

City of Adelaide

Tree Martin Management Plan

July 2026



Acronyms and Abbreviations

AW Act	Animal Welfare Act 1985 (SA) (note, this Act will be repealed by the new Animal Welfare Act 2025 (SA) on a date to be fixed by proclamation)
CAMBA	China-Australia Migratory Bird Agreement
CASA	Civil Aviation Safety Authority
CBD	Central Business District
CoA	City of Adelaide
DEW	Department for Environment and Water (SA)
H5 Bird Flu	Highly Pathogenic Avian Influenza
JAMBA	Japan-Australia Migratory Bird Agreement
LGA	Local Government Area
MOP	Member of public
NPW Act	National Parks and Wildlife Act 1972 (SA)
PIRSA	Department of Primary Industries and Regions South Australia
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement
RSPCA	Royal Society for the Prevention of Cruelty to Animals
SA	South Australia
SANAR	South Australia Native Animal Rescue
SOWFI	Save our Wildlife Foundation

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1. Introduction

1.1 Background

Tree Martins (*Petrochelidon nigricans*) are small, migratory birds that travel annually to South Australia (SA) from northern Australia, Papua New Guinea and Indonesia. They have visited the Adelaide Central Business District (CBD) for approximately ten years, arriving in late spring and roosting communally from dusk to dawn at sites within the city centre, typically between December and May. During daylight hours, they feed on small flying insects before returning to roost at dusk in large, concentrated flocks.

The Adelaide CBD presents both opportunities and challenges for Tree Martin management. The urban tree canopy and built infrastructure of the city provides sheltered roosting habitats, and the Tree Martin phenomenon has come to be regarded as a distinctive feature of Adelaide's urban ecology. At the same time, large roosting colonies in high-use precincts cause community concerns and tangible impacts to business, including faecal drop creating amenity and hygiene issues, odour, noise, and the risk of bird injury or death through entering buildings and collision with windows, overhead wires and other urban structures. See Section 4 for detail.

Leigh Street and Rundle Mall have been identified as primary roosting locations within the CBD (Figure 1), though Tree Martins may establish or shift roosts to other locations across the City of Adelaide (CoA) from season to season. The unpredictable nature of roost site selection, combined with the scale of annual aggregations, requires an adaptive management approach. It will require monitoring of actions and processes to ensure improvements can be made for future management.

Tree Martins are a protected native species. The CoA acknowledges its responsibilities under the *National Parks and Wildlife Act 1972* (SA), the *Animal Welfare Act 1985* (SA) (AW ACT), the *Biodiversity Act 2025* (SA), the *South Australian Public Health Act 2011* (SA), and the *Local Government Act 1999* (SA). Management activities, including the handling, transport and care of birds, must be undertaken in accordance with these legislative requirements and with permits issued to authorised individuals under the *National Parks and Wildlife Act 1972* (SA).

Effective management of Tree Martin roosting requires balancing a range of sometimes competing interests: the welfare of the birds, public health and safety, amenity for residents and visitors, the trading environment for CBD businesses, and the ecological value of the species' continued presence in the city. The CoA works collaboratively with the Department for Environment and Water (DEW), Green Adelaide, Primary Industries and Regions SA (PIRSA), SA Health, veterinary services, and accredited wildlife rescue organisations to deliver a coordinated, evidence-based response.

This Tree Martin Management Plan (The Plan) has been developed to provide the overarching framework for this coordinated approach, complementing the CoA's Tree Martin Management Operating Guidelines. The Plan guides monitoring, operational response, mitigation, stakeholder engagement and communications across the roosting season, and is intended to be reviewed and refined annually as knowledge of Tree Martin behaviour and the effectiveness of management measures continues to develop.

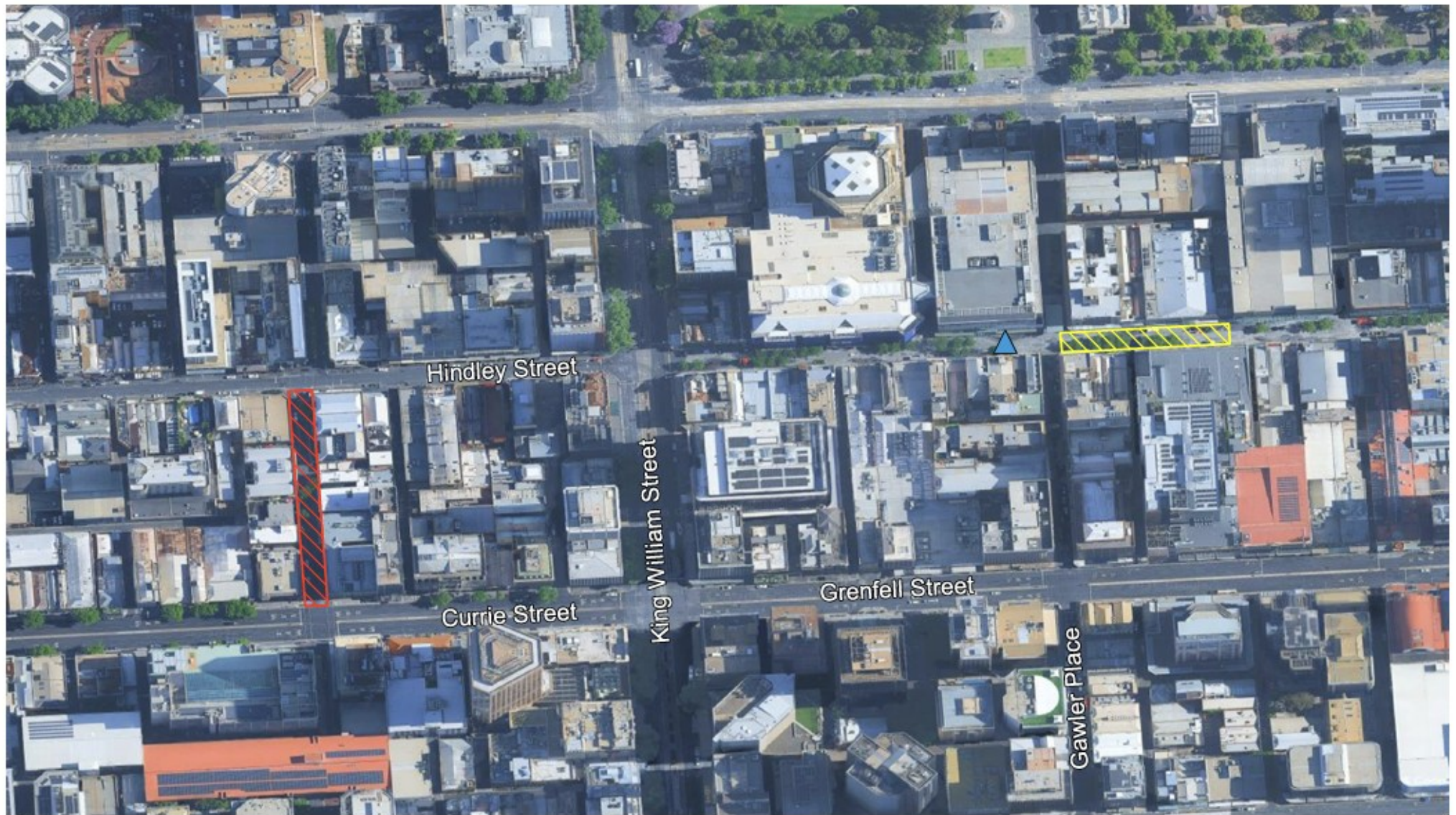


Figure 1: Historical and existing Tree Martin roost locations

City of Adelaide

Tree Martin Management Program 2026

-  Rundle Mall
-  Tree Martin roosts
-  Current roost (post-2024)
-  Initial roost (pre-2024)

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1.2 Purpose

The purpose of this Plan is to provide the CoA with an overarching strategic framework for the ongoing and coordinated management of Tree Martins roosting across its local government area.

1.3 Objectives of the Tree Martin Management Plan

Objectives of this Plan are to:

- Guide the management of Tree Martin roosting sites within the CoA Local Government Area (LGA)
- Inform the assessment of, and response to, newly formed Tree Martin roosts
- Minimise community and business impacts and reduce the potential for future conflict
- Improve community understanding and appreciation of Tree Martins, including their ecological role and conservation significance
- Support the community and businesses in co-existing with Tree Martins in the urban environment
- Clearly define roles and responsibilities for management actions across all relevant stakeholders
- Ensure all management activities are undertaken in accordance with relevant legislation, including the *National Parks and Wildlife Act 1972* (SA) and the AW Act.

1.4 Legislative Overview

The management of Tree Martins (*Petrochelidon nigricans*) in SA is governed by a combination of Federal and State legislation, as well as obligations arising from international agreements. All management activities associated with this program must be undertaken in compliance with the following instruments (see Figure 2).

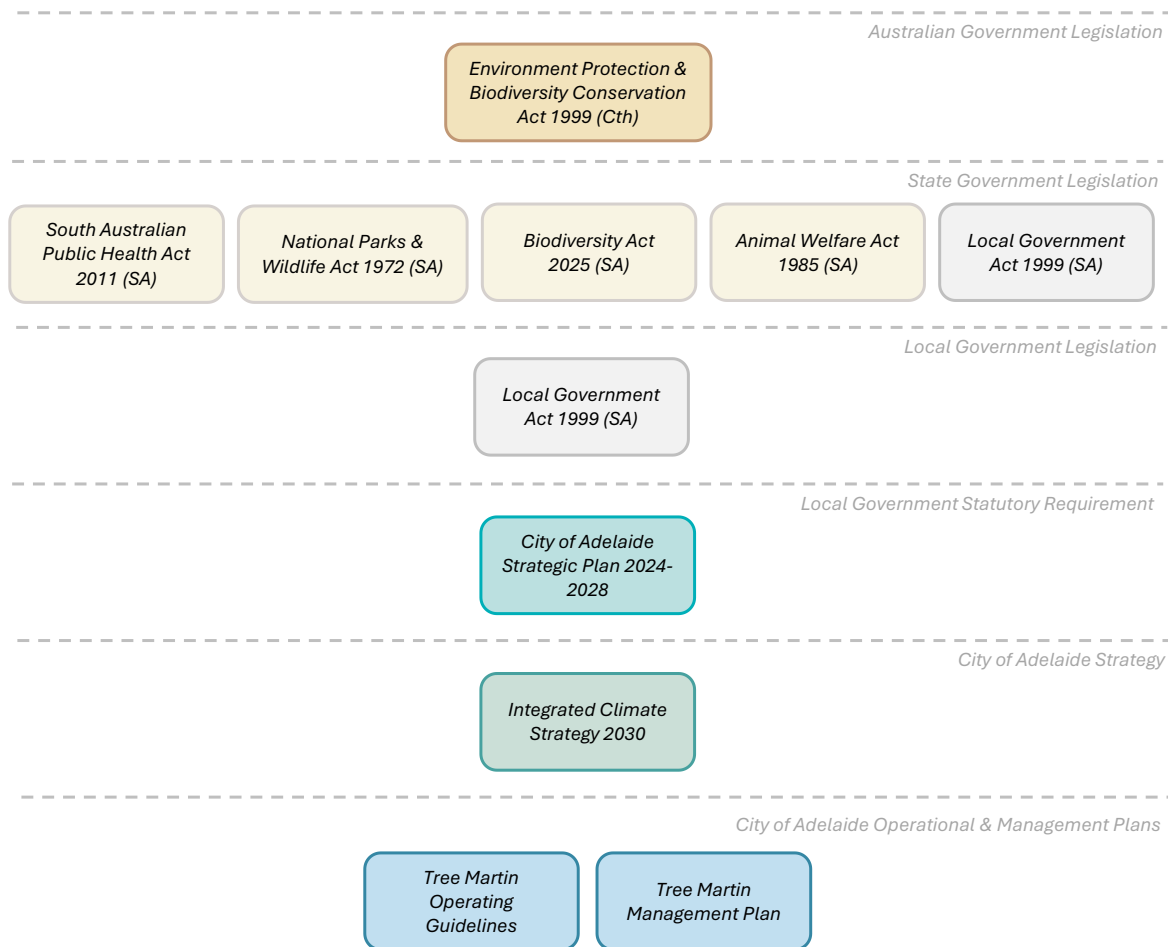


Figure 2. Legislative & Strategic Framework relating to Tree Martin

1.4.1 Australian Law

Where State and Federal legislation conflict, national law prevails.

The primary Federal instrument is the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act). The EPBC Act provides for the protection of the environment, particularly matters of national environmental significance, and retains the ability to regulate migratory bird species even where State Governments hold primary responsibility for land use and planning. Under the EPBC Act, any action likely to have a significant impact on a matter of national environmental significance, including listed migratory species, must undergo an assessment and approval process.

The Tree Martin is a listed marine species under the EPBC Act by virtue of Australia's obligations under international migratory bird agreements. Australia participates in the Japan-Australia Migratory Bird Agreement (JAMBA), the China-Australia Migratory Bird Agreement (CAMBA), and the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA), as well as the Convention on the Conservation of Migratory Species of Wild Animals (the Bonn Convention).

CoA has been advised that under subsections 254-254E of the EPBC Act, various offences are created with respect to certain actions in relation to a listed marine species, including actions resulting in death or injury. However, in each case, the relevant conduct is only unlawful in or on a Commonwealth area, which has limited, if any, application in the CoA area.

1.4.2 South Australian Law

At the state level, the most relevant legislative instrument is the *National Parks and Wildlife Act 1972* (SA) (NPW Act) and the *National Parks and Wildlife (Wildlife) Regulations 2019* (SA). The Tree Martin is listed as a protected animal (migratory bird) under the NPW Act. Under subsection 68(1) a person must not interfere with, harass or molest a protected animal unless he or she acts in pursuance of a legislative provision or a permit granted by the responsible Minister (the Minister for Climate, Environment and Water) or their delegate. This means that only approved individuals, who have undertaken training in line with the NPW Act, may handle the birds, and penalties apply if unqualified persons handle protected species.

In addition, advice from DEW clarifies that a permit is not required for the netting of trees if this action does not lead to any protected animal being caught, restrained or trapped and subsequently relocated and the trees are netted prior to being used by the protected animal (i.e. outside of the Tree Martin roosting season).

The welfare of Tree Martins during any management activities is further governed by the AW Act and *Animal Welfare Regulations 2012* (SA), which apply to all animals regardless of status and require that any handling or management be conducted humanely and in accordance with relevant codes of practice. The AW Act 1985 (SA) is due to be repealed and replaced by the AW Act 2025 (SA).

The *Landscape South Australia Act 2019* (SA) also provides relevant context, underpinning the role of the South Australia Government Agency Green Adelaide, in coordinating urban biodiversity outcomes across the metropolitan area, including the management of native fauna in the urban environment.

2. Tree Martin Ecology

2.1 Ecological Significance of the Tree Martin

The Tree Martin performs an ecologically beneficial role in the metropolitan Adelaide area, feeding on insects in the air while flying. Along with other martins, swallows and swifts, they are important for keeping flying insect numbers in check, particularly in the spring, summer and autumn when insect numbers are at their greatest.

Tree Martins are an excellent indicator of ecosystem health. Where Tree Martins are abundant, so are insects, collectively indicating that the ecosystem is functioning well. As high-speed aerial predators, they link terrestrial and aquatic ecosystems, transferring energy between flying insect swarms and the broader food web.

As they require tree hollows for breeding, the presence of Tree Martins during the breeding season typically indicates an environment with mature, healthy trees (such as Eucalyptus) and nearby water sources.

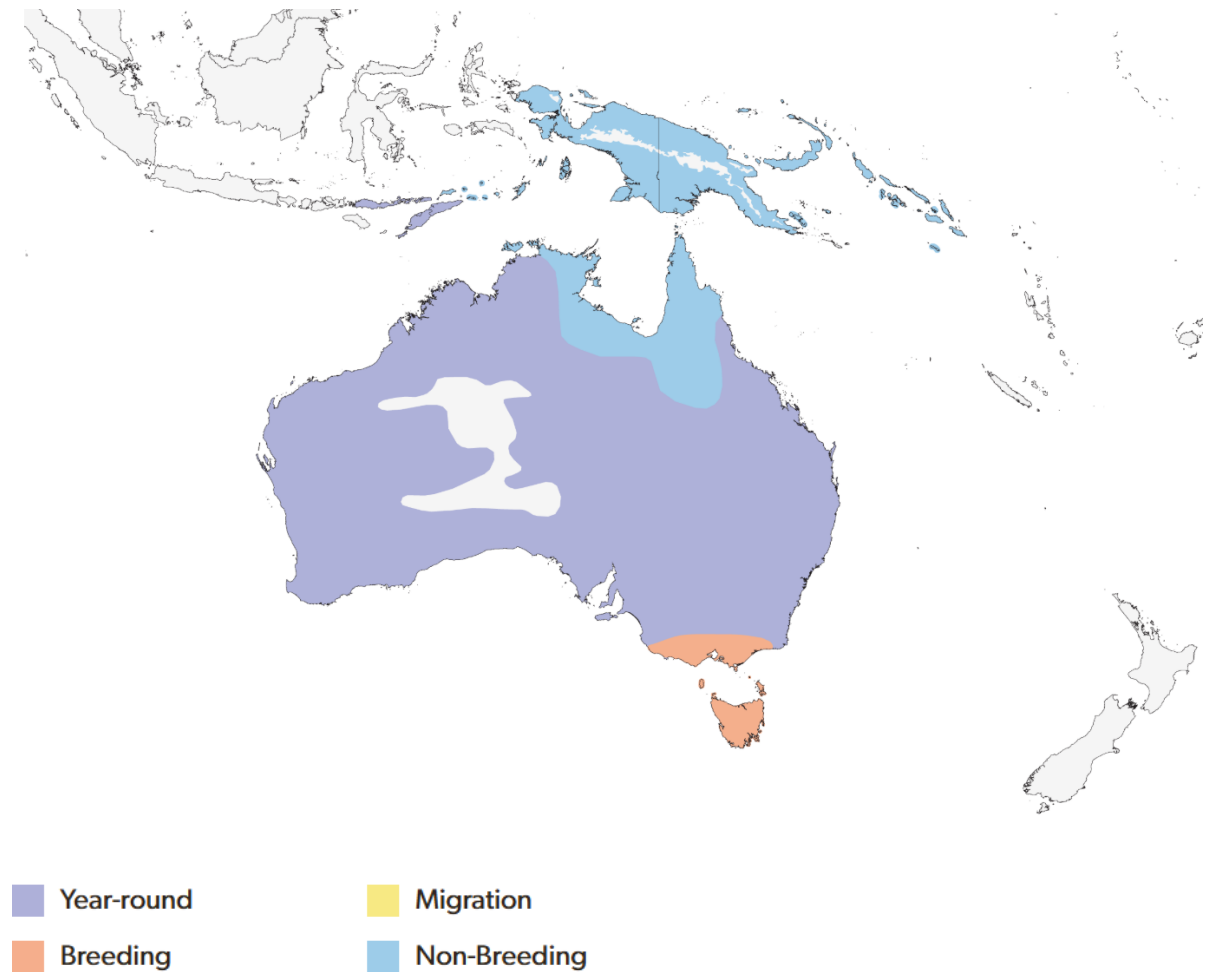
2.2 Species Overview and Migratory Behaviour

The Tree Martin is a member of the swallow family. It is a small bird weighing around 15 grams and has glossy blue-black feathers on the neck, back and crown, and cream feathers on the breast and belly. Its wings and notched tail are brownish grey, with a darker grey underneath and reddish-brown markings on the head. Males and females look very similar. Young are browner and paler.



Image: www.ebird.org (Ged Tranter)

Tree Martins are largely migratory, spending winter in northern Australia, New Guinea, the Solomon Islands and Timor, before heading south for the spring, summer and autumn (see Figure 3). Some populations are resident and some part-migratory: the population of a few wintering birds can be augmented by visitors in spring.



Distribution of the Tree Martin

Figure 3. Distribution of Tree Martin

Source: *Birds of the World*

2.3 Role as an Aerial Insectivore

Tree Martins feed aurally on insects including ants, beetles, bugs, flies and wasps. They tend to screen for insects by continually foraging while flying at the height of the tree canopy or higher, or low over open areas. They also sally for insects, which involves perching, flying out and capturing an insect then returning to the same or another perch to consume the prey. They usually forage in flocks comprising 30 to 60 birds (Semmens 1993 in HANZAB 2023).

Tree Martins are known to sometimes drink in flight, skimming over water (Blyth 1917 in HANZAB 2023).

2.4 Habitat Requirements and Hollow Dependency

Tree Martins breed in the southern two thirds of Australia mostly in tree hollows of large trees in woodlands. Accordingly, they require mature woodlands with trees old enough to contain hollows. Tree clearing and the associated loss of hollows is considered one of the greatest threats to Tree Martin populations (Turner 2001). They are also known to use artificial structures for nesting, such as steel tubing and vent holes in buildings (Green Adelaide 2025).

Tree Martins have been recorded nesting in all months, but most commonly in spring and summer from August to December (DEH 2008). The nest hollow is lined with grass and leaves, and the same hollow may be re-used year after year. Clutch size is usually three to five eggs. The sexes share nest building, and incubation is for 14 to 16 days (Morcombe, 2000). Where and precisely when Tree Martins breed in South Australia is unknown.

2.5 Conservation Status and Population Trends

The Tree Martin is listed as a species of Least Concern globally (Birds of the World 2020) and is widespread throughout South Australia. However, in the Greater Adelaide and Mount Lofty Ranges Region, they are locally recognised as a probably declining species (DEH 2008).

Populations of Tree Martins have decreased in Victoria due to logging of hollow-bearing trees (Birds in Backyards 2026). The numbers in the southern Western Australian Wheatbelt have decreased probably because of woodland clearing. Some populations in south-east Australia have declined potentially due to the expansion in range of the Common Starling (*Sturnus vulgaris*) which takes over nesting hollows. Insect biomass collapse is also a threat to populations (Hallmann *et al* 2017).

In recent years, members of the public (MOP) have recorded Tree Martin counts within the CoA on five occasions and submitted records to eBird between April 2023 and April 2024. Numbers ranged from 1,000 to 12,500 individuals, with some birds roosting in trees and others circling overhead. Recent counts (Avisure 2026) indicate that the roost numbers in the CoA LGA reach more than 20,000 individuals.

2.6 Significance of Urban Roosting in Adelaide

Tree Martins have been recorded in the CoA and surrounds from 1923, indicating a long-term presence in the area (Atlas of Living Australia 2026). They are increasingly common in urban and suburban areas with Perth and Adelaide the two Australian cities that record most Tree Martin activity (HANZAB, 2023). The roost in the CoA LGA is the largest recorded, reinforcing its significance.

2.7 Cultural Significance of the Tree Martin in Adelaide

Tree Martins have developed a unique cultural significance in the CoA, particularly due to the large seasonal roost in the city centre. Since approximately 2015, thousands of Tree Martins have gathered each summer and autumn in CBD locations such as Leigh Street and, more recently, Rundle Mall. These roosts have become a distinctive urban wildlife phenomenon, attracting the attention of residents, visitors, photographers, birdwatchers and the media.

They have become part of Adelaide's contemporary urban identity demonstrating how native wildlife can coexist with people in a highly developed environment and how roosting flocks serve as a visible reminder that cities can provide habitat for native species. The nightly arrival of thousands of birds at dusk has been described as a wildlife spectacle that allows residents to experience a natural phenomenon that would otherwise be associated only with rural landscapes.

Conflicts between conservation values and business concerns emerge when large numbers of Tree Martin's roost above outdoor dining and within shopping precincts. The exclusion of birds from Leigh Street and the subsequent establishment by the Tree Martins of a roosting site in Rundle Mall in late 2024, prompted extensive media coverage and community debate about how best to balance wildlife protection with commercial activity and public amenity. These discussions have increased public awareness of native bird conservation and the challenges of managing biodiversity in urban environments.

From a broader cultural perspective, the Tree Martins have become a symbol of Adelaide's reputation as a city that values its native wildlife. Green Adelaide has referred to the roost as a "shining case" of how urban landscapes can contribute to wildlife conservation, while local community discussions often describe the Tree Martins as an iconic seasonal feature of the city. Their annual arrival has become a recognised sign of seasonal change, linking Adelaide's urban environment with natural ecological cycles and reinforcing public appreciation of local biodiversity.

2.7.1 Traditional Owner Perspectives

The Kaurna people (Miyurna) are the traditional owners of the Adelaide Plains. The Adelaide Plains, including the area now defined as the City of Adelaide, were cared for and managed by Kaurna Miyurna for tens of thousands of years. The forced separation of Aboriginal and Torres Strait Islander peoples from their traditional lands, as well as European colonisation has drastically altered the Australian landscape, its care and management (City of Adelaide 2025).

No published Kaurna cultural traditions relating specifically to Tree Martins have been identified.

Any assessment of cultural significance will be undertaken in consultation with Kaurna representatives.

2.7.2 Post-European Experience

Since European settlement, Tree Martins have been valued primarily for their ecological role as aerial insectivores and their ability to adapt to modified Australian landscapes (Higgins et al. 2006). Their use of both natural and artificial nesting sites has enabled them to persist in agricultural and urban environments, making them an important example of native wildlife adaptation (Bell 1979). Tree Martins are also recognised as indicators of environmental health and contribute to scientific understanding of migration, urban ecology, and biodiversity conservation.

One of the most notable aspects of Tree Martin ecology since European settlement is their ability to adapt to human-altered environments. Historically, Tree Martin habitats were associated with open woodland containing large hollow-bearing trees, however, Tree Martins have begun to use bridges, culverts, buildings, and other artificial structures for nesting (Higgins et al. 2006). This adaptability has allowed them to persist in agricultural districts, towns, and cities despite extensive landscape modification.

Across Australia, communal roosts can involve thousands of birds and are often considered notable wildlife spectacles. These gatherings contribute to public awareness of native biodiversity and seasonal bird movements.

Australia's largest known urban Tree Martin roost is within the Adelaide CBD, accounting for its cultural significance within South Australia's capital. The annual gathering of approximately 20,000 birds within the city has become a distinctive seasonal event, contributing to Adelaide's identity. It supports public engagement with urban biodiversity and allows for community discussions about wildlife conservation and coexistence in urban environments.

2.8 Roost Preferences

Tree Martins tend to fly in large flocks as they approach their roosting site near sunset, they rise en-masse and then dive down together into the vegetation, avoiding predators such as Peregrine Falcons (*Falco peregrinus*) (Birds in Backyards 2026).

Research suggests that large communal roosts of aerial insectivores, like Tree Martins, provide multiple adaptive benefits, including predator avoidance, thermoregulation and information sharing about food resources (Beauchamp 1999; Ward & Zahavi 1973). Historical accounts by Serventy (1937) indicate that early roosts occurred in dense vegetation or crops, likely offering concealment from predators.

The narrow boulevards, flanked by three to four storey buildings, with noise, people and lighting to ward off predators and lack of vehicle traffic appear to have attracted Tree Martins to roost in the CBD. Callery Pear (*Pyrus calleryana*) and Chinese Elm (*Ulmus parvifolia*) trees have been preferred, particularly those with fairy lights which may assist in keeping predators away (Green Adelaide 2025).

These factors, combined with the species' strong site familiarity and social behaviour, suggest that Adelaide's urban environment offers perceived safety and suitable microhabitats, reinforcing the persistence of large seasonal roosts.

3. Stakeholders

3.1 City of Adelaide

The CoA is the local government authority responsible for managing the Adelaide CBD and its surrounds, including streets, and public infrastructure. 598 hectares of the Adelaide Park Lands (including the Squares) are under the care, control and management of the City of Adelaide with a further 334 hectares under the care and control and management of the Government of South Australia. The CoA holds strategic commitments to promote urban biodiversity and protect the welfare of wildlife, balanced against its obligations as a land manager for public health and amenity. In the context of this program, the CoA is the primary decision-maker regarding tree management, works and operational activities, and the implementation of mitigation measures within its boundaries, working in partnership with DEW and Green Adelaide to achieve positive wildlife outcomes.

3.2 Green Adelaide

Green Adelaide is a State Government Agency established under the *Landscape South Australia Act 2019* (SA). Working in partnership with Adelaide's 17 metropolitan councils, and the Kaurua Miyurna, Green Adelaide coordinates regional activities, provides funding, and educates the community on the importance of urban greening and biodiversity. Its priorities include controlling invasive pest plants and animals, increasing tree canopy cover, and creating urban spaces for flora and fauna to thrive. In the context of Tree Martin management, Green Adelaide's role is in supporting urban wildlife outcomes across the metropolitan area.

3.3 Department for Environment and Water

DEW is the State Government Agency responsible for managing and protecting the state's wildlife and natural resources. Operating through the National Parks and Wildlife Service SA (NPWSSA), DEW administers the NPW Act, which affords protection to most native mammal, bird, and reptile species and their eggs.

Under this framework, DEW issues permits for activities involving protected wildlife, including capturing, relocating, or destroying native animals, as well as for wildlife rehabilitation and interstate movement of native species. Where conflict arises between wildlife and human activity, DEW provides guidance on appropriate management options and enforces compliance with relevant codes of practice. In the context of urban wildlife management, such as Tree Martin roosting activity, DEW serves as the primary regulatory authority from which approvals and permits must be obtained prior to undertaking any works that may interfere with a protected animal.

3.4 SA Health

SA Health is responsible for protecting and improving the health of all people in South Australia. Its primary roles include managing public hospitals, delivering emergency medical care, preventing illness, and developing state-wide health policy and medical research. SA Health is responsible for the *South Australian Public Health Act 2011* (SA).

3.5 Department of Primary Industry and Regions South Australia

As the lead agency for animal and plant biosecurity in SA, PIRSA leads cross-agency collaboration with DEW, SA Health and other partner agencies, including the Local Government Association of SA, to prepare for biosecurity. The Biosecurity division of PIRSA works with the National Avian Influenza Wild Bird Surveillance Program, which is coordinated by Wildlife Health Australia. This program monitors avian influenza virus presence in wild birds to understand the risks and prevent infection in poultry flocks. Disease investigations are also performed in poultry and wild bird and wildlife mortalities, testing for avian influenza.

3.6 Affected Businesses, Residents and the Public Realm

The primary impacts reported by affected businesses relate to human and animal health concerns, odour, faecal drop and potential loss of trade, additional operational costs (employing additional security; implementing mitigation measures, and increased cleaning) and damage to stock arising from Tree Martins entering their buildings. Additional concerns include the risk of disease transmission, potential damage to trees, and the effects of droppings on the surrounding environment, including staining, odour, and damage to other surfaces.

3.7 Special Interest / Volunteer Groups

These groups may include those that share a common goal for the conservation and management of native wildlife (e.g. Royal Society for the Prevention of Cruelty to Animals (RSPCA), SA Native Animal Rescue (SANAR), Save our Wildlife (SOWFI), SA Fauna Rescue).

3.8 Other Community Members

Public interest in the Tree Martins roosting activity in the Adelaide CBD means that people not directly affected by their presence feel nonetheless invested in the wellbeing of the Tree Martins or are concerned about the impacts of their roosting behaviour.

4. Potential Impacts from Tree Martins

4.1 Human and Animal Health Concerns

The accumulation of bird droppings during the Tree Martin roosting season is the primary public health concern associated with large urban roosts. High volumes of droppings on footpaths, outdoor dining furniture, building facades and urban public realm infrastructure can create slip hazards for pedestrians and raise hygiene concerns for businesses, particularly food and beverage operators in affected precincts such as Leigh Street and Rundle Mall.

Birds can carry a range of diseases including respiratory, fungal, bacterial, parasitic and viral diseases. It is unknown what specific risks are posed by Tree Martins. However, precautions must be taken when handling birds and carcasses and dealing with their droppings.

Tree Martins are known as a synanthropic species, meaning they live in close association with humans and habitats created by human settlements. In combination with their migratory nature, which could allow them to spread disease over considerable distances, and their feeding association over and around waterbodies where waterfowl and shorebirds are present, there is potential for Tree Martins to act as a spillover or bridge host for diseases such as Avian Influenza.

The Highly Pathogenic Avian Influenza (H5 Bird Flu) was first detected in Australia in June 2026. In the event of a confirmed or suspected H5 Bird Flu outbreak in the Adelaide area, CoA would implement additional cleaning, public signage and staff safety measures in affected roosting areas, guided by PIRSA as the lead State Government Agency.

Tree Martins are agile flyers that naturally dart and circle in large numbers at dusk, making collision with windows, overhead wires and other urban structures, and entering buildings an inherent risk of urban roosting. Birds may be stunned, injured or killed as a result. Under the AW Act, a general duty of care applies to any person in charge of an animal, requiring reasonable steps to safeguard its welfare.

4.2 Faecal Droppings

The volume of faecal material deposited by large roosts is considerable. An estimated 20,000 birds regularly roosting within semi-mature street trees from dusk has been found to deposit large amounts of droppings presenting a serious risk to public hygiene. Faecal drop affects footpaths, outdoor dining furniture, vehicles, building facades and adjacent properties, creating both aesthetic and hygiene issues. In food service areas, contamination of outdoor dining surfaces presents a direct food safety concern under the *South Australian Public Health Act 2011* (SA). The physical properties of dried droppings, including their adhesive and corrosive nature due to the uric acid content, also make clean-up labour-intensive and may cause surface damage over time if not addressed promptly.

4.3 Odour

The accumulation of faecal matter beneath active roost sites generates noticeable odour, particularly following rain. In high-density urban precincts, this can create an unpleasant environment for pedestrians, diners, and retail customers. Odour intensity is closely related to roost size, the duration of roosting activity at a given location and the frequency of rain and cleaning. Where roost sites coincide with enclosed or semi-enclosed spaces such as alleyways or canopied retail precincts, odour is likely to be more pronounced and persistent.

4.4 Noise

Tree Martins are highly vocal, particularly at dawn and dusk when flocks are arriving at or departing from roost sites. The twittering calls of large congregations, numbering in the thousands, can generate significant noise, particularly in the early morning hours. This can be disruptive to nearby residents, hotel guests and workers. It may also affect the amenity of outdoor dining and retail precincts during peak roosting periods between January and May.

4.5 Water Quality

Faecal material deposited by roosting birds in urban areas can be transported via stormwater runoff into the broader drainage network. Bird droppings are a recognised source of bacteria and viruses in urban runoff, and faecal coliform bacteria counts in urban runoff can be significantly elevated above recreational health standards as a result. The presence and numbers of roosting bird species have been correlated with seasonal changes in water quality, including increased nitrogen and phosphorus loading. In an urban catchment context, this nutrient and pathogen loading has the potential to contribute to degraded water quality in receiving waterways, though the scale of impact from Tree Martin roosting specifically is likely to be modest relative to other urban stormwater pollutant sources.

4.6 Damage to Trees / Vegetation

While small amounts of bird droppings typically pose little threat to vegetation and may even act as a mild fertiliser due to their nitrogen content, excessive accumulation can lead to leaf burn, obstruction of sunlight absorption and promotion of fungal growth, all of which may harm sensitive vegetation. Plants under active bird roosts often develop discoloured, withered leaves and damaged growth due to nitrogen overload and chemical contamination from droppings. Where large numbers of birds roost in the same trees season after season, the cumulative effect of faecal deposition can progressively stress the host trees, potentially affecting their long-term health and structural integrity. This is a particular consideration given that the CoA's urban tree canopy represents a significant asset and the very habitat that attracts Tree Martin roosts in the first instance.

5. Tree Martin Management in the City of Adelaide

5.1 Known Roost Sites in the City of Adelaide

Roosting aggregations were originally reported in 2015 in Callery Pear street trees in Leigh Street in the city centre (Figure 4 and 5). The nine Callery Pear trees were netted in August 2024 to exclude Tree Martins from roosting. In December 2024, the Tree Martins began roosting in the six Chinese Elm trees located adjacent to Rundle Place in Rundle Mall (Figure 6 and 7).



Figure 4. Callery pear trees in Leigh Street.

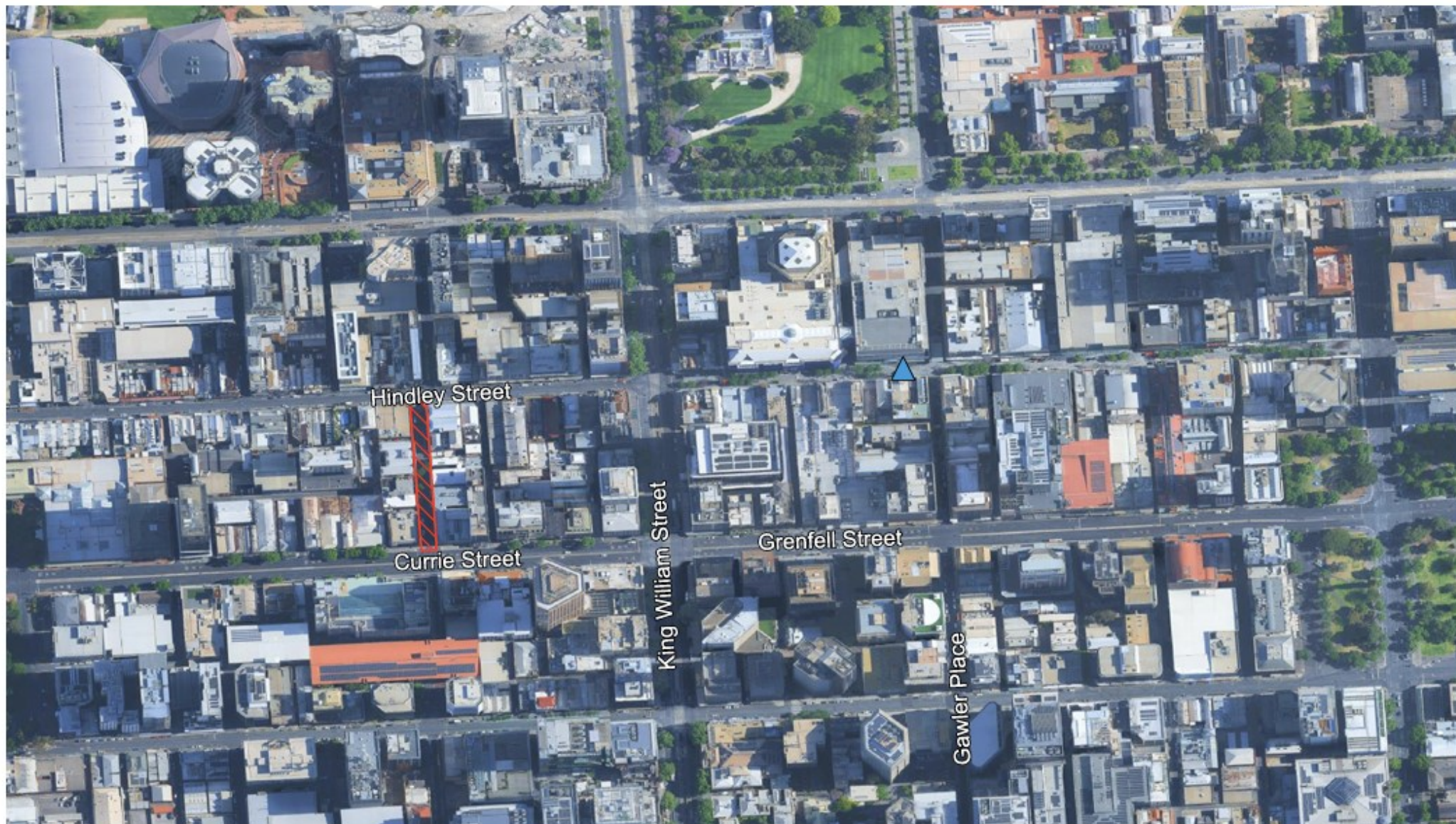


Figure 5: Leigh Street Tree Martin roost

City of Adelaide

Tree Martin Management Program 2026

 Leigh Street roost
 Rundle Mall

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Figure 6: Chinese Elm trees in Rundle Mall

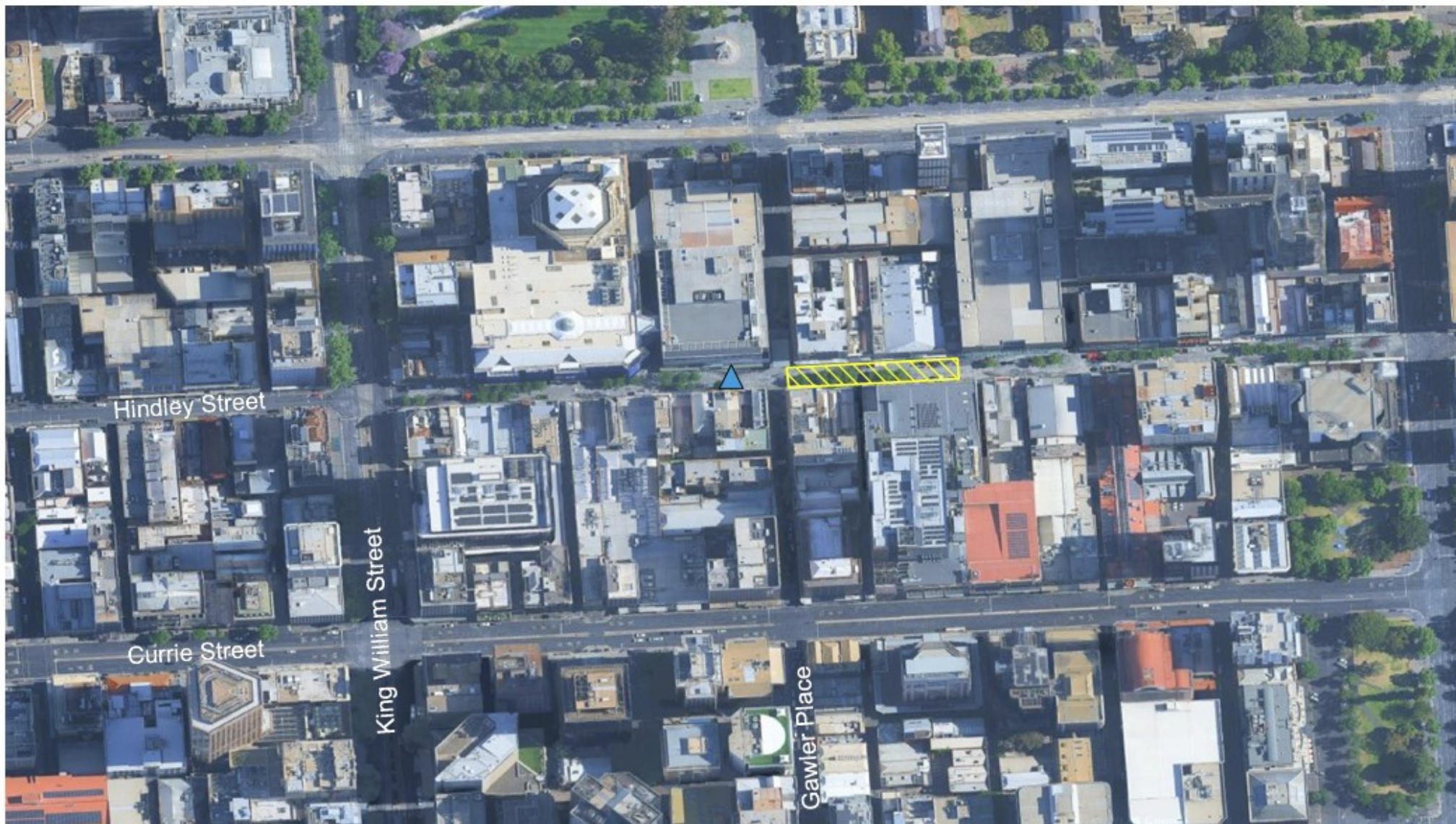


Figure 7: Rundle Mall Tree Martin roost

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Author: AS
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0 0.75 1.5 m

GDA 2020
Datum: GDA 2020
Units: Decimal Degrees

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5.2 Potential Roost Sites Where Conflict May Arise

There is a high probability that Tree Martins may move to new or previously undocumented roost sites in response to existing roost sites being abandoned either because of deliberate preventative measures, disturbance or some other reason. By identifying potential roost sites on Council-managed land, especially those in proximity to sensitive areas where conflict is likely to arise, the CoA can plan for and initiate more timely and appropriate roost management responses. Potential roosting areas were assessed in radius up to 2km from the existing Rundle Mall roost.

Assessing potential roost sites serves two purposes:

1. If actions are to be considered that would lead to the abandonment of an existing roost, the assessment provides an indication of where Tree Martins might move to and the level of conflict that may arise as a consequence. This information will be vital for determining the risks of undertaking dispersal, alternative management options, and the level of resources required to prevent Tree Martins moving to other high-conflict sites.
2. It provides a better understanding of the location of potential roost sites and assists the CoA to plan for and implement pro-active management to reduce the likelihood of sites becoming a “problem roost” in the future.

In classifying potential roosts, the probability of a site supporting a large number of Tree Martins and the potential negative impacts that may have on community, residents, commercial operators and Tree Martins have been considered.

Although potential roost sites have been identified, it is uncertain where Tree Martins may relocate.

5.2.1 Probability of a Roost Forming

Potential Tree Martin roost sites were identified by assessing the canopy and environmental features of vegetation patches around the CBD. Each location was either rated as high or low likelihood. Roost potential was considered high in areas that had extensive mature canopies with similar clusters of trees as known roost sites and met some or all of the following criteria:

1. **Tree suitability:** tall dense tree canopies with suitable perches, including Chinese Elm and Callery Pear tree species known to support roosting populations as well as similarly structured tree species (see below).
2. **Size:** tree canopies large enough to accommodate thousands of birds together.
3. **Location:** confined built-up areas with lights and low vehicle traffic that include nearby wide boulevards that allow for large flocks to gather and circle before coming to roost.
4. **Predator protection:** areas and tree structures that are interconnected and relatively safe from predators, with minimal human disturbance.

Chinese Elms typically grow 10m to 20m tall, with a broad, spreading canopy and fine textured foliage. Callery Pears typically grow 8m to 15m tall, with a dense rounded canopy. Potential other suitable tree species include, but are not limited to:

- All Platanus species: known for its broad canopies and its fast growth.
- Japanese Zelkova (*Zelkova serrata*): similar vase-shaped form, and canopy structure.
- All Celtis species: broad canopy and tough urban tree that handles drought and poor soils well.
- Crepe Myrtle (*Lagerstroemia indica*): smaller in height but normally develops a broad canopy.
- Chinese Pistache (*Pistacia chinensis*): rounded canopy that is similar to a mature Callery Pear.

5.2.2 Roost Site Conflict Assessment

In areas where a roost could form, the likelihood of conflict was rated as high, moderate or low based on an assessment of conflict factors (see Section 7.3).

Roost Site Risk Classification

The risk presented by potential roosts were rated:

- **High risk (undesirable):** high roost potential with high to moderate likelihood of conflict. These sites would be considered sub optimal for Tree Martins to establish a roost.
- **Moderate risk (undesirable):** low roost potential with high to moderate likelihood of conflict. These sites do not appear to be likely to sustain a roost, but if one formed, it would be considered a sub-optimal location.
- **Moderate risk (acceptable):** high roost potential with low likelihood of conflict. These sites appear to be suitable for a roost, and while some impacts could be expected, they would be relatively minor compared to other sites.
- **Low risk (acceptable):** low roost potential with low likelihood of conflict. These sites do not appear to be highly likely to sustain a roost, but if one formed, impacts would be expected to be relatively minor compared to other sites.

Locations were classified, see Appendix B.

6. Tree Martin Roost Management Options

Roost management options for the Tree Martin roosting colony must meet Council's legal obligations and be agreed upon under the relevant legislation and permit requirements issued by the DEW. These options range from minimal intervention, through to in-situ management and dispersal. When more intervention is required, financial costs and resource effort increase, as does the level of disruption experienced by the roosting flock.

For a full list of management options, please see Appendix C.

6.1 Minimal Intervention

Minimal intervention means that there will be little to no interference with the roosting flock. This may include a 'do nothing' approach, or a monitor only approach, and may involve:

- **Monitoring:** monitoring of the roosting flock, either nightly or weekly, to enable forward-planning or management responses in case additional triage is required. This involves estimating the flock size as it arrives at the roost. Skilled biologists count flocks which come in waves rather than all at once, making it possible to obtain an estimated number. Occasionally, birds are flushed from the roost. These birds are counted and subtracted from the overall total so that they are not double counted and accuracy is maintained.
- **Awareness raising:** for affected residents/commercial operators, CoA and other stakeholders, to continue to improve community knowledge on Tree Martin ecology, associated risks and management options. Signage at roosting site and information provided through communication channels.
- **Alternate roost sites:** enhancing alternative roosting sites that could attract Tree Martins to roost away from high conflict areas. This would require further research but could involve planting known suitable tree species in areas that would suit Tree Martins but limit conflict.

6.2 In-Situ Management

In-situ management refers to management activities that can be undertaken at an active Tree Martin roost site to reduce undesirable impacts to businesses and members of the community, whilst retaining the roost and minimising any impacts to the roosting flock. These management actions may include:

- Monitoring and awareness raising (see above). Population counts and observations are recorded where possible before, during and after and management action occurs.
- Modifications to windows (e.g. by adding decals), wires (e.g. by installing plastic covers (possum tails) to increase visibility and cushioning of overhead wires), and entrances to buildings (e.g. by closing doors at dusk), installing visual and audio deterrents to discourage birds from entering buildings, or netting structures.

- Cleaning faecal mess on a regular basis.
- Limiting disturbance to birds by having exclusion zones, limiting noisy work at dusk and at night, and limiting noisy/smokey street performances near the roost.
- Ensuring suitably trained professionals are available to respond to and triage stunned, injured and deceased birds and transport injured birds to veterinary care.
- Maintaining or enhancing the roost site for tree health, hygiene and bird welfare.

6.3 Prevention of Roost Establishment

Where a roost has previously formed or where a site is a likely alternative roost (see section 5.2.2) and these sites are deemed undesirable because of the high conflict risk, measures can be taken to prevent roosting prior to the next season. This could include:

- Modifying the roost by removing trees from the connected canopy structure, to minimise the attraction. It is unknown how much of a vegetation structure will need to be removed to successfully deter roosting.
- Temporarily or permanently netting trees with appropriately sized, wildlife friendly netting to deter roosting. A combination of maintenance of tree canopies and netting may be required.

Such modifications must be monitored to ensure Tree Martin welfare and assess where new roosts may form.

Installation of audio or visual deterrents to neighbouring buildings could be considered but are unlikely to prevent roosting and would incur a significant cost and require regular maintenance, with the potential of only working as a short-term solution.

6.4 Dispersal of Roosting Birds

Dispersal can be a resource and cost intensive, requiring experienced, qualified and licenced staff. Due to permit requirements under the NPW Act, dispersal activities and tools must be approved by DEW, and all staff carrying out active dispersal must have appropriate permits.

Noise, pyrotechnics, falconry or any range of deterrents could be used to disperse a roost with the aim that Tree Martins vacate the roost and roost elsewhere. Ideally the deterrent actions are adopted at dusk as the flock is attempting to roost and continues into the evening until they find an alternative location. The birds are likely to attempt to return to the roost each night, hence this approach requires monitoring and regular maintenance dispersal, which may be required over several months.

This approach comes with risks:

- The noise and disturbance could cause the flock to erupt from the site erratically, potentially leading to window and wire strikes or entry into buildings. This could result in increased Tree Martin death or injury and external impacts.
- Noise and disturbance could affect the public, residents and commercial operators nearby. There could be community members who view this approach as too invasive and object to it.
- There is potential for new roosts to establish in other non-desirable, high conflict areas.

7. Decision Support Framework

7.1 Primary Decision Tree

The actions CoA will take in response to roosting Tree Martins is dependent on a range of factors:

1. If the Tree Martins are causing or likely to cause conflict
2. If the roost is on Council managed land or not
3. The level of conflict
4. Whether the roost is existing or newly established
5. If roost prevention or dispersal strategies are suitable for the site.

The process for evaluating these factors is described in the Primary Decision Tree (Appendix A).

7.2 Identifying Council Responsibility

Although Council only has direct responsibility for wildlife issues that occur on Council managed/owned properties and land, it has taken a pro-active approach to understanding Tree Martin populations across the city. Where roosts form on private or State managed land, CoA will assist with information and provide community with educative materials. In certain circumstances CoA may decide to assist with monitoring the roost which will enhance understanding of the city-wide Tree Martin population.

Where roosts form on Council owned or managed land, the decision tree will guide how the roost will be evaluated and managed.

7.3 Assessing Potential for Human/Tree Martin Conflict

The likelihood of conflict is considered high if several of the following attributes are met:

- The area is within 50m of residential and/or commercial properties
- The number of affected properties is likely to be five or greater
- The sensitivity of the setting. Factors that increase sensitivity and therefore conflict potential include:
 - Density of the residential/commercial setting
 - Type of land use (open air dining, schools, hospitals, childcare centres, residential care housing, high volume foot traffic)
 - Presence of large clear glass windows, wires or other structures that could cause Tree Martin strikes and result in death or injury.
- Faecal drop, odour, noise and potential impacts on human health are likely to be high.

7.4 Determining the Management Approach

Each site, whether existing or newly established, will require an assessment and consideration given to the range of management options available to CoA. The process requires two steps:

Step 1: The scoring system will guide where monitoring and education alone will be sufficient to mitigate conflict, if in-situ management can be considered, or if roost prevention / dispersal strategies need to be considered.

Step 2: Consideration of the management actions required to achieve the desired outcome and the cost of such actions.

7.4.1 Step 1 - Scoring

The following decision matrix and associated information tables will guide the general response CoA will take for roosting Tree Martins, depending on where they roost and in what numbers.

	1	2	3	4	5	Score
No. tree martins	<1000	1,000-5,000	5,000-10,000	10,000-50,000	>50,000	
Distance from Residences/Commercial properties	>200m	100-200m	50-100m	10-50m	<10m	
No. Residences/Commercial properties impacted	1	2	2-5	5-10	>10	
Sensitivity of Setting	Very Low	Low	Medium	High	Very High	
Economic Impact	Very Low	Low	Medium	High	Very High	
Noise/Smell/Mess	Very Low	Low	Medium	High	Very High	
Peak No. Tree Martin deaths per day	0	1	2-10	11-20	>20	
Peak No. Tree Martin incidents excluding deaths per day	0	1-20	21-50	51-100	>100	
Total						

Total Score	Monitoring frequency	Actions
8-13	Once per month	Provide information, education, and community liaison
14-20	Once per week	Provide information, education, and community liaison Consider in-situ management options
21-30	Daily	Provide information, education, and community liaison Implement in-situ management options
31-40	Daily	Provide information, education, and community liaison Implement in-situ management options Prevent roosting prior to the season and/or disperse from site at commencement of new season

Attribute	Rationale	Assessment criteria
No. Tree Martins	Influences the potential impacts - higher numbers increase the impacts of all attributes	Peak count is used to determine the roost size for scoring purposes
Distance from Residences/Commercial properties	Influences the potential impacts – closer to buildings the greater impact of noise, smell, health and impact on assets and greater collision risk for birds	Measured from the nearest roost tree to the nearest property
No. Residences/Commercial properties impacted	Influences the potential impacts – more buildings the greater impact of noise, smell, health and impact on assets and greater collision risk for birds	Properties included must be directly impacted with bird collisions or entrapment, and/or affected directly by noise, smell and significant mess.
Sensitivity of Setting	The type of land use and the sensitivity of that land use around the roost will determine the likely impact	A roost in a natural area away from sensitive land uses scores very low. However, if that natural area is near a sensitive area the sensitivity increases significantly and may indicate a very high score. Other criteria that elevate the score include: density of the residential/commercial setting; type of land use (open air dining, school, hospital, childcare, residential care housing, amount of foot traffic); and large clear glass windows, wires or other structures that could cause Tree Martin strikes and result in death or injury.
Economic Impact	The impact on businesses from roosting Tree Martins could arise from	The economic impact will be linked to the number of properties affected, the sensitivity

Attribute	Rationale	Assessment criteria
	cleaning costs, loss of trade, mitigation costs, product contamination and reputation. If public amenity and visitor experience is impacted, this could have flow on economic implications to businesses and the CoA.	of the setting and the noise, smell and mess, but should be assessed in its own right.
Noise/Smell/Mess	These attributes affect the liveability of the area and disease risk as well as cost to maintain hygiene	If the noise is minor, score very low; somewhat annoying, medium; above acceptable noise levels, very high. If the smell is not offensive, very low; somewhat offensive, medium; very offensive, very high. If the amount of mess requires no clean up, score very low; weekly clean up, medium; daily clean up, very high. In assessing noise/smell/mess, the duration of the exposure will be a deciding factor.
Peak No. Tree Martin deaths per day	Indicator of impact on this protected species as well as the public concern for welfare	Peak number of deaths scores very low if there are zero deaths ranging up to very high for above 20 deaths per day. 20 deaths in a day on a regular basis could have a population level impact and it is likely to cause concern from numerous members of the community ¹ .
Peak No. Tree Martin incidents excluding deaths per day	Indicator of impact on this protected species as well as the public concern for welfare	Peak number of incidents scores very low if there are zero incidents excluding deaths, ranging up to very high for above 50 incidents in a day.

¹ Mortality events causing a sustained population decline of 1-2% is considered biologically significant, while losses exceeding 5-10% can trigger rapid population collapse. There are, however, many factors that influence population models, including the proportion of juveniles versus adults that die and how many successful fledglings are recruited to the population each breeding season. No population studies are available for Tree Martins.

7.4.2 Step 2 – Assessing actions and costs

Depending on the score, CoA will assess which management actions should be considered for implementation. Appendix C will guide the options to be selected from. Determining if actions should proceed will depend on an assessment of:

1. Probability of success. For instance, if preventing Tree Martins from roost using nets in trees, consideration must be given to where the roost may shift to. Will the action shift the problem somewhere else, potentially in a location that causes more impact to the species and the community. The greater the chance of success from the management initiative, the greater the drive to implement the action.
2. Cost of implementation to achieve success. The actions selected will have a range in cost implications from relatively low costs to extremely high costs associated with habitat modification, triaging injured birds, and extensive staff resourcing. CoA will consider budget requirements before proceeding with any actions.

8. Management Strategy

8.1 Minimum Intervention

Minimal intervention is the preferred approach for Tree Martin management in the City of Adelaide, except in cases of high human/Tree Martin conflict, or where Tree Martins are suffering from urban impacts. Minimum intervention strategies for low conflict roosts and for roosts that may form on non-council-managed land are discussed below.

8.1.1 Roosts on Non-Council Land, Not Warranting Council Involvement

Where a Tree Martin roost is:

1. Not on Council-managed land; and
2. Determined by CoA discretion to not warrant Council involvement,

CoA will provide relevant information and educative material to residents or commercial operators and will refer them to CoA Park Lands and Sustainability or DEW for further guidance or advice if roost management is required.

Where CoA sees benefit from understanding the local Tree Martin population, it may support monitoring on non-council owned or managed properties.

8.1.2 Roosts on Council-Managed Land with Low Likelihood of Conflict

In areas where there is a low likelihood of conflict on Council-managed lands, a minimal intervention approach will be taken that will involve:

1. Monitoring the roost to enable forward planning or management responses in case triage is required; and/or
2. Provide relevant information and education to residents or commercial operators; and/or
3. Discourage disturbance of the Tree Martin roost.

8.2 In-situ Management

In-situ management will occur at a roost where minimal intervention fails to resolve impacts to surrounding business, residents or members of the community, or on the Tree Martin population itself. In-situ management options are outlined in Section 6.2.

8.3 Roost Prevention and Dispersal

8.3.1 Existing Roosts

Where roosting occurs on Council-managed land that constitutes a high conflict area CoA will await the end of the roosting season and may adopt strategies to prevent roosting in future seasons. CoA may net trees that have been previous roosting sites, to prevent re-establishment of the roost in the following spring/summer. Advice from DEW is that a permit is not required for the netting of trees outside of the roosting season if this action does not lead to any protected animal being caught, restrained or trapped and subsequently relocated and the trees are netted prior to being used by the protected animal (i.e. outside of the Tree Martin roosting season).

In the longer term, following targeted investigations the CoA may consider alternative landscapes or tree species that are unlikely to support roosting populations of Tree Martins.

8.3.2 New Roosts

If Tree Martins attempt to roost in a new area of likely high conflict, CoA may initiate actions to prevent the roost from forming. It is important to ensure early intervention to identify sites and a wide-ranging monitoring program will be initiated from spring.

When a newly established roost is identified, the site will be assessed using the decision management tool (Section 7). If a score of greater than 35 is recorded, CoA may consider and adopt preventative measures such as:

- Extensive pruning, lopping or removal of roost trees to reduce the connected canopy structure.
- Temporarily or permanently netting trees with appropriately sized netting to deter roosting.
- In extreme cases, the complete removal of all trees or, if viable, the replacement with an alternative species in a high conflict area to prevent roosting.

If birds are already on site in a high conflict area early-intervention dispersal may be considered to prevent the colony from establishing a roost subject to support from DEW and Green Adelaide. Dispersal will only be undertaken by qualified and licenced staff, and dispersal activities and tools must be approved by DEW. In accordance with the NPW Act, all staff carrying out active dispersal must have appropriate permits. Dispersal will only be undertaken if the associated risks and likelihood of dispersal success is deemed acceptable. Strike risks and minimising harm to Tree Martins will be very important whenever dispersal is considered.

8.4 Research and Development

CoA is committed to fostering and participating in research that may be useful in better understanding Tree Martin ecology and developing management strategies, including partnerships with the university sector. The monitoring undertaken during the 2025-26 roosting season will contribute to this understanding.

Priority areas for research include:

Monitoring

1. Investigate the use of thermal cameras and AI to assist with detection, identification and automated counts of roosting Tree Martins.
2. Consider if transmitters can be fitted to several individuals to provide information on Tree Martin movements. This could assist in detecting new or unknown roosts, inform where nesting and foraging areas are, and indicate daily and seasonal movement patterns.

Ecology

3. Identify where Tree Martins that roost in the CoA nest and forage.
4. Determine the diet of the local Tree Martin population via eDNA or other method.

Management

5. Investigate landscapes that are suited to high density city areas that are non-attractive to Tree Martin roosting with a view to adopting these in likely high conflict areas.
6. Trial equipment and different in-situ approaches to develop a suite of tools that assist with managing Tree Martin conflict and reduce adverse impact to their populations.

Awareness Raising and Engagement

7. Prepare an integrated information and education program for residents or commercial operators. Look to improve understanding of the Tree Martin population, its ecological importance and understanding of how the community can coexist with nature.

9. References and Further Reading

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10. Glossary

Adaptive Management	A structured, iterative learning by doing approach. It requires monitoring of actions and processes to ensure improvements can be made for future management.
Aerial Insectivore	A bird that captures and consumes insects while flying.
Aggregation	Where birds gather in large numbers.
Biodiversity	The variety of plant and animal life within an ecosystem and the ecological processes that support them.
Canopy	The upper layer of tree foliage formed by branches and leaves.
Clutch size	Total number of eggs laid in a nest.
Communal Roost	A location where large numbers of birds gather together to rest or spend the night.
Conflict (Human/Wildlife Conflict)	A situation where wildlife behaviour negatively affects people, businesses, infrastructure, public health, or amenity, creating a need for management action.
Council-managed Land	Land owned or leased by Council; land under Council control such as reserves with Council as trustee; and local government roads.
Dispersal	The deliberate use of approved management techniques to encourage birds to abandon a roost and establish elsewhere.
Ecological Indicator Species	A species whose presence, abundance, or behaviour provides information about ecosystem health.
Existing Roost	A roost that has been recorded at the same location over multiple seasons or years and is considered an established component of the local urban environment.
Faecal Droppings	Bird excrement deposited beneath roost sites, which may create hygiene, amenity, odour and cleaning issues in urban areas.
Habitat	The natural or modified environment in which a species lives, feeds, breeds, or roosts.
High-Conflict Site	A location where a roost is likely to result in significant adverse impacts on people, businesses, infrastructure, public safety, public health, amenity, or the birds themselves, requiring active management intervention.

In-situ Management	Management actions undertaken at an active roost site to reduce impacts while allowing birds to remain at the site. Examples include cleaning, exclusion measures, and building modifications.
Low-Conflict Site	A location where a roost is unlikely to result in significant adverse impacts on people, businesses, infrastructure, public safety, public health, amenity, or the birds themselves, and where minimal management intervention is generally required.
Migratory Species	A species that regularly moves between regions or countries as part of its annual life cycle.
Minimal Intervention	A management approach involving little or no direct interference with a roosting flock, focusing instead on monitoring, education and planning.
New Roost	A roost that has recently become established at a location where communal roosting has not previously been recorded or has not occurred for an extended period.
Overwinter	When a proportion of the population of a largely migratory species such as Tree Martins stay at the roost year-round.
Protected Species	A species protected under legislation, making it unlawful to harm, capture, or interfere with individuals without appropriate authorisation.
Risk	The chance of something happening that will have an impact on objectives. It is measured in terms of consequences and probability.
Roost	The place where birds repeatedly return to in numbers to perch loaf or spend the night.
Roosting	When birds repeatedly return to a particular place in numbers to loaf or spend the night.
Roost Site Conflict	The likelihood that a roost will create adverse impacts for nearby residents, businesses, visitors, infrastructure, or the birds themselves.
Seasonal Roost	A communal roost occupied during parts of the year, typically outside the breeding season, which may vary in size, duration, and location between years.
Strike Risk	The risk of birds colliding with windows, overhead wires, buildings or other structures, potentially causing injury or death.
Synanthropic Species	A species that lives in close association with humans and human-modified environments.
Tree Martin	A small migratory swallow native to Australia that feeds on flying insects and forms large communal roosts outside the breeding season.

Urban Biodiversity	The diversity of plants, animals and ecological processes occurring within cities and urban environments.
Urban Ecology	The study of ecological processes and interactions between people, wildlife and the built environment in urban areas.

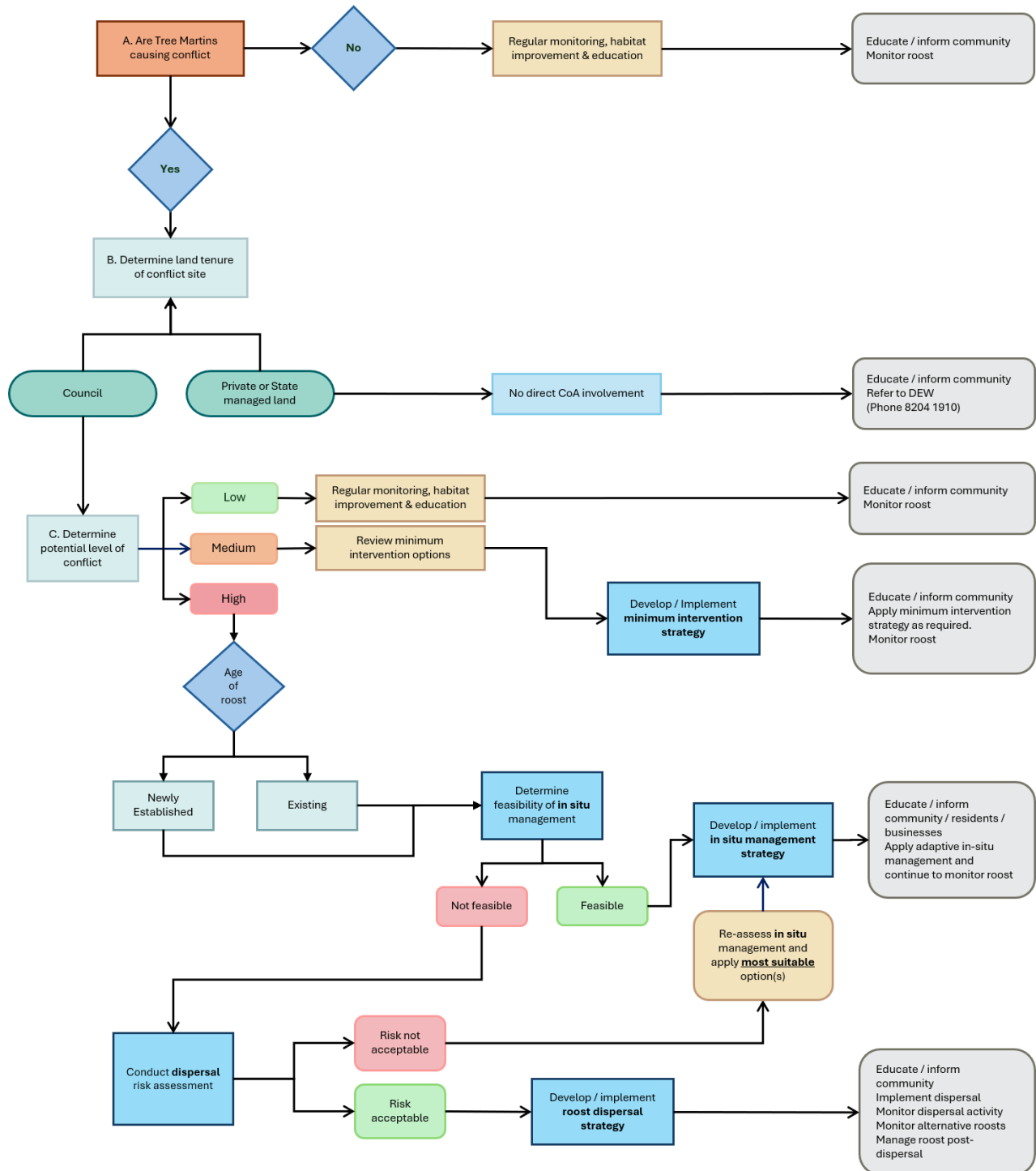
11. Appendices

Appendix A: Primary decision tree for managing human/Tree Martin conflict

Appendix B: Potential roost sites where conflict may arise and their categories

Appendix C: Management options

Appendix A: Primary Decision Tree for Managing Human/Tree Martin Conflict



Appendix B: Potential Roost Sites Where Conflict May Arise and Their Categories

Risk	Location	Roost Potential	Likelihood of Conflict	Comments
High (Undesirable)	Hutt Street	High	High	Mature avenue trees with good canopy development. The outdoor dining precinct in this area could increase its conflict despite the suitable canopy, depending on trees selected for the roost.
High (Undesirable)	Grenfell Street	High	High	More fragmented canopy than Rundle Mall but mature trees occur along much of the street. High pedestrian, vehicle and commercial activity which would cause increased conflict.
High (Undesirable)	Leigh Street	High	High	Previous Tree Martin roosting activity has been recorded within this area. Its hospitality-focused laneway design with outdoor dining and significant evening activity would continue to cause conflict despite its previous habitat usage, if roosting was to be re-established.
High (Undesirable)	Rundle Mall	High	High	Existing roost demonstrates ideal canopy characteristics preferred by the species. Conflict arises from high pedestrian activity, retailers, outdoor dining, and open planned building entrances.
High (Undesirable)	Gawler Place	High	High	Street trees provide continuity with the existing Rundle Mall roost. Heavy pedestrian use, retail activity and constrained streetscape make establishment undesirable.
High (Undesirable)	Vardon Avenue	High	High	Mature street trees provide suitable canopy structure. Extensive outdoor dining and hospitality uses could result in unacceptable amenity impacts if roosting occurred.

Risk	Location	Roost Potential	Likelihood of Conflict	Comments
High (Undesirable)	Ebenezer Place	High	High	Sheltered streetscape with suitable lighting and mature trees. High evening dining activity and limited ability to manage droppings or noise make the site unsuitable for long-term occupation.
High (Undesirable)	Victoria Square / Tarntanyangga	High	Moderate	Large open grassed area bordered by mature trees canopies. Highly activated space from December to May with evening activation, including food and beverage. Infrastructure and lighting for events may increase attractiveness as a roost location.
High (Undesirable)	Charlick Circuit	High	Moderate	Adjacent to the Adelaide Park Lands with broad mature streetscape trees and good flight corridors. Slightly lower pedestrian use than the CBD, with limited vehicle movements, making it a suitable alternative roost location. Nearby residential interfaces increase the likelihood of conflict.
Moderate (Undesirable)	Veale Gardens	High	Moderate	Dense mature vegetation, irrigation, water features and sheltered canopy create potential roost habitat. Although quieter than the CBD, regular recreational use and nearby residential interfaces increase the likelihood of conflict.
Moderate (Undesirable)	Wellington Square/Kudnartu	High	Moderate	Large mature canopy with open space suitable for a large flock. Lower commercial activity than the CBD but nearby residential interfaces and surrounding traffic increase the likelihood of conflict depending on trees selected for the roost.
Moderate (Undesirable)	Hindmarsh Square/Mukata	High	Moderate	Large mature canopy capable of supporting a substantial roost. Surrounded by offices, hotels, restaurants, traffic and public gathering areas, making conflict with people and infrastructure likely.

Risk	Location	Roost Potential	Likelihood of Conflict	Comments
Moderate (Undesirable)	Pirie Street	Low	High	Moderate canopy with strong commercial frontage. Conflict could arise due to potential high weekday pedestrian, increased vehicle activity and public transport.
Moderate (Undesirable)	Frome Road	Low	High	Mature avenue planting with connectivity to Botanic Park. Continuous vehicle traffic and pedestrian movement reduce its long-term roost potential.
Moderate (Undesirable)	Light Square/Wauwi	Low	Moderate	Continuous urban canopy with sufficient tree maturity to support communal roosting. Although habitat quality is moderate, high pedestrian activity, nearby residences, surrounding vehicle traffic and nighttime Fringe venue from January to April make this a sub-optimal location with potential conflict.
Moderate (Undesirable)	O'Connell Street	Low	High	Mature avenue planting with continuous canopy in sections. Hospitality, retail activity and high vehicle activity increases conflict in this location.
Moderate (Undesirable)	Melbourne Street	Low	High	Attractive streetscape with mature trees. Good canopy but has increased café, pedestrian and vehicle activity which could increase conflict.
Moderate (Undesirable)	Gouger Street	Low	High	Tree structure is generally less suitable than preferred roosting habitat with high vehicle activity. If a roost is formed, the restaurant precinct could experience significant amenity impacts.
Moderate (Undesirable)	Vaughan Place	Low	High	Sparse mature canopy with limited habitat value which would reduce the likelihood of roost establishment. Existing hospitality activity means any roost would be highly undesirable.

Risk	Location	Roost Potential	Likelihood of Conflict	Comments
Moderate (Undesirable)	Alfred Street	Low	High	Limited canopy continuity and relatively poor habitat quality. Its proximity to commercial activity, pedestrian movement and high vehicle activity means even a small roost could generate conflict.
Moderate (Undesirable)	Rymill Park / Murlawirrapurka (Park 14)	Low	Moderate	Large lake, mature canopy and open grassed areas provide excellent conditions for communal roosting. Has moderate vehicle activity. The highest frequented arts hubs during the Adelaide Fringe Festival with approximately 750,000 movements with food and beverage components means any roost would be highly undesirable.
Moderate (Undesirable)	Rundle Park / Kadlitpina (Park 13)	Low	Moderate	Sparse canopies made up of mature mixed-species canopies with strong connectivity to Botanic Park and the River Torrens/Karrawirra Pari. The highest frequented arts hubs during the Adelaide Fringe Festival with approximately 750,000 movements with food and beverage components means any roost would be highly undesirable.
Moderate (Undesirable)	Tarntanya Wama (Park 26) - Elder Park	Low	Moderate	In proximity to the River Torrens/Karrawirra Pari, its frequent events, tourism and public recreation usage substantially increase its conflict potential.
Moderate (Undesirable)	Hurtle Square/ Tangkaira	Low	Moderate	Mature trees and open lawn areas provide attractive roosting conditions. Close to the South Terrace Park Lands which increases its ecological connectivity, but surrounding residential land use makes the site undesirable from a conflict perspective.
Moderate (Undesirable)	Whitmore Square/lparriyi	Low	Moderate	Open Square with mature trees with less attractive canopy than other city Square locations. Nearby residents would likely be affected by noise and droppings if roosting occurred. Used as a venue for Fringe events.

Risk	Location	Roost Potential	Likelihood of Conflict	Comments
Moderate (Acceptable)	Frome Park/ Nellie Raminyemmerin Park	High	Low	Mature trees with good connectivity to the eastern Park Lands and River Torrens/ Karrawirra Pari corridor. Suitable canopy structure and lower commercial activity than the CBD.
Moderate (Acceptable)	War Memorial Drive	High	Low	Continuous avenue canopy adjacent to the River Torrens provides good landscape connectivity. Limited evening disturbance, with moderate vehicle activity makes this a suitable alternative roost location.
Moderate (Acceptable)	King Rodney Park / Ityamai- itpina	High	Low	Mature trees connected to eastern Park Lands provide suitable roosting opportunities while maintaining separation from commercial activity.
Moderate (Acceptable)	Botanic Road	High	Low	Broad avenue planting links Botanic Park and the eastern Park Lands, creating an attractive movement corridor for Tree Martins while avoiding high conflict areas.
Moderate (Acceptable)	Red Gum Park / Karrawirra (Park 12) – Riverbank north of Adelaide University	High	Low	Mature canopy and good connectivity to surrounding Park Land areas. Suitable for communal roosting with limited conflict.
Moderate (Acceptable)	Mistletoe Park / Tainmuntilla (Park 11) – Karrawirra Pari riverbank (northern side)	High	Low	Excellent riparian corridor with mature native trees and minimal evening disturbance. Suitable for long-term communal roost establishment.
Moderate (Acceptable)	Mistletoe Park / Tainmuntilla (Park 11) Adelaide Zoo perimeter	High	Low	Mature vegetation adjoining Botanic Park and the River Torrens/Karrawirra Pari provides strong habitat continuity. Evening visitor numbers are generally low, with limited conflict.
Moderate (Acceptable)	Northern section of Tamtanya Wama (Park 26)	High	Low	Mature avenue trees and open landscape structure provide good shelter. Moderate visitor usage and low evening conflict.

Risk	Location	Roost Potential	Likelihood of Conflict	Comments
Moderate (Acceptable)	Victoria Drive	High	Low	Mature avenue trees bordering Botanic Park and the River Torrens/Karrawirra Pari provide high-quality roost habitat with moderate vehicle activity.
Moderate (Acceptable)	Red Gum Park / Karrawirra (Park 12) - Torrens Parade Ground surrounds	High	Low	Mature trees adjacent to the River Torrens/Karrawirra Pari. Periodic events occur but evening conflict is generally low compared with CBD locations.
Low (Acceptable)	Brougham Gardens / Tantutittingga (Park 29)	Low	Low	Small garden reserve with scattered mature trees and low evening visitation. The canopy is discontinuous and unlikely to support a large communal roost, but any roost that forms is expected to have minimal impacts.

Appendix C: Management Options

The management options presented below were evaluated based on three key criteria: (1) Likely effectiveness in reducing Tree Martin impacts, (2) Feasibility of implementation including technical and operational considerations, and (3) Estimated cost, expressed as \$ (low), \$\$ (medium), and \$\$\$ (high). These criteria provide a transparent basis for comparing options and prioritising actions.

Management option	Description	Permit required? Yes/No	Cost	Advantages	Disadvantages	Likely effectiveness and feasibility
Passive management						
Monitoring roosts.	CoA or contracted biologists monitor, observe and record flocks and their roosting behaviours around Adelaide during the southward migration season.	Yes (only if triage for stunned, injured and deceased birds is to occur)	\$\$	Build knowledge on Tree Martin behaviour and helps to determine where alternative roosts may develop.	Monitoring could miss alternative roosts and is subject to availability of team members.	High – very effective in recording roost areas, numbers and behaviours. Early detection allows for mitigation methods to be implemented more quickly if required.
Signage for roosting trees.	Signage to deter MOP from shaking, kicking or disturbing roosting trees. Informs public that the species is protected.	No	\$	Informs MOP about potential health risks if they disturb the roosting flock and can potentially deter people from undesirable action.	Signage can be ignored, and disturbance caused by the MOPs shaking or kicking roosting trees may still occur.	Moderate – may deter MOPs disturbing the flock; however, signage may not stop incidents of shaking or kicking.

Management option	Description	Permit required? Yes/No	Cost	Advantages	Disadvantages	Likely effectiveness and feasibility
Public education	Continuation of public education through forums, workshops, social media, and online information.	No	\$	Assists the public's understanding as to Tree Martins roosting and the ways in which they can assist.	Different views and perspectives on how Tree Martins should be managed.	Moderate to high—public education is important to ensure people understand the species and management response.
Landscape modifications						
Removing roosting trees and replacing with a less appealing species.	Remove the Chinese Elms down Rundle Mall and replace them with a less dense species, that provides a less appealing roosting spot.	No	\$\$\$	Removes the roosting trees completely from Rundle Mall and forces the flock to roost elsewhere.	Not very cost effective or visually appealing, would require time for newly planted trees to mature to determine if suitable. Reduces shaded areas for MOP, diminishing both the aesthetic amenity and cooling effect in the precinct. Future trees may still encourage roosting.	Low to moderate – may be effective if appropriate tree species are chosen, however this may not be cost effective or desired as the site would be bare for some time. Using mature trees as replacements could speed the process.

Management option	Description	Permit required? Yes/No	Cost	Advantages	Disadvantages	Likely effectiveness and feasibility
Trimming of roosting trees.	Trimming of preferred roosting trees can be used to eliminate the dense canopy that connects roosting trees, making it less appealing to roost.	No	\$	Trimming of current roosting trees may reduce perching spots for roosting Tree Martins. Pruning away thick connecting canopy also exposes the flock to more elements potentially making it unappealing to roost.	Trimming trees may only offer temporary solutions, as branches may grow back or birds may relocate to neighbouring trees. May reduce the aesthetic appeal and cooling effect of the streetscape.	Low to moderate – may be effective if branches are trimmed before the roosting flock has established. Could be used for some trees in Rundle Mall.
Removing targeted trees to break canopies of roosting birds.	Removing connecting trees creates canopy gaps, which can disrupt the pathways used to shelter and travel between connecting trees.	No	\$\$	Separating tree canopies may cause the flock to seek denser, more interconnected trees elsewhere.	Birds may continue to perch on suitable trees in Rundle Mall (or other locations).	Low to moderate – may be effective if trees no longer provide a safe canopy for roosting.
Deterrent						
Visual deterrents e.g. owls, disco balls, reflective tape, etc.	Static or moving visual devices discourage roosting or perching. Birds habituate quickly if overused or left static.	No	\$	Triggers their natural fear of predation, and acts as a psychological barrier to make birds feel unsafe.	Short term options, as birds either become habituated to recognise the object to be non-threatening.	Low – not recommended for independent use. May assist in a varied deterrence toolkit.

Management option	Description	Permit required? Yes/No	Cost	Advantages	Disadvantages	Likely effectiveness and feasibility
Install spikes on surfaces to deter birds from landing/perching.	Spikes may deter landing/perching. Small birds may nest within spikes, and Tree Martins may perch on/between spikes if the correct width and configuration is not used.	Yes (if roosting site impacted)	\$	Generally humane and low maintenance, when installed correctly can deter birds from landing or perching.	Smaller birds such as Tree Martins may view wider-spaced spikes as an optimal shelter from predators.	Low to moderate – likely to be partially effective if designed and installed correctly. Not a complete solution.
Bright lights installed in roosting areas.	Floodlights reduce attractiveness of roost sites. Lights must cover all areas and be installed before birds return from migration for highest effectiveness. Only effective at night. Birds often relocate nearby.	No	\$	Bright artificial lighting acts as a strong ecological disruptor, potentially disorientating their natural nighttime migration.	Birds can become trapped in large brightly illuminated zones, causing them to circle endlessly. This could lead to exhaustion, habitat avoidance and increased risk of strikes.	Low – not recommended for independent use. May assist in a varied deterrence toolkit.
Birds of prey calls.	Emit bird of prey calls such as hawk and owl cries which can act as a bioacoustics deterrent, by exploiting natural survival instincts.	No	\$	Can be used to cover a large area, requires minimal installation. May be effective in deterring new roosting flocks.	Birds become habituated to the calls, ignoring the noise and continuing to roost.	Low to moderate – provides a short-term option and may clear out newly roosting birds, however birds may become habituated.

Management option	Description	Permit required? Yes/No	Cost	Advantages	Disadvantages	Likely effectiveness and feasibility
Increase lighting (gradually) within roost trees and/or along overhead wiring.	Fairy lights (or similar) can be installed along the branches of the roost trees on a gradual basis to slowly encourage the birds to move to more suitable locations. Lighting running along the lighting wires may increase visibility, reducing collisions.	No	\$	Increased lighting, particularly if very strong, may deter birds by disrupting their natural biological clocks and altering their perception to predation risk.	Fairy lights on current roosting trees proved ineffective in deterring Tree Martins. In fact, lighting may be enhancing the suitability of the area as it may keep predators away.	Very Low – Not currently effective. Not recommended.
Ultrasonic/audible deterrents.	Emit audible noises/high-frequency ultrasonic sound waves to confuse and disorient birds. Birds habituate quickly.	No	\$	Chemical free and admit frequencies outside of the human hearing range.	Not suitable for large spaces. Many studies have also indicated that a bird's hearing may be comparable to a human's range, making this device potentially ineffective to deter birds. Not suited to a some public spaces such as Rundle Mall.	Low – not recommended.

Management option	Description	Permit required? Yes/No	Cost	Advantages	Disadvantages	Likely effectiveness and feasibility
Visual deterrents e.g. lasers.	Non-lethal method used to deter birds, as birds perceive the moving light as an approaching threat.	Yes	\$	Birds generally do not habituate to the laser if not overused, often triggers flight response.	Can be quite costly, and effectiveness can vary depending on the species. Potential for laser beams to cause problems with human eyesight, including from reflection off surfaces.	Low – not recommended.
Physical barriers and infrastructure modifications						
Rundle Mall lighting upgrades and removal of overhead lighting/wires.	Upgrade the lighting infrastructure throughout Rundle Mall to reduce the need for overhead wires, reducing strikes.	No	\$\$\$	Reduces the risk of wire strikes down Rundle Mall by removing overhead catenary wiring.	Initial costs are high and may be unappealing to stakeholders.	Low – not recommended to reduce strikes. Initial outlay likely to be cost prohibitive. May cause unintended consequences for safety, and operation of Rundle Mall. Feasibility is questionable.

Management option	Description	Permit required? Yes/No	Cost	Advantages	Disadvantages	Likely effectiveness and feasibility
Wire strands/rolling perch.	Wiring must be at correct height and distance apart for Tree Martins and professionally installed. Polyurethane pipe can be added to the wire in 50 mm lengths to create a “rolling perch”, preventing perching and roosting.	No	\$\$	More aesthetic than installing bird spikes. Rolling perches provide a humane way to discourage birds from roosting on ledges.	Incorrect sizing can be less effective to smaller birds, that may squeeze between or underneath the wiring. Requires complex and precise installation.	Moderate to high – effective if correctly spaced and tensioned. Professional installation and maintenance required.
Bird slide.	Sloped ledges under eaves prevent nest building and perching.	No	\$	Low maintenance, permanent exclusion barrier. Creates a surface in which birds slide off and cannot perch.	Require knowledge to be properly installed, and they do not work on vertical or rounded surfaces.	Low to moderate – limited effectiveness and feasibility.
Application of decal/window film (e.g. Solyx SX-1975) to window exteriors within high-collision areas.	Window film applied to the exterior of windows deters birds from flying into reflective glass, preventing potential injuries or fatality. The film allows birds to see the glass, which helps reduce the risk of collisions.	No	\$\$	Placing film on store windows helps birds to see where the glass is and reduces the risk of collisions, as surfaces become less reflective.	May be unappealing to stakeholders as it may detract from the visual appeal and layout of their storefront.	High – easy to apply to shop windows and effective at reducing collisions.

Management option	Description	Permit required? Yes/No	Cost	Advantages	Disadvantages	Likely effectiveness and feasibility
Bird shock track or flex track.	Electrified track emits an irritating pulse to deter perching. This could be installed on perching points around the affected areas. Appropriate voltage must be used to ensure shocks do not cause significant pain or injury (including in wet weather). Flex track can be installed on flat and curved hard surfaces.	Yes	\$\$	Made from flexible PVC that can easily bend around corners and conform to different architectural shapes. Produces an intermittent static pulse that startles birds without harming them.	Prolonged exposure to elements or debris can cause it to short circuit, requires regular inspection and maintenance. Higher upfront cost for installation.	Moderate to high – effective for persistent perching. Professional installation and maintenance required.
Installing possum tail coverings over catenary wiring.	A grey silicon rubber that can be used to cover catenary wires down Rundle Mall, providing cushioning to minimise fatal wire strikes, and to make wires more visible to roosting birds.	No	\$	Adds increased visibility, due to colouring and wires appearing thicker. Offers some cushioning benefit to a degree to prevent fatal strikes.	Will degrade over time and require maintenance due to continuous elemental exposure.	High – easy to setup and install. May minimise the risk of fatal strikes occurring in Rundle Mall.

Management option	Description	Permit required? Yes/No	Cost	Advantages	Disadvantages	Likely effectiveness and feasibility
Obscured entry/door.	Consider temporary installations that deter birds from flying into buildings while maintaining visitor access. The focal period is 30-minutes prior to sunset to 1-hour after sunset (to be assessed and revised). For example: - streamers or paracord (e.g. plastic streamers or paracord curtains such as the Acopian Bird Savers, which people can part to walk through) - artwork or curtains (as above) - smoke machines (i.e. create a visual barrier to deter the birds, people can walk through) - light laser wall. The aim is to create a visual/physical deterrent that will deter/prevent the birds entering but does not impede people – and may attract people (e.g. an art installation).	No	\$	Creates a visual and physical deterrent to birds entering large opening, still allows people to enter.	May be prone to vandalism and could be potentially unappealing – businesses may be reluctant to install. Birds may still enter buildings.	Moderate to high – effective if setup correctly. Could be time-consuming to setup. May be prone to vandalism. Could be interpreted by businesses to reduce the amenity of their shopfronts / entrances, and potentially distract customers from entering.

Management option	Description	Permit required? Yes/No	Cost	Advantages	Disadvantages	Likely effectiveness and feasibility
Population management						
Food restriction	Coordination required by all stakeholders to implement food resource restriction strategies. May be complemented by dispersal at food resource sites.	No	\$	Restricting food resources may encourage the flock to move further out to find a more reliable source of food. This approach disrupts their habits without relying on harmful deterrents.	Requires precise knowledge on where the Tree Martins are going throughout the day to forage. Currently there is no accurate information available. If one food resource is restricted, birds may also travel elsewhere to find food. Very likely that Tree Martins are feeding on predominantly natural food sources that would be impossible to manage.	Low – not recommended.

Management option	Description	Permit required? Yes/No	Cost	Advantages	Disadvantages	Likely effectiveness and feasibility
Translocation	Capture and translocate Tree Martins. For multiple birds at an established roost site, birds are likely to either return or be replaced quickly.	Yes	\$\$	Sometimes translocation works well with establishing new and secure habitats for species.	Capturing, handling and releasing birds into an unfamiliar area may cause stress to birds, potentially leading to increased mortality. In most cases many translocated birds may return or be replaced by other birds.	Low – not recommended.
Active dispersal						
Falconry to disburse birds from roosting trees.	The use of trained raptors to exploit a species natural survival instinct. Effective in open areas and can be useful in preventing habituation.	Yes	\$\$	Highly effective for open areas, with the ability to patrol large areas quickly. Due to birds natural 'fight or flight response' there is no risk of habituation.	Raptors generally cannot be flown during heavy rain, strong winds or extreme temperatures. As they are diurnal hunters, they are generally ineffective at night to disperse roosting flocks.	Moderate – may assist with active dispersal as flocks begin to enter the tree canopy, if used in combination with other options, like netting trees. Requires trained personnel and birds.

Management option	Description	Permit required? Yes/No	Cost	Advantages	Disadvantages	Likely effectiveness and feasibility
Drones to monitor/disperse birds	Used to mimic predators and actively disperse birds. Can be paired with cameras for monitoring.	No (provided dispersal does not harm animals)	\$\$	Drones can be used to mimic the auditory and visual presence of predators using biomimicry. They can also be effectively used for real-time populations surveys in areas that are hard to reach or are inaccessible.	Birds may become habituated to the use of the drone, limiting its effectiveness as a tool for dispersal. Operational limits also include low light, weather and poor visibility. Flight plans require Civil Aviation Safety Authority (CASA) approval. Risks to public safety need to be considered.	Low – may assist in a varied deterrence toolkit. Flight plans will require CASA approval. Public safety and nuisance impacts will need to be considered.

Management option	Description	Permit required? Yes/No	Cost	Advantages	Disadvantages	Likely effectiveness and feasibility
Active dispersal by trained staff	May be used at nocturnal roost sites. More effective for nomadic species compared with sedentary species. Tools could include handheld visual deterrents, auditory devices lasers, pyrotechnics, etc. Interactions with the public will need to be carefully considered for any active dispersal activities. Types of dispersal must be target to the specific roosting location to prevent the risks of increased strikes.	No (provided dispersal does not harm animals)	\$\$	Utilising an array of active dispersal tools can discourage birds from establishing a permanent roosting site, encouraging them to relocate to a new area to roost. Unlike passive or static deterrents such as effigies, dynamic active dispersal tools may prevent habituation.	Types of dispersal must be targeted to the specific roosting location, as using the wrong dispersal tool may increase the likelihood of flushes and mortalities. Interactions with the public will need to be carefully considered for any active dispersal activities.	Moderate to high – provided sufficient frequency and variation in deterrence tools to avoid habituation.

Management option	Description	Permit required? Yes/No	Cost	Advantages	Disadvantages	Likely effectiveness and feasibility
Robird®	Similar to standard drones but designed to imitate raptors for greater dispersal effect.	No (provided dispersal does not harm animals)	\$\$	Prevents habituation by mimicking the appearance and flight pattern of a live bird of prey, triggering a birds 'fight or flight response'.	Flight plans require CASA approval and require trained personnel to operate. Robirds have short flight times per charge, therefore continuous coverage requires numerous batteries. Robirds cannot fly safely in heavy rain, extreme winds or at night.	Low – may assist in a varied deterrence toolkit. Flight plans will require CASA approval. Public safety and nuisance impacts will need to be considered. Interactions with the public will need to be carefully considered for any active dispersal activities.

Note: Breeding restrictions and/or culling birds is not considered suitable.

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