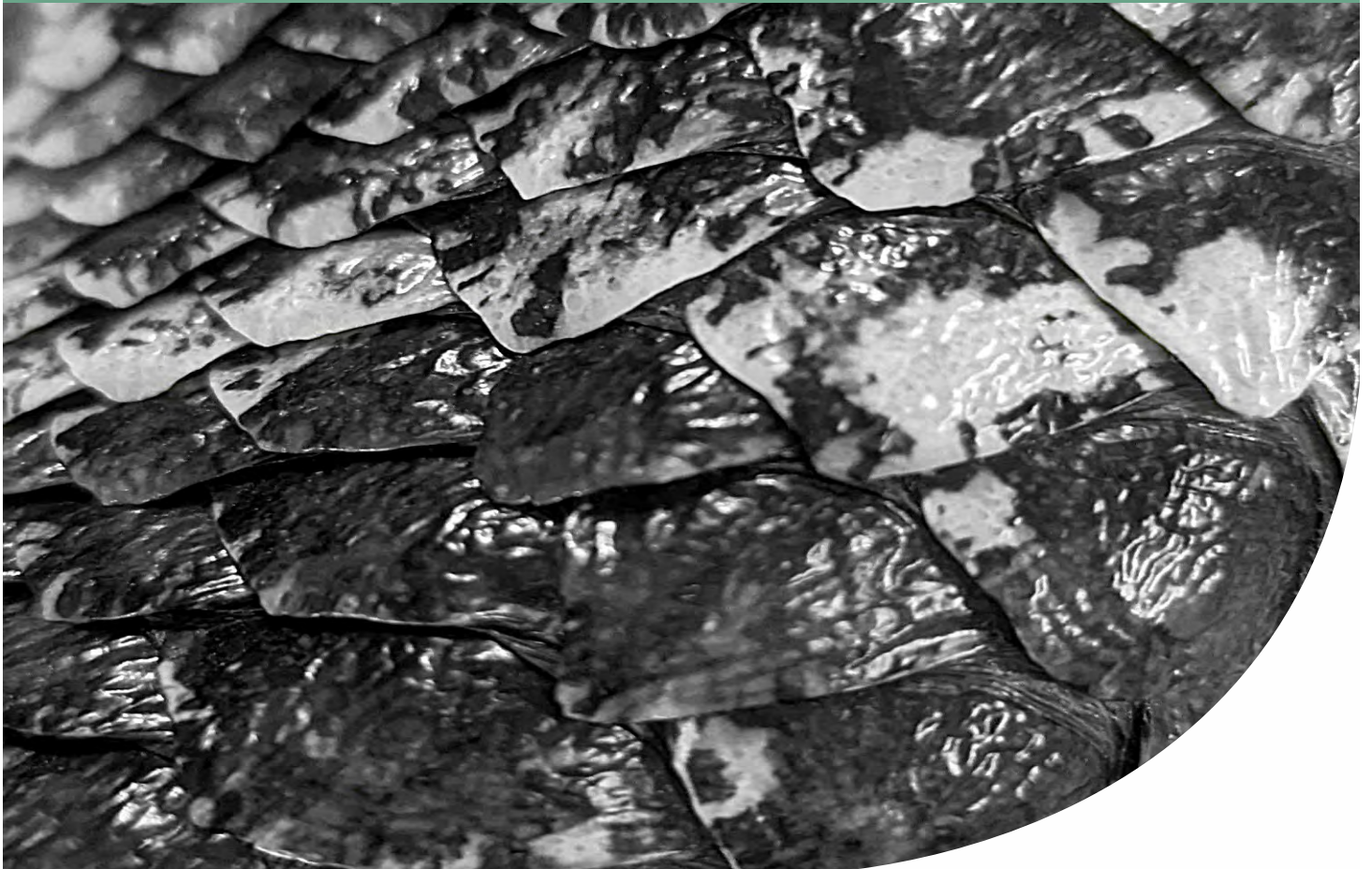


Targeted Reptile Assessment

Lake Claremont

Project No: EP24-019(01)

**Prepared for Town of Claremont
November 2024**



Targeted Reptile Assessment
Lake Claremont



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Executive Summary

Town of Claremont engaged Emerge Associates to conduct a targeted reptile assessment within Lake Claremont (referred to herein as the 'site').

As part of the assessment a desktop review of relevant background information was completed and a two-phase field survey was undertaken from 18 to 25 March (phase 1) and 7 to 22 October (phase 2). During the field survey trapping of reptiles was undertaken using a variety of methods and an assessment was made on the reptile habitat within the site to provide information on the reptile assemblage present and inform future management strategies.

Outcomes of the targeted reptile assessment include the following:

- The site consists of six broad habitat types:
 - **Ephemeral sedgeland:** areas of seasonally inundating sedgeland (4.24 hectares (ha)).
 - **Lake:** lake with areas of inundation ranging from permanent to semi-permanent (11.05 ha).
 - **Mixed woodland – closed understory:** Mixed woodland with native and non-native upper, mid and understory. Ground layer predominantly closed (7.45 ha).
 - **Mixed woodland – open understory:** Mixed woodland with native and non-native upper, mid and lower story with central areas containing a high proportion of *Eucalyptus gomphocephala*. Ground layer mostly open (6.45 ha).
 - **Riparian woodland:** Woodland primarily comprised of *Melaleuca* sp. and *Eucalyptus rudis* bordering Lake Claremont (2.83 ha).
 - **Parkland and hardstand:** Areas of lawn, hardstand and infrastructure with scattered trees (37.77 ha).
 - The two mixed woodland and riparian woodland habitats provide the most valuable habitat for reptiles in the site.
- Nine native reptile species were recorded within the site, which represents 90% of the species expected to occur based on statistical analysis.
- The majority of the reptiles recorded during the survey were in good condition.
- Almost all reptile species were recorded as juveniles and adults, indicating breeding populations exist across the species assemblage.
- No threatened or priority reptile species were recorded during the survey.
- No threatened or priority reptile species were considered to have a high or moderate likelihood of occurring within the site.

Appropriate reptile management strategies for the site may include the following:

- Increasing connectivity between the site and other areas of native vegetation in the region, such as Bold Park and Kings Park
- Creating connectivity to nearby areas with reptile habitat, such as Cottesloe Golf Club and Mt Claremont Oval bushland.
- Increasing habitat connectivity within the site by establishing dense vegetation between bushland patches
- Planting native grasses, herbs and shrubs at a high density
- Retaining fallen sticks, branches, leaf litter and wood debris
- Creating microhabitat spaces such as rocky outcrops, large boulders and fallen logs

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- Maintaining fire protection regimes
- Nomination of Lake Claremont as a relocation space for reptiles displaced due to development in the area.

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Appendix B

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Appendix D

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Habitat assessment sample data

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Abbreviation Tables

Table A1: Abbreviations – Organisations

Organisations	
ALA	Atlas of Living Australia
BoM	Bureau of Meteorology
EPA	Environmental Protection Authority
DAWE	Department of Agriculture, Water and the Environment (now DCCEEW)
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DoW	Department of Water (now DWER)
DPaW	Department of Parks and Wildlife (now DBCA)
DPIRD	Department of Primary Industries and Regional Development
DWER	Department of Water and Environmental Regulation
WAM	Western Australian Museum
WALGA	Western Australian Local Governments Association
WALIA	Western Australian Land Information Authority

Table A2: Abbreviations – Conservation codes

Conservation Codes	
CD	Conservation dependent
CR	Critically endangered
EN	Endangered
MI	Migratory
P1	Priority 1
P2	Priority 2
P3	Priority 3
P4	Priority 4
OS	Other specially protected
VU	Vulnerable

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Table A3: Abbreviations –Legislation

Legislation	
BAM Act	Biosecurity and Agriculture Management Act 2007
BC Act	Biodiversity Conservation Act 2016
CALM Act	Conservation and Land Management Act 1984
EBPC Act	Environment Protection and Biodiversity Conservation Act 1999
LA Act	Land Administration Act 1997
SCRM Act	Swan and Canning Rivers Management Act 2006

Table A4: Abbreviations – Units of measurement

Units of measurement	
DBH	Diameter at breast height
cm	Centimetre
ha	Hectare
km	Kilometre
m	Metre
m AHD	m in relation to the Australian height datum
mm	Millimetre

Table A5: Abbreviations - General

General terms	
AFD	Australian Faunal Database
DP (C3)	Category 3 Declared Pest
IBRA	Interim Biogeographic Regionalisation for Australia
MNES	Matters of National Significance
UFI	Unique Feature Identifier

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1 Introduction

1.1 Purpose

Emergence Associates (Emergence) were engaged by Town of Claremont to conduct a targeted reptile¹ assessment within various lots in Lake Claremont in Claremont, as shown **Figure 1** (referred to herein as the 'site').

The Town of Claremont recently developed the *Lake Claremont Management Plan 2022-2027* which seeks to better understand, manage and protect the native fauna within Lake Claremont. This targeted reptile assessment seeks to improve the knowledge of local reptiles within the site to this purpose.

1.2 Legislation and policy

Reptiles may be listed as threatened, extinct or specially protected under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the State *Biodiversity Conservation Act 2016* (BC Act). Threatened reptiles are classified as either 'critically endangered' (CR), 'endangered' (EN) or 'vulnerable' (VU). Extinct species are classified as 'extinct' (EX) or 'extinct in the wild' (EW)². Specially protected species are classified as 'migratory species' (MI), 'species of special conservation interest' (CD) or 'other specially protected' (OS). Commonwealth and/or State ministerial approval is required to impact threatened and specially protected reptiles.

Native reptiles that are not listed as threatened or specially protected, but are otherwise rare, under threat or poorly known, may be added to a Department of Biodiversity Conservation and Attractions (DBCA) priority list. Priority reptiles are classified as either 'priority 1' (P1), 'priority 2' (P2), 'priority 3' (P3) or 'priority 4' (P4). Priority listing does not afford direct statutory protection. However, the classification of priority species is taken into account during State and Local government approval processes.

Non-native reptiles that are regarded as having negative environmental or economic impacts may be listed as a 'declared pest' pursuant to the *State Biosecurity and Agriculture Management Act 2007* (BAM Act). Management of declared pests may be required during government approval processes.

Further information on legislation and policy relevant to reptile assessments is provided in **Appendix A**.

1.3 Scope of work

The scope of work was specifically to undertake a reptile assessment to the standard required of a 'targeted' reptile survey with reference to the Environmental Protection Authority's (EPA's) technical guidance (EPA 2020).

¹ *Chelodina colliei* (southwestern snake-necked turtle) were not targeted as a part of this survey but were opportunistically recorded.

² Currently there are no threatened species listed as extinct in the wild in Western Australia.

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As part of this scope of work, the following tasks were undertaken:

- Desktop study to provide contextual information and determine reptile likely to occur, including threatened, specially protected and priority taxa.
- A two-phase field survey to record a comprehensive list of reptiles and map reptile habitats.
- Analysis and mapping of contextual information and reptile habitat.
- Recommendations for reptile management.
- Documentation of the desktop study, methods, results, discussion and conclusions.

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2 Desktop Study

2.1 Site context

2.1.1 Location and extent

The site is located in the Town of Claremont in the Perth Metropolitan Region of Western Australia and extends over 45.55 hectares (ha) as shown in **Figure 1**. The site is bounded by residential properties as well as Scotch College on the south-west and Lake Claremont Golf Club in the south-east.

2.1.2 Climate

The South West region of Western Australia experiences a Mediterranean climate of hot dry summers and cool wet winters (BoM 2024). Recent rainfall at the closest weather station to the site has been somewhat inconsistent with long term averages, as shown in **Plate 1** (BoM 2024). Targeted surveys should be undertaken during the season that is most suitable for detection and identification of the targeted species (EPA 2020).

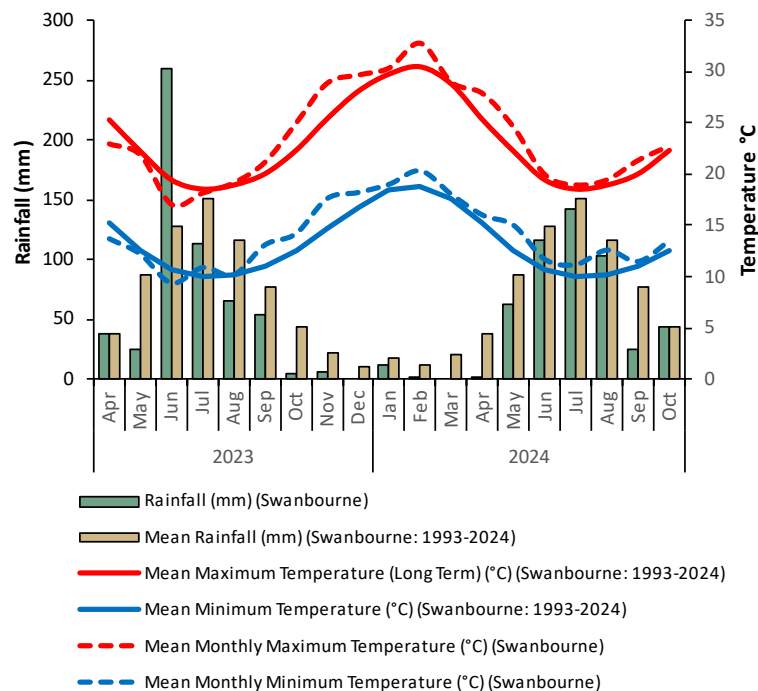


Plate 1: Rainfall and temperature 12 months prior to survey compared to long-term means

2.1.3 Geomorphology and soils

Landform and soils influence reptile habitat and species at regional and local scales. The site occurs on the Swan Coastal Plain, which is the geomorphic unit that characterises much of the Perth metropolitan area. The Swan Coastal Plain is approximately 500 km long and 20 to 30 km wide and is roughly bound by the Indian Ocean to the west and the Darling Scarp to the east. Broadly the Swan

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Coastal Plain consists of two sedimentary belts of different origin. Its eastern side comprises the Pinjarra Plain which formed from the deposition of alluvial material washed down from the Darling Scarp, while its western side comprises three dune systems that run roughly parallel to the Indian Ocean coastline (Seddon 2004). These dune systems, referred to as Quindalup, Spearwood and Bassendean associations, represent a succession of coastal deposition that has occurred since the late Quaternary period (approximately two million years ago) (Kendrick *et al.* 1991) and, as a result, they contain soils at different stages of leaching and formation. The site lies at the convergence of Quindalup and Spearwood dune systems, with the former located across the north west portion of the site and the latter in the remainder of the site with a small portion in the northwest site edge.

Examination of soil landscape mapping by DPIRD (2023) places the site in five soil landscape units, as described in **Table 1** and shown in **Figure 2**.

The site is not known to contain any restricted landforms or unique geological features.

Table 1. Soil landscape mapping units within the site (DPIRD 2023)

Soil landscape unit	Location within site	Description
S2 Phase	Northwest portion	CALCAREOUS SAND - white, fine to medium-grained, sub-rounded quartz and shell debris, of eolian origin
S7 Phase	Northwest corner, northeast and east portion, southeast corner	SAND - pale and olive yellow, medium to coarse-grained, sub-angular to sub-rounded quartz, trace of feldspar, moderately sorted, of residual origin
Spearwood wet, lake Phase	Central permanent lake area	Lake
Cps Phase	Area surrounding lake on all sides except northwest	peaty clay - dark grey and black, soft, variable organic content, some quartz sand in places, of lacustrine origin
LS1 Phase	Small overlap in eastern edge	LIMESTONE - light, yellowish brown, fine to coarse-grained, sub-angular to well rounded, quartz, trace of feldspar, shell debris, variably lithified, surface kankar, of eolian origin. Minor heavy minerals.

2.1.4 Topography

The elevation of the site ranges from 1 m in relation to the Australian height datum (mAHD) in the lake to 14 mAHD on the western side (DoW 2008) (**Figure 2**).

2.1.5 Hydrology and wetlands

Wetlands are areas of seasonally, intermittently or permanently waterlogged land such as poorly drained soils, ponds, billabongs, lakes, swamps, tidal flats, estuaries, rivers and their tributaries (Wetlands Advisory Committee 1977). Many wetlands provide important reptile habitat and support high levels of reptile biodiversity and endemism.

Wetlands of national or international significance may be afforded special protection under Commonwealth or international agreements. Review of the *Ramsar List of Wetlands of International Importance* (DBCA 2017) and *A Directory of Important Wetlands in Australia – Western Australia*

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(DBCA 2018) indicates that no Ramsar or listed 'important wetlands' are located within or near the site.

Examination of the Department of Water and Environmental Regulation (DWER) hydrography linear dataset (DWER 2018) shows one wetland or water related feature occurs within the site: "lake – perennial" (Lake Claremont).

The *Geomorphic Wetlands of the Swan Coastal Plain* dataset maps geomorphic wetland features and classifies them based on their landform shape and water permanence (DBCA 2023). Each wetland feature is assigned to one of three management categories: 'conservation', 'resource enhancement' and 'multiple use'.

A review of the *Geomorphic Wetlands, Swan Coastal Plain* dataset indicated that Lake Claremont is mapped as a conservation category sumpland wetland (unique feature identifier (UFI) 8199) (DBCA 2021a). The location of the geomorphic wetland in the site is shown in **Figure 3**.

2.1.6 Regional vegetation

Vegetation types and resulting reptile habitats strongly influence the diversity and composition of reptile taxa present within an area. Native vegetation is described and mapped at different scales in order to illustrate patterns in its distribution. At a continental scale the *Interim Biogeographic Regionalisation for Australia* (IBRA) divides the Swan Coastal Plain into two floristic subregions (Environment Australia 2000).

The site is contained within the 'SWA02' or Perth subregion, which is characterised as mainly containing *Banksia* low woodland on leached sands with *Melaleuca* swamps where ill-drained; and woodland of *Eucalyptus gomphocephala* (tuart), *E. marginata* (jarrah) and *Corymbia calophylla* (marri) on less leached soils (Beard 1990). This subregion is recognised as a biodiversity hotspot and contains a wide variety of endemic fauna species.

Variations in native vegetation can be further classified based on regional vegetation mapping. DBCA (2019) mapping shows the site as comprising the Karrakatta Complex – Central and South which is described as 'open forest of *Eucalyptus gomphocephala* - *Eucalyptus marginata* - *Corymbia calophylla*' (Hedde *et al.* 1980).

2.1.7 Historic land use

Detailed historical records of the land use and modifications of Lake Claremont are available in the latest management plan *Lake Claremont Management Plan 2024-2029* (Town of Claremont 2024). Namely, the site has been used as a dumping ground for building material waste (Town of Claremont 2024).

Over the course of European settlement Lake Claremont (previously known as Butler's Swamp) has experienced an increase in drainage due to altered hydrological regimes from urbanisation, commercial tree felling and general vegetation clearing.

Review of historical images available from 1953 onwards shows that the majority of the site was cleared of native vegetation prior to 1953 (WALIA 2024). With the exception of the northwestern

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portion of the site, the land adjacent to the lake has remained unvegetated until 2010 when revegetation works began in the north and east.

2.1.8 Bush Forever

The Government of Western Australia's Bush Forever policy is a strategic plan for conserving regionally significant bushland within the Swan Coastal Plain portion of the Perth Metropolitan Region. The objective of *Bush Forever* is to protect comprehensive representations of all original ecological communities by targeting a minimum of 10% of each vegetation complex for protection (Government of WA 2000a). *Bush Forever* sites are representative of regional ecosystems and habitat and have a key role in the conservation of Perth's biodiversity.

The majority of the site comprises *Bush Forever Site 220* (Lake Claremont, Claremont/Swanbourne). The site is listed as being a protected area boundary with no bushland or bushland linkage and mostly consists of open water and vegetated wetland (Government of WA 2000b).

The location of *Bush Forever Site 220* is shown in **Figure 2**.

2.1.9 Ecological linkages

Ecological linkages are linear landscape elements that allow the movement of fauna, flora and genetic material between areas of remnant habitat. This exchange of genetic material between vegetation remnants improves the viability of those remnants by allowing greater access to breeding partners and food sources, refuge from disturbances such as fire and maintenance of genetic diversity of plant communities and populations. Ecological linkages are ideally continuous or near-continuous as the more fractured a linkage is, the less ease flora and fauna have in moving within the corridor (Alan Tingay and Associates 1998).

The Perth Biodiversity Project, supported by the Western Australian Local Government Association (WALGA), identified and mapped regional ecological linkages within the Perth Metropolitan Region (WALGA and PBP 2004).

Ecological linkage no. 4 runs west to east through the majority of the site providing connectivity between the coast near Swanbourne and Kings Park. Review of aerial imagery indicates that the vegetation within the site is highly fragmented from surrounding vegetation and thus limiting its linkage function.

2.1.10 Reptile database searches

The Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) has compiled various datasets relating to 'matters of national environmental significance' (MNES) (DCCEEW 2024). The *Protected Matters Search Tool* provides general guidance on threatened and specially protected fauna listed under the EPBC Act that may occur within a location based on validated records and less reliable unvalidated habitat distribution modelling (DCCEEW 2024).

DBCA's *Threatened and Priority Fauna* database as well as the spatial portal of the Atlas of Living Australia (ALA) contain records of fauna species including those which are threatened, specially protected and priority in Western Australia (ALA 2024; DBCA 2024b). Searches of these databases

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provide point data for fauna within a location, comprising validated and historical unvalidated records.

A search was conducted for fauna species that have been recorded within a 10 km radius of the site using the *Protected Matters Search Tool* (DCCEEW 2024), *NatureMap* (DBCA 2024a), DBCA's conservation significant fauna database (reference no. 07-0324FA), Atlas of Living Australia (ALA 2024) and literature references.

A total of 86 reptile species were identified from database searches as occurring or potentially occurring within 10 km of the site³ as listed in **Appendix B**.

2.1.11 Pests

The term 'pest reptile' can refer to any reptile that requires some form of action to reduce its effect on the economy, the environment, human health and amenity. Pest reptile species are generally not native but some Australian or Western Australian fauna may also be considered pests.

A particularly invasive or detrimental pest species may be listed as a 'declared pest' pursuant to Western Australia's *Biosecurity and Agriculture Management Act 2007* (BAM Act), indicating that it warrants special management to limit its spread. Current pest status and control categories for Western Australia are provided in the *Western Australian Organism List* (DPIRD 2022). Further information on categories of declared pests is provided in **Appendix A**.

2.1.12 Previous surveys

No comprehensive reptile surveys in Lake Claremont have been undertaken to date. Town of Claremont is aware of the population of *Chelodina colliei* (southwestern snake-necked turtle) present within the lake from previous surveillance undertaken by Murdoch University in 2022.

2.2 Likelihood of occurrence

The distribution and habitat preferences of the threatened and priority reptile species listed in **Appendix B** was reviewed against site context information described in **Section 2.1**. Likelihood of occurrence of threatened, specially protected and priority reptile species within the site was classified as 'high', 'moderate', 'low', 'very low', 'negligible' or 'nil' as outlined in **Table 2**.

Table 2: Likelihood of occurrence assessment categories and definitions

		Reliable record ¹		Unreliable record ²
		Access to site not impeded	Access to site impeded	
Habitat	Suitable	High	Very low	Negligible
	Potentially suitable	Moderate		
	Unsuitable	Low		
	Absent	Nil		

¹Reliable record defined as DBCA or validated ALA record from the last ~20 years, ²Unreliable record defined as record >20 years old or PMST prediction.

³ Includes native and non-native species

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No threatened, specially protected or priority species were classified as having a 'high' or 'moderate' likelihood of occurrence.

All of the conservation significant reptile species identified in the desktop assessment (six species) were considered as having a 'very low' or 'nil' likelihood of occurrence. Refer to **Appendix C** for detail on individual species likelihood of occurrence.

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3 Methods

3.1 Field survey

Ecologists from Emerge visited the site on 18 to 25 March (phase 1) and 7 to 22 October (phase 2) 2024 to conduct the targeted reptile survey under the DBCA Regulation 27 licence BA27001070 and DPIRD scientific licence WAEC 24-02-08. Field survey dates and conditions are presented in **Table 3**.

Table 3: Field survey dates and weather conditions (Swanbourne Station – 9215)

Date	Minimum Temperature (°C)	Maximum Temperature (°C)	Rainfall (mm)
Phase 1			
18 March 2024	17.5	25.2	0
19 March 2024	14.5	26.9	0
20 March 2024	15.0	29.6	0
21 March 2024	17.6	29.0	0
22 March 2024	17.4	29.5	0
23 March 2024	16.2	28.4	0
24 March 2024	15.3	25.1	0
25 March 2024	14.9	27.9	0
Phase 2			
7 October 2024	12.7	22.0	0
8 October 2024	13.5	21.4	0
9 October 2024	13.8	20.8	0.6
10 October 2024	12.7	28.2	0
11 October 2024	18.0	29.1	0
12 October 2024	17.4	21.0	0
13 October 2024	12.3	22.2	0
14 October 2024	15.7	22.0	0
22 October 2024	11.0	21.0	0.2

3.1.1 Sampling

A range of techniques was used to assess habitat values for reptiles and detect the presence of reptiles within the site including habitat assessments, pitfall and funnel trap arrays, camera traps and active searches.

3.1.1.1 Habitat assessments

Sampling of reptile habitats was undertaken using non-permanent habitat assessment points. Habitat assessments were conducted across the site within different habitats. The habitat

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assessment was completed over an approximate 10-20 m radius of the sample location. The position of each sample was recorded with a hand-held GPS receiver (± 5 m accuracy).

The data recorded within each sample included:

- site details (site name, site number, observers, date, location)
- environmental information (soil type, bare ground, rock outcropping, litter, time since last fire event, water features, disturbance and microhabitat types)
- biological information (faunal group(s), dominant vegetation type, presence of canopy, shrub and ground vegetation layers)
- other notes as required.

3.1.1.2 Pitfall and funnel trap arrays

Four pitfall and funnel trap arrays were deployed.

The pitfall traps comprised a 20 L bucket dug flush into the substrate with 30 cm high flywire drift fencing connecting each pit in a line. The length of each array varied from 15-30 m depending on habitat conditions. Funnel traps (18 cm x 18 cm x 75 cm) were placed in an alternating fashion between each pitfall trap and a pair of funnel traps were located at the ends of each array (refer **Plate 2**). Locations of each trap array are shown in **Figure 4**.



Plate 2: Example of pitfall and funnel trap set up (site ID 4)

At least one array was deployed within each habitat type considered suitable for reptiles, with multiple installed where habitats were large and/or spatially distinct.

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A small amount of soil and a piece of egg carton was placed in the bottom of each pitfall trap and vegetation was placed over each funnel trap to provide shelter for fauna. Pit and funnel traps were checked within 3 hours of sunrise and at midday each day.

Two Elliot traps (9 cm x 10 cm x 33 cm) were placed in vegetation near each pitfall and funnel trap array but were removed after two days due to interference from the local quenda population.

3.1.1.3 Camera traps

Four camera traps (Ltl acorn Ltl-5310) were deployed during each survey phase, with each camera located close to a trap array. Each camera was set up to target microhabitats which were considered to likely provide shelter or basking habitat for reptiles.

3.1.1.4 Active searches

Transects were traversed on foot across the site, during the day, and the presence of any reptile species was recorded. Microhabitats such as logs, rocks and leaf litter were investigated and evidence of reptile individuals or secondary evidence such as tracks, scats and skeletal remains was also noted.

3.1.2 Survey effort

Survey effort during the targeted reptile survey was consistent with the technical guidance provided in *Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA 2020).

Trapping was undertaken over two phases which were each during the recommended reptile trapping season for the Swan Coastal Plain. Each trapping period was for a period of seven nights. A summary of survey effort is shown in **Table 4**. Logged tracks are shown in **Figure 4**.

Table 4: Summary of survey effort (number of traps x survey nights)

Survey period	Sample type		
	Pitfall	Funnel	Camera
Phase 1 (March 2024)	147	203	28
Phase 2 (October 2024)	147	203	28
Total	294	406	56

3.1.3 Demographic information

Where possible, a range of demographic information was recorded for each directly captured reptile. This included mass, snout-vent length, total length, sex (where dimorphic variation was obvious externally), life stage and condition. Each individual was marked with a non-toxic red marker for mark-recapture purposes (where possible and ethical). All animals were released in vegetation adjacent to point of capture.

3.2 Data analysis

3.2.1 Reptile identification

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Reptiles observed during the survey were identified in the field to the lowest taxonomic level. Where reptiles were unknown, photographs and/or noted observations were recorded. Unknown reptiles were identified through the use of taxonomic keys and field guides either *in situ* or following the field survey using digital photographs.

3.2.1.1 Nomenclature and sources of information

Taxonomy and nomenclature of scientific and common names for mammals, reptiles and amphibians follow the *Western Australian Museum (WAM) Checklist of the Terrestrial Vertebrate Fauna of Western Australia* (WAM 2022). Where common names were not provided by the WAM or the AFD, these have been derived from other sources as noted.

Literature listed in **Appendix A** represent the main publications used to identify reptile species and habitats within the site.

3.2.2 Reptile habitat

Reptile habitats were described according to the habitat assessment results as well as the dominant flora species and vegetation type present, as determined from observations made during the field survey.

The identified reptile habitats were mapped on aerial photography with the boundaries interpreted from aerial photography and notes taken in the field.

3.3 Survey limitations

It is important to note the specific constraints imposed on surveys and the degree to which these may have limited survey outcomes. An evaluation of the survey methodology against standard constraints outlined in the EPA's document *Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment* (EPA 2020) is provided in **Table 5**.

Table 5: Evaluation of survey methodology against standard constraints outlined in the EPA's Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020)

Constraint	Degree of limitation	Details
Level of survey	No limitation	A targeted survey was undertaken. The level of survey and survey effort are considered adequate to assess the reptiles and habitat values within the site.
Scope	No limitation	The survey focused on reptiles (with the exception of <i>Chelodina colliei</i>) and habitat values, with particular focus on conservation significant taxa with potential to occur within the site.
Proportion of reptiles identified, recorded and/or collected.	No limitation	All observed reptiles were identified where possible. Some individuals were viewed opportunistically and unable to be captured but are expected to represent the same species captured in the trapping effort.
Sources of information e.g. previously available information (whether historic or recent) as distinct from new data.	No limitation	Adequate information was available from database searches, previous surveys and literature references.

Targeted Reptile Assessment

Lake Claremont



Constraint	Degree of limitation	Details
The proportion of the task achieved and further work which might be needed.	No limitation	The task was achieved in its entirety.
Experience level of personnel	No limitation	This targeted assessment was undertaken by qualified zoologists with four and five years of zoological experience in Western Australia, particularly on the Swan Coastal Plain. Technical review was undertaken by a senior environmental consultant with over 14 years' experience in environmental science in Western Australia.
Suitability of timing, weather and season	No limitation	Each survey phase was undertaken during the recommended season for reptiles in the Swan Coastal Plain. Weather was suitable during each phase with clear weather and warm temperatures across each phase.
Completeness	No limitation	The desktop assessment and field survey components of the survey were completed comprehensively.
Spatial coverage and access	No limitation	Site coverage was comprehensive (track logged).
	No limitation	All parts of the site could be accessed as required.
Survey intensity	No limitation	The intensity of the survey was adequate especially with regards to the size of the site and the relatively low habitat value present.
Influence of disturbance	No limitation	The site is highly modified due to historical disturbance. However, no recent disturbance was noted that may have affected outcomes of the survey.
Adequacy of resources	No limitation	All resources required to perform the survey were available.
Compliance with EPA (2020) guidance	No limitation	The EPA guidance requires that a full list of all reptile species with potential to occur within the site is compiled. As part of this assessment a comprehensive list of reptile species of conservation significance was compiled. Non-conservation taxa with potential to occur within the site were not compiled into a list but are provided as raw data in Appendix B . Given that all species with potential to occur within the site are still identified within the relevant appendices this is not considered to affect the outcomes of this assessment.

Targeted Reptile Assessment Lake Claremont



4 Results

4.1 General site overview

The site is comprised primarily of parkland, modified bushland and Lake Claremont itself. The bushland is made up of a range of native and non-native plant species with a ground layer that ranges from completely absent along the slopes in the north-west, to woodchip mulch in the north to dense weedy undergrowth in the northeast and east along Lake Claremont. The site consists of sandy soils with little topsoil moisture and little subsoil moisture aside from some bushy patches to the east. There is evidence of the rubbish dump historically present in the site, with building debris in the soil throughout the bushland.

The lake is partially ephemeral with some permanent standing water in the southern portion in late summer/autumn. The rest of the lake is dry during summer and autumn and is accessible by terrestrial species.

The remaining area is hardstand, lawn, scattered trees and infrastructure serving recreation purposes for members of the public and providing limited habitat for reptiles.

4.2 Reptiles

4.2.1 Species inventory

A total of 9 native reptile species were identified to species level and two additional reptiles to genus during the field survey. A complete species list is available in **Appendix D**.

4.2.2 Threatened, specially protected and priority reptiles

No occurrences of threatened, specially protected or priority reptile species were recorded within the site.

4.2.3 Declared pests

No reptile species listed as a declared pest (C3) pursuant to the BAM Act were found to occur in the site.

4.2.4 Species richness

A total of nine species were recorded from 16 trap nights (two trapping phases and an additional active search day). A species accumulation curve derived from sample data is presented in **Plate 3**.

Targeted Reptile Assessment Lake Claremont

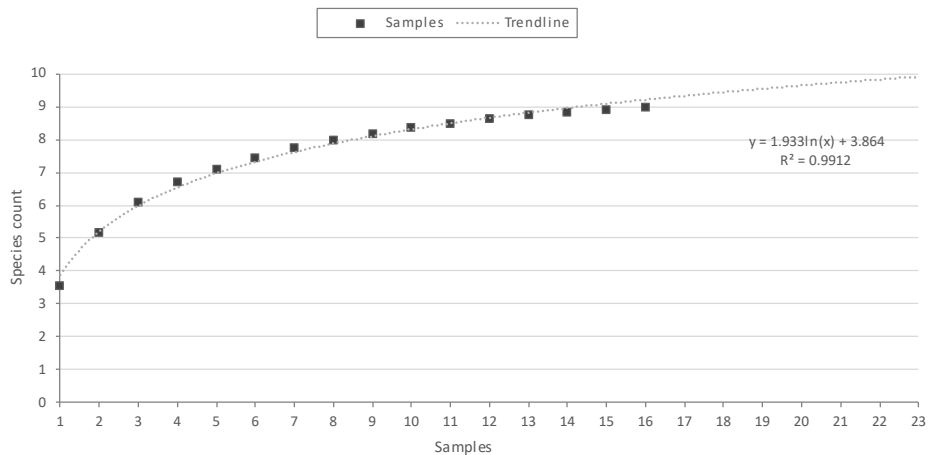


Plate 3: Species accumulation curve derived from sample data ($y = 1.933\ln(x) + 3.864$, $R^2 = 0.9912$).

Species richness for trappable reptiles was estimated in PRIMER v6 to be approximately 10 (Jackknife1, Chao2). Based on the trend of the species accumulation curve approximately 23 trap nights would be required to capture the remaining species.

4.3 Reptile habitat

Ten habitat assessments were undertaken within the site, as detailed in **Appendix E**. Six broad reptile habitats were identified, as listed in **Table 6**.



A description, the size of the area and a representative photograph of each habitat is provided in **Table 6**. The locations of each reptile habitat and habitat assessment are shown on **Figure 5**.

Targeted Reptile Assessment

Lake Claremont





Table 6: Reptile habitats identified within the site

Reptile habitat	Description	Habitat sample/s	Trap array/s	Total area (ha)	Proportion of site (%)	Representative photograph
Ephemeral sedgeland	<p>Area of seasonally inundating sedgeland found in the north and east of Lake Claremont. Includes some small patches of <i>Melaleuca</i> sp.</p> <ul style="list-style-type: none"> • Low microhabitat complexity. • Microhabitat is primarily comprised of dense sedges. • Provides little function aside from shelter for some reptiles when not inundated (and for <i>Chelodina colliei</i> during inundated seasons). 	1	-	4.24	6.07	
Lake	<p>Lake with areas of inundation ranging from permanent to semi-permanent.</p> <ul style="list-style-type: none"> • Provides habitat for <i>Chelodina colliei</i>. • Lakes edge may provide habitat for <i>Notechis scutatus</i> (tiger snake). • Provides limited habitat for other reptiles due to seasonal inundation. 	1	-	11.05	15.84	

Targeted Reptile Assessment

Lake Claremont

Table 7: Reptile habitats identified within the site



Reptile habitat	Description	Habitat sample/s	Trap array/s	Total area (ha)	Proportion of site (%)	Representative photograph
Mixed woodland – closed understory	<p>Mixed woodland with native and non-native upper, mid and lower story. Ground layer predominantly closed with small patches of bare ground cover.</p> <ul style="list-style-type: none"> Moderate microhabitat complexity. Microhabitats consist of woody debris, fallen logs, patches of dense leaf litter and artificial pallet habitats. These make up sheltering and basking habitat for reptiles. Soils are mostly sandy and suitable for reptile burrowing. Disturbances predominantly from weed intrusion. Evidence of gradual weed removal across the habitat. 	2	2	7.45	10.67	
Mixed woodland – open understory	<p>Mixed woodland with native and non-native upper, mid and lower story with central areas containing a high proportion of <i>Eucalyptus gomphocephala</i> trees. Ground layer mostly open with patches in the centre and north-west of the site lacking a ground layer entirely.</p> <ul style="list-style-type: none"> Low microhabitat complexity. Microhabitats consist of woody debris, fallen logs and occasional artificial pallet habitats. These make up sheltering and basking habitat for reptiles. Very sandy soils. West of the habitat on a south-east facing slope. Some disturbance from weeds. Evidence of informal walking tracks through fenced areas. 	3	2	6.45	9.24	

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Lake Claremont



Table 7: Reptile habitats identified within the site (continued)

Reptile habitat	Description	Habitat sample/s	Trap array/s	Total area (ha)	Proportion of site (%)	Representative photograph
Riparian woodland	<p>Woodland primarily comprised of <i>Melaleuca</i> sp. and <i>Eucalyptus rudis</i> bordering Lake Claremont. Has a patchy extent and is generally narrow.</p> <ul style="list-style-type: none"> • Low microhabitat complexity. • Microhabitats consist of woody debris and muddy soils. • Predominantly clay soils with some sandy patches. • Primarily serves a transition function from the wetland/lake to bushland habitats due to lack of shelter and protection on the ground level. • Areas of high weed disturbance. 	2	1	2.83	4.05	
Parkland and hardstand	<p>Areas of lawn, hardstand and infrastructure which serve recreational functions to members of the public with scattered trees and planted tree lines.</p> <ul style="list-style-type: none"> • Low microhabitat complexity. • Primarily serve a connectivity function for larger reptiles that may traverse between other habitats. 	1	-	37.77	54.13	

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5 Discussion

5.1 Reptiles

The nine reptile species recorded during the survey can mostly be described as ubiquitous habitat generalists, being less sensitive to disturbance or urbanisation. Even those with a higher degree of habitat specialisation, such as west-coast long tailed *Ctenotus*, still only require sandy soil which is typical of most urban bushlands in Perth. Overall, the reptile assemblage at Lake Claremont is typical of a suburban backyard. Given the recent (past 30 years) of natural area management being undertaken by Town of Claremont, with only approximately 10 years of vegetated understory and very little connectivity to surrounding bushland, this is an unsurprising finding. Additionally, four species of skink were recorded, with the Swan Coastal Plain taxa being the least sensitive reptile group to habitat fragmentation, and persisting in smaller patches of bushland for longer than other reptiles (How and Dell 2000).

There was a lack of higher trophic level species recorded within the site, with all of the species present being predominantly insectivorous. No varanids, snakes or burton's legless lizards were recorded, all of which represent saurophagous reptile groups which would prey on smaller reptiles, the latter of which is highly common across Perth and have been recorded in the local area. Both burrowing snakes, *Neelaps calonotos* and *Neelaps bimaculatus*, and *Varanus gouldii*, Gould's sand goanna are distributed across the Swan Coastal Plain and have been recorded consistently in Bold Park over the past 35 years (How *et al.* 2022).

All trapping periods were undertaken during the optimal season for reptile surveys on the Swan Coastal Plain and in optimal weather conditions according to *Terrestrial vertebrate fauna surveys for environmental impact assessment*. It is likely then that the overall lack of higher trophic level reptiles and the number of common habitat generalists found in the site are likely due to the altered and immature vegetation structure, lack of natural ground layer vegetation in most areas, small size of fragmented, fenced vegetated areas and the frequency and degree of disturbance associated with use of the reserve by pedestrians and their dogs.

There was a small selection of unavoidable bycatch during the survey. *Isodoodon fusciventer* (Quenda, P4) were recorded on the cameras several times, as well as a number of common birds. Both *Vulpes vulpes* (European red fox, DP(C3)) and a stray *Felis catus* (cat) were recorded on cameras across the site. Four frog taxa were captured in pitfall and funnel traps: *Crinia glauerti* (rattling froglet), *Limnodynastes dorsalis* (western banjo frog), *Heleioporus eyrei* (moaning frog) and *Litoria adelaidensis* (slender tree frog). Three of the frogs were found dead from dehydration and reported to WAEC as an adverse event in accordance with licence terms. Methods were subsequently amended to reduce likelihood of event recurrence.

5.1.1 Population demographics

A variety of ages was captured for each species, ranging from juvenile to adult. It is difficult to determine the sex of most species of reptile captured as there is little sexual dimorphism within the species. As such, only bobtails were able to be sexed, with one male, two females and two unable to be determined being recorded.

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Life stage was determined based on total length with individuals measuring under two thirds of the total length in the literature were categorised as juveniles. Consequently, all the species captured with the exception of the marbled gecko and south-western snake-necked turtle were determined to have individuals ranging from young juveniles to breeding adults. Dwarf skinks had an age ratio of almost 50:50 adults to juveniles, with elegant sliders having 58% adults and two toed-mulch skink having 70% adults. This provides evidence of reproductive populations of reptiles in Lake Claremont.

All captured individuals were categorised as being in 'good' condition except one two-toed mulch skink (out of a total of 10) and one elegant slider (out of a total of 18), both of which were emaciated and near death. Two individuals out of a total of 174 reptile captures indicate that the populations of each species within Lake Claremont are healthy.

It is difficult to estimate population size from the survey due to the small number of reptiles caught in each phase and as not all individuals were marked, largely to avoid stress to the individuals captured, particularly smaller species like dwarf skinks.

5.2 Reptile habitat

The quality of the reptile habitat within the site is strongly linked to the history of the site. The area surrounding Lake Claremont has been subject to a high level of ongoing historical disturbance and has only recently been revegetated. This is reflected in the lack of dense undergrowth in the northern areas particularly. Where a dense shrub layer is present, it comprises predominantly *Rhagodia baccata*, a coloniser species commonly used in coastal rehabilitation. The **mixed woodlands** habitats contain an array of non-native species (*Ficus macrophylla* and *Eucalyptus grandis*) and as well as species which do not reflect the endemic vegetation of the site (such as *Callitris preissii*). These habitats also lack the quantity and density of microhabitats that reptiles prefer, namely deep sandy soil with penetrating soil moisture from longer mulching of leaf litter and woody debris, fallen logs, rocks and areas of fallen debris (bark strips fallen from *Banksia* spp and *Eucalyptus* spp., leaf litter dropped from native trees). Additionally, the lack of a native grass and herb layer is stark in comparison to other native bushlands within the local region. **Plate 4** depicts a patch of woodland in Shenton Park which also lies within the Karakatta vegetation complex and shows the diverse strata and microhabitats present in native vegetation endemic to the area. While vegetation complexes are heterogenous and will therefore vary across regions, this provides an example of what native undergrowth may look like in a less disturbed system. In comparison the ground layers of the woodland habitats within the site are presented in **Table 6**.

Targeted Reptile Assessment Lake Claremont



Plate 4: Example of an area of remnant bushland in the same vegetation complex as Lake Claremont

The **riparian woodland** habitat is older than the rest of the vegetation with the patch in the northwestern portion along the edge of Lake Claremont, seemingly visible in aerial imagery as far back as 1953 (WALIA 2024). Evidence of disturbance is still present in this habitat but the melaleuca and large *Eucalyptus rudis* trees provide leaf litter and fallen bark which offer shelter for most small reptiles. It is unlikely the patches which become small islands when the lake is inundated support many reptiles but do provide habitat for species such as snakes, if they persist in the area.

5.3 Reptile management

Lake Claremont lies on the intersection of the Quindalup and Spearwood dune systems, two regions which have a unique and large biodiversity of reptiles (How and Dell 2000; Gozzard 2007). Protecting and managing bushland remnants within these regions is a key factor in preserving this biodiversity. Additionally, the site lies within a mapped ecological linkage and is classified as a *Bush Forever* site. These factors place Lake Claremont in an important position to potentially create a stronghold for reptiles in the area, supporting Bold Park and Kings Park.

Within Perth, fragmentation of bushland, both in the reduction of the size and connectivity of bushland is a significant driver of decline in reptile abundance and richness (How *et al.* 2022). This is particularly relevant to snakes and varanids; the abundance and even presence of these groups is closely related to the size of remnant bushland (How and Dell 1994). As such, the best form of management for reptile populations is an increase in habitat connectivity and extent. For the site this would mean an increase in connectivity to nearby areas outside Lake Claremont, but also creating connectivity within the fragments in the site.

The ultimate goal of connectivity would be to supplement the individuals within the site with those which could traverse from larger areas of bushland, like Bold Park and Kings Park. However, the high level of urban development located between the site and these remnants may mean this is unattainable. More achievable goals for connectivity may include the development of native vegetation under the fig trees on Narla Rd to connect habitat to the Cottesloe Golf Club, or the

Targeted Reptile Assessment

Lake Claremont



creation of a fauna underpass under Alfred Rd to connect to the bushland on the west side of Mt Claremont Oval.

Within the site, connecting the fragments of vegetation with dense layers of ground layer vegetation would increase the effective habitat size for reptiles.

Other management strategies would relate to the improvement of habitat quality. This can be separated into vegetation structure and microhabitats. Reptiles require ground layer vegetation for shelter, protection from predation, safe foraging and for breeding. The planting of native grasses, herbs and low shrub layer plants at a high density would provide this shelter and hopefully promote invertebrate abundance and diversity through increasing soil moisture and detritus. This would improve habitat conditions for other native fauna including quenda.

Whilst planting will ultimately create microhabitats, inclusion of artificial microhabitats, like the pallet habitats currently in the site, will be an key factor in improving reptile habitat by creating immediate spaces for reptiles to shelter, burrow beneath, bask and forage.

The *Lake Claremont Management Plan 2024-2029* outlines a range of management strategies currently in place for the site which may improve reptile habitat (Town of Claremont 2024). However, further refining management of the vegetation by not removing fallen sticks, bark or logs from vegetated areas during weeding or cleanup works would retain valuable natural microhabitat features for reptiles. Supplementing this with the placement of rocky outcrops, individual boulders and fallen logs which are excavated partially into the ground would create basking habitat and heterogeneity in the soil and ground layer.

Intense, single-event bushfires are particularly devastating to reptiles in urban environments due to the lack of refugia and no possibility for individuals to immigrate to surrounding areas (How and Dell 2000). Therefore, fire management of the Lake Claremont bushland is of key importance to the preservation of species in the site.

Lastly, it may be possible for Town of Claremont to nominate Lake Claremont as a relocation area for reptiles during development works within the town, subject to consultation with DBCA. This would provide a alternative method for increasing reptile species richness and genetic diversity in the site, which is currently limited due to the lack of extensive habitat connectivity.

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6 Conclusions

Outcomes of the targeted reptile assessment include the following:

- The site consists of six broad habitat types:
 - **Ephemeral sedgeland:** areas of seasonally inundating sedgeland (4.24 hectares (ha)).
 - **Lake:** lake with areas of inundation ranging from permanent to semi-permanent (11.05 ha).
 - **Mixed woodland – closed understory:** Mixed woodland with native and non-native upper, mid and understory. Ground layer predominantly closed (7.45 ha).
 - **Mixed woodland – open understory:** Mixed woodland with native and non-native upper, mid and lower story with central areas containing a high proportion of *Eucalyptus gomphocephala*. Ground layer mostly open (6.45 ha).
 - **Riparian woodland:** Woodland primarily comprised of *Melaleuca* sp. and *Eucalyptus rudis* bordering Lake Claremont (2.83 ha).
 - **Parkland and hardstand:** Areas of lawn, hardstand and infrastructure with scattered trees (37.77 ha).
 - The two mixed woodland and riparian woodland habitats provide the most valuable habitat for reptiles in the site.
- Nine native reptile species were recorded within the site, which represents 90% of the species expected to occur based on statistical analysis.
- The majority of the reptiles recorded during the survey were in good condition.
- Almost all reptile species were recorded as juveniles and adults, indicating breeding populations exist across the species assemblage.
- No threatened or priority reptile species were recorded during the survey.
- No threatened or priority reptile species were considered to have a high or moderate likelihood of occurring within the site.

Appropriate reptile management strategies for the site may include the following:

- Increasing connectivity between the site and other areas of native vegetation in the region, such as Bold Park and Kings Park
- Creating connectivity to nearby areas with reptile habitat, such as Cottesloe Golf Club and Mt Claremont Oval bushland.
- Increasing habitat connectivity within the site by establishing dense vegetation between bushland patches
- Planting native grasses, herbs and shrubs at a high density
- Retaining fallen sticks, branches, leaf litter and wood debris
- Creating microhabitat spaces such as rocky outcrops, large boulders and fallen logs
- Maintaining fire protection regimes
- Nomination of Lake Claremont as a relocation space for reptiles displaced due to development in the area.

Targeted Reptile Assessment Lake Claremont



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Lake Claremont



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Targeted Reptile Assessment Lake Claremont



7.2 Online references

The online resources that have been utilised in the preparation of this report are referenced in **Section 7.1**, with access date information provided in **Table R 1**.

Table R 1 Access dates for online references

Reference	Date accessed	Website or dataset name
Atlas of Living Australia	21 October 2024	Atlas of Living Australia – Spatial Portal
BoM (2024)	21 October 2024	Climate Data Online
DBCA (2024)	23 October 2024	NatureMap
DCCEEW (2024)	21 October 2024	Australian Faunal Directory
DCCEEW (2024)	23 October 2024	Protected Matters Search Tool
WALIA (2024)	23 October 2024	Landgate Map Viewer

Targeted Reptile Assessment Lake Claremont



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Figures



Figure 1: Site Location

Figure 2: Hydrography, Soils and Topography

Figure 3: Wetlands and Environmental Features

Figure 4: Trap Array Locations and Survey Effort

Figure 5: Fauna Habitat

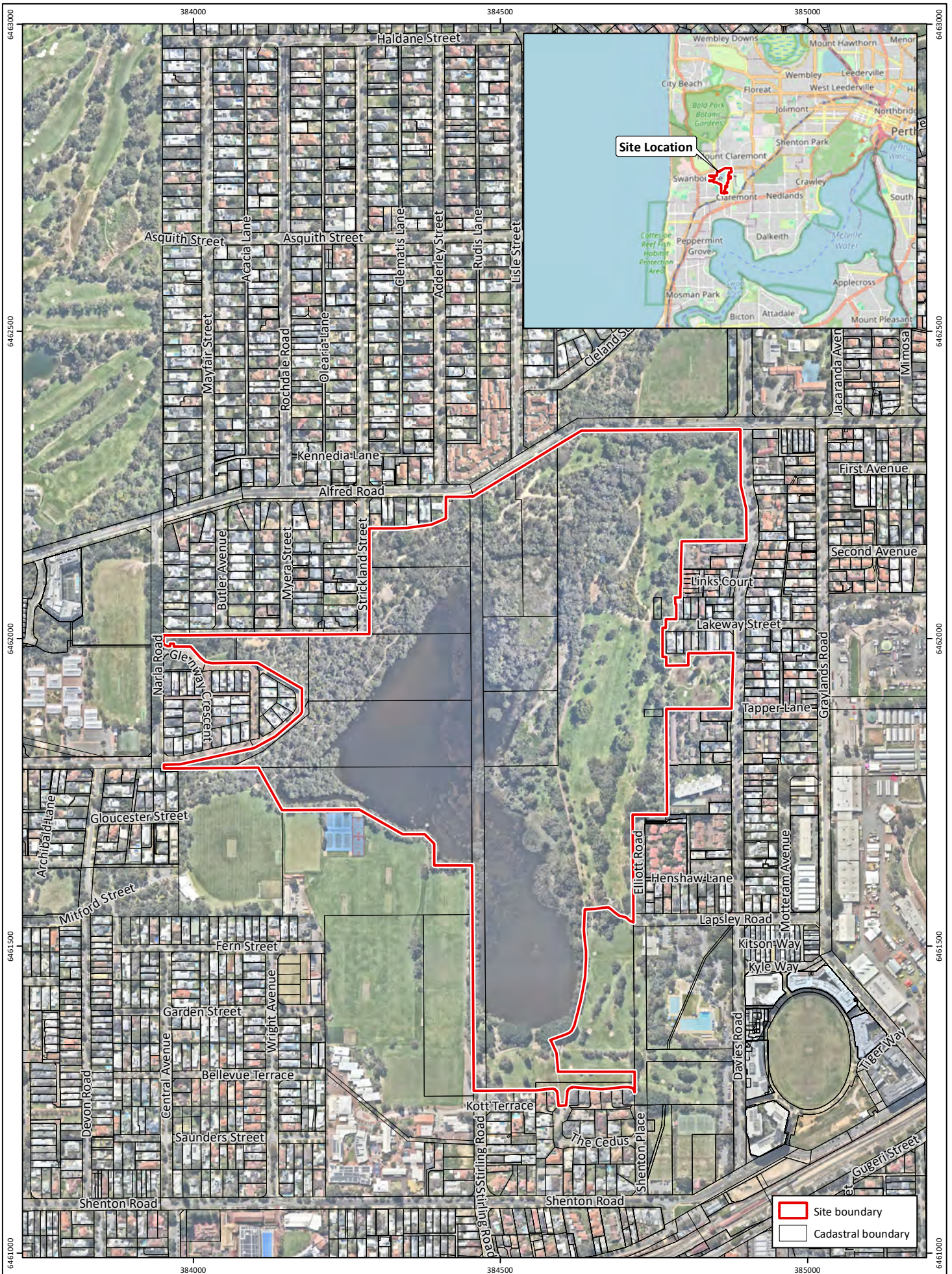


Figure 1: Site Location

Project: Targeted Reptile Assessment
Lake Claremont
Client: Town of Claremont

Plan Number: EP24-019(01)--F01
Drawn: GAR
Date: 30/10/2024
Checked: AJU
Approved: RAW
Date: 20/11/2024



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Scale: 1:8,000@A4
GDA2020 MGA Zone 50



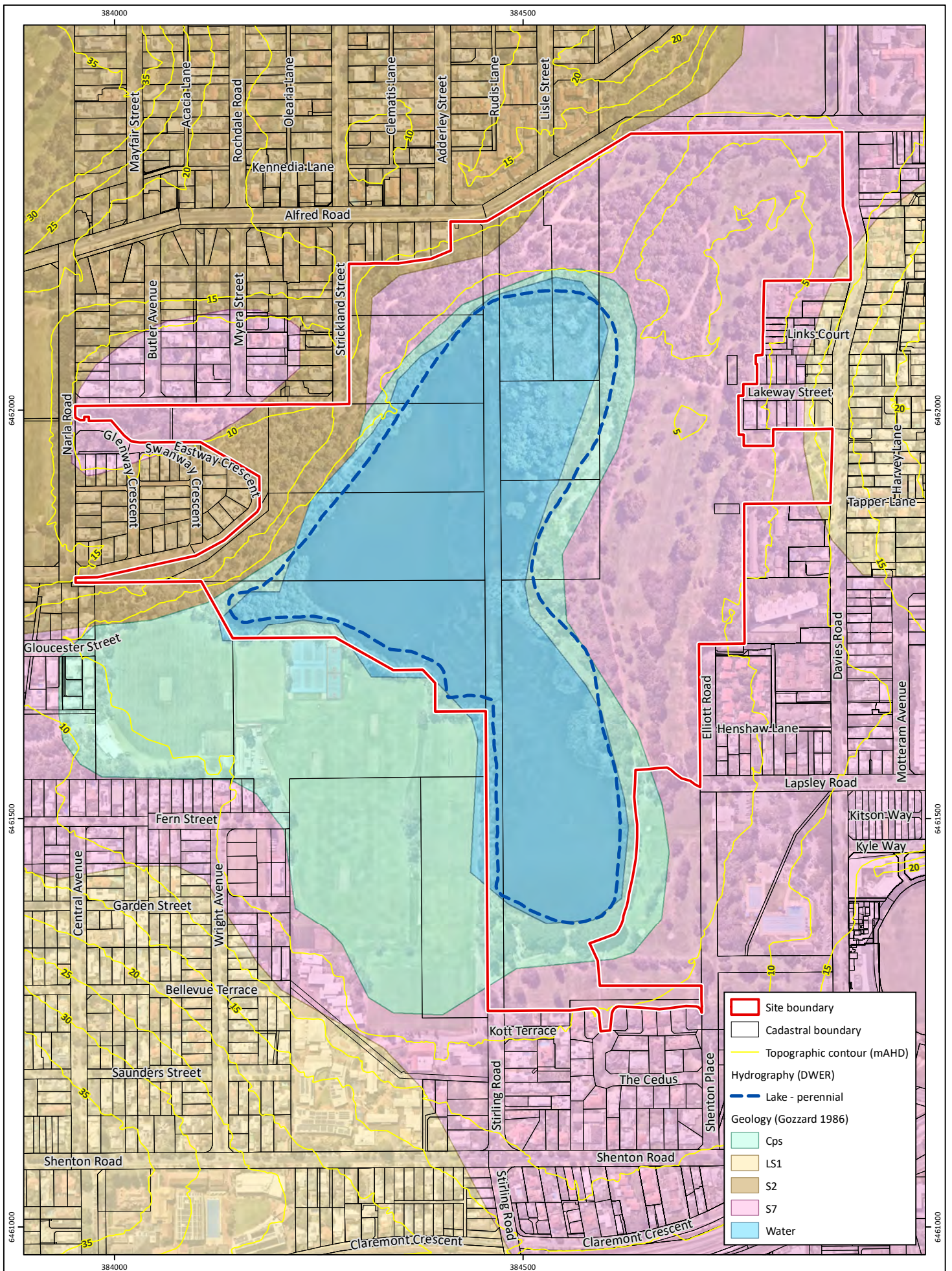


Figure 2: Hydrogeography, Soils and Topography

Project: Targeted Reptile Assessment
Lake Claremont

Client: Town of Claremont

Plan Number: EP24-019(01)--F02
Drawn: GAR
Date: 30/10/2024
Checked: AJU
Approved: RAW
Date: 20/11/2024



0 50 100 150
Metres
Scale: 1:6,000@A4
GDA2020 MGA Zone 50





Figure 3: Wetlands and Environmental Features

Project: Targeted Reptile Assessment
Lake Claremont
Client: Town of Claremont

Plan Number: EP24-019(01)--F03
Drawn: GAR
Date: 30/10/2024
Checked: AJU
Approved: RAW
Date: 20/11/2024



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Scale: 1:6,000@A4
GDA2020 MGA Zone 50





Figure 4: Trap Array Locations and Survey Effort

Project: Targeted Reptile Assessment
Lake Claremont
Client: Town of Claremont

Plan Number: EP24-019(01)--F04
Drawn: GAR
Date: 30/10/2024
Checked: AJU
Approved: RAW
Date: 20/11/2024



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GDA2020 MGA Zone 50

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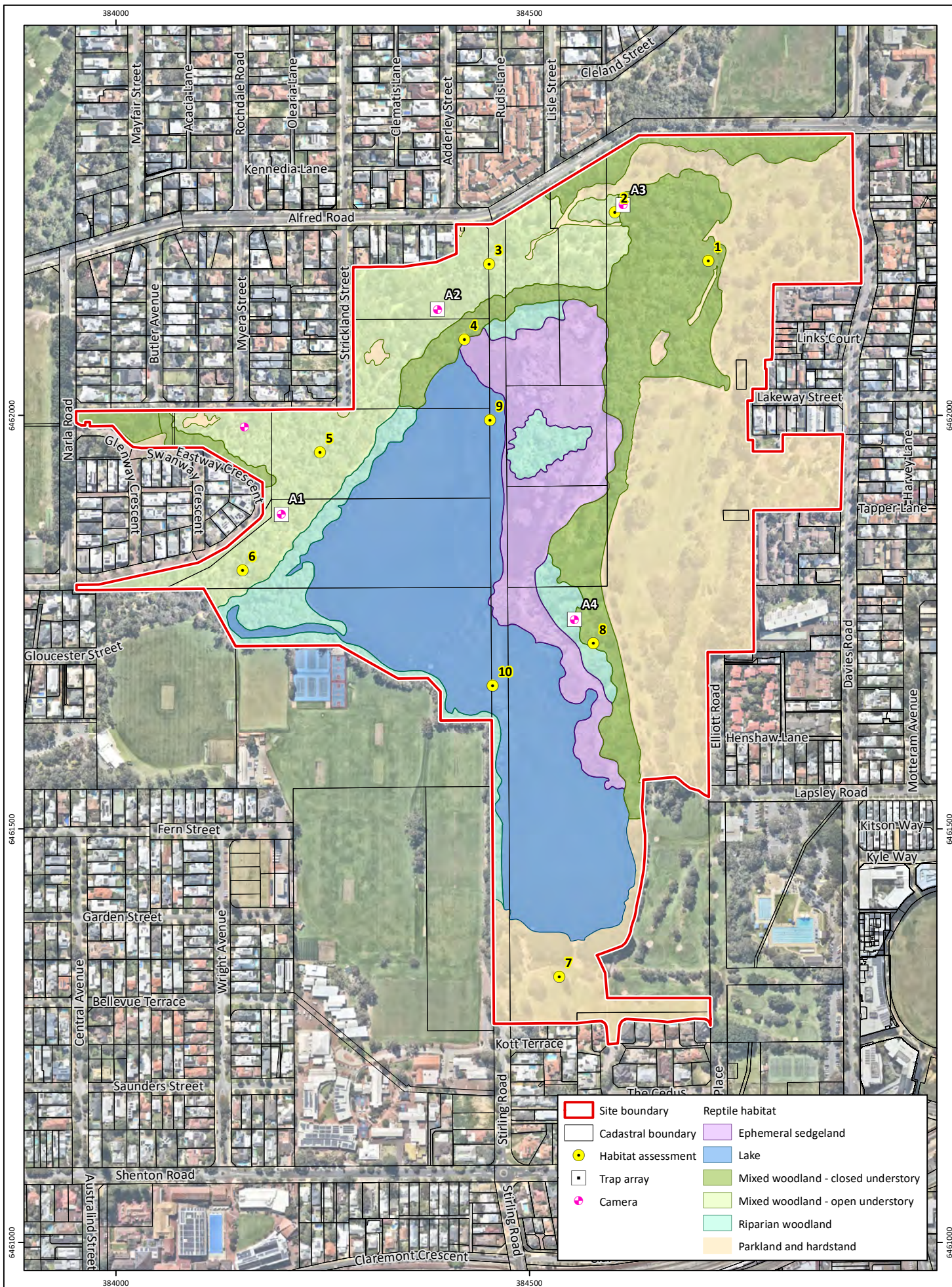


Figure 5: Reptile Habitat

Project: Targeted Reptile Assessment
Lake Claremont

Client: Town of Claremont

Plan Number: EP24-019(01)--F05
Drawn: GAR
Date: 30/10/2024
Checked: AJU
Approved: RAW
Date: 20/11/2024



Scale: 1:6,000@A4
GDA2020 MGA Zone 50



Appendix A

Additional information



Additional Background Information



Conservation Significant Fauna

Threatened and priority fauna

Fauna species considered rare or under threat warrant special protection under Commonwealth and/or State legislation. At the Commonwealth level, fauna species can be listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as 'threatened', 'migratory' or 'marine' as described in **Table 1**.

Migratory species comprise birds recognised under international treaties including:

- *Japan Australia Migratory Bird Agreement 1981* (JAMBA)
- *China Australia Migratory Bird Agreement 1998* (CAMBA)
- *Republic of Korea-Australia Migratory Bird Agreement 2007* (ROKAMBA)
- *Bonn Convention 1979* (The Convention on the Conservation of Migratory Species of Wild Animals).

Fauna species listed as threatened and migratory are protected in Australia as 'matters of national environmental significance' (MNES) under the EPBC Act.

Table 1: Definitions of conservation significant fauna species pursuant to the EPBC Act

Conservation Code	Category
X	Threatened Fauna –Extinct There is no reasonable doubt that the last member of the species has died.
EW [#]	Threatened Fauna –Extinct in the Wild Taxa which are known only to survive in cultivation, captivity or as a naturalised population outside its past range, or taxa which have not been recorded in its known and/or expected habitat despite appropriate exhaustive surveys.
CR [#]	Threatened Fauna – Critically Endangered Taxa which are considered to be facing an extremely high risk of extinction in the wild.
EN [#]	Threatened Fauna – Endangered Taxa which are considered to be facing a very high risk of extinction in the wild.
VU [#]	Threatened Fauna – Vulnerable Taxa which are considered to be facing a high risk of extinction in the wild.
Migratory [#]	Migratory Fauna All migratory species that are: (i) native species; and (ii) from time to time included in the appendices to the Bonn Convention; and (b) all migratory species from time to time included in annexes established under JAMBA, CAMBA and ROKAMBA; and All native species from time to time identified in a list established under, or an instrument made under, an international agreement approved by the Minister.
Ma	Marine Fauna Species in the list established under s248 of the EPBC Act

[#]matters of national environmental significance (MNES) under the EPBC Act

Additional Background Information



In Western Australia, fauna taxa may be classed as ‘threatened’, ‘extinct’, or ‘specially protected’ under the *Biodiversity Conservation Act 2016* (BC Act), which is enforced by Department of Biodiversity Conservation and Attractions (DBCA) (DBCA 2019). The definitions of these categories are provided in **Table 2**.

Table 2: Definitions of specially protected fauna schedules under the BC Act (DBCA 2019)

Category	Conservation Code	Definition
Threatened	CR	Critically endangered Threatened species considered to be facing an extremely high risk of extinction in the wild in the immediate future.
	EN	Endangered Threatened species considered to be facing a very high risk of extinction in the wild in the near future.
	VU	Vulnerable Threatened species considered to be facing a high risk of extinction in the wild in the medium-term future.
Extinct	EX	Extinct Species where there is no reasonable doubt that the last member of the species has died.
	EW	Extinct in the wild Species that is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form. Note that no species are currently listed as EW.
Specially protected	MI	Migratory species Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth Includes birds that subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds.
	CD	Species of special conservation interest (conservation dependent fauna) Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
	OS	Other specially protected species Fauna otherwise in need of special protection to ensure their conservation.

Additional Background Information

Fauna species that may be threatened or near threatened but lack sufficient information to be legislatively listed may be added to the DBCA's *Priority Fauna List* (DBCA 2018b). Species listed under priorities 1-3 comprise possible threatened species that do not meet survey criteria or are otherwise data deficient. Species listed under priority 4 are those that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons (DBCA 2019).

Priority fauna species are considered during State approval processes. Priority fauna categories and definitions are listed in **Table 3** (DBCA 2019).

Table 3: Definitions of priority fauna categories on DBCA's Priority Fauna List (DBCA 2019)

Conservation Code	Category
P1	<p>Priority 1 – Poorly known</p> <p>Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.</p>
P2	<p>Priority 2 – Poorly known</p> <p>Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.</p>
P3	<p>Priority 3 – Poorly known</p> <p>Species that are known from several locations and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.</p>
P4	<p>(a) Priority 4 – Rare species</p> <p>Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands.</p> <p>(b) Priority 4 – Near Threatened</p> <p>Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.</p> <p>(c) Priority 4 – Other</p> <p>Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>

Additional Background Information



Pest fauna

A number of legislative and policy documents exist in relation to pest fauna management at state and national levels. The *Biosecurity and Agriculture Management Act 2007* (BAM Act) is the principle legislation guiding pest fauna management in Western Australia and lists declared pest species.

Declared Pests

Part 2.3.23 of the BAM Act requires a person must not “a) keep, breed or cultivate the declared pest; b) keep, breed or cultivate an animal, plant or other thing that is infected or infested with the declared pest; c) release into the environment the declared pest, or an animal, plant or other thing that is infected or infested with the declared pest; or d) intentionally infect or infest, or expose to infection or infestation, a plant, animal or other thing with a declared pest”.

Under the BAM Act, all declared pests are assigned a legal status, as described in **Table 4**. Species assigned to the ‘declared pest, prohibited - s12’ category are placed in one of three control categories, as described in **Table 5**.

The *Biosecurity and Agriculture Management Regulations 2013* specify keeping categories for species assigned to the ‘declared pest - s22(2)’ category, which relate to the purposes of which species can be kept, as well as the entities that can keep them. The categories are described in **Table 6**.

The Western Australian Organism List (WAOL) provides the status of organisms which have been categorised under the BAM Act (DAFWA 2016).

Table 4: Legal status of declared pest species listed under the BAM Act (DAFWA 2016)

Category	Description
Declared Pest Prohibited - s12	May only be imported and kept subject to permits. Permit conditions applicable to some species may only be appropriate or available to research organisations or similarly secure institutions.
Declared Pest s22(2)	Must satisfy any applicable import requirements when imported and may be subject to an import permit if they are potential carriers of high-risk organisms. They may also be subject to control and keeping requirements once within Western Australia

Table 5: Control categories of declared pest species listed under the BAM Act (DAFWA 2016)

Category	Description
C1	Exclusion Not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2	Eradication Present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3	Management Established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

Additional Background Information

*Table 6: Keeping categories of declared pest species listed under the BAM Act (DAFWA 2016)*

Category	Description
Prohibited	Can only be kept under a permit for public display and education purposes, and/or genuine scientific research, by entities approved by the state authority.
Exempt	No permit or conditions are required for keeping.
Restricted	Organisms which, relative to other species, have a low risk of becoming a problem for the environment, primary industry or public safety and can be kept under a permit by private individuals.

Additional Background Information



Wetland Habitat

Geomorphic wetland types

On the Swan Coastal Plain DBCA (2017) have used the geomorphic wetland classification system developed by Semeniuk (1987) and Semeniuk and Semeniuk (1995) to classify wetlands based on the landform shape and water permanence (hydro-period) as outlined in **Table 7**. DBCA maintains a dataset of the *Geomorphic Wetlands of the Swan Coastal Plain* (DBCA 2018a).

Table 7: Geomorphic Wetlands of the Swan Coastal Plain classification categories (DBCA 2017)

Level of inundation	Geomorphology			
	Basin	Flat	Channel	Slope
Permanently inundated	Lake	-	River	-
Seasonally inundated	Sumpland	Floodplain	Creek	-
Seasonally waterlogged	Dampland	Palusplain	-	Paluslope

Additional Background Information



Literature

The main literature used for identifying fauna and fauna habitats is listed in **Table 8** below.

Table 8: Standard literature used for identifying fauna species and habitats.

Conservation Code	Category
Birds	Johnstone and Storr (1998b), Johnstone and Storr (1998a), Pizzey and Knight (2012), Slater <i>et al.</i> (2003)
Mammals	Menkhorst and Knight (2011), Triggs (2003)
Amphibia	Tyler and Doughty (2009), Bush <i>et al.</i> (2002)
Reptiles	Bush <i>et al.</i> (2002), Wilson and Swan (2021)

Additional Background Information



References

General references

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Slater, P., Slater, P. and Slater, R. 2003, *The Slater Field Guide to Australian Birds*, Reed New Holland, Australia.

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Tyler, M. J. and Doughty, P. 2009, *Field Guide to Frogs of Western Australia*, Western Australian Museum, Perth, Western Australia.

Wilson, S. and Swan, G. 2021, *A Complete Guide to Reptiles of Australia*, New Holland Publishers, Sydney, Australia.

Appendix B

Database search results



Class	Species name
Reptile	<i>Acritoscincus trilineatus</i> <i>Anilius australis</i> <i>Antaresia stimsoni subsp. stimsoni</i> <i>Aprasia repens</i> <i>Aprasia repens (Sand-plain Worm-lizard)</i> <i>Brachyurophis fasciolatus subsp. fasciolatus</i> <i>Brachyurophis semifasciatus</i> <i>Calotes versicolor subsp. versicolor</i> <i>Caretta caretta</i> <i>Chelodina colliei</i> <i>Chelodina oblonga</i> <i>Chelonia mydas</i> <i>Christinus marmoratus</i> <i>Christinus marmoratus (Marbled Gecko)</i> <i>Cryptoblepharus buehneri</i> <i>Cryptoblepharus plagiocephalus</i> <i>Cryptoblepharus sp.</i> <i>Ctenophorus adelaidensis</i> <i>Ctenotus australis</i> <i>Ctenotus fallens</i> <i>Ctenotus gemmula</i> <i>Ctenotus impar</i> <i>Cyclodomorphus celatus</i> <i>Cyclodomorphus celatus (Western Slender Blue-tongue)</i> <i>Delma fraseri</i> <i>Demansia psammophis subsp. reticulata</i> <i>Dermochelys coriacea</i> <i>Diplodactylus granariensis subsp. granariensis</i> <i>Diplodactylus lateroides</i> <i>Diplodactylus polyophthalmus</i> <i>Diplodactylus sp.</i> <i>Echiopsis curta</i> <i>Egernia kingii</i> <i>Egernia napoleonis</i> <i>Elapognathus coronatus</i> <i>Eretmochelys imbricata subsp. bissa</i> <i>Gehyra variegata</i> <i>Hemidactylus frenatus</i> <i>Hemiergis quadrilineata</i> <i>Heteronotia binoei</i> <i>Hydrophis elegans</i> <i>Hydrophis ornatus</i> <i>Hydrophis platurus</i> <i>Lerista elegans</i> <i>Lerista gerrardii</i> <i>Lerista lineata</i> <i>Lerista lineopunctulata</i> <i>Lerista praepedita</i>

Class	Species name
	<i>Lialis burtonis</i>
	<i>Lissolepis luctuosa</i>
	<i>Lucasium alboguttatum</i>
	<i>Menetia greyii</i>
	<i>Morelia spilota subsp. imbricata</i>
	<i>Morethia lineoocellata</i>
	<i>Morethia obscura</i>
	<i>Neelaps bimaculatus</i>
	<i>Neelaps bimaculatus</i> (Black-naped Snake)
	<i>Neelaps calonotos</i>
	<i>Notechis scutatus</i>
	<i>Parasuta gouldii</i>
	<i>Pletholax gracilis subsp. gracilis</i>
	<i>Pogona microlepidota</i> (Kimberley Bearded Dragon)
	<i>Pogona minor</i>
	<i>Pogona minor</i> (Dwarf Bearded Dragon)
	<i>Pogona minor subsp. minor</i>
	<i>Pseudechis australis</i>
	<i>Pseudonaja affinis</i>
	<i>Pseudonaja affinis subsp. affinis</i>
	<i>Pseudonaja mengdeni</i>
	<i>Pseudonaja modesta</i>
	<i>Pygopus lepidopodus</i>
	<i>Ramphotyphlops australis</i>
	<i>Simoselaps bertholdi</i>
	<i>Strophurus spinigerus</i>
	<i>Strophurus spinigerus subsp. spinigerus</i>
	<i>Testudo sp.</i>
	<i>Tiliqua occipitalis</i>
	<i>Tiliqua rugosa</i>
	<i>Tiliqua rugosa rugosa</i>
	<i>Tiliqua rugosa subsp. aspera</i>
	<i>Tiliqua rugosa subsp. rugosa</i>
	<i>Underwoodisaurus milii</i>
	<i>Varanus gouldii</i>
	<i>Varanus rosenbergi</i>
	<i>Varanus tristis</i>

Appendix C

Conservation significant species and likelihood of occurrence
assessment



Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
<i>Caretta caretta</i>	Loggerhead turtle	EN	EN (MI, MA)	Nesting on open sandy beaches on Dirk Hartog Island, South Murion and North West Cape. Foraging habitat os open ocean near Shark Bay, Western Australia through to Arnhem Land, Gove and into the Java Sea of Indonesia (DEC 2024).	Nil
<i>Chelonia mydas</i>	Green turtle	VU	VU (MI, MA)	Distributed across the ocean off the WA coast including around Rottnest Island. Often found in association with driftlines and rafts of Sargassum.	Nil
<i>Dermochelys coriacea</i>	Leatherback turtle	VU	EN (MI, MA)	Highly pelagic species, venturing close to shore mainly during the nesting season. Isolated nesting in offshore Australian islands. Some foraging around the south-west of WA.	Nil
<i>Lerista lineata</i>	Perth slider	P3	-	Sandy coastal heath and low scrubland. Banksia spp. woodland, Eucalyptus gomphocephala open woodland over deep sands, and coastal dunes immediately adjacent to the beach (Wilson and Swan 2021).	Very low
<i>Natator depressus</i>	Flatback turtle	VU	VU (MI, MA)	Adults inhabit soft bottom habitat over the continental shelf of northern Australia, extending into Papua New Guinea and Irian Jaya.	Nil
<i>Neelaps calonotos</i>	Black-striped snake	P3	-	Coastal and near-coastal dunes, sandplains supporting heathlands and Banksia spp. woodlands (Bush et al. 2010).	Very low

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
<i>Note: CR=critically endangered, EN=endangered, VU=vulnerable, CD=conservation dependent, MI=migratory, OS=other specially protected, P1=Priority 1, P2=Priority 2, P3=Priority 3, P4=Priority 4. Species with a high or moderate likelihood to occur within the site are shaded green.</i>					

References

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Appendix D

Species list



Species/Capture Matrix
Lake Claremont Targeted Reptile Survey

Species Name	Common Name	Capture Method				
		Trap Array 1	Trap Array 2	Trap Array 3	Trap Array 4	Opportunistic
<i>Acritoscincus trilineatus</i>	Southwestern cool skink	X	X	X	X	X
<i>Chelodina colliei</i>	South-western snake-necked turtle					X
<i>Christinus marmoratus</i>	Marbled gecko				X	
<i>Cryptoblepharus buchananii</i>	Buchanan's snake-eyed skink	X	X	X	X	X
<i>Ctenotus australis</i>	West coast long-tailed ctenotus		X	X		
<i>Ctenotus sp.</i>	<i>Ctenotus sp.</i>	X	X			
<i>Hemiergis quadrilineatus</i>	Two-toed mulch skink	X	X	X	X	
<i>Lerista elegans</i>	Elegant slider	X	X	X		
<i>Menetia greyii</i>	Common dwarf skink	X	X	X	X	X
<i>Scincidae sp.</i>	<i>Scincidae sp.</i>	X	X	X	X	
<i>Tiliqua rugosa</i>	Bobtail	X	X	X	X	X

Appendix E

Habitat assessment sample data



Sample Name: **1**

Project no.: EP24-019(01)

Date: 22/10/2024

Author: AJU

Easting

0.00

Northing

0.00

Datum/zone:

GDA94/Zone 50

Sample details

Dominant Vegetation Eucalyptus sp., Rhagada sp.

Habitat Type Woodland

Soil Type Sand,Loam

Tree Layer Present

Ground layer Present

Litter Cover Present

Microhabitats woody debris, fallen logs, dense leaf litter

Water features None

Disturbances N/A

Notes N/A

Rock Features None

Shrub Layer Present

Bare ground Cover Absent

Fire age >5 yr



Sample Name:

2

Project no.: EP24-019(01)

Date: 22/10/2024

Author: AJU

Easting

0.00

Northing

0.00

Datum/zone:

GDA94/Zone 50

Sample details

Dominant Vegetation Eucalyptus sp.

Habitat Type Woodland

Soil Type Sand,Loam

Tree Layer Present

Ground layer Present

Litter Cover Present

Microhabitats woody debris, fallen logs

Water features None

Disturbances N/A

Notes N/A

Rock Features None

Shrub Layer Present

Bare ground Cover Present

Fire age >5 yr



Sample Name: **3**

Project no.: EP24-019(01)

Date: 22/10/2024

Author: AJU

Easting

0.00

Northing

0.00

Datum/zone:

GDA94/Zone 50

Sample details

Dominant Vegetation Eucalyptus gomphocephala

Habitat Type Woodland

Soil Type Sand

Tree Layer Present

Ground layer Present

Litter Cover Present

Microhabitats woody debris

Water features None

Disturbances Walking tracks

Notes N/A

Rock Features None

Shrub Layer Present

Bare ground Cover Present

Fire age >5 yr



Sample Name: 4

Project no.: EP24-019(01)

Date: 22/10/2024

Author: AJU

Easting

0.00

Northing

0.00

Datum/zone:

GDA94/Zone 50

Sample details

Dominant Vegetation Melaleuca sp., Eucalyptus rudis

Habitat Type Woodland

Soil Type Sand

Tree Layer Present

Ground layer Absent

Litter Cover Present

Microhabitats woody debris

Water features Bordering lake

Disturbances Walking tracks

Notes N/A

Rock Features None

Shrub Layer Present

Bare ground Cover Present

Fire age >5 yr



Sample Name: 5

Project no.: EP24-019(01)

Date: 22/10/2024

Author: AJU

Easting

0.00

Northing

0.00

Datum/zone:

GDA94/Zone 50

Sample details

Dominant Vegetation Mixed planted

Habitat Type Woodland

Soil Type Sand

Tree Layer Present

Ground layer Absent

Litter Cover Absent

Microhabitats woody debris, fallen logs

Water features None

Disturbances N/A

Notes N/A

Rock Features None

Shrub Layer Present

Bare ground Cover Present

Fire age >5 yr



Sample Name: 6

Project no.: EP24-019(01)

Date: 22/10/2024

Author: AJU

Easting

0.00

Northing

0.00

Datum/zone:

GDA94/Zone 50

Sample details

Dominant Vegetation Agonis flexuosa, Banksia sp. Calitris sp.

Habitat Type Woodland

Soil Type Sand

Tree Layer Present

Ground layer Present

Litter Cover Present

Microhabitats woody debris, fallen logs

Water features None

Disturbances Walking tracks

Notes SE facing slope

Rock Features None

Shrub Layer Present

Bare ground Cover Present

Fire age >5 yr



Sample Name: 7

Project no.: EP24-019(01)

Date: 22/10/2024

Author: AJU

Easting

0.00

Northing

0.00

Datum/zone:

GDA94/Zone 50

Sample details

Dominant Vegetation Ficus sp.

Habitat Type Parkland

Soil Type Sand

Tree Layer Absent

Ground layer Absent

Litter Cover Absent

Microhabitats N/A

Water features None

Disturbances N/A

Notes SE facing slope

Rock Features None

Shrub Layer Absent

Bare ground Cover Absent

Fire age >5 yr



Sample Name: 8

Project no.: EP24-019(01)

Date: 22/10/2024

Author: AJU

Easting

0.00

Northing

0.00

Datum/zone:

GDA94/Zone 50

Sample details

Dominant Vegetation Eucalyptus rudis, Rhagada sp.

Habitat Type Woodland

Soil Type Sand,Clay

Tree Layer Present

Ground layer Present

Litter Cover Absent

Microhabitats woody debris

Water features None

Disturbances Weeds

Notes N/A

Rock Features None

Shrub Layer Absent

Bare ground Cover Absent

Fire age >5 yr



Sample Name: 9

Project no.: EP24-019(01)

Date: 25/03/2024

Author: NAW,AJU

Easting

0.00

Northing

0.00

Datum/zone:

GDA94/Zone 50

Sample details

Dominant Vegetation Lepidosperma sp.

Habitat Type Wetland

Soil Type Clay

Tree Layer Absent

Ground layer Present

Litter Cover Absent

Microhabitats dense sedges

Water features Seasonal inundation

Disturbances N/A

Notes N/A

Rock Features None

Shrub Layer Absent

Bare ground Cover Absent

Fire age >5 yr



Sample Name: 10

Project no.: EP24-019(01)

Date: 25/03/2024

Author: NAW,AJU

Easting

0.00

Northing

0.00

Datum/zone:

GDA94/Zone 50

Sample details

Dominant Vegetation N/A

Habitat Type Lake

Soil Type Clay

Tree Layer Absent

Ground layer Absent

Litter Cover Absent

Microhabitats N/A

Water features Lake

Disturbances Rubbish

Notes N/A

Rock Features None

Shrub Layer Absent

Bare ground Cover Present

Fire age N/A

