CITY of PERTH

Lord Mayor and Councillors,

NOTICE IS HEREBY GIVEN that the next meeting of the **Works and Urban Development Committee** will be held in Committee Room 1, Ninth Floor, Council House, 27 St Georges Terrace, Perth on **Tuesday, 24 May 2016 at 5.30pm.**

Yours faithfully

MARTIN MILEHAM
CHIEF EXECUTIVE OFFICER

19 May 2016

Committee Members:

Members:	**1st Deputy:**	**2nd Deputy:**
Cr Limnios (Presiding Member)		
The Lord Mayor	Cr Harley	Cr Chen
Cr McEvoy		

Please convey apologies to Governance on 9461 3250
or email governance@cityofperth.wa.gov.au

EMERGENCY GUIDE

Council House, 27 St Georges Terrace, Perth

City of Perth

The City of Perth values the health and safety of its employees, tenants, contractors and visitors. The guide is designed for all occupants to be aware of the emergency procedures in place to help make an evacuation of the building safe and easy.

BUILDING ALARMS

Alert Alarm and Evacuation Alarm.

KNOW YOUR EXITS

ALERT ALARM

beep beep beep

All Wardens to respond.

Other staff and visitors should remain where they are.

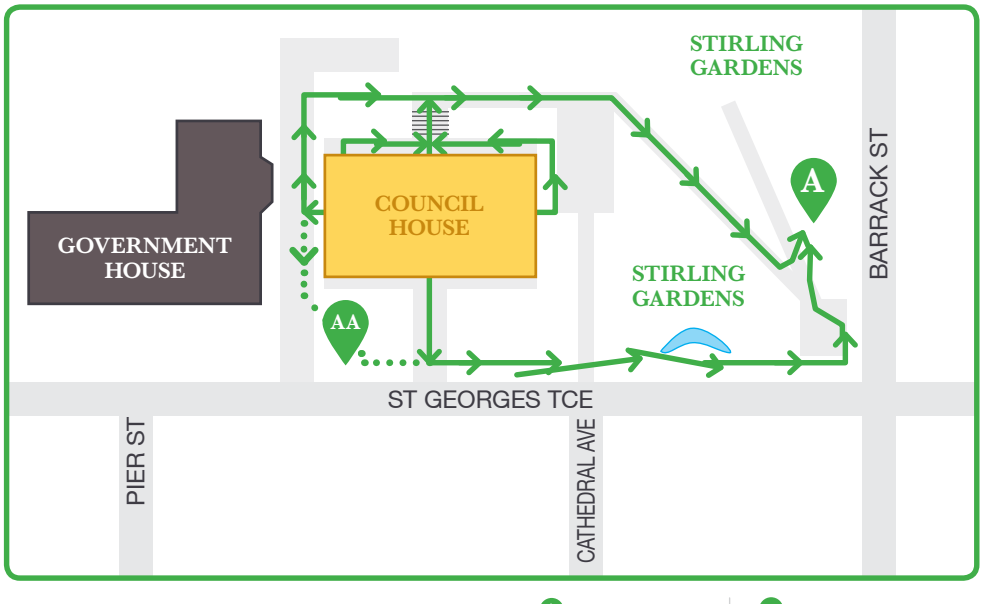
EVACUATION ALARM/PROCEDURES

whoop whoop whoop

On hearing the Evacuation Alarm or on being instructed to evacuate:

1. Move to the floor assembly area as directed by your Warden.
2. People with impaired mobility (those who cannot use the stairs unaided) should report to the Floor Warden who will arrange for their safe evacuation.
3. When instructed to evacuate leave by the emergency exits. Do not use the lifts.
4. Remain calm. Move quietly and calmly to the assembly area in Stirling Gardens as shown on the map below. Visitors must remain in the company of City of Perth staff members at all times.
5. After hours, evacuate by the nearest emergency exit. Do not use the lifts.

EVACUATION ASSEMBLY AREA



WORKS AND URBAN DEVELOPMENT COMMITTEE

Established: 17 May 2005 (Members appointed 22 October 2015)

Members:	**1st Deputy:**	**2nd Deputy:**
Cr Limnios (Presiding Member)		
The Lord Mayor	Cr Harley	Cr Chen
Cr McEvoy		

Quorum: Two

Expiry: October 2017

TERMS OF REFERENCE: OCM 24/11/15

To oversee and make recommendations to the Council on matters related to:

1. works required to construct, upgrade and maintain streets, footpaths, thoroughfares and other public places, including streetscape upgrades, landscaping initiatives and directional signage and graffiti;

2. design, construction and upgrading of parks, reserves, recreational and civic amenities and facilities and Council owned buildings, excluding Council House, the Perth Town Hall, City of Perth Public Lending Library and the Perth Concert Hall;

3. oversight of the implementation of the Lighting Strategy;

4. waste management.

This meeting is not open to members of the public

WORKS AND URBAN DEVELOPMENT COMMITTEE
24 MAY 2016

ORDER OF BUSINESS

1. **Declaration of Opening**

2. **Apologies and Members on Leave of Absence**

3. **Confirmation of Minutes – 12 April 2016**

4. **Correspondence**

5. **Disclosure of Members' Interests**

6. **Reports**

7. **Motions of which Previous Notice has been Given**

8. **General Business**

   8.1. Responses to General Business from a Previous Meeting

   - **"PTA Proposed construction of Fitzgerald Street Bus Lanes (City of Perth Section)" – deferred by the Works and Urban Development Committee at its meeting held on 12 April 2016.**

   The Manager Transport will provide an update to the Works and Urban Development Committee.

   8.2. New General Business

9. **Items for Consideration at a Future Meeting**

   Outstanding Reports:

   Nil

10. **Closure**

INDEX OF REPORTS

ITEM NO: 1

JACOBS LADDER – PROPOSED CLOSURE TO THE PUBLIC BETWEEN THE HOURS OF 7:00PM AND 7:00AM DAILY

RECOMMENDATION: ***(APPROVAL)***

That Council:

1. ***approves the advertising of its intention to close Jacobs Ladder on a daily basis from 7:00pm until 7:00am;***

2. ***agrees to seek Minister for Lands approval for the daily closure to the public of Jacobs Ladder between the hours of 7:00pm and 7:00am.***

BACKGROUND:

FILE REFERENCE:	P1025962
REPORTING UNIT:	Properties
RESPONSIBLE DIRECTORATE:	Construction and Maintenance
DATE:	17 May 2016
MAP / SCHEDULE:	Schedule 1 – Jacobs Ladder Remedial Works Access Gates

Jacobs Ladder was originally a wooden structure constructed in 1909. The City of Perth closed the site 50 years later due to its poor condition but several years later rebuilt the structure as it is today.

A recent engineering report determined that the ladder required some work to ensure public safety and it was closed to allow the work to be carried out. It is due to reopen on 30 May 2016.

LEGISLATION / STRATEGIC PLAN / POLICY:

Legislation	Section 58 of the *Land Administration Act 1997*	
Integrated Planning and Reporting Framework Implications	**Corporate Business Plan**	
	Council Four Year Priorities: Living in Perth	
	S9	Promote and Facilitate CBD Living
	9.3	Develop Noise Management Strategy

DETAILS:

The public use of Jacobs Ladder for programmed exercise routines has resulted in many complaints to the City from surrounding residents and others regarding the early morning use and noise levels.

In an effort to address the concerns of the surrounding residents, it is proposed to seek Minister for Lands approval to close the ladder from 7:00pm until 7:00am each day. Ministerial approval is required as Jacobs Ladder is technically a 'road' (extension of Cliff Street).

As part of the current rectification works, gates will be installed at the top and bottom of the ladder. If approved, the gates will be closed and locked at 7:00pm and reopened at 7:00am each day. These hours are commensurate with the City guidelines regarding noise during construction works.

Section 58 of the *Lands Administration Act 1997* contains a requirement for public invitation to comment on the closure which must be sought by way of advertising for a period of not less than 35 days.

Subsequent to the required advertising period, the City may seek Minister for Lands consent to the closure. Any submissions received from the public are to be provided to the Minister.

It is proposed that signage will be installed at the top and bottom of Jacobs Ladder reminding users to be respectful in this residential area and that group exercise is not permitted. These signs will be installed before the reopening of the ladder in late May.

FINANCIAL IMPLICATIONS:

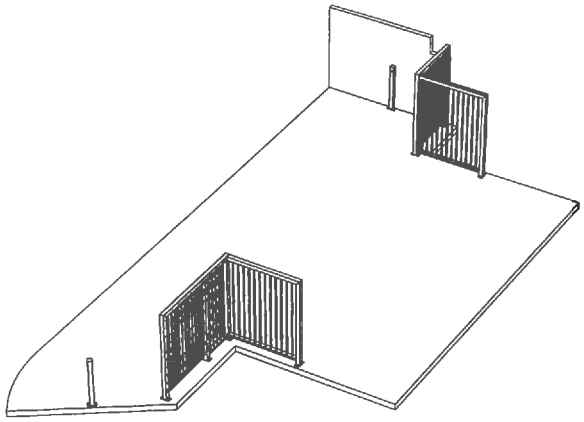
The previously approved cost of the current remedial works including the installation of the gates is $119,366.

All figures quoted in this report are exclusive of GST.

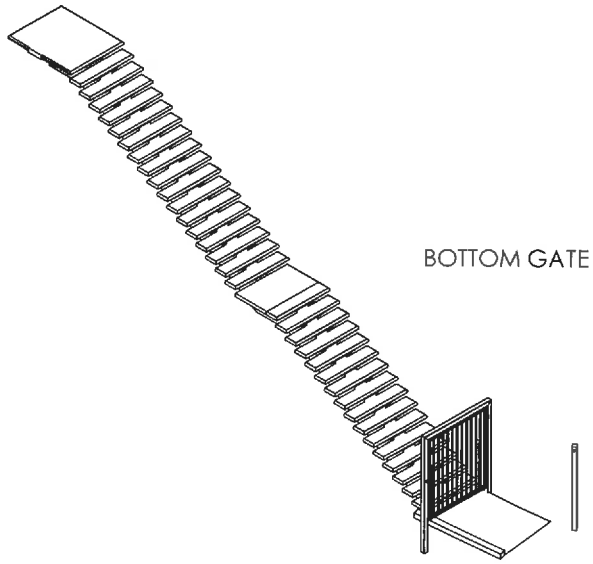
COMMENTS:

It is expected that, if the ladder is closed, there will be complaints from regular users and media coverage however there is merit in the closure in that it will minimise complaints from surrounding residents, prolong the life of the structure and reduce the likelihood of injury during low light times.

The proposal is supported.



TOP PLATFORM
REMOVE TWO
PANELS OF
EXISTING
BALUSTRADE FOR
GATE RETURN
FRAMES



BOTTOM GATE

FINISH: FINISH

REV	DATE	DESCRIPTION

LIVING IRON
UNIT 2 / 17 ZETA CRESCENT,
O'CONNOR
Ph 9314 5033 Fax 9314 5863
Email: livingiron@livingiron.com.au

TITLE: JACOBS LADDER REMEDIAL WORKS
ACCESS GATES
GENERAL ISOMETRIC VIEWS

DRG No:	DATE:	SHEET No:
3565-07	[illegible]	1/15
JOB No: 3565	REV: A	A3

SCHEDULE 1

ITEM NO: 2

APPROVAL FOR ADVERTISING – DRAFT CITY OF PERTH URBAN FOREST PLAN

RECOMMENDATION: ***(APPROVAL)***

That Council:

1. ***receives the draft City of Perth Urban Forest Plan as detailed in this report titled "Draft City of Perth Urban Forest Plan" and as detailed in Schedule 2;***

2. ***approves the advertising of the draft City of Perth Urban Forest Plan for consultation and feedback noting that a further report will be presented to Council detailing any comments received and any recommended changes to finalise the document.***

BACKGROUND:

FILE REFERENCE:	P1030783
REPORTING UNIT:	Co-ordination and Design
RESPONSIBLE DIRECTORATE:	Planning and Development
DATE:	16 May 2016
MAP / SCHEDULE:	Schedule 2 – Draft City of Perth Urban Forest Plan

At its meeting held on **13 May 2008**, Council adopted the Street Tree Framework to guide the selection of new trees to be planted in the City.

At its meeting held on **14 September 2010**, Council adopted the Urban Design Framework (UDF) 2029. The UDF recognises the need for our city to be robust and resilient enough to adapt to changing circumstances.

At its meeting held on **14 May 2013**, Council approved Policy 20.9 – Recognising the Amenity Value of the City's Trees that placed a monetary value on the amenity and environmental values of trees in parks and streets.

At its meeting **28 October 2014**, the following Council resolution was adopted:

"The Council recognises the need for a plan to ensure the City's trees and landscapes are resilient and responsive to a changing environment, and requests that:

1. an Urban Forest Plan be developed for the purposes of:

- *guiding the future development of the City's green infrastructure;*
- *setting targets to increase canopy cover in the public realm;*
- *replacing ageing tree populations; and*
- *protecting the City's existing trees and landscapes."*

At its meeting held on **15 March 2016**, Council adopted its Environment Strategy. The Environment Strategy articulates the City's aim to lead, inspire and work with our community to ensure Perth is one of the world's most environmentally sustainable cities.

A draft Urban Forest Plan for the City of Perth has subsequently been developed, informed by baseline research studies and various inputs from relevant technical and professional disciplines within the organisation.

LEGISLATION / STRATEGIC PLAN / POLICY:

Integrated Planning and Reporting Framework Implications	**Corporate Business Plan**	
	Council Four Year Priorities: Healthy and active in Perth	
	S16	Increase accessibility to green networks in the city.
	16.1	Finalise the development of the Urban Forest Plan

DETAILS:

An urban forest is broadly defined as the collection of green spaces, trees and other vegetation that grows within an urban area, on both public and private land. The City's draft Urban Forest Plan covers street and parkland trees planted on land located within the City of Perth boundaries.

The guiding principles of the draft Urban Forest Plan for the City of Perth are to:

- Mitigate the urban heat island effect by cooling our public spaces.
- Create healthy, robust and attractive public spaces that are comfortable for outdoor activity all year round.
- Design for liveability and health and wellbeing.
- Ensure the City is climate responsive.

Evidence based planning

The development of the City's draft Urban Forest Plan is underpinned by technical data collected and analysed by various specialists. These studies provided the data needed to enable the assessment of the City's existing urban forest against a range of commonly accepted performance indicators for urban forest management, including:

- existing levels of tree canopy cover.
- tree health.
- age diversity.
- useful life expectancy.
- species diversity

This data, collected over the summer of 2014 and 2015, included the following:

- Baseline measurements of existing tree canopy cover using high resolution airborne multispectral imaging.
- Audits to identify existing sites lacking adequate tree canopy cover.
- Street and parkland audit to ascertain information on the age, size, lifespan, species, health and structural condition and any historical and cultural significance of the City's trees.
- City-wide aerial mapping of heat island effect using airborne thermal imaging and satellite data.
- Thermal imagery at street level to ascertain the effect tree canopy size has on temperatures in the public realm.

While the satellite data used for the draft Plan was collected on 10 January 2014, this will be superseded in the final document by data from the heatwave experienced in February 2016 and will include areas such as Elizabeth Quay, Perth City Link and the new City of Perth boundary.

Findings

Research findings indicate that the City's Urban Forest is generally performing well against the key performance indicators:

- Health - 92% of trees are in good or excellent health.
- Age Diversity - there is good spread of age classes.
- Useful Life Expectancy (ULE) - 88% of trees have a medium to long term ULE.
- Tree Diversity – 40 different tree families and over 260 different tree species.

The research findings also highlighted some important challenges including:

- Increasing tree canopy cover to mitigate the urban heat island effect.
- Securing a sustainable water supply.
- Addressing the aging tree population.
- Improving tree diversity.
- Maintaining and maximising levels of tree health.

Refinement of the Plan through Consultation

The draft Urban Forest Plan is now at a stage where input from various relevant external stakeholders would add value to the document. It is proposed that the draft

Plan be made available to the general public on the City of Perth and Engage Perth websites. In addition to this, the following stakeholders will be contacted directly for feedback:

- Relevant State Government agencies;
- Adjoining Local Government authorities;
- Relevant academics from WA Universities;
- Relevant industry groups and professional institutes;
- Arboriculture Australia and nursery associations;
- Specific community interest groups; and
- Relevant infrastructure and service providers.

FINANCIAL IMPLICATIONS:

There are no direct financial implications associated with this Report.

There will be financial implications associated with the adoption of the final Urban Forest Plan and the associated implementation plan.

COMMENTS:

The City's Strategic Community Plan – Vision 2029+ identifies 'Greening in the City' as one of the important influencers in the planning of our city.

The City's draft Urban Forest Plan covers street and parkland trees planted on land located within the City of Perth boundaries. It currently excludes those parts of the City of Subiaco that will be amalgamated with the City of Perth, under the provisions of the City of Perth Act 2016. These areas along with Elizabeth Quay and Perth City Link will be included in the finalisation of the Plan.

The City of Perth's draft Urban Forest Plan is an important strategic action plan for the protection, management and expansion of the urban forest. It recognises the urban forest as a critical element of infrastructure for its on-going contribution to city liveability, community health and well-being and climate resilience. The proposed stakeholder consultation will enable the draft document to be refined, finalised and presented back to Council for consideration during August 2016.

CITY of PERTH

URBAN FOREST

PLAN

DRAFT

SCHEDULE 2

Table of Contents

Introduction

Traditionally urban trees have been valued for their beauty and aesthetic quality. They soften and add human scale to city streets. Avenues of trees and distinctive parklands help create an attractive city with a unique sense of place.

More recently, urban forests are also being valued for the range of ecosystem services they provide. They help to cool our cities and public spaces, improve air and water quality, reduce greenhouse gases, provide food and shelter for wildlife and improve levels of community health and well-being.

With more people choosing to live in cities, many are struggling to maintain a healthy environment and a high quality of life for their citizens. Australia is an increasingly urbanised country with approximately 70 percent of its population living in capital or other major cities (Australian Bureau of Statistics, 2013). The residential population of Perth increased by nearly 50 percent between 2006 – 2011. This trend is expected to continue, with a population of 28,500 predicted by 2030. (City of Perth, 2013)

As cities become more built up and lifestyles are more sedentary, access to green space is all the more important in promoting community physical and mental health and well-being.

Climate change brings another set of challenges. Our cities are heating up. Over the past 100 years heat waves have been the cause of more deaths than any other natural hazard in Australia (Steffan, et al., 2014). Predicted increases in temperatures and heat waves pose a potential risk to city liveability and the health of urban populations in future decades (Brown, et al., 2013) . More frequent and intense storm events also threaten to damage city infrastructure and buildings.

Perth is predicted to experience an increase in the number of hot days over 35 degrees Celsius from 28 to 67 days by 2070, along with increased disruption from climate related events including storms and heatwaves. Despite predictions for increased intensity of stormwater run-off, the City is also experiencing reduced levels of overall rainfall.

The range of environmental, social and economic benefits provided by healthy, resilient and sustainable urban forests means that they are uniquely placed to help cities meet future challenges.

Consequently, urban forests are increasingly recognised as an important part of a city's infrastructure and are emerging as indispensable assets in the creation of liveable cities. Many of the world's major cities are currently developing, funding and implementing plans to protect and grow their urban forests.

The City of Perth Urban Forest Plan

The City of Perth Urban Forest Plan is a strategic action plan for the protection, management and expansion of the urban forest. It recognises the urban forest as a critical element of City infrastructure. It aims to promote its long-term health and resilience and maximise its on-going contribution to City liveability, community health and well-being and an effective response to climate change.

The Plan is an evidence based document, bringing together the latest thinking and research from across the world and within Australia, with a particular focus on cities in hot, dry climates. It draws on the experience of these cities in the face of increasing urban challenges, while taking account of the uniqueness of Perth's locale and its particular set of issues.

A staged approach

The Plan is being developed in three stages, with this document representing Stage One.

Stage One is concerned with the overall urban forest, with a primary focus on publically owned and managed street and parkland trees

Stage Two will focus on trees planted on private property throughout the City

Stage Three will address the City's wider network of green infrastructure

Stage One: Street and Parkland Trees

Part A provides a definition of the urban forest and provides information on:

- the range of community benefits delivered
- its role in helping to cool cities
- the impact of climate change
- why the Urban Forest Plan is needed
- key drivers behind its development

Part B focuses on street and parkland trees and addresses the following:

- the historical development of the City's Urban Forest
- its existing character and condition
- key issues and challenges
- vision, goals and objectives
- implementation and monitoring

Plan area

Stage One covers street and parkland trees planted on land located within the City of Perth boundaries. It excludes those parts of the City of Subiaco that will be amalgamated with the City of Perth, under the provisions of the City of Perth Act 2016. Elizabeth Quay and Perth City Link are also excluded, as these were under the control of the Metropolitan Redevelopment Authority when Stage One was prepared. These exclusions will be addressed in a separate supporting document to be issued later in 2016.

Part A – The City of Perth Urban Forest Plan

1.1 What is an urban forest?

An urban forest is broadly defined as the collection of green spaces, trees and other vegetation that grows within an urban area, on both public and private land. Together, these green elements provide a range of benefits that enrich the quality of life and promote human well-being in the urban environment.

A primary distinguishing element of an urban forest, as compared to a 'natural' forest, is that it exists within a man-made environment, characterised by hard surfaces, a range of building types and concentrated human activity. This poses many challenges for its planning and management compared to more naturally vegetated areas.

The emerging discipline of Urban Forestry is concerned with the art and science of managing trees in urban environments to maximise the range of benefits provided to the community. Its focus is the health, resilience and sustainability of the urban forest as a whole.

"The aim of urban forestry is to improve the welfare of urban residents, the planting and care of trees is a means to that end, not an end in itself." (Johnston, 1985)

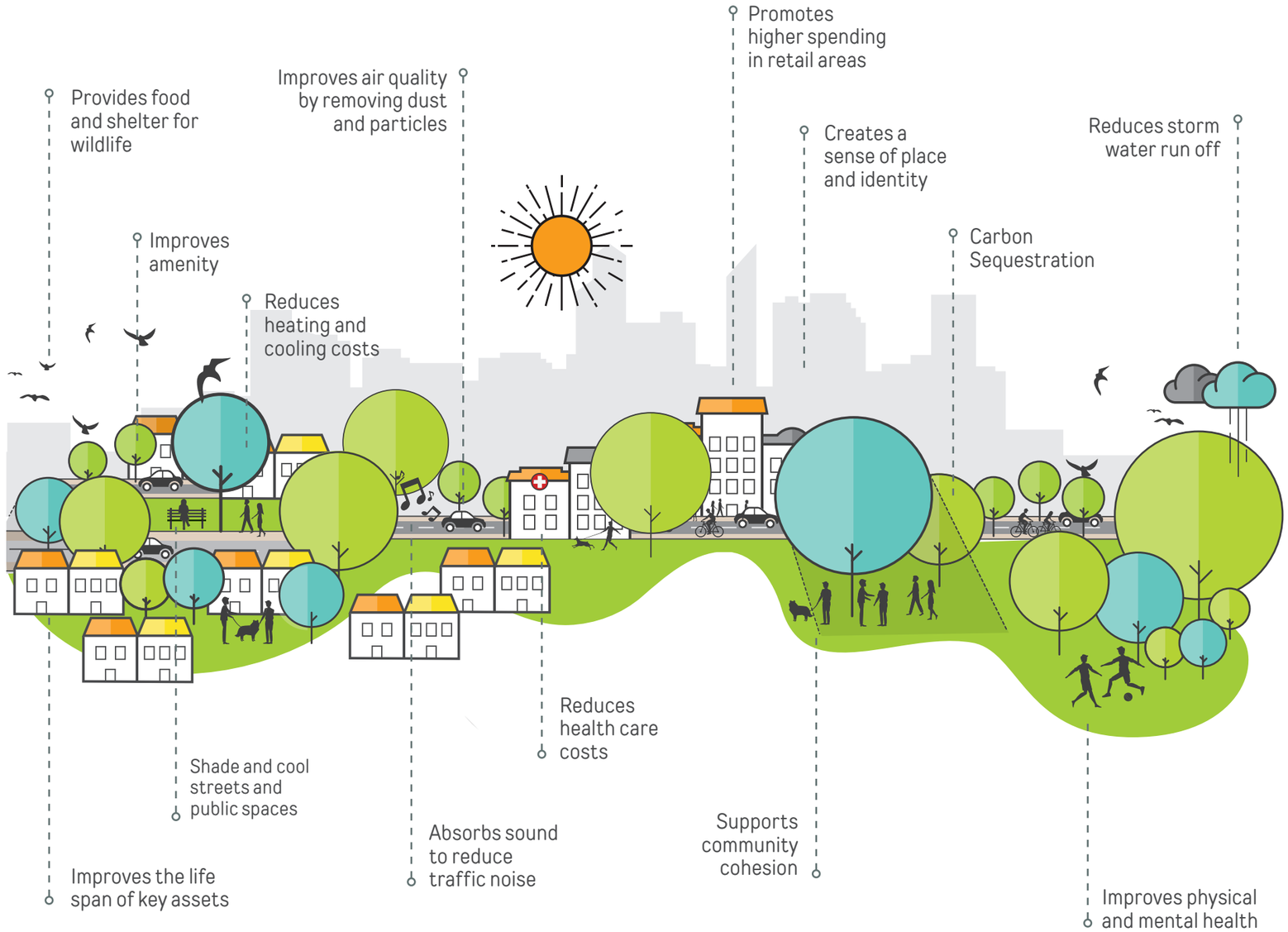


Figure 1. Benefits provided by the urban forest

1.2 What benefits can urban forests provide?

Urban forests can deliver a range of environmental, social and economic benefits to urban communities (See Figure 1).

Social benefits

Creates a sense of place and identity

Attractive street trees and well-designed green spaces enhance the quality of the urban environment, create a strong city image and foster a sense of connection to place.

Improves physical and mental health

Giving people the ability to access and interact with green space within cities has a range of positive health effects that improve individual and social well-being.

Supports community cohesion

Urban trees and greenery contribute to the creation of inviting public spaces that facilitate gathering and interaction, helping to promote community cohesion.

Reduces sun and heat related illnesses

Trees provide shade and protection from the potentially harmful effects of prolonged exposure to the sun and high temperatures. Research indicates that increasing the levels of vegetation in cities can reduce excess mortality rates.

Social Behaviour

Access to nature can have a positive effect on the social behaviour of communities, including a reduction in the level of some crimes.

Economic benefits

Improves amenity

Trees in streets enhance aesthetics and help increase property values.

Promotes higher spending in retail areas

City streets with large, well-tended trees help create attractive shopping environments where people are prepared to spend up to 9–12 percent more for goods and services.

Reduces heating and cooling costs

Trees planted to provide shade from the sun can cool buildings by up to 8 degrees Celsius, helping to reduce air conditioning costs.

Improves the life span of key assets

The shade provided by trees can increase the life span of road surfaces, reducing maintenance and replacement costs.

Reduces health care costs

People living in greener neighbourhoods are likely to exercise more. Increased levels of physical activity and improved mental health can all help to reduce community health care costs.

Environmental benefits and ecosystem services

Carbon sequestration

Trees capture and store carbon, removing it from the atmosphere and helping to mitigate the impact of global warming.

Shade and cool streets and public spaces

Trees provide shade and cool the surrounding air through the process of evapotranspiration helping to reduce urban temperatures and improve levels of pedestrian thermal comfort.

Improves air quality by removing dust and particles

Trees trap and absorb pollutants from the air, helping to improve air quality and levels of community health.

Absorbs sound to reduce traffic noise

Tree canopies help to muffle traffic noise from city streets and freeways.

Reduces stormwater runoff

Trees capture and filter stormwater through their canopies and root systems, helping to slow flow rates, reduce levels of stormwater run-off and improve water quality.

Provides food and shelter for wildlife:

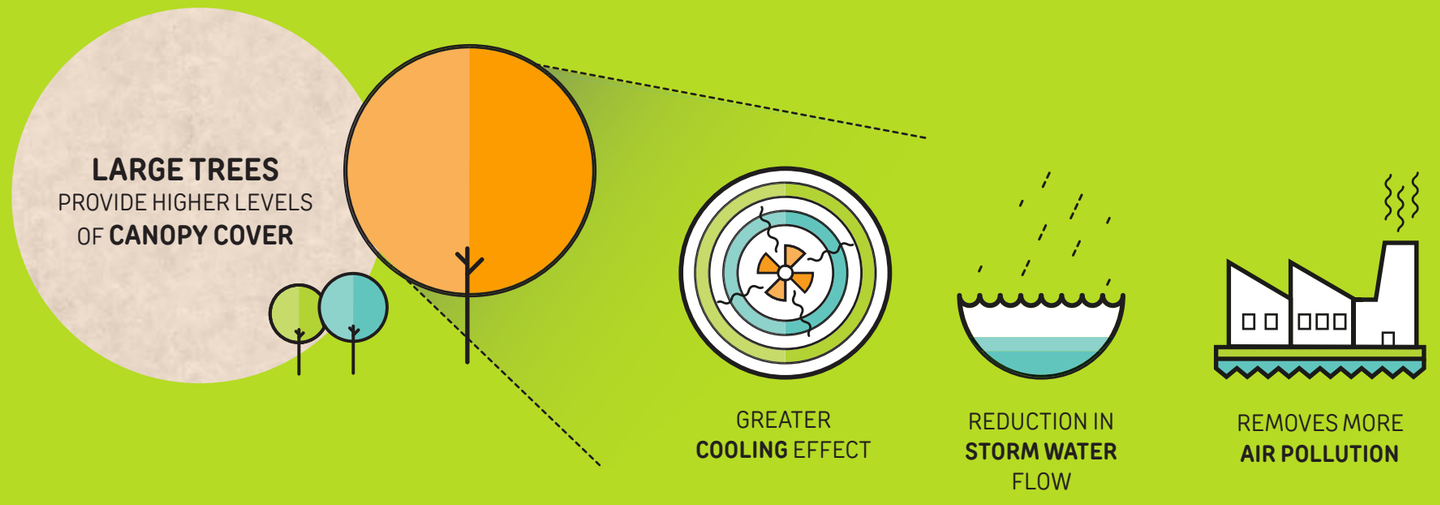
Tree canopies and other vegetation provide shelter for birds, bees and other wildlife and their fruit and flowers can be an important food source.

Larger trees, greater benefits

Large, healthy trees provide significantly greater benefits compared to smaller trees.

Larger trees tend to have greater leaf areas and provide higher levels of canopy cover, although this can be species dependant. Research shows that there is a direct co-relation between the amount of canopy cover and healthy leaf area provided by an urban forest and the level of community benefits delivered (Rogers, et al., 2015). Larger trees have been found to remove more air pollution, provide greater reduction in stormwater flows, have a greater cooling effect and provide greater economic benefits than smaller trees (Beecham & Lucke, 2015).

Tree size and the level and quality of canopy cover requires careful consideration in the management of the urban forest. When it comes to planning its future growth the emphasis should be on the size of the tree rather than the number of trees planted. Effort should be taken to maximise tree size in new tree planting plans taking cost and space constraints in to account.



1.3 Urban forests and the Urban Heat Island effect

One of the most significant benefits that urban forests offer is their ability to cool their immediate environment. This is particularly important in cities which are generally hotter than surrounding, less built up areas, sometimes by as much as 1-3 degrees Celsius or more (U.S Environmental Protection Agency (EPA), 2008). Urban surfaces can be highly effective at absorbing and storing heat during the day, creating higher daytime temperatures in cities. This heat is released at night leading to higher temperatures after dark. This phenomenon is known as the Urban Heat Island (UHI) effect.

As a result of the UHI effect city dwellers are exposed to higher temperatures for longer periods each day. Elevated night-time temperatures mean that people are not given the chance to recover from heat stress experienced during the day. During heat waves prolonged exposure to high temperatures can lead to increased levels of heat related illnesses and morbidity. Vulnerable groups such as children, the elderly and those whose health is already compromised can be particularly affected (Block, et al., 2012).

As temperatures rise with climate change, the UHI effect is likely to intensify. Unless this is addressed, it poses significant risks to the overall liveability of cities and levels of community health and well-being.

While many factors contribute to the UHI effect, the reduced level of vegetation in cities is a key issue. This is partly because vegetated land surfaces, with good moisture levels, remain cooler during the day compared to the hard impervious surfaces that characterise urban areas.

"Globally, extreme heat events (EHE) have led to particularly high rates of mortality and morbidity in cities as urban populations are pushed beyond their adaptive capacities... many cities expect catastrophic EHEs more often, as the frequency, intensity and duration of EHE's are projected to increase with climate change." (Norton, et al., 2015)

The cooling effect of urban forests

Urban trees have a key role to play in helping to mitigate the UHI effect. Trees provide shade, which prevents urban surfaces from heating up during the day. This also helps lower night-time temperatures as less heat is trapped for release after dark.

Up to 95 percent of incoming solar radiation can be blocked by a tree's canopy (Brown, et al., 2013). The quality of shading provided depends on a range of factors such as leaf size, angle and structure. Canopy architecture, canopy clumping and continuity along with the depth and density of canopy layers, is also important (Sanusi & Livesley, 2014).

While shade can be created through the introduction of man-made elements, such as shade cloth and awnings, these fail to provide the added cooling benefit created by urban trees through evaporative cooling (Cooperative Research Centre Water Sensitive Citie, 2014). In this process, trees use the heat from the surrounding air to convert water to gas, producing a cooling effect similar to two air conditioners running for 20 hours (Brown, et al., 2013).

"Trees reduce surface temperatures by reflecting and absorbing solar radiation, thereby providing shade. Trees also cool the surrounding area at the micro-scale through canopy transpiration. Increasing canopy coverage is one of the most cost effective strategies for cooling buildings and local neighbourhoods." (Norton, et al., 2013)

Shade and evaporative cooling provided by trees combine to help reduce city temperatures and the levels of heat stress experienced by urban populations. The City of Perth is already pursuing a range of strategies to help cool the City, including facilitating climate responsive built form and increasing green infrastructure as a whole. It is evident that the urban forest also has a key role to play and this is a key driver for the development of this Plan.

1.4 Urban forests and climate change

The exacerbation of the UHI effect in cities will create more challenging growing environments for urban trees and place them under increasing levels of heat stress. Along with reduced levels of rainfall, this may have a negative effect on the health and survival of urban trees.

The importance of irrigation

The ability of trees to contribute to urban cooling is also affected by rising temperatures and a lack of water. In periods of extreme heat, the evaporative cooling effect can be lost, just when it is needed most. Trees effectively shut down to prevent water loss and avoid water stress. High temperatures can also cause leaf scorch, and in some cases cause trees to drop their leaves altogether.

If trees are to continue to contribute to urban cooling by providing healthy canopies for shade and transpirational cooling, they will require supplementary watering through irrigation during hotter periods.

"Supplementary irrigation of UGI (Urban Green Infrastructure) in cities that experience hot, dry summers is a wise investment to ensure long term temperature mitigation, as well as other ecosystem services." (Norton, et al., 2015)

Species composition

As climate change progresses some tree species will respond and adapt successfully to changing environmental conditions, while others will struggle to survive and thrive. This may affect overall composition of the urban forest, with implications for future resilience.

Pests and Diseases

Pests and diseases pose a significant threat to urban forests. Climate change can exacerbate this by creating conditions in which the lifespan and distribution of existing pests and diseases can be extended and new ones introduced.

Climate change is likely to have a potentially negative effect on the overall health and resilience of the urban forest. Measures are needed to ensure that it is able to adapt and remain robust in the face of these challenges.

1.5 Why do we need an urban forest plan?

Growing and managing a thriving urban forest in the face of increasing challenges (See Figure 2) requires that a highly systematic and co-ordinated approach be taken. It is essential that:

- there is a clear and shared understanding across all disciplines of the importance of the urban forest and the measures required to ensure its health and vigour
- these measures are based on the latest scientific research and are relevant to the Perth context
- the effectiveness of these measures is monitored and assessed systematically

The City of Perth Urban Forest Plan sets out such an approach. It is intended for all those who have a stake, either directly or indirectly in the urban forest – its protection, management, expansion and promotion.

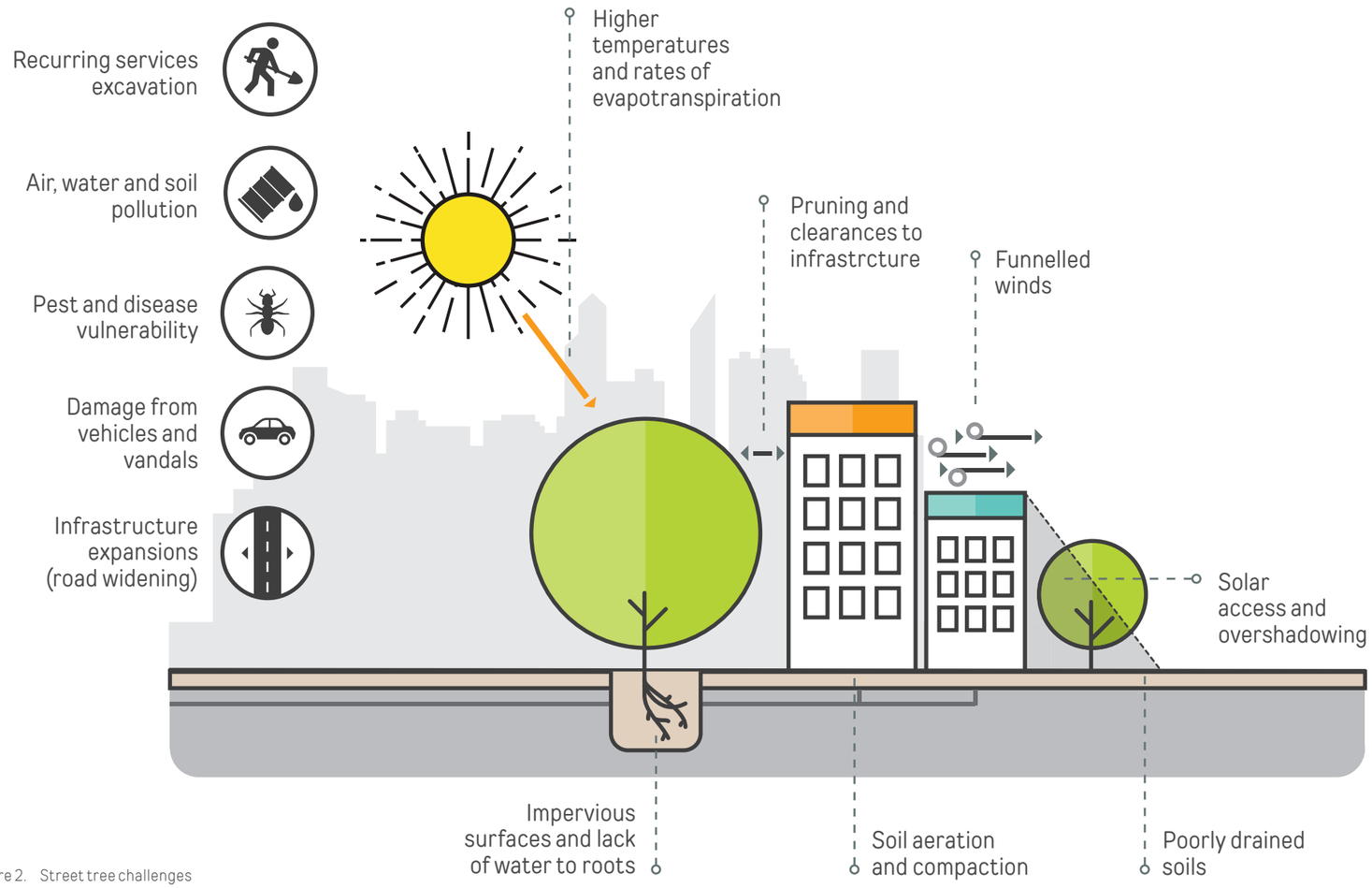


Figure 2. Street tree challenges

1.6 Strategic context

The City of Perth has set a clear direction for development in its Integrated Planning and Reporting Framework (IPRF). This Framework and the interaction between key City plans and the influence of informing strategies is outlined in Figure 3. The intent of the IPRF is to ensure the priorities and services provided by the City of Perth are aligned with community's needs and aspirations.

The City of Perth Urban Forest Plan is an Informing Strategy within the IPRF and works in conjunction with its suite of strategic and operational documents. It integrates the relevant challenges, aspirations and strategic directions outlined in these key documents:

- Vision 2029+: Strategic Community Plan
- Corporate Business Plan 2015-2019
- Environment Strategy
- Transport Strategy
- Urban Design Framework
- Public Spaces Public Life Study – Perth 2009

Figure 3. City of Perth Integrated Planning and Reporting Framework

Key strategic drivers

Three organisational strategic drivers underpin the development of the City of Perth Urban Forest Plan (See Figure 4).

Designing for liveability – expanding the urban forest will help create a greener, more beautiful, comfortable and inviting city.

Promoting community health and activity – the urban forest will create a diverse and accessible green network that facilitates a healthy and active urban lifestyle.

Managing climate change – a healthy, resilient and sustainable urban forest will help make our city climate responsive.

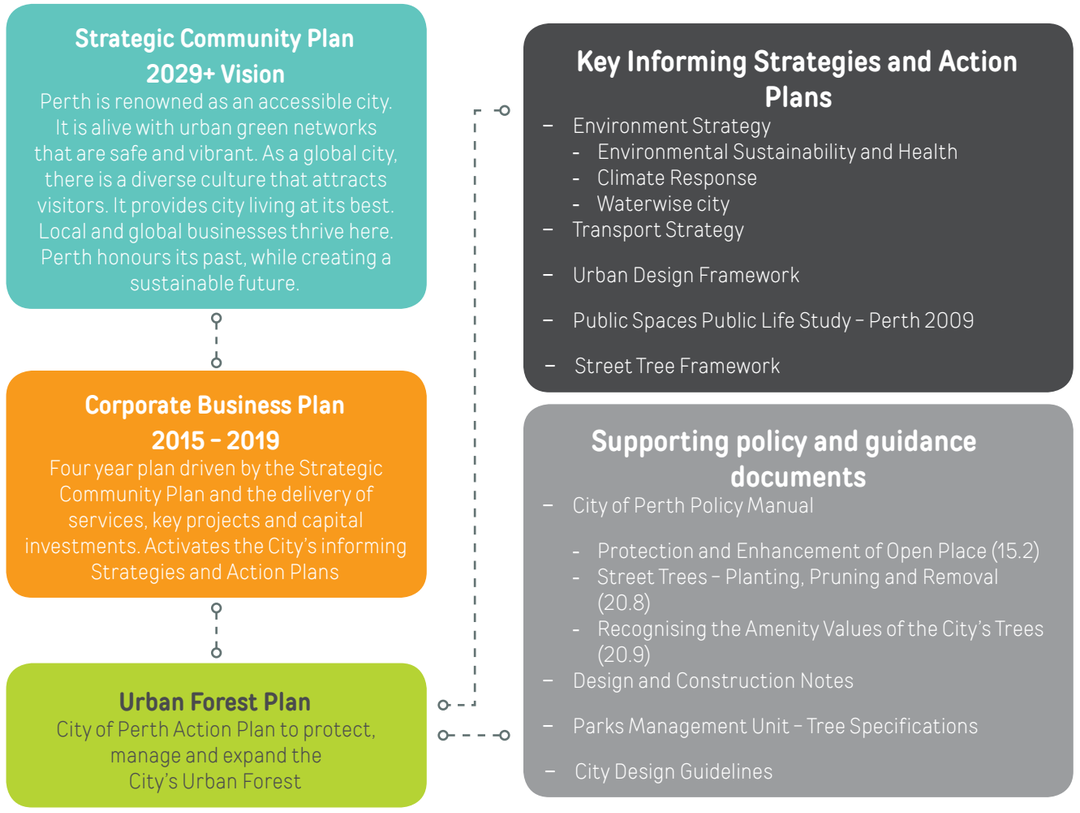


Figure 4. Organisational Strategic Context

Part B – Street and Parkland Trees

There are over 14,000 trees planted in the City's streets and parklands. In this context parklands include formal parks such as Wellington Square, Supreme Court Gardens and Russell Square in addition to more informal public open spaces including the Narrows Interchange. Trees in the City's surface car parks are also included. Collectively, these trees form the City's Urban Forest.

2.1 Planning for the City's Urban Forest

The process used to plan for the City's Urban Forest is based on a best practice approach structured around four key steps[1] (See Figure 5).

Step 1: What we have

Research undertaken to develop a detailed and comprehensive understanding of the existing character and condition of the City's Urban Forest (See information box on page 20). Findings used to identify issues and challenges.

Step 2: Where we want to go

Research findings combined with input from a process of community engagement to develop a vision, goals and objectives for the City's Urban Forest.

Step 3: How we will get there

Urban Forest Implementation Plan developed to identify actions to be undertaken to meet the objectives of the Plan. Indicative budgets, priority projects, timeframe and key roles and responsibilities clearly identified.

Step 4: Have we arrived

Monitoring framework developed to measure progress in implementing objectives.

Figure 5. Plan Process

[1] While there is no one, universally recognised 'best practice' approach to the preparation of an urban forest plan there are a number of key guidance documents that have informed the development of the City of Perth Urban Forest Plan. These include How to Grow an Urban Forest, 202020 Vision; the Urban Forest Management Plan Toolkit, California Urban Forest Council; Trees in the Townscape: A guide for decision makers, Trees Design Action Group; and Planning the Urban Forest, Schwab.

Evidence based planning

The City of Perth Urban Forest Plan is underpinned by the findings of a number of baseline research studies. These provide the technical data needed to assess the City's Urban Forest against a range of commonly accepted performance indicators for urban forest management, including:

- existing levels of canopy cover
- age diversity
- useful life expectancy
- tree diversity
- tree health (Kenney, et al., 2011)

Canopy Cover Baseline Study

High-resolution airborne multispectral imaging was acquired to measure the baseline canopy cover (i.e. vegetation greater than 3.0 metres in height) for all land, both publically and privately owned, within the City of Perth boundaries. This data was captured on 23 February 2015 and provides information on the percentage of overall canopy cover.

Street and Parkland Tree Audit

A comprehensive audit of all street and parkland trees was carried out over a four-month period in mid-2015. It gathered a range of information including:

- tree numbers and location
- species mix
- tree size
- tree age
- useful life expectancy
- health
- canopy quality and size
- structural condition
- historic/cultural significance

Canopy size data was used to calculate the level of canopy cover provided by the City's Urban Forest. All of the audit data has been captured in the City of Perth GIS database.

Thermal Imaging Baseline Study

Research was also commissioned on Perth's UHI effect. The Thermal Imaging Baseline Study acquired satellite, airborne and terrestrial thermal data to provide a visual representation of temperatures in the City during the day and after dark. The findings also provided an initial and broad assessment of the role of the existing urban forest in promoting urban cooling.

- Satellite data was collected mid-morning on the 10 January 2014, prior to the hottest night of 2014. The daytime temperature was 34.2 degrees Celsius, followed by 43.3 degrees Celsius the next day. The data collected provided information on daytime land-surface temperatures within the City, identifying a series of 'hot-spots'.
- Airborne thermal imaging was captured after 10.30pm on 3 March 2015, following a daytime maximum temperature of 30.6 degrees. The previous 16 days were all in excess of 26 degrees Celsius. The data collected provided information on residual night-time heat within the City.
- Terrestrial thermal imaging provided an indication of the average daytime temperatures in three City streets with different types and level of canopy cover. This data was collected between the hours of 13.30 and 14.00 during two afternoons in March 2015, when the ambient daytime temperature was 31 degrees Celsius. It provides an indication of how urban trees contribute to urban cooling.

Research findings from these three studies have been used to:

- Provide baseline data to help formulate goals and objectives for the City's Urban Forest.
- Establish benchmarks to measure and monitor change and progress in implementing the Plan

2.2 Historical development

Pre European settlement

Before European settlement, the land now covered by the City consisted of an ancient wetland, based on a series of lakes located between an area north of the existing railway line and the Swan River. Historically, these wetlands provided seasonal camping sites for the Aboriginal people and the lakes were essential for gathering food, including freshwater crayfish, turtles and frogs. The wetlands and the ancient campsites have significant cultural and spiritual value for the Wadjuk Noongar people, the traditional owners of this area. (Godfrey, 1988).

Pre European settlement, Perth's landscape was characterised by a mixture of open forest, fringing woodlands and closed scrub, mainly comprised of Eucalypts, Banksia and Melaleuca. The canopy cover provided would have been relatively open and sporadic in character, as indicated in Figure 6.

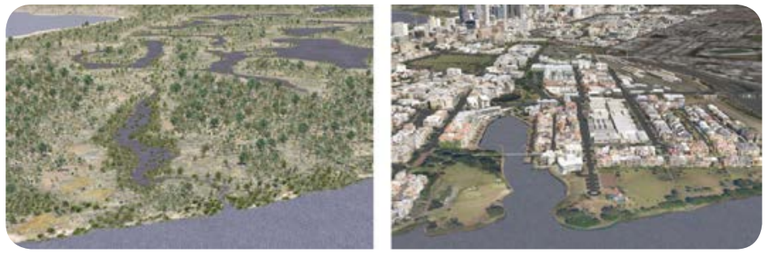


Figure 6. Re-imagining Perth's Lost Wetlands 2014. Collaboration project with ECU, Landgate, City of Perth and City of Vincent

Early European settlement

While the wetlands are the reason for Perth's long, narrow shape, this landscape has been significantly modified since the early 19th century due to of the arrival of European settlers and their aspirations to develop the area. This appetite to develop has come at a cost to the environment.

The original settlement of Perth was established on a ridge near Mt Eliza overlooking the Swan River. The wetlands provided early settlers with water and fertile soils. However, they also saw the wetland system as an impediment to development, which resulted in the majority of it being drained to provide alternative uses, including market gardening, municipal gardens and a town rubbish dump (Singleton, 1988).

In the late 19th century as urban development grew the need for designated parklands became a public debate. The "city beautiful" idea became popular with planners during this time and street trees along with small parks were promoted (Bold, 1911). During the early 20th century, the "garden city" movement pioneered by Ebenezer Howard influenced the Perth town clerk William Bold. Bold envisioned the development of a linked system of parklands, with the wetlands forming an integral part (Blackwell & Associates Pty Ltd, 1995).

The Post-War period

During mid to late 20th century, Perth experienced a mining boom resulting from the discovery of iron ore and natural gas throughout the state. This led to a surge in economic and property development in Western Australia. This had a significant effect on the state of Perth's urban forest as canopy coverage was reduced due to the influx of new buildings.

During this period, prominent Australian landscape architect John Oldham had a vision for Perth based on the idea of a unified landscape structured around Perth's wetland system. This vision was only partially realised and can be seen today in the Narrows Interchange parkland area (Blackwell & Associates Pty Ltd, 1995).

Recent times

In the last few decades, the City has continued to plant trees, with significant achievements made in increasing the level of street tree planting, particularly along east-west streets.

A major new tree planting programme was last carried out in the mid to late 2000's, with over 700 new trees planted in various locations throughout the City. The most recent Public Spaces Public Life Study by Gehl Architects (2009) acknowledges the valuable contribution this has made in improving the quality of public space and public life. The increased number of street trees has created a greener and more beautiful city, provided shade and made a city that is better to walk in.

In the last decade, new tree planting has been more sporadic in nature, mainly carried out as part of various streetscape upgrades and other capital works projects.

2.3 What we have – the City's Urban Forest today

Data collected by the Street and Parkland Tree Audit (2015) gives a total tree population of 14,811 for the City's Urban Forest. This includes:

- 6,833 street trees
- 7,725 parkland trees (including approximately 3,207 trees on Heirisson Island)
- 253 trees in City surface car parks

Collectively these trees have an estimated amenity value of $98 million. This figure does not include the value of the ecosystem services provided.

Over 40 different tree families exist within the City's Urban Forest, including over 260 different tree species. While the majority of these are common species, 47 are rarely planted in the Perth metropolitan area. These include:

- African Tulip Tree
- Durmast Oak
- Judas Tree
- White Fig

The City's parklands, including Harold Boas, Supreme Court, Stirling and Queens Gardens contain particularly diverse and varied collections of trees. Some of the oldest trees (100–150 years old) are also found in parkland areas, including:

- Camphor Laurel in Harold Boas Gardens
- Moreton Bay Figs in Russell Square
- Luscombe Oak and Sugar Gums in Supreme Court Garden
- Port Jackson Figs and Flooded Gums in Wellington Square
- Norfolk Island Pine in Stirling Gardens
- London Planes in Queen's Gardens and Victoria Avenue

The City of Perth Street Tree Framework

The selection of tree species for planting within the City's Urban Forest is currently guided by the City of Perth Street Tree Framework. This document sets out a list of existing and proposed tree species, including native and non-native trees. At present over 50 percent of the recommended tree species for planting are from the Myrtaceae family.

The Framework's approach to tree selection is based upon choosing a species that is most appropriate to its context and environmental factors. It is broadly reflective of 'the right tree for the right place' philosophy (Schwab, 2009).

Contemporary urban forestry increasingly promotes this philosophy as the primary guiding factor in tree selection processes. Trees are primarily chosen on their ability to grow and thrive given the specific environmental qualities and challenges of the planting site and its surroundings. This maximises its potential to grow into a large, mature tree with a healthy canopy.

Other factors considered in the tree selection process can include the species' ability to:

- promote recommended standards for tree diversity within the urban forest
- deliver required environmental, social or economic benefits
- support cultural and heritage values

The 'right tree for the right place' helps to promote a more balanced, sustainable and evidence based approach to the tree selection process. It is a valuable tool in urban forest management.

"We need much more specific knowledge to adequately select trees for urban areas to deliver a wide range of economic, social and environmental benefits. This will contribute to improving the welfare of urban residents in what is essentially a human habitat not a natural one." (Johnston, et al., 2012)

Issues and challenges

Research findings indicate that the City's Urban Forest is generally performing well against key performance indicators. However, it does face some important issues and associated challenges.

Existing levels of canopy cover

Canopy cover describes the percentage of urban land covered by tree canopy when viewed from above. It is commonly used as an indicator of the success of an urban forest and a measure of the level of community benefits delivered. The higher the level of canopy cover the greater the benefits provided. (Nowak, et al., 2010)

A number of cities have adopted the standard of between 30–40 percent canopy cover set by American Forests for cities in the United States. Other approaches suggest that canopy targets should be based on an assessment of the quality and quantity of available planting spaces and local environmental and climatic conditions, rather than the application of generic standards. (Kenney, et al., 2011)

Setting a canopy cover target is important as it provides a benchmark for measuring progress in increasing canopy cover.

At present, Perth has a relatively low level of overall canopy cover. Approximately ten percent of all of the land within the City's boundaries is covered by tree canopy (10.7 percent) and approximately 19 percent of street and parklands are covered (See Figure 7).

Challenge: Setting an achievable target and increasing the level of canopy cover provided.

Figure 7. Overall Canopy Cover

Overall canopy cover in City precincts

At the precinct level, Crawley is performing the best with a level of overall canopy cover of 21.2 percent across both its public and private realms. Perth and Northbridge have the lowest levels – 8.1 percent and 7.2 percent respectively. This is perhaps unsurprising given the built up and dense urban character of these areas. The outer precincts of East and West Perth have levels of 10.3 percent and 13 percent respectively, these higher levels perhaps reflecting their less dense and mixed commercial/ residential character.

City precincts recording the highest daytime surface temperatures also have some of the lowest levels of overall canopy cover, as shown in the table below.

Hottest Precinct	Temperature (degrees Celsius)	Overall Canopy Cover %
East Perth	33.5	10.3
Northbridge	33.4	7.2
West Perth	32.8	13.0
Perth	32.3	8.1
Heirisson	31.8	18.9
Crawley	31.3	21.2

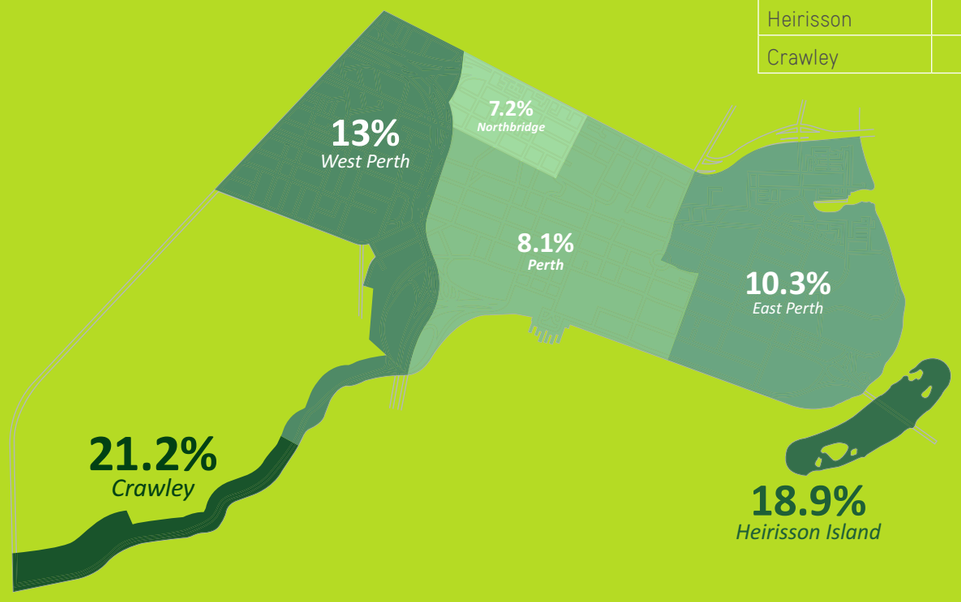


Figure 8. Levels of overall canopy cover by precincts

Ameliorating Perth's UHI Effect

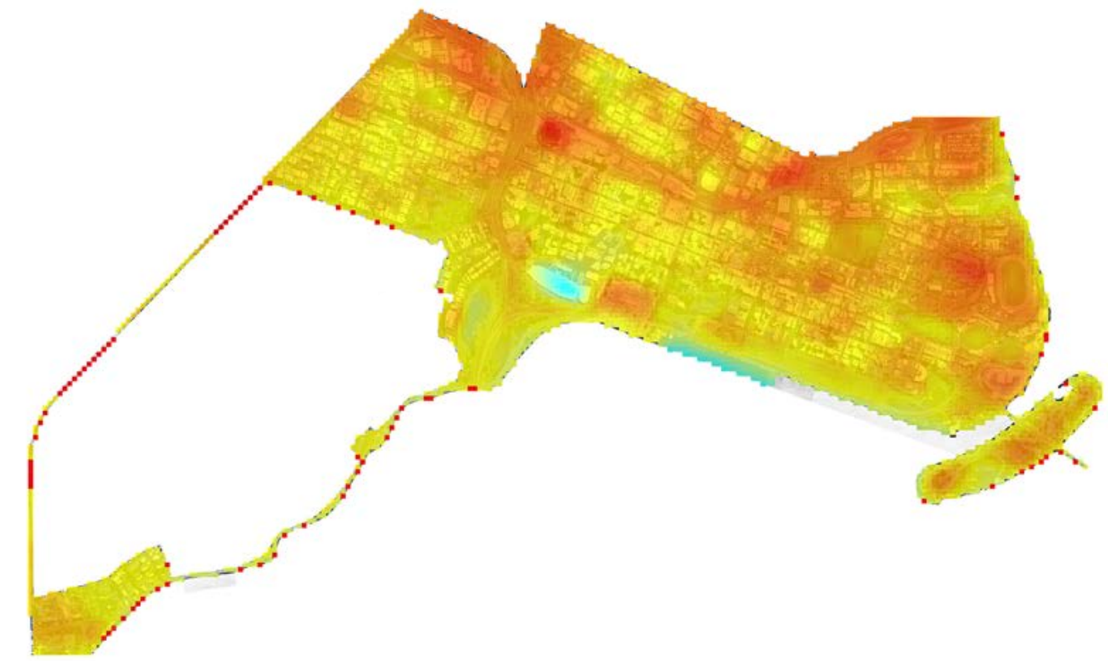
Increasing tree canopy cover and green space in a city is a cost effective strategy for cooling cities. Research indicates that a 10 percent increase in urban green cover could reduce the daytime surface temperatures in cities by around one degree Celsius. (Harris & Coutts, 2013)

Satellite imagery has identified a number of 'hot-spots' throughout the City. These 'hot spots' highlight areas with high land surface temperatures during the day (See Figure 9). These tend to be located where there is a high concentration of hard surfaces such as the freeway, railway lands, and large areas of unirrigated natural surfaces like the East Perth Cemetery. Some 'hot spots' are located in residential areas and around major gathering places. They also appear to correlate to those parts of the City with lower levels of canopy cover (See adjoining information box).

Airborne thermal imaging indicates the degree to which residual heat is trapped in streets and roads after dark (See Figure 10). These areas are hotter than the more natural surfaces of parklands and public open spaces.

Perth's UHI effect is contributing to higher City temperatures, with potentially negative impacts on City liveability and community health and well-being. With City temperatures predicted to rise there is potential for this situation to worsen over time. Planting more trees and increasing the level and quality of canopy cover in City 'hot-spots' and along streets and roads will help cool the City.

Challenge: Harnessing the potential of the City's Urban Forest to promote urban cooling, especially in 'hot-spot' areas.



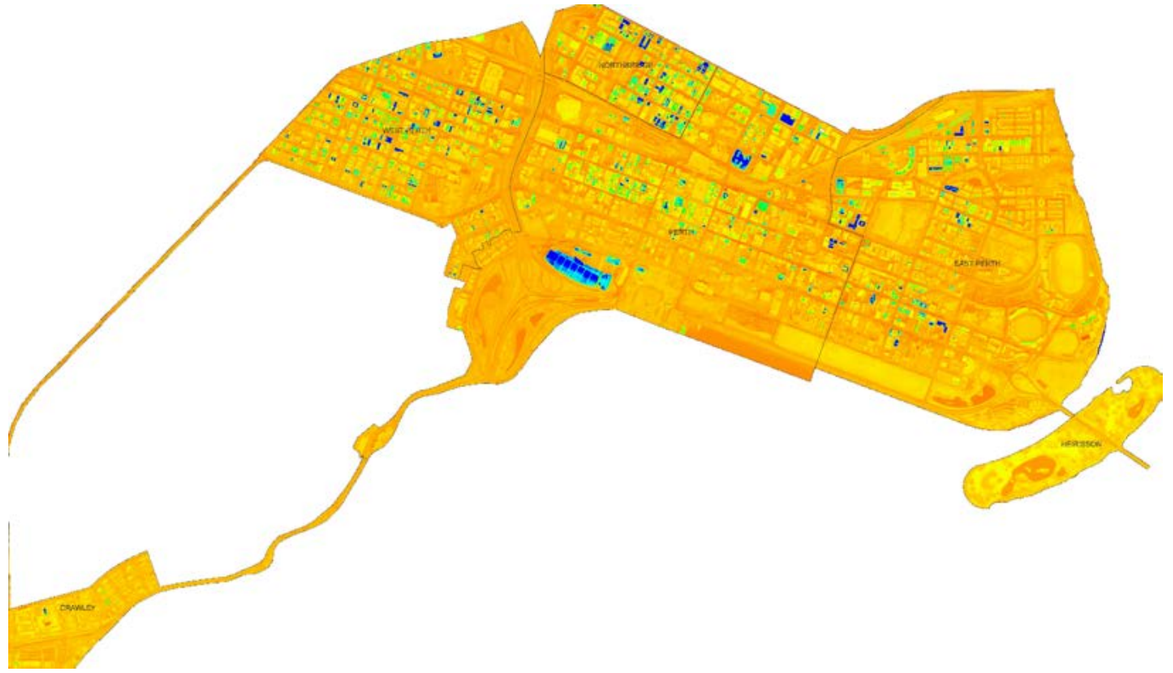
Legend

HIGH: 36C

LOW: 24C

Surface_tempature
(deg. C)

Figure 9. Satellite Imagery - 'hot-spots'



Legend

HIGH: 24C

LOW: 0C

Surface_tempature
(deg. C)

Figure 10. Airborne Thermal Imaging - residual heat

Cooling the City – the potential of street trees

Terrestrial thermal imagery of three of Perth's streets gives an indication of the role that trees can play in helping to cool the City. The images were captured during the early afternoon when the ambient daytime temperature was slightly over 30 degrees Celsius.

The three streets selected were:

Hay Street – between Barrack and Pier Street.

At the time of image capture, this section had no tree canopy cover.

Francis Street – between Lake and William Street.

This street section is characterised by sporadic tree planting of Spotted Gums, offering a moderate level of canopy cover.

Victoria Avenue – between Terrace Road and St Georges Terrace.

This street is characterised by regular planting of mature London Planes with a high and wide canopy that effectively encloses the street and shades nearly its entire land surface.

Hay Street recorded an average temperature of 35 degrees Celsius, 4 degrees hotter than the ambient daytime temperature and over 10 degrees hotter than Victoria Avenue. The average temperature of Francis Street was 28 degrees Celsius. While this was 3 degrees cooler than the ambient daytime temperature, it was 3.9 degrees hotter than Victoria Avenue. Victoria Avenue was the coolest of the three streets with an average temperature of 24 degrees Celsius, 6 degrees cooler than the ambient daytime temperature.

Water supply and management

In order to ensure the development of a robust, healthy urban forest capable of contributing effectively to urban cooling, it is imperative that steps are taken to ensure an adequate supply of water for supplementary irrigation. This is especially important during periods of extreme heat and during the establishment period for juvenile trees.

At present trees in the City's Urban Forest are irrigated for the first two years after planting. Trees up to four years old are also irrigated during periods of extreme heat. Water for irrigation is currently sourced from a mix of scheme water, ground water and water captured in surface water bodies including the Claisebrook Inlet and Lake Vasto in Ozone Reserve.

Perth faces a particular set of challenges when it comes to ensuring water supply for the City's Urban Forest. In addition to the drying trend associated with on-going climate change, summer rain is irregular and infrequent. Consequently, water is often least available when it is needed most to support tree health and maximise the cooling effect. In addition, the City is also committed to reducing its level of water use. Water restrictions can apply during periods of prolonged heat.

Water supply and management will increase in significance as more trees are planted to help with urban cooling. More trees will require more water. This issue will be partly addressed through the development of the Water Sensitive City Study proposed in the City's Environment Strategy. This Study will be undertaken to develop an integrated water management approach. This approach is underpinned by the premise that all water resources are supply sources and that water infrastructure and the urban landscape should have an integrated design for function and aesthetics.

"Water restrictions reduce the ecosystem service function of green space and vegetation, diminishing the cooling benefits locally and city wide, reducing human thermal comfort levels and increasing urban energy demands for building space cooling. The need to maintain water supply to urban trees and green spaces is evident...it is not a "waste" – it has quantifiable benefit that must be included in any policy about water use in urban areas." (Block, et al., 2012)

Challenge: Securing a sustainable water supply for the irrigation needed to support tree health and maximise urban cooling.

Age diversity within the City's Urban Forest

In urban forestry it is good management practice to have an even spread of trees across a range of different age classes. This promotes resilience and long-term sustainability, helping to ensure consistency in the level of canopy cover provided and the delivery of community benefits.

While the City's Urban Forest is generally performing well in terms of age class distribution the majority of trees are in the mature age class, reflecting a lack of significant levels of new tree planting programmes in recent times (See Figure 11).

Measures are also needed to protect 'veteran' trees (over 100 years old) and improve the aftercare and maintenance of juvenile trees to increase their levels of representation within the overall tree population.

Challenge: Developing and implementing measures to improve the balance of age classes over time.

"At a very basic level a tree population ideally needs enough large and mature trees, to deliver the widest possible range of environmental benefits in urban areas (and) enough trees in a number of younger age classes to replace these mature trees as they eventually die." (Rogers, et al., 2015)

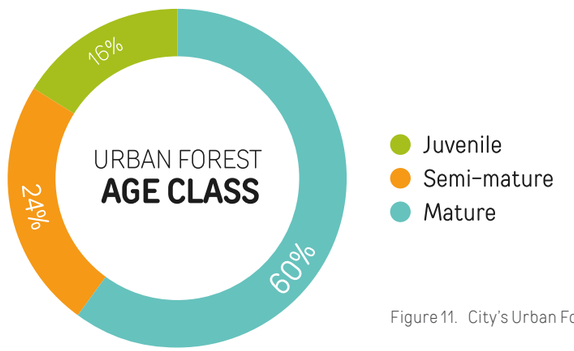


Figure 11. City's Urban Forest: Age Class

Replacement of aging trees

Useful Life Expectancy (ULE) is a measure of the potential time span remaining for a given tree in its existing location. A range of factors is taken into account including a particular tree's typical life span, environment, climate change impacts, land uses, pest and disease and soil quality and volumes.

ULE is an important management tool for urban forestry (City of Melbourne, 2012). It facilitates long term planning for the staged replacement of trees that are reaching the end of their ULE at the same time. This will prevent significant 'gaps' emerging in canopy cover, with a corresponding reduction in the level of benefits delivered.

While it is important to consider the ULE of an urban forest as a whole, it should also be assessed at precinct level to ensure that there will be no significant negative impact on local landscapes or the overall amenity of particular parts of a city.

Assessment of ULE at the species level is also useful as it can help to identify species that are performing poorly within an urban forest. Plans can be made to either improve the level of maintenance to increase the tree's health, or to replace affected the species with one that is more suited to the urban environment.

The City's Urban Forest is performing well in terms of the ULE of its total tree population. Nearly 70 percent of trees have a long term (ULE) and are expected to remain in place in the landscape for more than 40 years (See Figure 12 and 13).

Around 2 percent of trees (approx. 350 trees) will require replacement in the next 5 years and a further 10 percent (approx. 1,400 trees) in the next 5 -15 years.

At the precinct level, East Perth has the largest number of trees reaching their ULE in the next 15 years with 13 percent (approx. 550 trees) requiring replacement within this period. West Perth has the highest percentage of trees requiring replacement within 15 years at 18 percent (approx. 400 trees).

Of the top ten tree species, only the Queensland Box has a significant issue in terms of ULE, with nearly half these trees requiring replacement within the next 15 years. This species currently makes up 1.7 percent (approx. 600 trees) of the City's Urban Forest. The continued use of tree species with a high percentage of limited to short term ULE requires careful consideration.

Challenge: Replacing trees with a limited to short term ULE to avoid significant gaps in canopy cover.

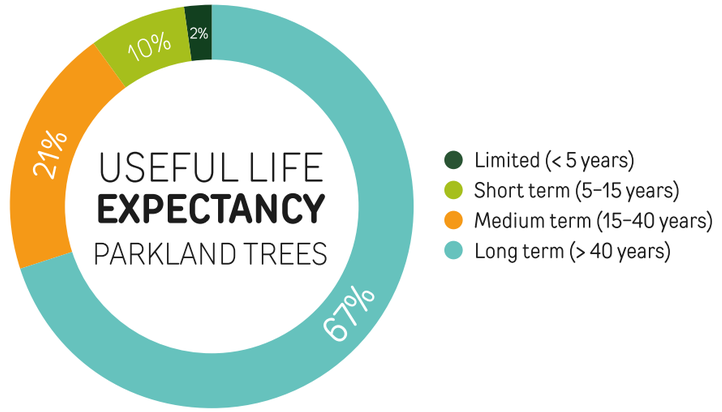


Figure 12. City's Urban Forest: Useful Life Expectancy

Figure 13. Location of trees with short to limited ULE

Imbalance in tree diversity

One of the most important considerations in urban forestry is the level of diversity of tree species present within an urban forest's overall tree population.

A high level of species diversity is highly desirable as it reduces the chance of a catastrophic loss of trees should one particular tree family or species be affected by an outbreak of a specific pest or disease, or be particularly susceptible to climate change or other environmental impacts. This is an important factor in promoting the long-term resilience of the urban forest.

In order to reduce this risk recommended standards for tree diversity promote the following:

- No more than 30 percent of an urban forest should be comprised of trees from the same tree family
- No more than 20 percent of an urban forest should be comprised of trees from the same tree genus
- No more than 10 percent of an urban forest should be comprised of trees from the same tree species.

The City's Urban Forest is currently over reliant on trees from one particular family (Myrtaceae). It is generally performing well in terms of species diversity with potential to increase the representation of tree species other than the London Plane.

Trees from the Myrtaceae family make up more than 40 percent of the total tree population, making it the largest family. This exceeds the recommended standard for tree diversity at the family level, by ten percent (See Figure 14).

The prevalence of Myrtaceae is partly due to it being native to Australia. It also includes more than 70 different species present in the City's Urban Forest, including the West Australian Peppermint, Queensland Box, Tuart, Swamp Paperbark, Spotted Gum, Marri, Jarrah, Flooded Gum and bottlebrushes.

The next most common family is the Casuarinaceae, which at 13.4 percent is well below recommended standards. This family is largely comprised of different species of sheoaks.

The London Plane makes up 11.3 percent of the City's Urban Forest, which is slightly over the recommended standard for tree diversity at the species level (1.3 percent). This is followed by the River Sheoak (8.8 percent) and the Flooded Gum (5.8 percent), both of which are below recommended standards (See Figure 15).

Challenge: Meeting or exceeding the recommended standards in terms of tree diversity within the overall tree population.

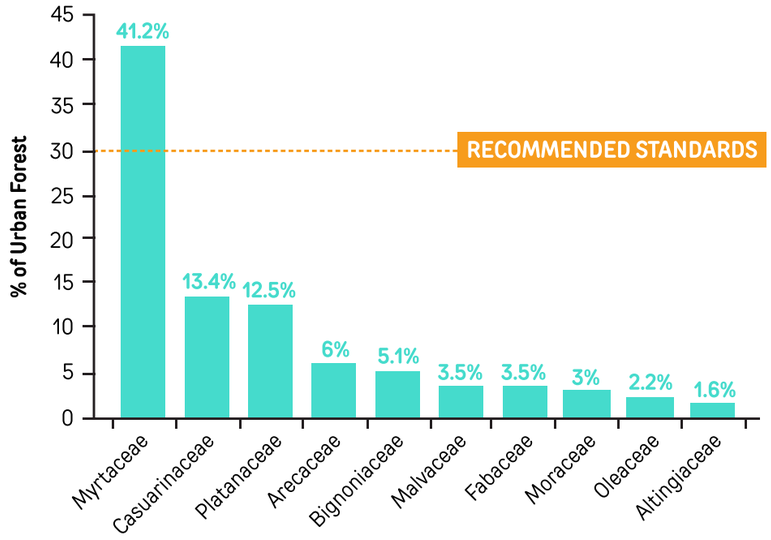


Figure 14. City's Urban Forest: Family Diversity

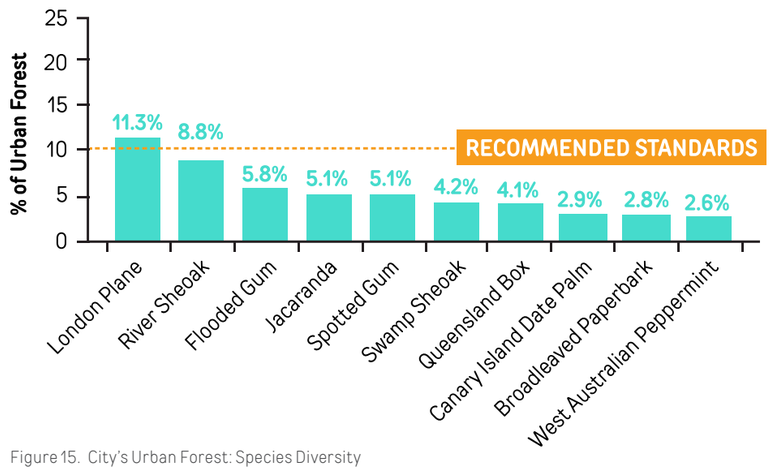


Figure 15. City's Urban Forest: Species Diversity

Native and non-native trees in the City's Urban Forest

Tree species vary in their ability to deliver benefits. Both native and non-native trees are capable of providing a range of economic, social and environmental benefits and the issue of whether to plant native or non-native species is a significant debate in urban forestry.

Native trees

A preference for planting native trees has been broadly evident in recent times, with over 60 percent of the trees in the City's Urban Forest being native species. These trees are often planted for reasons of nature conservation and the provision of habitat for native fauna. Native trees are often also selected for patriotic and wider landscape management reasons (Johnston, et al., 2012).

An automatic preference for planting native trees can influence the overall resilience of the urban forest and result in unmitigated risks. Increasing heterogeneity and complexity of species composition can allow for adaptive management in the face of climate change. Similarly, a wide diversity of native and non-native trees can mitigate disease spread and lessen the distribution of environmental pests.

Although they are currently over-represented, native trees within the Myrtaceae family will remain a significant component in the City's Urban Forest with a valuable role to play. They will continue to be considered for planting as part of new tree planting programmes, guided by the right tree for the right place philosophy and other provisions of the City of Perth Street Tree Framework.

Native trees will continue to be planted where they are considered to be most effective, for instance, along streets that are identified as wildlife corridors/eco zones and in parkland settings. Gateway plantings will also use native species where possible as a way of promoting local flora. Native tree planting will also be guided by the findings of the Biodiversity Study proposed in the City's Environment Strategy.

Non-native trees

A number of non-native species occurring within the greater Perth metropolitan region can provide ecological functions to native fauna. One example is the relationship of Carnaby's Black Cockatoo and non-native pines (Pinus radiata and P. pinaster) and Eucalypts (E. globulous).

In some instances, non-native trees can provide greater benefits than native species in the urban environment.

Research suggests that large-canopied, broadleaf trees, with thick or denser foliage can be more effective in urban cooling. A recent study comparing the different cooling effects of three common street tree species in Australia (London Plane, European Elm and River Gum) indicates that the higher the canopy quality, the cooler the midday microclimatic conditions under that canopy in summer. Conditions were significantly hotter under the River Gum, due to its thin, open canopy architecture and more pendulous leaf structure, in comparison to the denser, rounder canopy architecture of the European Elm and London Plane trees. (Sanusi & Livesley, 2014)

Non-native trees may also be better adapted to thrive in the increasingly challenging and harsh growing environments particularly associated with streets, whereas native tree are often better suited to more natural areas.

Including non-native trees within the urban forest also contributes to greater species diversity and improves its long-term resilience.

For these reasons, non-native trees will often be chosen for planting over native trees in particular parts of the City, especially in more built up areas, public spaces with high levels of pedestrian activity and residential areas.

The London Plane for example, is a popular and widely used urban tree species. It is frequently selected for planting within streets and public spaces in both Australian and other cities throughout the world. This is due to its ability to thrive in harsh urban conditions and provide a high level of ecosystem services.

"Important ecological considerations for species selection are often narrowed down to a debate on whether or not native trees should be systematically preferred. Such framing diverts attention away from a balanced approach considering both ecological value and resilience." (Trees & Design Action Group , 2012)

Maximising tree health

A high level of tree health within an urban forest is an important factor for a range of reasons. Healthier trees promote higher levels of amenity. They are also more likely to reach their expected life span and attain maximum levels of growth. Larger trees, with dense healthy canopies provide significantly more l benefits than smaller trees. Good levels of tree health also promote an appropriate age class mix and help reduce maintenance costs.

The City's Urban Forest is performing very well in terms of overall health with 92 percent of its trees in good or excellent health. This is partly attributed to the fact that the most commonly used street trees, the London Plane, Jacaranda and the Spotted Gum are well adapted to the urban environment, and have proven to be very good urban tree species in the Perth context.

However, the findings of the Street and Parkland Tree Audit uncovered some specific health issues that must be addressed if the current high level of health is to be maintained and maximised in future.

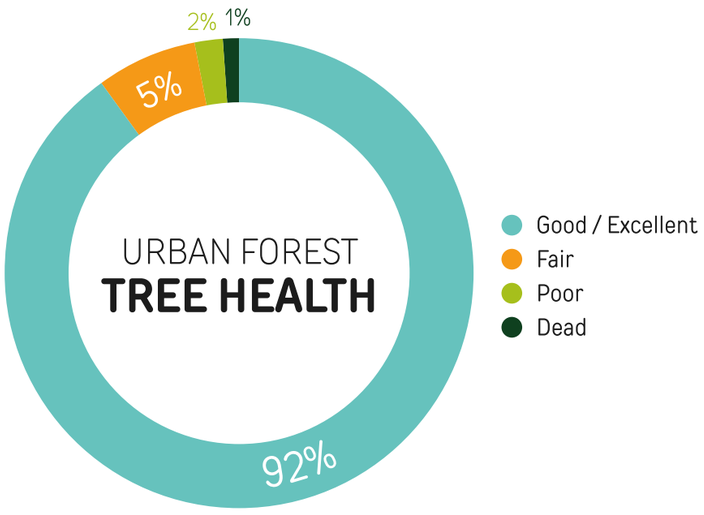


Figure 16. City's Urban Forest: Health

Pest and disease

A number of pests and diseases are present including:

- Olive Lace Bug in Olive trees
- Leaf-blister Sawfly in some Eucalypts
- Borer in the West Australian Peppermint
- Fusarium Wilt in the Canary Island Date Palm
- Powdery Mildew in the London Plane
- Canker in some Marri and Red Flowering Gums

Sunscald is affecting some trees, particularly those from the Acer, Brachychiton, Erythrina, Ficus, Fraxinus, Sapium and Zelkova genus. The use of these trees as street trees is not considered appropriate in Perth's climate and urban environment, consequently they often struggle to thrive and have poor levels of health.

While these pests and diseases do not appear to be having a significantly detrimental effect on tree health at present, they have the potential to significantly affect the City's Urban Forest if they escalate.

Environmental Issues

Reduced rainfall is suspected of having an impact on the health of a few species including a large number of mature Queensland Box and some fig trees including the Moreton Bay Fig and Small Leaved Fig. While other species seem to be adapting to the effects of climate change, this may change over time.

Car park trees

Only 79 percent of trees planted in the City's surface car parks are in good or excellent health, primarily because of the particularly harsh environments in which they grow. Over 20 percent of these trees will reach the end of their ULE in 15 years.

Deteriorating structural condition

Some tree species are exhibiting a deteriorating structural condition including the Western Australian Peppermint and Flame Trees in West Perth and the mature London Plane trees on Victoria Avenue and Mounts Bay Road. With future management options being limited, these will require replacement over the next 20 years.

Tree risk

Tree risk is largely addressed through appropriate pruning practices, however, there are a small number of tree species that have a higher potential for branch failure. These species are primarily native trees and include the Northern River, Sugar, Rose and Lemon Scented Gums, the Tuart and Bangalay. Together, these trees form less than 3 percent of the City's Urban Forest.

Management and maintenance

In some cases, the City's current management policies and practices relating to the procurement, planting and after care of juvenile and transplanted trees are contributing to lower levels of health and tree establishment. Mowing practices and the ineffective use of tree grates is causing damage to tree stems and bark, which is also affecting tree health.

Challenge: Developing and implementing appropriate management practices, policies and procedures to maintain and maximise levels of tree health.

Urban forest management

Contemporary urban forestry advocates a long-term, pro-active and strategic approach to the management of the urban forest. This approach focuses on the urban forest as a whole, and considers its overall health, resilience and on-going sustainability as a single entity over the longer term. (van Wassenaer, et al., 2012)

At present, there is no overall plan or strategy for the City's Urban Forest. Urban trees are managed and maintained on a short term, day-to-day basis that primarily addresses the needs of individual trees. This makes it difficult to assess how it is performing as a whole and how capable it is of delivering community benefits over the longer term.

Challenge: Developing and implementing a strategic and pro-active approach to managing the City's Urban Forest as a whole.

Community awareness of the urban forest

Community support plays a vital role in successful urban forestry (Schwab, 2009). However, there is often a lack of community awareness of the benefits provided by the urban forest. As a result, community concerns about urban trees can often outweigh appreciation of their importance in ensuring on-going liveability and climate resilience.

People interact with urban trees on a range of different levels, and opinions on the role and value of urban trees can vary widely. Some are concerned about leaf and fruit litter, allergies and the potential of trees to block views and cause damage from invasive roots and limb drop. This, coupled with a lack of awareness of the range of benefits trees provide, can mean that the larger community often undervalues them.

The City of Perth Urban Forest Plan will result in changes to where, when and how trees are planted within the City. This will affect the design of streets, squares and parklands and impact on how the community interacts with urban trees in the future.

The development of the Plan should therefore foster community support for the City's Urban Forest by raising awareness on the range of benefits it provides. It should also understand and respond to community values regarding urban trees, within the context of promoting the health and resilience of the City's Urban Forest.

Challenge: Developing community support for the protection, management and expansion of the City's Urban Forest.

2.4 Where we want to go – vision, goals and objectives

Draft Vision

The City's Urban Forest will be recognised and valued as an important asset and a key element of infrastructure, one that continues to deliver a range of benefits for our community's physical and mental well-being and the overall liveability, landscape character and climate resilience of our City.

The City's Urban Forest will be planned and managed in an integrated manner that above all optimises canopy cover and protects and promotes its sustainable growth, health and resilience in the face of continued urbanisation and climate change challenges.

Goals

The vision for the City's Urban Forest sets out the future direction and desired outcomes to 2036. The vision will be realised through the following goals.

Goal 1:

Protect existing trees

Goal 2:

Replace aging trees

Goal 3:

Promote sustainable water management

Goal 4:

Increase canopy cover within the City's Urban Forest

Goal 5:

Prioritise tree planting to help cool public spaces and City 'hot-spots'

Goal 6:

Promote balance and resilience in species composition

Goal 7:

Maintain tree health

Goal 8:

Implement a 'whole-of-forest' management approach

Goal 9:

Promote community engagement

Goal 1: Protect existing trees

Urban trees can take many years to establish and develop mature canopies. One of the most effective strategies to address the challenge of low canopy cover within the City's Urban Forest is to protect existing trees. The following objectives will help protect existing trees and maximise the level of canopy cover provided.

Priority objectives

1.1 Review all City practices and procedures, planning policies and design and construction notes to align with the objectives of the City of Perth Urban Forest Plan.

1.2 Develop and implement new policy to protect existing street and parkland trees from damage caused by construction and other works in the City.

1.3 Review and update City of Perth Policy 20.9 "Recognising the Amenity Value of the City's Trees" to include the ecosystem services provided by urban trees.

Other objectives

1.4 Include information on new tree valuations on the City of Perth website to help raise community awareness and appreciation of the level of benefits delivered by the City's Urban Forest.

1.5 Develop and implement a strategy to retain and value 'veteran' trees.

Goal 2: Replace aging trees

The City will plan for the gradual and timely replacement of trees that are reaching the end of their Useful Life Expectancy in the next 15 years. Trees may be replaced by a more suitable species guided by the Street Tree Framework.

Priority objectives

2.1 Implement the following replacement planting plan:

Timeframe	Number of trees to be replaced
2016	73 existing dead trees
2017-2020	71 trees replaced annually (limited ULE)
2021-2035	95 trees replaced per annually (short ULE)

Other objectives

2.2 Prioritise replacement planting in City precincts where significant gaps in canopy cover may emerge due to a significant proportion of trees reaching their ULE concurrently.

Goal 3: Promote sustainable water management

In order to maximise the cooling benefits of urban trees and ensure the on-going health and resilience of the City's Urban Forest, the City will plan proactively for an adequate and sustainable water supply for tree irrigation.

The City will also promote the use of water sensitive urban design to help retain water in the landscape. Soils with higher water content contribute to better tree health and lower daytime surface temperatures.

Priority objectives

3.1 Implement a pilot project to trial new methods and technologies for the effective capture and long-term storage of water for tree irrigation.

3.2 Prioritise the use of water sensitive urban design strategies and stormwater harvesting in all new tree plantings.

Other objectives

3.3 Complete a Water Sensitive Transition Study, as proposed in the City's Environment Strategy.

3.4 Ensure all new tree pits incorporate water retention features, where possible.

3.5 Promote the installation of permeable paving, where appropriate.

3.6 Monitor soil moisture levels.

Goal 4: Increase canopy cover within the City's Urban Forest

The level of canopy cover provided by the City's Urban Forest will be increased by 34 percent. This will be achieved through the implementation of a new programme of infill tree planting in selected City streets. (See Figure 17).

It is anticipated that up to 450 new trees will be planted within the City every year for the next four years. Species selection and the location will be guided by the Street Tree Framework and the development of community based urban forest precinct plans.

These new trees are expected to contribute approximately 20 ha of additional canopy cover to the City's Urban Forest by the time they reach maturity in 2056. The area of canopy that will be added is roughly equivalent to three times the size of Wellington Square.

The 34 percent increase is an initial target only and is likely be a conservative estimate. It does not take account of new trees that will also be planted as part of streetscape upgrades and other public realm projects within the City over the next four years.

Additional new tree-planting plans will also be developed in subsequent four year Implementation Plans.

Priority objectives

4.1 Develop and implement new street tree-planting plans (See Fig).

4.2 Prepare community based urban forest precinct plans.

4.3 Update tree procurement processes to ensure the timely availability of new trees.

Other objectives

4.4 Ensure opportunities for increased tree planting are factored into City capital works projects from the earliest stages of project planning.

Goal 5: Prioritise tree planting to help cool public spaces and City 'hot-spots'

The City will maximise the potential of street and parkland trees to help reduce City temperatures and ameliorate existing 'hot-spots', as part of its goal of increasing the level of canopy cover in the City's Urban Forest.

Priority objectives

5.1 Prioritise new tree planting in 'hot spot' areas and public spaces with high levels of pedestrian activity.

5.2 Select and plant tree species that have the ability to maximise the urban cooling effect in these areas.

5.3 Ensure an adequate level of irrigation is available to maintain the health and maximise the cooling potential of trees in these areas.

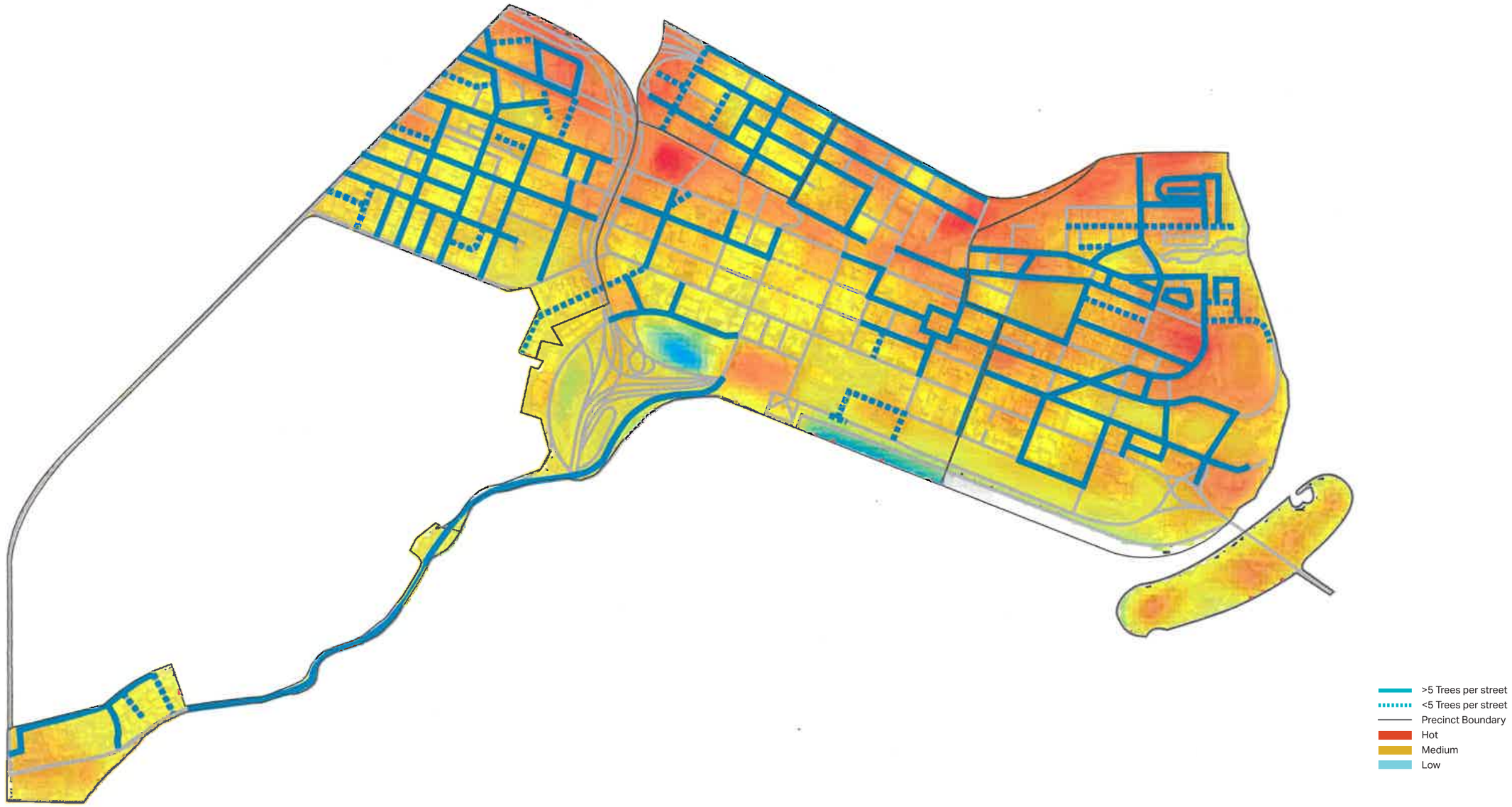


Figure 17. Proposed infill tree planting

Goal 6: Promote balance and resilience in species composition

Management of the City's Urban Forest will seek to establish a tree population that meets or exceeds recommended standards in terms of tree diversity. In the future, no more than 10 percent of the City's Urban Forest will be from the same tree species, 20 percent from the same tree genus and 30 percent from the same tree family.

Priority objectives

6.1 Review the City of Perth Street Tree Framework reinforcing the 'right tree for the right place' philosophy.

6.2 Identify and trial new tree species for future planting in the City's Urban Forest.

Other objectives

6.3 Biodiversity Study, as proposed in the City's Environment Strategy.

6.4 Update the Street Tree Framework every four years to take account of the outcomes of tree trials and findings from contemporary research.

Goal 7: Maintain tree health

Appropriate management tools will be developed and implemented to deal with the potential effects of climate change and the specific health challenges currently identified for the City's Urban Forest.

Priority objectives

7.1 Introduce measures for the early detection and treatment of either an escalation in existing pests and diseases, or the emergence of new ones.

7.2 Monitor, report and act on any other health impacts of climate change.

7.3 Select and plant tree species that are well adapted to existing and emerging environmental challenges, as part of the review of the Street Tree Framework.

7.4 Develop and implement practices and procedures for the strategic management of tree risk.

7.5 Bring existing tree management and maintenance practices and procedures in line with best practice, particularly with regard to the issues of:

- the procurement of good quality stock
- tree planting standards
- the aftercare and maintenance of juvenile and transplanted trees.

Other objectives

7.6 Prioritise the use of purpose built below ground structural cells where project goals and budgets allow, to help improve the growing environment for new trees.

7.7 Develop and implement a strategy to improve the health of trees in the City's surface car parks.

7.8 Introduce measures to ensure that staff and contractors are appropriately resourced, trained and supervised in the implementation of updated management and maintenance practices and procedures.

7.9 Develop management options and replacement strategies for significant tree stands with deteriorating structural condition.

Goal 8: Implement a 'whole-of-forest' management approach

The City of Perth Urban Forest Plan represents a first and significant step in promoting a more proactive, strategic 'whole-of-forest' management approach. It sets out a high-level, 20-year vision and associated goals for its protection, management and expansion.

The 'whole-of-forest' management approach is supported by the development of a four-year Implementation Plan and Monitoring Framework for the City's Urban Forest.

Priority objectives

8.1 Finalise the Urban Forest Implementation Plan and Monitoring Framework 2016-2020.

8.2 Regularly report progress in implementing objectives.

Other objectives

8.3 Update the City's GIS database to record the findings of the Street and Parkland Tree Audit (2015).

8.4 Maintain the City's GIS database to record on going changes and support monitoring of the City's Urban Forest.

8.5 Develop tree management and maintenance plans for parks and public open spaces.

8.6 Implement an appropriate management structure to support the effective planning and management of the City's Urban Forest.

8.7 Build effective working relationships with other city agencies that have a stake in the protection, management and expansion of the City's Urban Forest.

8.8 Complete regular, four yearly audits of street and parkland trees.

8.9 Complete regular, four yearly canopy cover and thermal imaging surveys.

Goal 9: Raise community awareness

The following measures will be undertaken to help raise community awareness on the benefits of the City's Urban Forest and promote support for the City of Perth Urban Forest Plan:

Priority objectives

9.1 Develop and implement a programme of community engagement to raise awareness of this Plan and facilitate input into its development.

9.2 Update the City of Perth website regularly to enable community access to information on the City's Urban Forest and community engagement initiatives.

9.3 Promote meaningful community involvement in the development of the urban forest precinct plans.

Other objectives

9.4 Develop policies and procedures to help address community concerns and provide guidance on the management and maintenance of urban trees.

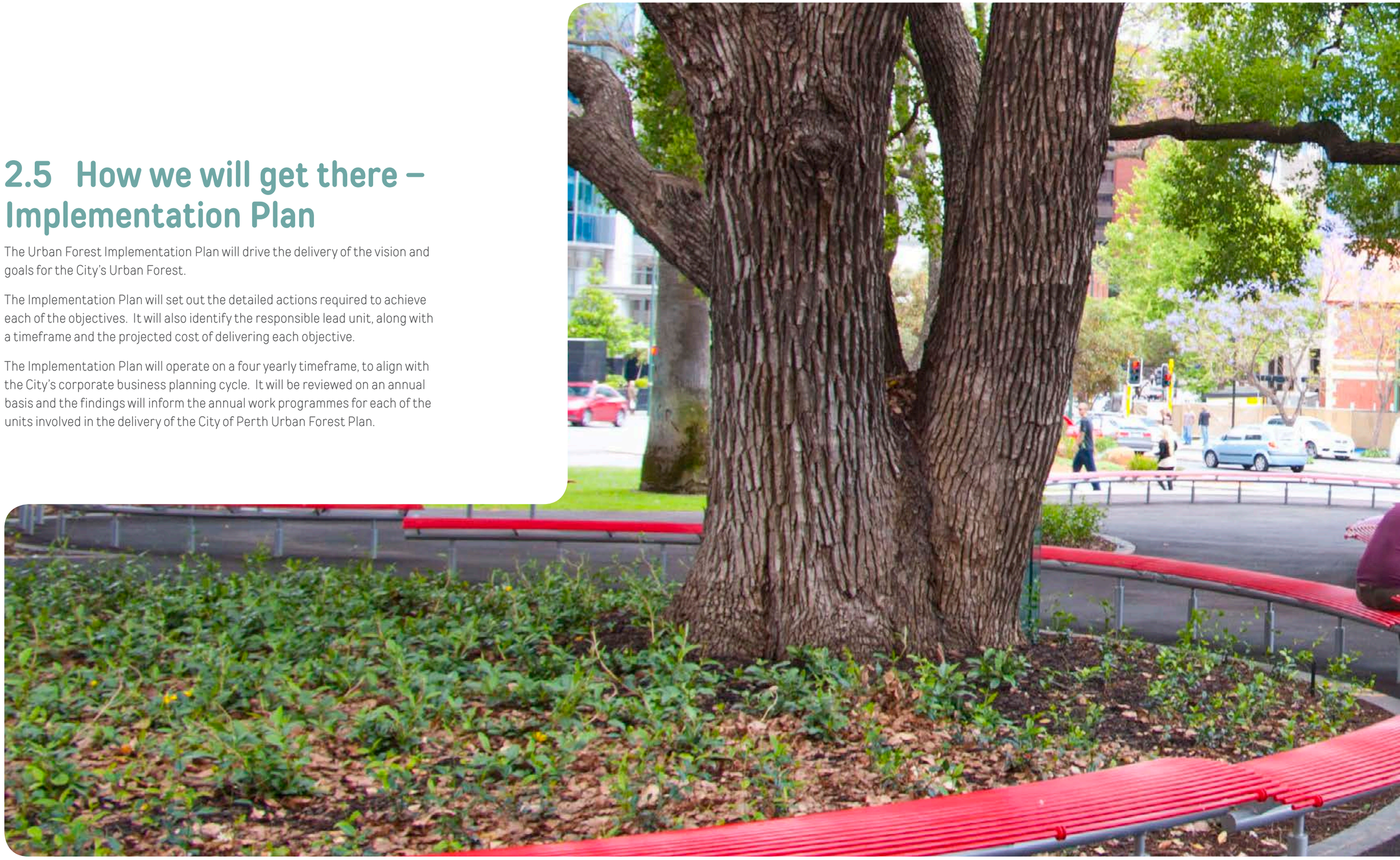
9.5 Continue to work with the community to increase awareness of environmentally sustainable living and deliver positive environmental outcomes through the delivery of an external engagement programme.

2.5 How we will get there – Implementation Plan

The Urban Forest Implementation Plan will drive the delivery of the vision and goals for the City's Urban Forest.

The Implementation Plan will set out the detailed actions required to achieve each of the objectives. It will also identify the responsible lead unit, along with a timeframe and the projected cost of delivering each objective.

The Implementation Plan will operate on a four yearly timeframe, to align with the City's corporate business planning cycle. It will be reviewed on an annual basis and the findings will inform the annual work programmes for each of the units involved in the delivery of the City of Perth Urban Forest Plan.



2.6 Have we arrived – Monitoring Framework

The Urban Forest Implementation Plan will include a Monitoring Framework to help track the progress of implementing each of the objectives for the City's Urban Forest. The Framework will identify a success measure for each objective and record the degree to which that measure has been achieved within a set timeframe.

The Monitoring Framework will be reviewed every year, as part of the annual review of the Implementation Plan. This will allow any difficulties or issues emerging with regard to attaining each of the goals to be identified and addressed early, allowing for adaptive management as implementation of the Urban Forest Plan progresses.

Glossary of Terms

Adaptive management

A systematic process for continually improving management by learning from the outcomes of previously employed policies and practices.

Canopy cover

The percentage of urban land covered by tree canopy when viewed from above.

Carbon sequestration

The process by which trees absorb and assimilate carbon dioxide from the atmosphere.

City's Urban Forest

For the purposes of Stage One of the City of Perth Urban Forest Plan the term 'City's Urban Forest' refers to all street and parkland trees planted on land owned or managed by the City of Perth. Parklands include formal parks and more informal open spaces. Trees in the City's surface car parks are also included.

Ecosystem services

Benefits provided to humans by goods and services delivered by ecosystems. (Source: Millennium Ecosystem Assessment 2005)

Rare trees

A tree species that is considered to be a rare species for the Perth metropolitan area. Consideration is given to the frequency of finding the trees' given species in other areas of metropolitan Perth as well as within the City itself.

Tree amenity

A quality, feature, or attribute of the tree that makes ti pleasant, attractive, and agreeable which is conducive to the comfort, convenience, and enjoyment of people. It is a physical feature within increases attractiveness and value of a site through contributions to the physical, psychological, or material comfort of people and which facilitates happiness, pleasure, enjoyment and contentment.

Urban forest

An urban forest is broadly defined as the collection of green spaces, trees and other vegetation that grows within an urban area, on both public and private land.

Urban Heat Island (UHI)

Many urban areas experience elevated temperatures compared to their outlying surroundings, this difference in temperature is what constitutes an urban heat island. (US EPA, 2008)

Useful Life Expectancy (ULE)

An estimation of the useful life remaining for a given tree taking account of its current health condition and known typical lifespan expected for the given species in its given location and situation.

Veteran trees:

Trees which are considered to be in excess of 100 years old.

Water sensitive urban design

Integrating water cycle management into urban design processes and outcomes.

Selected Bibliography

202020 Vision, 2015. How to Grow an Urban Forest, Melbourne: 202020 Vision.

Arbor Logic, 2015. Summary of Findings from City wide audit of Street, POS and Car Park trees, Perth: Arbor Logic.

ArborCarbon Pty Ltd, 2015. Baseline Canopy Cover and Thermal Imaging 2015, Perth: ArborCarbon Pty Ltd.

Australian Bureau of Statistics, 2013. Australian Social Trends. [Online]
Available at: http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/4102.0Main+Features30April+2013#bac7
[Accessed 7 May 2016].

Beecham, S. & Lucke, T., 2015. Street Trees in Paved Urban Environments – The Benefeits and Challenges. Adelaide, University of Adelaide.

Blackwell & Associates Pty Ltd, 1995. City of Perth Landscape Strategy, Perth: City of Perth.

Block, A., Livesley, S. & Williams, N., 2012. Responding to the urban heat island: Literature review of the potential of green infrastructure, Melbourne: Victorian Centre for Climate Change Adaptation Research.

Bold, W., 1911. 1911 Planning Report, Perth: City of Perth.

Brown, H., Katscherian, D., Carter, M. & Spickett, J., 2013. Cool communities: Urban Trees, climate and health, Perth: Curtin University.

California Urban Forests Council, n.d. Urban Forest Management Plan Tool Kit. [Online]
Available at: http://ufmptoolkit.com/index.htm
[Accessed 10 December 2015].

Campbell, P., James, S. & Edwards , C., 2011. London's Urban Forest: A guide for Designers, Planners and Developers – The Canopy, London: Trees & Action Group, Mayor of London .

City of Melbourne, 2012. Urban Forest Strategy: Making a Great City Greener 2012-2032, Melbourne: City of Melbourne.

City of Melbourne, 2015. How to Grow and Urban Forest, Melbourne: City of Melbourne.

City of Perth, 2013. Strategic Community Plan 2029+ Vision. [Online]
Available at: http://www.perth.wa.gov.au/sites/default/files/documents/STRATEGIC%20COMMUNITY%20PLAN%20VISION%202029.pdf
[Accessed 7 May 2016].

City of Perth, 2014. This is Wadjuk Country. [Online]
[Accessed 18 09 2015].

City of Sydney, 2013. Urban Forest Strategy, Sydney: City of Sydney.

Cooperative Research Centre Water Sensitive Cities, 2014. Impacts of water sensitive urban design solutions on human thermal comfort. [Online]
Available at: http://watersensitivecities.org.au/wp-content/uploads/2015/01/GreenCitiesandMicroclimate-no2.pdf
[Accessed 14 May 2015].

Cooperative Research Centre Water Sensitive Cities, 2013. Determine the microclimate influence of harvesting solutions and Water Sensitive Urban Design at the micro-scale. [Online]
Available at: http://watersensitivecities.org.au/wp-content/uploads/2015/01/GreenCitiesandMicroclimate-no1.pdf
[Accessed 14 May 2015].

Godfrey, N., 1988. The Value of Wetlands. Perth, Environmental Protection Authority, p. 8.

Hàbitat Urbà. Ajuntament de Barcelona, 2011. Street Tree Management in Barcelona, Barcelona: Hàbitat Urbà. Ajuntament de Barcelona (Barcelona City Council).

Harris, R. & Coutts, A., 2013. Urban Heat Island Report: A multi-scale assessment of urban heating in Melbourne during an extreme heat event: policy approaches for adaptation, Melbourne: Victorian Centre for Climate Change Adaptation Research.

Johnston, D. M., 1985. Community Forestry: a sociological approach to urban forestry. Arboricultural Journal, Volume 9, pp. 121–126.

Johnston, M., Nail, S. & James, S., 2012. 'Natives versus Aliens': the relevance of the debate to urban forest management in Britain, s.l.: Forestry Commission.

Kendal, D. & McDonnell, M. J., 2014. Potential Consequences for Management, Urban Ecosystems, and the Urban Public: Adapting Urban Forests to Climate Change, Melbourne: Centre for Urban Greenery and Ecology Publication.

Kenney, A. W., van Wassenaer, P. & Satel, A., 2011. Criteria and Indicators for Strategic Urban Forest Planning and Management. s.l., Arboriculture and Urban Forestry.

Norton, B. A. et al., 2015. Planning for cooler cities: A framework to prioritise green infrastructure to mitigate high temperatures in urban landscapes. Landscape and Urban Planning, Volume 134, pp. 127-138.

Norton, B. et al., 2013. Planning for a cooler future: Green infrastructure to reduce urban heat, Victorian Centre for Climate Change Adaptation Research, Melbourne: Victorian Centre for Climate Change Adaptation Research.

Nowak, D. J. et al., 2010. Sustaining America's Urban trees and Forests. [Online]
Available at: http://www.fs.fed.us/openspace/fote/reports/nrs-62_sustaining_americas_urban.pdf
[Accessed 22 December 2015].

Rogers, K., Sacre, K., Goodenough, J. & Doick, K., 2015. Valuing London's Urban Forest: Results of the London i-Tree Eco Project, London: Treeconomics.

San Francisco Planning Department, 2014. San Francisco Urban Forest Plan, San Francisco: San Francisco Planning Department.

Sanusi, R. & Livesley, S., 2014. Street tree diversity and canopy quality influences urban microclimate and pedestrian thermal comfort. Nursery Papers, Volume 10.

Schwab, J. E., 2009. Planning the Urban Forest: Ecology, Economy and Community Development, s.l.: American Planning Association Planning Advisory Service.

Segur, F. et al., 2015. La Charte De L'Arbre (The Tree Charter), Lyon: Grand Lyon La Metropole.

Singleton, J., 1988. The History and Tenure of Wetlands. Perth, Environmental Protection Authority, p. 33.

Steffen, W., Hughes, L. & Perkins, S., 2014. Heat Waves: Hotter, Longer, More Often, Australia: Climate Council of Australia.

Trees & Design Action Group , 2012. Trees in the Townscape: A Guide for Decision Makers, London: Trees & Design Action Group.

U.S Environmental Protection Agency (EPA), 2008 b. Reducing Urban Heat Islands: Compendium of Strategies, Chapter 2: Trees and Vegetation.. [Online]
Available at: http://www.epa.gov/heatisland/resources/pdf/TreesandVegCompendium.pdf
[Accessed 7 May 2015].

U.S Environmental Protection Agency (EPA), 2008. Reducing Urban Heat Islands: Compendium of Strategies, Chapter 1: Urban Heat Island Basics. [Online]
Available at: http://www.epa.gov/heatisland/resources/pdf/BasicsCompendium.pdf
[Accessed 7 May 2015].

van Wassenaer, P. J., Satel, A. L., Kenney, A. W. & Ursic, M., 2012. A framework for strategic urban forest management planning and monitoring. Birmingham, Forestry Commission, UK.

ITEM NO: 3

APPROVAL – CITY OF PERTH TAXI RANK DESIGN GUIDE

RECOMMENDATION: ***(APPROVAL)***

That Council:

1. ***approves the 'Taxi Rank Design Guide', detailed in Schedule 3, in line with the adopted CBD Taxi Rank Strategy and endorses the future implementation of taxi ranks in accordance with the Guide as detailed in this report; and***

2. ***notes that the 'Taxi Rank Design Guide' was developed together with the Department of Transport, the Taxi Council of Western Australia and will be used to guide the design of taxi ranks in other local government authorities.***

BACKGROUND:

FILE REFERENCE:	P1021424
REPORTING UNIT:	Coordination and Design
RESPONSIBLE DIRECTORATE:	Planning and Development
DATE:	2 May 2016
MAP / SCHEDULE:	Schedule 3 – Taxi Rank Design Guide Schedule 4 – Letter – Department of Transport

Perth's taxi service is a key component of the city's integrated transport network. A CBD Taxi Rank Strategy Working Group, formed in 2011 and consisting of the Department of Transport, City of Perth, Taxi Council of Western Australia and the Taxi Industry Forum of Western Australia, determined that improving taxi ranks was fundamental to improving the availability of taxis in the City. Consequently, the CBD Taxi Rank Strategy (the Strategy) was devised with an objective to:

"deliver an integrated approach to taxi ranks that aligns with the short, medium and long term vision for transport in the Perth CBD. The Strategy provides a framework for the provision of safe and secure ranks in the CBD that are easily identified and accessible for both taxi drivers and consumers."

At its meeting held on **13 March 2012** the following Council resolution was adopted:

"That the Council:

1. *approves the draft Taxi Rank Strategy, as detailed in Schedule 17;*

2. *notes that all future plans for modifying existing ranks or creating new ones as part of an implementation plan will be presented back to Council for consideration and approval;*

3. *notes that any funding required to modify existing or creating new taxi ranks will be shared with the State Government on a 75% State and 25% City split."*

The Taxi Rank Strategy was endorsed by the Minister of Transport in April 2012.

LEGISLATION / STRATEGIC PLAN / POLICY:

Integrated Planning and Reporting Framework Implications	**Corporate Business Plan** Council Four Year Priorities: Getting Around Perth S3	Proactive planning for an integrated transport system, including light rail, that meets community needs fan makes the sustainable choice the easy choice

Policy
Policy No and Name: 22.9 – On Street Parking Policy

DETAILS:

One of the key deliverables of the Strategy was to develop a CBD Taxi Rank Design Guide (refer to Schedule 3). Over the past 18 months, representatives from the City of Perth have met regularly with the Department of Transport and the Taxi Council of Western Australia to develop this document.

The guide provides a framework for creating new taxi ranks within the City of Perth, in particular:

- where to locate the taxi rank;
- what site investigations are required prior to designing the rank;
- who to consult with when designing a rank;
- how to determine the capacity and dimensions of the rank;
- universal access requirements;
- safety and security requirements;
- what critical infrastructure is required at the rank;
- what additional infrastructure may be provided at the rank for patrons; and
- how to implement rank infrastructure in constrained City of Perth streets.

The Guide also establishes the standard to which existing ranks shall be upgraded over time when funding becomes available.

The Guide was adapted from the Australian Taxi Industry Association (ATIA) Taxi Rank Design Specification, and has also been informed by:

- Legislation, such as the *Road Traffic Code* and the *Disability Discrimination Act*;
- City of Perth Design and Construction Notes;
- Australian Standards, such as the Design for Access and Mobility, Manual of Uniform Traffic Control Device, Parking Facilities – On-street Parking;
- Designing Out Crime Planning Guidelines;
- Disability Standards for Accessible Public Transport 2002; and
- City of Perth On-Street Parking Policy 22.9.

In addition, accredited access consultants were engaged to provide advice on access and design for people with disabilities, which has been incorporated into the document. The Guide has been presented in a user-friendly format and shall be reviewed every four years to ensure its content remains current.

FINANCIAL IMPLICATIONS:

There are no financial implications of this report.

COMMENTS:

A consistent approach to taxi rank design across the City will lead to a safer, more accessible and legible taxi transport service. The design guidelines ensure that taxi rank infrastructure will be seamlessly integrated into the City's often constrained streetscapes.

In a letter dated 4 April 2016, the Department of Transport formally approved the Taxi Rank Design Guide (refer to Schedule 4). The Department intends for the Guide to be adapted by other local governments to standardise the design and implementation of taxi ranks throughout Western Australia.

CITY OF PERTH

TAXI RANK

Design Guide

CITY of PERTH

Government of **Western Australia**
Department of **Transport**

Produced by the City of Perth in consultation with the Department of Transport, Western Australia.
Adopted by City of Perth Council: x
To be reviewed every 4 years

1 INTRODUCTION

2 IDENTIFYING A TAXI RANK LOCATION

3 TAXI RANK DESIGN

4 TAXI RANK INFRASTRUCTURE

APPENDIX

1 INTRODUCTION

The demand for taxis in the Perth metropolitan area over the last ten years has risen rapidly in line with dramatic population growth.

Between 2004 and 2010 there was a 65% increase in the number of taxis operating in the region. However within the City of Perth local government area where 22% of the Perth metropolitan ranks are located, there has not been a commensurate growth in rank capacity nor upgrade of infrastructure.

In light of this, the Minister for Transport established the CBD Taxi Rank Strategy Working Group in 2011, consisting of the Department of Transport, City of Perth, Taxi Council of Western Australia and the Taxi Industry Forum of Western Australia. The purpose of the Working Group was to address the role taxis play in the City's public transport network. The Group found that improving taxi ranks was fundamental to improving the availability of taxis in the City. Consequently, in April 2012, the CBD Taxi Rank Strategy was endorsed with an objective to:

> *'deliver an integrated approach to taxi ranks that aligns with the short, medium and long term vision for transport in the Perth CBD. The Strategy provides a framework for the provision of safe and secure ranks in the CBD that are easily identified and accessible for both taxi drivers and consumers.'*

One of the key deliverables of the Strategy was to develop a CBD Taxi Rank Design Guide. This document provides guidance on how to locate and design new taxi ranks within the City of Perth and establishes the standard to which existing ranks shall be upgraded over time when funding becomes available. A consistent approach to taxi rank design across the City will lead to a safer, more accessible and legible taxi transport service.

1.1 | Responsibility for Ranks

The responsibility for planning, constructing and maintaining taxi ranks lies with the owner or custodian of the land where the rank is to be located. Ranks located on private land, such as shopping centres or hotels, are the responsibility of the private land owner. On-street taxi ranks within the City of Perth local government area are generally the responsibility of the City of Perth whereas ranks located on railway reserve are the responsibility of the State Government. This Guide applies to all ranks located on City of Perth or State Government land.

1.2 | Supporting Documents

The following documents have informed the development of this Guide:

ATIA TAXI RANK DESIGN SPECIFICATION

The Australian Taxi Industry Association (ATIA) is the national peak representative body for the taxi industry. The ATIA Taxi Rank Design Specification (April 2012) provides guidelines for the design of taxi ranks across Australia.

LEGISLATION

All new and upgraded taxi ranks shall comply with the following Commonwealth and State Legislation:

- Road Traffic Code (2000); and
- Disability Discrimination Act (1992);

CITY OF PERTH DESIGN AND CONSTRUCTION NOTES

Available online through the City of Perth website, the Design and Construction Notes specify how to locate, design and construct the streetscape components of taxi ranks, such as street furniture and lighting.

www.perth.wa.gov.au/dcnotes

AUSTRALIAN STANDARDS

The following Australian Standards are applicable to this Guide:

- AS 1428.1-2009: Design for access and mobility - General requirements for access – New building work (Including Amendment 1, 2010);
- AS 1428.2-1992: Design for access and mobility - Enhanced and additional requirements - Buildings and facilities
- AS 1428.4-2002: Design for access and mobility - Tactile Indicators
- AS 1428.4.1-2009: Design for access and mobility – Part 4.1: Means to assist the orientation of people with vision impairment – Tactile ground surface indicators
- AS 1742.2-2009: Manual of uniform traffic control devices – Traffic control devices for general use (Including Amendment 1, 2010)
- AS 1742.11-1999: Manual of uniform traffic control devices - Parking controls
- AS 2890.5-1993: Parking facilities - On-street parking
- AS 1158.3.1-2005: Lighting for roads and public spaces - Pedestrian area (Category P) lighting - Performance and design requirements
- AS 2009-2006: Glass beads for pavement-marking materials
- AS 2700-2011: Colour standards for general purposes
- AS 4049.3-2005: Paints and related materials – Pavement marking materials – Waterborne paint – For use with surface applied glass beads

METROPOLITAN PERTH TAXI RANK AUDIT (2010)

Prepared for the Department of Transport, Estill & Associates audited all existing taxi ranks in the Perth metropolitan area, discussed issues relating to taxi operation in the City and identified opportunities for improvement in the immediate and mid-term future.

DESIGNING OUT CRIME PLANNING GUIDELINES

Published by the Western Australian Planning Commission in 2006, this policy document provides principles for the planning and design of the built environment to minimise the potential for criminal behaviour and to improve the perception of personal safety.

www.planning.wa.gov.au/publications/789.asp

DISABILITY STANDARDS FOR ACCESSIBLE PUBLIC TRANSPORT 2002

This document sets out the minimum accessibility requirements for premises associated with trams, trains, buses and coaches, taxis, ferries and aeroplanes. Since October 2002 all new public transport conveyances, premises and infrastructure shall comply, and facilities already in operation at that time have between five and thirty years to comply.

www.ag.gov.au

CITY OF PERTH ON-STREET PARKING POLICY 22.9

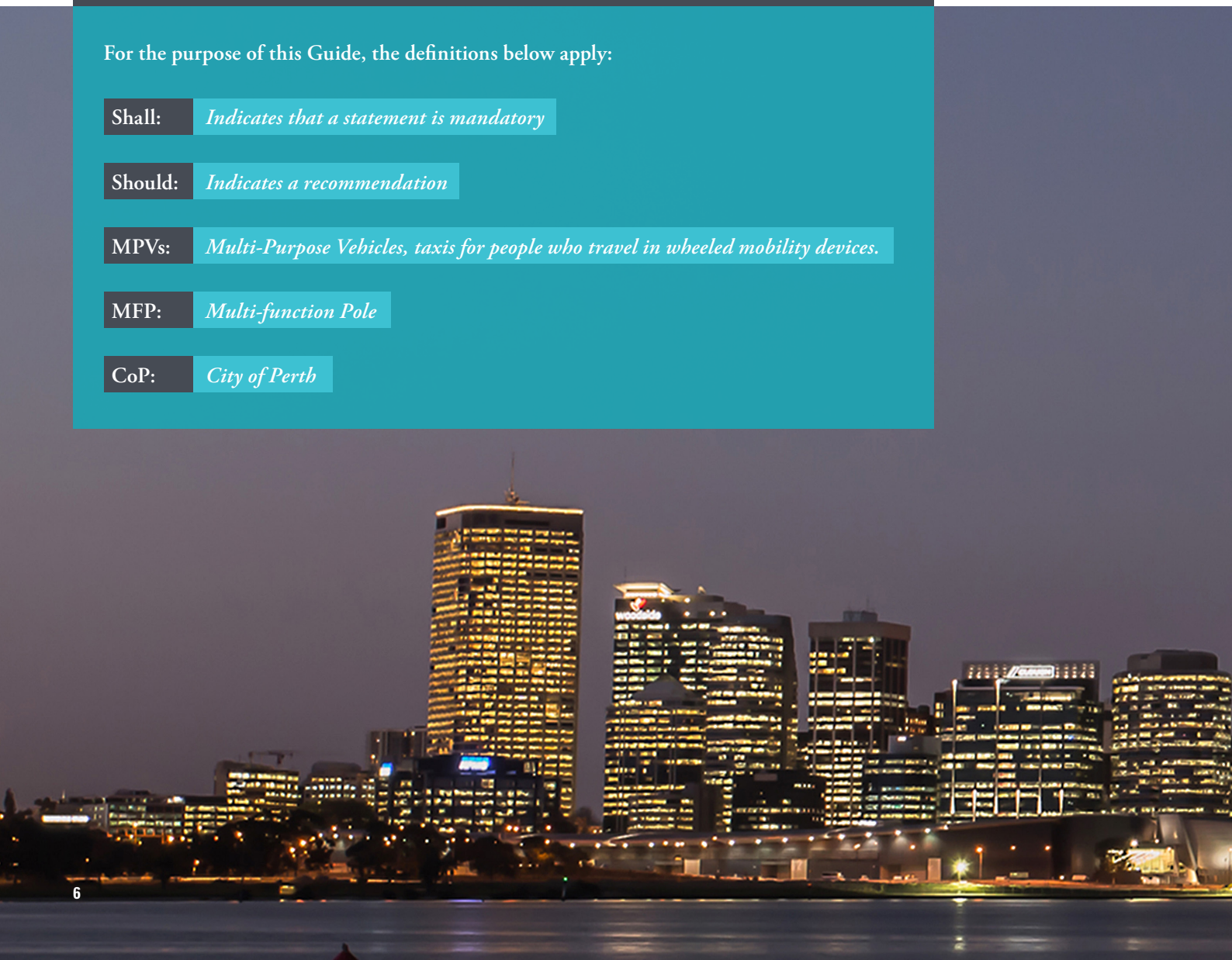
The provision of taxi ranks is broadly addressed under this policy which guides the allocation of often constrained kerbside space in the City. According to the Policy, space for Transperth buses, parking for people with disabilities and in some parts of the city, service vehicles are to be prioritised ahead of taxi ranks.

www.perth.wa.gov.au/street-parking-policy-229

1.3 | Definitions and Abbreviations

For the purpose of this Guide, the definitions below apply:

Shall:	*Indicates that a statement is mandatory*
Should:	*Indicates a recommendation*
MPVs:	*Multi-Purpose Vehicles, taxis for people who travel in wheeled mobility devices.*
MFP:	*Multi-function Pole*
CoP:	*City of Perth*



2 IDENTIFYING A TAXI RANK LOCATION

The need for new taxi rank facilities or the relocation of existing taxi ranks within Perth CBD generally arises as a result of new development or changes to passenger demand.

Existing taxi ranks may also require relocation in order to meet general accessibility or safety requirements. For new developments it is essential that taxi access and rank facilities are considered in the planning stages of the development. It may be difficult to retro-fit taxi rank facilities at a later stage.

2.1 | Consultation

As part of the taxi rank location process, discussions shall be held with:

- Taxi Council of Western Australia (TCWA),
- Taxi Industry Forum (TIFWA);
- Department of Transport; and
- City of Perth

In some cases it may be appropriate to consult the WA Police Headquarters for assistance on planning taxi rank locations. It is recommended that affected property owners are also consulted during this process.

2.2 | Locating the Rank

For new taxi ranks, choose a site that is:

CLOSE TO KEY CITY LOCATIONS

- Key city locations are major trip generators, including:
  - » Railway stations and other transport interchanges
  - » Major shopping destinations
  - » Hospitals
  - » Community facilities (eg. halls, libraries)
  - » Sporting venues
  - » Major parks
  - » Entertainment precincts (eg. stadiums, late-night venues)
  - » Major hotels
  - » Major office centres
  - » Educational centres

- Locate the rank within 400 metres (or a five-minute walking journey) of the entrance and/or exit of the facility. Note that areas with high potential population growth are likely to generate new passenger demands.

ACCESSIBLE

- A continuous accessible path of travel shall be provided to the taxi rank and taxi boarding point in accordance with AS1428.1-2009 and AS1428.2-1992. The route to the rank shall be as direct as possible and clearly signed for the convenience of all, but particularly to reduce fatigue experienced by people with disabilities. Identify barriers such as railways, freeways, rivers or busy roads which may increase access times and distances.
- Avoid locating taxi ranks on streets with a significant slope (ie. steeper than 1:14). Such sites are difficult, unsafe, and sometimes even impossible to access for people with a mobility impairment.
- Taxi ranks shall only be sited on footpaths that are sufficiently wide to avoid obstruction to pedestrians by waiting taxi passengers, especially when located near retail activity and licensed venues. If there is insufficient room, consideration should be given to the possibility of widening the footpath.
- Taxi ranks should be located within proximity of an intersection to maximise visibility of the rank and decrease the distance that passengers have to walk when crossing from the opposite side of the road.
- Taxi ranks should also be in accessible locations for drivers, providing easy access to and from Perth CBD.
- Ranks with capacity for only one vehicle should be located at the head or end of a road section.

CLEARLY VISIBLE

- Locate the taxi rank where there are clear sightlines for oncoming vehicles, taxi drivers and pedestrians. Avoid locations that are close to features which may block sight lines, such as a corner, curve, trough or crest of a hill. Refer to AS 2890.5 – 1993, Clause 3.5 for further guidance.

SAFE

- The rank shall be located:
  - » nearby other activities so that passive surveillance can occur and avoid isolated, derelict or underused locations including vacant land, car parks, alleyways and possible entrapment spots;
  - » at the same level as the main activity zone to promote surveillance;
  - » in a well-lit area, e.g. near street lighting or other existing sources of illumination
  - » within short, safe distances to and from stations, interchanges and stops, especially near night time venues;
  - » at the end of road section wherever possible; and
  - » nearby an intersection so that taxi passengers are able to cross the road easily and safely using the features generally provided at intersections, such as dropped kerbs, pedestrian refuge islands or signals

TAXI RANKS SHALL NOT BE LOCATED:

- **within the restricted area of an intersection, level crossing, pedestrian crossing, fire hydrant, Australia Post box or crossover as specified in AS1742.11**

2.3 | Other Things to Consider

DRIVEWAYS

- Taxi rank shelters, especially those with non-transparent advertising panels on the ends can obstruct driveway sightlines of on-coming traffic. When locating a taxi rank near a driveway crossover, the rank shall comply with 'No Stopping' areas nominated in AS1742.11 and shall take into consideration pedestrian and vehicle visibility splays.

POTENTIAL IMPACT ON SURROUNDING LAND USE

- Some businesses are more compatible with taxi ranks than other types. The types of businesses in the adjacent area should be considered when locating a taxi rank.
- Taxi layovers/feeders can negatively impact on adjacent landowners due to extended noise, fumes etc., and on the operation of intersections. Where possible, taxi ranks used for taxi layovers should be located away from residential areas, alfresco dining areas, and other sensitive frontages where ongoing noise and disturbance are undesirable.
- Some sites may be undesirable for taxi rank locations due to potential use by other conflicting users, e.g. adjacent to areas that generate large amounts of short-term high-turnover parking.
- Super Ranks (refer Section 4.4) shall be located where they will have minimal impact on adjacent land-use and street activity, eg. alfresco dining.

3 TAXI RANK DESIGN

The following process shall be undertaken when designing a taxi rank or upgrading a taxi rank within the City of Perth.

3.1 | Site Analysis and Data Collection

- Once a potential site has been identified, temporary rank signange shall be implemented for a trial period of 24 months. During the trial, passenger and driver numbers shall be collected and behaviours observed to determine demand, transport mode conflicts, passenger requirements and the overall suitability of the rank location.
- Data shall be collected at times, days and intervals as appropriate to provide a comprehensive overview of rank operations, and should include samples from:
  - » weekdays and weekends; and
  - » the morning, mid-day, evening and late night
- During the study, the following should also be identified and analysed:
  - » site constraints, eg. footpath widths, underground services, etc.;
  - » access for taxis and passengers;
  - » existing infrastructure which may be used to service the rank, eg. shade, building awnings, CCTV, lighting;
  - » new critical and additional infrastructure required to service the rank (refer Section 3.4 and 3.5); and
  - » the level of security required (consult with WA Police and the City of Perth)
- At the end of the trial period, an application may be made to the City to establish a permanent rank. The application shall summarise the findings of the trial and provide solutions to any issues identified.
- Following City approval of the rank location, the site shall be surveyed by an engineering surveyor to accurately map the location of existing utilities, topography, property boundaries and features including furniture and signage.

3.2 | Identifying the Capacity and Dimensions of a Taxi Rank

The Passenger Transport Regulations prohibit taxi drivers from allowing a taxi to stand anywhere other than a taxi rank whilst they are 'for hire'. Taxi ranks are therefore the only place where vacant taxis may stand. If no taxi rank space is available, vacant taxis have no option but to leave. Poor rank capacity may also result in taxis queuing on the road, causing traffic congestion. Ensuring adequate taxi rank capacity in areas of high passenger demand is therefore essential.

THE FOLLOWING STEPS WILL ASSIST IN DETERMINING THE CAPACITY AND LENGTH OF THE TAXI RANK:

Using the data collected via the site analysis process (refer 3.1) **calculate the frequency of taxis** using the rank during a one hour peak period. Consider surrounding future developments which may impact on demand and adjust accordingly.

Estimate average dwell time. A maximum 10-minute dwell time can generally be assumed for each taxi during the peak. After 10 minutes, taxis will often move to an alternative rank if there are no customers. Therefore the capacity of the rank will be determined by the maximum number of taxis that will be dwelling in the rank over a 10-minute period.

Determine the minimum length of the rank using the following formula (as specified by AS 2890.5:1993):

$$(5.4n) + 1m$$

n = the number of taxis to be accommodated

FOR EXAMPLE

If it is expected there will be 12 taxis servicing the rank over the peak hour, the rank will be serviced by a taxi every 5 minutes (60 minutes divide 12 = 5 minutes).

Therefore this rank will need to accommodate 2 taxis (10 minutes divide 5 minutes = 2 taxis). More accurate dwell times shall be obtained in locations where it is expected that taxis will dwell for longer during quiet periods, and the above calculation adjusted accordingly. For example, if you wish to allow for a maximum dwell time of 20 minutes, you should accommodate 4 taxis at the rank. (20 minutes divide 5 minutes = 4 taxis)

A taxi rank required to accommodate 2 dwelling taxis would be calculated as: (5.4 x 2) + 1m = 11.8m long.

3.3 | Universal Access

ACCESS FOR WHEELED MOBILITY DEVICES

Any kerb-side area where a wheelchair user may manoeuvre a wheelchair to gain access to a taxi shall be free of obstruction such as queuing rails and seating. Circulation space and passing space shall comply with 1428.2-1992.

Access to the road surface from the footpath shall be provided as specified in Section 4.0 of this guide. Grates located on the footpath or road surface where a mobility device user may be required to traverse are required to be of a type that does not allow the entrapment of mobility devices (eg. 'Heel Guard' grates).

MULTI-PURPOSE VEHICLES (MPVs)

All new taxi ranks in the vicinity of major transport interchanges and hospitals shall be designed to accommodate at least one MPV. The taxi zone shall be at least 8m long to ensure rear loading hoists can be deployed within the taxi rank defined area. Existing taxi ranks in these locations should be upgraded to disability access requirements to accommodate MPVs where possible.

While Australian Standards recommend a minimum width of 3.1m for accessible parking bays, space constraints and minimum footpath width requirements will prohibit this in most cases within the City. Therefore a minimum bay width of 2.4m shall be acceptable where 3.1m cannot reasonably be achieved.

3.4 | Crime Prevention Through Environmental Design (CPTED)

One of the primary considerations for taxi rank design is the safety of the taxi user, taxi driver and the general public.

Crime Prevention Through Environmental Design requires an integrated approach encompassing community, social and environmental strategies. The Office of Crime Prevention can provide advice on how to minimise the potential for criminal behaviour at taxi ranks. In addition to locating the rank in a safe area with good surveillance, the following criteria should be considered:

- design to reduce the risk of entrapment and to improve sightlines;
- provide adequate, identifiable, vandal proof signage for all user groups to assist orientation (refer to Appendix A: City of Perth Taxi Rank Sign Guide);
- design with graffiti resistant, vandal resistant materials wherever possible; and
- ensure areas adjacent are appropriately illuminated (limit shadow and contrast) and protected from weather.

4 TAXI RANK INFRASTRUCTURE

Taxi ranks fall in to one of three categories:

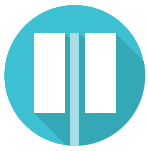
PERMANENT DEDICATED RANKS | DUAL USE RANKS | TEMPORARY RANKS

All new taxi ranks shall be permanent dedicated ranks, except for circumstances which demand shared use of kerb-side space (refer Section 4.2) or when the rank is required only on a short-term basis (refer Section 4.3).

4.1 Permanent Dedicated Ranks

CRITICAL INFRASTRUCTURE

Infrastructure mandatory for all permanent dedicated ranks are listed in the table below, and shall be implemented in accordance with 4:5 Figure 1. Existing taxi ranks should be upgraded to meet these basic requirements.

INFRASTRUCTURE	IMPLEMENTATION
 Taxi rank sign	• Shall be located at the head of the taxi zone • Signage poles shall be in 30% luminance contrast to the surrounding paving • Signage shall comply with Appendix A: City of Perth Taxi Sign Design Guide • A sign at the end of the rank is also desirable • The sign can be placed on a standalone pole or preferably attached to an existing pole to reduce street clutter • Taxi rank signs should not be positioned directly adjacent to the front door of a property, if possible, to maintain privacy • Taxi ranks designed to accommodate MPVs shall be identified with the international symbol of access in accordance with AS 1428.1- 2009, Clause 8.2

Taxi zone line markings	• Shall be provided in accordance with AS 1742.11-1999, Clause 7.1.2 • Paint colour: Golden Yellow, Colour Y14 as defined in AS 2700-2011 • Paint type: premium water-borne road marking paint suitable for use with drop-on beads in compliance with AS 2009-2006. The paint shall comply with the requirements of AS 4049.3-2005 • Paint application: 400 to 500 microns wet thickness • Dual-use taxi zones shall be marked as on-street parking
Tactile indicators	Shall comply with: • AS 1428.4.1-2009; • AS 1428.4-2002; and • CoP Design and Construction Notes

ADDITIONAL INFRASTRUCTURE

Additional infrastructure provided at a rank shall be determined by its context. The rank's location, popularity/ demand (existing or expected), site constraints and proximity to existing infrastructure are all factors to be considered and shall be identified during the site analysis phase (refer Section 3.2).

Existing infrastructure, such as street furniture and building awnings, within close proximity may be used to service the rank. For example, shelter provided by an awning of a building may fulfil the requirement for shelter. The level of infrastructure provided at ranks associated with hospitals, medical facilities and hotels shall be assessed in context with the assistance provided by staff and existing infrastructure at these venues. The table below provides guidance on what items of additional infrastructure are required at new or relocated permanent dedicated ranks. This infrastructure shall be implemented in accordance with 4.5: Figures 2-4.

INFRASTRUCTURE	REQUIRED IF THE RANK...	IMPLEMENTATION
CCTV	• is located in an area where there is a risk to the safety of taxi drivers or passengers • is deemed necessary following consultation with the City of Perth, Police and Main Roads WA; and • is not already covered by existing CCTV cameras	• May be implemented for general street coverage or specific cameras to pick up taxi licence plates, depending on the security issues particular to the rank site • Shall be mounted on the Multi-Function Pole or other appropriately positioned existing pole. Additional poles for CCTV are to be avoided. • Refer to 4.5: Figure 2

INFRASTRUCTURE	REQUIRED IF THE RANK...	IMPLEMENTATION
 **Lighting**	• illumination level is below that specified for the relevant P subcategory by AS 1158.3.1; or • has a shelter which requires lighting; and • there is access to power supply	• Illumination levels shall be uniform and comply with: » The City of Perth Lighting Strategy – 3.4 Lighting Hierarchy and 6.2 Lighting Master Plan[1] » CoP Design and Construction Notes 6.0 Lighting; and » AS 1158.3.1 • Should be energy-efficient • Shall be mounted either on an existing street light pole, Taxi Rank MFP or shelter. Additional poles for lighting are to be avoided. • Refer to 4.5: Figure 2
 **'Hail Taxi' push button assembly** (can be engaged by patrons waiting at a rank to hail passing taxi drivers)	• is in a location which requires enhanced visibility for taxi drivers; and • there is access to power supply	• Shall comply with CoP Design and Construction Note: Multi-Function Pole – Taxi Pole • Graphics shall comply with Appendix A: City of Perth Taxi Sign Design Guide • Refer to 4.5: Figure 2
 **Multi-Function Pole** with illuminated sign box and way-finding map	• is in a location which requires enhanced visibility for taxi patrons; and • accommodates at least four taxis; and • the location proposed for the pole does not conflict with underground services	• Shall comply with COP Design and Construction Note: Multi-Function Pole – Taxi Pole • Pole shall be in 30% luminance contrast to the surrounding paving • Signage and graphics shall comply with Appendix A: City of Perth Taxi Sign Design Guide • Refer to 4.5: Figure 2
 **Queuing rail**	• is a Super Rank (refer Section 4.4); and • the footpaths are sufficiently wide to maintain a minimum 2m wide path free of obstruction behind/beside the queue (3m wide in densely populated areas)	• Shall be grade 316 stainless steel with a height of 930mm • Handrail shall be 50mm diameter, 3mm stainless steel, brushed finish • Shall be located so as to not intrude where a person may board a taxi using a side or rear mounted ramp or hoist • Shall comply with AS1428.1-2009 • Design shall require approval from the City of Perth Coordination and Design Unit • Refer to 4.5 Figure 4

INFRASTRUCTURE	REQUIRED IF THE RANK...	IMPLEMENTATION
 Rubbish bin	• provides seating; or • is nearby a food or beverage outlet; and • there are no other rubbish bins within 10m of the rank	• Shall comply with CoP Design and Construction Note: Standard Litter Bin • To be located within 5m of the rank • Refer to 4.5: Figure 2
 Shelter	• is within proximity of a venue frequented by seniors; or • is within proximity of a medical facility; and • there is no other existing shelter (eg. building awnings) that allow a clear view of oncoming taxi's within the vicinity of the rank; and • location does not conflict with existing kerb-side uses such as alfresco; and • does not block views to heritage buildings; and • the footpaths are sufficiently wide to maintain a minimum 2m wide path free of obstruction behind the shelter (3m wide in densely populated areas); and • circulation space to kerb ramps and boarding access points for mobility device users will not be impeded	• Shall comply with City of Perth Design and Construction Note: Standard Taxi Shelter • The siting of taxi rank shelters either side of driveways shall take into consideration pedestrian and vehicle visibility splays. A minimum clearance of 1.2m is required • A 800 x 1300mm wheelchair seating space shall be provided within the shelter adjacent any provided seating • Circulation space around the shelter shall comply with AS1428.1-2009 • Refer to 4.5: Figure 2
 Mountable kerb for wheeled mobility device access	• is accessible for Multi-Purpose Vehicles; and • there are no existing pedestrian ramps or vehicle cross-over ramps which would reasonably provide convenient and safe access to the taxi rank	• Shall be a 1.6m length of mountable kerb with 0.6m of transition kerb either side • Kerbing material shall match that used in the street • Shall comply with CoP Design and Construction Notes • Minimum circulation spaces shall comply with AS 1428.1-2009 • Shall be located at the rear of the taxi zone • Refer to 4.5: Figure 3

[1] *Available from: http://www.perth.wa.gov.au/planning-development/city-initiatives/lighting-strategy*

INFRASTRUCTURE	REQUIRED IF THE RANK...	IMPLEMENTATION
 Seating	• is within proximity of a venue frequented by seniors or people with ambulatory disabilities; or • is within proximity of a hospital or other medical facility; or • is serviced infrequently by taxis (on average more than 10 minutes waiting time) during core[2] hours; and • there are no other public seats within 5m of the rank; and • the footpaths are sufficiently wide to maintain a minimum 2-metre wide circulation path behind/beside the seat (3-metre wide in densely populated areas); and • circulation space to kerb ramps and boarding access points for mobility device users will not be impeded	• Shall comply with City of Perth Design and Construction Note: Standard Seat • Should be orientated to allow a clear view of oncoming taxis and shall not obstruct vehicle sightlines • Placement of seating shall not obstruct wheelchair turning and circulation space (refer Section 3.4) • The amount of seating provided should relate to the number of patrons expected to use the rank • Refer to 4.5: Figure 3
 Accessible for Multi-Purpose Vehicles	• is within 50m of a major transport interchange or hospital	• Bay shall be minimum 8m long and 2.4m wide • Kerb shall be minimum 150mm high and maximum 190mm high and comply with CoP Design & Construction Notes • A section of mountable kerb shall provide access between the road surface and footpath • Refer to 4.5: Figure 3
 Rank Supervision	• is located in an active area where there is a high risk of crime to passengers waiting for taxis and for taxi drivers waiting for passengers	• Ranks shall be supervised by suitably qualified personnel

[2] Core times will vary depending on the surrounding land-use of the location, but are generally assumed to be 7am - 10pm.

4.2 | Dual Use Ranks

As there are different demands for kerb-side space in the City during the day and at night, dual use ranks may be considered in certain circumstances. For example, a loading zone may become a taxi rank at night outside a night-club. However, unauthorised use of dual use zones can be difficult to manage and they can cause confusion for people with vision impairments who are unable to visually determine if the rank is in operation. Therefore whenever possible, the rank should be located or relocated where it can be in operation at all times. When this is not possible, an application for a Dual Use Rank can be made to the City of Perth for consideration and approval.

The following infrastructure is mandatory at all Dual Use Ranks:

- Taxi Rank Flag Sign
- Signage for dual restrictions (shall comply with AS1742.11)
- Taxi zone line markings

Refer to 4.1 Critical Infrastructure and 4.5: Figure 1 for implementation guidance. Directional TGSI's to the taxi ranks sign shall not be implemented so as to avoid confusion during hours when the rank is not in operation.

The following additional infrastructure should be considered for implementation at Dual Use Ranks in accordance with 4.1 Additional Infrastructure and 4.5 Figures 2 and 3.

- CCTV
- Lighting
- Seating
- Rubbish bin

4.3 | Temporary Ranks

From time to time temporary ranks may be required to service large events. No permanent infrastructure shall be implemented at these ranks, however refer to Figure 4.5 Critical Infrastructure and Additional Infrastructure for guidance on what temporary infrastructure may be beneficial to provide in a temporary format.

4.4 | Super Ranks

Super Ranks shall only be implemented in circumstances where there is a high risk of crime to passengers waiting for a taxi and for taxi drivers waiting for passengers. Due to the high level of permanent infrastructure required at a Super Rank, they should otherwise be avoided as they prevent other kerb-side uses taking place in the street and obstruct pedestrian movement. WA Police and the City of Perth shall be consulted as to whether a Super Rank is required and where it should be located.

The following infrastructure is mandatory at all Super Ranks:

- Taxi rank flag sign
- Taxi zone line markings
- Tactile Ground Surface Indicators
- Security officer supervision
- CCTV
- Enhanced lighting (AS 1158.3.1-2005: Subcategory P1)
- Queuing rail
- Refer to 4.1 and 4.5: Figure 1 and 4 for implementation and guidance

The following additional infrastructure should be considered for implementation at Super Ranks in accordance with 4.5: Figures 2-4:

- Multi-function pole with illuminated sign box and way-finding map
- Accessible for Multi-Purpose Vehicles
- Mountable kerb for wheeled mobility device access
- Shelter

4.5 | Rank Infrastructure Typical Layout

FIGURE 1: CRITICAL INFRASTRUCTURE

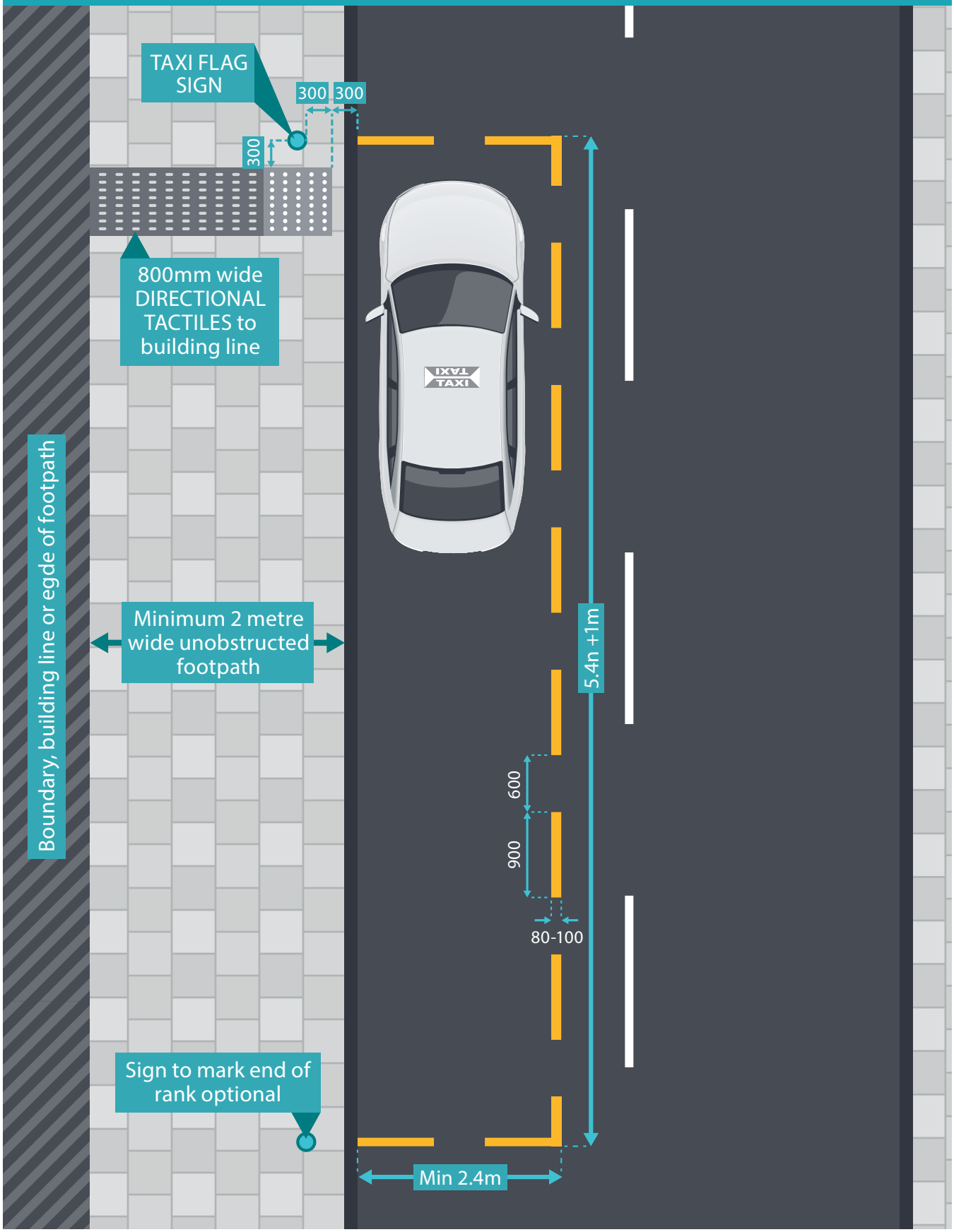


FIGURE 2: ADDITIONAL INFRASTRUCTURE

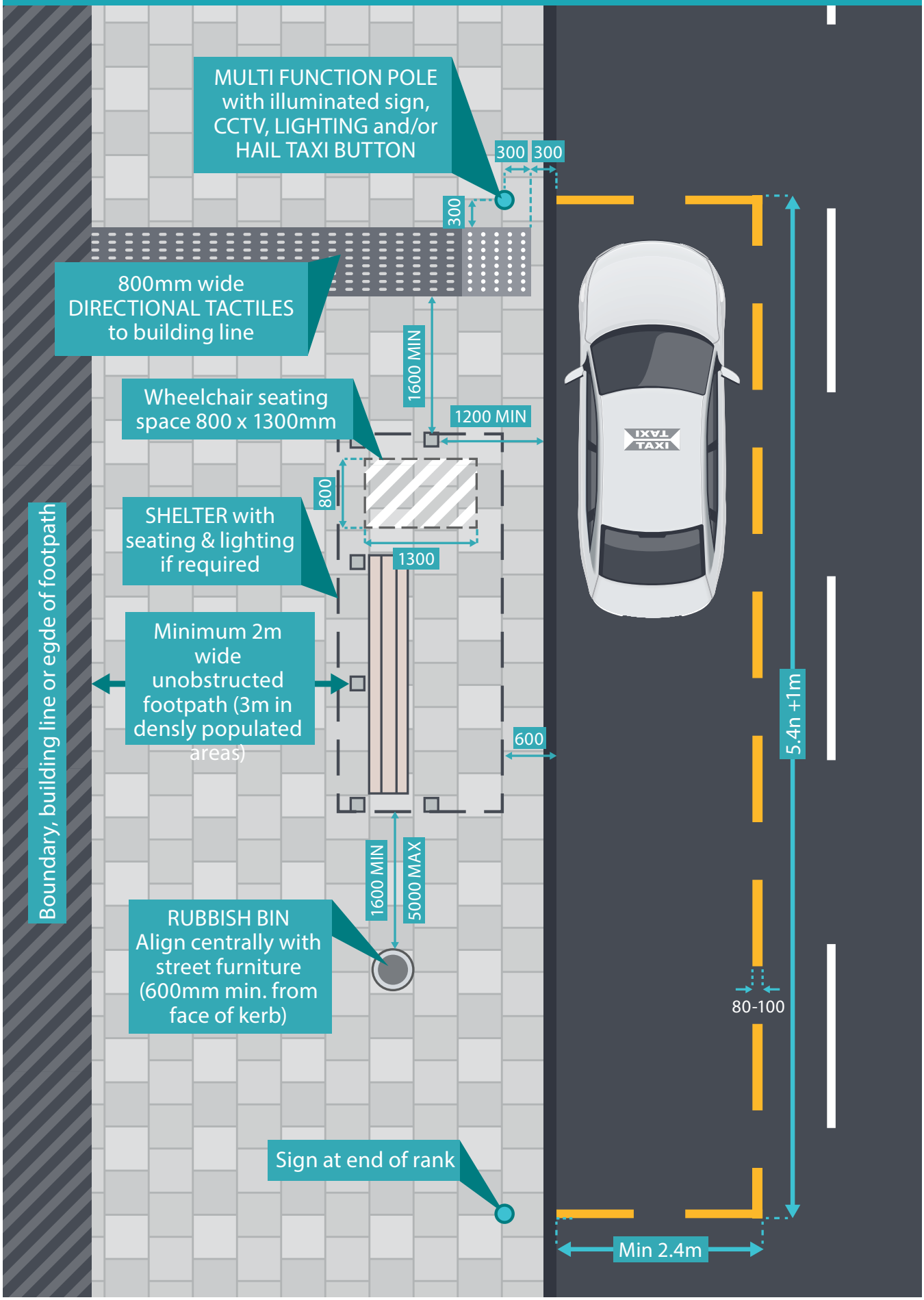


FIGURE 3: ADDITIONAL INFRASTRUCTURE

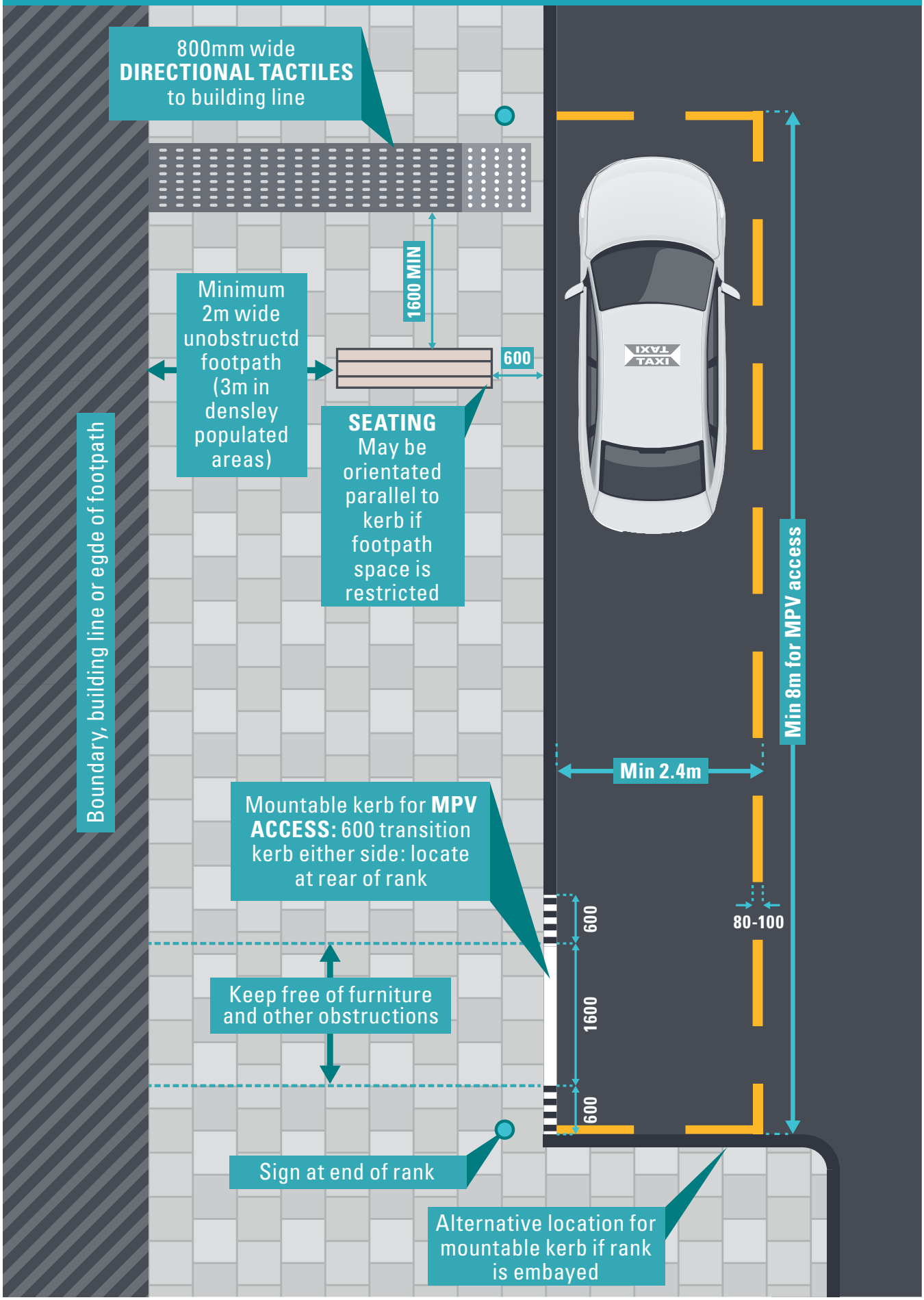
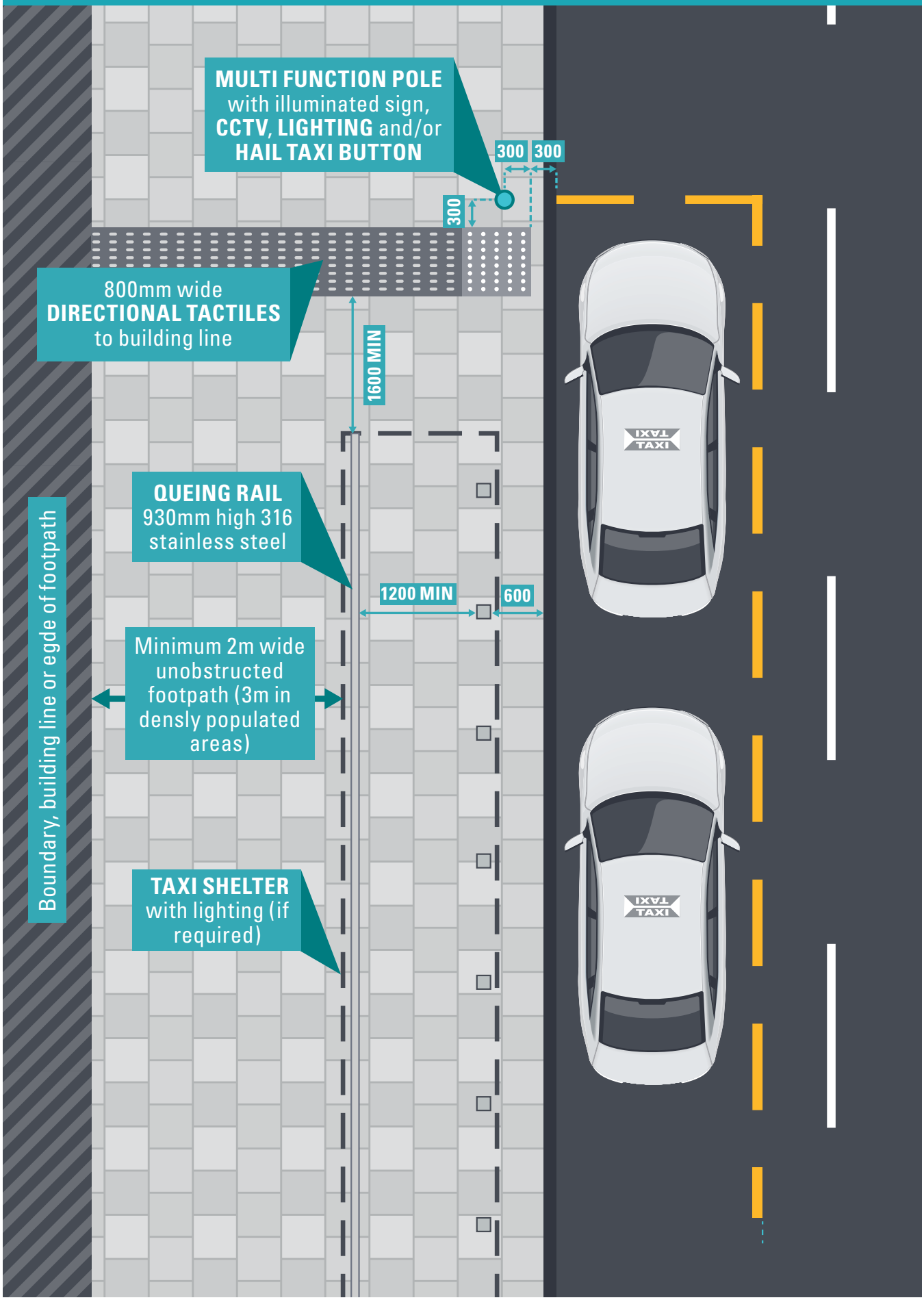


FIGURE 4: ADDITIONAL INFRASTRUCTURE



APPENDIX

CITY of PERTH

PERTH CBD

TAXI SIGN

Design Guide

120456D. 04/01/2016

1

FLAG SIGN

1.1 Pedestrian Sign

1.2 Parking Sign

2

MULTIFUNCTIONAL POLE SIGN

2.1 Illuminated Top Box Sign

2.2 Parking Plates

2.3 Map and Symbols

2.4 Push Button

3

TEMPORARY SIGN BAG

3.1 Taxi Sign Bag

4

SYMBOLS

4.1 Symbols used for Taxi signs

1 FLAG SIGN

1.1 PEDESTRIAN SIGN

1.2 PARKING TAXI SIGN

For sign installation and placement, refer to Taxi Rank Design Guide.

For Parking Plate, please refer to the Australian Standards AS 1742.11 (Parking Controls).

1.1 | Pedestrian Sign

BASE SPECIFICATION

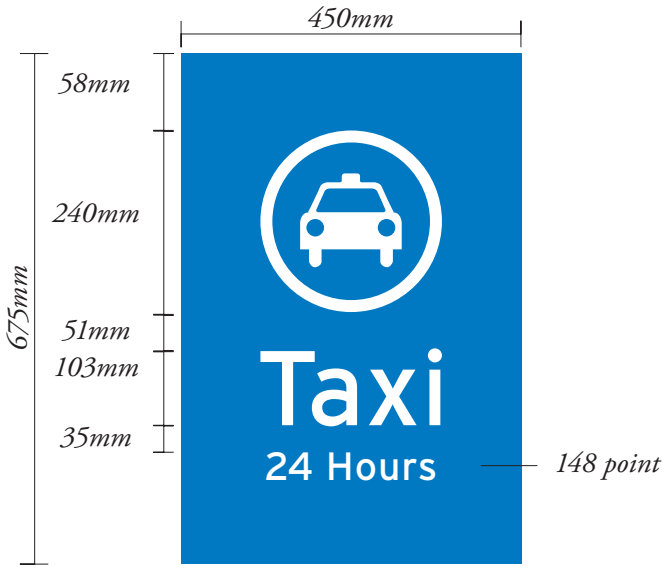
Graphic: White vinyl cut out on blue vinyl (Avery 709 Ocean Blue ref.2923891) adhered to sign plate

Sign plate: 3mm aluminum

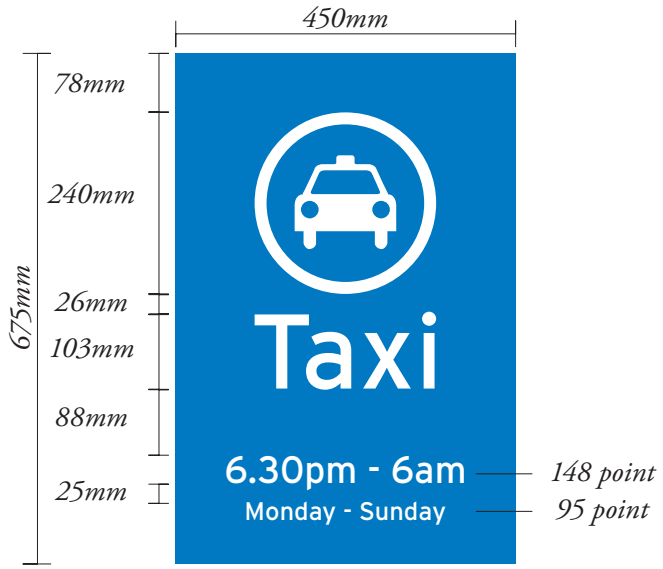
Font: Interstate Regular. Centre alignment.

675MM (H) X 450MM (W)

Option 1

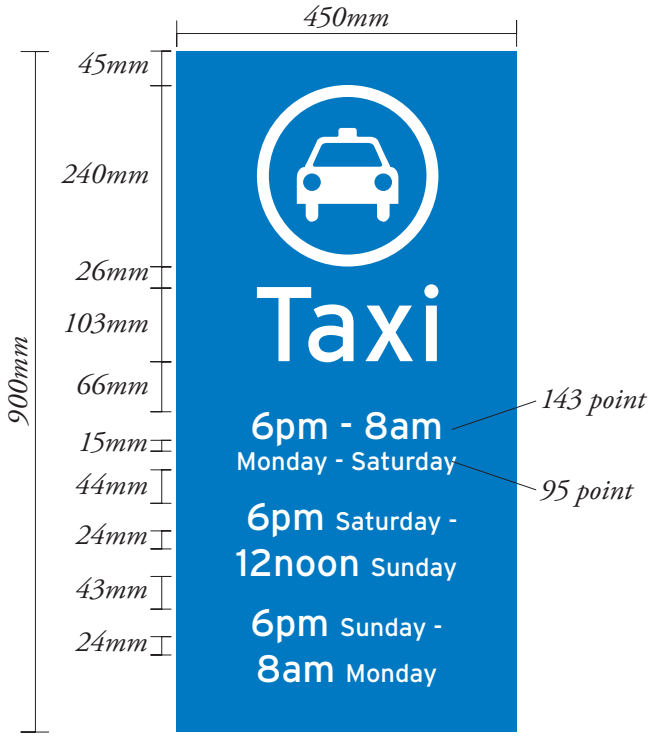


Option 2



900MM (H) X 450MM (W)

Option 1



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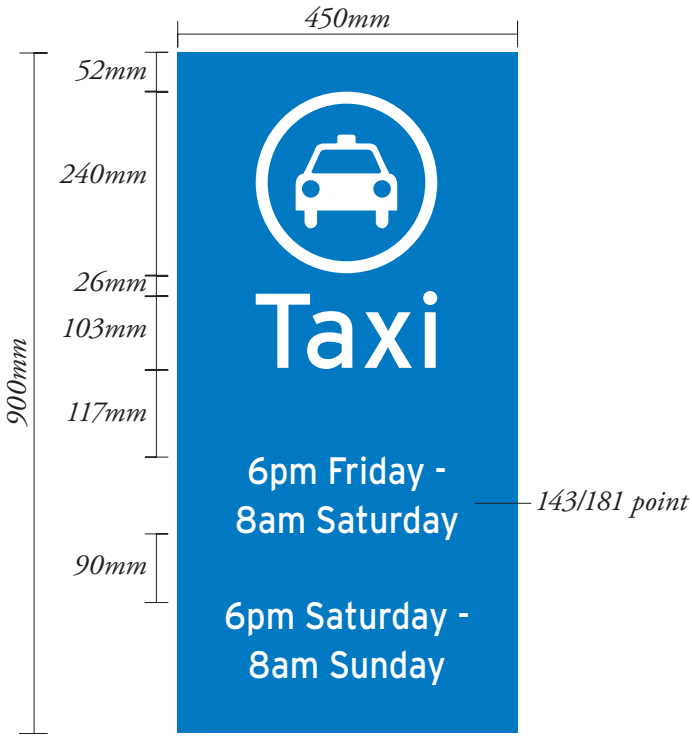

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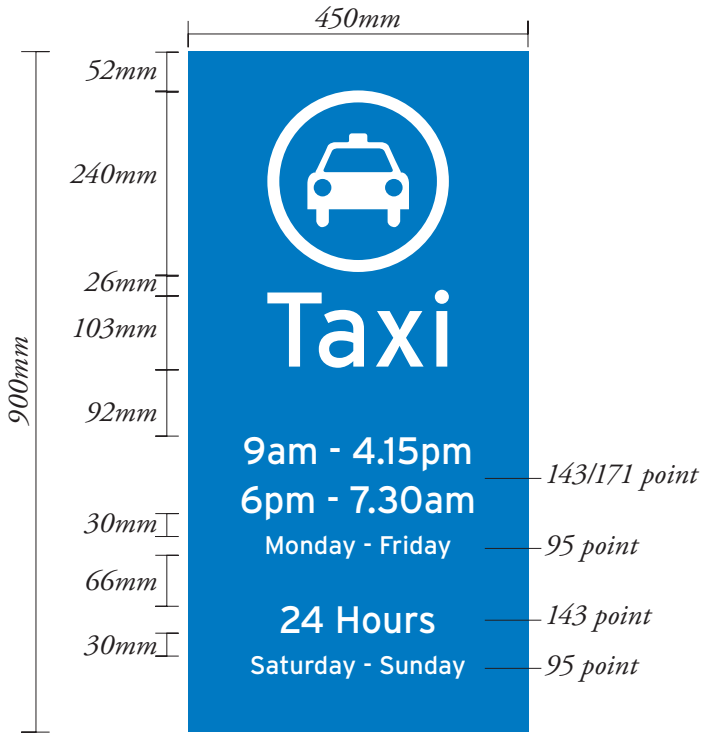

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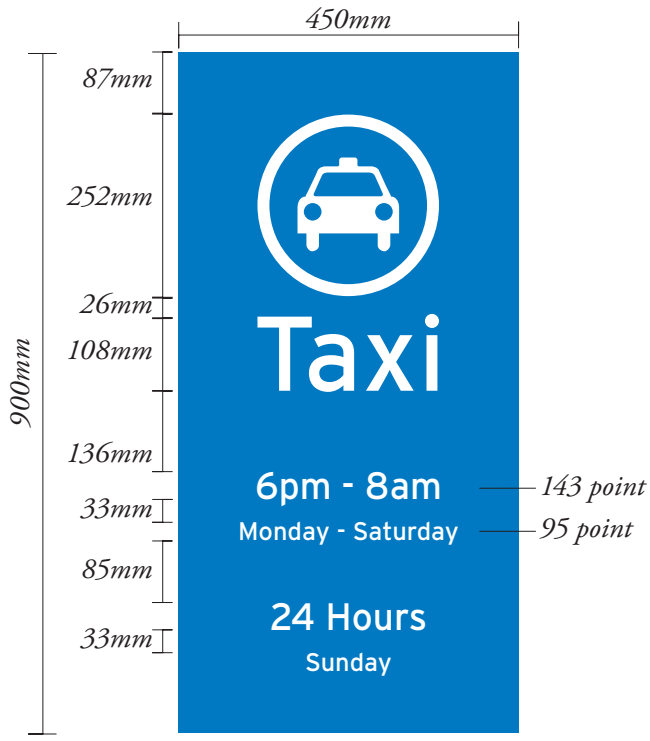
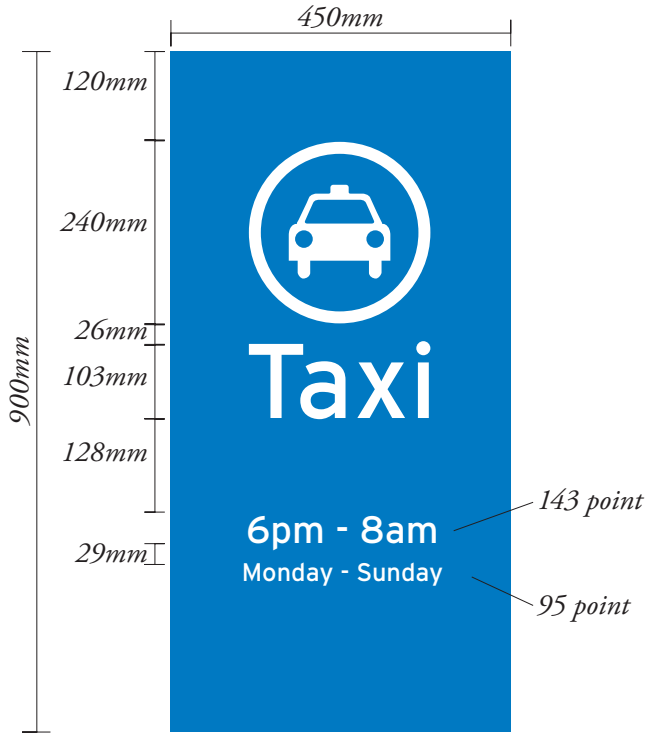


900MM (H) X 450MM (W)

Option 5



1.2 | Parking Sign

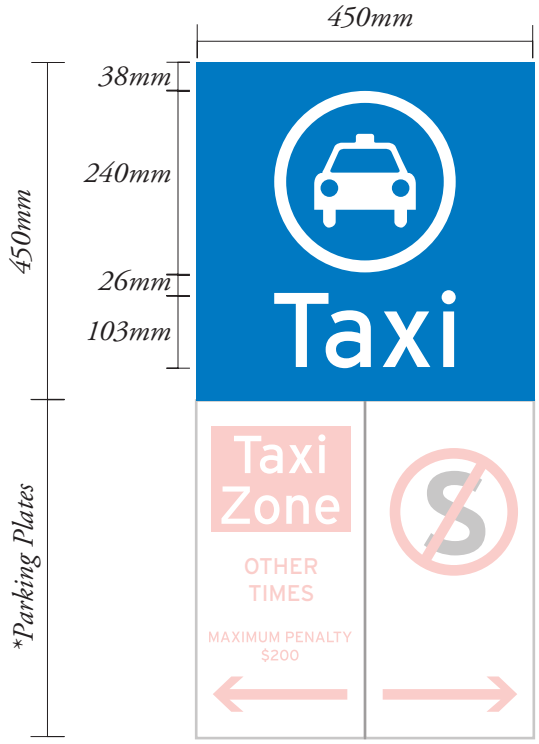
BASE SPECIFICATION

Graphic: White vinyl cut out on blue vinyl (Avery 709 Ocean Blue ref.2923891) adhered to sign plate

Sign plate: 3mm aluminum

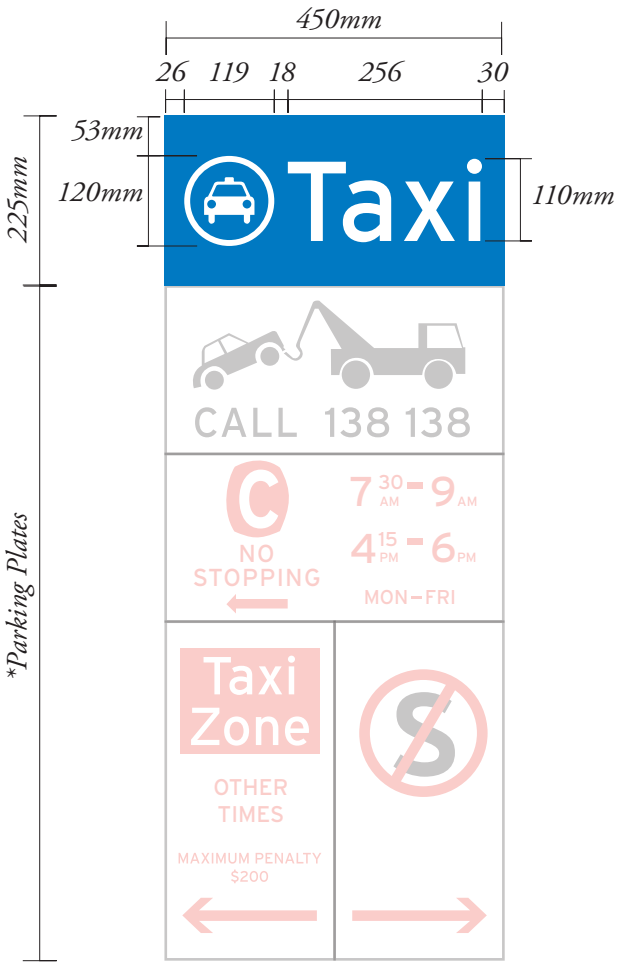
Font: Interstate Regular. Centre alignment.

450MM (H) X 450MM (W)



**For Parking Plate, please refer to the Australian Standards AS 1742.11 (Parking Controls).*

225MM (H) X 450MM (W)



*For Parking Plate, please refer to the Australian Standards AS 1742.11 (Parking Controls).

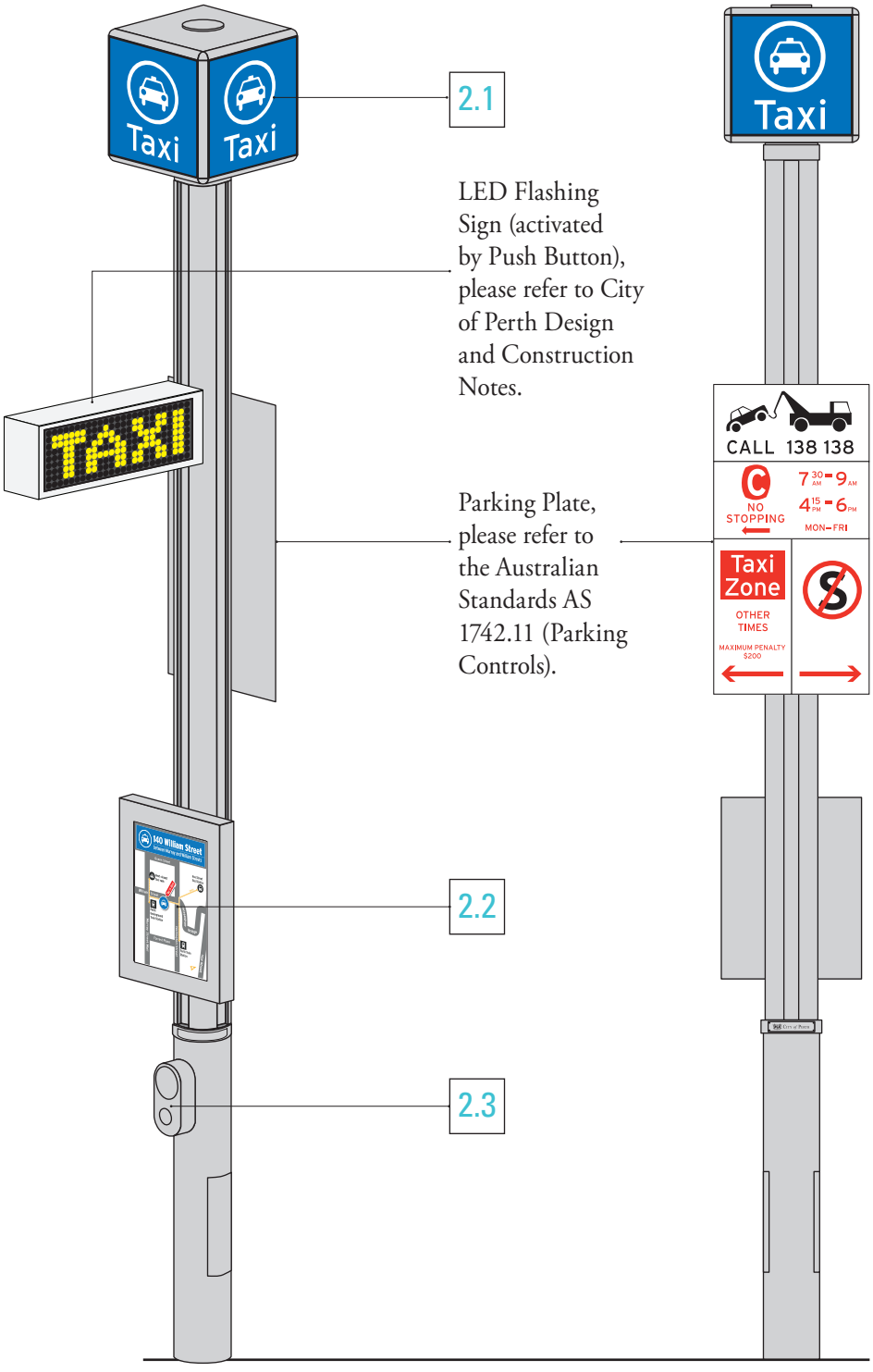
2 MULTIFUNCTIONAL POLE SIGN

2.1 ILLUMINATED TOP BOX SIGN

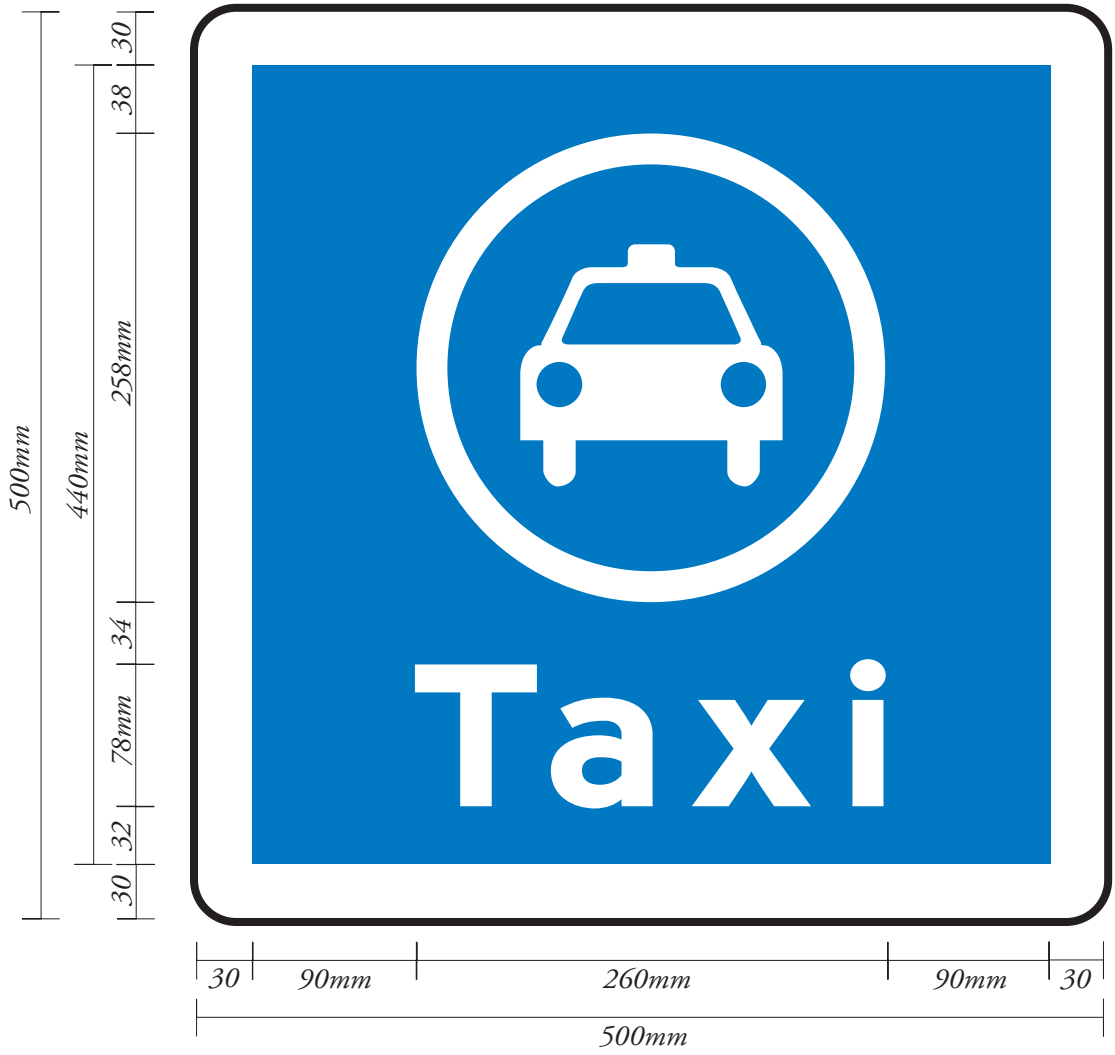
2.2. MAP

2.3. PUSH BOTTON

For sign installation and placement, refer to Taxi Rank Design Guide.



2.1 | Illuminated Top Box Sign



Material

Rotationally Moulded Polyethylene. Material can be sourced from MFP Systems Pty Ltd, phone: 0429 814 471

Paint

Masked and sprayed custom semi-clear base coat. This allows for graphic vinyl to adhere. Paint can be sourced from MFP Systems Pty Ltd, phone: 0429 814 471

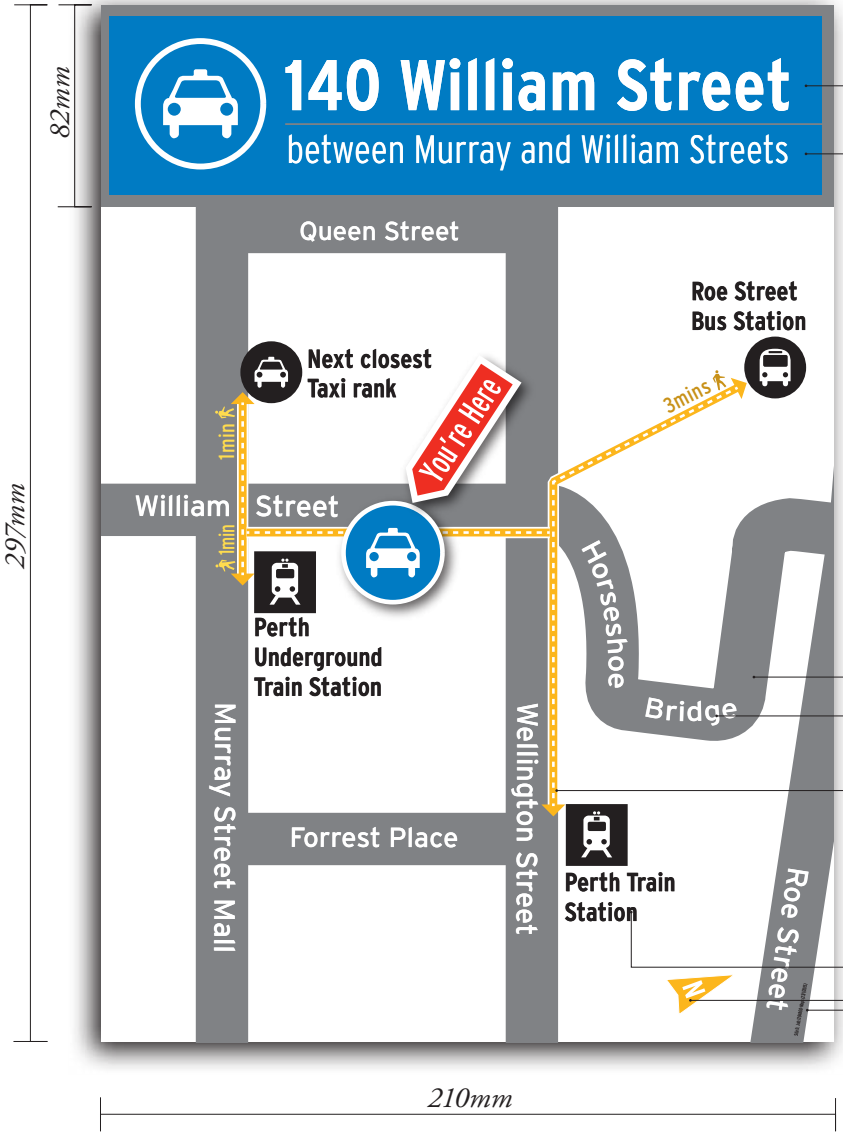
Graphic

Blue /White Translucent Vinyl. (Supplied by Signarama in Bankstown Phone: 02 9790 5511)

Main consultant

MFP Systems Pty Ltd, phone: 0429 814 471

2.2 | Map



Graphic: Digital print on vinyl

Size: A3. The content is limited to showing the location to the next nearest taxi stand and public transport landmark.

Name of map: Generally base on the street/road name the sign is located and the nearest building number.
Font: Interstate Bold Condensed
Size: 82 pt
Background fill: Pantone 300
Background stroke: 60% black,12pt

Location: Generally the nearest corner roads.
Font: Interstate Light Condensed
Size: 45.2 pt

Street/road:
Colour: 60% black
Stroke: 60pt
Font: Interstate Regular 30pt

Street/road name:
Font: Interstate Regular 30pt

Dotted arrow line: An indication the length of time taken to walk from the taxi stand to the closest public transport landmarks or next nearest taxi stand.
Stroke solid: 9pt Pantone 1235
Stroke dash: 3pt White

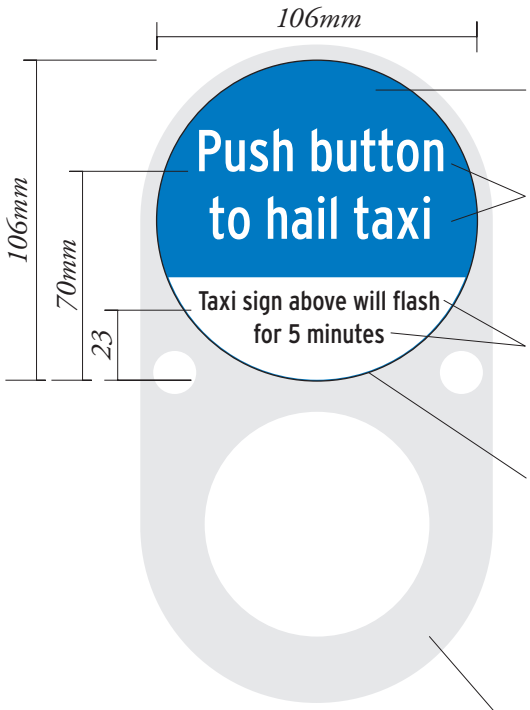
Transport landmark:
Colour: Black
Font: Interstate Bold Condensed
Size: 30/34 pt

Map orientation: The top of the map is always what is in front of the viewer looking at the map. Therefore north is not always straight up.

Map ID: This shows the map name, job number and date the map was created/modified.

Map symbols: Refer to section 4.1 of this document.

2.3 | Push Button



Colour: Matching to Pantone 300

Font: Interstate Regular Condensed
Size & Leading: 55/63 pts

Font: Interstate Regular Condensed
Size & Leading: 25/30 pts

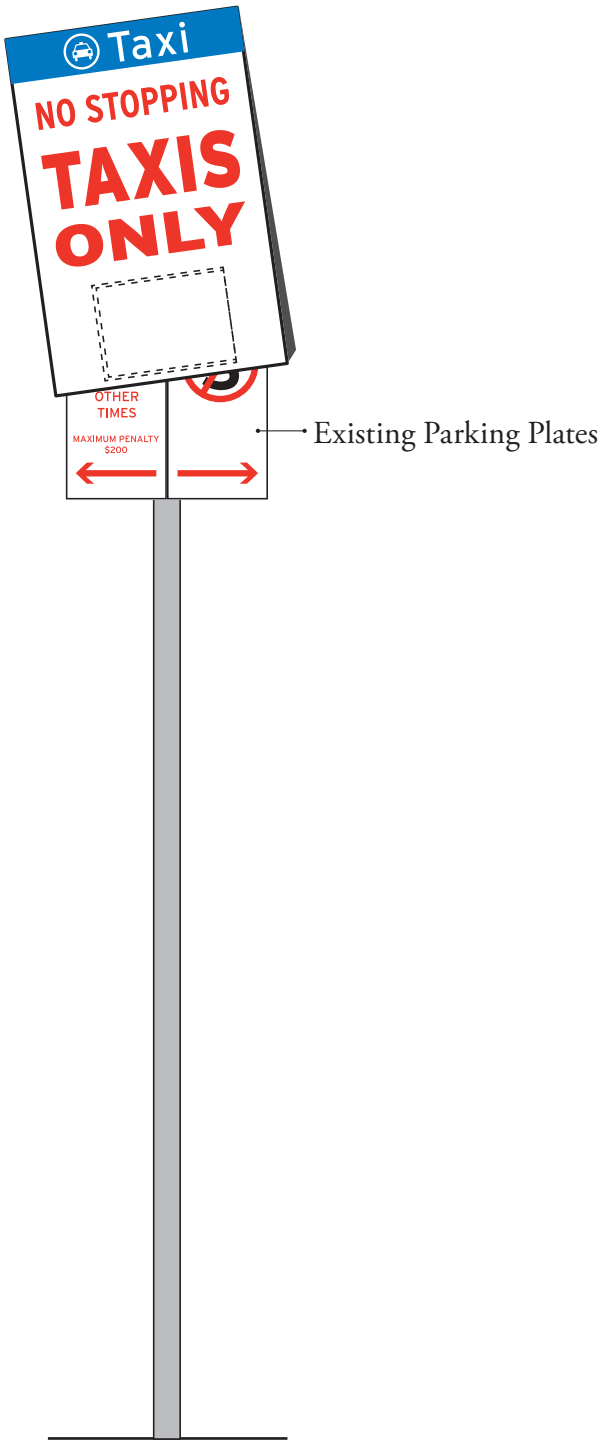
Graphic Text in circular piece:
Material: Aluminium disc 0.8mm thick
Blue background: Anodised Blue
White Lettering: Anodised in Clear
Black Lettering: Anodised Black

Housing:
Material: Aluminium Castings
(Supplied by Aldridge Traffic
Phone: 02 9736 3677)
Finish: Powder coating. 1st coat in silver and 2nd coat in clear

Main consultant
MFP Systems Pty Ltd, phone: 0429 814 471

3 TEMPORARY SIGN BAG

3.1 TAXI SIGN BAG



3.1 | Temporary Sign Bag

Screen printing
Colour: Match to Pantone 300

Screen printing
Colour: White

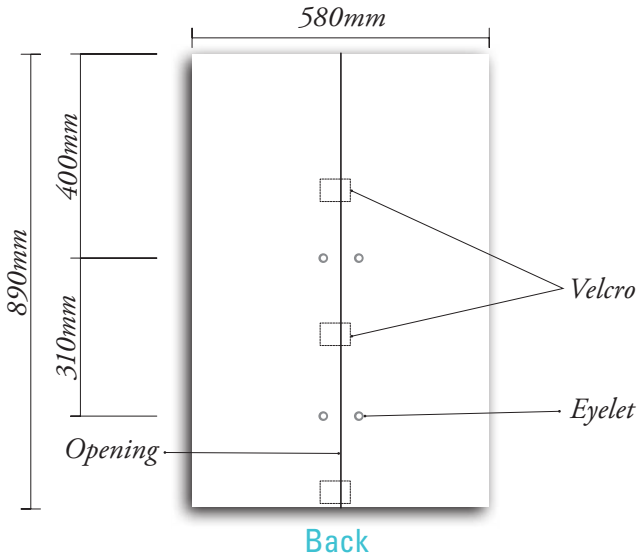
Screen printing
Colour: Match to Pantone 485
Font: Interstate Bold Condensed
Size: 270pt

Screen printing
Colour: Match to Pantone 485
Font: Interstate Black
Size: 620pt
Scale: 90% Verticle, 73% Horizontal

Screen printing
Colour: Match to Pantone 485
Font: Interstate Black
Size: 510pt
Scale: 80%

Plastic sleeve
(for A4 sheet parking information)
Outer size: 330mm x 240mm
Inner size: 320m x 225mm

Vinyl bag
Supplier: Trampoline Man
Phone: 9309 4737



Back

4 SYMBOLS

4.1 SYMBOLS: The following symbols can be extracted from this page.

Sign Symbols

Map Symbols

Taxi stand

Nearest taxi stand

Nearest train station

Nearest bus station

Location marker

Location marker

Walking

Walking Direction

North

Government of **Western Australia**
Department of **Transport**
On-demand Transport

Enquiries: Rick Roberts 92183648

Ms Caitlin Bell
Senior Urban Designer
Co-ordination and Design
City of Perth
Caitlin.Bell@cityofperth.wa.gov.au

Dear Ms Bell

TAXI RANK GUIDELINES

Thank you for your email dated 24 March 2016 regarding Taxi Rank Guidelines (Guide). I apologise for the delay in this response.

The Department of Transport (DoT) is supportive of the guidelines, which were formulated after extensive consultation with key stakeholders. DoT intends for the Guide to be adapted by other local governments to standardise the design and implementation of taxi ranks throughout Western Australia.

DoT welcomes consultation from the City of Perth on any review of the guidelines to maintain its currency. Although unable to commit to any ongoing funding, this can be reviewed on a project by project basis.

Thank you for the opportunity to comment.

Yours sincerely

Richard Roberts
A/Manager Industry Development
On-demand Transport
4/4/2016

20 Brown Street, East Perth WA 6001
Telephone (08) 9218 3648 Facsimile (08) 9218 3661 Richard.Roberts@transport.wa.gov.au
www.transport.wa.gov.au ABN 27 285 643 255

ITEM NO: 4

FUNDING FOR AN ADDITIONAL PURPOSE – FORREST PLACE WATER LABYRINTH DIGITAL SIGNAGE

RECOMMENDATION: ***(APPROVAL)***

That Council, in accordance with Part 6.8 (1a) of the Local Government Act 1995, approves by AN ABSOLUTE MAJORITY the amount of $50,000 (excluding GST) for the additional purpose of manufacturing two digital signs in Forrest Place, for the Water Labyrinth.

BACKGROUND:

FILE REFERENCE: P1007164-2
REPORTING UNIT: Marketing and Communications
RESPONSIBLE DIRECTORATE: Economic Development and Activation
DATE: 21 April 2016

Department of Health classified the Water Labyrinth in Forrest Place as a Class 4 Aquatic Facility in November 2014. The City of Perth Parks Unit has been issued a Certificate of Compliance in accordance with Regulation 15 (1) of the Health (Aquatic Facilities) Regulations 2007 and the Code of Practice for the Design, Construction, Operation, Management and Maintenance of Aquatic Facilities.

To ensure the City continues to operate in compliance with the code, certain conditions applicable to the public interacting with the Water Labyrinth need to be displayed at all times on signage. The signage must display advice as specified by the Department of Health including:

- Patrons not to drink the water;
- Directing patrons to the nearest drinking fountains;
- Directing patrons to the nearest public toilets;
- Advising patrons that babies and young children who ordinarily wear a nappy should wear an aqua nappy while using the water feature.

In addition, a risk assessment of the Water Labyrinth has identified that certain warnings and precautions are required to be displayed to mitigate the risk of injury, complaints and possible litigation against the City as a result of the public interacting with the Water Labyrinth. These include:

- Cautioning patrons that the area is slippery when wet;

- Advising patrons that there are risks associated with young children using water features and that carers must evaluate these risks before allowing children to participate;
- Children must be supervised by an adult at all times.

At present, temporary signage made of corflute displays the above guidelines to meet the Department of Health conditions. This signage needs replacing often and is not a sustainable option or visually attractive. Therefore permanent signage is required.

LEGISLATION / STRATEGIC PLAN / POLICY:

Integrated Planning and Reporting Framework Implications	**Strategic Community Plan** Council Four Year Priorities: Capable and Responsive Organisation. S18 Improve the customer focus of the organisation.

Policy
Policy No and Name: 9.1 – Budget Policies

DETAILS:

Benefits of Digital Signage

To improve the customer service standards the City provides, it is proposed the signage that is to display the required guidelines and conditions of use, is digital. This would provide the City with the opportunity to provide up to date and real-time information on the Water Labyrinth's operating times, planned outages (for events and/or maintenance) and can be used as a tool to communicate any unforeseen malfunctions in a timely manner directly to the users in Forrest Place.

Previously, the inability to target the users in Forrest Place on why the Water Labyrinth is not operating (whether it due to operating hours, scheduled events or unforeseen circumstances), has resulted in confusion, frustration and complaints. The digital signage would in turn reduce the number of complaints received by the City, particularly in summer, about the Water Labyrinth.

At present, this information is communicated to the public via the City of Perth website and on social media platforms and has minimal results in reaching those affected.

A secondary benefit of digital signage in Forrest Place is being able to promote and notify the public of upcoming events in the area. Using the signage as a marketing tool, in addition to its primary use will encourage visitors and city workers to return to the city for future planned events.

Design

Consultation has occurred with the Coordination and Design Unit with an agreed design for the digital signage being developed and discussed with potential suppliers. Initial quotes have been sourced from four suppliers for two proposed signage units (one to be positioned at the north end and one at the south end of Forrest Place, to best meet the objectives of the sign). Final quotes will need to be sourced once the project is approved.

Each sign would stand at approximately 2,100mm high and 850mm wide with a 55" LCD screen fitted in an enclosure, or casing. The casing would have a brush aluminium or high quality stainless steel finish, to complement the existing handrails and power outlet access doors in Forrest Place. The LCD screens will have software that will enable the Marketing and Communications Unit to control and update the content of the screens from the office, in real time. The screens have a 3 year guarantee; however the expected lifecycle of the digital signage is for many years with an expected annual maintenance spend to be negligible, as per advice from the manufacturer.

The casing is waterproof, treated to minimise glare, includes internal thermostat controlled fans to ensure no heat or condensation build up, key locks for theft deterrent and has specialised anti reflective and toughened glass that is resistant to scratches and chemical attack.

Under the draft revised City Planning Scheme (no2) Signs Policy, this signage is considered to be a ground based, small, animated sign located within the Retail Core Area of Forrest Place. The Policy states that animated content *"may be permitted on signs in public spaces within the Retail Core Area designed for people to linger for an extended period of time, where the content will add to the use and vibrancy of the area"* and that *"sign content that provides community information in public spaces within these areas is generally encouraged".*

FINANCIAL IMPLICATIONS:

ACCOUNT NO:	CW1957
BUDGET ITEM:	Cliff St / Mounts Bay Road
BUDGET PAGE NUMBER:	N/A
BUDGETED AMOUNT:	$50,000
AMOUNT SPENT TO DATE:	$0
PROPOSED COST:	$50,000
BALANCE:	$0
ANNUAL MAINTENANCE:	Negligible
ESTIMATED WHOLE OF LIFE COST:	$60,000

All figures quoted in this report are exclusive of GST.

Due to the changes experienced in the Economic Development and Activation Directorate as part of the organisational restructure, time constraints prevented the

additional funds being requested in the budget review before the deadline. Upon a late request of this, the advice given was to identify existing funds due the insignificant amount required for the project.

The Co-ordination and Design Unit have identified capital budget that is no longer required for the 2015/16 financial year, due to the Cliff Street / Mount Street upgrade project not proceeding in this financial year but being included for consideration in the upcoming 2016/17 Budget. Co-ordination and Design have agreed to provide $50,000 of this capital budget to the Water Labyrinth digital signage project.

No additional funds will be required for the electrical/fibre installation as this will be conducted by the City's network contractor and budgeted for by Information Services.

COMMENTS:

Digital signage has many benefits over a static ordinary sign and provides the City with the opportunity to improve on the customer service levels currently being offered to users of the Water Labyrinth. This aligns with the City's strategy of improving the customer focus of the organisation. Funds identified within the 2015/16 budget from Co-ordination and Design will fund this project and ensure Department of Health conditions are complied with, to reduce the risk of a temporary shutdown of the Water Labyrinth. A Gateways Project Brief and Status Workbook have been started for this project.