardalotus punctatus*	Spotted Pardalote		
Bird	*Phylidonyris novaehollandiae*	New Holland Honeyeater		
Bird	*Platycercus elegans*	Crimson Rosella		
Mammal	*Pseudocheirus peregrinus*	Ringtail Possum		
Reptile	*Pseudemoia entrecasteauxii*	Southern Grass Skink		
Bird	*Rhipidura albiscapa*	Grey Fantail		
Bird	*Rhipidura leucophrys*	Willie Wagtail		
Bird	*Strepera graculina*	Pied Currawong		
Bird	*Strepera versicolor*	Grey Currawong		

Category	Scientific name	Common name	Status	Origin
Bird	*Sturnus vulgaris*	Common Starling		*
Reptile	*Tiliqua scincoides scincoides*	Eastern Blue-tongued Lizard		
Bird	*Turdus merula*	Common Blackbird		*
Mammal	*Vulpes vulpes*	Red Fox		*
Bird	*Zosterops lateralis*	Silvereye		

Key:

EPBC Act 1999: EN – Endangered; VU – Vulnerable; Migratory/Marine – Listed on the EPBC Act 'migratory' (s209) or 'marine' (s248) species lists

FFG Act 1988: cr – Critically Endangered; en – Endangered; vu – Vulnerable; th – Threatened

* - Introduced species

Appendix 2 Growling Grass Frog survey data

Date: 19/12/2024	**Site 1: Temp (°C):** 22.1	**RH (%): 60.3**	**Cloud Cover (%): 50**	**Wind (Beaufort):** 0	**Rain:** 0
	Site 6: Temp (°C): 23.0	**RH (%): 60.2**	**Cloud Cover (%): 80**	**Wind (Beaufort):** 0	**Rain:** 0

Site:	Site Type:	Dry?	*L. raniformis* detected?	Other spp. detected?	Comments:
GGF/ST 1	Creek	N	N	N	High Cattle damage
GGF/ST 2	Creek	N	N	N	High Cattle damage
GGF/ST 3	Ephemeral Pool	Y	N	N	Dry, full of weeds
GGF/ST 4	Creek	Y	N	Y	Lim tas
GGF/ST 5	Creek	N	N	Y	Lim tas
GGF 6	Creek/drain	N	N	Y	Lim tas
GGF 7	Dam	N	N	N	Over-fence
GGF 8	Dam	N	N	N	Over-fence
GGF 9	Dam	N	N	Y	Lim tas
GGF 10	Ephemeral wetland	Y	N	N	

Date: 25/3/2025	Site 1: Temp (°C): 15.5	RH (%): 81	Cloud Cover (%): 0	Wind (Beaufort): 2	Rain: 0
	Site 6: Temp (°C): 14.4	RH (%): 86	Cloud Cover (%): 0	Wind (Beaufort): 0	Rain: 0

Site:	Site Type:	Dry?	*L. raniformis* detected?	Other spp. detected?	Comments:
GGF/ST 1	Creek	Y	N	Y	Lit ew, Crin sig
GGF/ST 2	Creek	Y	N	Y	Lit ew, Crin sig
GGF/ST 3	Ephemeral Pool	Y	N	N	
GGF/ST 4	Creek	Y	N	Y	Lit ew, Lim tas
GGF/ST 5	Creek	Y	N	N	
GGF 6	Creek/drain	N	N	N	
GGF 7	Dam	Y?	N	N	Over-fence, not visible
GGF 8	Dam	Y?	N	N	Over-fence, not visible
GGF 9	Dam	N	N	Y	Longneck turtle
GGF 10	Ephemeral wetland	Y	N	N	

Date: 26/3/2025	Site 1: Temp (°C): 15.7	RH (%): 72	Cloud Cover (%): 30	Wind (Beaufort): 3	Rain: 0
	Site 6: Temp (°C): 15	RH (%): 77	Cloud Cover (%): 50	Wind (Beaufort): 1	Rain: 0

Site:	Site Type:	Dry?	*L. raniformis* detected?	Other spp. detected?	Comments:
GGF/ST 1	Creek	Y	N	N	
GGF/ST 2	Creek	Y	N	N	Lit ew
GGF/ST 3	Ephemeral Pool	Y	N	N	
GGF/ST 4	Creek	Y	N	Y	Lim tas
GGF/ST 5	Creek	Y	N	Y	
GGF 6	Creek/drain	N	N	Y	
GGF 7	Dam	Y?	N	N	Over-fence, not visible
GGF 8	Dam	Y?	N	N	Over-fence, not visible
GGF 9	Dam	N	N	Y	Turtle
GGF 10	Ephemeral wetland	Y	N	N	

Appendix 3 Southern Toadlet survey data

Date: 25/3/2025	Site 1: Temp (°C): 15.5	RH (%): 81	Cloud Cover (%): 0	Wind (Beaufort): 2	Rain: 0
	Site 6: Temp (°C): 14.5	RH (%): 85	Cloud Cover (%): 0	Wind (Beaufort): 0	Rain: 0

Site:	Site Type:	Dry?	*P. semimarmorata* detected?	Other spp. detected?	Comments:
GGF/ST 1	Creek	Y	N	Y	Lit ewi, Cri sig
GGF/ST 2	Creek	Y	N	Y	Lit ew, Cri sig
GGF/ST 3	Ephemeral Pool	Y	N	N	
GGF/ST 4	Creek	Y	N	Y	Lit ewi, Lim tas
GGF/ST 5	Creek	Y	N	N	
ST 6	Drain	Y	N	N	Woodland cover
ST 7	Local depression	Y	N	Y	Good tussock cover, Lim tas
ST 8	Local depression	Y	N	Y	Lit ewi
ST 9	Creek/Drain	Y	N	N	Cattle access, Lit ewi
ST 10	Drain/End top of Creek	Y	N	N	Cattle access

Date: 26/3/2025	Site 1: Temp (°C): 15.7	RH (%): 72	Cloud Cover (%): 30	Wind (Beaufort): 3	Rain: 0
	Site 6: Temp (°C): 15.6	RH (%): 73	Cloud Cover (%): 20	Wind (Beaufort): 2	Rain: 0

Site:	Site Type:	Dry?	*P. semimarmorata* detected?	Other spp. detected?	Comments:
GGF/ST 1	Creek	Y	N	N	
GGF/ST 2	Creek	Y	N	N	Lit ewi
GGF/ST 3	Ephemeral Pool	Y	N	N	
GGF/ST 4	Creek	Y	N	Y	Lim tas
GGF/ST 5	Creek	Y	N	Y	
ST 6	Drain	Y	N	N	
ST 7	Local depression	Y	N	N	
ST 8	Local depression	Y	N	N	
ST 9	Creek/Drain	Y	N	N	
ST 10	Drain/End top of Creek	Y	N	N	

Date: 8/5/2025	Site 1: Temp (°C): 12	RH (%): 75	Cloud Cover (%): 70	Wind (Beaufort): 1	Rain: 0
	Site 6: Temp (°C): 11.1	RH (%): 86	Cloud Cover (%): 80	Wind (Beaufort): 0	Rain: 0

Site:	Site Type:	Dry?	*P. semimarmorata* detected?	Other spp. detected?	Field notes:
GGF/ST 1	Creek	Y	N	N	
GGF/ST 2	Creek	Y	N	N	
GGF/ST 3	Ephemeral Pool	Y	N	N	
GGF/ST 4	Creek	Y	N	N	
GGF/ST 5	Creek	Y	N	N	
ST 6	Drain	Y	N	Y	Ground damp; Lim tas
ST 7	Local depression	Y	N	N	Ground damp, Boobook nearby
ST 8	Local depression	Y	N	N	Ground damp
ST 9	Creek/Drain	Y	N	Y	Ground damp; Lim tas
ST 10	Drain/End top of Creek	Y	N	N	Ground damp

Appendix 4 Artificial refuge survey data

Date: 21/1/2025	**Start -Temp (°C):** 25.6	**RH (%):** 76	**Cloud Cover (%): 10**	**Wind (Beaufort): 2**	**Rain:** 0
	End - Temp (°C): 28.9	**RH (%): 65**	**Cloud Cover (%): 25**	**Wind (Beaufort): 2**	**Rain: 0**
Grid:	**Tile:**	**Species:**	**Count:**	**Refuge/Basking:**	**Comments:**
3	A6	*Lampropholis gucihenoti*	1	R	
3	D3	*Pseudemoia entrecasteauxii*	1	R	
2	E8	*Lampropholis gucihenoti*	1	R	

Date: 10/2/2025	Start -Temp (°C): 22.8	RH (%): 65	Cloud Cover (%): 0	Wind (Beaufort): 1	Rain: 0
	End - Temp (°C): 26.7	RH (%): 58	Cloud Cover (%): 0	Wind (Beaufort): 1	Rain: 0
Grid:	**Tile:**	**Species:**	**Count:**	**Refuge/Basking:**	**Comments:**
2	C4	*Pseudemoia* spp.	1	B	Seen basking
2	D2	*Lampropholis gucihenoti*	1	R	
2	E9	*Pseudemoia entrecasteauxii*	1	B	
3	A1	*Pseudemoia* spp.	1	B	Briefly seen under tile
3	D10	*Pseudemoia* spp.	1	R	Seen basking
3	B7	*Lampropholis gucihenoti*	1	R	
3	E8	*Lampropholis gucihenoti*	1	R	

Date: 13/2/2025	Start -Temp (°C): 25.4	RH (%): 55	Cloud Cover (%): 10	Wind (Beaufort): 2	Rain: 0
	End - Temp (°C): 27.8	RH (%): 52	Cloud Cover (%): 15	Wind (Beaufort): 2	Rain: 0
Grid:	**Tile:**	**Species:**	**Count:**	**Refuge/Basking:**	**Comments:**
2	A2	*Pseudemoia entrecasteauxii*	1	R	Seen basking
2	B10	*Pseudemoia entrecasteauxii*	1	R	
2	C3	*Lampropholis gucihenoti*	1	R	
2	D6	*Pseudemoia entrecasteauxii*	1	B	
3	A4	*Pseudemoia* spp.	1	B	
3	B3	*Lampropholis gucihenoti*	1	R	
3	B7	*Lampropholis gucihenoti*	1	R	
3	D8	*Lampropholis gucihenoti*	1	B	

Date: 26/2/2025	**Start -Temp (°C):** 23.2	**RH (%): 69**	**Cloud Cover (%): 40**	**Wind (Beaufort): 2**	**Rain:** 0
	End - Temp (°C): 25.9	**RH (%): 59**	**Cloud Cover (%): 25**	**Wind (Beaufort): 2**	**Rain: 0**
Grid:	**Tile:**	**Species:**	**Count:**	**Refuge/Basking:**	**Comments:**
3	A1	*Pseudemoia* spp.	1	B	
3	C4	*Pseudemoia* spp.	1	B	
3	E6	*Lampropholis gucihenoti*	1	R	
3	D7	*Lampropholis gucihenoti*	1	R	
3	D8	*Lampropholis gucihenoti*	1	B	
3	E15	*Lampropholis gucihenoti*	1	R	
4	C1	*Austrelaps superbus*	1	R	Juvenile
4	B12	*Lampropholis gucihenoti*	1	B	
2	A3	*Pseudemoia* spp.	1	B	
2	D8	*Pseudemoia* spp.	1	B	
2	E8	*Pseudemoia* spp.	1	B	

Appendix 5 Elliot trapping survey data

Date: 10/2/2025	Start -Temp (°C): 25.2	RH (%): 76	Cloud Cover (%): 50	Wind (Beaufort): 2	Rain: 0
	End - Temp (°C): 28.5	RH (%): 60	Cloud Cover (%): 50	Wind (Beaufort): 3	Rain: 0
Time: 1000-1930	**Trap ID:**	**Species:**	**Count:**	**Life Stage**	**Comments:**
Russell Creek -East	N/A	Nil			
Russell Creek – West	N/A	Nil			
Tozer Reserve	N/A	Nil			

Date: 11/2/2025	Start -Temp (°C): 26.1	RH (%): 85	Cloud Cover (%): 10	Wind (Beaufort): 3	Rain: 0
	End - Temp (°C): 28.4	RH (%): 73	Cloud Cover (%): 0	Wind (Beaufort): 2	Rain: 0
Time: 0800-1930	**Trap ID:**	**Species:**	**Count:**	**Life Stage**	**Comments:**
Russell Creek -East	N/A	Nil			
Russell Creek – West	N/A	Nil			
Tozer Reserve	59	Eastern Blue-tongued	1	Adult	
	76	Garden Skink	1	Adult	

Date: 12/2/2025	Start -Temp (°C): 28	RH (%): 79	Cloud Cover (%): 0	Wind (Beaufort): 2	Rain: 0
	End - Temp (°C): 30.5	RH (%): 61	Cloud Cover (%): 0	Wind (Beaufort): 2	Rain: 0
Time: 0800-1930	**Trap ID:**	**Species:**	**Count:**	**Life Stage**	**Comments:**
Russell Creek -East	4	Field Mouse	1	Adult	
Russell Creek – West	88	Garden Skink	1	Juvenile	
	96	Field Mouse	1	Adult	
Tozer Reserve	62	Eastern Blue-tongued	1	Adult	

Date: 13/2/2025	Start -Temp (°C): 23.6	RH (%): 75	Cloud Cover (%): 100	Wind (Beaufort): 2	Rain: 0
	End - Temp (°C): 26.9	RH (%): 71	Cloud Cover (%): 100	Wind (Beaufort): 2	Rain: 0
Time: 0730-1800	**Trap ID:**	**Species:**	**Count:**	**Life Stage**	**Comments:**
Russell Creek -East	3	Garden Skink	1		
Russell Creek – West	100	Field Mouse	1	Adult	
	111	Field Mouse	1	Adult	
Tozer Reserve	68	Eastern Blue-tongued	1	Adult	