

Report 6 of 2024

Urban tree canopy management



Report of the Auditor-General

Report 6 of 2024

Urban tree canopy management

Tabled in the House of Assembly and ordered to be published, 4 June 2024

First Session, Fifty-Fifth Parliament

By authority: T. Foresto, Government Printer, South Australia

*The Auditor-General's Department acknowledges and respects
Aboriginal people as the State's first people and nations, and
recognises Aboriginal people as traditional owners and occupants of
South Australian land and waters.*



www.audit.sa.gov.au

Enquiries about this report should be directed to:

Auditor-General
Auditor-General's Department
Level 9, 200 Victoria Square
Adelaide SA 5000

ISSN 0815-9157



4 June 2024

President
Legislative Council
Parliament House
ADELAIDE SA 5000

Speaker
House of Assembly
Parliament House
ADELAIDE SA 5000

Level 9
State Administration Centre
200 Victoria Square
Adelaide SA 5000
Tel +618 8226 9640
ABN 53 327 061 410
audgensa@audit.sa.gov.au
www.audit.sa.gov.au

Dear President and Speaker

**Report of the Auditor-General:
Report 6 of 2024 *Urban tree canopy management***

Under section 32(1)(c) of the *Public Finance and Audit Act 1987* (PFAA), I have conducted a review of the urban tree canopy management by the City of Holdfast Bay and the City of Port Adelaide Enfield.

I present to each of you my independent assurance report on the findings of the review. Copies of this report have also been provided to the City of Holdfast Bay and the City of Port Adelaide Enfield.

Content of the report

Our review assessed whether the City of Holdfast Bay and the City of Port Adelaide Enfield have effective activities in place to increase or maintain the tree canopy cover in their council areas.

My responsibilities

Reviews conducted under section 32(1)(c) of the PFAA are assurance engagements that assess whether a publicly funded body is achieving economy, efficiency and effectiveness in its activities. These engagements conclude on the performance of the activities evaluated against identified criteria.

The Auditor-General's roles and responsibilities in undertaking reviews are set out in the PFAA. Section 32(1)(c) of the PFAA empowers me to conduct this review while sections 32(4) to (6) deals with the reporting arrangements.

The review was conducted in line with the Standard on Assurance Engagements ASAE 3500 *Performance Engagements*. We complied with the independence and other relevant ethical requirements for assurance engagements.

Acknowledgements

The audit team for this Report was Salv Bianco, Iolanda Telford, Kris Slaytor and Sharon Ryan. They were assisted by RM Consulting Group Pty Ltd. The audit team were also assisted by Jueying Wu and Jennifer Huynh in developing the data published on the Auditor-General's Department's website.

We appreciate the cooperation and assistance given by the staff of the City of Holdfast Bay and the City of Port Adelaide Enfield.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Andrew Blaskett', written in a cursive style.

Andrew Blaskett
Auditor-General

Contents

Audit snapshot	1
1 Report overview	3
1.1 Introduction	3
1.2 Overall conclusions	4
1.3 The structure of this report	4
2 Key insights on urban tree canopy management for councils	5
2.1 Councils need current and high-quality data about their trees	5
2.2 Councils need to manage tree risks	6
2.3 Councils need to report and monitor performance against their tree targets	6
2.4 Councils should have separate targets for tree canopy and guidelines for tree species and age diversity	6
2.5 Councils need strategies to educate and encourage positive community attitudes about trees	7
3 Background	8
3.1 What is happening to Adelaide’s tree canopy	8
3.2 How climate change will impact Adelaide’s tree canopy	9
3.3 Why it is important to increase the tree canopy	10
3.4 Challenges for Adelaide’s metropolitan councils in increasing the tree canopy	11
3.5 Roles and responsibilities	12
4 City of Port Adelaide Enfield	14
4.1 Executive summary	14
4.2 Overview of the City of Port Adelaide Enfield	15
4.3 Data and asset management systems findings	18
4.4 Risk management findings	21
4.5 Monitoring and reporting performance findings	24
4.6 Strategic planning for tree management findings	26
4.7 What the City of Port Adelaide Enfield did well	27
5 City of Holdfast Bay	29
5.1 Executive summary	29
5.2 Overview of the City of Holdfast Bay	30
5.3 Data and asset management systems findings	33
5.4 Risk management findings	35
5.5 Monitoring and reporting of performance findings	37
5.6 Strategic planning for tree management findings	38
5.7 What the City of Holdfast Bay did well	40

Appendix 1 – Audit mandate, objective and scope	42
Appendix 2 – A model tree management framework	44
Appendix 3 – LiDAR measurement of metropolitan Adelaide’s tree canopy cover	45
Appendix 4 – Government frameworks for tree canopy	47
Appendix 5 – Extract from the City of Holdfast Bay’s response to our findings and recommendations	48
Appendix 6 – Response from the City of Port Adelaide Enfield	52
Appendix 7 – Response from the City of Holdfast Bay	53
Appendix 8 – Abbreviations and terms used in this report	54
Annexure	56
References	57

Audit snapshot

What we reviewed and why

Like the rest of the world, South Australia continues to experience a rise in average temperatures. Trees help mitigate the effects of rising temperatures and the build-up of heat in cities by providing shade and cooling, and many other benefits to the community.

The SA Government has acknowledged the importance of trees, setting voluntary long-term targets to increase and maintain tree canopy cover over metropolitan council areas. Many Adelaide metropolitan councils have also set their own tree canopy targets.

We reviewed two metropolitan councils to form a view on whether they have effective activities in place to increase or maintain the tree canopy cover in their areas.

What we concluded

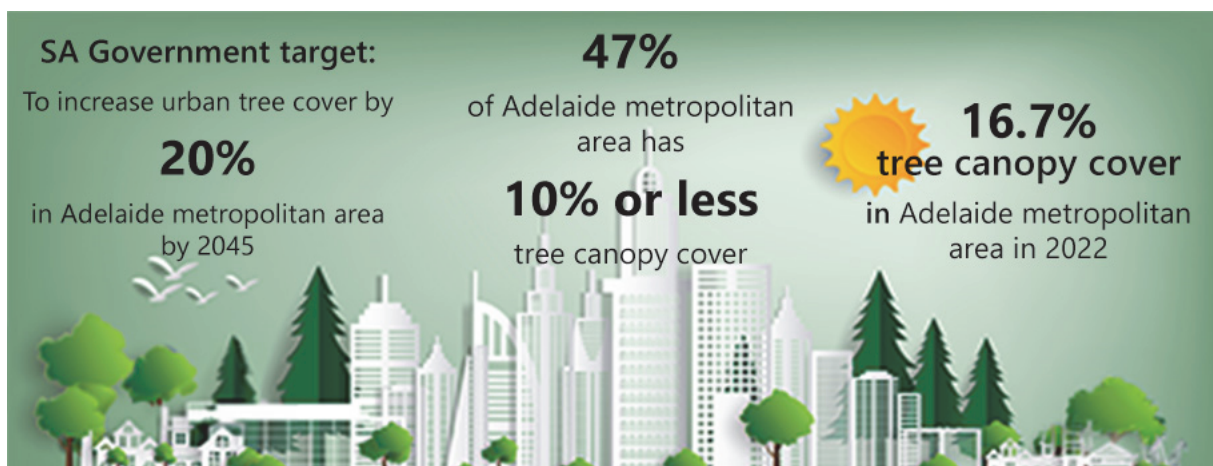
Both councils we reviewed had tree management activities to increase and maintain their tree canopies that were partly effective. Some activities were operating effectively but there were gaps in others that need to be addressed to be effective, such as maintaining council tree data and documenting the assessment and treatment of all tree risks.

Tree canopy management is an area that continues to evolve for Local Government. Both councils had a clear long-term commitment to increase their tree canopies and strategies to promote tree growth on private property – one council conducted an audit of its public trees and the other council had modelled tree data to set its tree canopy targets.

Key insights for councils

This report provides our key insights that all councils can consider in maintaining and growing a resilient and healthy tree canopy, including:

- maintaining current and high quality tree data
- managing tree risks effectively
- monitoring and reporting performance against their objectives and targets
- setting separate tree canopy targets and guidelines for tree species and age diversity
- implementing strategies to encourage positive community attitudes towards trees.



1 Report overview

1.1 Introduction

An urban tree canopy has many benefits. Trees give shade, reduce the urban heat island effect,^a improve air quality and community health and wellbeing, and help manage stormwater. Adelaide’s metropolitan councils recognise the important contribution trees make to the community, and most have set targets to increase and maintain their tree canopy cover in line with the SA Government’s voluntary long-term targets. Figure 1.1 shows the SA Government’s targets.

Figure 1.1: SA Government’s tree canopy target for Greater Adelaide¹

Target 5 – A green liveable city

For council areas with **less than 30%** tree canopy cover currently, cover should be **increased by 20%** by 2045.

For council areas with **more than 30%** tree canopy cover currently, this should be maintained to ensure **no net loss** by 2045.

Adelaide’s metropolitan tree canopy cover was 16.7% in 2022,² well short of the generally accepted target for urban areas of around 30%.³ This cover varies considerably across the city’s metropolitan council areas, with 47% of metropolitan Adelaide having tree canopy cover of 10% or less.⁴

Councils face many challenges in increasing and maintaining the tree canopy in a constantly changing urban landscape. Limited planting space, urban infill, the need for affordable housing, insufficient legislative protection for trees, vandalism and negative community perceptions are just some of the difficulties councils told us they experience.^b

Adelaide’s changing climate is also impacting our tree canopy. Climate projections predict that Adelaide will experience more extreme weather events in the coming years with longer and hotter heat waves, prolonged periods of drought, less annual rainfall, more intense storms and flooding.⁵ As Adelaide’s climate shifts, there is an increasing need for councils to ensure public trees are suited to these conditions to protect the tree canopy and help reduce the urban heat island effect.

While councils continue to develop and refine their tree canopy strategies, plant more trees and find innovative ways to improve tree health and resilience, they will need to educate, support and encourage their communities to retain and plant trees on private land if targets are to be met.

We reviewed two Councils, the City of Port Adelaide Enfield (PAE Council) and the City of Holdfast Bay (CHB Council), to assess whether they have effective activities in place to increase

^a Buildings, roads, roofs and concrete can absorb and trap heat in dense urban environments, making urban areas hotter than surrounding rural areas. This is referred to as the urban heat island effect.

^b We surveyed Adelaide metropolitan councils in November 2023 about how they are managing their tree canopies. See the annexure for more information.

or maintain the tree canopy cover in their council areas. We selected these Councils because they had low tree canopy cover, high population density, a high number of building approvals per km² and a high number of vulnerable community members.

We show the change in tree canopy cover over Adelaide metropolitan council areas for 2018 and 2019, and 2022 in a dashboard on the Auditor-General Department's website – www.audit.sa.gov.au. See the annexure for more information.

1.2 Overall conclusions

We concluded that both Councils had tree management activities to maintain and increase their tree canopies that were partly effective. This is because while some activities were operating effectively, we identified gaps in others that need to be addressed to be effective, such as:

- capturing and maintaining data about Council trees
- documenting the assessment and treatment of all tree canopy risks
- developing better functionality in tree management systems
- monitoring and reporting of performance.

Both Councils demonstrated a clear long-term commitment to actions to increase the tree canopy cover in their areas.

Our full conclusions including our findings, recommendations and the Councils' responses are detailed in section 4 for the PAE Council and section 5 for the CHB Council. Our findings and recommendations were shared with each Council.

Details of our audit mandate, review objective and scope are provided in appendix 1.

1.3 The structure of this report

This report details our review approach and results, including audit conclusions, findings and recommendations for the two metropolitan councils we reviewed as follows:

- section 2 provides some key insights from our audit work which councils can consider for their tree management activities
- section 3 provides an overview of what is happening to metropolitan Adelaide's tree canopy, the impact this is having on the environment and community, and what councils can do to protect and maintain their tree canopies
- section 4 provides an overview of the City of Port Adelaide Enfield's tree management activities, its current tree canopy measurement, the results of our review and the Council's responses
- section 5 provides an overview of the City of Holdfast Bay's tree management activities, its current tree canopy measurement, the results of our review and the Council's responses.

2 Key insights on urban tree canopy management for councils

Trees take time to establish, grow and provide shade, canopy and amenity. But they also require proper management in their planning, resourcing, planting and maintenance to achieve their maximum benefit and minimise their risks. There is no standard approach to managing trees.^c Each council must develop strategies and plans that address their own unique needs and circumstances. In conducting our review, we developed some key insights for councils to consider when planning how to increase and maintain their urban tree canopies.

2.1 Councils need current and high-quality data about their trees

Councils need current and high-quality data about their trees to maintain and grow a resilient, healthy canopy. Comprehensive data helps councils:

- make reliable, effective and informed decisions about their tree population (such as improvements to diversity of species and tree health), maintenance activities, resource allocation and priorities
- manage tree risks such as tree limb failure, die back and lack of species and age diversity in tree populations
- manage their responsibilities under the *Local Government Act 1999* (LG Act) by having records of tree inspections and condition, and a history of council work performed
- coordinate tree planting programs with asset works programs such as kerb and footpath replacement and road resurfacing
- respond to complaints or enquiries about trees.

Capturing tree data over time also means councils can analyse trends, monitor changes in the tree canopy and assess progress towards achieving targets and objectives.

Case study 1: Data about tree canopy composition

Between 2021 and 2023, the City of Holdfast Bay conducted an audit of its street and open space trees. This resulted in a database of its 21,100 trees (approximately). Data captured included tree numbers, species, age, health, risk status and plantable spaces. The Council will use this data to develop an urban forest strategy and tree management plan, including targets for tree planting numbers, guidelines for species diversity and the actions needed to achieve them. The data will also support the Council's move to a more proactive tree management approach.

^c Appendix 2 provides a model of a tree management framework councils could refer to when developing and reviewing their tree management frameworks.

2.2 Councils need to manage tree risks

Managing risk is a key feature of tree management and is essential for maintaining and growing the tree canopy. Councils should have documented risk frameworks, policies, procedures, tools and registers to evidence their approach to managing risks such as tree limb failure, die back and lack of species and age diversity in tree populations. This, together with regular monitoring and reporting, will help councils manage their tree risks, achieve their targets and grow a healthy, resilient tree canopy.

2.3 Councils need to report and monitor performance against their tree targets

To improve the likelihood of achieving their objectives and tree canopy targets, councils should periodically report and monitor their tree management activities. Where possible, they should consider the benefits of presenting results against targets and supplementing this with contextual information to help users understand and assess council performance.

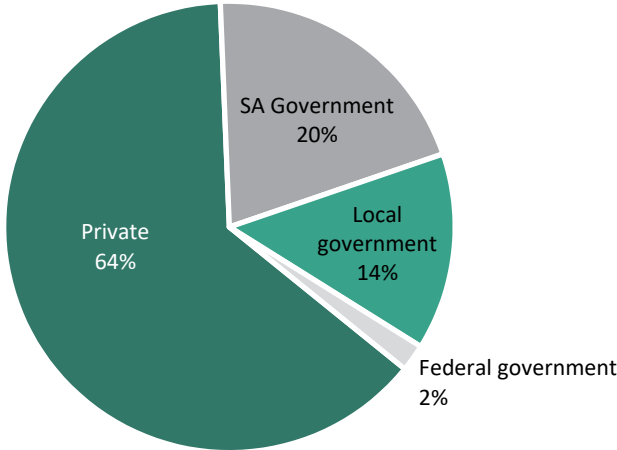
Performance reporting about council trees and tree canopy could include:

- the number of trees planted on and removed from council land
- plantable spaces available and filled
- watering, pruning and other maintenance
- the general health and condition of the tree population or segments of it
- changes in species diversity against target ratios or guidelines
- changes in average tree age in specific neighbourhoods against target ratios or guidelines.

2.4 Councils should have separate targets for tree canopy and guidelines for tree species and age diversity

A significant challenge for metropolitan councils working to increase their tree canopies is that much of the land in their areas is privately owned. Figure 1.2 shows the percentage of land use type in metropolitan Adelaide.

Figure 1.2: Metropolitan Adelaide by land use type



Source: Based on Green Adelaide 2022, *Urban tree canopy, green spaces and built environment data analysis and reporting 2022 Survey Area Technical Report*, January 2022, Government of South Australia, Adelaide.

The availability of council land for planting is also often limited by infrastructure like powerlines, storm and wastewater networks, footpaths and roads, and house and fence footings.

To recognise these limitations, some councils set separate tree canopy targets for different land use and tenures. This can provide a fairer measure of council performance and help guide different management or planning directions for various types of land use.

Councils should also set locally appropriate guidelines for tree species and age diversity to maximise the resilience of their canopies. A diverse mix of tree species will reduce the risk of widespread loss of one or more species to pests, diseases and climate extremes. Diversity of tree ages help councils ensure that new generations of trees are planted to replace those reaching the end of their natural life or that need to be removed because of poor structure or health.

Example 1: An exotic pest outbreak shows why tree species diversity is important

In July 2023, an outbreak of the Giant Pine Scale pest was discovered at the Elliston Reserve in Highbury in Adelaide’s north-east and another two locations in Hope Valley. This pest sucks the sap of pine trees causing branch die back and eventual death. Close to 800 trees were felled in a bid to stop the spread of the insects, which posed a threat to South Australia’s forest industry. The loss of so many trees drastically changed the landscape of the reserve, which is owned by the SA Government but maintained by the City of Tea Tree Gully. A revegetation plan will be developed for the reserve.^{vi}

2.5 Councils need strategies to educate and encourage positive community attitudes about trees

With so much private land in council areas, activities that support the retention of existing trees and encourage new planting of private trees are key to increasing the tree canopy. While the SA Government controls the removal of trees through the *Planning, Development and Infrastructure Act 2016* (PDI Act), councils can still influence community behaviour through programs and initiatives that highlight the value of having trees on private land.

Example 2: Council strategies to change community attitudes about trees

Both Councils we reviewed had initiatives to change community perceptions about trees and contribute to their maintenance, including:

- tree giveaways
- grants to residents to help maintain significant and regulated trees
- a tree of the month recognition program where trees nominated by the community were displayed on the Council’s website
- an ‘adopt a street tree’ program where responsibility for establishing trees was shared between residents and the Council.

3 Background

3.1 What is happening to Adelaide's tree canopy

In 2018 and 2019 Regional Climate Partnerships and individual metropolitan councils undertook a number of projects which measured tree canopy cover across metropolitan Adelaide using Light Detection and Ranging (LiDAR) data.^d

The council areas of the Town of Gawler and the City of Playford were only partially surveyed at this time and metropolitan Adelaide's tree canopy was calculated to cover 14.5% of the metropolitan area.

In 2022 LiDAR was again used to measure the tree canopy across the same 18 council areas. This time the Town of Gawler and the City of Playford were surveyed in full and the tree canopy was calculated to cover 16.7% of metropolitan Adelaide.⁷

To enable comparison between 2022 and 2018–2019 LiDAR results, Green Adelaide recalculated canopy cover for 2018–2019 based on the same method applied in 2022. When the parts of the Town of Gawler and City of Playford that were not surveyed in 2018–2019 were removed from the 2022 survey results, the tree canopy cover measurement rose to 18.3%, a net increase of 3.8%.^e This small increase in canopy resulted from existing mature trees having developed further crown spread and trees planted during the past few years having grown in height to 3 metres or more. However the gain in canopy was offset partly by tree loss from pruning and removal during this time. Although all Local Government areas experienced tree canopy cover increases, Adelaide's metropolitan tree canopy is still a long way from the SA Government target.

LiDAR measurement in 2022 shows that metropolitan Adelaide lost almost 7 million square metres of tree canopy across residential land through tree removal, pruning and storm damage between 2018 and 2022, enough to fill about 434 Adelaide Ovals.⁸

Urban areas (particularly residential) make up a significant portion of metropolitan Adelaide. High demand for housing has meant infill development has become a significant source of new housing in the metropolitan area, contributing to the loss of mature trees in many of Adelaide's neighbourhoods. New development often increases the amount of dark, impermeable surfaces such as roofing, roads, concrete and asphalt. This reduces the amount of space available for gardens and tree planting and passive irrigation through localised water infiltration necessary to maintain the health and survival of trees. LiDAR measurement in 2022 shows impermeable surfaces cover 29%⁹ of metropolitan Adelaide.

Appendix 3 provides further information about the LiDAR measurement of tree canopy in 2018–2019 and 2022.

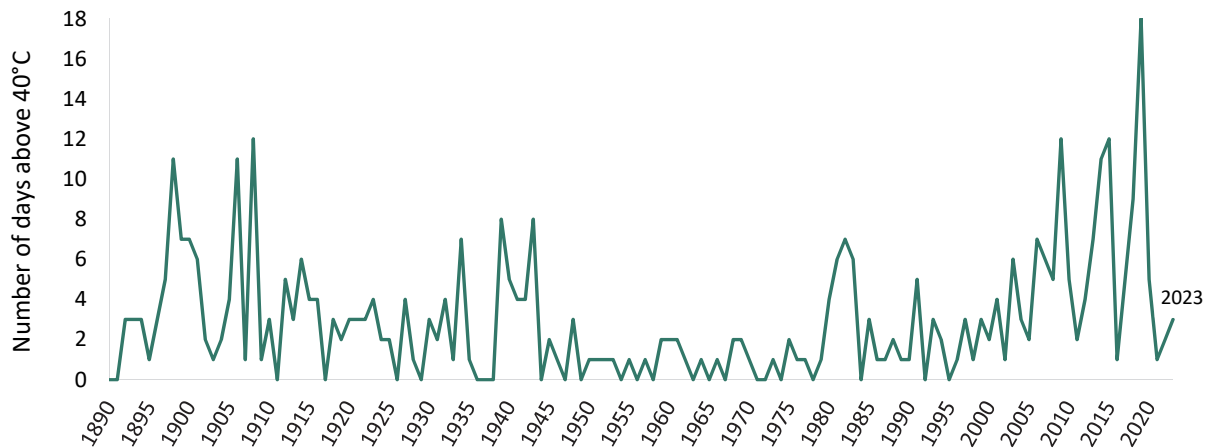
^d See appendix 3 for an explanation about the LiDAR data used to measure tree canopy cover in council areas.

^e We did not review LiDAR data from 2018–2019 or 2022 for its completeness and accuracy. We did not review Green Adelaide's recalculation of 2022 canopy cover based on the council areas surveyed in 2018–2019.

3.2 How climate change will impact Adelaide’s tree canopy

Climate change is a significant risk to the urban tree canopy. Records continue to show that South Australia’s climate is changing, with long-term shifts in temperatures and weather patterns.¹⁰ As well as a rise in average temperature of 1.15°C in South Australia in 2023,¹¹ there have been three times the average number of days reaching 40°C in Adelaide in the last 10 years than in the previous four decades.¹² Figure 3.1 shows the number of days above 40°C in Adelaide over the last 130 years.

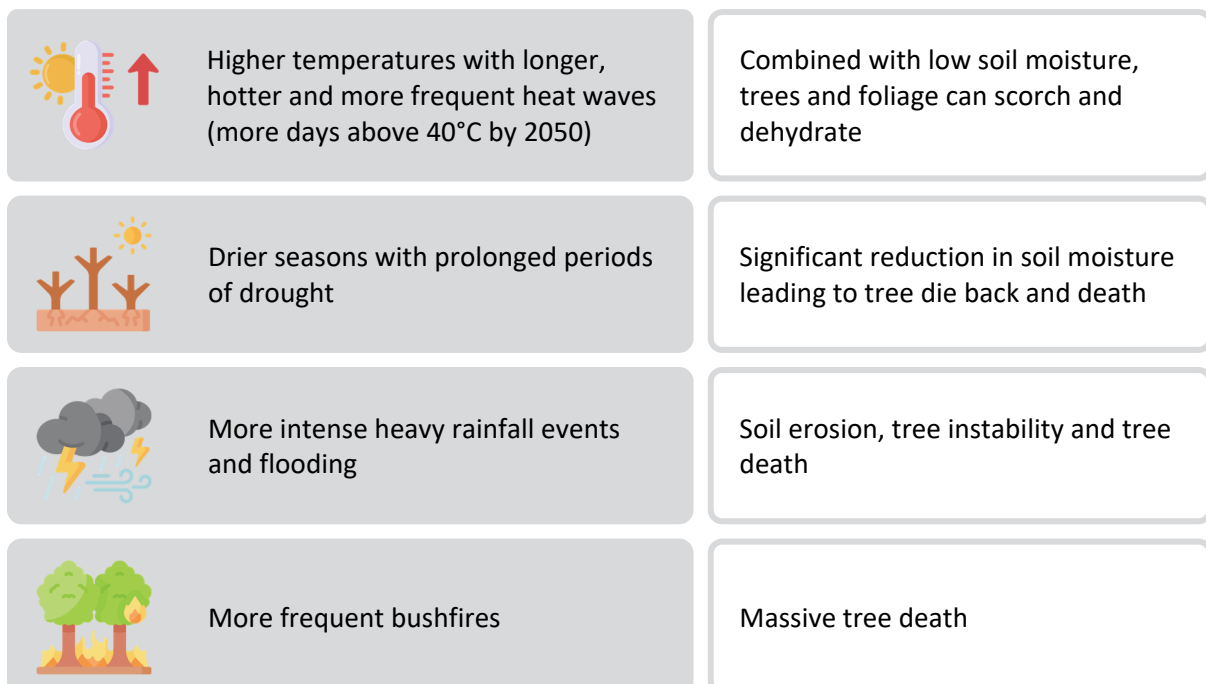
Figure 3.1: Number of days above 40°C in Adelaide over the last 130 years



Source: Based on data from the Australian Bureau of Meteorology, Climate Data Online – Map search (www.bom.gov.au)

Climate projections predict that Adelaide will experience more extreme weather events in the coming years.¹³ This can weaken tree health, leaving them vulnerable to pests and disease as shown in figure 3.2.

Figure 3.2: Predictions about Adelaide’s changing climate¹⁴ and its impact on trees



Some tree species will not survive sustained increases in temperature or long-term changes in rainfall. The lack of diversity of tree species and age of the tree populations in some council areas only compounds this problem, increasing the risk and frequency of tree death and further reducing the canopy.

Councils will need to consider the effects of climate change when planning their tree management activities. Factors such as species selection and the mix of tree ages can help to optimise the resilience of their canopy and reduce their exposure to these long-term changes and uncertainties.

3.3 Why it is important to increase the tree canopy

Studies show that average temperatures in large cities are between 2°C and 12°C higher than in rural areas.¹⁵ This is because the increase in artificial impermeable surfaces such as roads and buildings absorb more heat than natural surfaces like vegetation and water. Higher temperatures can negatively impact community health and wellbeing, the environment, economic productivity, infrastructure and public services.

3.3.1 The urban heat island effect

Some suburbs are more vulnerable to higher temperatures because of the urban heat island effect, created when there are large amounts of hard, sealed surfaces and less green cover like the tree canopy, parks and reserves. Hard surfaces absorb, store and radiate heat, while green cover reflects it, provides shade and releases water into the atmosphere through transpiration and evaporation.

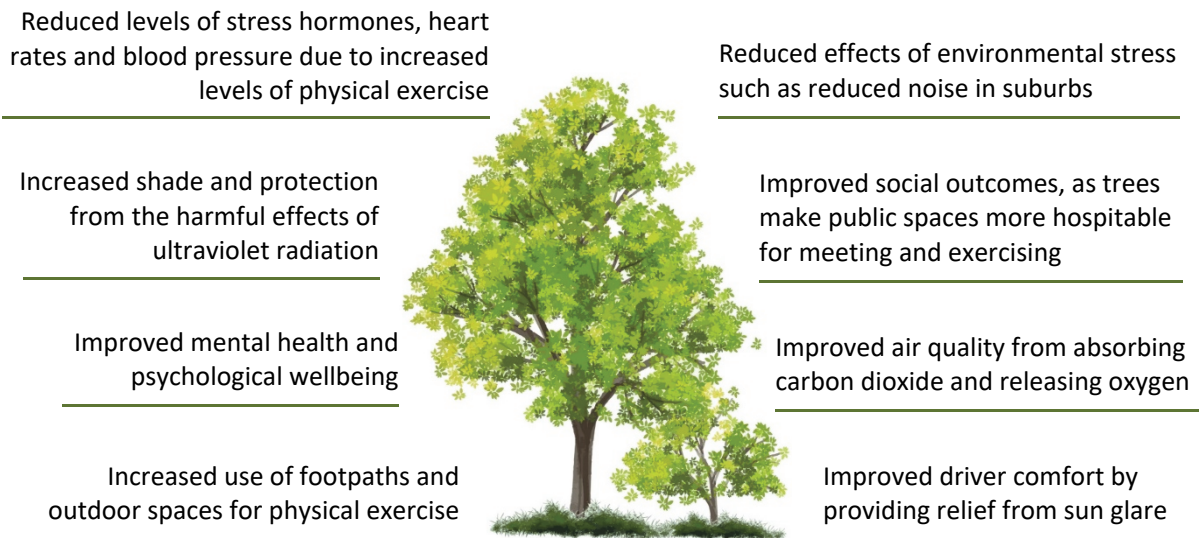
The loss of tree canopy increases the urban heat island effect, raising air temperatures and making extreme hot weather events more difficult to manage. It is predicted that South Australia will become hotter and drier with more frequent and intense extreme weather events because of climate change.¹⁶ Average temperatures across the state are projected to rise by as much as 2.1°C above the long-term average by 2050.¹⁷ Increasing the tree canopy will help cool our suburbs and better adapt to meet this challenge.

3.3.2 Community health and wellbeing

The projected increase in extremely hot days in Adelaide presents a serious risk to the health and wellbeing of residents. Adelaide is Australia's driest capital city and has particularly hot summers, with an average 10.5 hours of daily sunshine in summer.¹⁸ Adelaide already has the highest heatwave death rate of any major Australian city,¹⁹ and has one of the lowest tree canopy covers of Australia's state capitals.²⁰

Some benefits of trees and their impact on community health and wellbeing are shown in figure 3.3.

Figure 3.3: Benefits of trees and their impact on health and wellbeing²¹



3.3.3 The environment

Trees provide many environmental benefits, with urban forests described as ‘the engine room for urban ecosystems’.²² The benefits include:

- improving air quality and storing carbon (the most prevalent greenhouse gas) through sequestration
- filtering traffic-related and other urban pollutants and fine particulates
- providing habitat, food and protection to native plants and animals, increasing urban biodiversity
- cooling down the surrounding air by releasing moisture on leaves
- branches, bark and leaves intercepting water flow and reducing surface water runoff during heavy rainfall
- tree root systems absorbing stormwater runoff and reducing the nitrogen, phosphorus and heavy metal content in stormwater
- tree root systems preventing or stabilising soil erosion
- protecting the surrounding flora and fauna from weather by providing windbreak and rain cover protection.

3.4 Challenges for Adelaide’s metropolitan councils in increasing the tree canopy

Councils face many challenges in their efforts to increase the urban tree canopy. These include:

- the lack of available plantable space on public land

- existing infrastructure such as powerlines, storm and wastewater networks, footpaths, roads, house and fence footings which interfere with tree roots and crown spread
- the PDI Act allowing trees within 10 metres of a dwelling or in-ground swimming pool to be removed without development approval, with the exception of certain tree species and significant and regulated trees
- climate conditions and ongoing tree maintenance such as watering and pruning
- tree loss from storms, bushfires and drought and trees reaching the end of their natural life
- public concerns about the threat of damage, obstruction of view, and leaf, nut and bark litter
- the need for new developments, in particular housing
- changing developers' perceptions about the value of trees
- encouraging residents to retain existing trees or plant new trees on their properties
- vandalism of trees or the unapproved removal of them.

Addressing these challenges is key to councils achieving their targets and working towards the SA Government's long-term tree canopy targets.

3.5 Roles and responsibilities

Appendix 4 provides an overview of the state and local government frameworks that govern the roles and responsibilities for managing trees.

The SA Government has recently completed or has ongoing reviews related to this topic, including:

- a parliamentary inquiry into the urban forest, conducted by the Environment Resources and Development Committee (ERDC). The ERDC released its interim urban forest report on 18 October 2023.²³ It will release its final report in 2024.
- the State Planning Commission initiated the Open Space and Trees Project to better understand the use and benefits of open space and trees in an urban context, and the impact of infill development on our urban tree canopy. The project is in three parts, with part three currently on hold, pending the outcome of an expert panel review.^f
- the Expert Panel on Planning Reform's (the Panel) review of the PDI Act. The Panel provided the Minister for Planning with its final report on 6 April 2023. The SA Government prepared a response to this report, and both were publicly released on 28 March 2024.²⁴

^f An update on this project is available at <https://www.saplanningcommission.sa.gov.au/projects_and_engagement/commission_projects/Commission_Projects/open_space_and_trees_project>.

Appendix 5 provides an extract from CHB Council's response to our findings and recommendations because the Council details some of the legislative and regulatory barriers it has highlighted in submissions about trees and the urban forest to:

- the parliamentary inquiry into the urban forest
- the State Planning Commission's review of regulated and significant trees.

On 17 May 2024 the SA Government announced that it had introduced new planning regulations to better protect Adelaide's urban tree canopy and large, mature trees from removal. The changes include reducing the:

- trunk size for regulated trees from two metres to one metre
- trunk size for significant trees from three metres to two metres
- distance that allows trees near homes and pools to be removed without development approval from 10 metres to three metres.

The new planning regulations place pruning limits on regulated and significant trees allowing only 30% of the tree's canopy to be removed every five years.

4 City of Port Adelaide Enfield

4.1 Executive summary

4.1.1 Conclusion

We assessed the effectiveness of the PAE Council's tree management activities to increase or maintain the tree canopy in its area.

We concluded that its tree management activities were partly effective, because while some activities were operating effectively, gaps in others need to be addressed to be effective.

Activities where the PAE Council needs to take action to achieve effectiveness are:

- capturing and maintaining up-to-date data about its public trees
- documenting the assessment and treatment of all tree canopy risks
- developing better functionality in its tree management systems
- monitoring and reporting its performance.

Activities where the PAE Council was effective included having:

- a long-term tree canopy target
- strategies with specific actions to increase the tree canopy cover that continue to evolve
- strategies to increase public awareness about the value of trees and improve its tree canopy cover
- clearly defined roles and responsibilities for tree management activities.

The PAE Council demonstrated a clear long-term commitment to actions to increase the tree canopy cover in its area.

4.1.2 What we recommended

We recommended that the PAE Council should:

- determine the data it needs to make effective decisions about tree management activities, then capture and maintain this data
- develop system functionality that supports effective tree management
- document the assessments of all tree risks and accurately reflect the mitigating and treatment controls
- review the risk reporting process to support effective oversight of tree risks
- ensure accurate and relevant performance information is used and reported against its annual planting target

- develop performance reporting requirements that contribute to achieving its objectives and tree canopy target.

4.1.3 City of Port Adelaide Enfield's response

The PAE Council accepted our detailed findings and told us how it would action our recommendations. Its response to each recommendation is included in sections 4.3 to 4.6.

The PAE Council also provided the following feedback on our review:

We wish to acknowledge that it has been a valuable exercise, it has drawn our attention closer to several key areas of management of our tree canopy and its associated risk management. The exercise will result in positive improvements in both areas. In receiving the report Council was also pleased to see the review identified a number of areas where Councils' efforts across policy, strategy and program and service delivery are progressing positive impacts on improving on urban tree canopy management.

On behalf of Council's Administration team, I wish to acknowledge the professionalism and partnership approach taken by your team, who engaged constructively and widely with Council staff to ensure this review delivered value for both organisations.

Appendix 6 contains the PAE Council's full response to this report.

4.2 Overview of the City of Port Adelaide Enfield

4.2.1 About the City of Port Adelaide Enfield

The PAE Council is in the north-western suburbs of Adelaide, about eight kilometres from the CBD. It covers 51 suburbs over an area of around 94 km², and had a population of 138,600 people in 2023. This is a population density of about 1,474 people/km².

The PAE Council is a residential, commercial and industrial area with over 22,000 registered businesses.

4.2.2 Tree canopy target

The PAE Council's *Living Environment Strategy 2017–2022* includes the Greening our City program that aims to improve the greening of the council area and set a tree canopy target. In April 2021, the PAE Council endorsed the Greening our City program framework which includes a target to increase its tree canopy by 35% by 2050 as shown in case study 2.

Case study 2: The PAE Council's approach to setting a tree canopy target

The PAE Council measured and investigated changes to its tree canopy cover across the council area between 2008 and 2017. This included measuring the tree canopy cover over three tenure types (Local Government, SA Government and private). This provided information to enable the PAE Council to make planning decisions and assess the success of its greening activities.

From these investigations, the Council found:

- they needed to map the potential plantable spaces that they had identified and confirm its suitability for planting trees
- most canopy cover loss occurred on private land
- they needed to develop engagement and incentive programs to gain support from the community to retain and plant trees on private land
- they needed to develop a tree canopy target that at least meets *The 30 year plan for Greater Adelaide* by the SA Government.

In early 2021, the PAE Council performed further analysis to develop its canopy target and a five year tree planting program. This was performed in **two stages**.

Stage 1: Identify how many trees to plant

This considered the:

- tree canopy cover at that time
- net annual tree loss (0.08%)
- establishment success of new trees planted (85%)
- available land options by tenure type
- tree types and their growth parameters
- cost per tree to plant and maintain (\$540)
- rate of tree canopy cover change over time.

Stage 2: An analysis of plantable space in streets

This considered:

- urban heat islands within the council area
- social vulnerability
- plantable opportunities.

The Council found:

- it had 10% tree canopy cover which became its baseline for setting the target
- it had 54,701 plantable spaces in streets
- it would take 22 years to plant trees in the plantable street spaces – an average of 2,500 trees per year
- the proposed five year tree planting program would achieve 23% of plantable spaces.

Target: Achieve 13.5% tree canopy cover by 2050

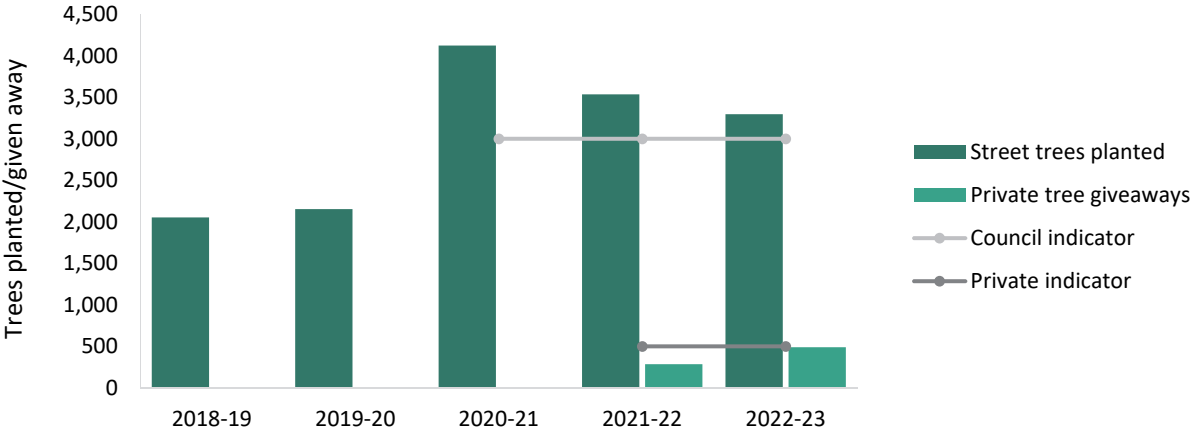
In April 2021 the PAE Council endorsed a tree canopy cover target to achieve a 35% increase from a baseline of 10% in 2017 to 13.5% by 2050. To achieve this target, the following yearly indicators were set:

- plant and maintain at least 3,000 new trees in council streets and reserves each year
- encourage other landowners to plant at least 500 new trees each year.

Source: Based on data from the PAE Council Greening our City program framework.

With the introduction of its tree canopy target, the Council committed to planting 3,000 trees on its streets and reserves each year. In 2021-22, it also implemented initiatives to encourage tree planting on private land through the Get Shady program where the Council provides a free tree to private property owners in the council area. The first year of this program targeted some of the hottest suburbs or those with low tree canopy cover. In 2022-23 it was offered to all property owners in the council area. Figure 4.1 shows the number of trees the Council has planted and given away against yearly indicators for the last five years.

Figure 4.1: Tree planting numbers and tree giveaways compared to yearly indicators

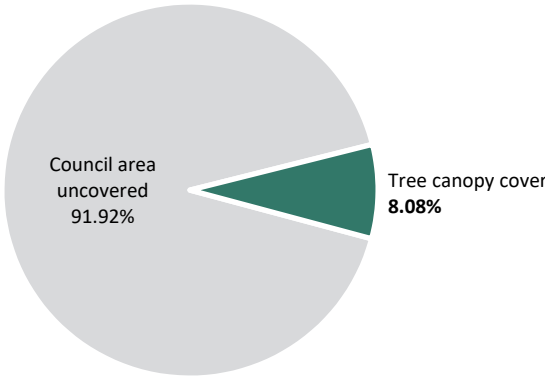


Source: Based on data from the PAE Council.

4.2.3 2022 tree canopy measurement

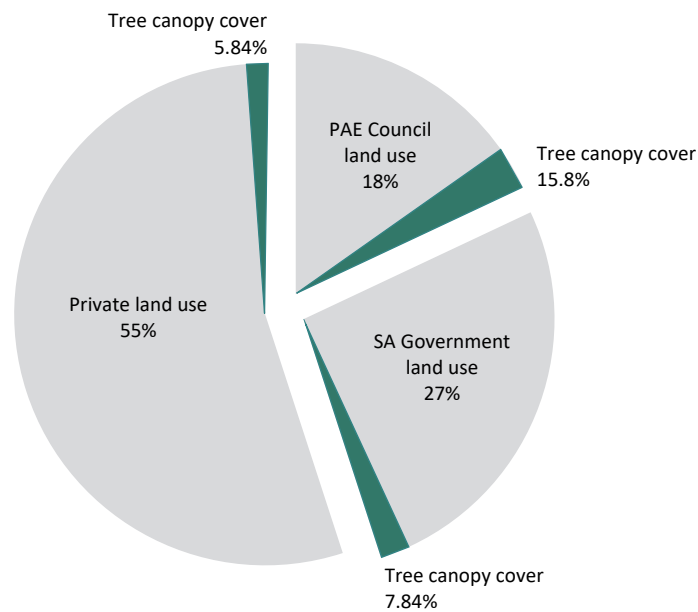
The LiDAR data shows that the PAE Council’s tree canopy cover was 8.08% in 2022, as shown in figure 4.2. This is a decrease of 1.9% against its baseline of 10%, but an increase of 1.5% against the recalculated LiDAR data for 2018–2019.

Figure 4.2: Total tree canopy cover in PAE Council area



As discussed in section 3.1 and appendix 3, there was a recent change in LiDAR measurement methodology. The PAE Council intends to review its tree canopy target based on the 2022 LiDAR data. Figure 4.3 shows a breakdown of the percentage of land use type and tree canopy over the PAE Council area based on 2022 LiDAR data.

Figure 4.3: Percentage of PAE Council by land use type and its tree canopy in 2022



Source: Based on Green Adelaide, *Urban tree canopy, green spaces and built environment data analysis and reporting 2022 Survey Area Technical Report*, January 2022.

4.2.4 Initiatives the PAE Council has implemented to improve tree health

The PAE Council has implemented initiatives to improve tree health, including:

- partnering with TreeNet in their street tree trial project to grow uncommon tree species in the Council’s nursery for planting on street verges. The project aims to determine whether these tree species are suitable to grow in a changing climate
- reviewing its street planting program to add new tree species and discontinue planting certain tree species that do not survive well in increased median temperatures and reduced annual rainfall
- future streetscape upgrade projects to install tree inlet systems for passive irrigation of street trees, water sensitive urban design raingardens and terrestrial verge gardens.

4.3 Data and asset management systems findings

4.3.1 The PAE Council does not have complete and accurate tree data

Recommendation

The PAE Council should determine:

- the data it needs to make effective decisions about its tree management activities to increase its tree canopy
- the most cost-effective way to capture, store and maintain a complete and accurate register of tree data.

Findings

We found that the PAE Council did not have a tree register providing a complete and accurate understanding of its tree population. This makes it difficult to exercise effective tree management.

The PAE Council performed a tree audit 12 years ago to capture data about its trees. It recorded the total number of the two most dominant tree species planted for each street. The data from the audit was stored in the PAE Council's tree management system but is not complete and accurate because:

- it has not been updated since the tree audit
- it did not include all PAE Council trees and did not provide the information about each tree needed to manage them effectively
- the system cannot be used to record individual tree data
- data on trees planted since June 2017 is recorded in another system.

The PAE Council advised us that it prunes all trees on its street verges every two years. While this cyclical program has shown benefits, the data recorded about it is not sufficient to properly inform strategic tree management activities. For example, the trees pruned are assessed for risks such as limb failure, tripping hazards and root conflicts with houses and infrastructure, but this assessment is not documented. There is an opportunity for Council staff to record more tree data to build the tree data profile.

An effective tree management system could store tree data like tree species, location, planting date, health and risk ratings, and maintain this data efficiently. It is important for staff to be able to easily access this information to make effective and efficient decisions about tree management.

City of Port Adelaide Enfield's response

Council has recently initiated the procurement of a new Tree Management software application – Forestree that is a purpose-built application to enable the collection and storage of tree data and support effective tree management services. This application will support Council to plan and implement the collection of accurate, comprehensive and complete tree data across the entire City. It will also support Council's ongoing efforts to improve programming of key tree management activities such as tree planting, pruning and removals, as well as responding to enquiries, complaints and emergency response efforts.

In conjunction with the implementation of Forestree, Council will undertake planning for the most effective and cost-efficient approach to:

- *transitioning its existing tree data into the new Forestree application*
- *establish a methodology and program to undertake data collection on its existing trees*
- *establish protocols for data capture on any new trees being planted.*

Council is also engaging with other Councils that are using Forestree and have valuable insights to share regarding its implementation, integration with other key enterprise systems, and system set-up that supports effective data capture and storage.

4.3.2 The PAE Council's systems do not support effective tree management

Recommendation

In developing its tree management system, the PAE Council should consider system functionality that helps:

- team leaders to easily allocate and monitor work to staff and contractors for maintenance programs
- staff and contractors to update tree records for maintenance data and risks easily and promptly
- staff access to data to update it, analyse it and use it for decision making
- staff to create reports to support their tree management activities.

Findings

We found that the PAE Council keeps data about its trees in various systems and manual records like spreadsheets. When tree data is dispersed it makes it difficult for PAE Council staff to access and analyse the data they need to make proactive, effective and efficient decisions about tree management. There is therefore:

- an increased risk of data error in maintaining various systems, in particular manual records
- reactive rather than proactive tree maintenance
- potential limitations and inefficiencies in data analysis and reporting.

At the time of our review, the PAE Council advised us that it was considering a new tree management system. A more effective tree management system could provide benefits like:

- a register to store tree data (such as tree species, location, planting date, health, risk ratings) and the ability to maintain this data efficiently
- the ability to manage tree maintenance activities efficiently and effectively (such as creating, coordinating and monitoring planting, watering and pruning programs, and coordinating planting programs with footpath and kerb maintenance programs)
- the ability to manage community complaints and requests, and record when and how they were resolved
- information to monitor and evaluate performance against the Council's objectives and targets.

City of Port Adelaide Enfield's response

The new tree management software package (Forestree) has a range of modules that include fit-for-purpose user-friendly tools that enables access for staff and contractors engaged in tree management services. Examples of modules relevant for staff workflows include:

- tree inspections undertaken on field devices*
- works programming and allocation according to various type of works activities e.g. planting, pruning, removal*
- collection of relevant and accurate tree data, associated with each activity/work program*
- work efficiently and effectively with contractors and ensure adequate data and information flow between parties*
- ability to drill down through data that supports team leaders to assign priorities, allocate work, monitor service delivery against targets and indicators and gain insights to inform future programs.*

Planning and programming of tree planting on a seasonal basis and ensuring adequate data on each tree is collected as it is planted.

As Forestree is implemented a staged approach to integration with other key Council digital applications and enterprise systems will be programmed and progressed in line with Council's Digital Transformation Program.

4.4 Risk management findings

4.4.1 The PAE Council has not documented some of its risk assessments and assessment of controls

Recommendation

The PAE Council should ensure that:

- its parks and gardens risk register documents the risk assessment for all tree risks and accurately reflects the existing controls that are in place to mitigate these risks
- any further treatment controls that need to be developed to reduce the risks to an acceptable level are recorded separately from existing controls
- all inherent high and extreme risks are reported to the executive leadership team (ELT) to give them effective oversight and management of tree management risks.

Findings

The PAE Council's risk management policy and procedure outline the key elements of a sound risk management process. It defines roles and responsibilities, processes and reporting requirements.

Effective risk management involves identifying, analysing, mitigating, monitoring, evaluating and communicating risk and treatment controls. Having a risk register is key to performing these activities.

Assessment of risks

While the PAE Council advised us of its tree management risks, we found that its assessment of some of those risks was not documented in its parks and gardens risk register. Some of the missing assessments were the risks of:

- not achieving its tree canopy targets
- inequitable distribution of tree canopy cover across vulnerable communities
- tree data not being maintained to understand the status of its tree population, and individual tree health, diversity and risk rating.

Assessment of controls

The PAE Council's parks and gardens risk register records the outcome of the risk assessment process but not the existing controls it has in place to mitigate them and support the residual risk rating. The residual risk rating should reflect the exposure remaining after action has been taken to manage it. If it is not acceptable, additional controls need to be developed and implemented.

For some risks in the parks and gardens risk register, the inherent risk rating was reduced from extreme to a moderate residual risk rating. The controls identified were not existing controls, but controls that needed to be developed and implemented. Because they were not existing controls, the residual rating should have remained extreme, and a separate risk assessment performed for any proposed controls.

Reporting of risks

In line with the PAE Council's risk management policy and operating guideline, the ELT is responsible for reviewing strategic and operational risks. Its asset management steering group is required to report all high and extreme risks to the ELT.

In practice, only risks that have a high or extreme residual risk rating are reported to the ELT. However, risks with a high or extreme inherent risk rating should also be reported so that the ELT can ensure controls are in place to mitigate them to an acceptable level and are operating effectively.

Without a clearly documented assessment of all risks, management cannot determine and demonstrate whether:

- risks have been adequately assessed and treated, and the remaining risk levels are acceptable to the PAE Council
- current controls and other risk treatments are effective, including controls being implemented, monitored and evaluated to ensure they remain appropriate
- risk information is being reported to senior management, council committees and the elected body, as required by the PAE Council's risk management policy.

City of Port Adelaide Enfield's response

Corporate Risk Management

The Council acknowledges that it has not formally defined 'inherent risk' in any of its corporate documentation or policy. Furthermore, staff have communicated to the Auditor General's Department (AGD) that the ISO 31000 – Risk management standard does not provide an explicit definition of 'inherent risk', and that this concept is subject to debate within the professional sphere.

The AGD has articulated inherent risk as risks existing in the absence of any implemented controls or actions. However, Council has diverged from this approach and interpretation in practice. The rationale behind this departure lies in the limited value of speculating on scenarios devoid of mitigations or controls, as it would entail considering situations where key personnel/roles or current state assessments do not exist.

In practical terms, this deviation could result in a subjective qualitative assessment wherein every inherent risk is deemed catastrophic. Such an approach would offer limited value to the Council's Executive, who are committed to prioritising the escalation of high-catastrophic residual risks. The current operational protocol involves Council staff evaluating the current state of risk, with existing controls, and assessing the effectiveness of those controls. This allows staff to consider the current state of their operations. This methodology aims to provide an accurate depiction of the current risk environment, rather than delving into hypothetical scenarios where controls or measures may be absent (unless that is an actual depiction of the current state).

Council will endeavour to explicitly define inherent risk to avoid any confusion and will look to ensure this is further understood through its future risk training and organisation risk engagement programs.

Operational Risk Management Practices

To support Council's continued improvement in managing risks at an operational level, the implementation of the new Forestree application will be used to support team and program leaders to consistently assess tree risks, through the entire tree management process including planting, pruning, canopy management, complaint management, and potential emerging risks. The application has a specific module assigned to tree risk assessment and control measures for operational services and standards. The system is based upon Quantified Tree Risk Assessment (QTRA) methodology. The module has standardised risk levels which will assist in effectively assessing risks and prioritising works. This type of improved system functionality will support leaders and staff to have improved data capture and insights into individual tree risk management and create reports to build further knowledge of risk patterns in particular species, areas or locations.

Council will continue to invest in training for relevant arboriculture staff, particularly focused on the QTRA methodology. QTRA has also been used within the legal system associated with claims for damages and or physical harm arising from whole/part tree failures.

4.5 Monitoring and reporting performance findings

4.5.1 Improvements in performance reporting are needed

Recommendation

The PAE Council should review its monitoring and reporting process to ensure accurate and relevant performance information is used and reported against its annual planting target.

The PAE Council should develop performance reporting requirements that contribute to achieving its objectives and tree canopy targets. These could include:

- numbers of trees removed, and new and replacement plantings during the period
- changes in overall tree population diversity and performance against target ratios or guidelines
- status of tree population health
- plantable spaces available for public planting
- estimated trees lost on private land
- estimated canopy spread or loss
- tree risks.

Findings

The PAE Council's annual report records the total number of street and reserve trees planted during the financial year. It improved this reporting in 2022-23 by comparing the actual trees planted with the annual tree planting indicators it had set.

We found the actual trees planted figures used in 2022-23 were based on the number of plants issued from its nursery for planting and not the actual trees planted. Tree plantings are recorded in a system that records the tree species, location and year planted, but the PAE Council is not using this system to monitor and report planting numbers.

It is important that actual performance is compared to targets for the PAE Council to monitor and assess whether its actions are successful, or changes are needed to achieve its objectives and long-term tree canopy target.

The PAE Council told us that it is developing an Urban Greening and Biodiversity Management Plan and will include targets to increase the tree canopy and indicators for tree planting. This document was not available at the time of our review.

City of Port Adelaide Enfield's response

Council currently records newly planted street trees through a mapping application using GIS software. The GPS location, date, and species are recorded. Going forward, it is the Council's intention to record this information into the new tree management software application (Forestreet) where all tree data will be stored, updated and used for reporting and future planning. This will support improved reporting of tree plantings against annual targets.

The draft Urban Greening and Biodiversity Plan contains several monitoring metrics within the monitoring and evaluation section. Those relating to tree canopy and the urban forest include:

Metric 1: Total canopy cover % (include private and public)

Measurement: LiDAR analysis of canopy cover % >3m in height

Target: 35% increase by 2050

Measurement: Canopy growth: using LiDAR analysis change detection from 2022 data.

Target: Greater % of canopy growth versus loss from pruning and removal.

Measurement: Street and Reserve tree planting: using Forestreet, record date, location, and species of new trees planted/year by Council.

Target: 2,500 planted on public land (streets, parks & reserves) and 500 planted on private land.

Measurement: Tree removals: using Forestreet, record date, location, and species of trees removed on Council land.

Metric 2: % of Green spaces

Measurement: green space extent: using LiDAR and NDVI data.

Target: no change or increase from baseline 2022 data (16.47%).

Metric 3: Urban forest health and diversity function

Measurement: Using Forestreet, keep a record of Council tree species, analyse diversity of tree species.

Target: increase from baseline collection data 2024/25, working towards a targeted species, genus, and family ratio of 5/10/15%.

Forestreet module includes a tree planting app that provides numerous opportunities to load every tree planted each year with a predictor that allows Council proactive tree planting strategies to meet targets set by the Urban Greening and Biodiversity Plan.

The data collected on tree species also allows predictive tree species selection in coming years to maintain species consistency and or modify species selections to achieve species diversity within specific suburbs/areas.

4.6 Strategic planning for tree management findings

4.6.1 The PAE Council has not set specific tree canopy targets for land use and tenure

Recommendation

The PAE Council should consider setting tree canopy targets that are specific to land uses and tenures and based on available plantable space and resources. Specific strategies, actions and resource allocations can then be planned to achieve those targets.

Findings

In April 2021 the PAE Council endorsed a target to increase its tree canopy cover by 35% by 2050. A well-known challenge to Adelaide metropolitan councils in their efforts to increase their tree canopies is that they do not own or control a large portion of the land in their areas. The amount of land controlled by councils and available for planting is further limited by infrastructure such as powerlines, storm and wastewater networks, footpaths and roads, and house and fence footings.

To recognise these limitations, many councils set separate tree canopy targets for different land uses and tenures. For example, another local council has split its tree canopy targets by land use and ownership:

We will increase average township tree canopy cover to 20% by 2043 and to 30% by 2073 by meeting the following targets:

- *Average Road reserve tree canopy from 11% to 20%*
- *Average Open space tree canopy cover from 7% to 30%*
- *Aiming for net gain of tree canopy cover on private residential land within township boundaries.*

It is important to link the performance targets set to what the PAE Council can deliver through its planned strategies, allocated resources and available planting space. Setting more specific targets will help to inform its actions and more accurately measure its performance.

City of Port Adelaide Enfield's response

In light of new, more accurate LiDAR data Council intends to review the tree canopy target set in 2023 regarding the overall % of tree canopy cover across the LGA.

The review will consider setting specific targets based on land use types, an analysis of resourcing and improved strategies and action to achieve targets.

Council will consider the timing of this review.

4.7 What the City of Port Adelaide Enfield did well

We identified PAE Council activities to increase the tree canopy and tree health in its area that were operating effectively.

4.7.1 The PAE Council has a *Living Environment Strategy*

The PAE Council had a *Living Environment Strategy 2017–2022* with a foundation initiative being the Greening our City program. The program aimed to:

- increase urban greening in the city's public realm (streets, parks, trails, coastline and waterways)
- improve the integration of its tree and vegetation planting program in the design of its streetscapes, roads and stormwater infrastructure
- educate the private sector and community
- adopt evidence-based approach in target setting and prioritisation of opportunities for urban greening.

The PAE Council advised us that it is revising its plans and developing an Urban Greening and Biodiversity Management Plan, which will continue to provide tree canopy targets and indicators. This document was not available at the time of our review.

4.7.2 The PAE Council has undertaken detailed tree canopy cover modelling and set a long-term target

The PAE Council has performed detailed tree canopy cover modelling based on a range of scenarios to determine the most appropriate tree canopy cover target and a five-year planting program.

4.7.3 The PAE Council has strategies to increase public awareness and improve its tree canopy cover

The PAE Council has strategies that aim to increase public awareness about the value of trees and improve the tree canopy cover on private land. These strategies include:

- the Get Shady program. This was established as an incentive program to increase tree planting on private land. In 2022 the PAE Council provided 150 property owners in the hottest suburbs with a free advanced (1 metre high) tree to plant on their land. In 2023, it provided 300 trees to property owners. This program is continuing in 2024.
- a grant program to help residents maintain large trees (with a trunk circumference of at least 2 metres) on their properties. The maintenance works intend to prevent the removal of the tree and extend its lifespan. This program contributes to the PAE Council's tree canopy targets and provides amenity benefits to the local neighbourhood.

4.7.4 The PAE Council has clearly defined roles and responsibilities for tree management

The PAE Council has clearly defined, documented and communicated to staff their roles and responsibilities for tree management, including:

- program delivery and oversight
- reporting
- risk management.

This has given staff transparency and understanding about work expectations, and how they contribute to the PAE Council's broader strategic objective of increasing the tree canopy.

5 City of Holdfast Bay

5.1 Executive summary

5.1.1 Conclusion

We assessed the effectiveness of the CHB Council's tree management activities to increase and maintain the tree canopy in its area.

We concluded that its activities were partly effective, because while some activities were operating effectively, gaps in others need to be addressed to be effective.

Activities where the CHB Council needs to take action to achieve effectiveness are:

- maintaining data about its public trees
- documenting the assessment and treatment of all tree canopy risks
- developing better functionality within its tree management systems
- monitoring and reporting its performance.

Activities where the CHB Council was effective included it having:

- a long-term tree canopy target
- strategies with specific actions to increase the tree canopy cover that continue to evolve
- strategies to increase public awareness about the value of trees
- clearly defined roles and responsibilities for tree management activities.

The CHB Council demonstrated a clear long-term commitment to actions to increase the tree canopy cover in its area.

5.1.2 What we recommended

We recommended that the CHB Council should:

- develop system functionality to ensure:
 - tree data is able to be easily accessed and maintained by staff in line with their work responsibilities
 - staff can easily produce comprehensive reports to support their analysis, decisions and monitoring of activities
 - staff can easily produce reports for monitoring against Council objectives and tree canopy targets
 - staff can consistently assess and record tree risks, access and maintain this data and retrieve information about works performed
- documenting the assessment and treatment of all tree canopy risks.

5.1.3 City of Holdfast Bay’s response

The CHB Council accepted our detailed findings and told us how it would action our recommendations. Its response to each recommendation is included in sections 5.3 to 5.6.

Appendix 7 contains the CHB Council’s full response to this report.

5.2 Overview of the City of Holdfast Bay

5.2.1 About the City of Holdfast Bay

The CHB Council is a south-western coastal council area of Adelaide, about 11 kilometres from the CBD. It covers an area of around 14 km² and had a population of 38,000 people in 2022. This is a population density of about 2,767 people/km².

The CHB Council area is predominantly residential with some commercial and industrial land use. There were around 4,500 residential dwellings approved to be built in the area in 2023-24. The CHB Council includes the suburbs of Glenelg and Brighton, which are popular tourist destinations and are widely known for the iconic Norfolk Pines that line much of the esplanade and surrounding streets.

5.2.2 Tree canopy target and 2022 measurement

The CHB Council’s *Environment Strategy 2020–2025* includes a target to increase its tree canopy by 10% from a baseline of 15.28% in 2018 to 16.8% in 2030. This target was based on original 2018–2019 LiDAR data, but due to the change in measurement methodology discussed in section 3.1 and appendix 3, the measurement was recalculated in 2022.

The recalculated LiDAR data for 2018–2019 measures the CHB Council’s tree canopy at 10.17%. LiDAR data shows that since then, its tree canopy cover has increased slightly to 11.73% in 2022, as shown in figure 5.1.

The CHB Council intends to revise its tree canopy target based on the 2022 LiDAR data.

Figure 5.1: Total tree canopy cover in CHB Council area in 2022

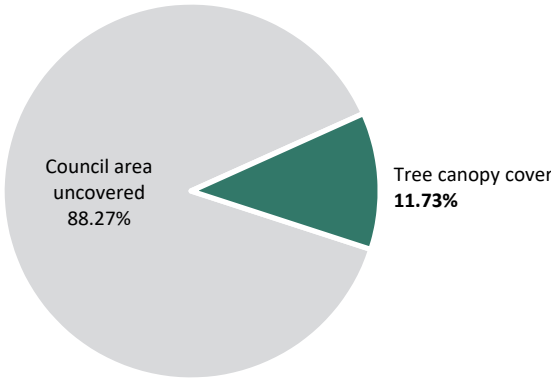
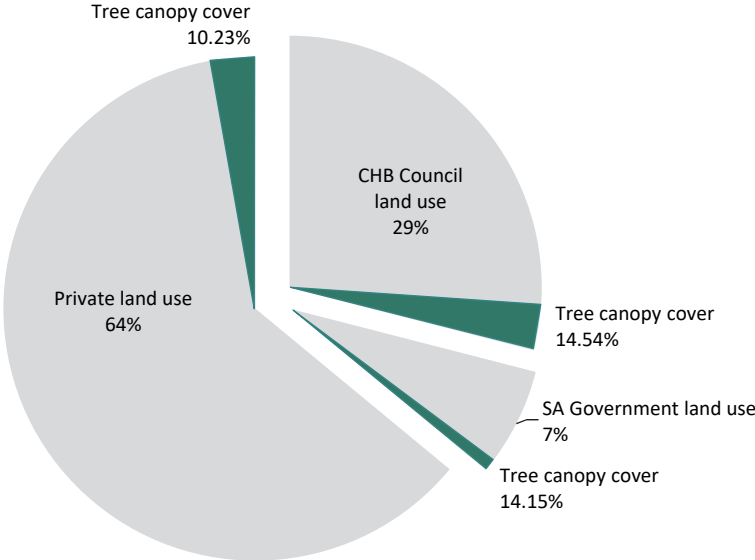


Figure 5.2 shows a breakdown of the percentage of land use type and tree canopy over the CHB Council area based on 2022 LiDAR measurements.

Figure 5.2: Percentage of CHB Council by land use type and its tree canopy in 2022

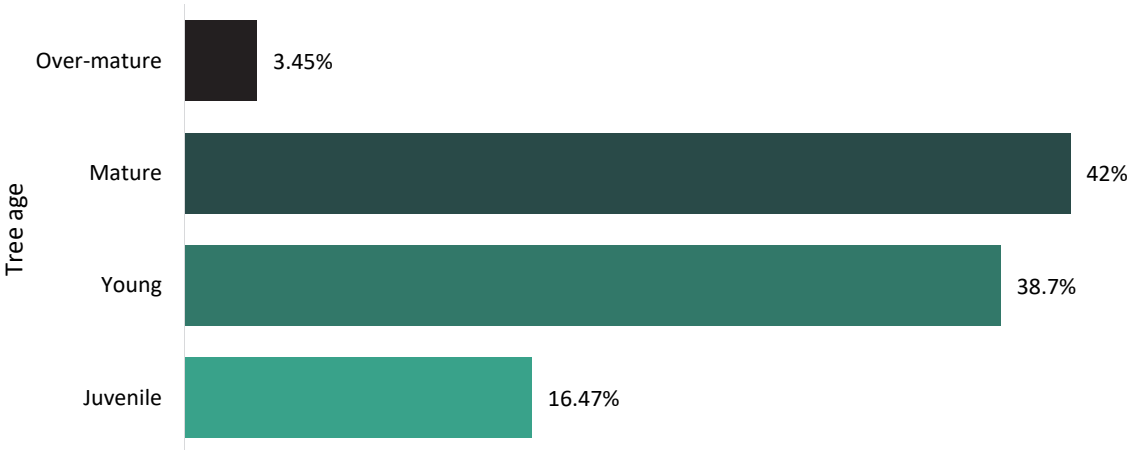


Source: Based on the *Urban tree canopy, green spaces and built environment data analysis and reporting 2022 Survey Area Technical Report*, January 2022, Green Adelaide, Government of South Australia, Adelaide.

5.2.3 CHB Council tree canopy data

The CHB Council’s tree audit found the Council has approximately 21,100 street and open space trees and most of its trees are young or mature in age as shown in figures 5.3.

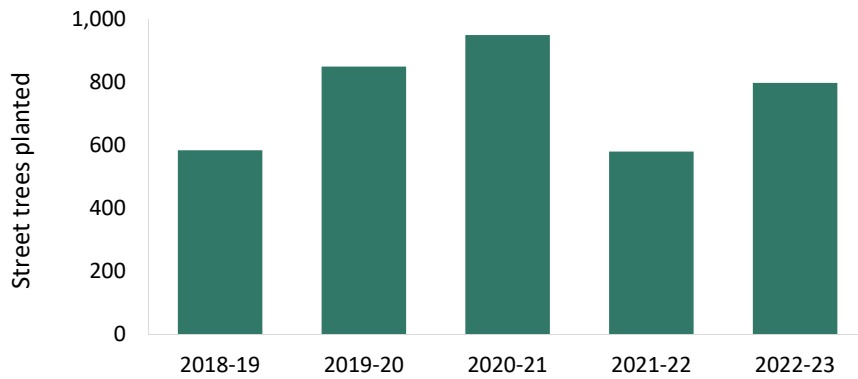
Figure 5.3: CHB Council’s public trees by age distribution



Source: Based on data from the CHB Council.

Figure 5.4 shows the number of street trees planted by the CHB Council in the last five years.

Figure: 5.4 Number of street trees planted by the CHB Council in last 5 years



Source: Based on data from the CHB Council.

5.2.4 Innovative techniques the CHB Council has used to improve tree health

During our review we observed some innovative techniques the CHB Council has used to improve the health of the trees in its area. These include using water sensitive urban design (WSUD) to improve street and open space tree health, through the passive infiltration of stormwater.

WSUD provides environmental benefits such as capturing rainfall runoff to prevent flooding and improving stormwater quality, which reduces sediment and pollution into waterways. It is also highly valuable for providing supplementary irrigation to urban vegetation and improving tree and canopy health and longevity.

We saw several examples, as shown in figure 5.5 where the CHB Council had used:

- WSUD in the form of rain gardens to capture stormwater runoff, including in high-traffic streets and in parks from tennis courts to passively irrigate trees and vegetation
- street tree inlets to redirect stormwater from roads to tree roots, which increases the available water for the surrounding street trees.

Figure 5.5: Examples of WSUD under Norfolk Pines in Glenelg and a street tree inlet to redirect stormwater to tree roots in South Brighton



5.3 Data and asset management systems findings

5.3.1 The CHB Council's system does not support effective tree management

Recommendation

In developing its tree management system, the CHB Council should consider system functionality that:

- lets staff and contractors update tree records for maintenance data and risks easily and timely
- gives staff access to data to update it, analyse it and use it for decision making
- lets staff create reports that provide information to support their decision making on tree management activities.

The CHB Council should prepare a plan of the system changes needed for actioning and monitoring.

Findings

We found that the CHB Council's enterprise management system was not mature enough to support effective tree management. It did not have functionality to:

- ensure accurate and complete tree data was maintained
- provide information needed to perform tree management activities effectively.

Maintaining complete and accurate tree data

From 2021 to 2023, the CHB Council conducted the first audit of its public trees. It collected comprehensive data that gave an up-to-date picture of its tree population, species diversity and other tree demographics such as information about an individual tree's health, location, age and risk status. A tree asset management system was used to record this data and individual tree records were updated to show the maintenance work needed or performed. This ensured the CHB Council had current and complete information about its trees.

In early 2023, the CHB Council stopped using the tree asset management system and built tree management functionality into its existing enterprise management system. Tree data was transferred in from the tree asset management system, but not all of the functionality needed to support tree management was fully developed.

We found that:

- some CHB Council staff did not have access to tree data in the enterprise management system that they needed to perform their roles
- one Council officer maintained manual records to support certain tree management activities.

As a result, tree data obtained during the CHB Council's audit was not being fully maintained in the enterprise management system, increasing the risk of it becoming redundant.

Gaps in reporting capability

We found that the enterprise management system's reporting capabilities were still being developed for key tree management activities. For example, the system could not produce automated reports to help staff evaluate and monitor tree management activities like:

- annual planting, including details about planned tree species, planting dates and locations
- watering routes
- risk-based tree maintenance and inspection programs
- tree health and risk status
- performance against objectives and targets.

We also found that staff had difficulty accessing information in the enterprise management system, making analysis and decisions more difficult and time consuming.

It is important for staff to be able to easily access information that helps them make effective and efficient decisions about their work, such as:

- setting performance targets or guidelines for tree diversity and annual planting to achieve the CHB Council's long-term tree canopy target
- deciding on the timing, level and allocation of resources needed to maintain healthy trees and increase the tree population
- managing risks such as tree limb failure, tripping hazards and root conflicts with footpath and road infrastructure
- managing work crews and contractors
- assessing whether tree management activities are achieving the CHB Council's objectives and targets
- deciding whether strategic plans for urban forest and tree management need to change.

The functionality an effective tree management system could provide includes:

- a register to store tree data such as tree species, location, planting date, health and risk rating, and the ability to maintain this data efficiently
- the ability to manage tree maintenance activities efficiently and effectively. These activities include creating, coordinating and monitoring planting, watering and pruning programs, and coordinating planting programs with footpath and kerb maintenance programs
- the ability to manage community complaints and requests, and record when and how they were resolved
- information to monitor and evaluate performance against the CHB Council's objectives and targets.

Plan for changes to the enterprise management system

We found that the CHB Council did not have a documented plan of the changes to the enterprise management system needed to improve access and reporting. It is important to have a plan to ensure all the required system changes are identified, prioritised, allocated for actioning and monitored for progress.

City of Holdfast Bay's response

During the public tree data collection and assessment (2021-2023), Council captured comprehensive data of all individual trees. After the audit this data was transferred into council's asset management register.

Council has committed to build additional functionality for tree management into the existing enterprise asset management system to address the gaps identified in the review.

5.4 Risk management findings

5.4.1 The CHB Council's system does not support effective management and reporting of tree risks

Recommendation

As a matter of priority, the CHB Council should develop system functionality to support the effective management of tree risks.

The CHB Council should review its processes to ensure reporting is in place to help it oversee its key tree risks.

Findings

We found that the CHB Council's enterprise management system did not support the effective management of tree risks because it did not:

- have a built-in risk assessment methodology to help staff assess tree risks. This could lead to inconsistencies in how staff assess and conclude on tree risks
- give staff easy access to tree risk ratings and information about work previously performed on trees to address identified risks. We found that staff could only see the complete history of work performed on a particular tree and the effect on its risk status by looking at all the individual work orders for the tree.

It is important for staff to have access to information to monitor, evaluate and report on tree risks efficiently. The CHB Council's system, however, could not provide this. For example, it could not provide a list of all high-risk trees for staff to use to monitor tree health and update the corporate risk register. We found that staff were instead keeping manual records about high-risk trees and there was no evidence that these risks were being reported in line with CHB Council policy.

City of Holdfast Bay's response

See response in section 5.4.2.

5.4.2 The CHB Council had not documented some of its tree management risk assessments

Recommendation

The CHB Council should:

- comprehensively review its tree data and tree management practices to identify and assess all tree risks
- maintain a complete central record of the risk assessments and treatment plans needed to monitor and report on tree risks.

Findings

The CHB Council's risk management policy and procedure outline the key elements of a sound risk management process. It defines roles and responsibilities, processes and reporting requirements.

Effective risk management involves identifying, analysing, mitigating, monitoring and communicating risk. Having a risk register is key to performing these activities.

The CHB Council's corporate risk register identifies its strategic, operational, asset and project risks and requires enough information to be recorded to tell elected members and staff how risks will be managed.

We found that the corporate risk register included strategic and operational tree management risks but did not recognise some relevant risks, such as the risk of:

- tree data not being maintained to understand the status of the CHB Council's tree population, and individual tree health, diversity and risk ratings
- specific trees assessed as high operational risks not being managed effectively
- adverse impact to trees and the tree canopy from Council or State managed civil or capital works
- adverse impact to trees from natural events, such as pest outbreak or disease
- Council trees and the tree canopy not being resilient to climate change and extreme weather events, such as warming average temperatures and lower average annual rainfall
- negative public perceptions of trees.

Without a complete listing of all risks, management cannot determine and demonstrate whether risks are:

- adequately assessed and treated
- being reported to senior management, council committees and elected members, as required by the CHB Council's policy.

City of Holdfast Bay's response

During the public tree data collection (2021-2023), every tree was assessed for risk. High risk trees were identified in real time to be dealt with urgently. By the completion of the audit, council had no identified high risk trees remaining. Each tree has an ongoing assessment frequency based on its risk status.

Existing operational tree risks are captured in the operational risk register. Through the development of the tree management plan, council will undertake a review of its tree risks and update the operational risk register. This will ensure central reporting enables appropriate oversight of these risks.

5.5 Monitoring and reporting of performance findings

5.5.1 The CHB Council has limited performance reporting

Recommendation

The CHB Council could improve its reporting of tree management performance by sourcing actual tree planting numbers from its enterprise management system and reporting this against its annual planting target.

In finalising its draft urban forest and tree management plans, the CHB Council should develop and document performance reporting requirements that contribute to achieving its objectives and tree canopy target. These could include:

- numbers of trees removed, and new and replacement plantings during the period
- changes in overall tree population diversity and performance against target ratios or guidelines
- status of tree population health
- plantable spaces available for public planting
- estimated trees lost on private land
- estimated canopy spread or loss

Findings

The CHB Council's reporting of its tree management performance is limited to the yearly tree planting numbers it publishes in its annual report. It told us that these numbers are based on the maximum plantings that could be achieved with the resources it allocates. This is taken from records that staff maintain about the purchase of trees rather than being actual planting data sourced from the enterprise management system.

It is important that actual performance is compared to targets for the CHB Council to assess whether its actions are successful or changes are needed to achieve its objectives and long-term tree canopy target.

We noted that the CHB Council's draft urban forest and tree management plans do not specify reporting requirements for the achievement of objectives or targets for new and replacement tree plantings, tree population health, tree risks and species diversity.

City of Holdfast Bay's response

Council's tree performance reporting will be refined and integrated into the development of the strategic planning documentation.

5.6 Strategic planning for tree management findings

5.6.1 The draft urban forest and tree management plans are missing some key elements

Recommendation

The CHB Council should consider including our suggestions in its draft urban forest and tree management plans.

Observations

The CHB Council engaged a consultant to help develop an urban forest plan and a tree management plan. These plans will reflect the outcomes of the CHB Council's 2023 tree audit and the 2022 LiDAR data. They aim to support a proactive, best practice approach to managing public trees and related risks and increasing the CHB Council's tree canopy.

We considered the draft plans available at the time of our review and identified some areas that could be improved to help the CHB Council achieve the aim of these plans, which included analysing comprehensive tree data to inform its planning activities.

We suggested that the plans explain how they relate to each other to help users understand their purpose and linkage.

City of Holdfast Bay's response

Council will consider these recommendations in detail and select appropriate placing for the inclusion of them in development of the strategic planning documents.

Council has made significant progress on developing its action plan with specific actions to improve our overall urban forest management to achieve targets, including allocation of resources.

The strategic planning documents were required to be put on hold due to the time delay in delivery of the 2022 tree canopy data capture from the state government. It was critical to understand the baseline 2018 data set and subsequent change in canopy to 2022 to undertake accurate modelling to develop canopy targets.

5.6.2 The CHB Council does not set specific tree canopy targets for land use and tenure

Recommendation

The CHB Council should consider setting tree canopy targets that are specific to land uses and tenures and based on available plantable space and resources.

In finalising its urban forest and tree management plans, the CHB Council should consider specific strategies, actions and resource allocation to achieve the specific targets set.

Findings

The CHB Council's *Environment Strategy 2020–2025* includes a target to increase its tree canopy by 10% from a baseline of 15.28% in 2018 to 16.8% in 2030. A well-known challenge to Adelaide metropolitan councils in their efforts to increase their tree canopies is that they do not own or control a large portion of the land in their areas. The amount of land controlled by councils and available for planting is further limited by infrastructure such as powerlines, storm and wastewater networks, footpaths and roads, and house and fence footings.

To recognise these limitations, many councils set separate tree canopy targets for different land uses and tenures. For example, another local council has split its tree canopy targets by land use and ownership:

We will increase average township tree canopy cover to 20% by 2043 and to 30% by 2073 by meeting the following targets:

- *Average Road reserve tree canopy from 11% to 20%*
- *Average Open space tree canopy cover from 7% to 30%*
- *Aiming for net gain of tree canopy cover on private residential land within township boundaries.*

Some councils have also set annual tree planting targets that are linked to their tree canopy targets.

It is important to link the performance targets set to what the CHB Council can deliver through its planned strategies, allocated resources and available planting space. Setting more specific targets will help to inform its actions and more accurately measure its performance.

City of Holdfast Bay's response

A subset of targets specific to land use types, available plantable space and council resources will be included in the urban forest strategy and tree management plans following the release of the tree canopy data by the state government.

5.7 What the City of Holdfast Bay did well

We identified CHB Council activities to increase the tree canopy and tree health in its area that were operating effectively.

5.7.1 The CHB Council has an Environment Strategy

The CHB Council has an *Environment Strategy 2020–2025* that identifies five environmental action themes, each with its priority activities and benefit rankings. It includes tree-related action items that will help the CHB Council increase its tree canopy, improve tree health and raise community awareness about the value of trees. The elements of the strategy concerning trees will be supported by the urban forest and tree management plans when they are finalised.

5.7.2 The CHB Council conducted a tree audit

High-quality data about trees is key to a council maintaining and growing a healthy urban forest. Council staff can make more efficient and effective decisions about tree management if they are evidence based.

Between 2021 and 2023, the CHB Council conducted the first audit of its public trees, which produced a database of over 21,100 trees. The audit identified that the Council had around 6,000 more trees than it had estimated and around 5,500 plantable spaces. It captured wide-ranging data about the CHB Council's trees, including data about species diversity, tree health, age, useful life expectancy, works required and risk status.

This data will help the CHB Council to develop informed urban forest and tree management plans, identify priority actions and set attainable targets or guidelines that consider available

plantable space and species diversity needs. It will also help the CHB Council to better understand what resources are needed to support and grow its trees and increase its tree canopy.

We did not review the CHB Council's tree audit process.

5.7.3 The CHB Council has strategies to increase public awareness about the value of trees

The CHB Council has an Adopt a Tree program, where it allocates new trees to be planted on residents' verges each year. Registration is free and trees are issued on a 'first come first serviced' basis. Residents must commit to watering the new trees for the first three to four years after planting.

The CHB Council also has a Tree of the Month program that aims to increase community awareness about the value of trees and the role they play in providing shade and habitat, cleaning the air and supporting public health and wellbeing. Residents can nominate a tree that is significant to them and it is showcased on the CHB Council's website.

5.7.4 The CHB Council has clearly defined roles and responsibilities for tree management

The CHB Council has clearly defined, documented and communicated to staff their roles and responsibilities for tree management, including:

- program delivery and oversight
- reporting
- tree risk assessment and treatment.

This has given staff transparency and understanding about work expectations, and how they contribute to the CHB Council's broader strategic objective of increasing the tree canopy.

Appendix 1 – Audit mandate, objective and scope

Our mandate

The Auditor-General has authority to conduct this review under section 32(1)(c) of the *Public Finance and Audit Act 1987 (PFAA)*. This section allows the Auditor-General to review the efficiency, economy and effectiveness of the activities of a public funded body.

Section 4 of the PFAA includes a council constituted under the *Local Government Act 1999* (LG Act) in the definition of a publicly funded body.

Our objective

The objective of our review was to conclude on whether selected metropolitan councils have effective activities in place to increase or maintain the tree canopy cover in their areas.

Our review covered the period from July 2018 to November 2023. This period aligns with the capture of tree canopy data across metropolitan Adelaide by SA Government entities in partnership with councils in 2018–2019, and Green Adelaide in 2022 for the update of *The 30 Year Plan for Greater Adelaide*.

What we reviewed and how

We considered whether the two councils we selected to review had:

- documented plans and/or strategies to increase or maintain the tree canopy cover
- governance structures to manage and oversee their performance while working towards their tree canopy target
- systems and process to effectively manage their tree data and monitor and report on their outcomes.

Figure A1.1: Performance audit sub-objectives

Audit area	Audit sub-objective
Tree canopy planning	Does the Council effectively plan its tree canopy activities.
Governance structures and practices	Does the Council have effective governance arrangements over its tree canopy activities, including: <ul style="list-style-type: none"> • establishing clearly defined roles and responsibilities • monitoring the performance of tree canopy activities and its performance against targets • risk management processes for managing its tree canopy.
Management of tree canopy data	How effectively the Council manages information about its trees to increase and/or maintain its tree canopy.

We reviewed documents in detail and held discussions with Council staff to conduct our review. We considered:

- LG Act requirements
- Council objectives, targets, policies and plans for tree canopy management
- the 2017 update of *The 30 Year Plan for Greater Adelaide* by the SA Government, which includes tree canopy targets for council areas
- the *Planning, Development and Infrastructure Act 2016*
- the Electricity (Principles of Vegetation Clearance) Regulations 2021
- risk management processes based on ISO 31000:2018 *Risk management guidelines*.

We engaged a subject matter expert to provide guidance and advice to us throughout our review and to ensure that our findings and recommendations were consistent with sound industry practice.

What we did not review

We did not assess:

- Council risk management practices across all functions. We focused on risks relevant to managing the tree canopy
- compliance with significant or regulated trees legislation
- how other land holders are managing their trees
- the completeness and accuracy of LiDAR tree canopy data
- the merits of alternative tree canopy measurement methodologies
- the Council's tree audit process.

Appendix 2 – A model tree management framework

This model tree management framework is one that councils could refer to when developing and reviewing their own frameworks.²⁵



We did not consider all aspects of this tree management framework in our reviews of the PAE Council and CHB Council.

Our review focused on the key activities related to our review objective:

- planning (including key strategies, objectives and targets)
- governance arrangements (including roles and responsibilities, performance monitoring and reporting, risk management)
- management of tree canopy data and information.

Appendix 3 – LiDAR measurement of metropolitan Adelaide’s tree canopy cover

What LiDAR is and what its data says about the tree canopy

LiDAR measures the time taken for a laser pulse to travel from an airplane’s sensor to the ground surface and be reflected back again to create a highly accurate point cloud which defines the height and horizontal extents of ground features. The point cloud can be used to produce spatial datasets which describe features on the earth’s surface, such as trees and buildings in three dimensions. This method measures the height and horizontal extents of tree canopy (defined as vegetation greater than 3 metres in height) and provides a repeatable measure of canopy for monitoring of change over time.

Between 2018–2019 a number of projects were conducted through partnerships between the SA Government and Regional Climate Partnerships (representing the 18 metropolitan councils) to capture tree canopy data across metropolitan Adelaide using the LiDAR method, as shown in figure A4.1.

Figure A4.1: Adelaide metropolitan council areas surveyed in 2018 – 2019

Council	Area surveyed	Council	Area surveyed
City of Adelaide	Complete	City of Onkaparinga	Complete
City of Burnside	Complete	City of Playford	Partial
Campbelltown City Council	Complete	City of Port Adelaide Enfield	Complete
City of Charles Sturt	Complete	City of Prospect	Complete
Town of Gawler	Partial	City of Salisbury	Complete
City of Holdfast Bay	Complete	City of Tea Tree Gully	Complete
City of Marion	Complete	City of Unley	Complete
City of Mitcham	Complete	Town of Walkerville	Complete
City of Norwood Payneham & St Peters	Complete	City of West Torrens	Complete

The Town of Gawler and the City of Playford were only partially surveyed at this time. Tree canopy was measured at a resolution of 1 metre x 1 metre by LiDAR.

In 2022 LiDAR was again used to measure the tree canopy across the same 18 Adelaide metropolitan council areas. This time the entire council areas of the Town of Gawler and the City of Playford were included and the tree canopy was measured at a 0.5 metre x 0.5 metre resolution. This survey calculated a tree canopy cover of 16.7% over the 2022 study area extent.²⁶

To enable consistent comparison and meaningful change detection analysis, the 2018–2019 LiDAR data was recalculated to a 0.5 metre x 0.5 metre resolution, bringing it into line with the 2022 data. This calculated Adelaide’s tree canopy cover at 14.5% of combined study footprint of the 2018–2019 surveys.

Green Adelaide also recalculated the canopy cover for 2022 based on the same metropolitan area measured in 2018–2019. When only the parts of the Town of Gawler and City of Playford which were previously captured are included in the 2022 survey results, tree canopy cover is calculated at 18.3%.^g

The net increase in the tree canopy of nearly 4% between 2018 and 2022 is due to the increase in crown spread of existing mature trees and the trees planted over the past few years having grown in height to 3 metres or more. The gain in canopy was however offset in part by tree loss from pruning and removal during this period.

g We did not review LiDAR data from 2018–2019 or 2022 for its completeness and accuracy. We did not review Green Adelaide’s recalculation of 2022 canopy cover based on the council areas surveyed in 2018–2019.

Appendix 4 – Government frameworks for tree canopy

SA Government	Local Government
<p>Role</p> <p>Responsible for the regulation and management of the urban greening framework relevant to urban tree canopy</p>	<p>Role</p> <p>Responsible for managing, developing, protecting, restoring, enhancing and conserving the environment in their council areas in an ecologically sustainable manner</p>
<p>Act</p> <p><i>Planning, Development and Infrastructure Act 2016</i></p> <p><i>Landscape South Australia Act 2019</i></p>	<p>Act</p> <p><i>Local Government Act 1999</i></p>
<p>Plans/Strategies</p> <p><i>The 30 Year Plan for Greater Adelaide (Regional Plan)</i></p> <p><i>Climate Change Action Plan 2021–2025</i></p> <p><i>State Landscape Strategy</i></p> <p><i>Green Adelaide Regional Landscape Plan 2021–2026</i></p>	<p>Plans/Strategies</p> <p>A council will determine its policies, objectives and strategies for tree management and the actions it will take to increase or maintain tree canopy</p>

Appendix 5 – Extract from the City of Holdfast Bay’s response to our findings and recommendations

Context, Challenges and Opportunities

Our urban forest is inclusive of all trees within the City of Holdfast Bay on public and private land. Trees are also subject to a range of diverse legislative and regulatory requirements. As the management of the urban forest is a joint responsibility and impacted by a number of stakeholders, it is important to recognise the external constraints that impact the success of achieving an increase in canopy across the city as a whole.

During the last 18 months, council has made two significant submissions about trees and the urban forest to the:

- Planning System Implementation Review
- Parliamentary Inquiry into the Urban Forest

We would like to take this opportunity to summarise some of the legislative and regulatory barriers to retaining, managing and increasing the urban forest, which we identified through these processes.

Conflict Between Trees and Utilities

There are several state-government laws, regulations or policy documents that restrict the trees that can be planted on public land, including:

- *Electricity (Principles of Vegetation Clearance) Regulations 2021*; including the Approved and Permitted Species lists maintained by the Office of the Technical Regulator that mandate which species may be planted under power lines;
- *Water Industry Act 2012*, including the SA Water Tree Planting Guide which mandates which species may be planted in the vicinity of water and wastewater infrastructure; and
- Operational Instruction 19.8: Trees in Medians and Roadsides in the Urban Environment, which mandates vegetation clearances from road corridors.

These documents treat trees only as a risk to critical infrastructure or life, rather than as green infrastructure with the same value as grey infrastructure. While trees can pose a risk to infrastructure, these documents ignore the numerous benefits that trees provide to the community.

As infrastructure proliferates with urban sprawl and infill, regulations that allow trees to be removed and limit replacement plantings, make it impossible for councils to achieve canopy targets on public land alone, especially because most metropolitan councils own a lower proportion of land than private landowners, as is the case for the City of Holdfast Bay.

There is an urgent need to incorporate a more sophisticated understanding of trees as community assets and an important mitigator of climate risk, rather than simply as a threat to infrastructure. There is also a need for harmonisation of all tree-relevant legislation and regulation to ensure this balanced and wholistic view of trees is promulgated across all state government policies, aligning infrastructure and development regulation with the principles of the 30-Year Plan for Greater Adelaide (and/or its replacement, the Greater Adelaide Regional Plan), and government commitments to greening and increasing canopy, such as the Urban Greening Strategy currently being developed by Green Adelaide.

Undergrounding and Aerial Bundling of Power Lines to Avoid Conflict

Independent of legislative and regulatory reform to the utilities sector, one of the simplest initiatives the state government could invest in to improve the extent of the urban forest and its performance is to underground power lines, including in common services trenches under roadways and in new land divisions, which combine electricity, gas, water, sewerage and communications services in a single trench. The placement of a common trench in the middle of a roadway would increase the amount of above- and below-ground space for planting on the verge, increasing the number and size of trees that can be planted on roadsides.

Alternatively, the bundling of power lines together (called 'aerial bundle cabling') overhead is also a cost-effective approach to existing suburbs with a similar outcome, making more space for tree canopy and reducing the need for large pruning clearances. Both of these approaches also increase the stability of the electricity grid due to reduced damage in storms and fires.

However, retrospectively undergrounding power lines is expensive (ca. \$3,000 per metre). The Power Line Environment Committee (PLEC) is a committee assisting the Minister responsible for the *Electricity Act 1996* in assessing and recommending locations for the undergrounding of overhead power lines. PLEC has annual funding in the order of \$10M, and operates in a co-funding model, whereby councils are invited to apply for funds to support undergrounding in specific areas.

Councils are generally expected to contribute at least one third of the costs of undergrounding (ca. \$1,000 per metre) and are expected to also commit to all of the costs of aesthetic improvement of the space after the undergrounding has happened.

This high requirement for council funds and limited co-funding available through PLEC means that undergrounding of existing overhead cables remains rare. In addition, in the current selection criteria of the PLEC funding program, tree canopy is not considered as part of the decision-making about locations to receive funding, therefore locations that could potentially provide important additional canopy are ignored.

Providing additional funding to PLEC, reducing the level of co-funding required by councils, and including expansion of urban tree canopy in the funding criteria, would allow the removal of more overhead power lines, thereby improve safety and public amenity, and increasing opportunity for greening. Undertaking more undergrounding would possibly also reduce the net cost per metre due to efficiencies of scale.

Alternatively, the state government could identify high priority targets for undergrounding (e.g. specific major transport corridors) to target for power line undergrounding and greening, providing the majority funding as a major project. Such projects could effectively transform barren transport corridors into shady boulevards with high public amenity and increased appeal for active transport users.

Landscape South Australia Act 2019

The *Landscape South Australia Act 2019* prevents the planting of species declared as weeds including common trees such as Aleppo pine (*Pinus halepensis*), box elder (*Acer negundo*) and desert ash (*Fraxinus angustifolia*). These species are prohibited because they have the potential to pose a risk to South Australia's environment and primary industries.

Prohibiting the planting of these species in rural, regional and peri-urban areas has sound logic. However, the traits that allow them to grow and proliferate also make some of them effective urban trees. For example, the desert ash has been planted extensively as a street tree and is popular in gardens because it is shady and performs well. The major risk this species poses is its ability to colonise and spread along streams, which may not be an issue in some urban contexts.

New developments

Developers are often heavily criticised for perceived failings in the environmental or social amenity created by their developments, particularly when large trees are removed to facilitate building.

Under the current legislation, it is extremely difficult for councils to enforce or prosecute vandalism of trees (removal, damaging, poisoning), with limited mechanisms to defer illegal removal of public trees.

Linking tree retention and other public good outcomes to economic incentives (e.g. charging developers the full assessed financial value of a tree before approving its removal) would ensure that commercial and public good incentives are better aligned. Another proposed financial incentive method is the use of tree bonds, especially for regulated and significant trees. The bond value would be derived using an agreed methodology embedded in the PDI Act, would be charged prior to development approval, and only refunded in part or in full depending on the extent of any damage suffered by the tree, as assessed by a qualified consulting arborist.

Large trees valued by industry-accepted methodologies often exceed \$100,000 in value, therefore funds accumulated through these processes would be significant enough to support major greening projects, including the purchase of land for pocket parks or other greening opportunities. Such an approach would lead to more certainty for developers, and to development that is in line with public expectations.

Planning, Infrastructure and Development Act 2016

The *Planning, Development and Infrastructure Act 2016* (PDI Act) is the primary mechanism for protecting trees on private land in the greater Adelaide area. The City of Holdfast Bay has provided extensive and specific feedback on the tree protection mechanisms and exemptions within the PDI Act as part of the Planning System Implementation Review. The Act and its regulations require significant improvements in order to retain more private trees.

If Adelaide is to reach its canopy target as set out in the 30 Year Plan for Greater Adelaide, it needs mechanisms to retain, protect and increase tree canopy on private land. This is because the majority of the urban forest is on private land, where the majority of tree loss happens. In the City of Holdfast Bay, the council controls only 29% of the tree canopy, where 64% is controlled by private land owners. Due to significant changes in the planning system between the previous Development Act and the current PDI Act, councils now have no control over trees on private land, therefore the City of Holdfast Bay is currently putting a lot of effort into researching and developing creative ways in which we can encourage and incentivise retention and planting of private trees.

Infill development increases the number of access points to a road that significantly reduces space for trees. More acceptance of combined driveways or stronger clearance zones around existing trees is required.

One of the most important changes that needs to be made to the PDI Act is to remove the ability to remove any tree (other than *Eucalyptus* or *Agonis flexuosa*) that is within 10 metres of a dwelling or in-ground swimming pool, which effectively means that most 'protected' trees in urban areas are exempt from protection, or become exempt after a block with one house on it is subdivided into two or more blocks with multiple dwellings. Reducing or removing this distance will significantly enhance protection for existing trees and bring South Australia into line with other states where the majority of councils do not have a distance provision.

The tree protections currently in place in the PDI Act are defined by the size of the circumference of a tree trunk. This is inadequate both in terms of the specific sizes that are used (2 metres or more for regulated trees; 3 metres or more for significant trees), and because only one measure is used. In the

benchmarking study *Urban Tree Protection in Australia: Review of regulatory matters* produced by The University of Adelaide, commissioned as part of the Planning System Implementation Review, it was shown that the majority of the 101 non-South Australian councils included in the study used at least two measures of tree size. These include tree trunk circumference, canopy spread and tree height. It is considered best practice to use at least two of these measures for specific tree protection regulations.

Regulated trees are often removed by the state government on state government land because both the state Department for Infrastructure and Transport, and the Department for Education have exemptions under the PDI Act. However, these types of locations have particularly high risks associated with increased urban heat. The Federal Government (e.g. Department of Defence) also has an exemption from these State laws and therefore has little responsibility to maintain or protect trees on its land (e.g. significant trees at Warradale Army Barracks).

The University of Adelaide review confirmed that South Australia's tree protections were markedly less stringent than those in other Australian capital cities and that the exemptions to protection in South Australia were so broad that few trees in Adelaide's urban setting are actually protected against removal for development. The University of Adelaide report provides several recommendations on reforms that would improve canopy retention on private land.

We would like to thank the Auditor-General and the Department's team for undertaking the review. The timing has assisted the development of our tree management documentation and the recommendations will assist with our commitment to increase our tree canopy and ongoing tree management improvements. We hope these findings will support the industry as a whole in South Australia to improve tree management and result in increased tree canopy cover across the state.

Appendix 6 – Response from the City of Port Adelaide Enfield



20 May 2024

Mr Andrew Blaskett
Auditor-General
Level 9
State Administration Centre
200 Victoria Square
ADELAIDE SA 5000

BY EMAIL: records@audit.sa.gov.au

Dear Mr Blaskett

Review of urban tree canopy management

I write in response to your letter dated 14th of May 2024. We appreciate the opportunity to review and provide comment on your proposed Report to Parliament.

I can confirm that Council's administration has reviewed the report and do not see the need for changes.

Once again, I wish to acknowledge that this has been a valuable exercise and express our appreciation for the professional partnership approach your team, specifically Sharon Ryan and Kris Slaytor, have taken throughout the process.

Yours sincerely

A handwritten signature in black ink that reads "Claire Boan".

Claire Boan
Mayor

Email: claire.boan@cityofpae.sa.gov.au

Office of the Mayor

CIVIC CENTRE
163 St Vincent Street,
Port Adelaide SA 5015
PO Box 110,
Port Adelaide SA 5015

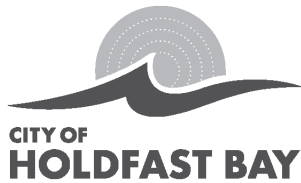
COUNCIL OFFICES
Enfield Library
1 Kensington Crescent, Enfield
Greenacres Library
2 Fosters Road, Greenacres

CONTACT
P (08) 8405 6600
E service@cityofpae.sa.gov.au
www.cityofpae.sa.gov.au

FOLLOW US
A row of four social media icons: Facebook, Twitter, Instagram, and YouTube.
[@CityofPAE](https://www.instagram.com/CityofPAE)



Appendix 7 – Response from the City of Holdfast Bay



OFFICE OF THE MAYOR

21 May 2024

Mr Andrew Blaskett
Auditor-General
Level 9, State Administration Centre
200 Victoria Square
ADELAIDE SA 5000

Dear Mr Blaskett

Review of urban tree canopy management

Thank you for your letter dated 14 May 2024 including the relevant extracts of the proposed Report to Parliament for our final comment.

Following a review of the proposed report, I am pleased to advise that City of Holdfast Bay is satisfied with the report and has no further comment to provide.

We wish to thank your Department for the thorough review of our urban tree canopy management and look forward to implementing the recommendations made.

Yours sincerely



Amanda Wilson
Mayor

Appendix 8 – Abbreviations and terms used in this report

The terms used in this report were sourced from legislation, *The 30 Year Plan for Greater Adelaide* and information published by Green Adelaide.

Abbreviation/Term	Description
AGD	Auditor-General's Department
CHB Council	City of Holdfast Bay
Council area	All area within the boundary of the Council
ELT	Executive leadership team
ERDC	Environment Resources and Development Committee
Impermeable surfaces	Impermeable surfaces impede the filtration of water into the soil and are mainly artificial structures such as pavements, roads and buildings
LGA	Local Government area, also known as Council area
LG Act	<i>Local Government Act 1999</i>
LiDAR	Light Detection and Ranging (LiDAR) measures the time taken for a laser pulse to travel from an airplane's sensor to the ground surface and be reflected back again to image landscape features in three dimensions. LiDAR is used to measure tree canopy cover
Metropolitan council	Comprises Adelaide, Burnside, Campbelltown, Charles Sturt, Gawler, Holdfast Bay, Marion, Mitcham, Norwood Payneham and St Peters, Onkaparinga, Playford, Port Adelaide Enfield, Prospect, Salisbury, Tea Tree Gully, Unley, Walkerville and West Torrens councils
PAE Council	City of Port Adelaide Enfield
PDI Act	<i>Planning, Development and Infrastructure Act 2016</i>
PFAA	<i>Public Finance and Audit Act 1987</i>
Sequestration	The process of trees storing carbon
Tree canopy cover	The horizontal extents of the crown of the tree over an area of land when seen from above. It is usually expressed as a percentage of an area of interest, or square metres. As an individual tree grows and the crown expands, the canopy cover increases. Trees are classed as vegetation $\geq 3\text{m}$ in height. Allows for the percentage of tree canopy cover to be calculated across a range of areas of interest (eg LGA or unit area)

Abbreviation/Term	Description
Urban infill	The development or construction of additional housing units into an existing subdivision or neighbourhood within the current built-up urban area of metropolitan Adelaide. It excludes the greenfield and township areas in the greater Adelaide region
Urban heat island	Urban areas that are significantly warmer than surrounding rural or natural areas due to human activities, artificial and impermeable surfaces and land uses
Urban tree cover	Trees and shrubs located in street verges, parks and backyards
WSUD	Water sensitive urban design

Annexure

Data will be published on the Auditor-General's Department's website

Section 32(6) of the *Public Finance and Audit Act 1987* allows the Auditor-General to publish information including data on a website. I have published a summary of the council survey responses and Green Adelaide's LiDAR data for 2018–2019 and 2022 on the Auditor-General Department's website – www.audit.sa.gov.au.

Each council's area is unique and presents its own set of challenges for increasing and maintaining its tree canopy cover. For example, soil types, rainfall volume and amount of grassland and grassy woodlands varies between each council. The data presented should not be used to compare one council against another.

Council survey responses

To provide insight into how Adelaide metropolitan councils are managing their tree canopies, we surveyed 18 councils. We did not verify their responses or audit the results of our survey. We did not form a conclusion about their responses.

We have included some of their summarised responses in section 3 of this report, such as the challenges faced by councils in working towards achieving their targets and the SA Government's targets.

Adelaide tree canopy cover LiDAR data

We obtained LiDAR data about metropolitan Adelaide's tree canopy cover between 2018–2019 and 2022 from Green Adelaide. We did not review the LiDAR methodology or audit its data.

References

- ¹ Department for Trade and Investment 2020, *The 30 Year Plan for Greater Adelaide*, Government of South Australia, Adelaide.
- ² Green Adelaide 2024, *New data shows extent of Adelaide's tree canopy*, Government of South Australia, Adelaide, 10 April 2024, <<https://www.greenadelaide.sa.gov.au/news/2024-metro-adelaide-tree-canopy-data>>, viewed 7 May 2024.
- ³ Konijnendijk, C, *Evidence-based guidelines for greener, healthier, more resilient neighbourhoods: Introducing the 3-30-300 rule*, Journal of Forestry Research, 26 August 2022, Volume 34.
- ⁴ Green Adelaide 2022, *Urban tree canopy, green spaces and built environment data analysis and reporting 2022 Survey Area Technical Report January 2022*, Government of South Australia, Adelaide.
- ⁵ Department for Environment and Water 2022, *Guide to climate projections for risk assessment and planning in South Australia 2022*, Government of South Australia, Adelaide.
- ⁶ Kelly, I, *Nearly 800 trees axed after pest infestation*, InDaily, 23 March 2024, <<https://www.indaily.com.au/news/adelaide/2024/03/22/nearly-800-trees-axed-after-pest-infestation>>, viewed 7 May 2024.
- ⁷ Green Adelaide 2022, *Urban tree canopy, green spaces and built environment data analysis and reporting 2022 Survey Area Technical Report January 2022*, Government of South Australia, Adelaide.
- ⁸ Based on a measurement of the Adelaide Oval of 16,132 m².
Aguis M, *Skinny flat: new Adelaide Oval one of League's thinnest*, Port Adelaide Football Club 2024, <<https://www.portadelaidefc.com.au/news/714084/skinny-flat-new-adelaide-oval-one-of-leagues-thinnest>>, viewed 7 May 2024.
- ⁹ Green Adelaide 2022, *Urban tree canopy, green spaces and built environment data analysis and reporting 2022 Survey Area Technical Report January 2022*, Government of South Australia, Adelaide.
- ¹⁰ Environment Protection Authority 2023, *Climate Change Impact*, Government of South Australia, Adelaide, <<https://soe.epa.sa.gov.au/environmental-themes/climate/climate-change-impact>>, viewed 21 March 2023.
- ¹¹ Australian Government Bureau of Meteorology, *South Australia in 2023*, Commonwealth of Australia, Canberra, <<http://www.bom.gov.au/climate/current/annual/sa/summary.shtml>>, viewed 7 May 2024.
- ¹² Department for Environment and Water 2023, *Tracking changes in South Australia's environment, Trend and condition report cards overview 2023*, Government of South Australia, Adelaide.
- ¹³ Department for Environment and Water 2022, *Guide to climate projections for risk assessment and planning in South Australia 2022*, Government of South Australia, Adelaide.
- ¹⁴ Department for Environment and Water 2022, *Guide to climate projections for risk assessment and planning in South Australia 2022*, Government of South Australia, Adelaide.
- ¹⁵ CRC for Low Carbon Living Limited, 2017, *Guide to Urban Cooling Strategies*, Department of Industry, innovation and Science, Commonwealth of Australia, Canberra, p. 5.
- ¹⁶ Department of Environment and Water 2020, *Directions for a Climate Smart South Australia*, Government of South Australia, Adelaide, p. 5.
- ¹⁷ Department of Environment and Water 2020, *Climate Change Action Plan 2021–2025*, Government of South Australia, Adelaide, p. 8.
- ¹⁸ CRC for Low Carbon Living Limited, 2017, *Guide to Urban Cooling Strategies*, Department of Industry, innovation and Science, Commonwealth of Australia, Canberra.
- ¹⁹ The Australia Institute, January 2019, *Heat Watch, Extreme Heat in Adelaide*, Commonwealth of Australia, Canberra, <<https://australiainstitute.org.au/wp-content/uploads/2020/12/P666-Heatwatch-Adelaide-WEB-.pdf>>, viewed 21 March 2023.

-
- ²⁰ Jacobs, B, Mikhailovich, N, and Delaney, C, *Benchmarking Australia's Urban Tree Canopy: An i-Tree Assessment, Final Report*, May 2014, Institute for Sustainable Futures, Government of New South Wales, Sydney.
- ²¹ Meyer-McLean, B, Taylor, B, Rogers, S and Gaglio, D. 2022, *Creating more space for trees*, University of Adelaide, Adelaide, Version 3, 3 March 2023, p. 18, <<https://static1.squarespace.com/static/5c4d88b5aa49a11b1eae4b9f/t/62af135f0aa92c0c9b71adb4/1655640938929/Final+CREATING+MORE+SPACES+FOR+TREES+V2+1+June+2021.pdf>>, viewed 23 March 2023.
- ²² Meyer-McLean, B, Taylor, B, Rogers, S and Gaglio, D. 2022, *Creating more space for trees*, University of Adelaide, Adelaide, Version 3, 3 March 2023, p. 17, <<https://static1.squarespace.com/static/5c4d88b5aa49a11b1eae4b9f/t/62af135f0aa92c0c9b71adb4/1655640938929/Final+CREATING+MORE+SPACES+FOR+TREES+V2+1+June+2021.pdf>>, viewed 23 March 2023.
- ²³ Environment, Resources and Development Committee, *ERDC Interim Urban Forest Report 181023 signed*, Parliament of South Australia, Adelaide, <<https://parliament.sa.gov.au/en/Committees/Committees-Detail>>, viewed 22 March 2023.
- ²⁴ Expert Panel for the Planning System Implementation Review, *Final Report and Recommendations 2023*, March 2023, Government of South Australia, Adelaide, <https://plan.sa.gov.au/__data/assets/pdf_file/0011/1350875/final-report-and-recommendations-2023-expert-panel.pdf>, viewed 22 March 2023.
Champion, N, Minister for Planning, *Transforming our Planning System: Response of the South Australian Government to the Final Report and Recommendations of the Expert Panel for the Planning System Implementation Review*, March 2024, Government of South Australia, Adelaide, <https://plan.sa.gov.au/__data/assets/pdf_file/0003/1350876/government-response-to-the-final-report-and-recommendations-2023-expert-panel.pdf>, viewed 22 March 2023.
- ²⁵ Adapted by Caffin, M. 2024 from Kenny, van Wassenaeer and Satal, 2011, *Criteria and Indicators for Strategic Urban Forest Planning and Management*.
- ²⁶ Green Adelaide 2022, *Urban tree canopy, green spaces and built environment data analysis and reporting 2022 Survey Area Technical Report January 2022*, Government of South Australia, Adelaide.

