LIVERPOOL CITY COUNCIL

TREE MANAGEMENT TECHNICAL GUIDELINES

[DRAFT FOR PUBLIC EXHIBITION]
JUNE 2024

LIVERPOOL CITY COUNCIL

Document Control

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For further information

This strategy was produced by Arterra Design on behalf of Liverpool City Council's City Design and Public Domain Team within the Planning and Compliance Directorate.

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Front Cover Image: View looking west along Charlton Drive, Chipping Norton, Liverpool NSW. (Source: Arterra)

EXECUTIVE SUMMARY

Liverpool City Council recognises that trees are an important part of our natural and cultural landscape. We are committed to promoting and protecting these important assets. This Tree Management Technical Guideline is a vital part of our tree management commitment. It is a step towards maintaining and managing our trees in a professional, consistent and appropriate way.

Trees are an important part of urban environments. Although numerous, and often simply taken for granted, they are a vital part of our community's asset. They are also living organisms and subject to various external influences and lifespans. They are represented by a large variety of sizes and species. They exist in a variety of locations and contexts; from private property, public streets, parkland, commercial developments and other government controlled lands. In natural settings and forests, trees can often be left to grow, mature and die with little or no human intervention. In more urban settings, however, our trees often require more specific management techniques and considerations. This document outlines Council's intentions and protocols to manage our tree resource, both public and private, in a proactive, professional way and wherever possible following established and evolving 'best-practice' tree care.

Council is mindful that the significant green infrastructure of our area are some of the most defining and precious elements of the urban landscape. We must continue to expand, protect, manage and replace our trees in order to pass on a legacy for the enjoyment and benefit of present and future generations.

Image: Woodwood Park adjoining Hoxton Park Rd, Liverpool NSW. (Source : Arterra)

"Rich in nature, rich in opportunity, creating community; our place to share and grow."

Acknowledgment of Country

We would like to acknowledge the Cabrogal Clan of the Darug Nation who are the traditional custodians of the land that now reside within Liverpool City Council's boundaries. We acknowledge that this land was also accessed by peoples of the Dhurawal and Darug Nations.

Background Image: Indigenous artwork in the former Liverpool City Library forecourt, Liverpool NSW. (Source: Liverpool City Council)

TABLE OF CONTENTS

This section of the Guidelines establishes the context and importance of trees within the Liverpool City Council area. It outlines their benefits, why we need to manage them as valuable assets and the general context of this document with regard to other relevant Council and government policies.

1.0 INTRODUCTION

1.0 INTRODUCTION

1.1 Purpose of the Guidelines

The purpose of the Technical Guidelines is to provide documented and standardised processes that ensure consistency in our ongoing protection, management and maintenance of all urban trees within Liverpool City Council Local Government Area (Liverpool LGA).

Trees are one of Council's most significant assets. This document, together with our overarching Tree Policy and Tree Management Strategy, will ensure that we:

- Recognise that our existing trees are important natural assets that create many benefits.
- Establish our commitment and future strategic directions for the expansion, planting, protection, management and ongoing maintenance of our tree resource.
- Document our normal tree management and maintenance practices based on best industry practice.
- Provide a framework for consistent decision making, documentation and standardise our processes and policies.
- Recognise that some trees can have especially important natural heritage or cultural heritage significance that warrant enhanced protection and management.

When we care for our lands, and care about something no matter how small, it often contributes to the health of the whole. We need to acknowledge that we are all just a small part of something much bigger. We may plant the seeds, others will water and tend to those young seedlings, so that eventually others may stand under a tree and benefit from its shade and beauty.

When we plant trees and take responsibility for tending them while they grow, we contribute to the health of the wider environment by providing shelter, shade, food or habitat for animals, insects, birds, and ourselves. If each of us works to ensure the success of one plant, one tree, one animal, one small part of the landscape, then the 'whole' can flourish.

Figure 1: Trees are an extremely valuable part of our urban environments. This photo illustrates a wonderfully shaded walkway in Dunumbral Park, Cecil Hills, making Liverpool a more liveable and enjoyable place to reside, work and play. (Source:Arterra)

1.2 Introduction
Purpose and Scope of the Guidelines

1.2 Scope of the Guidelines

The scope of this Guideline covers all trees under the direct management and control of Liverpool City Council. It also provides overarching guidance and direction for the management of trees that are privately owned or managed within the City, to the extent that it can apply.

This document is not intended to cover or inform activities such as native bushland regeneration or bushland management. Nor is it intended to directly control tree management practices for areas under the control of utilities providers, or other statutory or government bodies.

Tree management in these other areas will primarily be the responsibility of the relevant land manager, however, the principles contained within this document shall still be considered the basic standard and framework for tree management activities.

There are entire text books written about tree management. It is unrealistic for this guide to cover all elements and potential eventualities that surround tree management in a complex urban setting. It is designed to simply and succinctly outline Council's key principles, activities and requirements within our normally expected tree management and maintenance regime. It is also designed to provide guidance and education regarding the myriad of activities that are required to maintain these complex and living assets.

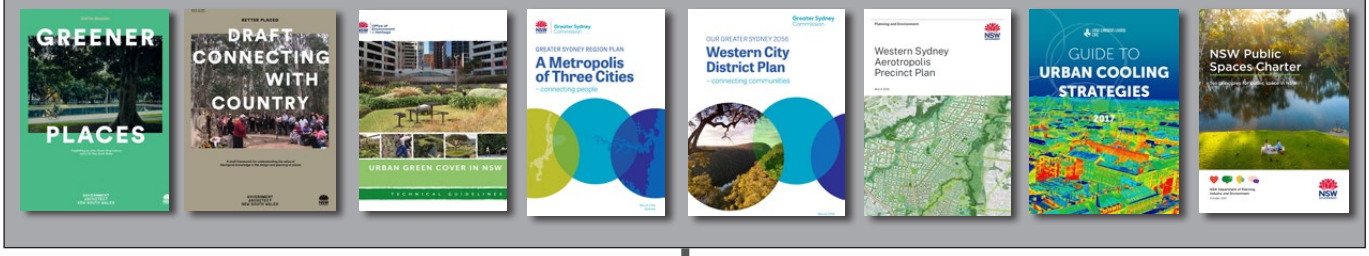
If a tree is well planned for, well selected, well planted and well established in its early years, in theory, it should require only minimal ongoing interventions. Every tree however, will have a finite lifespan and at some point may need to be managed or removed.

Obviously not every tree within the Liverpool LGA has had the benefit of excellent planning, selection and planting methods. Therefore, we also need to manage trees that exist within our area that may not be well positioned or the most appropriate species. We must always remind ourselves that trees are living things and sometimes factors well outside of anyone's control may also impact upon trees and require intervention.

Figure 2: Trees are an extremely valuable part of our urban environments. This photo illustrates a Smooth-bark Apple (***Angophora costata***) growing in Horningsea Park, making a valuable contribution to the streetscape, shade and canopy cover. (Source:Arterra)

1.3 Introduction
Context and Framework

OVERARCHING STRATEGIC POLICIES



COMMUNITY STRATEGIC PLAN (2022-2032) / OUR HOME, LIVERPOOL 2027

SOCIAL	ENVIRONMENT	ECONOMIC	CIVIC LEADERSHIP
Healthy Inclusive Engaging	Liveable Sustainable Resilient	Evolving Prosperous Innovative	Visionary Leading Responsible

OTHER CONTROLS AND CONSIDERATIONS

FEDERAL LEGISLATION
- Environment Protection and Biodiversity Conservation Act 1999

NSW LEGISLATION & PLANNING
- NSW Environmental Planning & Assessment Act 1979
- NSW Biodiversity Conservation Act 2016
- NSW Heritage Act 1977
- NSW Roads Act 1993
- NSW Rural Fire Service Amendment (Vegetation Clearing) Act 2014
- NSW Trees (Disputes Between Neighbours) Act 2006
- Western Parkland City SEPP 2021 (NSW)
- SEPP (Biodiversity and Conservation) 2021

COUNCIL PLANNING CONTROLS
- Local Environment Plan 2008
- Liverpool DCP 2008
- Liverpool City Centre Public Domain Master Plan 2020
- Edmondson Park South DCP 2012
- Western Sydney Aerotropolis DCP 2022
- Growth Centres Precinct DCP 2021
- Recreation, Open Space and Sports Strategy 2018-2028
- Liverpool Climate Policy 2023

AUSTRALIAN STANDARDS
- AS4373-2007 Pruning of Amenity Trees
- AS4970-2009 Protection of Trees on Development Sites

INDUSTRY STANDARDS AND GUIDES
- WSROC Urban Heat Toolkit
- Arboriculture Australia - Minimum Industry Standards (MIS)
- QTRA - Quantified Tree Risk Assessment
- TRAQ - Tree Risk Assessment Qualification
- VALID - Tree Risk Assessment Protocol

LIVERPOOL'S TREE MANAGEMENT FRAMEWORK

TREE POLICY

Establishment of the overarching principles and framework for the implementation of Council's tree management

TREE MANAGEMENT STRATEGY

Detailed outline of Council's tree management vision and objectives including establishment of strategic directions required to fulfil the policy principles, including canopy coverage targets, tree risk management, tree planting, tree maintenance, implementation and community engagement

TREE MANAGEMENT TECHNICAL GUIDELINES

Detailed requirements, procedures and standard specifications to be applied around the management of trees within the Liverpool local government area. Specifically outlines tree:-
- Protection and Preservation
- Planting and Selection
- Best Practice Management and Maintenance

1.3 Introduction
Context and Framework

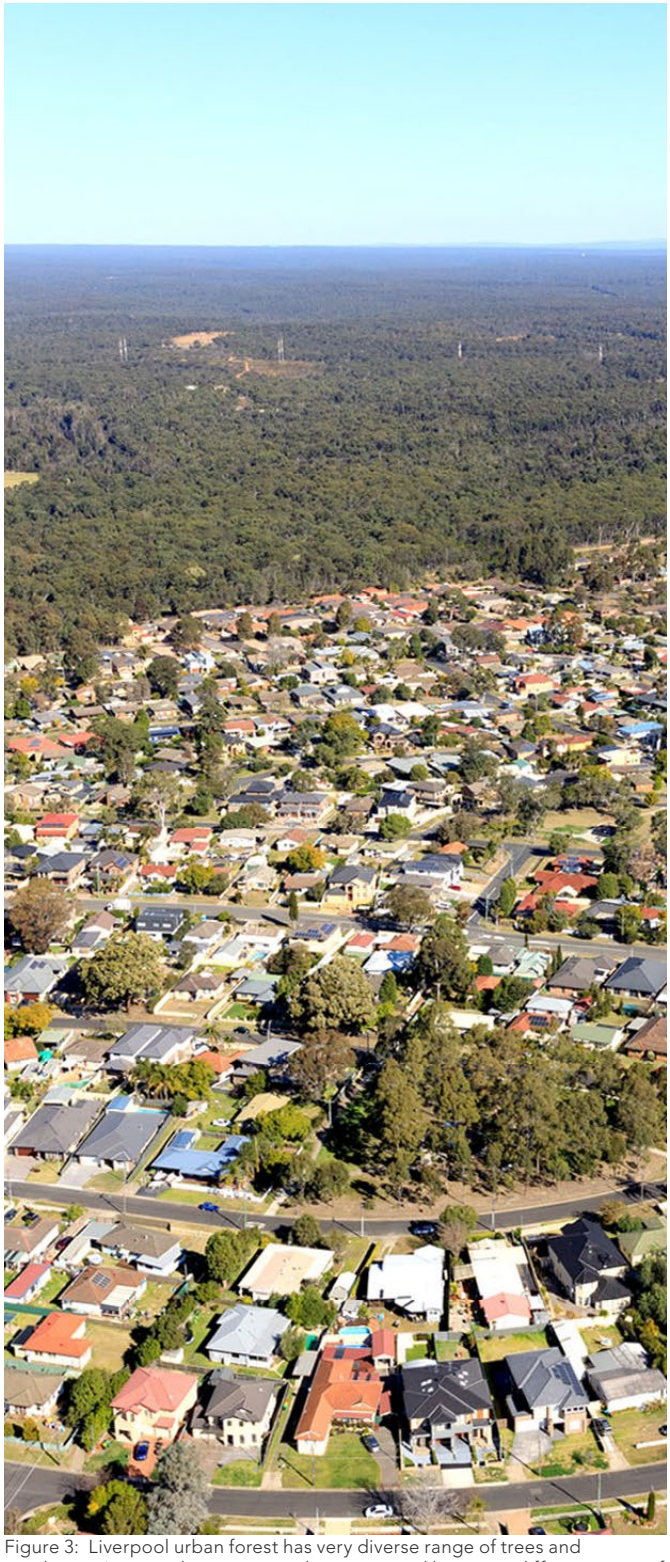


Figure 3: Liverpool urban forest has very diverse range of trees and conditions. Liverpool covers a very large area and has many differing types of land uses. At present we are also blessed with some large areas of bushland and native vegetation. (Source: Liverpool City Council)

1.3 Context and Framework

These Guidelines form a critical part of the Liverpool City Council Tree Management documents that provide the necessary tools to effectively manage trees in our area. The primary documents comprise Council's:

- Tree Policy
- Tree Management Strategy
- Tree Management Technical Guidelines

The Liverpool City Council Tree Management Guidelines have been considered in relation to many other existing and draft Council documents, as well as other government policies that will influence the future directions and outcomes of tree management and development in our area. This has included documents such as:

- Liverpool City Council Community Strategic Plan 2022-2032
- Liverpool City Council Our Home, Liverpool 2027 (Community Strategic Plan Update Developed in 2017)
- Liverpool City Council Local Environmental Plan 2008
- Liverpool City Council Development Control Plan 2008
- Liverpool City Centre Public Domain Master Plan 2020
- Liverpool City Council Recreation, Open Space and Sports Strategy 2018-2028
- Liverpool City Council Liverpool's Biodiversity 2019
- Liverpool City Council Liverpool Bike Plan 2018
- Western City District Plan — Our Greater Sydney 2056 (updated 2018)
- Western Sydney City Deal — Smart Cities Plan
- A Metropolis of Three Cities — Greater Sydney Regional Plan
- Clean Air and Urban Landscapes Hub - Cities for People and Nature (2020)
- NSW Government Architects Office –(Draft) Greener Places (Oct 2017)
- NSW Government Architects Office -The Green Grid-creating Sydney's open space network
- Low Carbon Living CRC – Guide to Urban Cooling Strategies (July 2017)
- National Green Infrastructure Network-Urban Ecology : Theory Policy and Practice in NSW (May 2017)
- The Nature Conservancy Washington – Outside our Doors (2016)
- The Nature Conservancy Washington – Planting Healthy Air (2016)
- NSW Department of Planning, Industry and Environment, NSW Public Spaces Charter (October 2022)
- Committee for Sydney Nature Positive Sydney - Valuing Sydney's Living Infrastructure (February 2023)
- WSROC - Urban Heat Planning Toolkit (2021)

1.3 Introduction
Context and Framework

Figure 4: Liverpool urban forest has very diverse range of trees and conditions from our CBD, parklands, low density residential development through to some extensive industrial and warehouse areas. (Source: Liverpool City Council)

Many of these documents have very compatible objectives and complement this Guideline. Likewise the implementation of many of the objectives and strategies contained in the Tree Management Strategy and this Guideline will enhance the realisation of these other policies, particularly by:

- Increasing planting opportunities within the City;
- Increasing the canopy coverage of the City;
- Reinforcing the primary green and habitat corridors within the City;
- Increasing and promoting the use of native tree species.

This document is broken into three main sections which focus on the most important tree management issues, being:

- Protection and preservation of our existing trees.
- New tree planting, their selection and their establishment.
- Tree risk management, routine maintenance and tree removals.

This document provides the framework for tree management to be applied consistently to our 'typical' operational requirements. The vast majority of situations will be broadly covered, however, should the specific circumstances of a particular tree, design project, capital works project or event not be adequately addressed, it remains the responsibility of the relevant project leader (design, operations or event) to seek adequate clarification before any work is undertaken in the vicinity of trees.

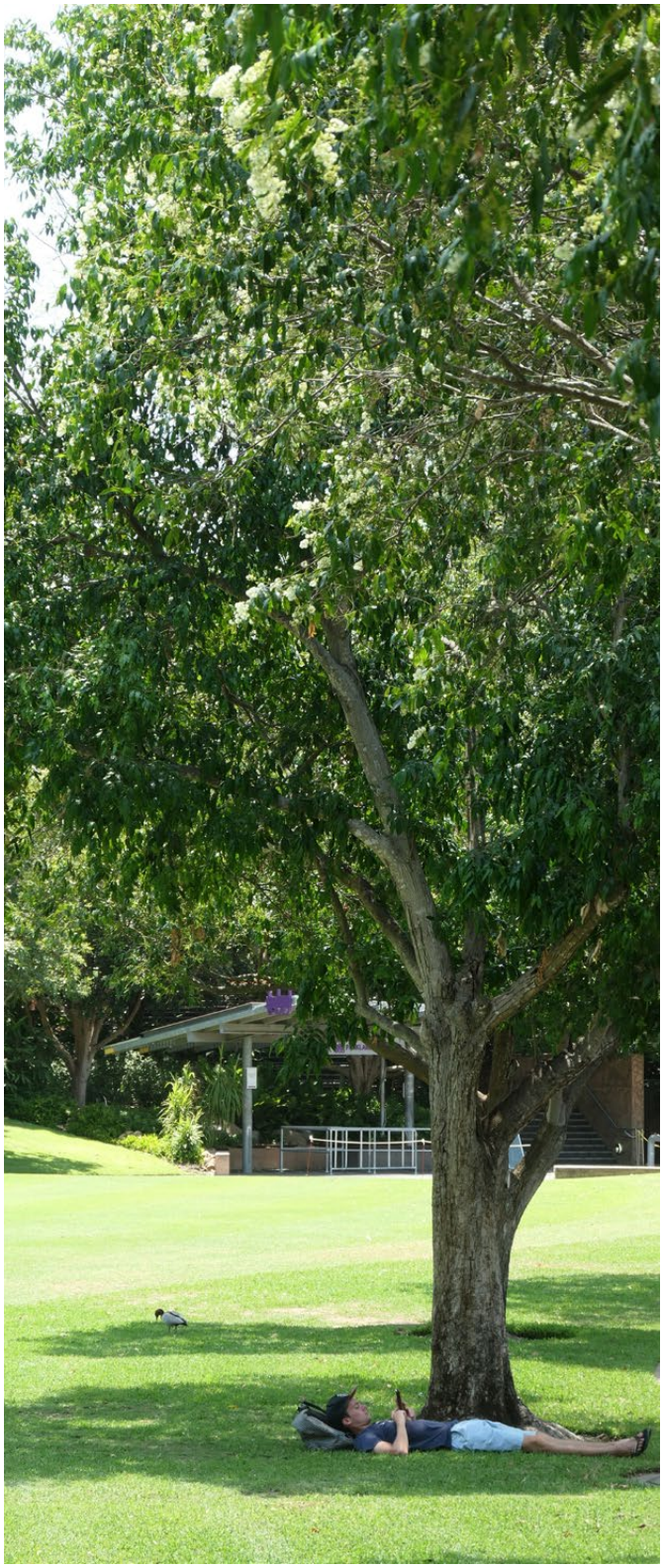


Figure 5: Trees and shade are more than just beautiful things. It is now recognised that they are vital for economic outcomes, social and environmental benefits as well as our health and well-being (Source: Arterra)

1.4 Introduction
Tree Management Objectives

1.4 Tree Management Objectives

The following tree management objectives have been formulated and are outlined in detail in our Tree Policy and Tree Management Strategy. These objectives are specifically aimed at trees located in actively used parks, streets and other urban settings. They do not specifically relate to natural bushland or agricultural areas. Trees in these areas are more appropriately managed under biodiversity and bushland provisions in the relevant legislation.

The primary tree management objectives outlined by this Guideline are to:

- Proactively and properly protect and maintain our current tree assets.
- Conserve and enhance the historical, natural and cultural values of Liverpool.
- Ensure new trees are installed with the proper planning, selection, best-practice planting and establishment methods.
- Manage and maintain our trees, within intensively used areas, so that tree related risks are maintained at acceptable levels.
- Develop and maintain accurate records of our trees and canopy coverage to properly inform future management decisions and the future planning of all tree related resources.
- Educate and inform all staff, contractors, event organisers and the general community about the value of the tree resource and how it should be enhanced, maintained and protected.
- Selectively and appropriately remove existing trees that are inappropriately positioned or that are negatively impacting on natural, cultural, heritage, or scenic qualities of our area.
- Recognise that our existing remnant, and newly planted trees, can greatly enhance the biodiversity and wildlife habitats within our area and wider Sydney.

Figure 6: Liverpool has a wide diversity of trees to manage from magnificent endemic trees like this Grey Box (*Eucalyptus molucanna*) through to much smaller and non-native urban trees. (Source: Arterra)

Figure 7: Trees should be seen as an integral and important part of all developments and adequately catered for from the start of the design process. (Source: Arterra)

1.5 Introduction
Tree Benefits

Figure 8: Trees have numerous social, economic, environmental and human well-being benefits (Source: Arterra)

1.5 Tree Benefits

Trees are generally considered valuable by most people and can be important heritage and natural assets. Trees provide many social, economic and environmental benefits. They provide links to our natural and cultural heritage, beautify, soften and define outdoor 'rooms', provide wildlife habitat, provide shade to our play areas and other passive recreation spaces and play a significant role in determining the overall character of our City.

Some examples of the numerous direct and indirect benefits of trees and urban greening include:

- Reducing the urban heat island effect and moderation of other weather extremes and winds.
- Providing cooling and shading to pedestrians and buildings.
- Lowering energy use (due to the above).
- Increasing longevity of pavements and road surfaces due to shading.
- Shading of parked cars and reduction in hydrocarbon emissions.
- Storage of carbon dioxide.
- Interception and storage of rainwater and stormwater via leaves and roots.
- Filtering of particulate matter and polluting gases.
- Ameliorating wind.
- Production of atmospheric oxygen and uptake of carbon dioxide.
- Provision of habitat for native fauna, birds and insects.
- General human health, calming and wellbeing.

On this last point, Australia has one of the highest urbanised populations in the world, with around 90 per cent already living in cities and large towns and it's increasing. Higher density living comes with many challenges and impacts on our health and well-being.

There is no greater good that can be done for promoting our health than the protection and enhancement of greenery on which all humans depend (Coutts, C. and Hahn M. 2015). This is especially for mental health. As outlined by the World Health Organisation, "good mental health enables people to realise their potential, cope with the normal stresses of life, work productively and contribute to their communities". Simply being in, nearby, or with a view of green spaces may help build mental health capacity, contribute to our ability to restore depleted cognitive capacities, enhance recovery from stress and increase our optimism. We also prefer to seek out greenery that has a higher density of tree canopy cover rather than simple spaces such as large grassed areas. (Astell-Burt, T., 2019)

The World Health Organisation calls 'stress' the health epidemic of the twenty first century. Mental ill health and suicide are costing Australia up to $180 billion a year (the Productivity Commission found in October 2019). Anxiety and depression are estimated to cost the European Union €170 billion a year and in the USA over $210 billion.

Finding a way to manage this is critical to our health and wellbeing and trees and other greenery can help immensely.

1.5 Introduction
Tree Benefits

A 2019 Australian longitudinal study titled 'Association of Urban Green Space with Mental Health and General Health Among Adults in Australia' by Prof Astell-Burt and Dr Feng found that urban communities with an adequate amount of tree cover - not just grass and green space - were psychologically healthier than those that didn't.

In neighbourhoods with a **tree canopy of 30 per cent or more**, adults had 31 per cent lower odds of developing psychological distress, and 33 per cent lower odds of rating their general health as fair or poor over six years. Urban green spaces with open grass, rather than a tree canopy, did not deliver the same benefits. This research, which focused on Sydney, Newcastle and Wollongong, helps provide a solid target to work towards to provide the community with tangible psychologically health outcomes.

Importantly, there are many other health benefits associated with urban greenery, such as reductions in cardiovascular disease, lower skin cancer rates, and 22 per cent lower odds of insufficient sleep.

Urban greening also has massive benefits for our urban areas connectivity and walkability. Walking and cycling are important benchmarks for a liveable city. High levels of walking mean a city is safe, vibrant and easily accessible by everyone.

Another pressing challenge is urban air quality. In most cities, the most damaging air pollutant is particulate matter. Fine particulate matter (less than 2.5 microns in diameter) can be deeply inhaled into our lungs and is estimated to cause 3.2 million deaths per year primarily from strokes and heart disease. It also contributes to chronic and acute respiratory diseases, including asthma. One study forecasts that by 2050, fine particulate matter could kill 6.2 million people per year world-wide. (The Nature Conservancy, 2016).

Trees and urban greening therefore play an important role in making our air healthier, too. Dozens of studies now show that the leaves of trees filter out particulate matter from the atmosphere, along with absorbing many other air pollutants. Air pollution has been found to be often worsened by excessive heat, which in turn, causes increased chemical reactions to occur with other volatile organic compounds. Ground level ozone concentrations are found to radically increase as ambient temperatures increase.

Finally, quality shade provision can also reduce exposure to damaging ultra violet light (UV) by up to 75 per cent. This can be provided by either built 'shade-giving' structures or trees, but trees also produce numerous other benefits.

Figure 9: We naturally prefer to seek out quality green space that has a higher density of tree canopy cover rather than simple spaces such as large grassed areas that provide little diversity or complexity. Areas with more than 30% tree canopy cover have substantial benefits to our health and well-being as well as addressing urban heat. (Source: Arterra)

1.6 Introduction
Tree Costs and Liabilities

Figure 10: Although trees have substantial benefits, trees that are poorly planned or the wrong size and shape for the spaces provided can actually detract from our environments and ultimately represent a cost and liability to Council and the community generally. (Source: Arterra)

Figure 11: Insufficient preparation of planting areas and lack of the provision of soil volume for adequate tree growth is one of the leading causes of longer term costs and liabilities for the community and should be better addressed as part of Council's Tree Management Strategy and guidelines moving forward to help minimise longer term issues and liabilities. (Source: Arterra)

1.6 Introduction
Tree Costs and Liabilities

1.6 Tree Costs and Liabilities

While trees play a vital role in our urban landscapes, we also recognise that trees of the wrong type, in poor condition or growing in the wrong place, can create problems and risks that may not be considered tolerable. We have certain obligations with respect to the protection of trees, and also responsibilities to manage tree risks and other liabilities.

Tree management in Liverpool requires a delicate balance between all the various tree related liabilities (financial and otherwise) and the many benefits that trees provide. Our aim is to provide the best possible outcomes in terms of the preservation of heritage, environmental stewardship and the provision of safe, functional, accessible, sustainable and aesthetically pleasing public streets and recreation facilities.

We also need to consider that new trees are very costly to purchase, install and maintain, typically taking many years to grow large enough to provide all the benefits associated with a large, healthy, well established tree.

Tree planting requires very careful planning, and implementation to realise the greatest ongoing benefits. Poor planning, planting in the wrong position, poor planting area preparation, poor quality nursery stock and inappropriate establishment maintenance can all give rise to substandard trees. This can result in increased costs during ongoing maintenance or premature tree failure and replacement. All of this can result in wasted time, money and other resources.

Some of the issues we must consider when managing our trees or planning for new tree planting include:

- Are the species and location appropriate in the environmental and cultural context?
- Are the trees causing, or likely to cause, significant impacts to surrounding infrastructure? Appropriate physical offsets should be provided to minimise likely tree related impacts to buildings, shelters and other assets such as play equipment, lighting, pathways, roads, drainage, signage, and fences etc.
- Consideration of amenity, health and safety. Is the species appropriate to the location? Does it unacceptably contribute to slip, trip, or fall hazards? Does it unreasonably contribute to known irritant or allergen issues? Does it provide appropriate sight lines for passive surveillance or create unwanted screening that may facilitate or hide antisocial or undesirable behaviour?
- Is the species a recognised weed or a potentially invasive species? Is the tree appropriate to the natural or heritage context of the location? Should it be retained or removed for environmental reasons? Heritage contexts and environmental issues sometimes require a very delicate balance.

Figure 12: Any tree has the potential to fail. They are living things and never stronger than the intrinsic properties of the wood that make them up structurally. Most failures are related to extreme weather. Some tree defects can be observed and suitable actions taken to limit risks from tree failures to acceptable levels using a recognised system of assessment. The removal of all risk, however is unreasonable as we all accept some level of risk when we go about our daily lives, in return for the benefits and enjoyment provided. The reality is that trees can and may fail but seldom is anyone injured. (Source: Arterra)

This section of the Guidelines establishes the requirements and procedures Council will apply to help retain and protect our existing trees.

2.0 TREE PRESERVATION

2.0 TREE PRESERVATION

2.1 Overview

Tree preservation, protection and management are very critical components within the overall management of Liverpool's natural and urban environment:

- To ensure the health and well being of our community
- To mitigate urban heat and adapt to a changing climate
- To ensure the protection and preservation of our existing and substantial natural and cultural heritage.
- To protect and enhance our natural ecosystems.
- To protect and enhance Liverpool's aesthetic appeal.

2.2 General Definitions & Guidance

What is a tree?

All trees within the Liverpool Local Government Area are important, and need to be considered, as they contribute directly to our natural, aesthetic or heritage assets.

The intent of this document, is to specifically address what is considered a 'tree', as defined by our Tree Policy. A 'tree' for the purposes of our documents is typically defined as:

A woody perennial plant greater than 5m tall and with a trunk diameter of at least 140mm when measured at a height of 1.4m above the ground or a canopy spread greater than 4m.

Clearing of vegetation, as it relates to urban trees, is covered under numerous items of legislation as well as Councils' own requirements. Figure 14 provides an overview of tree management and vegetation controls and the processes that may usually be involved in applications to prune or remove a tree. Other plants and vegetation shall typically be dealt with under other general landscape controls or bushland management provisions. **We note that all vegetation on public land is protected regardless of size or species.**

Figure 13: Council wish to manage all our tree assets in accordance with best practice. This includes a large variety of trees and settings, from our urban trees right through to roadside and other trees in the more rural areas of our LGA. (Source: Arterra)

2.2 Tree Preservation
General Definitions and Guidance

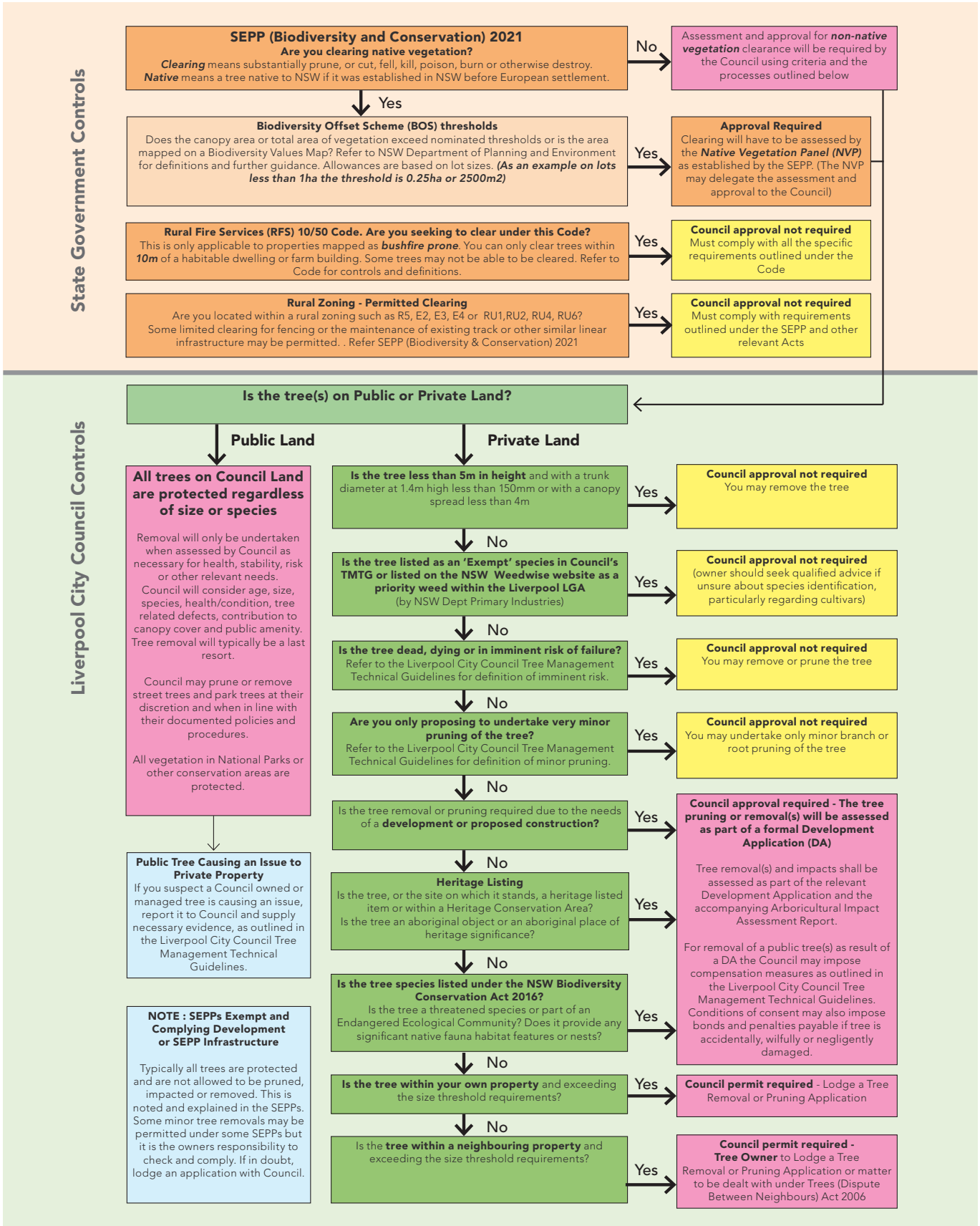


Figure 14: Clearing and Approval Guidance - Diagram illustrating the typical controls and process for trees within our LGA. (Source: Arterra)

2.2 Tree Preservation
General Definitions and Guidance

Endemic, native, or exotic trees?

Species diversity is a critical component in managing a sustainable urban forest. The wider the range of botanical species and families, the lower the likelihood of canopy cover degradation and catastrophic losses in the event of unexpected pest and disease outbreak, or from critical impacts such as a changing, warming climate or extended droughts. Increased diversity also helps to support more diversity of fauna, by providing a variety of food and habitat throughout different times of the year.

While we will often favour the planting of species naturally occurring within our local area, it is important to recognise the vital role that trees from the wider Sydney basin, east coast Australia, and even further afield, can play, in providing a broader range of forms and ability to thrive in a broader range of conditions.

There is often much debate about the use of locally indigenous (often called endemic) tree species. Whilst locally indigenous species may be the most appropriate for some local environmental conditions and projects, the growing conditions within many of our more intensive urban environment are often very different from where such trees would naturally grow. The soils and hydrology are often radically altered, they are often surrounded by pavements and the trees need to work within urban conditions and acceptable ongoing maintenance regimes.

Figure 15: Not all trees are the same and many have specific characteristics that make them better for urban areas. Trees such as this Weeping Lilly Pilly (*Waterhousea floribunda*) provide many benefits and particularly good levels of shade and will continue to cool our air and transpire during heatwaves. (Source: Arterra)

While we acknowledge that the natural vegetation assemblage in this part of Sydney would have been primarily open forests, and grassy woodlands, many of the species that grew in such communities would not greatly contribute to our wider urban forest goals. They would not always relate well to the new built forms or the streets. Disturbed soil profiles, soil compaction, higher nutrient status, altered drainage patterns and paved surfaces are just a few of the problems with which our urban trees must contend, and many endemic trees are not well adapted to deal with such environments.

When addressing this issue, a more useful division may be to view species origin and suitability in three categories:

- locally indigenous (or endemic) natives;
- natives from other parts of wider Sydney or Australia; and
- exotic species from other areas of the world.

Local natives have the advantage of being climatically suited and live in some degree of equilibrium with natural pest organisms such as insects and fungi. Use of local natives promotes biodiversity and the creation of wildlife corridors, reinforces an 'Australian' sense of place, and some can be very drought resistant.

Natives from other cooler or wetter regions may be less climatically adapted and while they may enjoy freedom from some local pest organisms, if they become infested they may succumb faster and be less able to recover. Exotics may be almost completely free of our native pests and diseases but run the risk of being devastated if other pests are accidentally introduced.

With regard to NSW east-coast native species, and their suitability as urban and street trees, the species that are often best adapted are usually from drier rainforest and rainforest margins, particularly those species that come from littoral rainforests. Most of these trees are long lived, shade tolerant and importantly shade producing. These species often continue to transpire during prolonged heat-waves, which can provide important cooling effects through evapotranspiration. Some other species like many of our *Eucalyptus* species (Gum trees) tend to slow or shut down their metabolic processes during the heat of the day and therefore make only modest contributions to mitigating urban heat island effects during summer. They also often have sparser foliage, so are not as successful as other species in providing worthwhile shading to our pavements, buildings and parks.

Another set of highly successful urban tree species come from freshwater swamps and other areas that are poorly drained and aerated. Species from these environments are often highly resistant to root rot organisms and their root systems are well adapted to particularly adverse soil conditions.

2.2 Tree Preservation
General Definitions and Guidance

Many of our more familiar natives such as *Eucalyptus* trees are often from relatively open and much drier vegetation communities. These species may perform poorly in our highly urban areas. They are often more adapted to soils of very low nutrient status and with lower rainfalls where rot organisms are at a disadvantage. Consequently these species are often less tolerant to interference with their root systems, including compaction, waterlogging and construction damage.

Some native tree species can also display highly variable habits which makes it difficult to establish and maintain a more consistent tree avenue, or achieve necessary clearances to buildings and vehicles. They are also highly adapted to natural fire regimes or dryland conditions and as a consequence they may be pre-disposed to 'bolt' in growth for brief periods when post-fire soil nutrients are temporarily higher. As this increased growth pattern can often persist in unnaturally high nutrient, moisture, or fire-free environments the tree can become structurally weak, thin and elongated and their foliage and bark can become susceptible to attack by insects and other pests. Prominent examples of this phenomenon are our Wattles (*Acacia sp.*) and Tea Trees (*Leptospermum sp.*) and some inland *Eucalyptus* species.

An important advantage of using exotic trees within an inner urban context is that they include numerous and useful options of deciduous species, which provide greater sun access to the streets, and residences through the winter months. Some native trees are deciduous but generally they loose their leaves in spring or early summer (an inheritance of their more monsoonal origins). The Red Cedar and White Cedar (*Toona ciliata, Melia azedarach*) are the closest native trees we have to being winter deciduous but both of these suffer from severe pest problems under urban conditions and are often unreliable performers.

Many exotic deciduous species have the advantage of hundreds of years of selective breeding, which ensures quality stock and consistent performance. They are normally pollution tolerant and more resilient to interference with their roots or damage during construction works. The canopy shapes and branch architecture of many such exotic trees are readily able to tolerate pruning and shaping that is required for urban infrastructure and street clearances.

In summary, both natives and exotics have their strengths and weaknesses for use as trees within Liverpool. Our strategy aims to plant the right tree for the right location, for the right reasons and to **continually strike an appropriate balance between the many competing objectives when it comes to appropriate tree selection.** For further information and guidance refer to Section 3.0 Tree Planting and Selection.

Figure 16: Although we favour endemic species, deciduous and exotic trees have a very useful role to play in built up and urban areas to provide good shade in summer as well as providing sun in winter (Source:Arterra)

Figure 17: Many of our native and endemic species are not well suited to intensive urban areas and may not provide useful and worthwhile shade or greenery (Source:Arterra)

2.2 Tree Preservation
General Definitions and Guidance

Tree care basics

Trees are dynamic living organisms. Trees can be very susceptible to damage, stress and declining rapidly if overly impacted by pests, disease, inappropriate pruning, mechanical damage or construction related impacts.

Trees take decades to grow and mature but can be injured and killed in a very short time frame. This is particularly due to the irreparable damage of the often shallow, extensive and unseen root systems. It is rarely possible to repair a stressed or damaged tree after the damage has occurred. Proper tree protection is the key to minimising construction related and other impacts. Severing of roots can also lead to potentially unsafe instability of a tree, as a structure.

As a living organism a tree remains alive by completing the following chemical reaction -

Carbon Dioxide and water in combination with chlorophyll and light is converted to Glucose and Oxygen

$$[CO^2 + H^2O + light = sugar\ (CH^2O\ [Glucose]) + O^2]$$

This complex natural process ultimately leads to the plant cells 'respiring' and producing energy for survival; a natural requirement for all living cells. Anything that affects a plant's photosynthesis and then cellular respiration will inevitably affect the overall plant health. The limiting factors of photosynthesis and respiration will typically be the availability of oxygen, water and nutrients that make up the important chemical molecules and reactions.

Figure 19: This image shows an exposed and relatively typical root system for an urban tree. It illustrates that roots are generally surface oriented, in order to capture water and air. (Image Source: https://twitter.com/Fingalcoco/status/1017711142167293952/photo/2)

Figure 18: Although we all see and appreciate the above the ground parts of a tree, the unseen and often extensive roots are equally vital for the heath, resilience and longevity of the tree. Contrary to popular belief, tree roots are also generally surface oriented, in order to capture water and air and they spread well past the drip line of the canopy. (Source : International Society of Arboriculture)

2.2 Tree Preservation
General Definitions and Guidance

Trees have five basic requirements to survive and successfully grow:

- oxygen (and particularly oxygen within the soil allowing tree roots to survive);
- water (a cellular necessity and primarily taken up by the tree roots);
- light and sufficient foliage (in order to photosynthesise and create the resources needed for cellular survival);
- soil (for physical anchorage and the supply of critical chemical nutrients); and
- physical space (both above and below ground to grow).

Importantly, a minimum of 15% soil oxygen is required for active root growth and nutrient uptake. Less than 10% available soil oxygen starts to restrict root extension and growth and a minimum of 3% soil oxygen is required to just maintain root existence. Less than this will result in root death (Harris 1999).

Relevant Australian Standards

The following documents represent the key standards that are applicable to tree preservation and protection. Council shall defer to these standards, or any relevant update or revision of these.

- Standards Australia, 2007, AS 4373-2007 Pruning of amenity trees. Standards Australia, Sydney.
- Standards Australia, 2009, AS 4970-2009 Protection of Trees on Development Sites. Standards Australia, Sydney.
- Standards Australia, 2007, AS 4687-2007 Temporary fencing and hoardings. Standards Australia, Sydney.
- Standards Australia, 2018, AS4419-2018 Soils for landscaping and garden use. Standards Australia, Sydney.
- Standards Australia, 2012, AS4454-2012 Compost, soil conditioners and mulches. Standards Australia, Sydney.

2.3 Tree Preservation
Tree Protection and Preservation

2.3 Tree Protection and Preservation

This document provides the technical guidelines and specifications for tree protection and management to be applied consistently to our 'typical' operational requirements. The vast majority of situations will be broadly covered, however, should the specific circumstances of a particular tree, design project, capital works project or event not be adequately addressed, it remains the responsibility of the relevant tree owner, manager, project leader (design, operations or event) to seek adequate clarification before any work is undertaken in the vicinity of any 'tree'.

Protected Trees

A permit or development consent is required to ringbark, cut down, top, lop, prune, remove, injure or wilfully destroy a tree that meets the Council's definition of a tree (Refer to Section 2.2 - what is a tree).

All trees on public land whether under Council's control, or that of another government authority, shall also be considered and treated as a Protected Tree, **regardless of size, age or species.**

Exceptions to 'Protected Trees' include tree species that are listed as 'Exempt Species' in Table 2 or are identified as 'Priority Weeds' within the Liverpool LGA on the NSW Weed Wise website. These exemptions only apply to trees on private land. These exemptions do not apply to any Heritage listed trees or properties or Heritage Conservation Areas.

Pruning of Trees

Pruning has a direct impact on the health, structure and viability of a tree. All pruning of live tissue results in a wound to the tree, which the tree has to then attempt to seal and compartmentalise. Incorrect pruning techniques can lead to increased risks of internal decay and disease within the tree, much the same as a wound in animals can lead to disease and infection.

Pruning of the canopy also has the consequence of removing valuable foliage, which in turn removes an essential source of energy production from the tree. The tree will then also spend considerable reserves of energy in trying to re-grow the losses of the foliage. Branches and trunks are also important transport and storage tissues within the tree.

Tree pruning is to be undertaken by suitably experienced, insured and qualified Arborist's only. Pruning work is to be in strict accordance with to AS4373-2007 Pruning of Amenity Trees. Refer to Council's Standard Tree Pruning Specifications that are included at Appendix 5.5.

Tree pruning, when required, shall typically aim to minimise the size and number of wounds resulting from the pruning. It should ensure that any remaining canopy is well balanced with appropriate weight and crown distribution. Personnel should use only clean, sharp pruning implements for all pruning work, ensuring that cuts are made without damage, tearing or bruising of the remaining vascular tissue. Do not paint or treat any of the resulting pruning wounds.

Minor Works and Tree Pruning

Tree pruning or other tree works that are of very minor nature and part of normal tree maintenance in an urban area or pest and disease control may be accepted and not require formal approval form Council.

Works that may be permitted to trees on private land, or to trees located on public trees only where, and to the extent, it overhangs a private property boundary, without the need for a permit or a development consent are outlined below. This is as long as the pruning:

- Is to provides clearances that are consistent with the Tree Management Technical Guideline for tree clearance pruning in Section 4.6 (Figure 68), and where the branch size is less than the diameter sizes detailed in Table 1.
- Does not remove more than 5% of a trees canopy and does not damage or affect the health or structural stability of the tree;
- Involves the pruning of very minor roots with a diameter of less than 50mm (but not with 2.5m of the trunk) or any roots occurring within a stormwater drain or sewer service line regardless of distance from trunk.
- Removes branches within 0.5m of electrical service lines to private properties. This exemption applies to tree branches only, not to tree trunks.
- Removes deadwood - being completely dead branches that are still attached to the tree(s)
- Is undertaken in accordance with the relevant Australian Standard for the Pruning of Amenity Trees, using a qualified Arborist (minimum Australian Qualification Framework (AQF) Level 2 in Arboriculture).

Table 1 - Minor Pruning - Permitted Sizes

Location	Maximum Branch Size
To provide clearance over a local street vehicle travel lane where the branch is lower than 4.5m	100mm
To provide clearance over a local street parking lane or pedestrian pathway where the branch is lower than 2.5m	100mm
Within 2m above any approved building, measured from the surface of the structural component, such as a wall or roof on the building's edge	50mm
Within 0.5m of a domestic power or telecommunication service line	50mm
Tree root (but not within 2.5m of the trunk).	50mm.

Pruning outside these parameter will need to be approved via an application to Council to through a Development Application.

2.3 Tree Preservation
Tree Protection and Preservation

Weeds and Exempt Species

Weeds or other invasive species, may have been intentionally planted in the past, but are now species that are considered undesirable or inappropriate to our public domains. Although many weeds are often grasses, small herbs and shrubs, they may also include some tree species.

Weedy trees and invasive tree species are found throughout the Liverpool area, often growing along our creek banks and in native vegetation regeneration areas. In more limited numbers they may also exist as scattered trees throughout various streets and park landscapes.

These trees typically include Willow (*Salix spp*), Camphor Laurel (*Cinnamomum camphora*), African Olive (*Olea europea ssp cuspidata*), Chinese Hackberry (*Celtis sinensis*), White Poplar (*Populus alba*), Privet (*Ligustrum spp*), Acacia baileyana (Cootamundra Wattle) and Silky Oak (*Grevillea robusta*).

Where resources permit, Council will attempt to systematically control and remove self-sown weed trees or other invasive tree species, unless they are historically relevant to a particular location or context. Our focus will be to target areas where they have the greatest potential to adversely impact important native vegetation communities, bushland or waterways.

Council will try to target trees while they are still young and small, and while they are relatively inexpensive and easy to remove. Larger trees may only be removed when funds and other relevant circumstances allow.

Figure 21: Celtis sinensis (Chinese Hackberry). (Source: Arterra)

Figure 20: Celtis sinensis (Chinese Hackberry). (Source: Arterra)

Figure 22: Olea euroea subsp. cuspidtata (African Olive). (Source: Arterra)

2.3 Tree Preservation
Tree Protection and Preservation

Table 2 - Exempt Species List	
Exempt Species	**Common Name**
Edible Fruit Trees (such as *Citrus spp., Prunus spp., Persea spp., Malus spp., Diospyros spp., Cydonia spp.* ***(only when <10m in height) (and not including Syzygium spp. or Acmena spp.)***	Edible Fruit Trees such as Lemons, Orange, Plums, Peach, Nectarines, Apple, Persimmon, Quince, Avocado etc.
Acacia baileyana	Cootamundra Wattle
Acacia saligna	Western Australian Golden Wattle
Ailanthus altissima	Tree of Heaven
Cotoneaster glaucophyllus	Cotoneaster
Celtis sinensis	Chinese Hackberry
Celtis occidentalis	Hackberry
Cinnamomum camphora	Camphor Laurel
Cupressocyparis leylandii	Leighton Green Cypress
Cupressus macrocarpa "Brunniana"	Golden Cypress
Dovyalis caffra	Kei Apple
Erythrina crista-galli	Cockscomb Coral Tree
Erythrina x sykesii	Coral Tree
Ficus elastica and hybrids	Rubber Trees
Gleditsia triacanthos ***(not including recognised hybrids)***	Honey Locust
Grevillea robusta	Silky Oak
Lagunaria petersonii	Norfolk Island Hibiscus
Ligustrum lucidum	Large Leafed Privet
Ligustrum sinensis	Small Leafed Privet
Lycium ferocissimum	African Box Thorn
Melia azedarach ***(only when <10m in height)***	White Cedar
Olea europea subsp. cuspidata (syn. Olea africana)	African Olive
Opuntia spp.	Prickly Pear
Parkinsonia aculeata	Parkinsonia
Poplar spp.	Poplars
Prosopis spp.	Mesquite
Robinia pseudoacacia ***(not including recognised hybrids)***	Black Locust
Salix spp.	Willows
Schefflera actinophylla	Umbrella Tree
Schefflera arboricola	Dwarf Umbrella Tree
Syagrus romanzoffiana (syn. Cocos plumosa	Queen Palm / Cocos Palm
Tamarix aphylla	Athel Pine
Toxicodendron succedaneum	Rhus Tree
Vachellia karroo	Karoo Acacia
Vachellia nilotica	Prickly Acacia

Figure 23: It is illegal to damage, kill or remove a tree without consent. Council will vigorously defend against any wilful and deliberate vanadalism and damage to our valuable tree population. (Source: Arterra)

Tree Vandalism, Damage and Unauthorised Removals

In accordance with the Liverpool Development Control Plan and Tree Policy it is an offence to damage, prune or remove a privately owned tree or any Council managed tree. Council may initiate legal action against any person, either in the Local Court or Land and Environment Court, who fails to obtain consent prior to intentionally pruning, damaging or removing a tree. (Refer Section 2.2 and Figure 14 and Section 2.4 Penalties and Enforcement)

Residents are specifically advised not to attach items to any Council owned or managed tree for any unauthorised purposes. As examples, residents and trades people must not:

- attach signs, flags, bunting or banners to trees;
- place wires, ropes or lights within the canopy or branches of trees;
- erect tree houses or other structures within or around trees;
- attach swings or rope ladders etc.; or
- cut or otherwise damage roots or trunks at ground level to undertake fencing, walling, garden edging, new planting or gardens where this may severe tree roots.

If a property owner believes that a Council managed tree is causing damage to their property, essential utilities or other such services, they are advised to consult the relevant Tree Management Strategy sections for further guidance and advice before taking any actions that may injure or kill the tree.

2.4 Tree Preservation
Penalties and Enforcement

2.4 Penalties and Enforcement

Council takes unlawful or unauthorised removal, branch or root pruning or damage to trees very seriously. Council may pursue enforcement and penalties. Refer to Section 2.2 for guidance on when approval is required for tree work and how to go about applying for tree removal or pruning.

Council may pursue action against both individuals or companies that may be found to willingly or negligently breach requirements for:

- Unauthorised removal of trees on public or private property
- Unauthorised clearance of vegetation which may include trees and other protected native vegetation
- Wilful or negligent damage to trees which may include intentional damage, ringbarking, pruning or poisoning.

Council will enforce unauthorised or unlawful tree removal or damage in line with its Enforcement Policy 2022.

An unlawful activity means any activity or work that has been or is being carried out:

- Contrary to the terms or conditions of a development consent, construction certificate, approval, or licence;
- Contrary to an environmental planning instrument that regulates the activities or work that can be carried out on particular land;
- Without a required permit, development consent, approval, or licence;
- Contrary to a legislative provision regulating a particular activity or work; or
- In contravention of an Act, and constituting an offence.

Unlawful activities and illegal clearing of vegetation are generally identified through complaints that are received from concerned members of the public or through Council's own routine inspections that are carried out by authorised Council officers.

The nature of the tree removal, or tree related damage, will be assessed by Council staff (or by appointed independent consultants). Council will then take into consideration the seriousness of the breach when considering further action.

Council may:

- Issue penalty notices (PN), per infringement, in line with current relevant policy and legislation. This means a penalty notice which is used for offences prescribed by legislation whereby a fine is given by the Council. Council may issue a penalty infringement notice, per infringement. Where multiple trees are involved this may result in multiple infringement notices. The value of such fines is prescribed by NSW legislation. Fines may vary depending on whether the entity responsible for committing the offence is an individual or a company.
- Council also has the option of initiating a criminal prosecution and thereby seeking a pecuniary (monetary) penalty in either the Local Court or the NSW Land and Environment Court. Fines in the NSW Land and Environment Court may exceed $1million for corporations.

Council will apply industry guidelines when determining the potential valuation of a damaged or removed tree, when determining court action or issuing Penalty Notices. Councils tree valuation procedures are outlined in Section 2.7 Tree Valuation and Compensation for Removal.

2.5 Tree Preservation
Tree Reports and Assessments

2.5 Tree Reports and Assessments

Arborist Reports and Qualifications

Council will require a professional arborist report be submitted to support the following activities:

- an application to prune or remove a tree;
- an application to prune or remove a tree due to potential risks to life or property; or
- an application for any construction activity that may impact on a trees health or stability or otherwise require its removal.

Minor pruning in line with requirements outlined in Section 2.3 and Table 1 will not require approval or a report.

A professional **consulting arborist** provides tree management advice and prepares tree reports. A **practising arborist**, **utility arborist** or **tree worker** undertakes tree pruning and removal works. Council will only accept tree reports prepared by consulting arborists with a qualification equivalent to the Australian Qualifications Framework Level 5. (AQF5)

An arborist's report shall normally be reviewed and assessed by a Council officer who also holds this same level of qualification. Tree reports must be impartial and only contain opinions that can be substantiated.

Most consultant arborists are members of professional organisations that require ongoing professional development. This helps ensure they provide up-to-date, appropriate and professional advice.

Consultant arborists usually charge for written and verbal advice. The cost of a tree report depends greatly on the report type, scope and number of trees to be assessed. There are no standardised professional rates but most consultant arborists have similar hourly rates to that of engineers, architects and landscape architects. You should always agree on the consultancy fees and confirm this and the scope of work in writing before work starts.

General Arboricultural Assessment Reports

An arboricultural assessment report assesses the overall condition of a tree and its growing environment and gives management recommendations. It usually forms part of an application for approval to remove or prune a tree on private property.

All reports should have the following as a minimum:

- **Title page**: with the site address, client, date, revision number, and name, contact details and qualification of the author.
- **Introduction:** outlining scope of the report and purpose
- **Methods**: methods used in the report, limitations and list of plans and documents reviewed as part of the report, and noting any revision or issue numbers and dates.
- **Site**: description of the site and any site/ environmental conditions which may impact the trees.
- **Tree data**: species, dimensions, health and structural condition assessment – this must reflect the size and condition of the trees at the time the report is submitted to us.
- **Discussion and recommendations**: including interpretation of results and recommendations.
- **References**: resource material referenced within the report using the Harvard system.
- **Appendices**: supporting information, clear photographs of trees and identified defects, and plan showing tree locations.

The following more specialised reports may require additional and more specific information to be addressed.

Tree risk assessment reports
A tree risk assessment report determines the level of risk posed by a tree over a specified time frame. The consultant arborist must utilise, and be qualified in the application of, a recognised tree risk assessment method such as QTRA, TRAQ or VALID.

If your consultant arborist finds a potential major, internal structural defect in your tree, they may recommend further internal diagnostic testing. The two most common testing devices are resistance drilling (Resistograph) and sonic tomography (Picus Tomograph). Test results from these assessments should be included in any risk assessment, if they are undertaken and relied upon for tree management recommendations.

Root mapping assessments
A tree root mapping report may be requested if Council has concerns regarding the likely impacts of proposed development on tree roots, or a property owner is asserting that a tree is causing structural damage to significant structures, and seeking its removal or pruning of the roots. A root mapping assessment must include the minimum requirements of a General Arboricultural Assessment Report plus the following additional information .

- A scaled plan showing trench location in relation to the subject tree and relevant structures, and tree protection zone and structural root zone areas
- Trench information including orientation, length and depth (including impediments to achieving the required excavated depth), along with clear photos of the trench and roots.
- Root information: location, size and orientation of roots greater than 25mm in diameter.

2.6 Tree Preservation
Tree Protection During Construction

- Discussion and recommendations that evaluate the impacts of the proposed works on the tree, mitigation of impacts, and recommendations for alternative/tree sensitive design and tree protection methods.
- Appendices that include supporting information, clear photographs of trees and identified defects, and overall plan showing tree locations.

Tree pruning reports and specifications
A tree pruning report may be requested if Council has concerns regarding the likely impacts of proposed pruning, or a property owner is seeking major pruning of a tree. A pruning report and specification must include the following.

- The reason for the pruning, including the pruning requirements and pruning class applied as defined by Australian Standard 4373 (2007) Pruning of Amenity Trees.
- Branch information: branch size, location and percentage of crown to be removed.
- Photographs: annotated photos that clearly show the individual branches to be pruned.

Figure 24: As part of additional information to support developments or claims of damage, Council may insist on suitable non-destructive root mapping and exposure. (Source: Arterra)

2.6 Tree Protection During Construction

A critical tree management outcome for existing trees on development sites is to maintain and protect the tree assets we currently have. Lack of coordination, or thought for trees, by different disciplines, consultants and contractors who organise or carry out work within our area can have significant impacts to the existing trees.

Council shall insist that all assessment and work on construction sites, that may impact trees, is undertaken in strict accordance with the steps and principles outlined within AS 4970-2009 Protection of Trees on Development Sites.

Important Definitions

Appropriate protection of trees, particularly through the establishment of adequate Tree Protection Zones (or TPZ), is the key to minimising construction or event-related impacts to our trees.

A TPZ incorporates the 'minimum' area both above and below the ground at a given distance from the trunk in order to provide protection for the tree. Most importantly it represents the root zone required to be kept uninjured to maintain a healthy and viable tree. Roots will usually extend well beyond this zone, so this represents the minimum remaining root zone required, assuming all others are lost or damaged due to construction or other disturbance. It is typically calculated as a circle centred on the trunk, unless existing site conditions indicate otherwise.

The Structural Root Zone (SRZ) is the smaller area immediately around the base of the tree at a given distance from the trunk. The woody roots and soil cohesion in this area are considered vital to the 'structural' stability of the tree. Damage or removal of soil or roots from this area will typically render the tree unstable and require its removal. It is typically calculated as a circle, centred on the trunk, unless specific site conditions indicate otherwise.

Designing and Working Around Trees

Tree protection must start at the planning stage of any proposed subdivision, building work, renovation, landscape or earthwork project, service upgrade or repair. Tree protection must not be an after thought.

It is essential an accurate topographical and feature survey is undertaken prior to starting the planning and design of any work. This is normal practice and should include the exact location, levels and details of all existing trees.

After this is completed, it should be issued to an AQF Level 5 consulting arborist who shall then complete a pre-development tree assessment. Ideally this should be done and issued to all relevant design or engineering consultants together with their brief, to inform all design processes.

2.6 Tree Preservation
Tree Protection During Construction

The consulting arborist's recommendations and TPZ offsets should be implemented by the design team for all trees intending to be retained. This is particularly important if designing within the vicinity of any trees identified as Significant Trees, which must be given extra consideration.

As a rule, **no work of any kind** shall typically be allowed within a tree's SRZ unless extensive, non-destructive investigations are undertaken and orchestrated by an AQF Level 5 consulting arborist, to verify the proposals will not have any detrimental impacts to the tree.

All new works should be designed to avoid tree damage and impacts. Consideration must include not only the proposed works but also any proposed services, construction methods, construction access and even final landscaping. Typically, new work should be restricted to areas outside the calculated TPZs. There should be no cultivation of existing soils within a TPZ. Any landscape planting within the TPZs should be installed within a 100-200mm thickness of newly imported, manufactured topsoil. Topsoils from other sites or of unknown origin shall not be used. Use of plants of an appropriate size (typically smaller than a 200mm container size) helps avoid damage to existing surface roots, when landscape planting is undertaken around existing trees.

Tree protection is important even for small works. Minor works such as seat or furniture installation, service repairs etc. that may not involve detailed design or documentation should still give due consideration to tree protection. Employees or Contractors of the Council should complete a suitable minor works checklist prior to starting any work and confirm that the processes or methods they are intending to employ have taken into account tree protection requirements (both overhead and below ground).

The following outlines the process for managing tree protection during construction works. Where significant works are proposed and are to take place within the vicinity of any tree(s) the following process shall typically be adhered to.

- A detailed site survey shall be undertaken and a pre-development tree assessment completed and issued to relevant design professionals.
- The project design and documentation shall be prepared in consultation with a nominated consulting arborist with a view to minimising the foreseeable project impacts on the adjacent tree(s).
- As part of any formal Contract for any works undertaken by Council, or on private development sites, a suitable Tree Protection Plan and accompanying Specification shall be prepared that clearly shows the proposed extent of works and the detail and location of all the required tree protection measures that are to be installed and remain in place for the duration of the construction.

Figure 25: Trees can be easily damaged by careless construction activity. Proper protection from the start is key to successful tree protection and retention. (Source: Arterra)

Driveways and Site Access

Removal of an existing street tree should be a last resort for any new or relocated driveways, unless the tree(s) is very small or has clearly reached the end of its useful life expectancy.

When planning any new driveway, or driveway modification, an owner needs to clearly demonstrate that alternative design solutions have been explored to preserve any existing street trees, before Council will consider the removal of an otherwise healthy street tree.

Where there is a request to expand an existing driveway or install a new driveway (or other such access) to a private property and it requires the removal of a street tree, the following considerations shall be made by Council in reaching a determination.

2.6 Tree Preservation
Tree Protection During Construction

- Are there suitable alternatives or options to relocate the driveway elsewhere?
- How significant and prominent is the tree and its contribution to the local environment or streetscape?
- Is the tree healthy and vigorous?
- Are there suitable alternative locations for a replacement tree if the driveway is installed?
- Allocation of suitable tree removal and tree replacement costs, should the removal and a replacement tree be agreed. (Refer to Section 2.7)

The supply of a new tree, the tree pit preparation and the methods of planting the tree shall follow the relevant technical guidelines, specifications and planting details as outlined in Sections 3.0 and 5.0 of this Guideline document.

Street and park trees will typically not be allowed to be pruned for any temporary or construction related access. The developer or owner must ensure that suitable measures are implemented to protect the tree(s) throughout the construction phase. If no other alternatives are available, the Council may approve minor pruning, in which case it must be undertaken in accordance with requirements outlined in this Guideline and undertaken only by a qualified practicing or utility arborists.

Figure 26: When working close to trees, it may even be necessary to install temporary trunk protection measures to limit accidental damage to delicate bark and branches. (Source: Arterra)

Tree Assessment Requirements and Development Applications

As part of a Development Application, where works may impact existing trees within or immediately adjacent to a development site, an Arboricultural Impact Assessment is to be submitted. This shall be undertaken by a suitably qualified consulting arborist (minimum AQF5) and include all trees likely to be impacted by the proposed works. This may include neighbouring property trees or immediately adjoining park or street trees.

This assessment shall include assessment of impacts for temporary excavations, gantries, construction access, deliveries, cranage, piling and all services. This assessment shall clearly indicate what impacts, if any, are likely to be experienced and how they are intended to be managed or mitigated.

The assessment shall include a suitable Tree Protection and Removal Plan, clearly showing all the trees to be retained and any trees proposed for removal. Their nominal TPZs shall be documented and prepared by the Consulting Arborist to accompany the Impact Assessment, for the Council's review. As a minimum, all Arboricultural Impact Assessment Reports shall include the following.

- A clear summary of the proposal.
- The tree retention values and relevant tree protection zones and structural root zone for all trees within 5m of the property boundaries and any tree protection zones of trees on adjoining properties that extend into the site.
- An impact assessment which includes a suitable listing of trees proposed for removal or retention, the percentage of tree protection zone and structural root zone encroachment and if this is minor or major, and consideration of factors for any major encroachments and options for mitigation of impacts, and recommendations for alternative/tree sensitive design and tree protection methods.
- Where pruning works are specified the assessment must include the pruning requirements, the pruning class as defined by Australian Standard 4373 (2007) Pruning of Amenity Trees, the branch sizes and locations (including photographs which clearly show individual branches to be pruned) and the estimated percentage of crown to be removed.
- Tree plans showing tree removal and/or retention and tree protection zones and structural root zone for trees proposed for retention. These plans must be drawn to scale and show an accurate representation of the existing canopy.

2.6 Tree Preservation
Tree Protection During Construction

Root Mapping and Investigations

Where major incursions are proposed Council may insist on appropriate 'non-destructive' root mapping or other such investigations are carried out in order to support the level of impact that may be suggested.

Any root mapping investigations and subsequent reports must be carried out in accordance with **Root mapping assessments**, specified in Section 2.3.

Minimum Tree Protection Requirements

Tree Protection shall typically be expected to be installed as per any approved Tree Protection Plans and the required tree offsets shall be enforced by Council.

Prior to the commencement of any site works, and at appropriate intervals as conditioned by Council, the Council's Tree Management representative (for Council projects) or the nominated project consulting arborist, (for private works) shall regularly inspect the site to confirm, record and report back to the Council or relevant Private Certifier on the following:

- Required tree protection is appropriately installed as per the Tree Protection Plan.
- Confirm the status of the tree protection measures noting any breaches or shortcomings that need to be rectified in the tree protection measures.
- The condition of the trees, specifically noting any damage or visible deterioration of tree health since the previous inspection.

Figure 27: A key protection measure is the provision of adequate exclusion fencing to protect both the above and below ground portions of the tree from damage. (Source: Arterra)

Figure 28: When access is required close to trees it may be necessary to install temporary or permanent ground protection to prevent root damage and soil compaction. (Source: Arterra)

2.6 Tree Preservation
Tree Protection During Construction

Tree Bonds, Compliance and Enforcement

Council may impose enforceable monetary bonds in order to protect trees during construction and allow for suitable remedies or replacements to occur should trees be removed or damaged during development or construction works. The amount of the bond and the method upon which the bond will be issued shall be outlined in the relevant Development Application - Conditions of Consent. This is similar to the approach Council takes in applying bonds on other public infrastructure such as roads, kerbs and footpaths.

The Council may also impose monetary penalties, in the case where bonds are not applied, should property owners, or their Contractors, be found to have negligently or wilfully caused damage to trees. Refer Section 2.4

Penalties shall be structured to place a monetary value on the tree as a whole, in the case of serious damage or death of the tree, and also on a pro-rata basis for any damage caused to only part of the tree. This will be based on the relevant size of the component damaged (ie. root or branch) and using accepted tree valuations methods that are outlined within Council's Tree Management Strategy and the following Section 2.7.

Figure 29: Council may impose a bond on trees to ensure they are better protected and to also fund suitable and timely replacements should they be damaged during development (Source: Arterra)

2.7 Tree Preservation
Tree Valuation and Compensation for Removals

2.7 Tree Valuation and Compensation For Removals

Trees are assets and have numerous values. These values are monetary, social, economic, environmental, historic and aesthetic. Council understands that trees are unique assets and also living organisms and therefore their monetary value varies depending on a multitude of circumstances such as their:

- Size;
- Age;
- Historical or cultural association;
- Environmental, canopy or shade contribution;
- Species;
- Location and public visibility;
- Habitat value; and
- Numerous other contributing factors.

Council may attribute a monetary value to a tree, or a group of trees, for one of the following reasons.

- To determine the broad economic value of trees as assets to Council and the community at either a LGA or precinct scale.
- To value a tree(s) that has been unlawfully or negligently damaged or removed.
- To determine appropriate monetary bonds or contractual penalties to be applied during construction, development or events.
- To determine the appropriate and reasonable compensation amount to be applied to a tree(s) when a public tree is being requested to be removed for the needs of a private development (for example the remove of a street tree for access).
- To determine the level of effort or budget that is reasonably spent when trying to retain, support or prolong the life of a significant tree.

There are numerous published and recognised methods for calculating the monetary value of trees. A tree valuation methodology shall be adopted by Council that is consistent with, or endorsed by, the current version of Arboriculture Australia's "Tree Valuation – Industry Guidance on Tree Valuation Methodologies, Practices and Standards".

Council's preferred valuation methods shall be one of the following:

- The Thyer Method (refer also practice note below regarding relevant base costs).
- Tree Valuation method presented within the Tree Valuation – Industry Guidance on Tree Valuation Methodologies, Practices and Standards (MIS506) (Arboriculture Australia & New Zealand Arboricultural Association, 2022).
- The Melbourne City Tree Amenity Tree Valuation Method.
- One of the relevant methods outlined within the Council of Tree and Landscape Appraisers Guide (9th Edition or later).
- The calculated ecological services value utilising the i-Tree valuation tool.
- A direct replacement cost (but only where a tree is very small or young enough to be reasonably replaced, like for like).

These above methods are considered reliable and suitable methods under the recent Tree Valuation – Industry Guidance on Tree Valuation Methodologies, Practices and Standards (MIS506) (Arboriculture Australia & New Zealand Arboricultural Association, 2022). Council reserves the right to utilise any suitable valuation method that meets the above the requirements. The costs associated with any required tree removal, necessary ground preparation and establishment maintenance costs are all usually reasonable to include within a tree valuation. Some of the methods outlined above do this overtly while others may not.

Practice Note. When using the **Thyer Method**, the value of the 'base cost' should be extrapolated from the originally used 2011 figures for planting a 5 litre sized container tree in a grassed area that were given by the NSW Landscape Contractors Association. In 2011 this was a cost of $ 24.20. Using an averaged annual CPI increase from that date, of 3% p.a., a **2024** figure of **$36.60** shall be applied as the base cost.

2.8 Tree Preservation
Trees and Event Management

2.8 Trees and Event Management

General Considerations

Festivals and events often involve the movement and setup of numerous large and small vehicles, stalls, marquees, generators, carnival rides and other mobile equipment. The event can then also draw very large crowds, some of which are forced through small or controlled entry points. All of this can have very significant and potentially long lasting impacts to the Council's trees. The potential tree impacts that need to be managed during an event are summarised below:

- Ground surface damage and compaction of the tree root zones and soils from intensive pedestrian traffic, vehicular traffic, loading and unloading of equipment, storage and stockpiling of materials, parking of vehicles, plant and equipment;
- Contamination of soils in the vicinity of trees from; accidental chemical spills, wash down/ cleaning of equipment, refuelling of generators and dumping or spilling of waste liquids;
- Damage caused by inappropriate attachment of items, cables, ropes or signage to trees;
- Mechanical impact damage from passing vehicles and equipment; and
- Physical damage to trees and branches resulting from inappropriate patron activities.

The key considerations to minimise potential related tree impacts include:

- Careful consideration of the event site location, layout and parking needs.
- Controlled vehicular site access and parking.
- Exclusion zones, fencing or other protections to avoid mechanical damage to trees (trunks and overhanging branches).
- Installation of temporary tree protection barriers and temporary ground surface protection, wherever required, to limit or prevent excessive soil compaction.
- Communication with event organisers, including mandatory site inductions which include and stress tree protection requirements.
- Event security during the event to include active crowd supervision in order to prevent or limit damage to trees during the event, or inappropriate vehicle parking or other anti-tree behaviour.
- Careful planning and consideration of fuel storage and equipment refuelling.
- Careful planning and consideration of generator placement and the location of any hot exhaust emissions.
- Implementing appropriate penalties or bonds to cover negligent tree related damages.

Figure 30: Events within some of our streets, parks and reserves are common and need to be carefully controlled and managed to avoid tree impacts. (Source: Arterra)

2.8 Tree Preservation
Trees and Event Management

Event Planning

Council has prepared a simple Event Planning protocol and information sheet (refer Appendix 5.2). This shall be given to all event organisers to facilitate them lodging a suitable event plan and considering tree related matters.

All event organisers must submit to Council at least 4 weeks before any planned event a detailed plan, preferably with reasonably scaled and accurate diagrams that clearly indicate the proposed location and extent of equipment being brought in, or installed. This should also include the location of primary access points for bump in-bump out. The requirements for tree protection and consideration must be clearly communicated to event organisers during all negotiations and arrangements with the Council's event liaison officer, to ensure it is not an after-thought.

Suitable contingency plans must be put in place should inclement weather conditions occur. Extensive rain prior to the event bump-in, for example, could make the ground largely impassable to vehicles and greatly increase the risk of unacceptable soil compaction.

Event Site Layouts

The best tree protection measure is to design the event layout to maintain adequate clearances between trees and any equipment being brought in or installed. Appropriate clearances will minimise the likelihood of both impact damage and soil compaction within the root zone of trees.

Event organisers must:

- Consider and maintain appropriate clearances to all lower branches of trees as well as to the trunk.
- Ensure stalls and other facilities shall typically be sited to be accessed clear of trees and to be easily accessed from already hard paved areas or from 'ground protected' walkways.
- Ensure intensive pedestrian activity (eg. dance or performance areas) when placed under the drip-line of any tree, that is only covered in grass or earth, suitable temporary ground protection matting is applied for the extent that is applicable under the tree's drip line.
- Ensure generators are typically maintained and positioned at least 10 metres from any tree trunk. Exhausts from generators must not discharge towards trees or upwards when under tree canopies.

Vehicle Movement and Ground Protection

The movement of vehicles is of particular concern. Appropriate clearances and ground protection are necessary to minimise the likelihood of both impact damage and soil compaction within the root zone of trees. Event organisers must adhere to the following principles.

- Primary site access points - heavy equipment installations and storage areas within close proximity to trees shall be clearly identified and have temporary ground surface protection matting or suitable plates or boarding installed per the approved site layout plans and event planning document.

Figure 31: Trafficking of wet ground near to trees can have devastating effects to soil and roots and must be avoided. Temporary ground protection will normally be needed whenever vehicles need to cross soft ground to load and unload equipment. (Source: Arterra)

2.8 Tree Preservation
Trees and Event Management

Figure 32: Appropriate ground protection is often readily available and can make a great difference to tree protection and patron enjoyment in vehicle or high pedestrian traffic areas. (Source: Arterra)

- Vehicular access - the parking of vehicles, storage and installation of heavy equipment under any trees on the site shall typically be prohibited unless approved temporary ground surface protection matting or plates are installed per the approved site layout plans.
- Where vehicular access is required for 'Bump In' and 'Bump Out', under or through trees, and the area is not already hard paved, the access way shall have temporary ground surface protection matting or plates installed per the approved site layout plan to limit soil compaction and tree root disturbance. This will be exceptionally important if any periods of wet weather are experienced within 7 days of the event or during the event.
- All vehicular movements in the vicinity of trees, particularly of vehicles greater than 3.5 metres in height and/or 8 metres in length, must be supervised by a 'spotter'. This must be an authorised employee or representative of the Council to ensure compliance with tree protection standards. This is particularly important during the periods of most intensive vehicular activity such as during 'Bump In' and 'Bump Out'. All large items that are unloaded by crane or vehicle mounted lifting equipment should also be subject to a 'spotter' to limit potential foliage or branch impacts. The 'spotter' must supervise the truck movement and signal to the driver, warning of any possible conflict to be avoided between the truck, its load and nearby tree branches and trunks. Alternative access arrangements must be implemented if the truck cannot safely fit under existing tree branches. No tree branches are to be pruned or snapped off.
- If a truck must leave a paved pathway to avoid any low hanging trees, suitable ground protection mats or plates must be placed over the grassed areas being travelled by the vehicle.
- The nominated event manager is to ensure strict compliance with the above by all suppliers and delivery personnel to prevent tree damage.

Communication and Site Inductions

Event organisers shall ensure that all contractors and stall operators are appropriately inducted prior to working on the event site. Tree protection shall be a key component in the site induction and must be maintained at the forefront of event workers' minds.

All site inductions shall include explanation of any exclusion zones and the description and identification of the tree protection protocols and the restrictions surrounding access and activities with regard to maintaining tree protection.

Generators, Fuel Storage and Equipment Re-fuelling

Contamination of soils from fuel or other chemical spills can have devastating effects on trees, grass and other vegetation. The following must be adhered to during events.

- Any on-site, bulk fuel (fuel cells) must be stored a minimum of 15 metres away from the trunk of any tree.
- Generators, or other powered equipment (light towers, portable cold rooms, etc.) shall typically be positioned at least 10 metres from any tree. Exhaust emissions shall be directed away from any overhead canopy or branches.
- Mobile equipment refuelling is to be carried out with extreme care to prevent any spills or overflow.
- Refuelling shall be done at a minimum of 10 metres from the trunk of any tree and with appropriate bunding and/or spill trays or ground protection in place.
- A 'fuel spill management kit' is to be on hand at the location of all refuelling activities.
- All refuelling is to be carried out by a team of two people. One to control the filling mechanism the other to observe the integrity of the equipment, manage any malfunctions and efficiently deploy the spill kit in the event of any fuel spill.

2.8 Tree Preservation
Trees and Event Management

Security and Crowd Control

The Event organisers shall ensure the event security team and other event volunteers are adequately briefed to ensure they actively engage with patrons to particularly prevent adults and teenagers from climbing trees during the event, to minimise the likelihood of tree limb failure and accidental injury to patrons. Security and volunteers shall also be vigilant to prevent intentional or accidental vandalism to trees.

Extreme Weather

In the process of event planning, due consideration should be given to the possibility of extreme weather impacting upon the event. The risk of tree failures is greatly elevated during periods of very heavy or prolonged rain or during very strong wind conditions.

Consideration should be given to how the event will be managed to minimise risks associated with possible tree failures in the event of extreme weather conditions. Winds of gale force (8 on the Beaufort scale or in excess of 63-75km/h) present a very serious and real risk to trees. Even healthy trees with no observable defects may fail in such high wind conditions. Branches may break out of trees and trees may even be up-rooted, particularly if it is preceded by periods of prolonged or heavy rains. It is recommended that events be suspended and the site evacuated should winds of this level be experienced.

Penalties

Consideration shall be given by Council (depending on the size and purpose of the event) to imposing contractually enforceable penalties, that may be charged against event organisers, should their contractors and/or stall-holders be found to have caused avoidable damage to trees.

Penalties shall be structured to place a monetary value on the tree as a whole, in the case of serious damage or death of the tree, and also on a pro-rata basis for any damage caused to only part of the tree. This will be based on the relevant size of the component damaged (ie. root or branch) and using accepted tree valuations methods that are outlined within Council's Tree Management Strategy and the Tree Valuation section 2.7.

2.9

Tree Preservation
Tree Disputes and Appeals

2.9 Tree Disputes and Appeals

Council shall not intervene or resolve any disputes between neighbours concerning trees or tree related matters on private property. Any such disputes shall be referred to resolutions under the NSW Trees (Disputes Between Neighbours) Act 2006.

It is worth noting that the above Act does not apply to trees on land that is vested in, or managed by, Council.

If a Council managed tree is suspected of causing notable damage to significant private structures it will typically be a requirement for the owner of the property to adequately and clearly establish that the tree is actually causing the damage. They also need to reasonably demonstrate that the damage is significant and that continued and future damage cannot be overcome by any other reasonable and practical measures.

A property owner is responsible for inspecting and maintaining all built structures on their land. Council does not inspect private properties for signs of damage.

If property owners or residents believe that they have been unfairly treated with regard to any tree related matters, or Council has been negligent or unprofessional in their management of trees or tree related requests they should raise their concerns directly with the Manager of Council's Tree Management Team.

Alternatively they may refer their concerns to Council's Internal Ombudsman. The Internal Ombudsman provides residents, community members, ratepayers, local businesses, staff, Councillors and other Council stakeholders with an impartial service to address concerns or complaints about administrative conduct, unethical behaviour by Council, corrupt conduct, misconduct or maladministration.

This section of the Guidelines establishes the requirements and best practice procedures that Council will apply when selecting and then planting new trees throughout our community.

3.0 TREE PLANTING AND SELECTION

3.0 TREE PLANTING AND SELECTION

3.1 Right Tree, Right Place

Street and park trees are long term assets and investments that may typically live between 50 to 150 years, so appropriate species selection is vitally important.

Many of Liverpool's streets and parks are already planted with established or remnant trees. Council adheres to the principle of the 'right tree for the right location'. Council will generally aim to preserve and protect our existing trees wherever possible. Some exceptions to the this general policy may occur and include trees and species that are:

- performing poorly;
- considered 'grossly' out-of-scale with the street or particular location; or
- have proven themselves to be particularly damaging to pavements and other structures within that location.

In assessing what tree to choose for any given space, it is vital to recognise that trees are living organisms. No tree can accommodate all potential constraints and requirements perfectly. There is no perfect urban tree. It will always be necessary to find the "best" fit for certain spaces, street and park circumstances and potentially compromise on some aspects.

Figure 33: Council will always seek to select and plant trees that are appropriate to their position. Our aim will always be to maximise the potential for shade and canopy cover and longevity. We also need ot be looking to trees that are climate adaptive. (Source: Arterra)

Our key tree selection objective is still to ensure the selection of the 'right tree for the right location'. In other words, to ensure that the selection of the species is optimised for the local environmental conditions and the other constraints of the planting location. We aim to ensure that the tree makes a positive contribution to the environmental, amenity, aesthetic and heritage values of the area and that foreseeable negative aspects are minimized as much as reasonably possible.

When selecting an urban tree it is vital to consider numerous important physical and other characteristics. These relate to the fundamental environmental, functional and aesthetic requirements. The basic criteria that need to be considered in selecting any tree are:

- The ultimate size, habit and form of the tree.
- General form and branching architecture and its ability to be formatively pruned and its natural clearances to the ground and other overhead structures.
- Tolerance to being used in paved or urban areas.
- The type and quality of the shade that it casts.
- Tolerance of the tree to a variety of prevailing soil conditions.
- Tolerance and adaptability of the tree to potential future climate regimes over the next 50-100 years and also the site specific microclimate and other extremes that might occur.
- Expected heatwave and drought tolerance.
- Pest and disease tolerance.
- Deciduous or evergreen foliage.
- Foliage size and colour.
- Wind tolerance and resistance to undue damage or branch failures.
- Longevity and growth rate.
- Pollution tolerance.
- Potential of the tree to be an allergen or irritant.
- Maintenance levels required (pruning, disease control, fruit fall; etc.).
- Amount and nature of potential tree generated litter (such as bark, flowers, fruit, leaves, twigs).
- Commercial availability in a variety of larger sizes.
- The risk of it becoming an environmental or invasive weed.
- Contribution to biodiversity and habitat outcomes.

3.1 Tree Planting and Selection
Right Tree, Right Place

Figure 34: Adequate canopy coverage, shade and transpiration during hot months is key to our long term targets and outcomes. Good quality shade makes our streets, parks and plazas more usable in summer and can promote healthy activity and walking within our communities (Source: Arterra)

Research has consistently shown that medium to large trees provide the greatest ecological and community benefits in comparison to small trees. They create more canopy spread and shading benefits, absorption of more gaseous pollutants, lower levels of tree vandalism, and achieve higher canopy clearances, than very small trees. Medium and larger growing trees are also commonly longer lived than smaller trees. Larger trees, however, do require larger soil volumes and more physical space above and below ground than small trees. This needs to be designed and factored in to any new plantings. However the ultimate benefits to the community are often exponentially increased over their lifetime.

Using the paradigm of 'right tree for the right location', a medium to large tree will only be specified and planted in an area where there is sufficient space, and the growing conditions are suitable for the reasonable foreseeable life span of the tree. Smaller trees will also have a place in the urban forest particularly for areas where physical space, overhead wires, parking and traffic restrictions or exposure present overriding factors.

Canopy Cover Is Crucial

In addressing extreme heat, numerous research studies now consistently outline the benefits that trees and tree canopy cover provide. These affects have been measured at both the individual street or lot level and on a precinct scale. When addressing the impacts of urban heat, research confirms that we need tree canopy at both these local and precinct scales - ideally with a minimum of 30 per cent canopy cover.

Increased urban greening is now a recognised, mainstream technique to mitigate urban heat. 'Urban greening' facilitates the cooling of our homes, businesses, plazas, streets and parklands via evapotranspiration, shading and providing cooler surfaces thereby reducing the mean radiant temperatures.

Canopy trees actively help to cool any hot air and hot surfaces around them, through shading and evaporative cooling. Even individual trees can make a valuable difference to air temperatures at the scale of an individual property, but recent studies have shown that larger groupings of trees, that combine to provide >40% canopy cover, at the scale of a city block can reduce local ambient air temperature by more than 1.3°C (Ziter, C. et al 2019).

3.1 Tree Planting and Selection
Right Tree, Right Place

Reducing paved surfaces at the same time also helps to reduce heat that is absorbed and radiated back into the air. Therefore extreme heat is moderated most effectively where there are both more tree canopy cover and less hard paved surfaces.

Figure 35: Tree selection when close to native bushland areas may also need to consider Asset Protection Zone requirements and avoid species that may contribute to hazard and fire spread. (Source: Arterra)

Bushfire and Asset Protection Zones (APZs)

A large area of the Liverpool Council area is identified as bushfire prone land. Many of the our urban areas are surrounded by large areas of native vegetation or border significant riparian corridors.

Many streets that are on the edges of the urban areas that front these larger areas of native vegetation may form part of an Asset Protection Zone. The planting of additional trees within these zones may increase the risk of fire damage to persons and property and may also limit safe access for emergency services during a bushfire. Careful consideration should be given to planting of street and park trees on the urban periphery to manage bush fire risks.

A number of factors need to be considered when planning street and park tree planting when in fire prone areas. This includes the characteristics of particular tree species and the placement and spacing of trees along a street or park. Trees with the following characteristics may also reduce the impact of bushfires on our urban areas, including trees with:

- high moisture content in their leaves;
- an open branching pattern;
- a clear trunk to at least 2m from ground level;
- smooth bark on the trunk and branches; and
- wide, thick and fleshy leaves.

The placement of street trees in bushfire prone areas can reduce the risk of fire damage if the trees are:

- spaced so that the canopies do not touch when mature;
- a safe distance from buildings, driveways, water supplies and powerlines; and
- planted away from shrubs or other small bushy trees that could transport a ground fire into the canopy.

The planting of trees in some streets may increase the bushfire hazard and as such, not all streets that may appear to have sufficient space, will be planted with street trees. This will be assessed by Council on a case by case basis.

Figure 36: Some residential areas front remnant native bushland and therefore the provision of appropriate Asset Protection Zones will be required. (Source: Arterra)

3.1 Tree Planting and Selection
Right Tree, Right Place

Figure 37: Although we may favour the use of native and endemic trees, in many situations, the community greatly appreciates the beauty of deciduous and exotic trees and trees that can provide valuable solar access to walkways and living spaces in winter. (Source: Arterra)

Habitat

Council is aiming to achieve a far greater diversity of urban tree species, thereby providing a greater diversity and abundance of food sources, shelter, roosting and nesting opportunities. This will typically be through providing a greater diversity of trees within individual streets or parks, often in combination with an increased use of native species, while still catering to some important other needs such as heritage, winter solar access, appropriate tree sizes, tree longevity, tree form and habit, ongoing maintenance requirements and community expectations.

The natural landscape of Liverpool and the wider Sydney area has changed dramatically and is almost unrecognisable from its state before colonisation more than two centuries ago. Ecosystem health and biodiversity are still important for a sustainable world. Protecting and improving our urban biodiversity, while also reclaiming and managing functional ecosystem health in Liverpool, can play a vital role in improving the health of our residents and the liveability of the LGA. Biodiversity and habitat can be enhanced by providing environmental conditions and supporting functional ecosystems that will support a diversity of plant species and then in turn these plant communities may provide habitat for wildlife. (Rowe, B., 2019).

Solar Access

Where appropriate, species should be selected that will provide an appropriate level of solar access to nearby dwellings during winter. This is usually most important to east-west oriented roads in areas with lower-rise flanking buildings. It can also be important in higher-rise apartment streets where deciduous or less dense trees can provide light to other otherwise very shaded streets in winter. In meeting this objective, consideration is also given to other principles such as species diversity and the existing street and park characters.

An important advantage of many exotic species, in a suburban and particularly urban contexts, is that they include most of the useful and proven deciduous trees that can provide far greater solar access to the streets and houses through the winter months. There are very few Australian native trees that are deciduous, and generally those that are, loose their leaves in spring or early summer.

Many exotic deciduous species have the advantage of decades, if not hundreds of years of selective breeding which ensures improved stock. In summary, both natives and exotics have their strengths and weaknesses for use as urban trees. Liverpool's Tree Management Strategy aims to plant the right tree for the right location, for the right reason and strike an appropriate balance between endemic and non-endemic species.

Figure 38: Trees provide enormous benefits to us and also to wildlife. They are valuable for birds and other large and small animals. (Source: Arterra)

3.1 Tree Planting and Selection
Right Tree, Right Place

Figure 39: Liverpool has an extensive and diverse urban forest but there is still much work to be done to enhance and expand this valuable resource. (Source: Arterra)

Our overall tree management approach strives to achieve a far greater diversity of species. Urban trees are a vitally important part of our wider urban forest and can provide valuable and linked corridors of vegetation and tree canopy that can promote and enhance native habitat and provide sources of food, shelter and other benefits for our native birds, animals, insects and other creatures. Well planted and shady streets and parks can provide important respite and corridors for the movement of species. This can be particularly important for bees and other insects that may not be able to fly large distances in more open or exposed areas.

We are planning to introduce far more trees into our streets, including some streets that may have never had trees. We also aiming to reduce reliance on exotic species in favour of more regionally endemic native species. The combination of these initiatives and our continued goal to increase urban greening generally will allow our streets, parks and drainage reserves to be utilised to improve ecological connections and provide useful stepping stones for our native urban fauna, particularly between our major parklands such as Western Sydney Park, South Creek Corridor, Bents Basin and the Georges River foreshores.

We have focussed on exploring and choosing tree species that will be more resilient to identified and foreseeable climate change impacts, thereby providing greater resilience for our tree canopy and urban forest in times of droughts, heatwaves and generally warmer climate scenarios.

3.2 Tree Planting and Selection
Planning and Design Considerations

3.2 Planning and Design Considerations

Climate Change

Adapting to climate change is critical for a resilient, sustainable and forward-thinking approach to our tree planting. We recognise that there needs to be a change and adoption towards tree species that have been assessed as better suited to warmer climates and increased heatwave extremes. The City also needs to increasingly investigate and promote the use of water sensitive design strategies that may assist to passively irrigate our urban trees wherever possible. This will allow them to better deal with extremes and drought conditions.

Climate change poses a serious risk to all people, future generations and should be treated as a national emergency. Average temperatures climbing above 2°C from existing temperatures would have a devastating impact on Australia, including:

- more extreme weather events;
- reduced rainfall and prolonged droughts;
- longer, hotter and more frequent heatwaves;
- water scarcity;
- more extreme bushfires;
- increased risks to food production;
- reduced biodiversity; and
- inundation of low lying and coastal areas.

As Australia's climate inevitably changes over the next 50-100 years, the species of trees and other plants used in our LGA today may not be suited to the range of conditions presented by the new climate. Research has found that Sydney's climate would be more like present day Grafton, in less than 30 years. As part of our Tree Management Technical Guidelines we have selected several suitable tree species that have not been commonly used in Liverpool. These trees have been chosen as they are expected to cope better with our future climate. Likewise we have ceased to utilise and promote some commonly used species that we believe are not going to be well suited to our future hotter and drier conditions.

It is expected that potential water use restrictions and lower than average rainfalls, that have previously been experienced in Sydney, will continue and potentially worsen into the longer term. Trees that we select now will need to be capable of surviving average drought periods, in reasonable condition and without reliance on potable water supplies. Passive irrigation through the use of Water Sensitive Urban Design initiative will be designed into many of our new or upgraded park and street tree planting projects and will assist our trees by allowing additional water in times of drought and generally promote better health and growth during normal times.

Figure 40: Beyond the obvious dilemmas of heat and drought, one of the concerns for tree management is increased storm and storm intensity (Source: Arterra)

Figure 41: Droughts, extreme heat and bushfires could all have major impacts to our urban forest and we need highly resilient and appropriate tree planting to cope and flourish into the future (Source: Arterra)

3.2 Tree Planting and Selection
Planning and Design Considerations

Intrinsic Climate and Soils

Trees are living things. The capacity of any tree to establish and grow successfully depends greatly on the basic environmental conditions at the planting site being within the tolerance range of the species selected. The underlying geology and soil provides access to nutrients and water as well as physical support for the tree. Soils can differ greatly in terms of the nutrients they provide, their drainage characteristics, oxygenation and depths.
In Liverpool our dominant soils are formed from the underlying Wianamatta shales. These usually produce relatively heavy clay soils with only moderate fertility but good water holding capacity.

In some outer lying eastern and western areas of the LGA, the underlying geology is transitioning to Hawkesbury Sandstones which typically produce very shallow, sandy, and extremely low nutrient soils.

We must also remember that many urban areas throughout Liverpool are also highly disturbed. In many instances the original topsoils will have been completely disturbed or removed and replaced with imported materials, often including rubble, building debris and other unnatural landfill materials. This is particularly common around industrial areas, the Liverpool CBD, and some river foreshores.

With regard to our natural climatic conditions, Sydney is located on the south-east coast of Australia and enjoys a relatively moderate (temperate) climate. We generally escape the extremes of temperatures that are more common in the interior of the continent and the very high humidity and rainfalls of the more tropical coastal areas.

We generally experience warm and wet summers and autumns and then a cool and drier winter and spring. Our average daily maximum temperatures around 28°C occur between December and March with our average daily minimum temperatures of around 6°C occurring between June and August. Importantly we do average around 7 or 8 days a year where temperatures are less than 2°C and numerous winter mornings where frosts are common. Any trees selected must be able to thrive in both our current, and also our predicted future, climatic conditions.

Being slightly inland from the coast we usually experience typical 'sea breeze' phenomenon in our warmer months. Winds in the morning are generally light and from the west or south-west. Later in the day when the land heats up and the air above rises, it is replaced by air and winds that switch to the east and south-east bringing cooler 'sea breezes'. Our strongest winds are typically in summer months and from the south and south-east.

Figure 42: Endemic trees are well placed to cope with our natural soils, climate and pests and should be a foundation for future tree planting (Source:Arterra)

Figure 43: Our soils are often far from natural as we move into disturbed and more intensive urban areas. This is where exotic species can help play a part in our urban forest solutions (Source:Arterra)

3.2 Tree Planting and Selection
Planning and Design Considerations

In winter there is a general trend of cooler breezes blowing form the west and south west, generally lighter in the mornings, and becoming stronger during the afternoons.

Often more importantly, however for tree planting in urban areas, is the consideration of microclimatic conditions that are present within a particular location. In the CBD and around high-rise and dense apartment areas, in particular, overshadowing caused by taller buildings, wind tunnel effects and reflected and re-radiated heat from north or western facing areas can result in the need for tree species that are particularly hardy and resilient to these adverse conditions.

Species Diversity

Trees provide shelter, food and other habitat resources for a range of fauna species, including small mammals, birds, reptiles and insects. Wherever possible, consideration will be given to planting trees that expand and provide greater connections between open spaces or larger vegetated areas, particularly those identified as priority habitat areas. This is to increase the area of available habitat and assist in the movement of native fauna species between those areas. Although native trees are preferable in this regard, exotic species also have some habitat value. A mix of species may be used where appropriate to improve outcomes and resilience of our urban forest.

Figure 44: Our naturally heavy clay soils often lead to challenges around waterlogging and soil aeration and compaction (Source: Arterra)

Figure 45: Planting small trees too close to edges and not taking advantage of parks and open spaces to plant larger trees is a massive waste of opportunity and resources. (Source: Arterra)

Size and Space

Very large trees within confined spaces often result in unacceptably high management costs and potential infrastructure and property damage. Conversely small growing trees within broad streets or open parklands rarely contribute significantly to our environment or the visual quality of the street or to enhancement of our vital canopy coverage and habitat. We will endeavour to select trees that are in scale with their surroundings. Where appropriate we will always aim to utilise the largest growing species possible, for the space available.

Species should still be selected such that the ultimate mature size of the tree has consideration of the relevant constraints, such as footpath and nature strip widths, overhead power lines, building setbacks and vehicle clearances.

The optimum range is a tree that is not too small that it fails to make a contribution to amenity of the urban area, and not so large as to dominate and cause significant problems to its surroundings. In some instances, the constraints imposed by a particular street or urban environment will limit the size of a tree selected or occasionally restrict tree planting altogether.

3.2 Tree Planting and Selection
Planning and Design Considerations

Hardiness and Longevity

Proven performance of the species under the current and future environmental conditions of the locality is vitally important. Trees are a very long term investment and substantial amounts of money are often invested in their purchase, planting and maintenance. New species should be trialled and tested on a smaller scale before implementing their more widespread use.

Our selected tree species have been chosen to be resistant to foreseeable pests and disease. A greater diversity of species across Liverpool and even within individual streets and parks, is also important in reducing the potential impact of any future devastating diseases that may impact on a specific tree species.

Many of the costs associated with the management of trees in an urban environment are associated with either the early establishment phase or the senescent phase and the ultimate removal of the tree. Using hardy, longer lived tree species that require less frequent replacements or mid-life maintenance helps us to minimise tree management costs and maximise tree related benefits.

Form and Habit

Selected urban tree species should have an appropriate and predictable form, usually with an upright trunk, spreading canopy and stable branch structures. Street trees, in particular, need to have a form that allows traffic and pedestrian movements around and under the tree. In the CBD desirable tree forms include trees that exhibit a single straight main trunk that supports a domed crown. In some particularly restricted areas and locations they may need to have narrow columnar forms. In some areas with particular constraints and small soil volumes we may rely on the use of hardy palm trees, in order to provide any planting.

Figure 46: The right tree for the right location can add substantial benefits and amenity to even the most urban of areas, both deciduous and evergreen have their place. (Source: Arterra)

Tree Type - Evergreen or Deciduous

Our urban tree species palette includes both evergreen and deciduous trees. Evergreen species can provide year round screening, greenery and shelter from winds. Deciduous trees provide stimulating seasonal interest whilst maximising access to winter sunlight. In some residential areas and some CBD streets, deciduous trees are extremely useful to maximise summer shading and winter light, particularly for well used footpaths and park areas, and to buildings located on the southern side of an east-west oriented street.

Availability

The selected tree species must also be capable of being commercially grown and available in a suitable size for urban and public tree planting. Generally, the tree stock that will be used for our streets and prominent parks are larger and advanced container grown stock in order to provide the suitable visual impact, pedestrian clearances and the adequate resistance to casual damage or intentional vandalism.

We will typically have greater flexibility for species and installation size selection when planting within lesser used parks and open spaces.

3.2 Tree Planting and Selection
Planning and Design Considerations

Figure 47: Quality nursery stock is key to all successful tree planting and long term results. (Source: Arterra)

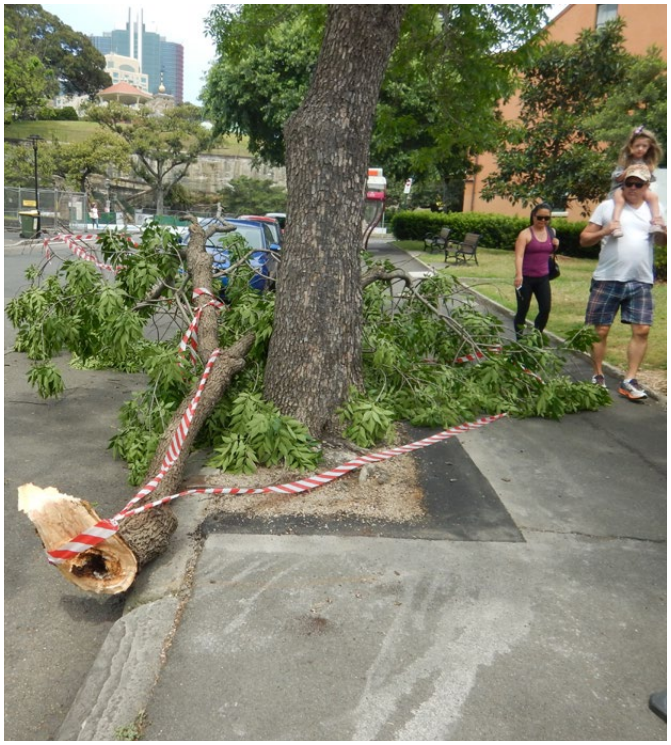


Figure 48: Any tree can fail for a variety of reasons. Species that are known to commonly cause maintenance or safety issues will be typically avoided for use where such issues may cause ongoing burdens to Council or the community. (Source: Arterra)

Invasiveness

Some species are known to be, or have the potential to be, serious environmental weeds due to their ability to self propagate and invade bushland and water way areas. Those with known propensity for this within a local and urban context will be avoided.

Some species may have a slight propensity for invasiveness, but can still be suitable and valuable selections for urban planting when used well away from bushland areas.

Safety and Maintenance

All trees that are selected have been identified to require minimal maintenance once they have become established. Trees that require regular and ongoing maintenance, pruning, pest and disease control are typically avoided.

Limb loss can occur on an occasional basis in most trees, due to age or to wind and storm breakage. Trees that are renowned for having particularly brittle branches, poor branch attachments and are more regularly known for sudden limb failure of larger branches (commonly known as summer branch drop) will normally be avoided for use in higher use urban areas.

All trees shed bark, leaves, twigs, fruit and flowers. This is a natural process, part of their growth and needs to be accepted. However, our selected urban tree species must have an acceptable level of nuisance that may be created through the natural shedding of leaves and fruit, particularly when used within a street or plaza environment. Those with very large or heavy seed pods, excessive leaf drop, or hard and rounded fruits or fleshy fruits or flowers that may lead to slip and fall hazards will typically be avoided.

Most urban tree species, due to their positions and nature, have the capacity to interact with and cause some damage to buildings, kerbs, pavements and services. Their considered placement, provision of adequate soil volumes from the start, creation of suitable pavement openings and the choice of an appropriate species for the spaces available are all important.

Despite this, tree species that are renowned for extremely vigorous root systems, buttressing roots systems and excessive root flares that often cause pavement uplift should be restricted to areas where adequate space can be provided such as within parks. Council may also investigate the use of alternative footpath materials and other design measures to help minimise tree root and infrastructure interaction. This is particularly important in retaining existing trees. We may explore removing paving around tree bases, expanding tree pit size, utilising flexible or suspended pavements in order to retain important existing trees.

3.2 Tree Planting and Selection
Planning and Design Considerations

Timing of Planting

Trees are living things and when they are young they are at their most vulnerable. Tree planting should ideally be undertaken in either Autumn or Winter. This will greatly increase the success of the planting and reduce the establishment maintenance burdens. Planting in spring and summer often exposes trees to incredible stresses from heat and evaporation well before they have managed to expand and grow their root systems to support that burden. Likewise, pests and diseases are often more prevalent in these warmer months.

This timing should be adopted for all new major tree planting projects undertaken by Council. Private developers and other authorities should also be encouraged to consider proper timing for any major tree planting projects.

Trees must be regularly maintained, ideally for a minimum of 24 months from the date of their planting, to ensure adequate establishment maintenance and survival. This is to include pest and disease monitoring and control, watering and timely replacement of any failed trees, where required. Undertaking planting and then not seeing that though to the ultimate survival of the tree is a waste of valuable efforts and resources. It is most efficient to properly plan and resource tree planting to give young trees the best chances of success and effective establishment.

Figure 49: The best time for new planting is during autumn or winter. This allows young plants to establish some roots and resilience before the challenges of excessive heat or dry weather that often causes severe stress in young trees. (Source: Liverpool City Council)

3.3 Tree Planting and Selection
Species Selection

Figure 50: There are many forms and types of trees. From evergreen to deciduous and from tall and narrow canopies to broad and spreading. There are numerous factors that need to be considered when selecting species and much will depend on whether it is in a park with good space, or it is on a street or in private property close to buildings and pathways. (Source: Arterra)

Figure 51: Large and spreading trees such as this Morton Bay Fig, where space can be provided, can provide important, long lived and civic scaled trees. These will greatly contribute to our canopy cover, livability and amenity over the next 50-100 years and need to be planted and replaced. (Source: Arterra)

3.3 Species Selection

When we plant any tree within Council managed areas, we need to make sure that the proposed species is appropriate. The species selection should relate to prevailing urban conditions and when in a larger park or more natural areas, it should ideally relate to more naturally occurring vegetation types that would have occurred in and around our area.

Species selection must always be carefully considered. We have already covered many of the fundamentals but again to reinforce that the final species selection must involve considering:

- **Environmental Conditions** - Any tree planted must be appropriate to the local soils, drainage and microclimatic conditions. It is unrealistic to expect trees that are not well suited to overcome these inherent issues and they will inevitably fail or present an unnecessary maintenance burden on Council.
- **Size** - Is the ultimate size of the tree properly considered and will there be enough space around the tree and in between other trees. Surrounding trees and overshadowing can easily suppress or alter the proper forms of a tree and render it permanently disfigured.
- **Type of Tree** - Trees can be evergreen, deciduous, and various basic forms (fastigiate/columnar and narrow or broad and spreading). Will it provide dense or dappled shade? Both may be appropriate depending on the particular circumstances.
- **Other Issues** - Does the tree present any known allergy or irritant problems, does it have any known pest or disease susceptibility, is it likely to become an environmental weed? Is it known for excessive limb drop, fruit or flower shedding? All of these should be weighed up before the final selection.
- **Views and screening** - Will the tree potentially impact or detract from any important views? Will it provide the required or desired screening? Different trees have different inherent heights and density of foliage. Will it block view lines between pedestrians, cyclists, signage and vehicles?

3.3 Tree Planting and Selection
Species Selection

Preferred Species List

Council has developed a comprehensive species list of trees considered most suitable for planting within our area. We have analysed hundreds of potential trees based on their physical traits, expert experience and opinion, biodiversity needs, historical performance, indigenous knowledge, and their ability to survive into the future changing climate. These are trees selected from a very wide range of candidates and have been determined to be most suitable and desirable for planting within the LGA.

This list importantly covers a broad range of possible locations such as our streets, urban and civic plazas, carparks, larger public parks, smaller neighbourhood parks, and even private properties.

The Preferred Species List provides a list of tree species and highlights those considered more suitable for particular locations, such as fulfilling the most taxing needs of street planting and planting under wires.

Although there are potentially thousands of trees from which to choose, only a select set of trees have been identified as ideal candidates for planting within Liverpool to try and meet our strategic objectives, more effectively spend our limited resources and try and prevent use of inappropriate trees.

Figure 52: Street trees are important but need to be very carefully considered based on verge size, surrounding pavement and relationship to traffic lanes. (Source: Arterra)

This listing has been developed using the knowledge of Council's experienced staff and specialist advisers, that together have a very long history of managing and installing trees throughout Western Sydney. We have also engaged with a number of industry and technical experts in the field of tree selection. Table 3 outlines our preferred species listing and will be the guide and basis for most tree selections undertaken by Council. Users of this list should pay particular attention to the 'guidance of use' columns, which indicate where certain tree species may be more suitably used.

Our Preferred Species List is a diverse assemblage that caters well for the majority of tree planting needs in the near future. It includes over **100** different tree species with over **50** different genus of trees and **27** different families. When one examines the different tree species recommended the following diversity is highlighted.

Tree Size
12% are civic-scaled trees
33% are large trees
28% are medium sized trees
26% are small trees

Tree Origins
41% are endemic to the area
25% are native to other areas of NSW or Australia
34% are from other parts of the world

Tree Type
75% are evergreen trees
23% are deciduous trees
2 % are palm trees

Glossary of Terms Used in the Species List

Potential Height
This is the reasonable mature height range for a tree in a normal urban situation, within western Sydney. Trees may or may not achieve these heights depending on soil volumes and growing conditions. It is important to note that larger heights and sizes may be given for trees in some sources based their natural forest situations but they will usually never reach these heights when growing in harsher and non-natural environments like urban parks and streets.

Ultimate Size Class
This is a broad classification to indicate the mature trees contribution to canopy cover and general landscape amenity. It is based on both the height and spread of the tree. Civic trees are trees that usually require a lot of space and should only be planted in larger parks or areas specifically assessed as capable of supporting the tree.

3.3 Tree Planting and Selection
Species Selection

Canopy Cover
This is the approximate mature contribution to canopy cover based on the area of canopy, as projected in plan view onto the ground. It is expressed in square meters and is based on the expected size of the tree at approximately 40-50 years of age.

Native / Exotic
Native is a tree that is native to wider Australia while the term Endemic is used to refer to a species that hails from the Sydney Bioregion. In this context endemic may be used interchangeably with the term indigenous. Exotic is tree not native to Australia.

Usage Guidance - Parks
Tree suitable for use in parks and similar open spaces where soil volumes and space are typically not constrained.

Usage Guidance - Bushland / Riparian
This term is used to indicate trees that may be considered when closer to natural areas or along reconstructed or urban drainage reserves, detention basins and the like. This is not intended to indicate species suitable for bushland or native area restoration. It is noted that Liverpool LGA is a very large and diverse natural area and has a multitude of natural soil conditions. Consideration must be given to species selections that relate to either a sandstone dominated environment or that of the more wide spread shale landscapes. (Refer to Section 3.5 and Appendix 6.4 within the Tree Management Strategy for further information and guidance surrounding naturally occurring tree species).

Usage Guidance - Streets Urban
This term is used to indicate trees that may be suitable for streets that are more urban and constrained in nature. For example they are typically streets that are in more built up areas and may have narrow verges and normally will be full paved. Soil volumes may be highly constrained and needing improvement at the time of planting. Buildings and traffic movement may be relatively close by to the tree.

Usage Guidance - Streets General
This term is used to indicate trees that may be suitable for streets that are more residential in nature and less constrained for tree planting. For example they are typically streets that are in older and lower density housing areas or industrial estates that may have reasonably wide verges and normally will be expected to have grassed or planted strips in which to plant. It may be expected that the tree can access and utilise surrounding natural soils and the buildings and traffic movement lanes are further from the tree.

Usage Guidance - Under Wires
This term is used to indicate trees that may be suitable for streets when there are overhead power lines or other utility wires and limited opportunities for planting a larger tree away from the wires. In this instance a small tree that may grow under the wires, without excessive pruning, is better than no tree planting.

Figure 53: Tree selection should aim to install the largest reasonable tree while still considered important contexts such as its relationship to buildings, soil volumes that are able to be provided, biodiversity and proximity to natural areas. (Source: Arterra)

Usage Guidance - Invasive Alert
This term is used to indicate trees that may be suitable for planting but only in specific and controlled situations. This includes species that may be good urban trees and historically used, but may have a propensity to self seed into natural or semi-natural areas or peoples yards or vacant lands. They maybe still suitable for highly built up areas or areas well away from native vegetation or waterways.

Soil Volume Guidance
This is provided as a very broad guideline to the expected minimum soil volumes made available for reasonable tree health and growth. Site specific conditions, numbers of trees and harshness of the planting site, and availability of water must all be factored to any final planting decisions. Generally speaking, the more soil volume provided, the healthier the tree will be.

3.3 Tree Planting and Selection
Preferred Species List

Table 3 - Preferred Species List

Species	Common Name	Potential Height	Ultimate Size Class	Typical Ultimate Canopy Extent (Canopy Cover)	Native/ Exotic	Evergreen/ Deciduous	Parks	Bushland /Riparian	Streets Urban	Streets General	Under Wires	Invasiveness Alert	Guideline Soil Volume Requirement	Comment or Note
CIVIC SCALED TREES														
Afrocarpus falcatus	**Outeniqua Yellow Wood**	20-25m	Civic	314m2	Exotic	Evergreen	Y					Y	50-90m3	
Agathis robusta	**Queensland Kauri**	20-25m	Civic	175m2	Native	Evergreen	Y						50-90m3	
Araucaria bidwillii	**Bunya Pine**	20-28m	Civic	78m2	Native	Evergreen	Y						50-90m3	Large cones - not near high use areas
Araucaria columnaris	**Cook Pine**	20-28m	Civic	78m2	Exotic	Evergreen	Y			Y			40-60m3	Civic for height
Araucaria cunninghamii	**Hoop Pine**	20-28m	Civic	78m2	Native	Evergreen	Y						50-90m3	
Corymbia citriodora	**Lemon-scented Gum****	20-25m	Civic	314m2	Endemic	Evergreen	Y					Y	50-90m3	Overused, invasive - limited use only
Eucalyptus camaldulensis	**River Red Gum**	20-28m	Civic	314m2	Native	Evergreen	Y						50-90m3	
Eucalyptus pilularis	**Blackbutt**	20-25m	Civic	314m2	Endemic	Evergreen	Y						50-90m3	
Eucalyptus saligna	**Sydney Bluegum**	20-28m	Civic	314m2	Endemic	Evergreen	Y						50-90m3	
Ficus macrophylla	**Morton Bay Fig**	20-25m	Civic	314m2	Native	Evergreen	Y						70-100m3	
Ficus microcarpa var. hillii	**Hills Weeping Fig**	20-25m	Civic	314m2	Native	Evergreen	Y						70-100m3	Avoid frost prone areas
Ficus obliqua	**Small Leaf Fig**	20-25m	Civic	314m2	Native	Evergreen	Y						70-100m3	
Quercus lusitanica	**Lusitanian Oak**	18-25m	Civic	175m2	Exotic	Deciduous	Y						50-90m3	
LARGE TREES														
Angophora costata	**Smooth-barked Apple**	12-20m	Large	175m2	Endemic	Evergreen	Y	Y	Y	Y			40-60m3	
Angophora floribunda	**Rough-barked Apple**	12-20m	Large	175m2	Endemic	Evergreen	Y	Y		Y			40-60m3	
Angophora subvelutina	**Broad-leaved Apple**	12-20m	Large	175m2	Endemic	Evergreen	Y	Y		Y			40-60m3	

** = Limited and specific ongoing uses only - minimise general usage # = Only use small trees within parks when larger trees are specifically not suitable

Species	Common Name	Potential Height	Ultimate Size Class	Typical Ultimate Canopy Extent (Canopy Cover)	Native/ Exotic	Evergreen/ Deciduous	Parks	Bushland /Riparian	Streets Urban	Streets General	Under Wires	Invasiveness Alert	Guideline Soil Volume Requirement	Comment or Note
Castanospermum australe	**Black Bean**	15-18m	Large	175m2	Native	Evergreen	Y						40-60m3	Large fruit - No use over car parks
Casuraina cunninghamiana	**River She-Oak**	15-18m	Large	175m2	Endemic	Evergreen	Y	Y					40-60m3	
Casuraina glauca	**Swamp She-Oak**	15-18m	Large	175m2	Endemic	Evergreen	Y	Y					40-60m3	
Corymbia maculata	**Spotted Gum**	18-25m	Large	175m2	Native	Evergreen	Y	Y		Y			40-60m3	
Eucalyptus amplifolia	**Cabbage Gum**	20-25m	Large	175m2	Endemic	Evergreen	Y	Y		Y			40-60m3	
Eucalyptus baueriana	**Blue Box**	20-25m	Large	175m2	Endemic	Evergreen	Y	Y		Y			40-60m3	
Eucalyptus botryoides	**Bangalay**	18-25m	Large	78m2	Endemic	Evergreen	Y	Y		Y			40-60m3	
Eucalyptus crebra	**Narrow-leaved Ironbark**	20-25m	Large	175m2	Endemic	Evergreen	Y	Y					40-60m3	
Eucalyptus elata	**River Peppermint**	20-25m	Large	175m2	Endemic	Evergreen	Y	Y					40-60m3	
Eucalyptus eugenioides	**Thin-leaved Stringybark**	20-25m	Large	175m2	Endemic	Evergreen	Y	Y					40-60m3	
Eucalyptus fibrosa	**Broad-leaved Ironbark**	20-25m	Large	175m2	Endemic	Evergreen	Y	Y					40-60m3	
Eucalyptus longifolia	**Woolybutt**	20-25m	Large	175m2	Endemic	Evergreen	Y	Y					40-60m3	
Eucalyptus microcorys	**Tallowood**	20-25m	Large	175m2	Native	Evergreen	Y			Y			40-60m3	
Eucalyptus moluccana	**Grey Box**	20-25m	Large	175m2	Endemic	Evergreen	Y	Y					40-60m3	
Eucalyptus parramattensis	**Parramatta Red Gum**	20-25m	Large	175m2	Endemic	Evergreen	Y	Y					40-60m3	
Eucalyptus paniculata	**Grey Ironbark**	20-25m	Large	175m2	Endemic	Evergreen	Y	Y		Y			40-60m3	
Eucalyptus sideroxylon	**Mugga Ironbark**	20-25m	Large	175m2	Endemic	Evergreen	Y	Y		Y			40-60m3	
Eucalyptus tereticornis	**Forest Red Gum**	20-25m	Large	175m2	Endemic	Evergreen	Y	Y		Y			40-60m3	
Ficus rubiginosa	**Port Jackson Fig**	15-20m	Large	175m2	Endemic	Evergreen	Y	Y					40-60m3	
Liriodendron tulipifera	**Tulip Tree**	15-20m	Large	175m2	Exotic	Deciduous	Y		Y	Y			40-60m3	
Platanus x acerifolia 'Bloodgood'	**London Plane****	18-25m	Large	175m2	Exotic	Deciduous	Y						40-60m3	Climate, allergies issues - very targeted use only

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Species	Common Name	Potential Height	Ultimate Size Class	Typical Ultimate Canopy Extent (Canopy Cover)	Native/ Exotic	Evergreen/ Deciduous	Parks	Bushland /Riparian	Streets Urban	Streets General	Under Wires	Invasiveness Alert	Guideline Soil Volume Requirement	Comment or Note
Podocarpus elatus	**Illawara Plum Pine**	18-25m	Large	175m2	Native	Evergreen	Y						40-60m3	
Quercus acutissima	**Sawtooth Oak**	18-25m	Large	175m2	Exotic	Deciduous	Y						40-60m3	Round hard fruits-not in high pedestrian areas
Quercus canariensis	**Algerian Oak**	18-25m	Large	175m2	Exotic	Deciduous	Y						40-60m3	Round hard fruits-not in high pedestrian areas
Quercus cerris	**Turkey Oak**	18-25m	Large	175m2	Exotic	Deciduous	Y			Y			40-60m3	Round hard fruits-not in high pedestrian areas
Quercus coccinea	**Scarlet Oak**	18-25m	Large	175m2	Exotic	Deciduous	Y			Y			40-60m3	Round hard fruits-not in high pedestrian areas
Quercus phellos	**Willow Oak**	18-25m	Large	175m2	Exotic	Deciduous	Y		Y	Y			40-60m3	Round hard fruits-not in high pedestrian areas
Quercus rubra	**Red Oak**	18-25m	Large	175m2	Exotic	Deciduous	Y			Y			40-60m3	Round hard fruits-not in high pedestrian areas
Syncarpia glomulifera	**Turpentine**	18-25m	Large	175m2	Endemic	Deciduous	Y	Y		Y			40-60m3	Round hard fruits-not in high pedestrian areas
Ulmus parvifolia 'Todd'	**Chinese Elm**	10-12m	Large	175m2	Exotic	Deciduous	Y		Y	Y			40-60m3	Ensure true cultivar - this is a sterile variety
MEDIUM TREES														
Acacia implexa	**Hickory Wattle**	10-15m	Medium	78m2	Endemic	Evergreen	Y	Y					25-35m3	
Acacia melanoxylon	**Blackwood**	10-15m	Medium	78m2	Endemic	Evergreen	Y	Y		Y			25-35m3	
Acmena smithii	**Creek Lilly-Pilly**	10-15m	Medium	78m2	Endemic	Evergreen	Y	Y	Y	Y			25-35m3	Climate - targeted use only with adequate water
Alpitonia excelsa	**Red Ash**	10-15m	Medium	78m2	Endemic	Evergreen	Y	Y		Y			25-35m3	
Angophora bakerii	**Narrow-leaved Apple**	10-15m	Medium	78m2	Endemic	Evergreen	Y	Y					25-35m3	
Caesalpinia ferrea	**Leopardwood**	10-15m	Medium	78m2	Exotic	Deciduous	Y		Y	Y			25-35m3	Avoid frost prone areas
*Celtis australis***	**Southern Hackberry**	10-15m	Medium	78m2	Exotic	Deciduous	Y		Y	Y		Y	25-35m3	
Corymbia eximia	**Yellow Bloodwood**	10-18m	Medium	78m2	Endemic	Evergreen	Y	Y	Y	Y			25-35m3	
Corymbia gummifera	**Red Bloodwood**	10-18m	Medium	78m2	Endemic	Evergreen	Y	Y		Y			25-35m3	
Eucalyptus haemastoma	**Scribbly Gum**	10-15m	Medium	78m2	Endemic	Evergreen	Y	Y					25-35m3	
Eucalyptus racemosa	**Hard-leaved Scribbly Gum**	10-15m	Medium	78m2	Endemic	Evergreen	Y	Y					25-35m3	

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Species	Common Name	Potential Height	Ultimate Size Class	Typical Ultimate Canopy Extent (Canopy Cover)	Native/ Exotic	Evergreen/ Deciduous	Parks	Bushland /Riparian	Streets Urban	Streets General	Under Wires	Invasiveness Alert	Guideline Soil Volume Requirement	Comment or Note
Eucalyptus punctata	**Grey Gum**	18-25m	Medium	78m2	Endemic	Evergreen	Y	Y		Y			25-35m3	
Eucalyptus robusta	**Swamp Mahogany**	10-15m	Medium	78m2	Endemic	Evergreen	Y	Y		Y			25-35m3	
Flindersia australis	**Crows Ash**	15-20m	Medium	78m2	Native	Evergreen	Y		Y	Y			25-35m3	
Fraxinus pennsylvanica 'Urbanite or Cimmaron'	**Red Ash**	12-18m	Medium	78m2	Exotic	Deciduous	Y			Y			25-35m3	
Glochidion ferdinandi	**Cheese Tree**	8-12m	Medium	78m2	Endemic	Evergreen	Y	Y	Y	Y			25-35m3	
Harpullia pendula	**Tulipwood**	8-12m	Medium	78m2	Native	Evergreen	Y		Y	Y			25-35m3	
Jacaranda mimosifolia	**Jacaranda**	10-15m	Medium	78m2	Exotic	Deciduous	Y		Y	Y		Y	25-35m3	
Koelreutaria bipinnata	**Chinese Rain Tree**	10-15m	Medium	78m2	Exotic	Deciduous	Y		Y	Y		Y	25-35m3	
Lophostemon confertus	**Brush Box**	20-25m	Medium	78m2	Native	Evergreen	Y		Y	Y			25-35m3	
Melaleuca leucadendra	**Weeping Paperbark**	15-18m	Medium	78m2	Native	Evergreen	Y			Y			25-35m3	
Melaleuca quinquinervia	**Broad-Leaf Paperbark**	18-20m	Medium	78m2	Endemic	Evergreen	Y	Y		Y			25-35m3	
Nyssa sylvatica	**Black Tupelo**	8-12m	Medium	78m2	Exotic	Deciduous	Y		Y	Y			25-35m3	
Pyrus nivalis	**Snow Pear**	8-12m	Medium	78m2	Exotic	Deciduous	Y		Y	Y			25-35m3	
Pyrus ussuriensis	**Macnhurian Pear**	8-12m	Medium	78m2	Exotic	Deciduous	Y		Y	Y			25-35m3	
Quercus ilex	**Holm Oak**	12-15m	Medium	78m2	Exotic	Evergreen	Y			Y			25-35m3	Round hard fruits-not in high pedestrian areas
Syzygium paniculatum	**Brush Cherry**	8-12m	Medium	78m2	Native	Evergreen	Y			Y			25-35m3	
Waterhousea floribunda 'Green Avenue'	**Weeping Lilly Pilly**	18-25m	Medium	78m2	Native	Evergreen	Y		Y	Y			25-35m3	
Zelkova serrata 'Green Vase'	**Japanese Zelkova**	10-12m	Medium	78m2	Exotic	Deciduous	Y		Y	Y			25-35m3	

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Species	Common Name	Potential Height	Ultimate Size Class	Typical Ultimate Canopy Extent (Canopy Cover)	Native/ Exotic	Evergreen/ Deciduous	Parks	Bushland /Riparian	Streets Urban	Streets General	Under Wires	Invasiveness Alert	Guideline Soil Volume Requirement	Comment or Note
SMALL TREES														
Acacia binervia	**Coastal Myall**	8-12m	Small	38m2	Endemic	Evergreen	Y#	Y					10-25m3	
Acer buergerianum	**Trident Maple**	8-12m	Small	38m2	Exotic	Deciduous	Y#		Y	Y		Y	10-25m3	
Backhousia citriodora	**Lemon-scented Myrtle**	7-10m	Small	38m2	Native	Evergreen	Y#		Y	Y	Y		10-25m3	
Brachychiton populneus	**Kurrajong**	7-10m	Small	38m2	Native	Evergreen	Y#			Y			10-25m3	
Buckinghamia celsissima	**Ivory Curl Flower**	7-10m	Small	38m2	Native	Evergreen	Y#		Y	Y			10-25m3	
Callistemon viminalis cv.	**Bottlebrush**	7-10m	Small	38m2	Native	Evergreen	Y#		Y	Y	Y		10-25m3	
Camellia sasanqua cv.	**Camellia**	6-8m	Small	38m2	Exotic	Evergreen	Y#			Y	Y		10-25m3	
Cupaniopsis anacardioides	**Tuckeroo**	8-15m	Small	38m2	Endemic	Evergreen	Y#	Y	Y	Y			10-25m3	
Elaeocarpus eumundi	**Eumundi Quondong**	10-20m	Small	38m2	Native	Evergreen	Y#		Y	Y			10-25m3	
Gordonia axillaris	**Gordonia**	5-8m	Small	38m2	Exotic	Evergreen	Y#			Y	Y		10-25m3	
Guioa semiglauca	**Wild Quince**	8-10m	Small	38m2	Native	Evergreen	Y#		Y	Y			10-25m3	
Lagerstroemia indica x L. fauriei cvs.	**Crepe Myrtle**	8-10m	Small	38m2	Exotic	Deciduous	Y#		Y	Y	Y		10-25m3	
Livistona australis	**Cabbage Tree Palm**	15-20m	Small	38m2	Endemic	Palm	Y#	Y	Y				5-10m3	Palm - good for very restricted areas
Magnolia grandiflora 'Exmouth'	**Bull-bay Magnolia**	12-15m	Small	38m2	Exotic	Evergreen	Y#		Y	Y			10-25m3	Climate - targeted use only with adequate water
Magnolia grandiflora 'Little Gem'	**Bull-bay Magnolia**	5-8m	Small	38m2	Exotic	Evergreen	Y#		Y	Y	Y		10-25m3	Climate - targeted use only with adequate water
Melaleuca decora	**White Feather Honeymyrtle**	8-10m	Small	38m2	Endemic	Evergreen	Y#	Y		Y	Y		10-25m3	
Melaleuca linariifolia	**Snow in Summer**	8-10m	Small	38m2	Endemic	Evergreen	Y#	Y		Y			10-25m3	
Melaleuca styphelioides	**Prickly Paperbark**	8-10m	Small	38m2	Endemic	Evergreen	Y#	Y		Y			10-25m3	
Pyrus calleryana 'Chanticleer'	**Callery Pear**	6-8m	Small	38m2	Exotic	Deciduous	Y#		Y	Y	Y	Y	10-25m3	
Syzygium leuhmannii	**Riberry**	8-12m	Small	38m2	Native	Evergreen	Y#						10-25m3	

** = Limited and specific ongoing uses only - minimise general usage # = Only use small trees within parks when larger trees are specifically not suitable

Species	Common Name	Potential Height	Ultimate Size Class	Typical Ultimate Canopy Extent (Canopy Cover)	Native/ Exotic	Evergreen/ Deciduous	Parks	Bushland /Riparian	Streets Urban	Streets General	Under Wires	Invasiveness Alert	Guideline Soil Volume Requirement	Comment or Note
Tristaniopsis laurina	**Water Gum**	7-10m	Small	38m2	Native	Evergreen	Y#		Y	Y			10-25m3	
Tristaniopsis laurina 'Luscious'	**Glossy-Leaved Water Gum**	6-8m	Small	38m2	Native	Evergreen	Y#		Y	Y	Y		10-25m3	
Viburnum odoratissimum	**Sweet Viburnum**	6-8m	Small	38m2	Exotic	Evergreen	Y#			Y	Y		10-25m3	
Photinia x fraseri 'Robusta'	**Red Photinia**	6-8m	Small	38m2	Exotic	Evergreen	Y#			Y	Y		10-25m3	
Washingtonia filifera	**Desert Fan Palm**	20-25m	Small	38m2	Exotic	Palm	Y#						5-10m3	Palm - good for very restricted areas
Washingtonia robusta	**Mexican Fan Palm**	20-25m	Small	38m2	Exotic	Palm	Y#						5-10m3	Palm - good for very restricted areas
Xylosma senticosum	**Xylosma**	6-10m	Small	38m2	Exotic	Evergreen	Y#		Y	Y	Y		10-25m3	

** = Limited and specific ongoing uses only - minimise general usage # = Only use small trees within parks when larger trees are specifically not suitable

Figure 54: A wide variety of native and exotic trees are required throughout our urban areas. We also need to be utilising trees that are more likely to survive and flourish in our changing climate (Source: Arterra)

3.3 Tree Planting and Selection
Species Selection

Edible Fruit Trees

The request for Council to plant edible fruiting trees often arises, particularly in built up urban areas. This is particularly prevalent where residential allotments are small and private open space is very limited or confined to courtyards or balconies. There may also be great cultural desires to plant trees such Olive Trees.

Whilst fruit trees can be highly desirable, they are not generally appropriate for use as urban street or park trees due to a range of factors which are outlined below. Council promotes the planting of fruiting trees within private gardens and courtyards or within specific public areas like 'community gardens', where such planting is endorsed and highly applicable. Management obligations in these settings are also more clearly defined. Care will still be needed, however, to ensure fruiting trees do not invade our bushland and waterways or become weeds. Appropriate thought should also be given to not planting trees that pose an excessive nuisance to your neighbours.

Figure 55: Fruit trees have their place, but their placement and management needs to be carefully considered before using them as urban trees (Source: Arterra)

The main implications in using fruit trees as street or public domain trees are:

- A fruit tree is usually small growing and does not achieve our desired and endorsed urban tree canopy outcomes. They also tend to be relatively short lived compared to many other tree species that would otherwise be utilised. Often a fruit tree only has a productive life for production of fruit of 15 to 25 years before it is usually replaced in an orchard situation.
- Generally speaking, for a fruit tree to successfully grow and produce edible fruit they require very favourable growing conditions. Typically, urban trees face a much harsher and neglected growing environment than is suited for a fruit tree to grow, thrive and produce good fruit.
- The level of maintenance required for a fruit tree is much greater than many other species of trees. Most fruit trees need regular and expert pruning and fruit thinning to succeed. The onus of cleaning up spoiled fruit, spraying for pests and diseases, etc. and the ultimate responsibility and liability regarding the fruit is also unclear, and can lead to numerous legal complications. Community members who may undertake to diligently tend to such trees initially may also move away, and then maintenance falls back on Council.
- The financial cost involved to maintain and manage a fruit tree would ultimately be greater and would fall back to Council, even if residents initially offer to maintain such trees.

Ultimately the decision to plant a fruit tree will be determined by Council on a case-by-case basis, and only when the other overall objectives of the Tree Management Strategy are not compromised and canopy coverage in our streets or parks is already well catered.

3.4 Tree Planting and Selection
Soil Volumes and Soil Quality

3.4 Soil Volumes and Soil Quality

Tree growth is strongly influenced by soil fertility and soil structure, as it affects the movement of air, water and nutrients. Well-constructed and quality soil conditions function like a reservoir, enabling trees to accept, store and transmit water, nutrients and energy and provide room for roots to expand and propagate. (Carpani, 2016, Lindsey and Bassuk, 1991)

Tree roots typically grow in a shallow and wide plate-like arrangement (Refer Figure 17 and 18). They do this to maintain appropriate access to water, nutrients and most importantly soil oxygen. It is therefore more appropriate to provide wide and shallow rooting areas for all new trees. Tree pits with depths greater than 1.2 metres will typically be a waste of resources as the tree will rarely access soil volumes at these lower depths. This is particularly relevant for the soils associated with Liverpool as the ability to achieve soil depths without excessive excavation are limited. Tree pit design shall typically be required to achieve the minimum soil volumes specifies below and have available minimum soil depths of ideally 0.8 metres. The typical maximum depth of soil that should be calculated and provided is 1.2 metre, unless very specific considerations are required.

The typical methods to achieve urban tree soil volumes include such systems as:

- Providing larger open soil areas such as grass or garden areas immediately surrounding the new tree.
- Vaulted soil pit design where pavements surrounding the trees are suspended just above the tree pit soils via suspended and reinforced concrete sub-pavements and piers and/or beams.
- Structurally supportive systems such as proprietary reinforcing systems like 'MastaVault', 'Strata Vault' and 'Strata Cells'.
- Structurally supportive soils (specifically designed and manufactured aggregate and soil mixes that provide a soil matrix capable of supporting pavements and loads while still providing aerated spaces for root development).

The opportunity exists for these systems to be utilised, where necessary during any detailed design for new tree planting. Regardless of system, any new trees should ideally be located within designated gardens or planting areas with sufficient space around the base of the trunks to allow for the proper ultimate expansion of the trunk, root flare and its structural root zones. Trees should typically be planted at least 1.5 – 2.0 metres away from any walls, buildings or pavement edges, and even further for larger trees. In existing street contexts this may need to be relaxed to 0.7 metres.

Figure 56: Numerous methods are now available for integrating trees and their necessary soil volumes within urban environments while still allowing pavements and roads to continue successfully above. The above illustrates a proprietary system, Strata Vault by Citygreen, being used at Barangaroo Sydney. (Source: Citygreen)

3.4 Tree Planting and Selection
Soil Volumes and Soil Quality

Figure 57: Numerous methods are now available for integrating trees and the necessary soil volumes within urban environments while still allowing pavements and roads to continue successfully above. The above illustrates results of providing excellent soil conditions throughout this area using a proprietary structural soil system below pavements at Barangaroo Sydney. (Source:Arterra)

3.4 Tree Planting and Selection
Soil Volumes and Soil Quality

Figure 58: Despite being unseen, adequate soil volumes and soil quality usually result in much healthier and resilient trees for the longer term . (Source: Arterra)

Figure 59: Examples above of the extensive soil resources provided beneath the final pavements for the trees installed at Chatswood Mall in 2009 which has resulted in exceptionally successful growth. (Source: Arterra)

Figure 60: Numerous methods are now available of integrating trees and their necessary soil volumes within urban environments while still allowing pavements and roads to continue successfully above. With nearly 70 m3 of soil for each tree the growth, health and resilience of the trees is clear to see. (Source: Arterra)

3.4 Tree Planting and Selection
Soil Volumes and Soil Quality

If planted within a paved area, the tree should be planted within a well-designed, properly prepared and designated 'tree pit' with sufficient surrounding soil volumes and subsoil drainage to prevent excessive infrastructure damage or premature tree failure and poor condition in the future. When planting new trees within pavement areas or restricted areas, the soil volume should be to sufficient to enable the tree to reach its mature size in a healthy and full state. To survive indefinitely a mature tree requires a minimum of 0.6 cubic metres of soil for every square metre of the mature trees projected canopy area.

As a guide, for trees that are likely to achieve the following canopy spreads they should be provided with the following soil volumes.

- 4 metres spread needs approximately 8-10 cubic metres of soil.
- 6 metres spread needs approximately 20-25 cubic metres of soil.
- 8 metres spread needs approximately 30-40 cubic metres of soil.
- 10 metres spread needs approximately 50-70 cubic metres of soil.
- 20 metres spread needs approximately 180-200 cubic metres of soil.

The above guidance is within a normal street, plaza or landscape setting. The needs per tree can be marginally reduced if the trees can share soil volumes with other adjoining trees or if the soil is subject to regular and permanent irrigation. In order to provide these volumes it will be very necessary to consider the following strategies highlighted previously.

- Use of expanded sized tree pits / planting areas.
- Use of structural soil systems (structural soils or plastic support mechanisms).
- Use of 'vaulted' soil pits with pavements bridging over the root zones.

An important consideration for Liverpool is the existing site constraints where heavy clay soils or compacted and altered urban sub-soils may radically inhibit tree root development, putting further emphasis on the importance of providing adequate soil volumes at the time of design and planting. For example, the above adherence to soil volumes becomes much more pertinent in areas where the trees are located over rock, buried structures or on raised on-structure podiums or where other major infrastructure or building basements will inevitably inhibit the available rooting volume.

It is also critical that all new trees are installed at the correct depths with any new soil and mulch carefully placed and allowing the top of the pre-existing root flare to just remain visible.

For trees planted within grassed areas, the base of the trunks should be surrounded with a minimum 3 metre diameter of recycled hardwood coarsely chipped mulch. This prevents the otherwise avoidable impacts to the trunk and root flare from mower and line trimmer damage. It is important the mulch is not too deep and is of a free draining nature. Excessively thick mulches or very fine organic mulches can become hydrophobic and actually prevent water from reaching the soil zone or introduce unwanted pathogens to the soil and tree.

Figure 61: Apart from suspended pavements or proprietary plastic products, another common solution is the use of structurally gap-graded soils that support pavements while leaving spaces for roots to grow in a finer soil matrix between the coarse aggregate. (Source: Arterra)

3.5 Tree Planting and Selection
Planting Positions and Restrictions

Figure 62: Planting a tree correctly is important to its long term success. It must be well chosen, well positioned and well cared for in its first few years.(Source: Liverpool City Council)

3.5 Planting Size, Positions and Restrictions

Where should our trees be positioned? When finally placing the tree the people installing it need to look up, look down, and look around. Is the tree appropriately positioned with regard to all the surrounding constraints? This must particularly consider the ultimate size of the tree and the likelihood it will be growing and increasing its size for many decades. It is often far too easy to forget about the ultimate size of the tree, its trunk and roots will attain.

Trees must be correctly positioned with regard to existing or proposed infrastructure. When planting a tree within the public domain consideration shall be given to the distance the tree is from:

- road kerbs, crossings, intersections and edging;
- edge of pathways and cycleways;
- playground apparatus and the future climbability of the tree;
- underground services and pits, including irrigation and power;
- light poles, lights and CCTV cameras;
- nearby buildings, shelters and awnings;
- gates and the required clearance for gate opening;
- important road or approved business signage;
- building openings, solar collectors and digital receivers;
- fences and the future climbability of the tree; and
- existing adjoining trees or other future proposed trees.

Nursery stock for planting in any public area (by Council or private developers) shall meet AS2303 Tree stock for landscape and follow the following size guidelines.

Table 4 - Sizes - Parks and General Urban Areas

Container Volume	Min. Supply Height (m)	Clear trunk height (m)	Comment / Application
<150mm	0.3	n/a	Well protected areas in parks (mass planting only)
5 Litre	0.5	n/a	Well protected areas in parks (mass planting or when species difficult to acquire)
15-25 Litre	0.7	n/a	Special use only. Must be pre-approved
45 Litre	1.5 - 2.0	0.8	Typical minimum size for quiet residential streets or specimens in parks
75 Litre	1.8 - 2.4	1.2	Preferred size for parks and existing local streets
100 Litre	2.0 - 2.4	1.5	Minimum for new local streets and urban streets and district or regional parks
200 Litre	3.0 - 3.5	1.5	Business districts and near any major intersections
400 Litre	5.5	2.0	Preferred for major plazas and streets within Liverpool City Centre

3.5 Tree Planting and Selection
Planting Positions and Restrictions

There are many limitations to the positioning of street trees on verges and immediately behind street kerbs. Distances from infrastructure elements such as intersections, pedestrian crossings, light and electricity poles, stormwater inlets, underground service pits and bus stops are important consideration when determining final planting locations. Typically this will require individual site assessment and will be assessed and determined on a case by case basis.

Typical Street Tree Spacing

It is important to not over plant or plant trees too closely together. This can often result in a very malformed tree or suppressed tree growth. It is often far better to plant trees with regard to their ultimate sizes and not have them over-compete for limited available soil and resources.

Avoid over planting for short term or instant effects. A measured approach to planting should always be adopted to allow future trees to mature with full and symmetrical canopies wherever possible. This generally makes the trees easier to manage in the long term, with better health and the ability to replace them more easily when the time comes. Such forethought gives the trees greater potential to find adequate resources rather than competing with each other, above and below ground.

Taking into account other relevant clearance requirements, urban trees, when planted in groups or as formal or informal rows are to be typically planted as follows:

- small trees – spaced at a minimum of 7 to 10 metre intervals;
- medium trees – spaced at a minimum of 10 to 15 metre intervals; and
- large trees – spaced at a minimum of 15 to 20 metre intervals.

Exceptions to these requirements may be warranted and considered for specific hedge or screen planting requirements or for drainage corridor or embankment stabilisation projects.

Sight Lines and Distances from Infrastructure

It is important to identify existing or proposed road elements and infrastructure when placing trees within a street. Acceptable clearances and sight lines to intersections, signs, light poles, crossings and other road elements should be maintained. The following table outlines the standards that Council will typically apply with regard to tree placement in road reserves. These dimensions are for typical streets and may need to be increased depending on the design speed of the streets and traffic volumes.

The following tables outline the minimum standards that will typically be applied for all new tree planting, as well as for any self sown seedlings that may inadvertently occur.

Table 5 - Minimum Planting Clearances - Parks and General Urban Areas

Layout, Item or Consideration	Typical minimum distances or other requirement
Major Services & Stormwater Inlet Pits - distance from nearest edge of pit structure	2.0m
Minor Infrastructure Pits (eg. irrigation and water valves etc.) - distance from nearest edge of pit structure	1.2m
Masonry Buildings - distance from nearest wall or footing	3.0m
Lightweight / Non-Masonry Buildings or shelters - distance from nearest wall or footing	2.0m
Building Awnings & Canopies – where they project out from the structures. Distance from overhead structures taken as the vertical alignment projected to the ground and the centre of the trunk	1.0m
Pathways – distance from nearest edge of path to the centre of the trunk	2.0m
Inflexible Kerbs and Edges – distance from nearest point of edging to the centre of the trunk	1.0m
Playground Equipment and required fall zones (including extent of any moveable items) – distance from apparatus to the centre of the trunk	1.5m
Fencing – distance from fence to the centre of the trunk	1.5m
Fencing – distance from fence to the centre of the trunk if clear stem of 1.8 metres is achieved at time of planting and fence is not a masonry fence with below ground footings	0.5m
Gate swings and opening – distance from any projected and required gate swing path to the centre of the trunk	0.8m
Light poles/ CCTV – distance from pole to the centre of the trunk	3.0m
Signs – distance from pole to the centre of the trunk on the visible side of the sign	2.0m
Existing Mature Trees – with low and overhanging canopy	New trees not planted under canopy of existing trees, particularly if they are low or dense.
Adjacent to new or proposed trees – distance between centre of the trunks for row or avenue planting	Not less than 4m for small trees Not less than 8m for medium sized trees Not less than 15m for large trees

3.5 Tree Planting and Selection
Planting Positions and Restrictions

Council may consider alterations to these dimensions when the placement of the tree can be shown to not adversely affect safety or the future integrity of nearby infrastructure. Considerations shall also be given to pre-existing street trees and site conditions. Council will not normally remove a mature tree that has historically been planted within these tolerances unless the impacts of retaining the tree are found to be clearly unacceptable and can not be otherwise mitigated through appropriate pruning or infrastructure relocation.

Where possible, street trees should be located at least 3m (or 5m on 80km/h roads) from the edge of nearby travel lanes, but only when the verge is currently wide enough for this to reasonably occur. The width of roadside opportunities for parking or otherwise marked travel lanes can be taken into consideration when assessing this distance and does not necessarily mean the tree needs to be 3m from the edge of the "kerb". This distance is also a measurement to the centre of the new tree and not to the estimated edge of future trunk growth.

Table 6 - Tree Placement Guidelines Within Streets

Road and Layout Element	Typical Street Tree Planting Clearance
Street intersection - distance from projected line of the intersecting kerb line on approach side	10m (on approach) 6m (on departure)
Stormwater inlet pit - distance from nearest edge of pit structure	2m
Driveway - distance from driveway edge on approach side	3m
Driveway - distance from driveway edge on non-approach side	2m
Traffic Lights - distance from signal pole on approach side	> 10m
Pedestrian crossings - distance from outer edge of crossing on either side	10m (on approach) 7m (on departure)
Street lighting pole - minimum distance from the pole to centre of tree trunk (unless there are other light sources to consider)	3m
Cycle ways - clearance from edge of cycleway path to centre of tree trunk	0.5m

Bus Stops

Clearances and setbacks for trees near bus stops are to be determined on a case by case basis. When a bus stop is proposed by other authorities to be installed in a street that currently has not had a bus stop or a bus stop is proposed to be relocated, the existing street trees should be considered as a material constraint. Existing street trees should not be unreasonably removed to facilitate a new bus stop unless all other possible alternatives have been explored. Where a bus stop is positioned adjacent to an existing street tree, the impacts to the trees roots and canopy shall be considered and minimised to maintain the tree's health and vitality.

Figure 63: Tree planting is a crucial step we must get right in our overall tree management strategy. (Source: Liverpool City Council)

Figure 64: Tree positions with streets must consider the practical aspects of their surroundings, like bus stops and pedestrian crossings. (Source: Arterra)

3.5 Tree Planting and Selection
Planting Positions and Restrictions

Table 7 - Recommended 'Best Practice' Tree Planting Methodology		
Item	**Timing**	**Comment**
Excavate planting hole to optimum depths and diameter	At the time of delivery of stock or before, depending on scale of planting and size of hole required	Depth shall typically be at least the depth of the supplied container plus 100mm. The diameter shall be at least 3 x times the diameter of the supplied container diameter. This may need to be varied, however, for sites that have identified contamination or archaeological impacts or constraints.
Assess and check drainage in planting hole or area	At the time of delivery of stock or before, depending on scale of planting and size of hole required	Ensure free draining and rectify through appropriate means if drainage is impeded. Suspend planting operation if serious concerns are observed. Partially fill planting hole with water and observe infiltration rate.
Ensure safe handling of stock at delivery	At delivery and installation	Always lift by handles on bags or pots. Large trees are to be lifted by machines taking majority of weight via rootball. Avoid lifting by trunks at all times as this often causes injury. Avoid rough handling or relocating tree using the trunks or branches.
Water stock immediately upon delivery	At delivery and then daily until planting	Water directly on to the rootball using suitable soft spray nozzles and then water daily if the stock is not installed immediately.
Water stock well immediately prior to planting	Just prior to installation	Saturation of rootball should be achieved approximately 2-3 hours prior to planting
Prune rootball extremities	Just prior to installation or before backfilling for very large stock	'Shave' the entire sides and bottom of rootball by 10-15mm using a clean and very sharp spade or saw or knife to trim of any encircling roots and promote good root direction and division.
Plant the tree with appropriate 'North' orientation	At installation	North should be indicated by N or a paint mark line on the container of trees that are >45L
Plant at the correct depth and ensure trunk is vertical	At installation	Ensure rootball crown (top) is maintained at existing site soil levels or just above, particularly if drainage is in anyway compromised. Build up small pad of well consolidated site or imported soil under the rootball to prevent any settlement. Adjust levels of tree to ensure tree is planted in a balanced orientation and trunk is not leaning.
Backfill the planted tree	At installation	Backfill with appropriately firmed and consolidated layers of soil and in the correct profile of soils. Avoid deep burial of any rich organic matter or over compaction of the soils. Incorporate ameliorants as required and ensure rootball crown is not buried or covered over by backfill soils.
Water once installed	At installation	Ensure thorough watering of rootball and surrounding soil immediately after installation using a suitable soft spray nozzle. Irrigation to be installed if available.
Support the tree if required	At installation	Trees should not require staking but if the tree is not fully self supporting or exposure to extreme winds is likely, provide a temporary timber stake and loosely applied hessian strapping support as per standard planting details and specifications.
Establishment maintenance	24 months following installation	Apply regular watering, and slow release fertilising and formative pruning as per establishment maintenance procedures outlined.
Documentation and replacements	At installation and then every 12 months	Trees shall be immediately entered into the Councils database of trees with their species, date of planting and supporting photographs. Damage or failures of trees to be recorded and appropriate replacements undertaken.

3.6 Tree Planting and Selection
Tree Procurement and Quality

3.6 Tree Procurement and Quality

Considerable effort can be wasted if new trees die shortly after planting, or if the tree is supplied in a substandard form or condition that may ultimately lead to its poor performance or the later development of serious structural defects and poor health. As outlined by authors such as Gilman (Gilman 2012), most tree defects that occur within mature trees were present and readily identifiable at the time the tree was initially planted. It is therefore essential that the tree and its roots be in optimal condition when it is delivered and planted.

Figure 65: Trees must be grown and delivered to achieve certain minimum standards. Sub-standard trees with obvious defects should never be accepted. (Source:Arterra)

An important aspect in the implementation of tree planting is in the planning and procurement of nursery stock. Implementing a 'forward-thinking' and pre-planned approach to plant procurement has numerous benefits, which include the following.

- Securing favourable contract growing prices.
- Ability to prepare and coordinate planting at optimum times of the year.
- Ability to purchase trees of the required species and cultivars.
- Ability to purchase trees of the required sizes and dimensions and formatively pruned to suit street tree, plaza or park installation.
- Assurance of the required quantities, including allowance for replacements when necessary.
- Ability to inspect and demand high quality stock, free of above and below ground defects.

In summary, wherever possible and reasonable all trees should be sourced and supplied as part of an advanced plant supply contract with one or more reputable commercial suppliers and they shall conform to the NATSPEC "Guide for assessing the quality of and purchasing of landscape trees" by Ross Clark 2003 and AS AS2303 – 2018 Tree Stock For Landscape Use. In short, substandard trees with obvious defects should never be accepted.

Figure 66: Well grown trees from the start can alleviate a lot of future issues. Most tree defects that occur within mature trees were present and readily identifiable at the time a tree was initially supplied and planted. (Source: Arterra)

3.7 Tree Planting and Selection
Tree Establishment, Staking and Protection

Figure 67: We must plant more trees to achieve our long term objectives and create a beautiful, resilient and sustainable environment for our community. (Source: Arterra)

3.7 Tree Planting and Selection
Tree Establishment, Staking and Protection

3.7 Tree Establishment, Staking and Protection

The maintenance of planted trees shall commence immediately following their installation, and then be continued for a period of no less than twenty four (24) months to ensure their successful establishment within Council managed areas. After this period the maintenance of the tree shall fall into the general requirements outlined in Section 4.0 Tree Maintenance and Management.

The tree establishment maintenance shall typically be focused on the following principles.

- Maintenance and monitoring of any appropriate protection methods and staking with removal of any stakes or temporary tree guards as soon as the tree is satisfactorily established and unlikely to be subject to further foreseeable damage.
- For smaller trees appropriate vermin control (particularly for rabbits or similar) may need to be implemented, but again this should be removed as soon as practicable, and ideally recycled or reused for next rounds of planting.
- All newly planted trees should be regularly assessed for their watering requirements. Appropriate supplementary watering applied whenever necessary during the first 24 months will help ensure the trees continue to thrive, despite potential adverse weather conditions. Care should be exercised by staff and contractors to ensure trees are not over watered, which often presents with similar symptoms to lack of water. Another symptom that often presents as water deficiency is the root rot disease, *Phytophthora*. If tree failure is not readily explained by under or over watering the manager should undertake a test with the Royal Botanic Garden Sydney Plant Pathology Department or other appropriate testing facility. It is increasingly common that soil around plants from even reputable nurseries may contain *Phytophthora* disease prior to delivery.
- An appropriate slow release fertiliser shall be applied prior to the completion of the establishment maintenance period to ensure the surrounding soil is provided with all essential nutrients and trace elements prior to transferring to general ongoing tree maintenance regimes.
- Assess and undertake any formative or clearance pruning. If trees are appropriately grown and sourced from reputable nurseries, the need for formative pruning should be relatively minimal. Within the first 24 months following planting, however, each tree should be inspected at least once by an AQF Level 5 Arborist and formative pruning carried out, as required. This will correct any visible growth defects, poor branch structures and/or start to guide appropriate long term clearances to vehicles, pedestrians and to other assets. If this is done when pruning wounds are less than 50mm in diameter, the young tree will usually quickly compensate and seal the wounds, and is far preferable to allowing serious defects to develop within a more mature tree.
- Replace any failed, vandalised or otherwise damaged trees in a timely fashion.

Figure 68: Creating a substantial mulched area around our trees can alleviate a lot of maintenance issues and usually promotes good and healthy tree growth. (Source: Arterra)

This section of the Guidelines establishes the requirements and procedures that Council apply when managing and maintaining our existing trees and future trees that are planted throughout our community.

4.0 TREE MAINTENANCE

4.0 TREE MAINTENANCE

4.1 Overview

Trees are one of the most difficult and complex elements to manage in an urban environment. They are living and dynamic items that respond to, and interact with their surrounding environment.

Inappropriate maintenance such as improper pruning can also impact the trees, leading to increased risks of failure, inappropriate reductions of all-important foliage and increased risk of pathogen attack or decay. Lack of care and control of hygiene can also lead to the inadvertent spread or introduction of diseases.

Trees drop leaves, bark, fruit, cones, flowers and sometimes even branches. Trees offer habitat for birds and animals, that may also cause nuisance and unwanted mess. This is part of natural processes and part of a tree's living and growing. Just because a tree does these things, does not mean it is a problem or dangerous. We need to accept many of these things in return for the enormous environmental, aesthetic, social, heritage and economic benefits they provide.

In natural environments, trees can live, die and fail with little or no detrimental impact to humans. However, in more highly used and urban settings, trees need to be more proactively managed. Tree risks are not equal for all areas. Large trees, in close proximity to heavily used areas and in the declining stages of their life need far different care, monitoring and approaches than smaller trees in the middle of a large park or in a more natural area, that is rarely visited.

While tree maintenance is a necessity in an urban setting, if the tree is well planned for, well selected, well planted and established in its early years it should usually require only minimal ongoing maintenance. Every tree, however, will have a lifespan and at some point will need to be removed. We must remember, however, that not every tree within Liverpool has had the benefit of excellent planning, selection and planting. Therefore, we also need to manage trees that may exist within the LGA that may not be well positioned or the most appropriate species. Sometimes factors well outside of Council's control may also impact upon trees and require intervention.

The main tree maintenance activities that we will carry out are:

- management of identified unacceptable tree related risks to life and property;
- tree pruning for clearances, sight-lines, improvement of tree structure, or reduction of risks;
- tree removals due to risk, tree decline or management of undesirable environmental or heritage impacts;
- tree surround maintenance such as mulching, fertilising, soil improvement and occasional supplementary watering; and
- pest and disease monitoring, and where feasible and economically realistic, disease control.

The Liverpool City Council area covers a very large area and contains a large number of trees. We also have a very limited budget to maintain all of the Council trees and other facilities. The management of the tree assets, like other elements, has to be prioritised. We employ staff and contractors to manage our assets and have prepared detailed technical specifications for all types of asset maintenance, including tree maintenance.

Tree work shall be undertaken in line with the specifications included within this document. Importantly, part of Council's commitment includes the inspection and monitoring of most of the trees within our care and control. Over the coming years, all trees within the main urban areas and parks will be inspected and recorded. This will provide the Council with more accurate information regarding our current tree population and will fulfil Council's obligation to exercise a reasonable duty of care. It is intended this inspection regime will be ongoing, so that all Council's trees within urban and more heavily used areas are visually inspected for issues or defects, at least once every 3-5 years and where required, in some instances even more frequently.

Figure 69: Trees are a valuable asset and resource but they must be managed throughout their life to ensure they are not posing an unacceptable risks to our community. (Source: Arterra)

4.2 Tree Maintenance
Managing Tree Related Risks

4.2 Managing Tree Related Risks

Trees provide us with substantial benefits. They are also dynamic, living elements and potentially large structures. They will live, decline and die and therefore they may present a variety of risks throughout their life. We all accept a certain level of risk as part of our daily lives. The provision of 'no risk' is not a realistic prospect.

It is important to note that any tree can fail, even healthy trees, and particularly in extreme weather. This failure can be for a large variety of reasons, both natural and man-made. Defects in trees are not always visible. They may be internal, very high up or below the ground. Appropriately trained professionals can identify some defects and some symptoms and features that may relate to an increased likelihood of failure.

Council will inspect and monitor the trees within our urban areas and higher use parks and other actively used locations on a regular basis to fulfil our obligation to exercise a reasonable duty of care. The Council will not inspect or monitor trees on private property or in areas managed and controlled by other government authorities.

The rigour and frequency of our tree inspections will be dictated by the:

- location and the level of use surrounding the tree(s);
- proximity to important structures or infrastructure;
- size of the tree(s); and
- the historical or environmental significance of the tree(s).

The basis of our tree risk management will be through the use and application of formally accepted tree risk assessment protocols.

These are tree-specific, systematic processes that provide information to help us make informed decisions that promote the safety of people and property while enhancing tree benefits, health, and longevity.

The assessment of tree risk currently adopted by the Council is the engagement (or direct employment) of appropriately trained professionals that are qualified in an internationally recognised tree risk rating system, being one of:

- the Quantified Tree Risk Assessment (QTRA) System;
- the International Society of Arboriculture's - Tree Risk Assessment Qualification (TRAQ); or
- Valid Tree Risk Assessment system (VALID).

4.2 Tree Maintenance
Managing Tree Related Risks

Tree risk management is not about precisely predicting or preventing tree failure. Tree risk management is about taking a systematic approach that broadly identifies tree related risks and then determining, using a uniform and repeatable method, the probability of a tree failure event and its likely consequence.

Trees with even a very high risk of failure may be completely acceptable in areas that are seldom visited. Conversely trees in very highly used areas may need to be actively managed or even removed to appropriately manage risk. The levels of acceptable risk may also be affected by the relative importance or significance of the tree. In some instances, for very important trees for example, we may tolerate an elevated level of risk.

In practical terms, it is Council's role to reasonably manage tree related risks to an 'acceptable' level. But often there can be a gross disproportion between the costs of undertaking risk mitigation compared to the actual 'risk of harm'. For example if the risk is very remote or the consequence of a failure is very minor it may be completely unreasonable to spend hundreds or even thousands of dollars to reduce the identified risk any further.

It is expected that Council staff, and also members of the wider community, will undertake passive assessment for tree related risks in all parts of the LGA, at all times. That is, our tree and park management staff, will typically note and then report on any visibly obvious tree risk features, as they go about daily routines. When these are noted, or reported to Council, these shall be dealt with via our more active and formalised risk assessment protocols.

Council tree management teams will normally focus on more active risk assessments. The frequency of inspections that will be undertaken by Council shall be using the following general guideline:

- For important trees with a previously identified elevated risk of harm, inspections shall be undertaken **annually**
- For trees in highly used areas or within 30 metres of significant property assets such as major playgrounds, historic structures, significant shelters or toilet facilities, and car parks, inspections shall be undertaken at least **every 3 years**
- For all other streets and parks, inspections shall be undertaken at least once every **5 years**.

It is important to understand the 'costs' involved in tree risk mitigation are often not just a monetary measure. The impact of unnecessary pruning or removal of a significant tree must also be considered a 'cost'. Aging or vulnerable trees may not recover from extensive pruning works. As significant trees age and decline, and the level of risk from their failure becomes unacceptable (as determined by a recognised system), rather than pruning or removal, a more appropriate course of action may be to simply exclude public access from around the tree. This will remove the potential for harm and consequently lower the risks to acceptable levels.

Ultimately what is deemed an acceptable level of tree related risks will be impacted by a number of key variables.

- The significance of the tree (heritage, environmental, aesthetic).
- The location of the tree and the number and monetary value of potential targets (this could be people and cars per day, or the value of the assets under threat).
- The size, location and type of the hazard (the size of the part likely to fail and the direction in which it is likely to fail).
- The probability of the failure occurring at all and whether it may be weather affected. For example in some situations it may be highly unlikely for any people to be under a tree when it is raining heavily or a wild storm.
- The relative 'costs' and viability of risk reduction or mitigation measures. Costs are principally monetary or personal injury but we must also consider loss of heritage, habitat and amenity.

Each tree subject to inspections will be assessed on their specific needs and merits. Some of the risk mitigation measures that we may typically adopt include:

- More intensive or internal assessment of the tree such as aerial inspections, or special internal decay testing or static load testing.
- Selective pruning to remove the hazardous part.
- Complete removal of the tree depending upon the circumstances and the significance of the tree.
- Installation of simple signage notifying people of the potential hazard and the conditions that may lead to increased risks (eg. high winds).
- Establishment of an informal or formal exclusion zone around the tree.
- Relocation of picnic, seating or play equipment.
- Closure of roads or parking areas to reduce the number of likely 'targets' in the event of tree failure.
- Artificial bracing, propping or reinforcing of the tree.

All of the above must consider the relative 'costs' and viability of target reductions or risk mitigation. We must also consider the loss of public access, accessibility, inconvenience or potential revenue that may be foregone.

4.3 Tree Maintenance
Tree Roots and Infrastructure

4.3 Tree Roots and Infrastructure

Tree roots can sometimes impact sewers, stormwater pipes or other building structures. It is important to establish the cause of the problem and who may be responsible for rectifying it.

If a tree is suspected to be causing notable damage to significant private structures it will typically be a requirement for the owner of the property to clearly establish that the tree is actually causing the damage and that the damage is significant and that continued and future damage cannot be overcome by any other reasonable and practical measures. A property owner is responsible for inspecting and maintaining all built structures on their land. Council does not inspect private properties for signs of damage.

In regard to the above, significant damage is a relative term, and will usually be assessed with respect to the likelihood of the need for repetitive repairs and the relative costs compared to the significance and value of the individual tree(s) concerned. For example repairs or replacement of very minor pavements or garden walls once every 15-20 years due to tree root growth would generally be considered acceptable. However, the replacement or repair of walls or pipes every 2-3 years near a tree that will continue to substantially increase in size would indicate that the tree is generally unsuitable for the location.

Figure 70: Roots can interact with our structures and other infrastructure and may cause damage that may need to be addressed. Council will usually require clear evidence that it is actually the tree roots are primarily causing the issue and the damage that is claimed. (Source: Arterra)

Tree roots rarely cause major structural damage to buildings. This is because the footings of buildings are usually deep and substantial, and not easily moved or damaged by roots. Likewise, it is rare for a tree root to cause a crack and enter into a properly installed and well-maintained pipe. However, once a pipe has deteriorated or is damaged, roots from all different types of trees, plants and even grasses can grow into the pipe. Movements in the surrounding soil can cause joint failures or cracking which then causing moisture and nutrients to leak into the soil. Failure of junctions between PVC and terracotta pipes is also common. PVC pipe systems have fewer joins that are securely glued together and rarely fail. The most efficient way to prevent root damage to your services is to replace old terracotta pipes with new PVC or UPVC pipes. Upgrading essential infrastructure is an important part of owning a property.

It's also common for old, and even new, buildings to have fine cracks in cement rendering or plaster. These are known as settlement cracks and usually do not indicate a structural fault. They are not usually a cause for concern. Large or wide cracks (wider than 5mm) in the structural supporting walls of a building may indicate movement in the foundations of a building or other structural weakness. There are many possible causes of property damage. Many older properties show cracks and signs of damage due to the construction techniques and materials used at the time they were built. Clay soils common in Liverpool can expand and contract in reaction to the amount of moisture in the soil. This is known as having reactive clay foundations. Inadequate compaction during construction or excess moisture in foundation soils can also cause subsidence and movement in buildings.

The removal of a tree is generally not considered justified when the damage is restricted to very minor structures such as unit paving, fencing, minor footpaths or driveways or due to old and deteriorating sewer or drainage lines where reasonable and practical repairs can be carried out. This is a principle largely upheld by the NSW Land and Environment Court.

What to do

What should you do if you think damage to your pipes or structure may be caused by a tree on Council land? Where possible you should expose the area, carry out any essential repairs in the case of leaking pipes, inform Council and ask us to investigate. If council-owned trees have caused the damage, you may be able to claim for the cost of the repairs. It is best if you undertake the following:

1. If concerned about structural cracks, the property owner should engage a structural engineer to assess the damage and advise of the likely cause. The engineer must base their assessment on evidence rather than just theoretical assumptions that the damage is caused by a tree. They should illustrate the damage and document the reasons or the evidence that clearly shows why they believe the Council owned tree is the cause of the damage. This may involve excavating within your

property to locate and photograph roots and their proximity to the building or the significant structure. At this stage, the roots should not be severed or removed.

2. Obtain three written quotations for the necessary repairs.
3. If the works require an excavation on a Council road or footpath, you will need to obtain a separate road-opening permit from the Council prior to undertaking the work.
4. Most importantly, notify Council of the scheduled works so that Council can arrange for an appropriate Council officer to inspect the exposed pipes, or proof of the root causing damage to footings, or structure, during the works. This will enable all parties to confirm if Council tree roots have caused the problem or if the pipe or other structure has been damaged or deteriorated for some other reason.
5. While on site, the Council officer will take photos to keep on record. You should also keep your own records of the damage, the investigations and repairs.
6. Carry out any necessary repair work to avoid any further damage and/or reduce the hazard. This does not mean the Council has accepted any liability for damages. It is the property owner's decision to carry out the repairs.
7. If the above investigations reveal the damage has been caused by Council owned trees, you may make a formal claim for the cost of repairs. Include all the above information in your claim and address it to the Risk Management Unit at Liverpool City Council. Council will then assess our liability and make a determination as to whether the Council can assist you with the cost of the repairs.

Why Council Takes This Approach?

This approach is required for insurance and governance purposes because the works relate to a private asset and may involve spending of public funds on the repair. It is important to have very clear evidence for any insurance claim, particularly if there is a chance that the initial damage may have been the result of other causes. The clearer the evidence provided, the greater the likelihood of a positive result in any claim.

4.4 Pest and Disease Control

Pests and diseases can pose a great risk to the health and longevity of our tree assets. Pest and disease threats are increasing and changing within our urban environments due to climate change, greater global trade, movement of people and gradual reductions of Australia's biosecurity measures.

Pest and disease control in public trees and parks and on a large scale can be challenging, costly, and in many circumstances, not even practical or feasible. Some diseases will also have no effective treatments. Where feasible, Council shall attempt to take appropriate preventative and corrective actions to ensure that pest activity and disease outbreaks do not pose a significant risk to our urban forest or impact on the visual quality or enjoyment of our area.

There are several known pests and diseases that have, and can affect the trees in Liverpool. As with much of Sydney, these include:

- Australian Honey Fungus (*Armillaria luteobubalina*)
- Plane Anthracnose (*Apiognomonia veneta*)
- Cuban Laurel Thrips (*Gynaikothrips ficorum*)
- Eucalypt / Grey Box Psyllid (*Cardiaspina sp.*)
- Fig Psyllid (*Mycopsylla fici*)
- Figleaf Beetle (*Poneridia australis*)
- Fusarium Wilt (*Fusarium oxysporum*)
- Painted Apple Moth (*Teia anartoides*)
- Pink Wax Scale (*Ceroplastes rubens*)
- White Rots (*Phellinus sp.*)
- Phytophthora dieback (*Phytophthora cinnamomi*)
- Sycamore Lace Bug (*Corythucha ciliata*)
- Winter Bronzing Bug (*Thaumastocoris sp.*)
- Myrtle Rust (*Uredo rangelii*)

Figure 71: In a changing climate there is often increased risk of pests. Many of our trees may become more susceptible to serious pests and disease outbreaks and we therefore need a resilient and diverse urban forest to prevent any devastating consequences. (Source: Arterra)

4.5 Tree Maintenance
Watering and Fertilisation

These diseases can have a devastating effect on tree populations. Overseas examples, such as Dutch Elm Disease and Emerald Ash Borer, illustrate how quickly entire tree populations can be all but wiped out. Analysis and ongoing monitoring of any major pests and diseases is a critical part of our tree management. The ways we will deal with pests and diseases include:

- Monitoring for pests and diseases on a continuous basis as part of regular tree inspections, our proactive maintenance program and any reactive tree maintenance works. Regular monitoring and timely intervention is critical to limiting impacts on the tree population. Treatments for pest and disease, if available, cost effective and safe to perform, shall be performed at the earliest opportunity after identification. The timing of treatment may be dependent on the nature of the pest, as some treatments will be best performed at certain stages of the pests life cycle.
- Maintaining existing trees and selecting new trees to create a diverse range of species thereby managing the inherent risk from pest and disease outbreak. The more diversification, the less risk of major tree and canopy cover loss from a major pest or disease event.
- Maintaining appropriate and healthy trees. Maintaining existing trees in as healthy state as possible and ensuring any new plantings are installed with best practice methods helps provide a resilient tree population. A tree's ability to cope with a pest or disease depends in large part on the environment in which it is growing. Some of our trees are growing in very tough environments. Coping with compacted soils, shade, wind, pollution, limited water, constricted root system and over pruning often makes it more difficult for trees to deal with pests and disease outbreaks.
- Reviewing any unexplained tree deaths. Typically we will submit suitable tissue and soil samples for analysis to an appropriate plant pathology laboratory so that we can record and understand the reason behind tree decline.
- Implementing appropriate hygiene protocols such as cleaning and sterilising of tools (cutting and digging tools) when moving from one tree to the next, and limiting opportunities for cross contamination via cuttings or soil movement between different areas, particularly if pest or disease has previously been recorded in that portion of the area.

4.5 Watering and Fertilisation

Passive Irrigation & WSUD

The twin challenges of modern-day stormwater management and climate resilience require our urban developments and tree management to depart from out-dated and traditional approaches and implement a new view on water infrastructure. The more that we embrace integrated stormwater management, the more we will have a cleaner, greener future where we are able to better manage risks, keep water costs low, and provide the widest possible range of environmental, economic and social benefits. It will also reduce our reliance on, and use of very valuable potable water. (Valderrama, 2018)

Water and plants are natural partners. Many natural systems rely on the intrinsic connections between plants and water. Plants require water for photosynthesis and growth, and without adequate water plants will die. Plants also contribute to the natural cycle of water through the landscape, as their roots absorb moisture from the soil and transpire it into the atmosphere. In doing so, they effect local humidity and temperature. (CoS-GSS, 2021)

Mutual benefits are gained from a more sustainable and integrated approach to water management. For example, recent stormwater studies conducted in Melbourne reveal that the integration of trees within 'rain gardens' has the potential to markedly increase the evapotranspiration of water from the 'rain gardens' and therefore further reduce volumes of stormwater runoff (Thom, 2020).

The design of all new streets, plazas, parks and urban renewal precincts must focus on using the local water as a resource to increase and sustain our greening initiatives. Renewed efforts need to be placed on conserving, capturing and reusing water that would otherwise be collected and immediately discharged. Potential opportunities to enhance and reconnect water and green infrastructure exist at all scales, and include:

- diverting surface stormwater to green landscaped areas and trees whenever possible;
- using permeable pavements (where hard surfaces are necessary) to allow water to recharge ground water storage;
- local collection and storage of storm water for use in efficient landscape irrigation and passive irrigation;
- localised treatment of wastewater and re-distribution for use in private and public greening;
- promoting the greening of previously hard surfaces, including available space within roadways and rooftops;
- ensuring the use of 'smart' irrigation systems that are linked to soil moisture, prevailing weather and other sensors to avoid wastage; and
- careful species selection that balances drought and heat tolerance, together with the need for transpiration and shading during hot days and heatwaves.

4.5 Tree Maintenance
Watering and Fertilisation

Investing in a landscape driven approach to sustainable water management can often cost less to construct, reduce the amount of impervious surfaces, better manage or eliminate stormwater runoff, and protect our fragile streams more effectively than conventional approaches. Inspired by nature, these predominantly vegetative systems also provide ancillary benefits that underground pipes and concrete channels do not, including:

- conserve water and embodied energy;
- reduce urban heat island effects and reducing thermal gains in our creeks and waterways;
- recharge groundwater supplies;
- create additional habitat and supporting biodiversity;
- buffer and reduce noise, sediments and other pollutants;
- improve human health and comfort;
- provide more adaptive, multi-use, attractive and resilient infrastructure; and
- make water and pollution more visible and re-educate people about waters use and benefits (Liptan, 2017).

Future street and park designs shall typically direct surface water and runoff, wherever technically possible, towards existing and new trees and other green infrastructure to passively irrigate the plants in an ever-warming climate.

Figure 72: All vegetation needs water to grow and survive. We must continue to improve the way we support our trees and other vegetation through better use of passive irrigation and water sensitive urban designs that provides water to trees when it does rain. (Source: Arterra)

Fertilisation

Given the size of the LGA and the numbers of trees being managed by Council, it is not considered practical to provide wide spread or ongoing application of fertilisers, or the like.

Similarly, many of our park and drainage corridor trees are native and well-adapted to surviving in the current soil conditions. Major soil chemistry abnormalities are not normally observed or expected. Where we need to manage important or significant trees, that may be showing unexplained signs of ill health we shall typically take a representative soil sample and have it tested by a reputable testing laboratory for any serious nutrient or other chemical imbalances. Where practical, we shall then implement the recommendations to improve the horticultural qualities of the soil through appropriate application of ameliorants immediately around the required tree(s).

For important trees that may be showing signs of acute stress or nutrient deficiency the following guidance is provided. Fertiliser shall typically be a quality and controlled release fertiliser applied at the recommended dosages. This will typically be less than 50 grams/m^2. The use of soil wetting agents such as 'Wettasoil™', 'Saturate™', 'Chemwet™' or other approved alternatives may also be used in accordance with manufacturer's recommendations. This can be important to improve the water penetrating capacity of any hydrophobic or compacted soils.

For particularly stressed or injured trees the use of growth stimulants such as 'Auxinone™' by Barmac Industries at a rate of 10ml Auxinone™ mixed with 10 litres of water together with a soil wetting agent to the area around the tree root surfaces may be applied to trees in accordance with manufacturer's recommendations.

4.6 Tree Maintenance
Tree Pruning

4.6 Tree Pruning

Pruning Standards

Pruning should not be seen as an essential, normal or necessary tree activity for most trees and will generally not be required except for specific and identified reasons. Pruning has a direct impact on tree health, structure and viability. All pruning of live tissue results in a wound to the tree, which the tree will attempt to seal and compartmentalise. Incorrect pruning techniques can lead to decay and disease within the tree.

Pruning of the canopy also has the consequence of removing valuable foliage, which in-turn removes an essential source of energy production from the tree. The tree will then spend considerable reserves of energy on trying to regrow the lost foliage. Branches and trunks are also important transport and storage tissues within the tree.

Increasing research also illustrates the importance of natural tree branching structure and the ability of the tree to deal with strong winds. The mass damping effect of multiple branches moving in multiple directions during storms helps protect trees and reduce the destructive energy acting on the tree. Excessive removal of branches can reduce this mass damping effect and may contribute to increased failure rates.

Figure 73: Although many trees may not require pruning, our urban trees will sometimes require intervention to remove defective branches or provide the necessary clearances. It is vital this is done using best practices and professional arborists. (Source: Arterra)

Most trees should not typically require pruning on any regular basis. Should pruning work be required it shall be in accordance with Arboriculture Australia's - Minimum Industry Standard (MIS 308) - Tree Pruning and AS 4373 Pruning of Amenity Trees. It should only be undertaken by suitably qualified arboricultural personnel using sharp and clean tools. Where there is a risk of the spread of disease from one tree to another, the pruning tools shall be disinfected between trees.

Typical Types of Pruning

The types of tree pruning work that may need to be undertaken include the following:

- Deadwooding: This is the removal of dead or dying branches. If deadwooding is proposed then Council or our Contractors shall remove all dead branches greater than 50mm in diameter on young trees less than 10m in height. They will remove all dead branches of greater than 75mm diameter for existing mature trees greater than 10 metres in height, but only where practical or as advised by the Council. Trees in remote or naturalistic environments shall typically not require deadwooding. If undertaken in more natural areas, and on suitable sized trees, opportunities for habitat feature creation may be considered where practicable to create spouts, bird and fauna hollows and microbat slits and hollows.
- Crown raising: This will involve the removal of some selected lower branches as required to create adequate building, vehicular or pedestrian clearances. These shall be as per the table X.X (and a point measured at 1 metre radius from the centre of the main trunk outward).
- Selective Pruning: This will involve the removal of selected branches and only as required to remove an identified hazard, defective or otherwise abnormal branch. Pruning of branches larger than 100mm in size should be reviewed by a suitably qualified AQF5 consulting arborist before being pruned.
- Formative pruning: This is normally small scale and relatively minor pruning that is undertaken on young trees to improve their longer term health and structure. The aims of formative pruning are specifically:
  - to enhance form and improve structure, or to directionally shape young trees;
  - to reduce the development of any structural weaknesses;
  - as a precursor to more specialized pruning; and
  - to accommodate site constraints and reduce encroachment on utilities or buildings as the tree grows. eg: clearance to lights, signs, poles, wires and buildings.

4.6 Tree Maintenance
Tree Pruning

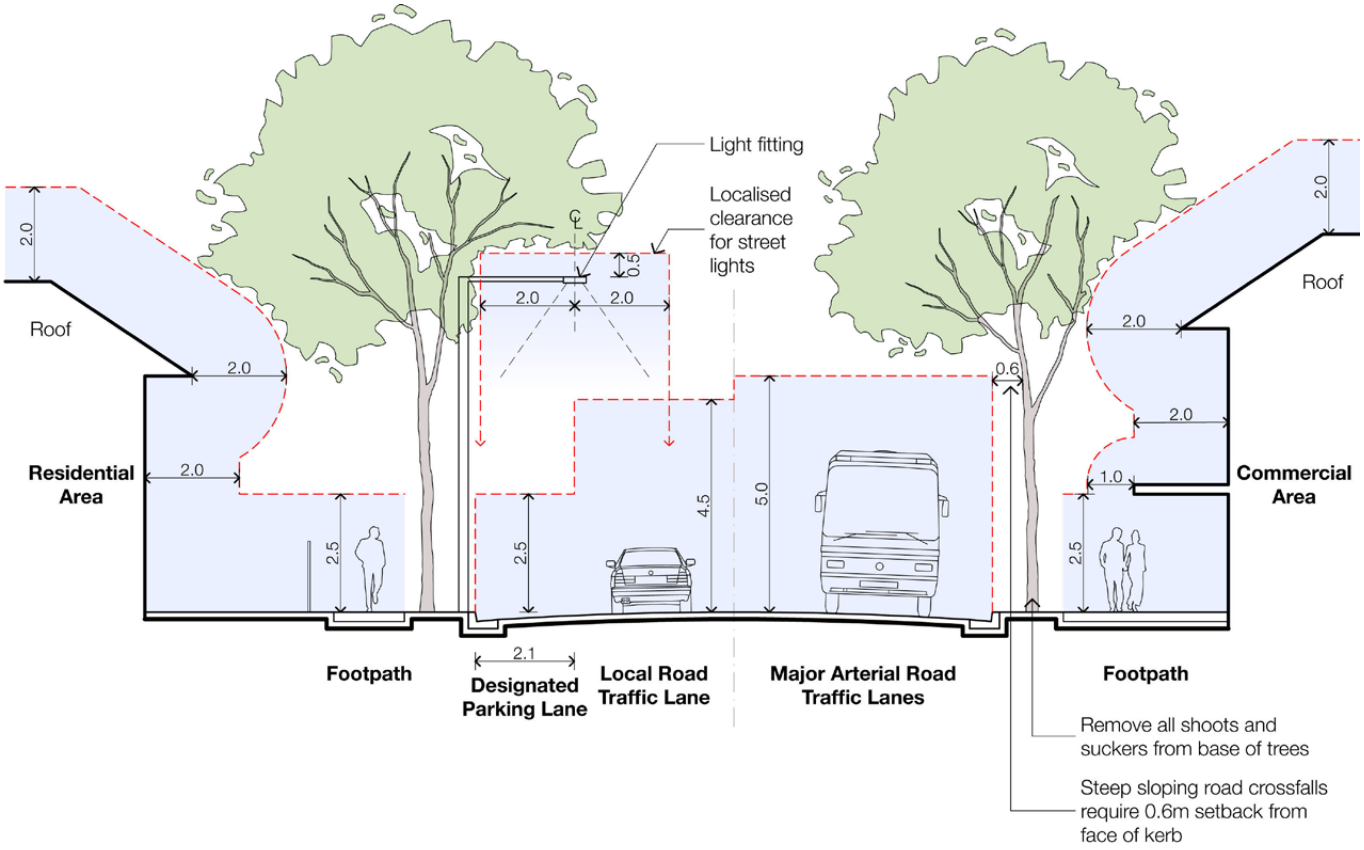

Figure 74: Typical clearances Council will endeavour to maintain for trees growing in our most urban environments. We will always need to consider site specific circumstances and tree health and forms (Source: Arterra)

Council will prune trees to maintain reasonable and safe clearance between trees and pedestrians, vehicles and private property. Council has developed specific guidelines with regard to tree pruning for clearances and to maintain views and solar access. Refer to Figure 66 for a graphic illustration of the proposed clearances and offsets for mature tree pruning. This is a guideline illustration only and actual clearances required will ultimately depend on individual site constraints and case by case assessment.

Council will not typically prune a tree for the provision of views or creation of solar or digital receiver access. Council will avoid pruning practices which disfigure the tree or are detrimental to its healthy and safe condition.

Table 8 - Standard Clearances and Pruning Guidelines

Item	Clearances Required
Roads	2.5 metre height clearance over parking spaces, 4.5 metres over main vehicle travel lanes, increasing to 5.0 metres on major arterial roads
Bus lanes and stops	4.5 metre height clearance over dedicated bus lanes and bus stops
Pedestrian paths	2.5 metre height clearance or where sight lines are required to pedestrian crossings
Buildings/structures	2 metre all round clearance except for awnings where 1m will be provided
Private electrical service wires	0.5 metre all round clearance
Road Signs/Traffic signals	As required to provide adequate sight lines in normal travel direction
Lighting	As required to provide adequate illumination
CCTV	As required to provide adequate visual access to critical areas
Main electrical powerlines	As required or directed by relevant energy authority and the voltage of the cables.

4.6 Tree Maintenance
Tree Pruning

The removal or pruning of street trees is permitted in association with approved road works under sections 88, 107, 138 and 139 of the Roads Act 1993. Council is largely responsible for all planting, removal and maintenance of street and roadside trees on local roads. Importantly, declared main arterial, motorways or 'State' roads are the responsibility of the Roads and Maritime Services (RMS) (previously the Roads and Traffic Authority). The Liverpool LGA contains several 'State' roads that fall under the jurisdiction of the Roads and Maritime Services (RMS) and Council may not have the ability to manage, prune or remove trees along these roads.

Trees and Powerline Clearance Pruning

Ausgrid is the state owned corporation responsible for the electricity network that provides power to Sydney homes. Under the NSW Electricity Supply Act 1995 No.94, Ausgrid is responsible for ensuring street trees (as well as private property trees) are trimmed to maintain a minimum safety clearance between the tree and power lines. The typical safety clearance distance is 1.5 metres around bare, low voltage overhead wires and 2metres around the power poles. This safety clearance distance may be even greater on higher voltage lines.

If trees are within 3 metres of any Ausgrid power lines, only vegetation management workers authorised by Ausgrid are permitted to carry out tree pruning work. Council is typically not responsible for clearance pruning of trees near power lines.

In theory, pruning is carried out by contractors who follow the Australian Standard AS4373-2007 Pruning of Amenity Trees. Ausgrid also employs qualified arborists to audit the work of their contractors. Each contractor is also supposed to employ arborists to help monitor standards and ensure they are maintained.

Periodically Ausgrid may amend their policies, environmental codes and work practices. Recent examples of this include their adoption in 2015 of the Vegetation Management Common Requirement (Version 7.4) dated October 2014 and the Private Service Wire Defect Notifications Policy 2015. If residents receive correspondence from Ausgrid, or their authorised representatives, about requests for the pruning of trees and vegetation around private service wires, they should contact Ausgrid directly for any further information or clarification required. Council's Customer Service staff or Tree Management staff may also be able to provide some limited advice and/or assistance to resolve residents' concerns.

Figure 75: Clearance of trees from overhead power lines is an important issue. High voltage lines, in particular, often need very significant offsets which can radically disfigure and effect trees. Council will continue to endeavour to engage with utility providers and utilise the 'right tree for the right location' approach to minimise conflicts and maintenance burdens while still achieving our canopy cover targets. (Source: Arterra)

4.7 Tree Maintenance
Tree Mulching and Surrounds

Aerial Bundled Conductors (ABC)

From the ground, Aerial Bundled Conductors (ABC) look like a single thick cable, however ABC contains the normal group of overhead services bundled together to reduce the cross sectional area necessary for the provision of overhead services. This method of cabling reduces conflict with trees. Pruning requirements are usually much reduced and branches can be trained around the ABC more easily.

Priority for ABC conversion is usually given to major roads and particular problem streets where the conflicts between trees and overhead services are identified. Council and Ausgrid maintain an ongoing program to convert some conventional overhead wires to ABC however the cost of this conversion is considerable and is often not favoured by Ausgrid due to the reduced life expectancy of the cables.

Council shall attempt to influence the relevant power authorities to implement ABC in order to help limit unacceptable pruning of our urban trees. Priority for this intervention shall be given to streets where ABC installation will allow larger trees to be planted or continue the growth of newly planted trees unimpeded by the wires before the typically disfiguring pruning is undertaken. Streets where most trees that have already been trained around existing wires will be of lower priority, as the conversion of these streets will have only limited benefits.

Figure 77: Conversion of power lines to ABC is an important initiative to help retain and promote tree planting and around power lines. (Source: Arterra)

Figure 76: Mulches surrounds can improve tree health and prevent maintenance problems from grass mowing around mature trees. (Source:Arterra)

4.7 Tree Mulching and Surrounds

The area immediately around a tree is vitally important. It is where the unseen but all important roots reside. The quality of the soil conditions surrounding the tree, particularly younger trees, often has a direct impact on the health of the tree and its resilience. We will maintain the area around existing trees to promote tree health and ongoing protection.

Trees located within grassed areas within parks shall typically have a clearly defined mulched area under the tree to a minimum of 2-3 metre radius. This shall be a suitable recycled hardwood and coarsely chipped mulch. This helps prevents otherwise avoidable impacts to the trunk and root flares from mower and line trimmer damage. It is important the mulch is not too deep and is of a free draining nature. Excessively thick mulches or very fine organic mulches can become hydrophobic and actually prevent water from reaching the soil zone or introduce unwanted pathogens to the soil or tree.

A mulch ring around trees is a simple and vital way of maintaining soil quality around the trees, promoting moisture retention, reducing and reversing soil compaction, decreasing soil temperature fluctuations, and increasing nutrients and general microbial activity. We will typically ensure that:

- tree bases are relatively weed free and that grass re-growth is controlled;
- mulch is level in appearance and regular in shape;
- herbicides are appropriately used to treat to edges of the tree bases; and
- mulch around tree bases is maintained between 75-100 mm thick at all times and that mulch is no higher than 50mm when directly against tree trunks.

To the extent that limited Council resources permit we will aim to implement similar initiatives for our street trees. We will target, as a priority, these surrounds when they have been installed as part of new planting.

4.8 Tree Maintenance
Tree Removals and Replacement

4.8 Tree Removals and Replacement

Private Tree Removals and Replacements

Council require anyone removing a tree to obtain approval in writing from Council prior to the removal (except in the case of an emergency). Refer Section 2.3.

Council will typically require private owners to plant a replacement tree. The offset ratio for replacement will be based on a case by case basis but will typically be
1 to 1 for lots less than 600m2
2 to 1 for lots 601-1000m2
3 to 1 for lots >1000m2.

Minimum size of replacement trees will typically be **45L**, however Council may condition larger sizes when particularly large or significant trees are removed. Council may waive the need for replacement planting if the owner can make sufficient and reasonable justification that a replacement tree would be impractical and unsustainable.

Unauthorised (Resident) Planting on Council Land

Council may identify situations where trees have been planted on the Council managed road reserves or within parks or drainage reserves without the written approval of Council.

Although these are sometimes suitable trees, there are potential issues relating to insurance, public safety, environment and the integrity of overhead and underground services that must be considered.

It may also represent an unacceptable maintenance burden to Council, or a significant cost to later remove a tree. These unauthorised trees may also result in Council's strategic visions not being achieved. Council therefore, does not permit planting of trees on Council land by any person other than Council staff or contractors and Council may remove any such trees without the need for notice.

If residents wish to have tree planted within the verge adjacent to their house or in a nearby park they should lodge a request with Council.

Council Tree Removals

Generally, Council will not consider leaf, fruit, sap or bark drop or bird and bat droppings as valid reasons to prune or remove a tree. These are natural processes of normal tree growth and use by wildlife.

Council will seldom remove a healthy tree. Council tree replacements will usually only happen gradually over time, as trees need replacing. As such, existing street and park trees, regardless of species, will normally be left to grow for their natural life and will only be removed if they have become a safety issue, an unacceptable hazard or ongoing remedial tree or infrastructure works become financially unviable.

Figure 78: Unauthorised planting of tree on public land needs to be discouraged and carefully controlled. Council support the desire for trees but any tree planting should be specifically undertaken and endorsed by Council. (Source: Arterra)

Council aims to maintain, expand and conserve the overall canopy coverage within the LGA. Council will remove urban trees in the following circumstances.

- The tree is dead or dying, or unacceptably disfigured or very poorly formed.
- The tree is assessed as being hazardous due to recognisable structural or health defects and where remedial or selective pruning cannot eliminate the risk, or where such pruning will leave the tree unacceptably disfigured or poorly formed.
- The tree is causing public infrastructure damage, which is considered significant and cannot be overcome by other reasonable and practical measures.
- The tree is causing significant damage to significant private structures. It will typically be a requirement to positively establish that the tree is causing the damage and that the damage is 'significant' and that continued and future damage cannot be overcome by other reasonable and practical measures.
- Any other reason, at the discretion of Council's staff, which can be justified by either technical or legal grounds according to the particular circumstances.

Council aims to continue reinforcing the existing character of our parks and streets, planting as many trees as possible, unless there are specific issues or problems to address or there are clear opportunities for park or streetscape or

4.8 Tree Maintenance
Tree Removals and Replacement

canopy cover improvements in line with our adopted Tree Management Strategy.

If a tree is removed it will typically be felled to ground level and the stump ground out. For any tree removal works, where trunks or branches have cavities or native spouts, that may have potential impact on native wildlife, a suitably trained wildlife handler (WIRES or approved equivalent), must be engaged to inspect and potentially relocate any animals prior to works. For identified important habitat trees Refer also Section 4.11 - Special needs and considerations for further guidance.

In the event that native or endangered wildlife is encountered during the course of normal tree removal works, and the tree was not previously assessed as having potential wildlife, work will be temporarily stopped until a trained wildlife handler attends the site or the animal otherwise safely relocates itself or the tree is further assessed by a qualified and licensed ecologist.
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Succession Planning

While retaining and protecting existing trees is a priority, it is important to remember that trees naturally grow, age and ultimately die. On this basis a plan for suitable propagation, procurement and replacement planting also forms part of our tree management.

Good succession and replacement planting begins long before anything is planted in the field. Careful pre-planning is sometimes required to ensure the planting is appropriate on a number of levels. When replacing a number of trees or significant trees Council will undertake suitable succession planning.

Succession planning is only required for the most significant trees and any historic row, avenue or copse plantings. Succession planning should only commence when there is evidence the relevant trees are showing signs of serious decline or ill-health. If this process is commenced too early there is danger of the planning being lost, ignored or becoming irrelevant with passing years and managerial changes. For most situations a suitable 'Succession Plan' should be a simple 2-3 page document that addresses the following points:

- Clearly identify the specific tree(s) to be replaced.
- Describe their location and provides a map, survey or diagram accurately depicting their location and in the case of a row, avenue or copse, their quantity.
- Provide a brief overview of the known significance of the tree(s) (ie. environmental, cultural heritage, scientific, aesthetic, habitat value etc).
- Describe the proposed replacement planting strategy (removal and replacement in the same location, replacements grown adjacent to the existing tree(s) while awaiting for the ultimate removal of the existing tree, block replacement, staggered, offset replacement etc.)
- Provide a methodology for the sourcing, timing and preparation of replacement tree stock with a minimum of:
  - the anticipated timeline for the replacement project;
  - the method of propagation (cuttings, seeds, other).
  - who will undertake the propagation and of how many (need to allow for failures and further replacements if necessary);
  - where the stock will be propagated and grown (what nursery and for how long); and
  - at what size will they be transported and planted, particularly if its likely to need archaeological assessments.

Major Street or Public Area Upgrades

The exception to Council's policy for not removing trees unnecessarily may be when major street or park improvements or upgrade works are required or if there is a specific plan to revitalise a particular street or area. Even then, unnecessary tree removal will still be avoided where ever possible.

Council's method for larger scale tree removal and replacement in any given street, plaza or major park depends on a number of important and inter-related factors:

- Size and significance of the trees being replaced;
- Whether they are part of a consistent avenue planting;
- The nature of the problem(s) that the trees may be causing; and
- The nature of the replacement trees being suggested and whether there will be room under other existing trees for the new planting.

For particularly significant trees or isolated trees that are not part of a recognised avenue planting, they will typically be removed one at a time and replaced with a suitable new tree. This allows the trees to be replaced gradually without significant impacts to the overall amenity of the area.

This may not be effective if the trees are part of a larger grouping or if major street changes or improved planting techniques are proposed. In such cases, Council will be seeking to achieve economies of scale in the new works and flexibility in addressing new footpaths, services or road works that may otherwise damage existing trees.

When the trees are part of a group or avenue, Council will typically remove the identified problem or substandard trees as small groups. For long avenues this will typically be in a 'block' style replacement leaving some groups or 'blocks' remaining in between the new planting. This keeps the overall integrity of the street planting while replacements begin to mature. As the new planting matures Council will

4.8 Tree Maintenance
Tree Removals and Replacement

Figure 79: Failed and dead trees will occur and should be removed and replaced in a timely fashion to mitigate risks and maintain our canopy cover. (Source: Arterra)

return to remove the remaining 'blocks'. Depending on the size of trees being replaced and the length and importance of the avenue, this process will usually be completed over a multi-year year program in either 2-3 stages, leaving 2-3 years between removals and replacements. This length of time is important so that Council can properly program and budget the works and also to allow time for the new trees to reach a suitable size before removing further trees.

Replacement of Removed Trees

Where a Council tree is removed, Council will install a suitable replacement tree at or very close to the removed tree. They will follow the spacing and placement guidelines outlined in our Guidelines and may locally adjust the placement as needed.

The replacement species shall be as outlined in these Guidelines or other relevant approved Council plan, for that particular street or park. Where a choice of species is possible the species selected will take into consideration the localised environmental, functional and aesthetic aims and the reason for the previous trees removal. The species selected shall be at the sole discretion of the Council.

Notification of Tree Removals and Planting

Where practicable and feasible the Council will provide at least 14 days notice for the planned removal of public trees. This notification will typically be in accordance with Table X and via a notice on the Councils website and a suitable weather proof notice attached to the tree. For emergency removal, replacements of failed or dead young trees or very minor street tree removals, typically no notice will be provided.

Table 9 - Notification of Council Tree Removals

Activity	Notification Period and Extent
Emergency Removal	• No prior notification
Minor Street or Park Tree Removal (including trees up to 5m)	• 7 days prior notification to immediately adjacent properties stating reason for removal
Standard Street or Park Tree Removal	• 28 days prior notification to all surrounding or adjacent properties and those opposite stating reason for removal • A3 sized weatherproof notice attached to tree • Proposed tree removal included on Council's website
Registered Significant Tree Removals	• Notification of planned removal and reason for removing the tree and/or reason for removing it from the Council's Register of Significant Trees to be presented and formally endorsed by Councillors • 3 months prior notification to all surrounding or adjacent properties stating reason for planned removal • A3 sized weatherproof notice attached to tree • Proposed tree removal included on Council's website

4.9 Tree Maintenance
Emergency Tree Works

4.9 Emergency Tree Works

Proactive tree management and maintenance will normally reduce the level of reactive tree maintenance activities or unexpected tree management. However when dealing with urban trees and trees that are a legacy from previous periods there will always be unexpected and ad-hoc maintenance requirements. Similarly, unusual or extreme weather events can lead to unexpected tree issues and storm damage.

Very occasionally, the immediate removal or pruning of a tree or number of trees may be required due to imminent danger to life or property. In the event of an emergency situation approval will not be required from the Council. In the event of major property damage or a tree causing personal injury or death we will expect the relevant emergency services personnel and any tree Contractors engaged to deal with the incident to take photographic evidence of the tree failure and any damages sustained to property. They should report the failure a soon as practical to the Council's call centre (phone 1300 36 2170).

Tree failures or storm damage clean-up will be dealt with in a timely fashion by Council's contracted maintenance program providers.

Accidental Tree Damage

Should a tree be accidentally damaged, timing can be of the essence, particularly with bark injuries, trunk damage or chemical contaminations. Report such damage as soon as practical to the Council's call centre (phone 1300 362 170).

Where a branch has been broken, it shall be removed and the damaged end pruned to a suitable branch collar and in line with accepted pruning practice. If the branch has been torn out of the trunk, assessment shall be made and the damage cleaned up as much as practicable, without sustaining further damage to the tree.

If bark has been dislodged from the trunk or large branches, it may be possible to reinstate it to the tree using suitable non-injurous strapping and wrapped with moist hessian and/ or industrial cling film to tightly reattached the damaged bark. This process is time critical and must be done within hours of the damage. This may limit water loss and in some rare cases allow the tree to potentially develop the formation of a "traumatic phellogen" that may resume its function as a producer of the protective cork or bark layer. The covering should be removed after approximately 4 weeks and checked. At this time, any dead or unviable material should then be carefully removed and the damage to the tree re-assessed.

If tree roots are accidentally disturbed or excavated, any broken and torn sections shall be carefully exposed by hand and suitably pruned leaving only clean cuts, to minimise risks of infection by fungal pathogens and to promote potential for new root growth. Damaged trees may also warrant receiving additional follow up care and the tree may be provided with supplementary watering and fertiliser applications to help sustain the trees health and growth.

Refer to section 4.10 if soil contamination is expected or exposed in the course of emergency tree works.

Figure 80: Trees are very easily damaged by passing vehicles or construction equipment. Proper protection is always the key, as it is seldom possible to repair a damaged tree. (Source: Arterra)

4.10 Tree Maintenance
Soil Contamination and Trees

4.10 Soil Contamination and Trees

General Considerations

Liverpool LGA has historic uncontrolled filling in some areas. It is common for contaminated soils to be encountered. Some of the more common contamination encountered may be items such as:

- heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc),
- petroleum and/ or hydrocarbons (TPH, Benzene, toluene, ethylbenzene, xylenes),
- organochlorine pesticides (OCPs) and organophosphate pesticides (OPPs), polychlorinated biphenyls (PCBs),
- and asbestos.

This needs to be considered with regard to tree management for the following reasons:

- Digging and preparation for tree planting may mean that contaminated soils are encountered
- Failures of trees that results in roots and attached soils lifting out the ground may expose contaminated soils
- Grinding out of tree stumps may expose contaminated soils and create dust that may contain contaminants
- Undertaking non-destructive root investigations or pot-holing that may expose contaminated soils and create dust that may contain contaminants
- Remediation of site with contamination often requires the treatment, capping or removal of contaminated soils. This can have significant impacts to the health of existing trees.

The following guidance is provided regarding contamination and tree related work.

Tree Planting and Soil Preparation

When planting new trees Council shall consult relevant registers or mapping of known contamination areas. (Consult with internal Liverpool City Council Environmental Health Team). If planting within any areas of know contamination, specific controls and staff inductions shall be carried out to ensure all workers are aware of the contamination, the nature and potential depth of the contamination is understood and appropriate precautions, procedures and protective equipment is observed. This may necessitate Council engaging specialist consultants and Contractors to test the area or undertake remediation or soil removal prior to planting.

In areas where contamination is known or observed existing spoil created during excavation for the new tree may need to be appropriately removed and disposed off site with replacement soil provided using clean imported soils and backfill.

When planting new trees in areas not mapped or expected of contamination, vigilance is still to be exercised by all Council supervisors and appointed Contractors for the potential presence of soil contamination such as asbestos. Should any signs of potential contamination be noted during excavations, work shall be suspended immediately until the nature of the potential contamination is identified and properly managed if required.

Figure 81: Tree work and activities may need to be modified on sites with identified contamination. (Source: Arterra)

4.10 Tree Maintenance
Soil Contamination and Trees

Figure 82: Tree work and activities may need to be modified on sites with identified contamination. Work that disturbs soils or creates dust that could be contaminated may need to be avoided, or performed by specialists (Source: Arterra)

Emergency Work Where Soil is Exposed

During emergency tree works where soil has been exposed, rudimentary checks and site observations should be undertaken by Council staff, or their engaged contractors, to inspect for possible signs of subsoil contamination. If contamination is suspected the area should be appropriately cordoned off from the public. Above ground tree parts may be removed where safe to do so, but stump removal may need to be delayed until the site is inspected by trained contamination experts and advice given as to required safety precautions for Council staff, contractors and the general public.

Stump Grinding and Non-destructive Root Investigation Works

Before undertaking stump grinding, or non-destructive digging and root investigations such as air-spades and water jetting with vacuum extraction, Council shall first consult relevant registers or mapping of known contamination areas. If the area is known to have potential contamination extra precautions are to be applied. This may entail leaving the stump in place and simply felling tree to the ground level and leaving in place (where safe to do so).

Prior to any grinding work, the stump grinding contractor should inspect the site for any signs of potential contamination, particularly the presence of asbestos.

If the contamination is minor or deemed acceptable for the stump to be ground, out and the area prepared for replacement tree planting, the stump grinding contractor shall observe additional methods to control and suppress dust. This may include

- use of smaller or more specialised grinding equipment (or non-dust producing digging equipment)
- use of increased barricading and exclusion distances
- use of improved personal protection equipment such as coveralls and masks and filtered breathing equipment
- use of dust suppression spays and misters while grinding (or undertaking non-destructively digging)

4.10 Tree Maintenance
Soil Contamination and Trees

- appropriate removal and disposal of grindings and surrounding loosened soils and then replacement with clean imported fill

Tree removal and stump grinding on private lands should follow similar guiding principles.

Remediation of Contaminated Sites Near Existing Trees

Sites that are identified with contamination often need to be remediated and made safe. This often requires removal, and /or treatment of the contaminated soils. This can often lead to significant impacts to existing trees and special considerations may need to be made. Typically contaminated sites will need to be examined by a trained 'site hygienist' who will advise on the nature of the contamination and advise on the appropriate remediation measures. If existing trees are present, that need to be retained, the remediation measures must be discussed and resolved with a qualified arborist, prior to being undertaken.

The NSW EPA Contaminated Land Management Guidelines for the NSW Site Auditor Scheme (3rd Edition) (2017)11 provides the following requirements to be taken into consideration:

- Remediation should not proceed in the event that it is likely to cause a greater adverse effect than leaving the site undisturbed; and
- Where there are large quantities of soil with low levels of contamination, alternative strategies should be considered or developed.

The most common methods of treating soil contamination are:

- Complete removal of the contaminated soil layer to a given depth and disposal off site.
- Selective removal of the contamination via close visual inspections and then specific removal and disposal of the visible contamination.
- Chemical treatment of the soils to render contamination safe or inert. This is typically only available for some specific chemical contaminants.
- Excavation and removal of contaminated soil layers or pockets of contamination and re-burial on the site or nearby at required depths with suitable capping
- Placement of a suitable geotextile and/or marker layers to separate and identify the contamination and then the capping of the contamination with clean imported soils.

All of the above can have very dire consequences on the roots of existing trees and can lead to tree death and/or instability.

The following measures shall therefore be applied with regard to existing trees.

- Typically if the contamination is located outside of the calculated Tree Protection Zone (TPZ), as calculated under the AS4970 - Protect of Trees on Development Sites, these soils may be treated, removed or capped as required and the loss of roots will be tolerable.
- Where contamination is found within the TPZ areas. Excavation and/or disturbance of soils within the TPZs will typically not be permitted without the approval of an appointed arborist. Contaminated soils will instead require capping and management in-situ. Chemical treatments to render contamination inert shall typically not be allowed within TPZ area due to the possibility of these altering soil chemistry or being detrimental to tree roots and affecting tree health.
- If contamination is very isolated and minor in nature then some removal of surface soil may be tolerated to a maximum of 100mm depth, if undertaken using suitable non destructive methods such as vacuum extraction. (Note this is usually only suitable in friable and non-clay based soils).
- The capping soils must be suitable and not detrimental to tree health. Capping shall typically be achieved through the installation of between 150mm-300mm of clean imported organic topsoil. The imported organic topsoil should be:
  - Hills Bark Blower Organic Garden Mix; or
  - Benedict Organic Garden Mix (M13); or
  - An approved equivalent manufactured garden soil with a maximum 20% organic matter by volume.
- Capping material must be highly permeable and must not exceed 300mm in depth. Capping material should not be compacted. Placing soil at depths greater than 300mm or using heavy clays can have detrimental affects on tree health.
- If asbestos is present, a marker layer may be required to be laid under the capping layer to delineate contaminated soil from clean capping soil and identify the contamination to future contractors or owners. When installed around trees the marker layer should be a very open geo-grid material that readily allows air, water and finer tree roots to pass through unhindered. (Minimum of 50mm openings between grids). Fine or non-permeable geotextiles or plastic sheeting must be avoided, as these may impact or restrict root growth and lead to significant tree health impacts.

4.10 Tree Maintenance
Soil Contamination and Trees

Planting New Trees and Contamination

When planting new trees within a contaminated soil area this may be possible with limited issue or restrictions
Typically the following measure shall be applied when planting trees within a known contaminated area.
Where possible the levels should be raised and the contaminated soils left in place and capped with clean and imported soils. This sill then allow planting of the new trees with minimal change to normal and documented procedures. Depending on the nature of the contamination a marker layer may be required. Any marker layer should be as deep as possible, to avoid impacting tree root development or drainage. Marker layers deeper than 700-800mm below finished surfaces should have little impact to trees or tree roots.

If such depths can not be readily achieved within a wider area markers layers may be shallower surrounding the new tree but must be locally deepened immediately around the tree to go under the installation size of the root ball and should not be closer than 3m radius to the centre of the tree if installed vertically or near vertically.

Marker layers under or around trees must be a very open geo-grid material that readily allows air, water and finer tree roots to pass through unhindered. Fine or non-permeable geotextiles or plastic sheeting or the like must be avoided as these may impact or restrict root growth and lead to tree health impacts. (Refer - Typical planting details at Appendix 5.7 - Standard Planting Details)

In rare occasions, if contamination is a major concern and capping and marker layers are not appropriate then trees may still be installed but planted in small or very small container sizes. For example if soil is contaminated and would otherwise prevent tree installation and excavations then trees could be installed using 'tubestock' sized trees that can be done with very little if any soil disturbance.

Figure 83: Planting can be undertake successfully within contaminated environments. If a maker layer is required it should allow natural root development and be open weave geo-grid when surrounding tree planting holes, to allow finer roots to penetrate. The space given to around the tree itself should still be as generous as possible. (Source: Arterra)

4.11 Tree Maintenance
Special Needs and Considerations

4.11 Special Needs and Considerations

Root Barriers

Root barriers are not recommended and will typically not be required. Their installation around existing mature trees can have significant and detrimental impacts to existing trees' roots. They shall only be installed when specifically warranted to protect a significant piece of infrastructure or an important heritage structure.

Independent assessment by an AQF5 arborist will be completed prior to the installation of any root barriers to determine if the root barrier is appropriate and will achieve the desired protection from roots. It will also be necessary to ensure that the subsequent impacts to any mature tree is acceptable.

Transplanting

Although it is technically possible to transplant many trees such as Figs, most palms and some smaller deciduous and other exotic trees, Council will seldom have the resources or ability to consider transplanting trees. Likewise, private developments that rely on transplanting an existing tree need to be seriously questioned in terms of realistic and affordable outcomes.

Council will usually recommend consideration of other alternatives that leave the trees in their current location rather than move them. This is due to the following key reasons.

- The extreme difficulty in gaining appropriate and workable access to all sides of a tree and the likely engineering difficulties with undermining or disturbing surrounding structures and services.
- The substantial costs associated with cranage, traffic control, transport, and the engineering of suitable support systems.
- The costs associated with the ongoing maintenance of transplanted trees, once they are compromised by the move.
- The very real likelihood, even if successfully transplanted, of the transplanted tree declining in overall health and condition and then shedding limbs, having a sparse canopy and ending up an increased tree 'risk' and a potential eye-sore rather than an asset for many years to come.

Transplanting of trees shall only be considered by Council in extremely rare and highly specific circumstances. Council shall typically engage the services of appropriately experienced and qualified (AQF5) arborists together with suitably experienced mature tree transplanting contractors to advise on the feasibility of tree transplanting.

Figure 84: Transplanting is a complex, and costly process. If it is ever undertaken or endorsed by Council, it needs to be done by experienced professionals and must include adequate follow up care and maintenance regimes to be successful. (Source: Arterra)

4.11 Tree Maintenance
Special Needs and Considerations

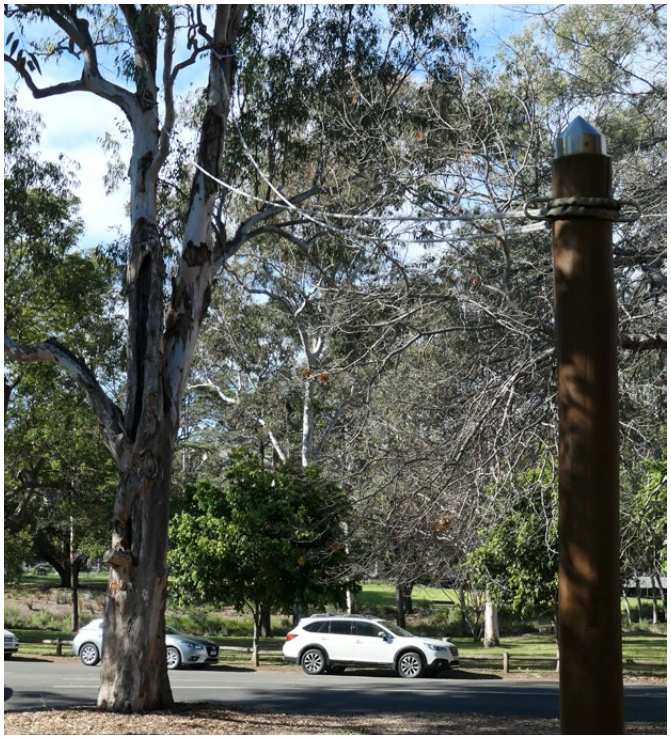

Figure 85: Artificial propping or bracing is a highly specialised skill and needs to be properly installed and frequently monitored. It will typically be reserved for only our utmost significant of trees. (Source: Arterra)

Artificial Bracing and Propping

Interventions such as bracing or propping will not normally be implemented by Council due to the large costs and potentially short-term efficacy. It will only be considered as a last resort to avoid complete removal of a very important tree. This type of tree management will only be implemented for the very highest value habitat or heritage trees.

If needed, it shall be designed and installed by experts in the field of tree bracing and support. It will then need to be monitored on an annual basis. Rigging and other fixtures shall be inspected and replaced when worn or damaged, as necessary.

Any such work must be undertaken strictly in line with Arboriculture Australia's - Minimum Industry Standard (MIS 310) - Tree Support Systems.

Figure 86: Artificial propping or bracing is a highly specialised skill and needs to be properly installed and frequently monitored. It will typically be reserved for only our utmost significant trees. (Source: Arterra)

4.11 Tree Maintenance
Special Needs and Considerations

Figure 87: When some trees reach the end of their natural life, their use and benefits may be prolonged through thoughtful creation of habitat or 'stag ' trees. (Source: Arterra)

Habitat, Hollows and Stag Tree Creation

Some of the existing larger native trees located within the LGA may be identified as important habitat trees presenting with a variety of hollows and smaller spouts or nests.

If these begin to decline or die, and where viable and appropriate, they may be pruned to form what are known as "live stags", thereby preserving as many existing hollows as possible and retaining most of their habitat value. This may substantially reduce the likelihood of tree and branch failures in the short to medium term.

All work shall be undertaken in line with Arboriculture Australia's - Minimum Industry Standard (MIS 312) - Environmental Arboriculture.

To create a live stag Council shall typically involve:

- having any habitat features or active nests assessed by a qualified and licensed ecologist or wildlife carer. (Refer below)
- assessing the overall form, lean and balance of the proposed live stag tree and remove any excessively leaning or outreaching branches;
- removing any severely decayed or hollowed material that may be likely to fail within the foreseeable future;
- typically remove all branches and dead wood below 150mm in diameter, and in accordance with normal pruning practices;
- potentially limit or exclude general access around the base of the tree;
- retain as many existing hollows, spouts and cavities without further treatment or pruning: and
- inspect for and arrange for any active termites to be treated if they are still active and present within the tree.

Tree Removals With Noted Habitat Features

Landowners have a duty of care to avoid cruelty and harm to native, introduced or domestic animals when pruning or removing trees even when in accordance with permits. Landowners must be aware that clearing of trees and vegetation has the potential to result in harm to native animals and loss of their natural habitat.

Accidental or incidental injury to wildlife is not a focus of compliance enforcement, which is consistent with the NSW Office of the Director of Public Prosecution's guidelines. However, deliberate cruelty to animals may be subject to prosecution under the Prevention of Cruelty to Animals Act 1979.

Care must be taken to minimise your potential for harming wildlife such as having tree hollows checked and looking for active bird nests and tree dwelling animals such possums before commencing pruning or removals.

4.11 Tree Maintenance
Special Needs and Considerations

A suitable fauna ecologist shall be present during any live stag creation or work on any tree with a notable hollow in case a removed or retained hollow has any fauna present and requires appropriate relocation or protection.

If the public or our contracted Tree Contractors witness any displaced, orphaned or injured wildlife they should contact either:

- the Office of Environment and Heritage, or
- A licensed fauna rehabilitation group for assistance.

The fauna rehabilitation page of the Office of Environment and Heritage website provides further advice and a full list of licensed providers such as the WIRES Wildlife Rescue group. Only people authorised under an Office of Environment and Heritage wildlife licence may take a native animal into care. Rehabilitating a native animal without an authority is illegal and can lead to prosecution. You are not allowed to keep rescued native animals as pets.

Landowners who clear trees and vegetation are not exempt from prosecution under the National Parks and Wildlife Act 1974 for harm to protected fauna, or for deliberate cruelty to animals under the Prevention of Cruelty to Animals Act 1979. Note: 'protected fauna' is as defined in the National Parks and Wildlife Act 1974.

Figure 88: Tree hollows are vital for many native species of birds and mammals in Australia. It is vital such resources are maintained within our urban forest. (Source: Arterra)

4.11 Tree Maintenance
Special Needs and Considerations

Figure 89: Tree hollows are vital for many native species of birds and mammals in Australia. It is vital such resources are maintained within our urban forest. Powerful Owl photographed in a suburban park in northern Sydney (Source: Arterra)

The appendices to the Guidelines provides many of the standard specifications, requirements and procedures that Council will apply when managing, protecting, planting or removing our trees.

5.0 APPENDICES

5.1 APPENDICES
PRE-PLANTING CHECKLIST


Background Image: Source Liverpool City Council

PRE-PLANTING CHECKLIST

PERSON COMPLETING FORM

NEAREST STREET NO. STREET OR PARK NAME

SUBURB DATE

TREE DETAILS

SPECIES

ESTIMATED MATURE SIZE (Tick the appropriate box)
Small (<10m) ☐
Medium (10-20m) ☐
Large (>20m) ☐

CONTAINER SIZE

CHECKLIST

(Tick the appropriate box)	YES	NO	N/A
1. Are there overhead structures, wires, awnings, street lights, or other trees that should prevent this tree being planted?	☐	☐	☐
2. Has the register of contaminated sites been checked and are there any signs of potential contamination present?	☐	☐	☐
3. Are there nearby underground obstructions such as services, pits, walls etc that should prevent this tree being planted in this location?	☐	☐	☐
4. If in a street is this location adjoining a public reserve or park with more significant trees and therefore a street tree would detract from this more significant planting?	☐	☐	☐
5. If multiple trees are being planted, are the trees spaced far enough apart? (min. 7m for Small, min. 10m for Medium, min. 15-20m for Large)	☐	☐	☐
6. Does the planting pit / location likely provide sufficient soil volume /clearances / adequate drainage and is it sufficient for long term growth of the tree?	☐	☐	☐
7. Is the tree likely to cause any sight line issues to pedestrians, cyclists, traffic lights, signs, driveways or intersections?	☐	☐	☐
8. Are there any solar collectors nearby that should be considered? (This is not applicable for 'replacements' of pre-existing trees)	☐	☐	☐
9. Is the clearance to the kerb and footpaths sufficient? (minimum 700mm to kerbs, minimum 700mm to footpath, 3m to +60km travel lanes on rural road/motorway)	☐	☐	☐
10. Does the park, street or verge form part of an Asset Protection Zone for bushfire management that may prevent this tree being planted?	☐	☐	☐

NOTE: IF ANY OF THE ITEMS LISTED ABOVE MAY IMPACT THE LONG TERM VIABILITY OF THE PROPOSED TREE THEN SEEK ADVICE FROM YOUR SUPERVISOR OR COUNCIL'S REPRESENTATIVE FOR DIRECTION.

The tree is a replacement tree. ☐ **The tree is a new tree in a vacant location.** ☐

NOTES / RECOMMENDATIONS

5.2 APPENDICES
TREES AND EVENT PLANNING

EVENT PLANNING AND TREE PROTECTION INFORMATION SHEET

Overview

Trees are an important component of Liverpool's Streets and Parks. It is the **responsibility of the event organiser** to adequately and actively protect the Council's trees in the course of planning and holding any event.

Trees are easily damaged particularly during bump-in and bump-out due to:

- Impacts with vehicles or equipment or
- Soil compaction within the tree root zones.

Trees are easily damaged during the event by event staff, contractors and patrons through:

- Inappropriately attaching things to trees;
- Vehicle or equipment impacting with the tree, branches or foliage;
- Breaking of branches, trunks and foliage;
- Spilling or dumping of chemicals; or
- Compacting the soil within the trees root zone.

Trees may also present risks to patrons in the event of extreme weather conditions such as storms or very high winds.

To ensure the best outcome for your event and the ongoing health of our trees please consider and adhere to the following information and requirements.

Prior to your event

Prepare and submit to the Council an event plan, including a suitable site layout plan showing:

- Proposed equipment layout, vehicular and pedestrian access routes and provision for appropriate offsets for safe clearance to trees
- Proposed bump-in / bump-out routes with consideration to avoid trafficking in close proximity to trees
- Locations for placement of heavy items such as generators and cool rooms to be well clear of trees
- Major pedestrian and vehicular routes are to avoid trees
- Proposed tree and ground protection measures as required by the Council. This may include items such as temporary fencing or bunting, water filled barriers, ground protection mats, and signage

During your event

- Install tree and ground protection as per the approved event site plan.
- All contractors and event staff shall be briefed on the importance of tree protection.
- Bump-in / bump-out routes shall avoid trafficking under or in close proximity to trees.
- Ensure a Council representative acts as a 'spotter' to observe and direct all heavy vehicle movement and equipment installations if in the vicinity of trees .
- Alternative access shall be implemented if the required truck cannot safely fit under tree branches. No tree branches are to be pruned or snapped off.
- Do not affix anything to trees.
- No branches or foliage shall be damaged or removed to facilitate equipment installations.
- Heavy equipment shall be installed per the approved event plan on appropriate ground protection.
- Ensure generators are located at least 10 metres from trees and exhaust emits away from trees and foliage.
- Bulk fuel stores shall be kept a minimum of 15 metres away from any tree.
- Refuelling shall be done a minimum of 10 metres from any tree. Appropriate bunding and ground protection is required during all refuelling operations regardless of distance to trees.
- A 'fuel spill management kit' shall be on hand at the location of any refuelling activities.
- Any refuelling shall be carried out by a team of at least two people.
- Event security is to ensure patrons do not climb or accidentally or intentionally damage trees.
- In the event of extreme weather conditions such as storms or very high winds the event shall be suspended and the site evacuated in accordance with the pre-agreed Emergency Management Plan for the event.

Compliance

The Council may impose monetary bonds and/or penalties for event related damages to trees, grounds and Council's assets as per the event agreements.

5.3 APPENDICES
STANDARD TREE SUPPLY SPECIFICATIONS

1. General conditions and quality
All trees to be provided to the Council are to conform to the NATSPEC guide and "Guide for assessing the quality of and purchasing of landscape trees" by Ross Clark 2003 and AS2303:2018 "Tree Stock for Landscape Use". The following specification details the requirements for the supply and transportation of trees and palms.

2. Definitions and sizing
Definitions for the terms used within this specification shall be in accordance with the AS2303:2018 "Tree stock for landscape use".

Term	Definition
Batch	Quantity of tree stock of the same species, container size, type, age from the same origin.
Calliper	Trunk diameter measured at 300mm above the root crown, or 50% of the overall height, whichever is the lower height, expressed in millimetres.
Central Leader	Clearly defined single, relatively straight, trunk.
Clean Stem Height	Distance between the uppermost surface of the root ball and the first order branches of the trunk that is free from branches.
Self-Supporting	Tree stock supporting its above ground parts in an upright position without movement of ≤30° from vertical, stem breakage, injury or loosening of roots in the growing media.
Size Index	Numerical expression of the size of the tree above ground. It is the product of the height of the tree (in metres) and the calliper (in mm). (ie. height x calliper)
Destructive Root ball Inspection	The washing away or removal of all soil from a root ball to allow for detailed inspection and assessment of root development.
Partial Investigative Root ball Inspection	A method of exposing a section of a root system to enable inspection of root development by washing away a wedge-shaped section from the stem to the extremity of the root ball. This soil can be gently replaced so the tree is not significantly damaged.

Nursery stock shall meet design criteria for minimum dimensions, container size and shape, plant shape or special pruning requirements outlined in this document and the table below.

Container Volume	Height above container (m)	Calliper at 300mm	Clear trunk height (m)
45 Litre	1.5 - 2.0	30-35 mm	0.8
75 Litre	1.8 - 2.4	40-45 mm	1.2
100 Litre	2.0 - 2.4	> 50 mm	1.5
200 Litre	3.0 - 3.5	> 60 mm	1.5
300 Litre	4.2	> 70 mm	1.5
400 Litre	5.5	> 70 mm	2.0

2. Labelling of stock
Clearly label individual trees and batches with the species name and cultivar / variety / provenance if appropriate. The label is to withstand transit without erasure or misplacement.

3. True to type
The trees supplied and planted shall be the species, and variety or cultivar that the Council has specified.

4. Health and vigour
The trees supplied shall be healthy and vigorous at the time of delivery and planting. Supply trees with foliage size, texture and colour at the time of delivery consistent with the size, texture and colour shown in healthy specimens of the nominated species. Supply trees with extension growth consistent with that exhibited by vigorous specimens of the nominated species.

5. Pest and disease
Trees shall not be diseased or show evidence of pest attack that could affect the long term health of the tree or adjoining plantings. Supply trees with foliage and soil free from attack by pests and diseases. For Australian native trees with a history of attack by native pests (eg. Ficus macrophylla & Eucalypts), evidence of previous attack must be restricted to less than 15% of the foliage and there must be no actively feeding insects or evidence of damaging fungal attack.

6. Injury
Supply only trees free from injury and wounds , except properly made pruning cuts made in accordance with AS4373:Pruning of Amenity Trees.

7. Self supporting
Supply only trees that are self supporting.

8. Stem taper
Supply trees where the calliper at any given point on the stem is greater than the calliper at any point higher on the stem.

9. Formative pruning
Ensure a clean-cut at the branch collar that complies with AS4373-2007:Pruning of Amenity Trees. Trees are not to be pruned into a saleable shape just prior to shipment. All pruning shall be a clean-cut at the branch collar, no lopping or topping of trees is to be carried out and the diameter of any wound must not exceed 50% of the calliper immediately above the point of pruning.

Clean stem height: trees shall be supplied with a clean stem height of 35-40% of total tree height. For example a 5m tree is to be pruned to 2m maximum (clean stem height must not exceed 40% of total tree height). Restrict fresh cuts (i.e recent, non-calloused) to <20% of total tree height.

5.3 Appendices
Standard Tree Supply Specifications

10. Crown symmetry
The symmetry of the crown is an important aspect of the presentation and appearance of the tree in the landscape. Difference in crown distribution on opposite sides of the stem axis must not exceed 20%.

11. Stem structure
Species with an excurrent form: Supply trees with a defined central leader and the apical bud intact. Trees that have had their leaders cut or damaged will not be accepted. Supply trees with a single stem roughly in the centre of the tree with any deviation from vertical <15°.

Species with decurrent form: Supply trees where the central stem is not divided at any point lower than the clean stem height nominated, and that the stem junction at the point of division is sound.

All species: Ensure that branch diameter is less than or equal to one-half of the calliper immediately above the branch junction.

12. Included bark
Supply trees where the branch/stem bark ridges at junctions between stems and branches and between co-dominate stems are convex, except for species prone to include bark that are known to remain strong (as approved by Council).

13. Trunk position
Supply trees with the distance from the centre of the trunk to any extremity of the rootball is not varying by >10%.

14. Compatibility of graft unions
When purchasing named cultivars propagated by grafting, it is critical that the graft union is sound and that the scion and root stock are compatible. The union between the scion and the root stock must be sound for the entire perimeter of the graft. The diameter of the scion immediately above the graft must be equal to the diameter of the rootstock immediately below the graft (+or -20%).

15. Indication of north
Trees in containers >100 litres: Indicate the northerly aspect during growth in the nursery and ensure it is marked so to withstand transit without erasure or misplacement.

16. Root division
Trees in containers >45 litre: Primary division of roots is to have occurred within the outer 50% of the rootball at <100mm intervals.

17. Root direction
Ensure that roots, from the point of initiation, generally grow in outwards (radial) or downwards direction, and that any deviation from the established direction <45°.

18. Root ball occupancy
Soil Retention: On shaking or handling of the unsupported rootball at least 90% of the soil volume shall remain intact.

19. Root ball depth
Rootball depth assessment for containers/rootballs 45 litres or larger must:

- have a depth of less than or equal to the maximum depth specified for palms;
- have a diameter greater than or equal to their depth; and
- rootballs (regardless of size) must not exceed 550mm in depth (except for palms).

20. Height of root crown
Ensure that the trees root crown is at the surface of the rootball and free from suckering.

21. Non-suckering rootstock
Grafted cultivars/varieties: Supply trees grafted onto non-suckering rootstock.

22. Quality Assessment and Compliance
The installer must submit suitable documentation to demonstrate compliance with the requirements of this specification and AS2303:2018 Tree stock for landscape use. Documentation for each differing batch and different species shall be issued to the Council at 3 monthly intervals and at least 7 days prior to their dispatch.

As a minimum, the tree stock inspection forms are to be in accordance with the 'Example A' form contained in Appendix C of AS2303:2018. The required compliance testing that is referenced in that form shall be performed in accordance with the scope and protocols outlined in Appendix A and B of the standard, with the exception of the sampling size, which shall be amended as per the table below. The sample size shall be equal for both above and below ground assessments.

No. of Trees in Batch	Minimum No. to be sampled
1-4	all trees in batch
5-20	4
21-50	6
51-100	10
>100	10 + 2% of number to be supplied in excess of 100

All documentation shall be retained by the supplier for a minimum of 3 years from the date of supply.

5.3 Appendices
Standard Tree Supply Specifications

23. Transport and Unloading

Carefully load, transport and unload, at the nominated site, the specified trees. All trees are to be delivered in such a way to prevent in transit wind damage. All trees shall be watered prior to loading for delivery. Plants shall not be contained within delivery vehicles for a period longer than 24hrs.

Trees shall be carefully unloaded using methods appropriate to the size and weight of the trees. Damage to trees sustained during transport or unloading will result in those plants being rejected. Plants shall conform to the requirements at the time of delivery to the planting site. Transpiration shall be minimised during transport to prevent subsequent wilting or unseasonal defoliation. Plants that have been allowed to wilt or dry out during transport shall be rejected, irrespective of any previous acceptance.

The soil mass of the root ball shall be securely contained and supported during transport. Root balls that have been unreasonably fractured, deformed or slumped during transit or unloading shall not be accepted.

24. Non-conforming specimens

Any tree not conforming to the specifications and standards listed in this specification shall be rejected and suitable replacements provided. If non-conforming trees are provided, the Council require new stock that complies to be supplied and planted, or alternatively may provide replacement specimens and deduct the costs from any applicable bank guarantee or bond.

5.3 Appendices
Standard Tree Supply Specifications

Background Image: Source Arterra

5.4 APPENDICES
STANDARD TREE PLANTING AND SOIL SPECIFICATIONS

1. General
This specification describes the appropriate techniques to be used to install new street trees within the Liverpool Local Government Area (LGA).

There may be allowance for some variation in the techniques to be used, however any change to the techniques from those described here must be submitted in a Work Method Statement for approval by Council prior to any work being carried out.

Tree planting works shall be undertaken by an Arborist or Horticulturist with minimum certification in accordance with Australian Qualifications Framework Level 2.

2. Typical scope of work
The scope of work for tree installation work typically comprises:-

1. Demolition of existing tree pits, surrounds or cutting of the existing pavements.
2. Excavation of subgrade for tree pits, installation or connection of suitable drainage.
3. Supply and installation of imported and existing soil mixes.
4. Installation of trees.
5. Supply and installation of wooden stakes, ties and guys where required to maintain temporary stability and provide temporary protection.
6. Installation of supplied semi-permanent tree guards where specified.
7. Supply and installation of various styles of tree bases, to the Councils specification, (after an initial six (6) month soil settlement).
8. Reinstatement of pavement in any aborted tree pits.
9. Maintenance of planted trees for a specified period following completion of planting.

3. Standards
All works shall be in accordance with the relevant standards. The following standards are referred to in this section:-

1. AS4419-2018 Soils for landscaping and garden use;
2. AS4454-2012 Compost, soil conditioners and mulches;
3. AS4373-2007 Pruning of amenity trees.

4. Statutory requirements
The installer is responsible for compliance with all relevant statutory requirements.

The installer shall apply for a Road Opening Permit and be able to demonstrate clear working programs and sequences. Site specific pedestrian and vehicular traffic control plans are to be submitted as part of this application and shall conform to NSW Roads and Maritime Services guidelines and any other statutory requirements. These plans shall include any requirements for parking of work site vehicles and the delivery of materials.

Approval from the NSW Police Traffic Management Centre and NSW Roads and Maritime Services may be required when the work has an impact on traffic flow on major roads.

5. Environmental controls
The installer shall ensure that all materials and the execution of the work are ecologically sound, environmentally benign and consistent with the principles of sustainable development.

The installer shall take all practical precautions to ensure that dust and noise caused by the works are kept to a minimum. The installer shall take all practical precautions to prevent the spread of dirt and mud along roads and paths. The installer shall be responsible for all localised sediment and erosion control of work and stockpiles under their control and use.

The installer must comply, and make sure that sub-contractors comply, with the general provisions of this clause and any other environmental protection provisions within the requirements of any statute, by-law, standard and the like related to environmental protection.

6. Inspections
Provide not less than 48 hours notice so that a Council Representative can make the following inspections:-

1. Delivery of tree stock prior to planting.
2. Tree(s) set out and placed in tree pits before backfilling.
3. Tree planting completed.
4. Footpath reinstated.
5. Periodic inspections during maintenance period.
6. Completion of plant establishment period.

7. Existing site investigations
The installer shall confirm with the Council the exact location of all tree pits associated with tree planting works.

In accordance with NSW electricity and gas supply regulations, all excavations for tree planting require the review of underground service plans sourced from Dial Before You Dig service. Specialist service location tools or expertise may be required when underground service plans are insufficiently detailed or where plans indicate that services are close to the intended planting location. The installer shall be responsible for the rectification of all pavement surfaces where inspections have been undertaken including the making good of any excavation or site markings.

The installer shall notify the Council immediately upon discovery of services or obstructions that prevent any planned tree planting. All services shall be considered live until determined otherwise. No liability is accepted, by the Council or the Service Authorities, for accidents resulting from contact or disturbance to services.

5.4 Appendices
Standard Tree Planting and Soil Specifications

In the event of any damage to any service, the installer shall immediately notify the relevant authority and the Council and satisfy all requirements of the authority concerned.

The installer shall be liable for all damage caused by the tree installation works to all existing buildings and structures. The installer shall make good all damage at their expense.

8. Spoil
Surplus excavated material must be immediately removed from the site. This includes debris resulting from site clearance and excavated material not reusable as topsoil, filling, mulch or the like, unless otherwise specified or directed. Existing topsoil with any stump grinding debris incorporated within it will be removed from site and not re-used in the new planting site.

The installer shall be solely responsible for the safe and harmless disposal of material away from the site. Surplus excavated material shall not be permitted to remain in place overnight.

Existing tree base materials, such as unit pavers or stone tiles, can be recycled and reused in the new tree bases as long as specifications allow.

9. Extent of excavations
Excavate to an equivalent depth of the new tree rootball measured from the underside of any concrete base slabs, or as shown on the details. Do not disturb services, and excavate by hand around any existing services as required.

The installer shall measure the rootball depth of each tree to determine the appropriate tree pit depth. Allow additional depth to achieve specified falls for subsoil drainage lines and to satisfy finished levels.

Safety precautions must be in place to prevent public entry to work site area.

10. Existing pavement
The existing pavement shall be cut by a road-saw or other suitable tool to the dimensions shown in the details. Cutting shall only be at right angles and parallel to the kerb. The cut shall have a neat straight edge and smooth face. Kerbs must not be cut under any circumstances. In the case of cutting unit paving, ensure that the cuts are made along the joints without damage to the surrounding pavers. Unit paving may be dismantled rather than cut if this option minimises damage.

11. Subgrade preparation
Cultivate or rip the subgrade at the base and sides of tree pits to a depth of 100mm. During cultivation, thoroughly mix in any materials required to be incorporated into the subsoil. Remove stones exceeding 70mm and any rubbish or other deleterious material brought to the surface during cultivation. Grade the base of tree holes to the required design levels and shapes after cultivation.

12. Root control barriers
Root barriers will typically not be required, and shall only be installed when specifically instructed by Council.

13. Soil and tree rooting volumes
Some sites may have existing site soils that are incompatible with tree root growth, have paved surfaces requiring heavy compaction of the site soils, or sites where all soil media available to trees needs to be imported. The following table specifies the minimum drained soil volume for trees where the soil volumes require improvement.

Tree planting	Harsh planting sites (Minimum soil volume per tree)	Favourable planting sites (Minimum soil volume per tree)
Small trees (<7m height / 5m spread)	15m3	10m3
Medium Trees (7 – 15m height/ 6-10m spread)	50m3	30m3
Large Trees (15m+ height / 12-15m spread)	80m3	50m3

Important notes regarding above table and volumes:

1. Harsh planting sites are those that have moderate to high temperatures, winds, hard paved surfaces surrounding, shallow soil profiles (A and B horizons) and no organic mulch.
2. Favourable planting sites are those that are partially shaded and protected from winds, with limited hard / paved surfaces, low reflection, moderate soil depth (600mm+) that is free draining and organic mulch applied regularly.
3. When the tree is irrigated regularly, soil volume can be reduced by 10%.
4. Where the trees have shared root systems, soil volume can be reduced by 10%.
5. When using structural soils, the volume of rock or plastic cells (or other) must be subtracted to determine soil rooting volumes. However, the soil depth can often be increased due to increased air at depth, provided there is adequate drainage.
6. Council may relax requirements for single infill or replacement trees when existing pavements can not or are not being disturbed.

14. Soil- testing and investigations
For all sites to be planted a site soil investigation shall be conducted as part of the planting operations. This assessment shall typically be carried out for all sites, whether natural or disturbed.

5.4 Appendices
Standard Tree Planting and Soil Specifications

A representative site soil survey shall be carried out to identify and assess any adverse physical or chemical soil properties that may impact on the future successful establishment of a tree to the site. Record findings as part of the tree planting work, report any significant issues to Council, and make recommendations for any soil or site remediation work required to make the site suitable for tree planting.

Upon excavation, if the tree site appears to show poor subterranean condition (poor drainage, contamination, or anaerobic conditions), the installer shall immediately notify the Council.

15. Soil- profiles and depths

The required soil profiles are dependent on the location and type of materials placed around the tree base. The following plantings shall have the following profile horizon structure.

The following planting types shall have the following soil depths as a minimum.

Planting type	Total drained soil depth	Topsoil depth (Soil Type A horizon)	Subsoil depth (Soil Type B horizon)
Trees planted in paved locations, with decomposed granite or porous paving around the tree base. (100L – 200L nominal tree size)	Minimum 700mm Maximum 800mm	nil	700mm
Trees planted in grass or garden beds with organic mulch surface treatment. (100L – 200L nominal size)	600mm	200mm	400mm

Important Note: These soil depths are above all drainage layers or soils known to be freely draining. Further, these soil depths are minimums, and topsoil must not be increased beyond 400mm.

16. Drainage layers

Where a drainage layer is coarser particle size than around 5mm diameter, a transition layer may be needed between it and the soil media to prevent soil migrating into the drainage gravel layer. Generally this will be an intermediate very coarse sand or fine gravel. Do not use geotextile fabrics over the drainage layer to prevent soil migration.

17. Subgrade preparations

Before installing specified tree pit backfill soil, the following subgrade treatment must be applied to all finished subgrade areas:-

- Smooth and trim to relative level to accommodate the required overall soil depths
- Remove rocks > 70 mm diameter
- Remove rubbish such as construction generated waste, concrete slurry, plastics, metals and glass
- If required by soil testing, apply any necessary soil ameliorants to subgrades
- Use appropriate hand tools when working on smaller sites / individual tree pits or around underground services. If size permits use an excavator with a tyne attachment to loosen the subgrade and mix the ameliorants to 200 mm depth to incorporate. Break up clods but do not overly compact or smooth (leave the surface 'keyed' to accept the imported soil mixes).

18. Soil- types and mixes

Soil Type A - Normal Tree Planting Topsoil (A Horizon)
A sandy loam to clay loam topsoil mix designed for general purpose, on-grade landscape garden bed planting of grasses, woody and herbaceous annuals and perennials that have a high nutrient requirement for sustained optimum growth, and are not subject to compaction by pedestrian or other traffic.

A suitable commercially available product such as Scapeworks® Premium Garden Mix, or Benedict's Smart Mix6®, or an approved equivalent manufactured garden soil with a maximum 20% organic matter by volume, may be used.

The heavier textured soils in this specification may require the use of engineered solutions (drainage techniques) where excessive wetness is anticipated. Note that the organic soil variant should not be chosen for low P plantings and should not be used below 300mm.

The use of site reclaimed topsoil may be permitted, subject to investigation and testing.

Soil Type B -Imported Subsoils or Ameliorated Subgrades (B Horizon)
This specification is to be used to manage the importation of subsoil, or its manufacture from on-site materials, where existing subgrades do not provide sufficient quality to qualify as a rooting medium to provide rooting depth and volume sufficient for larger plantings.

A suitable commercially available product such as Scapeworks® B Horizon Mix, or Benedicts 80:20 Washed Sand and Screened Soil Blend, or an approved equivalent manufactured soil with a maximum 5% organic matter by volume, may be used.

This soil shall be generally a low organic matter material that is well balanced chemically, is not saline or sodic or excessively acidic or calcium deficient and not dispersive. It is designed to provide improved rooting depth for larger plantings and reduce the likelihood of waterlogging. It may be made using existing site subsoil or imported fill materials or a blend of both. It is not generally considered to require the application of fertiliser but must be low in P if used for P-sensitive plantings.

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Standard Tree Planting and Soil Specifications

Drainage and Transition Layers - Coarse Sand
This shall be washed, sharp coarse river sand 0.25 to 2.0mm in diameter, free of weeds, debris or other deleterious material.

19. Soil- physical and chemical properties
Generally, all soils must be free of 'unwanted material' and must meet all the requirements of the Tables that follow. Where variations from these requirements occur refer to Soil Quality Control specifications and hold points.

Soil - Physical Property	Units	Normal Target Range
Texture, preferred range	n/a	Sandy loam to clay loam
Organic matter	% dwb	< 25 Type A < 5 Type B
Permeability (@ 16 drops by McIntyre Jakobsen)	mm/h	> 30
Wettability	mm/h	> 5
Dispersibility in water		1 or 2 (AS 4419) category
Particles sizes (naturally occurring)		
>50 mm	% w/w	nil
> 20 mm	% w/w	< 10
2–20 mm	% w/w	< 20
Visible contaminants > 2 mm (glass, plastic and metal)	% w/w	< 0.5

Chemical Property	Units	Normal Target Range
pH in water (1:5) Standard range	pH units	5.4–6.8
pH in CaCl2 (1:5) Standard range	pH units	5.2–6.5
Electrical conductivity (1:5)	dS/m	< 0.65
Phosphorus – P-tolerant/ standard plants. Acid soils method 18F1	mg/kg	50–150
Phosphorus – P-tolerant/ standard plants. Alkaline soils method 9B1 or 9C1	mg/kg	30–60
Phosphorus for P-sensitive plants, acid soils method 18F1	mg/kg	< 30
Phosphorus for P-sensitive plants, alkaline soils method 9B1 or 9C1	mg/kg	< 20
Exchangeable sodium (Na)	% of ECEC	< 7%
Exchangeable potassium (K)	% of ECEC	5–10%
Exchangeable calcium (Ca) method 18F1 or 15A1 in alkaline soils	% of ECEC	60–80
Exchangeable magnesium (Mg)	% of CEC	15–25
Exchangeable aluminium (Al)	% of CEC	< 2
Exchangeable Ca:Mg ratio	Ratio	3–9
Available iron (Fe)	mg/kg	100–400
Available manganese (Mn)	mg/kg	25–100
Available zinc (Zn)	mg/kg	5–30
Available copper (Cu)	mg/kg	1–15
Available boron (B)	mg/kg	0.5–5
Available N (N as nitrate)	mg/kg	> 30

Note 1 to Properties Table
For alkaline soils the pH in water (1:5) range shall be 6.8-8.0
For alkaline soils the pH in CaCl2 (1:5) range shall be 6.5-5.5

Note 2 to Properties Table: Base level requirements for fertilisers are to be verified by laboratory testing and per agronomist's report.

20. Soil- testing and quality control
The installer must verify compliance with the product specification. This is done in two parts: initial compliance certification and then quality control, as described below.

Before any soil installation, the installer or soil manufacturer will submit samples of trial blends likely to meet the performance specifications to a testing laboratory. The trial blend must be based on available test information on components and, if necessary, employ an agronomist for

5.4 Appendices
Standard Tree Planting and Soil Specifications

advice. They must allow sufficient time for testing and re-formulation in the case of failure to satisfy the performance criteria. Once compliant, a test certificate clearly stating compliance with the applicable criteria must be presented to the Council.

Manufacturer's product representation: For imported soils from soil manufacturers, a 'product representation' document produced by the supplier may be accepted as compliance certificate if:

- it is an off-the-shelf product line, not a custom mix
- a representative test certificate is available and is acceptably recent (within 6 months)
- the testing covers all those criteria in the performance specification, and
- the manufacturer's quality assurance system is externally certified.

21. Soil- quality record keeping
Growing media initial compliance certification records must be kept in an easily retrievable manner that provides for traceability of purchase and location on site. Each compliance certification for all the product specifications used on site must be identified by date, quantity to be supplied and a copy of the formulation used to reach compliance.

All quality control and compliance testing as required by the product specifications must be arranged by the installer, and carried out by an approved soil testing laboratory. All compliance records will be made available to the Council on request.

Compliance certificates will be in the form of a report clearly stating the material is compliant, with an attachment showing the test result relied upon. In the case of minor non-compliance or substantial compliance, a clear statement must be obtained from a qualified independent agronomist waiving the compliance and certifying the sample is compliant with or without conditions.

22. Soil - non-compliance
In the case of substantive non-compliance, a clear statement must be obtained from a qualified independent agronomist waiving the need for compliance and certifying the sample is fit for purpose.

Typically, there shall be no further placement of the soils that are non-compliant until suitable compliance is demonstrated.

Non-compliance with the specified target range criteria does not necessarily render a soil not fit for purpose but making this judgment requires an expert person to take responsibility for such deviation. Also, a conditional compliance certificate may be issued requiring that a certain fertiliser or further organic matter or some other amendment be added, with the aim of achieving compliance.

23. Soil stockpiling
For normal tree planting work there shall be no stockpiling of soils on site. Typically all materials are to be moved directly from the carrier to the hole or only stockpiled for a very short period of time. Adjoining pavement and road surfaces are to be maintained in a clean and tidy state at all times. The pavement surface is to be maintained in a clean and tidy state at all times.

24. Drainage
Subsoil drainage is to be installed as per Council requirements and will be determined on a site by site basis.

25. Bad ground
Bad ground shall be ground considered unsuitable for the purpose of the works, including filling liable to subsidence, ground containing cavities, faults or fissures, ground contaminated by harmful substances or ground which is, or becomes soft, wet and unstable and the like.

If bad ground is encountered in, or adjacent, to any tree pit during the work, notify Council immediately and obtain instructions before carrying out any further work in the affected area.

26. Planting conditions
Do not plant in unsuitable weather conditions such as extreme heat, cold, wind or rain. Avoid planting where unseasonable and adverse weather is forecast within 24 hours of the operations. No trees are to be planted on days exceeding temperatures of 30° Celsius. Generally tree planting is preferred during the cooler months from March to August (autumn and winter).

27. Lifting of trees
It is preferred that all trees are carried or slung via the root ball. In the event that the trees have to be repositioned or lifted by the trunk, the installer shall provide adequate soft padding to the trunk in the form of underfelt, carpet or rubber wrapping and use only soft slings during the lifting. Serious damage to the cambium tissue of the stem as a result of poor lifting techniques will require replacement of the tree.

28. Placement
When the tree pit is excavated and the hole is the correct size, place the rootball in its final position. Ensure the trees are centred and plumb and the top of the rootball level with the finished surface of the surrounding soil mix.

Do not use the trunk of the tree as a lever in positioning or moving the tree in the planting hole.

29. Initial Watering
Thoroughly water the tree rootballs before planting and then immediately after planting. Prevent the rootballs from drying out during the transportation or planting phase.

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Standard Tree Planting and Soil Specifications

Apply water so as not to disturb the soil. Raise the moisture within the root zone to field capacity. Ensure potted rootball is thoroughly wet through the entire soil profile. Continue watering at a rate and frequency as required to avoid water stress in the plant.

30. Alignment and orientation
Position the tree at the setout distances as indicated in the details. Ensure trunks are set vertically and aligned with other new or existing trees.

Orient the tree's trunk north where indicated by supplied markings where applicable. (+or- 20°). Adjust within the above tolerances so that the primary lowest branches are generally aligned parallel with the kerb and any adjoining road way (and NOT extending out into roadway).

31. Root trimming at installation
All trees shall have the outer 10-25mm of the external root ball faces pruned or sliced away using secateurs or other suitable sharp blade or spade. Avoid excessive disturbance to the remaining rootball during this trimming and discontinue if excessive rootball soil begins to fall away. Do not leave the rootballs exposed for extended periods. Cover the rootball with moist hessian if backfilling can not occur immediately.

32. Backfilling
Backfill with soil mix as specified in soil mixes and in accordance with the details and specification. Lightly compact the soil to ensure all voids around rootballs are filled and that no air pockets are retained.

Ensure that the backfill soil is not placed over the top of the potted rootball. The top of the rootball and plant stem must be kept level with the top of the backfill.

33. Mulching
Any soil conditioners and mulch shall comply with AS4454-2012 Composts, Soil Conditioners and Mulches. Unless otherwise noted the mulch shall be a minimum of 50mm depth and a maximum of 75mm depth.

Mulch types shall be: -

1. minus 15mm sized graded aged horticultural pine bark fines or
2. minus 50mm sized recycled urban wood waste
3. Decomposed granite gold colour, lightly compacted and installed as shown in details.

Mulch shall be free of deleterious and extraneous matter, including soil, weeds, rocks, twigs and the like. Place the mulch so that it is not in direct contact with the trunk. Feather mulch layers away from trunk at the root crown.

34. Tree establishment period
The tree establishment period commences at the date of practical completion for a period specified by Council.

All trees shall also be maintained immediately following their installation, as per the specifications below, up until the above tree establishment period commences. Tree maintenance works shall be undertaken by an Arborist or Horticulturist with minimum certification in accordance with Australian Qualifications Framework Level 2.

The installer shall submit a program prior to the commencement of the tree establishment period. The program shall detail all works required during the planting establishment period including:-

1. Rectification of defects;
2. Provision of materials;
3. Watering;
4. Fertilising;
5. Control of weed growth;
6. Replacement of dead, damaged or stolen plants.

The installer shall provide 7 days notice of any works to replace trees as part of planting establishment. Throughout the tree establishment period, the installer must continue to maintain new trees and carry out maintenance work including, but not limited to:-

- weeding and rubbish removal from tree surrounds;
- fertilising;
- pest and disease control;
- replacement replanting (on approval from Council);
- adjustment, removal or replacement of stakes & ties;
- formative and selective pruning to AS 4373 and;
- mulching to maintain and reinstate to depth specified.

35. Establishment watering
Allow for 10% of the planted container volume to be applied every 2 days for the first 2 weeks and then 20% of the container volume once per week for 3-4 months. Despite above guideline, installer is to monitor and maintain soil moisture during summer months ensuring the rootball does not dry out and causes wilting. Ensure the bottom of the tree planting hole does not become saturated. (The above is based on spring to early autumn planting – the above frequency may be halved for winter plantings).

Inspection results and the maintenance procedures shall be recorded and submitted to the Council every 3 months. The various ongoing maintenance practices shall be carried out to the satisfaction of Council.

36. Tree guards and supports
The installer shall supply and install 3 wooden stakes with hessian ties per tree, for all trees planted up to 200 litre in size. Where advised by Council, the installer shall allow to supply and install metal tree guards and grates on specified trees.

5.4 Appendices
Standard Tree Planting and Soil Specifications

When trees are installed within grassed surrounds, plastic collar guards are to be installed regardless of being mulched.

37. Fertilising
The following table details the required fertiliser program.

Timing	Product and application rate
At time of planting	Slow Release landscape fertiliser suitable for trees and shrubs, 9 to 12 months release time. Osmocote or approved equivalent applied according to manufacturers directions.
6 months after planting and then monthly through to the end of the plant establishment period.	Organic liquid fertiliser. Seasol or approved equivalent applied to soil as per manufacturers directions.

38. Aeration or watering pipes
Only to be installed where detailed within Councils standard details or noted in project specific requirements. The aeration pipe will be 50mm slotted 'Ag-Pipe'. These will be without a geotextile sleeve. Any surface grates will be separately specified by Council, where necessary.

39. Tree bases during establishment
Tree bases surrounded by permeable pavements or flagging etc. shall be left as soil or filled with a thin layer of decomposed granite for the first six (6) months to allow for any settlement of the rootball and backfill soil.

Following the six (6) month settlement period, the tree base as specified in the detail is to be installed.

The tree base is to be maintained in a safe and level condition at all times.

Failure of the tree bases prior to agreed practical completion timing will require rectification by the installer. This failure equates to any area of the tree base slumping/lifting/cracking or creating a trip hazard (variation of more then 10mm) and will require rectification by the installer.

40. Pavement rectification
Reinstate and make good to match exactly the surrounding pavement, to the satisfaction and approval of the Council, all pavement, paving, concrete, brick or other surface damaged or affected by the tree planting and tree base installation works.

Existing materials salvaged from the site must be approved by the Council for reuse and must match existing pavement. Where temporary asphalt topping is required, approval of Council shall be sought.

41. Failure replacements
Where trees are damaged or die or fail to maintain vigorous growth typical of the species due to neglect or inadequate maintenance, the installer shall replace, replant and maintain trees of the same species, size and quality.

5.4 Appendices
Standard Tree Planting and Soil Specifications

5.5 APPENDICES STANDARD TREE PRUNING SPECIFICATIONS

1. Overview

Pruning has a direct impact on the health, structure and viability of a tree. All pruning of live tissue results in a wound to the tree, which the tree has to attempt to seal and compartmentalise. Incorrect pruning techniques can, and do, lead to decay and disease within the tree, much the same as a wound in animals can lead to disease and infection.

Pruning of the canopy also has the consequence of removing valuable foliage, which in-turn removes an essential source of energy production from the tree. The tree will then also spend considerable reserves of energy in trying to regrow the losses of the removed foliage. Branches and trunks also hold important transport and storage tissues within the tree.

As per Council's Tree Management Strategy, Council will generally not consider maintenance or creation of views, leaf, fruit, sap or bark drop or bird and bat droppings as valid reasons to prune or remove a tree.

Figure 90: Pruning must be done to strict standards and by professional arborists (Source: Arterra)

2. Canopy pruning

Pruning of branches of street trees shall be as directed by the Council Tree Management Officers. Pruning is only to be undertaken by a qualified arborist (under the supervision of a person with AQF Level 4 or above). Work is to be in strict accordance with to AS4373-2007 Pruning of Amenity Trees. Wounds are not to be treated.

Generally, evaluate the existing plant habit and form together with the desired habit, clearances and form as determined by Council and gain approval prior to any pruning. Minimise the size and number of wounds resulting from all pruning.

Use crown maintenance techniques on all protected trees to improve health and appearance. Use crown modification techniques on all protected trees to accommodate adjacent proposed structures and future construction access. Ensure remaining canopy is balanced with appropriate weight and crown distribution.

Use only clean, sharp pruning implements for all pruning work, ensuring that cuts are made without damage, tearing or bruising of vascular tissue.

Deadwooding

Remove all dead branches greater than 30mm in diameter as required on young trees less than 5m in height. Remove all dead branches of greater than 50mm diameter for existing mature trees greater than 5m in height.

Formative Pruning

Selectively remove branches as required to promote proper form and branching habit, typical for the natural growth habit of the species. For species with an excurrent branching habit, ensure the development of a dominant central leader. Remove lesser competing leaders where required. Ensure that no greater than 15-20% of the total foliage area is removed at any one time. Trees occurring below new or existing overhead power lines shall be pruned to create a lower and multi-branched canopy well below minimum clearances in line with Ausgrid guidelines.

Selective and Reduction Pruning

Remove identified branches for building clearance requirements. These should be removed to a suitable internal lateral branch at least 1/3 the diameter of the branch removed or to the branch collar at the stem. Also remove any broken, damaged and defective branches as required. Remove crossing and rubbing branches and branches with included bark at their junction to ensure proper form and branching habit as required.

5.5 Appendices
Standard Tree Pruning Specifications

Crown Lifting
Remove the lower branches as required to create adequate vehicular and pedestrian clearance up to a minimum height of 2.4m on the pedestrian side or over parking lanes and 4.5m on the trafficable roadside lanes (at 1 metre radius from the centre of the main trunk and outward). Ensure that at least 50% of the foliage arises from the lower two-thirds of the trunk.

Epicormic Growth and Suckers
Typically remove all epicormic growth occurring on the main trunks or basal suckers as and when they occur. If major pruning was undertaken it may be necessary to manage and allow some epicormic growth to mature to provide necessary foliage cover.

Palms
Only remove the old and spent fruits and fronds. Never remove the terminal shoot. To avoid transmission of diseases, tools shall be thoroughly disinfected between trees.

3. Root pruning
Pruning roots of Council managed trees shall only be as directed and approved by the Council Tree Management Officers. Root pruning shall be undertaken only a qualified arborist (AQF Level 4 or above).

Prior to any excavations, check that there are no existing underground services along the proposed cut lines that may be damaged. Roots are not, under any circumstances to be cut using normal excavation machinery of any sort. This usually results in splitting and massive disturbance well past the intended line of the cut.

Preliminary root pruning using a high pressure water knife or air spade is allowable along an alignment of the final cut. Using a high pressure water jet, cut through the soil and tree roots from the surface down to the nominated depth or rock, whichever comes first and in the location(s) as shown on any supplied drawing(s) or as directed by Council. All visible roots greater than 50mm diameter are to be exposed by hand excavated and then pruned if necessary to provide clean cuts.

When required to cut roots, use only appropriate and sharp hand tools (e.g. secateurs, hand saw) such that the remaining root system is preserved intact and undamaged. Roots are to be typically cut back by hand, and square to the edge of the excavation. Do not cut any tree roots exceeding 100mm diameter unless permitted by Council and after detailed evaluation by an AQF Level 5 arborist.

Excavations within root zones should be kept open for as short a period as possible. Any excavated faces containing fibrous roots is to be supported immediately after excavtion, where necessary, to prevent soil loss from around the retained roots.

4. Post root pruning care
Cover the cut face of the roots with moist hessian or jute immediately after pruning. Maintain in a moist state until permanent or temporary backfilling can be achieved.

If no temporary measures are required and finished levels can be achieved, backfill all excavations around tree roots with a mixture consisting of one part by volume of site soil and three parts of washed course sand with a neutral pH value, free from weed growth and harmful materials. Place the backfill in 150-200mm layers and thoroughly water the root zone surrounding the tree.

Apply root inducing hormone, Auxinone by Barmac Industries (or an approved equivalent) at a rate of 1 part Auxinone to 50 parts water together with a soil wetting agent to the area around the cut root surfaces once per month for 3 months.

Figure 91: Root pruning must be done only when absolutely essential and to strict standards and with utmost care. (Source: Arterra)

5.6 APPENDICES STANDARD TREE PROTECTION SPECIFICATIONS

1. Staff training and inductions

All staff working on the nearby Construction sites must be properly inducted and briefed regarding tree protection prior to working on the site. All inductions shall include description and identification of the Tree Protection Zones (TPZ) and the restriction on the work and activities with regard to the trees.

The site foreman shall ensure that all new staff and contractors are appropriately inducted and that brief "tool box" meetings are conducted regularly to ensure Tree Protection is maintained at the forefront of all construction workers minds and they aware of the following tree protection requirements.

2. Temporary tree protection fencing

All tree protection fencing shall be either 1800mm high galvanised chain wire or welded mesh with a minimum of one lockable gate into each separately fenced enclosure. Fence posts are to be minimum 50mm diameter galvanized steel posts. Excavated concrete footings are not permitted. Temporary above ground fencing must be bolted together and secured with all necessary back stays and bracing to prevent it being easily moved or blown over.

Note : Star pickets and bunting or danger tape shall not constitute acceptable tree protection fencing.

3. Trunk and branch protection

Trunk and major limb protection shall be installed to any tree within 5 metres of the work site prior to any delivery of machinery or works commencing, and shall remain in place for the duration of the works. It shall consist of wrapping of each tree trunk and any major branches within the work area with either a suitable coils of 50mm plastic 'ag' pipe or a double layer of hessian or similar material to limit damage. The under lying protection material must not be fasten in place with non expandable wire or cable ties or the like that my injure the bark when the tree grows and expands. The installer must then space planks (50mm x 100mm or similar), at maximum 100mm intervals, and fixed against the trunk and underlying protection material with suitable metal strapping. The trunk protection boards shall not be fixed to the tree in any instance, or in any fashion, e.g., no nails or screws are to be used. When protecting irregular trunks or larger branches the length of the protection battens may need to be tailored in length the better work with the bends and shape of the branches.

For smaller and recently planted street trees, the trees may be better protected using temporary fencing panels or suitably positioned water-filled barricades.

4. Trenching and excavations near trees

All the excavations and trenching within the Tree Protection Zone radius of street trees shall be by non-destructive methods only and carried out under the supervision / direction of an appropriately qualified (AQF5) consulting arborist. Hand excavation using suitable hand tools is the preferred method of excavation. If water jet and vacuum extraction are employed, the water pressure must be kept as low as possible to minimise the likelihood of damaging the bark surrounding any roots exposed.

All roots encountered greater than 50mm diameter are to be retained and carefully exposed. Conduits and services, if required to be installed are to be carefully threaded through and under available voids to minimise any root damage and protect the trees.

Any minor roots encountered when undertaking trenching, may be cut cleanly at the edge of the trench by the installers, using a sharp, clean handsaw, if necessary, although it would be beneficial if they could be retained and worked around, like in the other situations above, wherever possible.

Approval must be sought from the Council to cut any roots greater than 50mm diameter.

5. Demolition and ground protection

Demolition of paths and other structures required within a TPZ shall be done with small tracked equipment or by hand, with care to limit damage and disturbance of the root zone. All such work within TPZs shall be directly supervised and overseen by a qualified Project Consulting Arborist (AQF5).

Vehicular movement and access shall typically not be approved through the TPZ areas, however if it is necessary and it is proposed to create any access or haul road, or similar access for construction, the Contractor shall install rumble strips / boards over the TPZ ground surface. No excavation below existing levels shall be allowed. The Contractor must first place a suitable permeable geotextile to the extent required and then a 100mm thick layer of wood chip mulch or coarse no-fines gravel over the extent to be covered with the rumble strip / boards. Then place hardwood boards (minimum 3600 x 200 x 75mm) on their flat edge, side by side, with a 30 - 50mm gap to form a rumble strip. These boards are to be held together with three galvanised metal bracing straps nailed to each board. The two outer straps are to be approximately 200mm in from the ends of the boards. The third strap is to be along the centre line of the boards.

5.6 Appendices
Standard Tree Protection Specification

6. Canopy pruning
The Contractor shall not undertake pruning of any branch of any street tree without permission. If pruning or small branches or limbs are required for machinery access, or any other reason, contact the Council's Street Tree Coordinator.

7. Kerb removal adjacent to trees
Existing sections of kerbs adjacent to any street tree shall not be removed without approval from the Council Coordinator. Removal of kerbs adjacent to mature trees that are resting on relying on that kerb can cause trees to become unstable and fail or damage important roots.

8. Tree protection signage
Suitable signage as defined by AS 4970-2009 Appendix C shall be affixed to the external side of the fencing at a spacing of not less than 1 sign per 30 lineal metres of fence.

Temporary signs, or any other items, shall not be fixed or attached to any street tree.

9. Stockpiling and storage of materials
Typically no unauthorised access, storage of materials or stockpiling shall be permitted within the Tree Protection Zones once they are established. The following shall be specifically excluded from occurring with established and defined TPZs:

- Placement of site sheds or parking of cars, trucks or any other machinery within the fenced TPZs,
- Stockpiling of materials, or installation of machinery washout areas within or immediately upslope from a TPZ or any other protected tree;
- The washing down of wheel barrows, concrete pumping equipment, paint cans/brushes, acids etc. near existing trees (Whether fenced or otherwise).
- Fuel powered pumps or generators or air compressors;
- Storage of chemicals, fuel or other powered mechanical equipment;
- No refuelling or servicing of any vehicle or equipment within a TPZ.

10. Damage to trees to be retained
Any damage sustained to any Council street or Park trees, or a tree required to be protected under the conditions of a Development Application is to be immediately reported to the Council's Coordinator, to determine the appropriate response for maintaining the health and structural integrity of the tree(s).

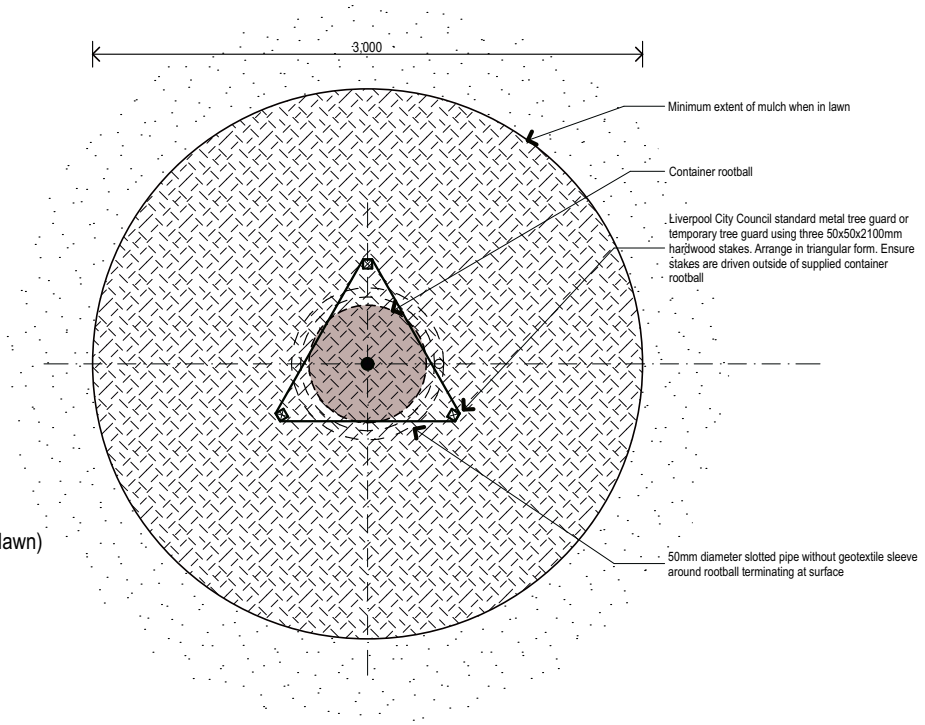
Should any damage occur to Council's trees and not be rectified by the Contractor to a satisfactory standard, as directed by Council's Street Tree Coordinator, Council will undertake the necessary works, which may include the full replacement of trees, and all associated costs will be recovered.

Damage to Council trees may also result in a prosecution being sought under Sections 626 and 629 of the Local Government Act for an offence where such damage occurred wilfully or negligently. Significant financial penalties can be imposed for such offences.

5.7 APPENDICES
STANDARD PLANTING DETAILS

Background Image: Source Arterra

NOTE 1:
All details are to be read in conjunction with any site specific DA conditions or Council issued Contract Documentation. Refer also to Liverpool City Centre Public Domain Technical Manual for tree planting details within this area where applicable.



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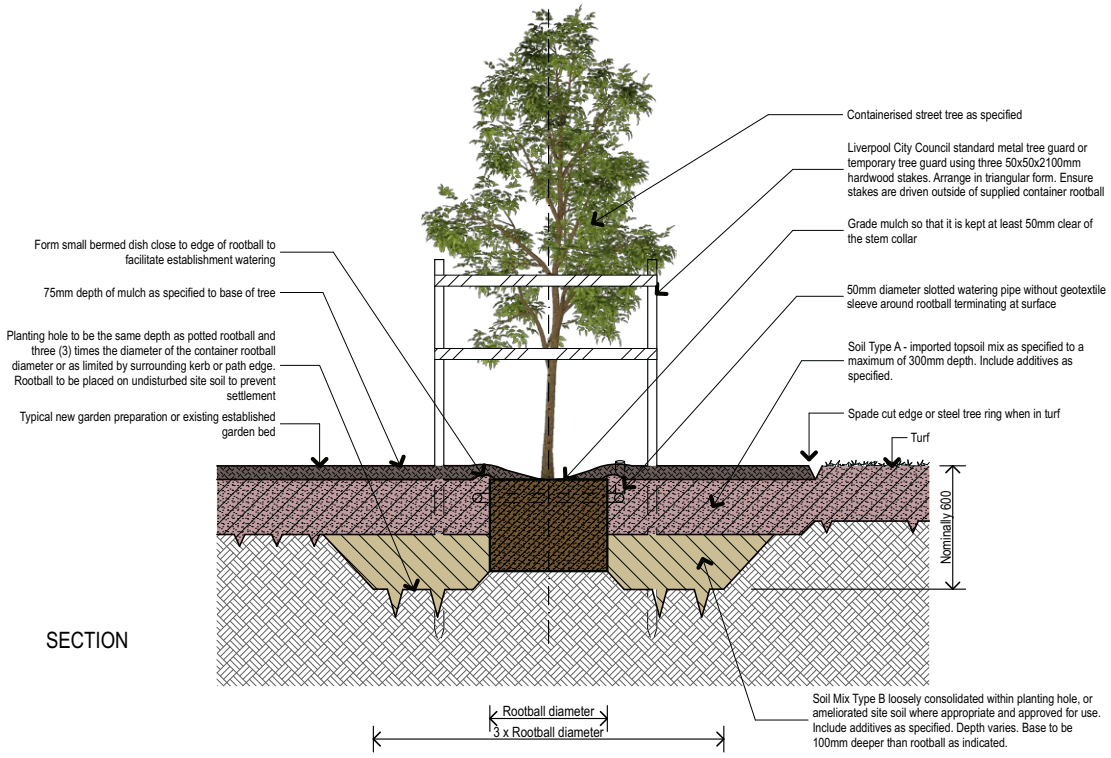

SECTION

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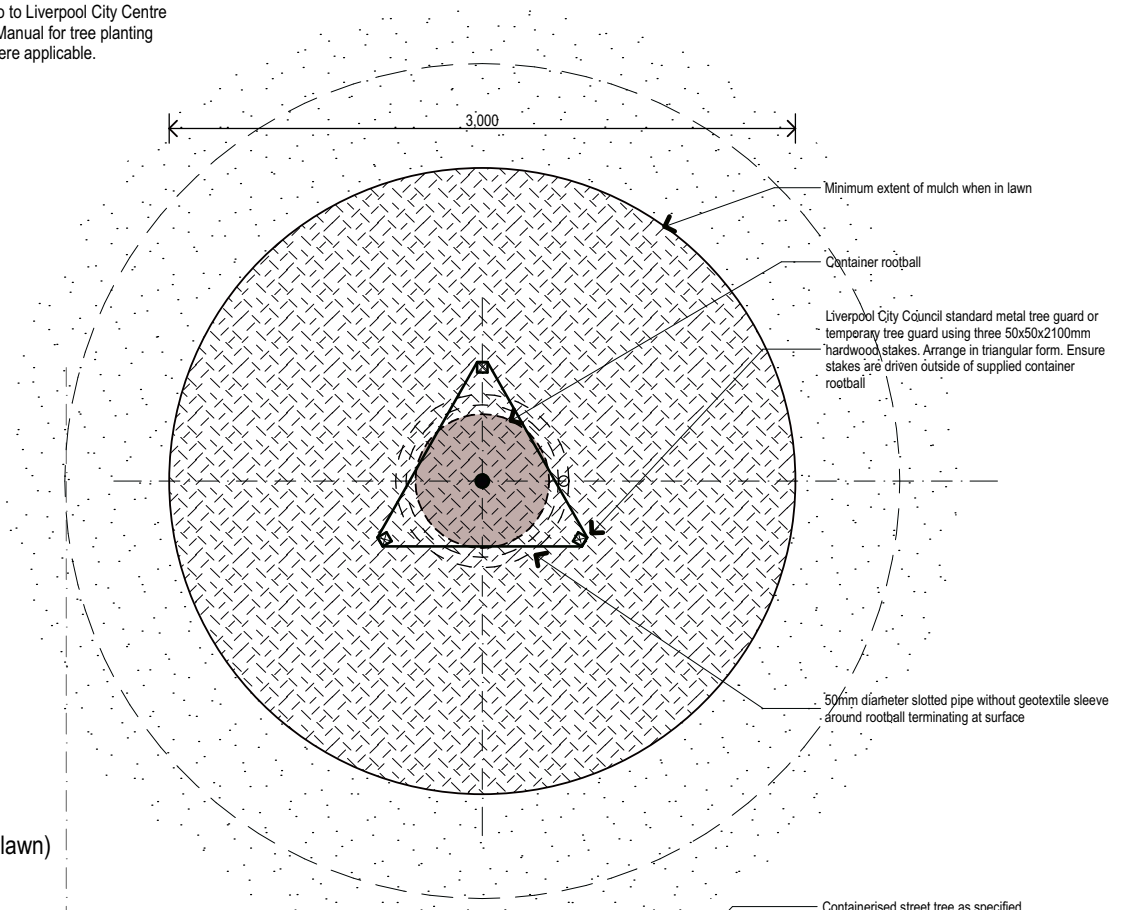
TYPE 1a - TREE PLANTING IN WIDE OPEN TURF

NOTE 1:
All details are to be read in conjunction with any site specific DA conditions or Council issued Contract Documentation. Refer also to Liverpool City Centre Public Domain Technical Manual for tree planting details within this area where applicable.



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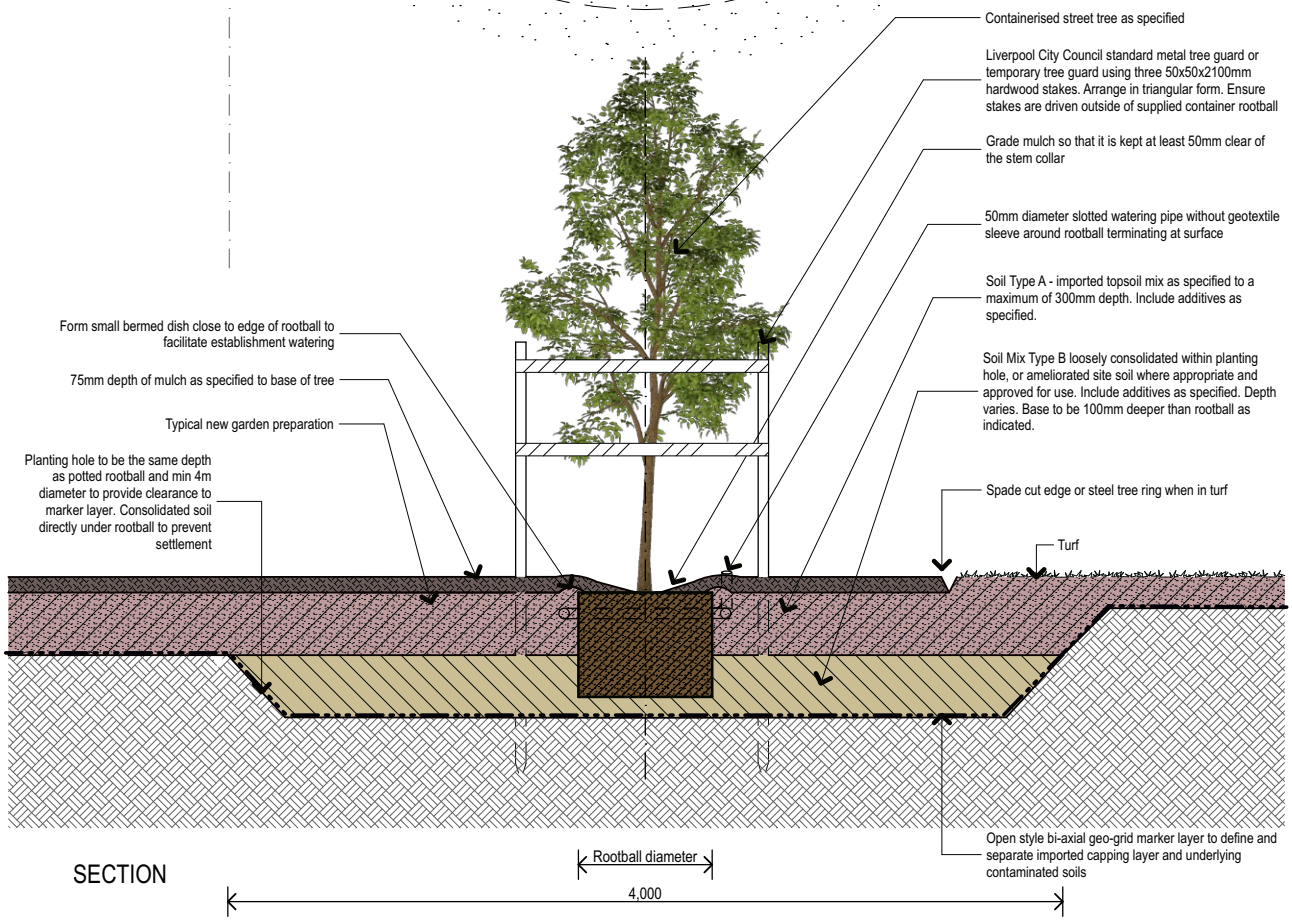
(When in lawn)



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TYPE 1b - TREE PLANTING IN WIDE OPEN TURF WITH CONTAMINATION MARKER LAYER

NOTE 1:
All details are to be read in conjunction with any site specific DA conditions or Council issued Contract Documentation. Refer also to Liverpool City Centre Public Domain Technical Manual for tree planting details within this area where applicable.

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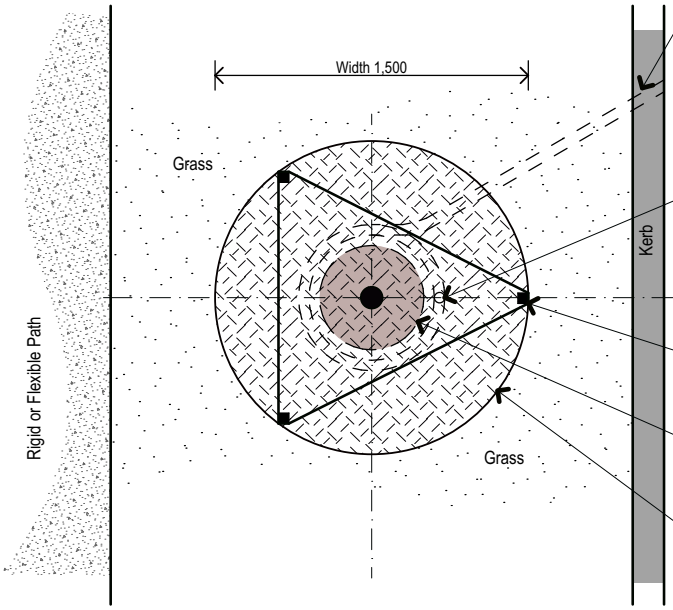

WSUD OPTION:
Cut 50mm diam. hole at 30-45º angle towards direction of flow into gutter and push slotted pipe into end for passive watering from stormwater flows. Proprietary kerb inlet installation subject to approval by Council

50mm diameter slotted pipe without geotextile sleeve around rootball terminating at surface

Temporary tree guard using three 50x50x1800mm hardwood stakes at edge of planting pit. Arrange in triangular form to minimise conflict with opening car doors. Ensure stakes are driven outside of supplied container rootball

Container rootball

Planting hole to be three (3) times the diameter of the container rootball diameter or as limited by kerb or path edge. 75mm depth of mulch as specified (Chipped recycled wood waste, no fines, if nothing specified) to the base of tree to the extent of planting hole excavation. Tree planting area edging as specified by Council. (No edge if nothing specified)

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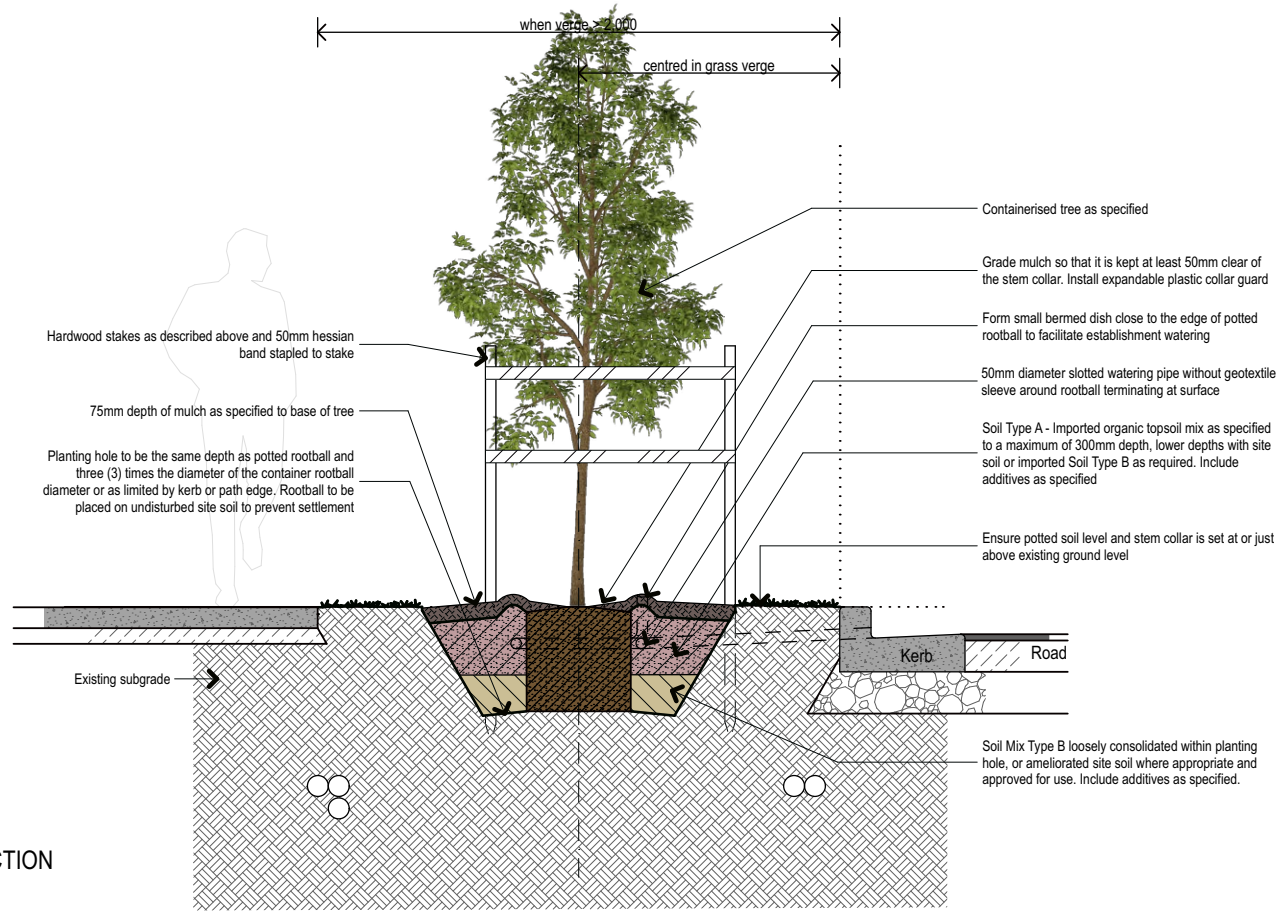

Containerised tree as specified

Grade mulch so that it is kept at least 50mm clear of the stem collar. Install expandable plastic collar guard

Form small bermed dish close to the edge of potted rootball to facilitate establishment watering

50mm diameter slotted watering pipe without geotextile sleeve around rootball terminating at surface

Soil Type A - Imported organic topsoil mix as specified to a maximum of 300mm depth, lower depths with site soil or imported Soil Type B as required. Include additives as specified

Ensure potted soil level and stem collar is set at or just above existing ground level

Soil Mix Type B loosely consolidated within planting hole, or ameliorated site soil where appropriate and approved for use. Include additives as specified.

Scale 1: 25 @ A3 0 500 1000mm

TYPE 2 - TREE PLANTING IN WIDE GRASSED VERGE

NOTE 1:
All details are to be read in conjunction with any site specific DA conditions or Council issued Contract Documentation. Refer also to Liverpool City Centre Public Domain Technical Manual for tree planting details within this area where applicable.

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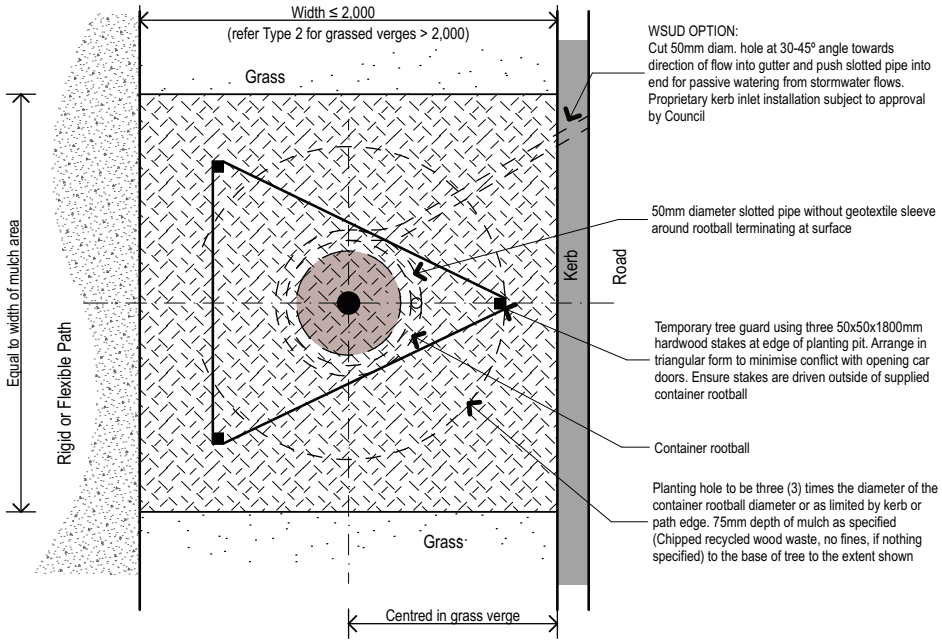

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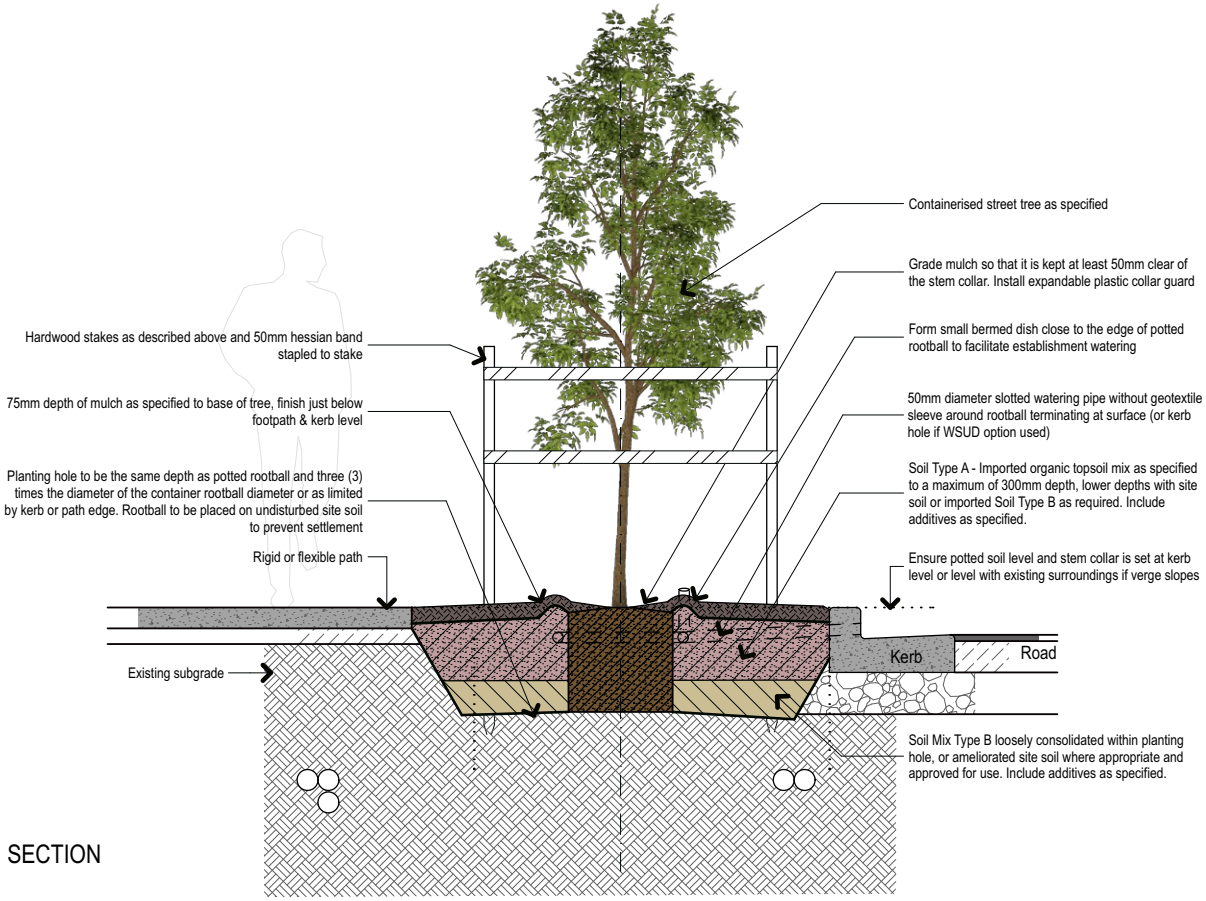

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TYPE 3 - TREE PLANTING IN NARROW GRASSED VERGE

NOTE 1:
All details are to be read in conjunction with any site specific DA conditions or Council issued Contract Documentation. Refer also to Liverpool City Centre Public Domain Technical Manual for tree planting details within this area where applicable.

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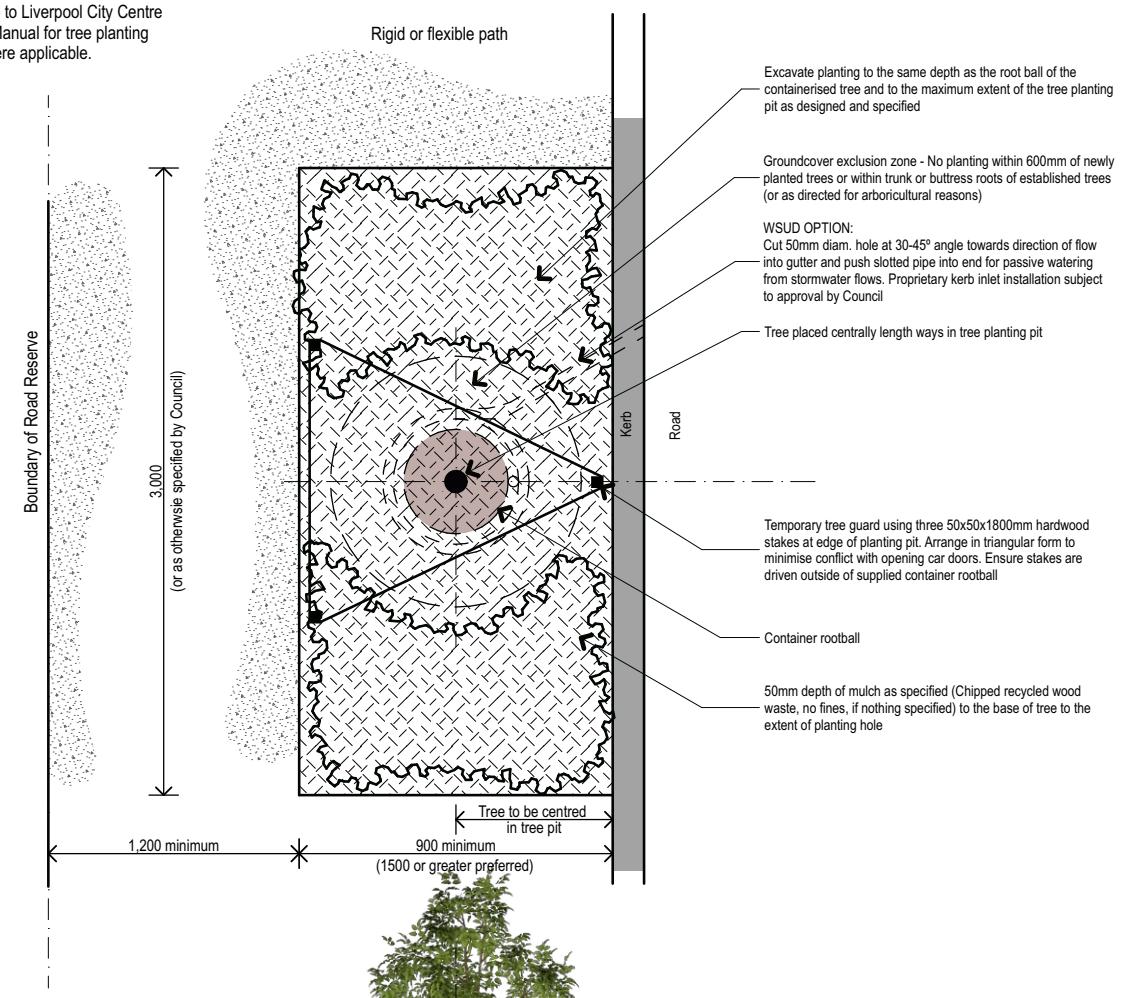

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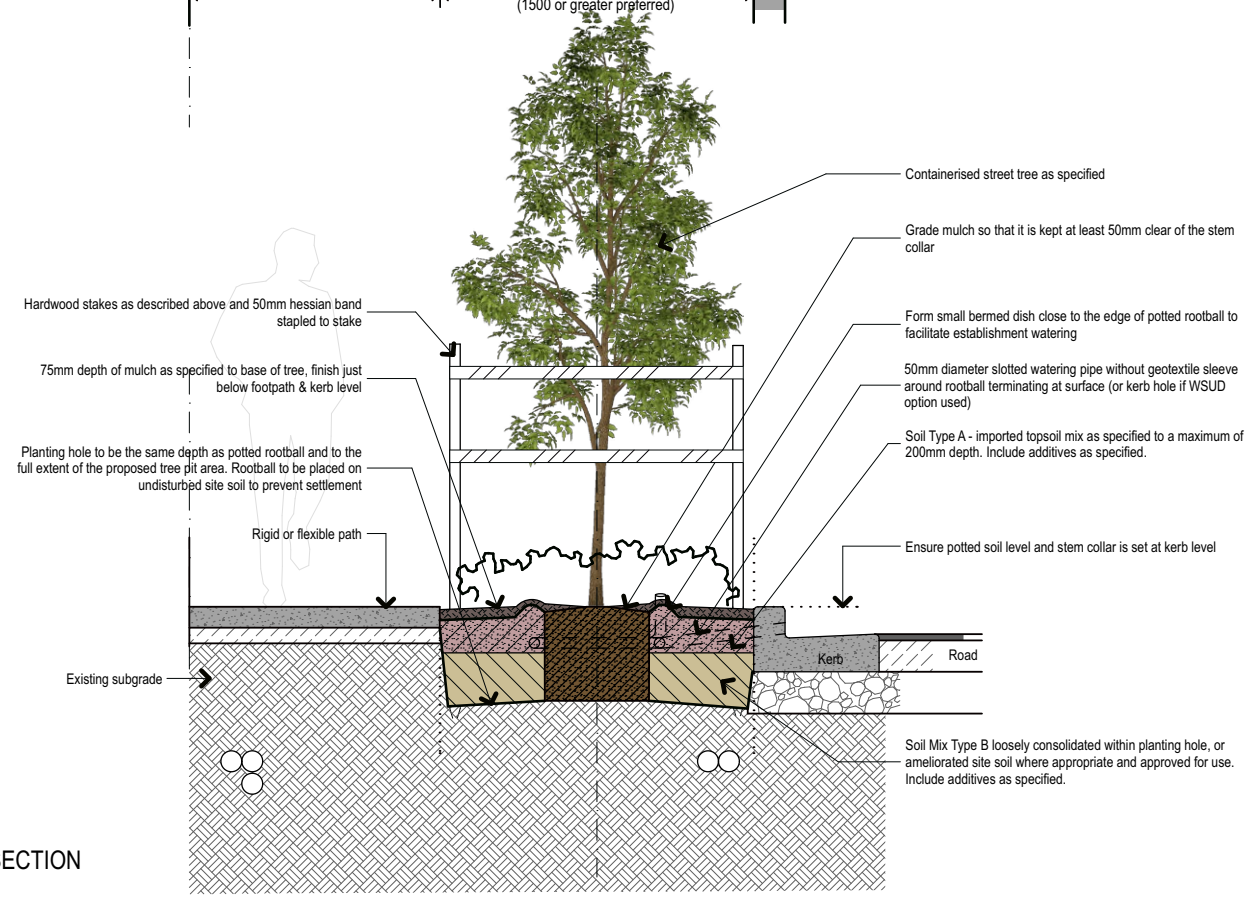

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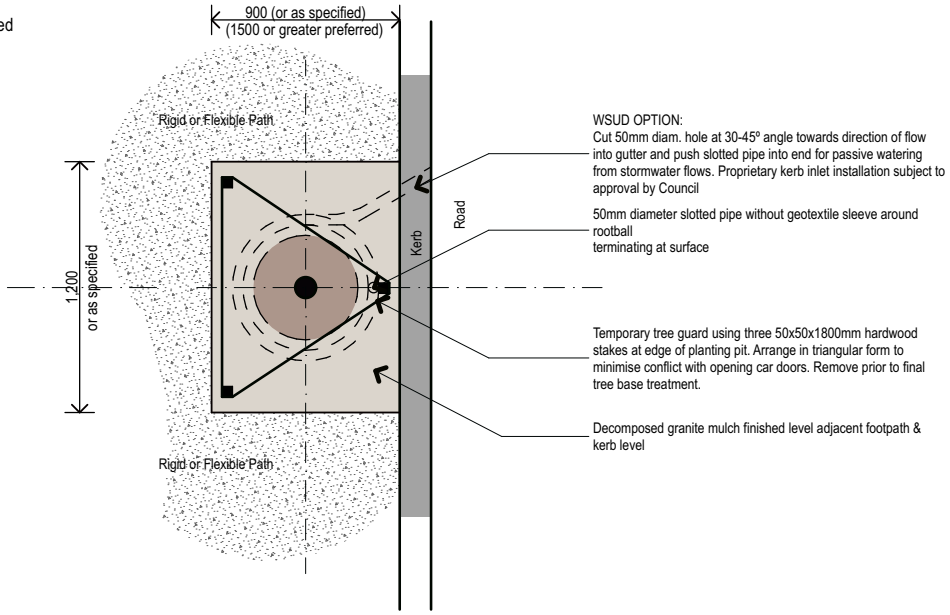
TYPE 4 - TREE PLANTING IN FULLY PAVED VERGE WITHIN STREET GARDEN

NOTE 1:
All details are to be read in conjunction with any site specific DA conditions or Council issued Contract Documentation. Refer also to Liverpool City Centre Public Domain Technical Manual for tree planting details within this area where applicable.

NOTE 2: Existing Trees
a. Size of tree pit may vary depending on depth of surface roots or trunk flare of mature trees.
b. Paving construction may be altered to accommodate tree roots at the direction of Council.
c. Tree pit surface to be installed level with surrounding paving, leaving surface roots exposed where necessary.



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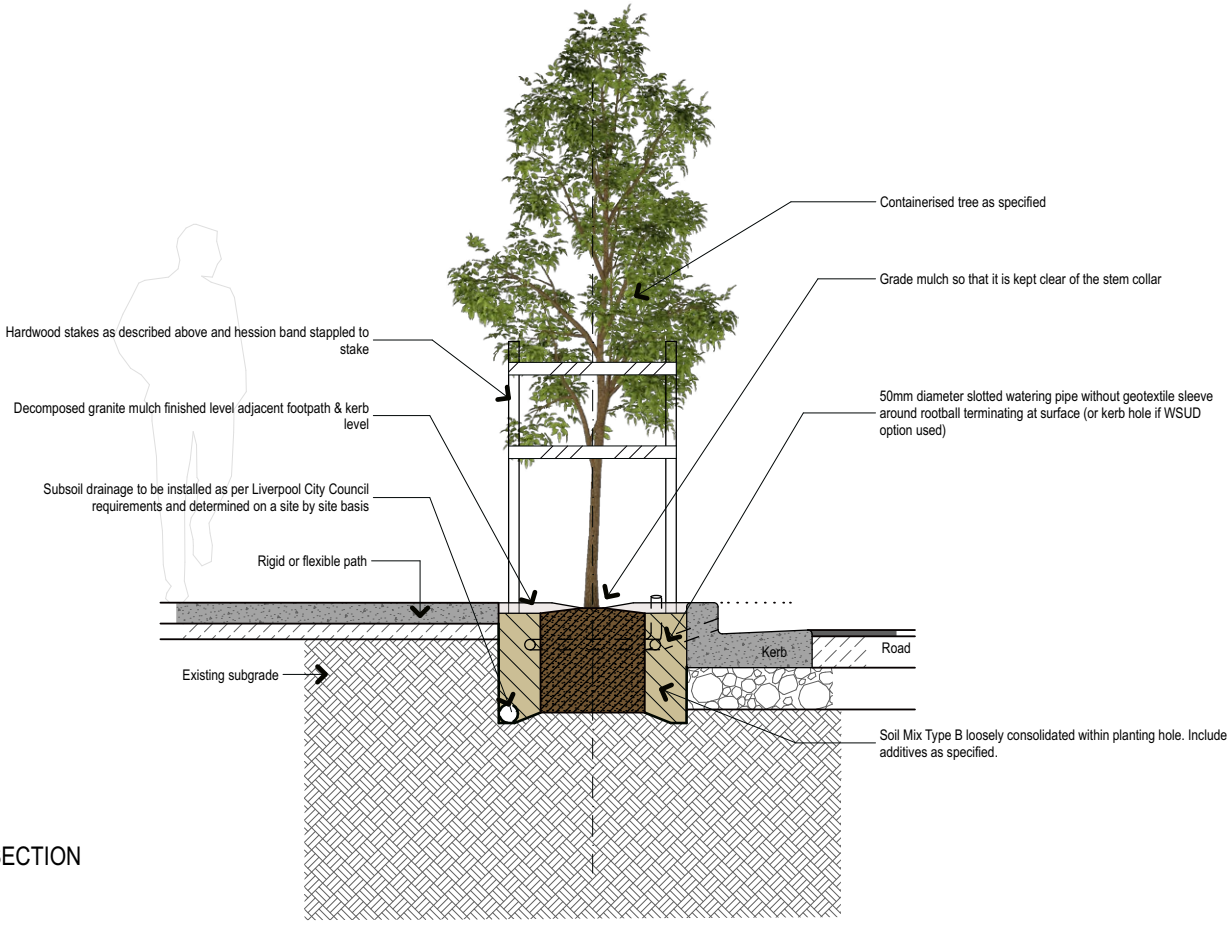

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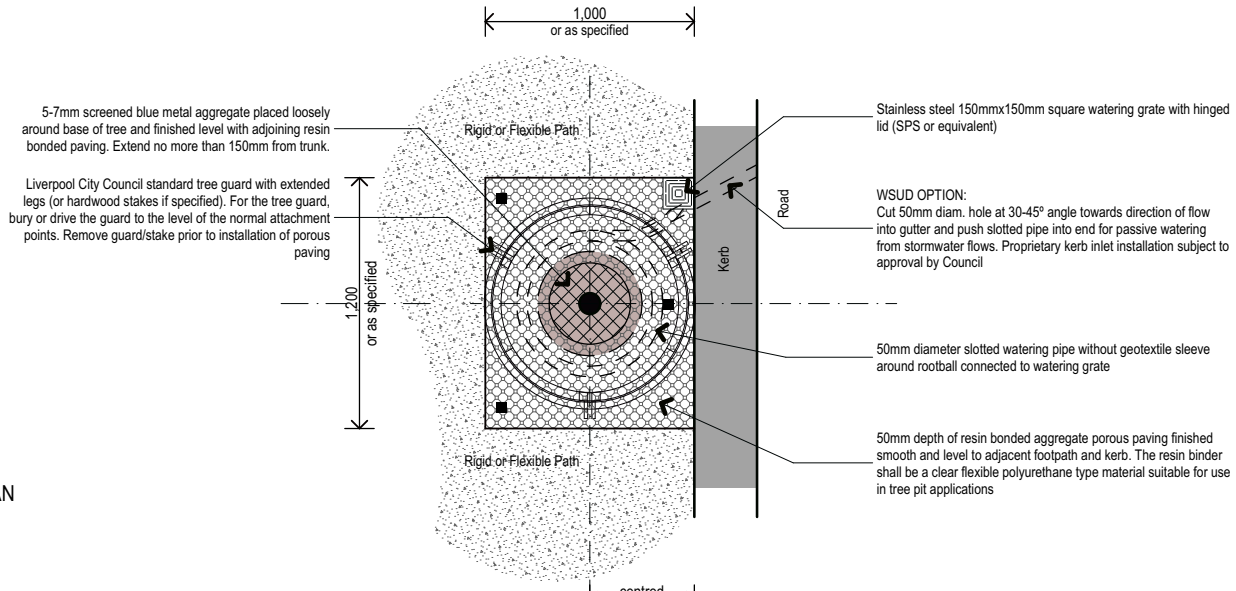
TYPE 5 - TREE PLANTING WITH DECOMPOSED GRANITE SURROUND

NOTE 1:
All details are to be read in conjunction with any site specific DA conditions or Council issued Contract Documentation. Refer also to Liverpool City Centre Public Domain Technical Manual for tree planting details within this area where applicable.



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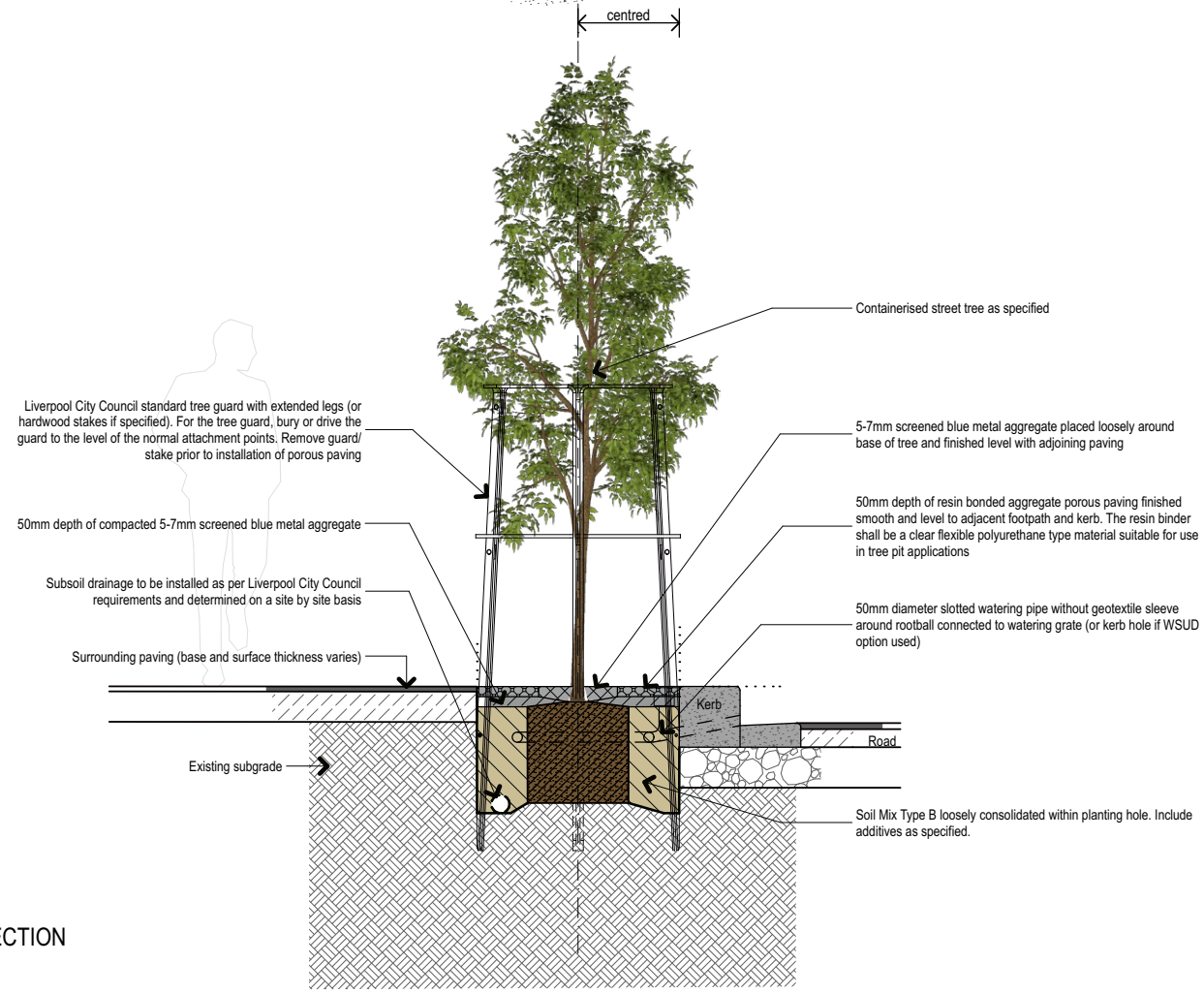

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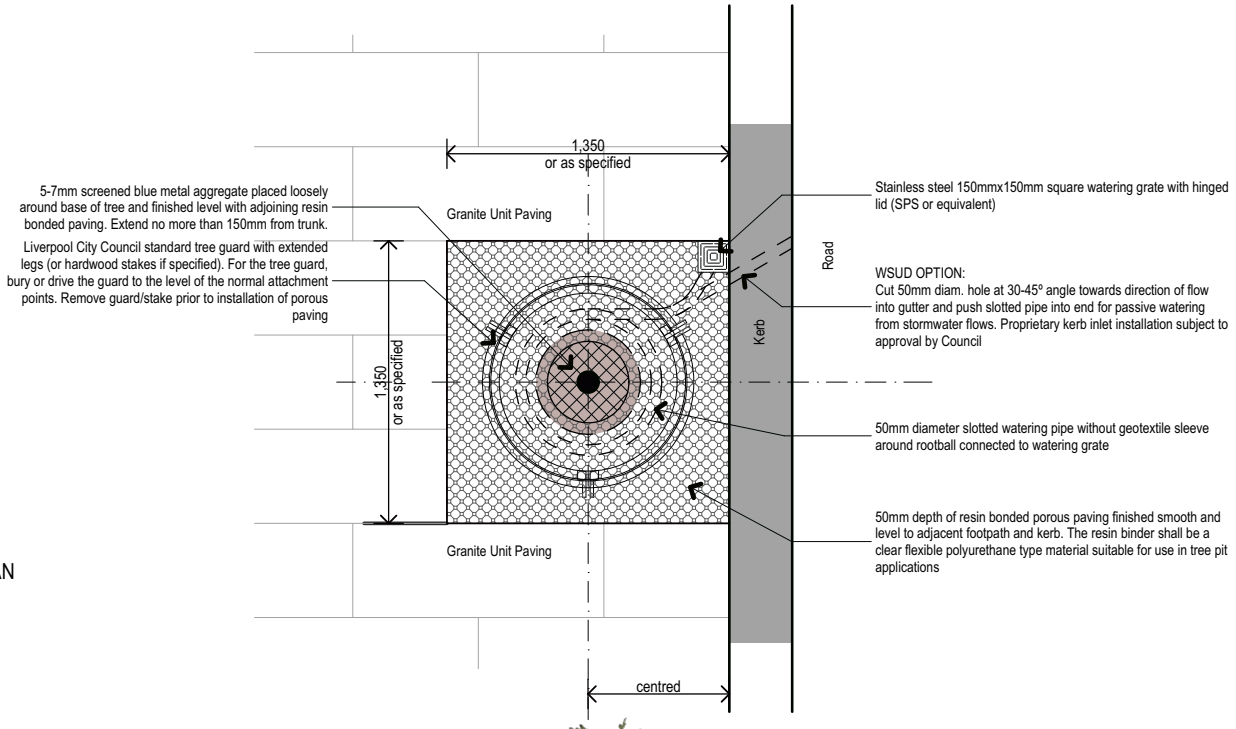
TYPE 6 - TREE PLANTING WITH POROUS PAVING SURROUND

NOTE 1:
All details are to be read in conjunction with any site specific DA conditions or Council issued Contract Documentation. Refer also to Liverpool City Centre Public Domain Technical Manual for tree planting details within this area where applicable.

PLAN



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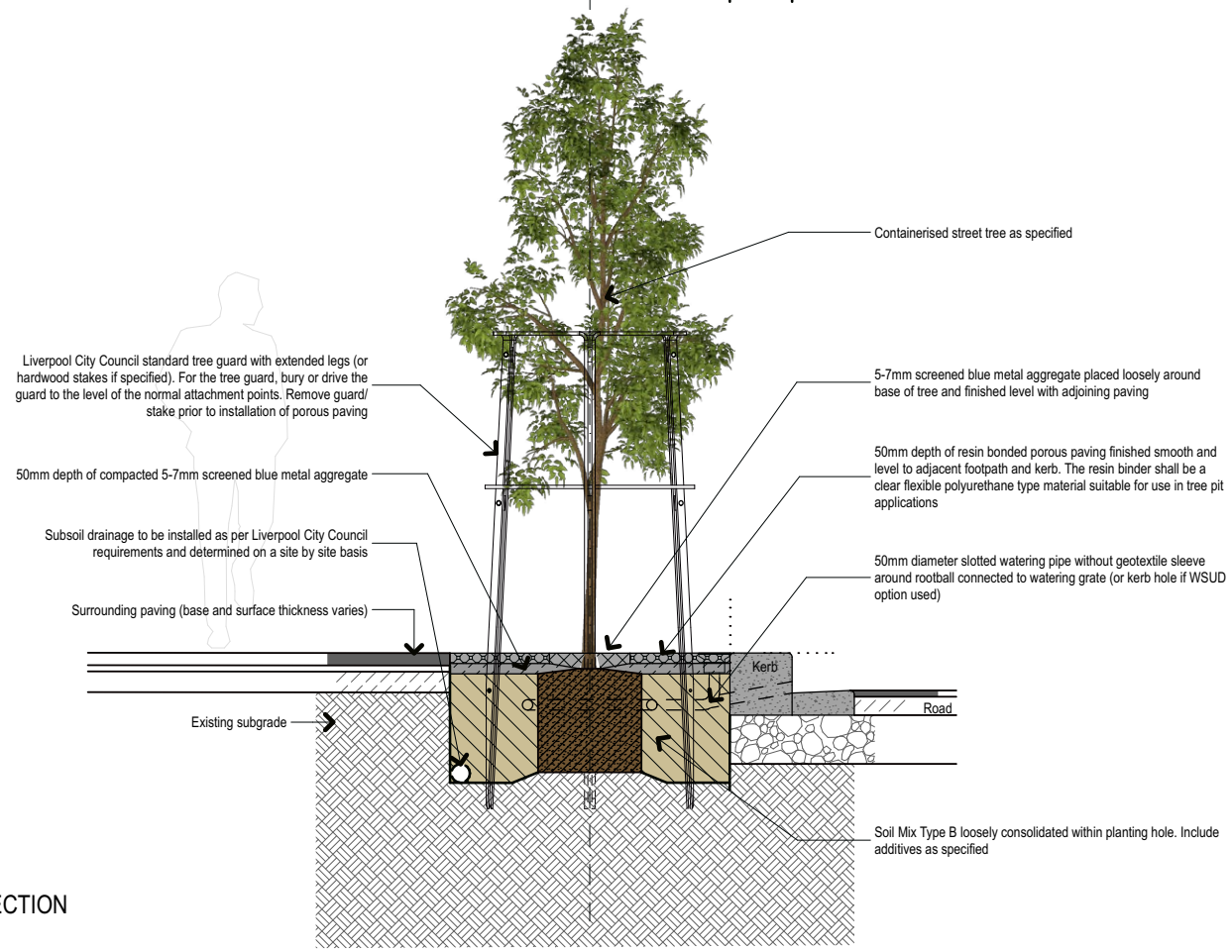

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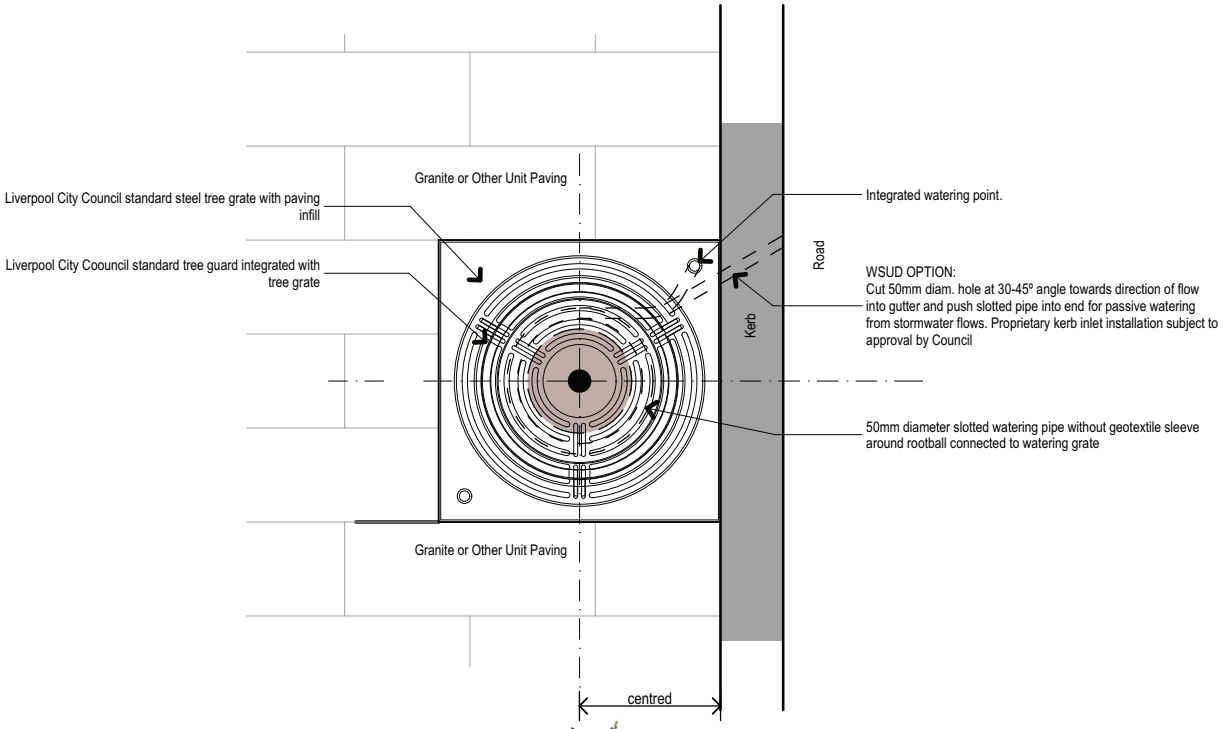
TYPE 7 - TREE PLANTING IN CBD OR OTHER SPECIFIED LOCATIONS - POROUS PAVING

NOTE 1:
All details are to be read in conjunction with any site specific DA conditions or Council issued Contract Documentation. Refer also to Liverpool City Centre Public Domain Technical Manual for tree planting details within this area where applicable.



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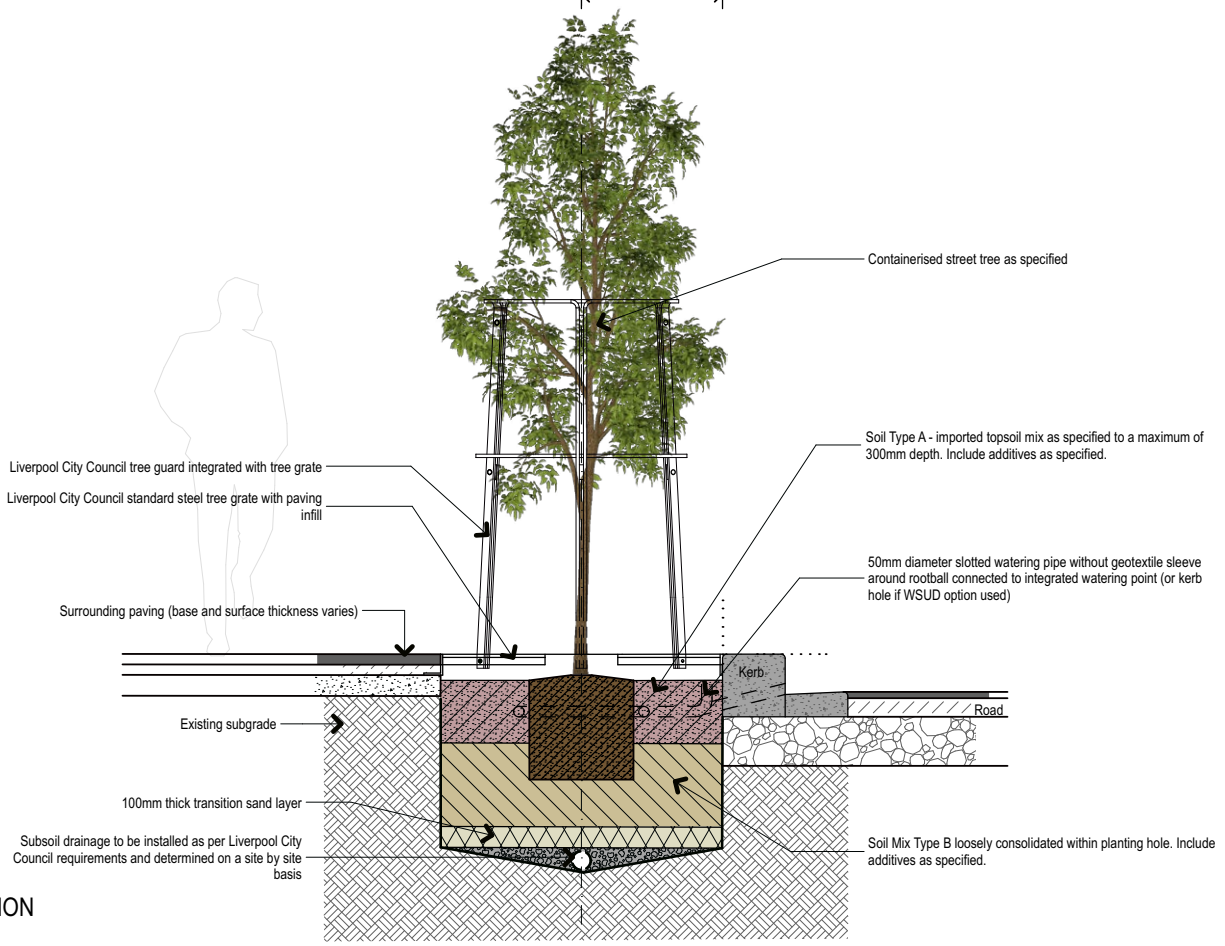

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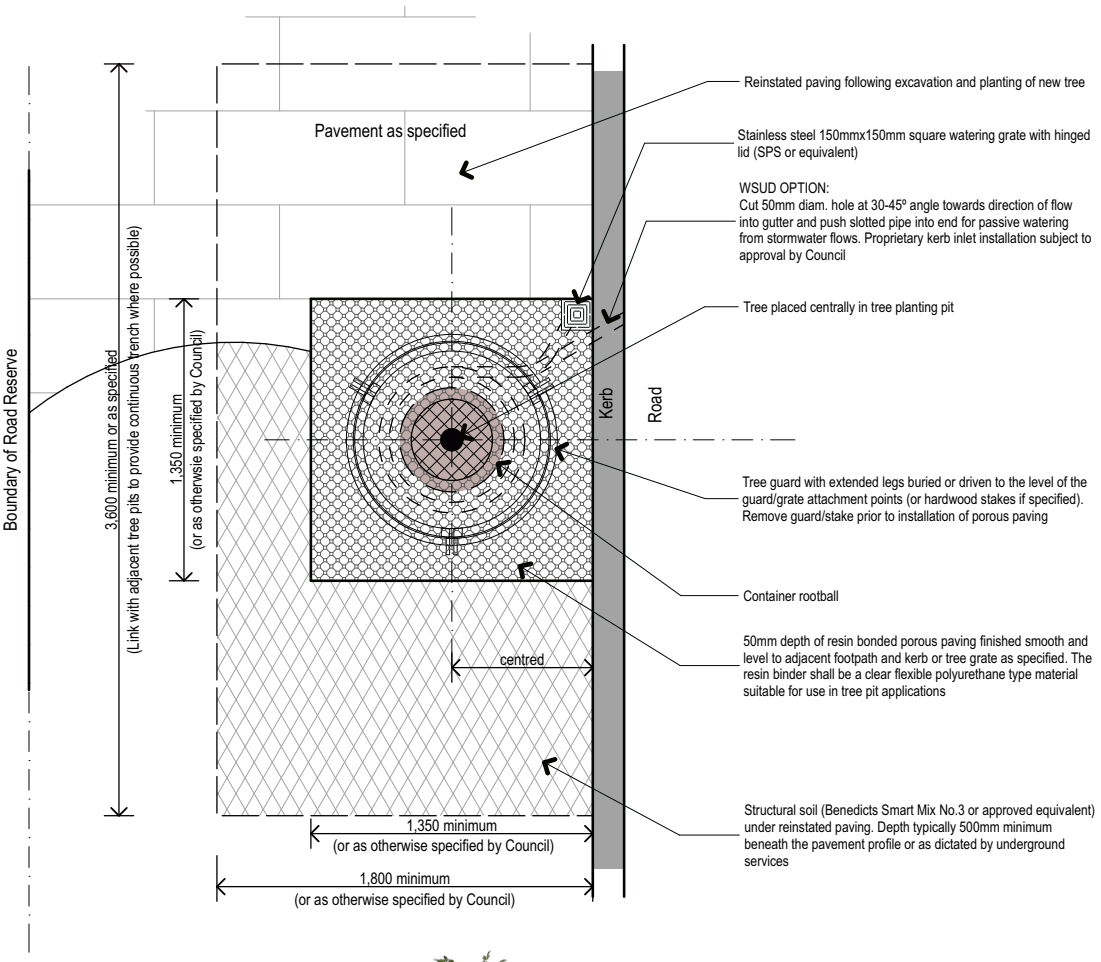
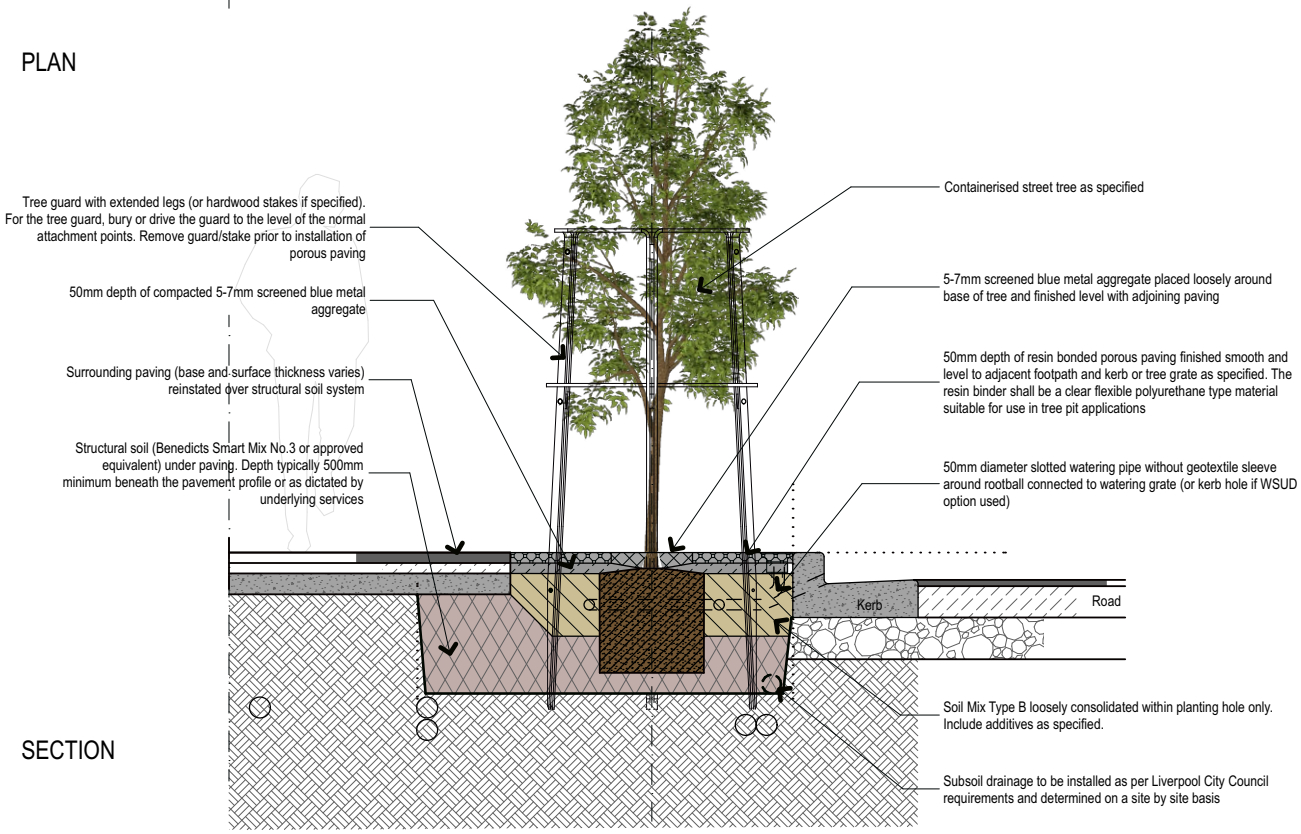
TYPE 8 - TREE PLANTING IN CBD OR OTHER SPECIFIED LOCATIONS - TREE GRATE

NOTE 1:
All details are to be read in conjunction with any site specific DA conditions or Council issued Contract Documentation. Refer also to Liverpool City Centre Public Domain Technical Manual for tree planting details within this area where applicable.



PLAN



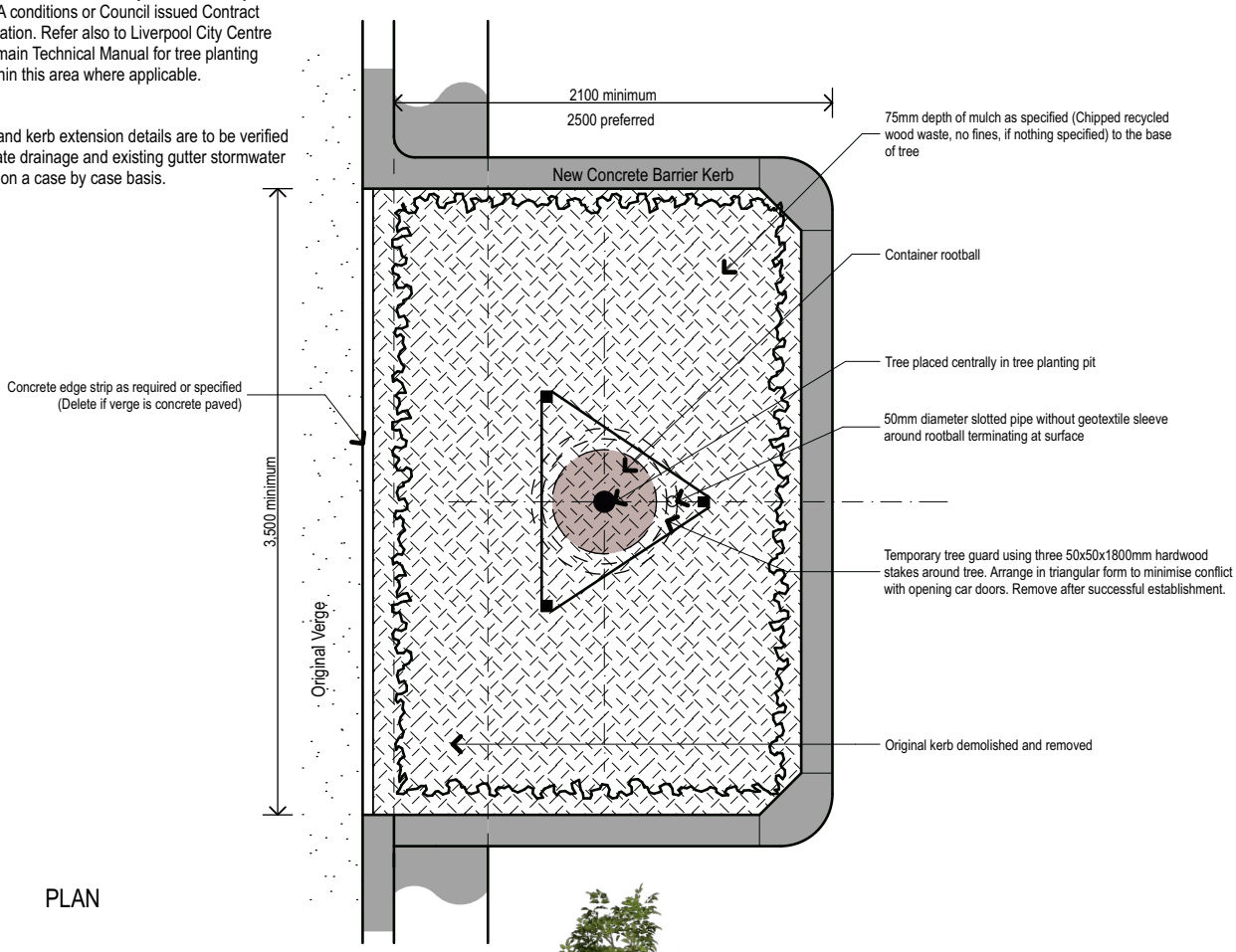
SECTION

Scale 1: 25 @ A3 0 500 1000mm

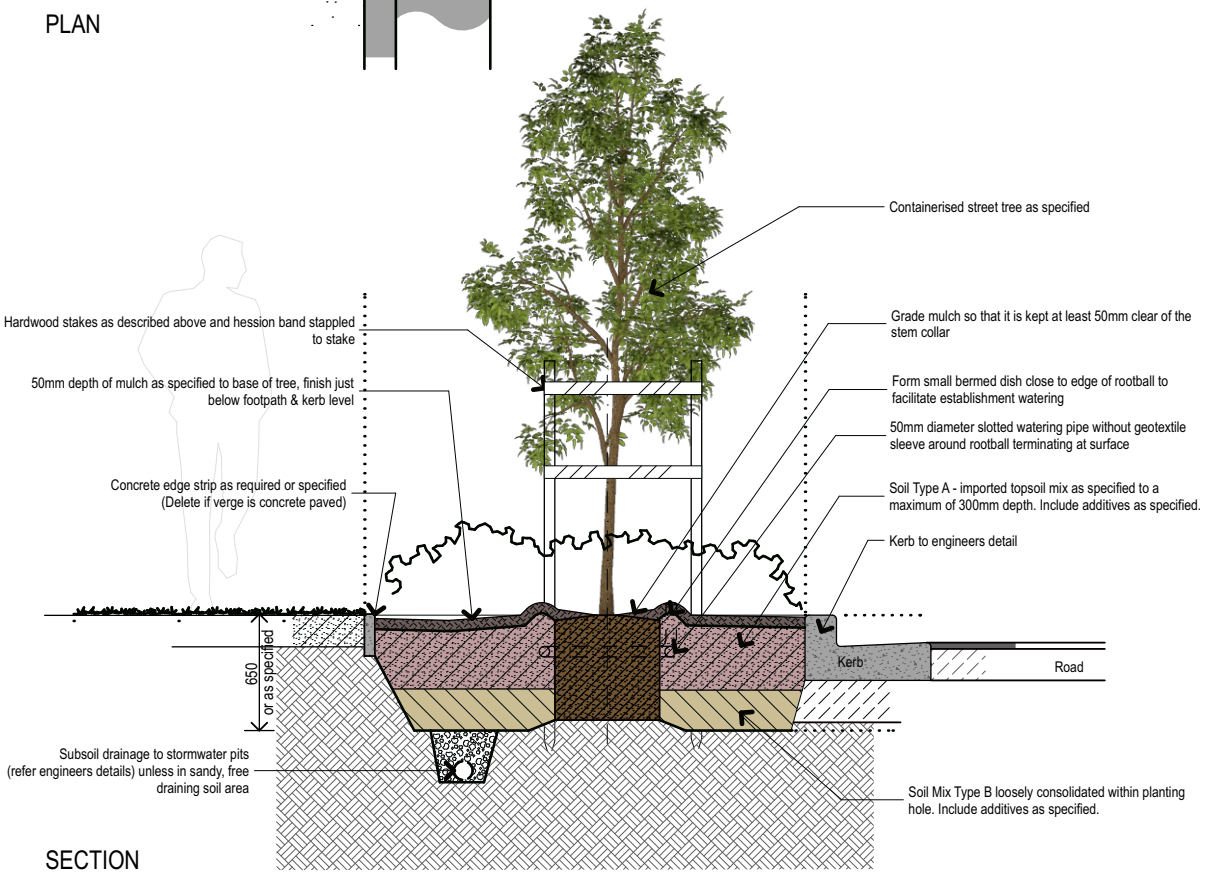
TYPE 9 - TREE PLANTING IN FULLY PAVED VERGE WITH EXPANDED SOIL VOLUME

NOTE 1:
All details are to be read in conjunction with any site specific DA conditions or Council issued Contract Documentation. Refer also to Liverpool City Centre Public Domain Technical Manual for tree planting details within this area where applicable.

NOTE 2:
All blister and kerb extension details are to be verified for adequate drainage and existing gutter stormwater discharge on a case by case basis.



PLAN

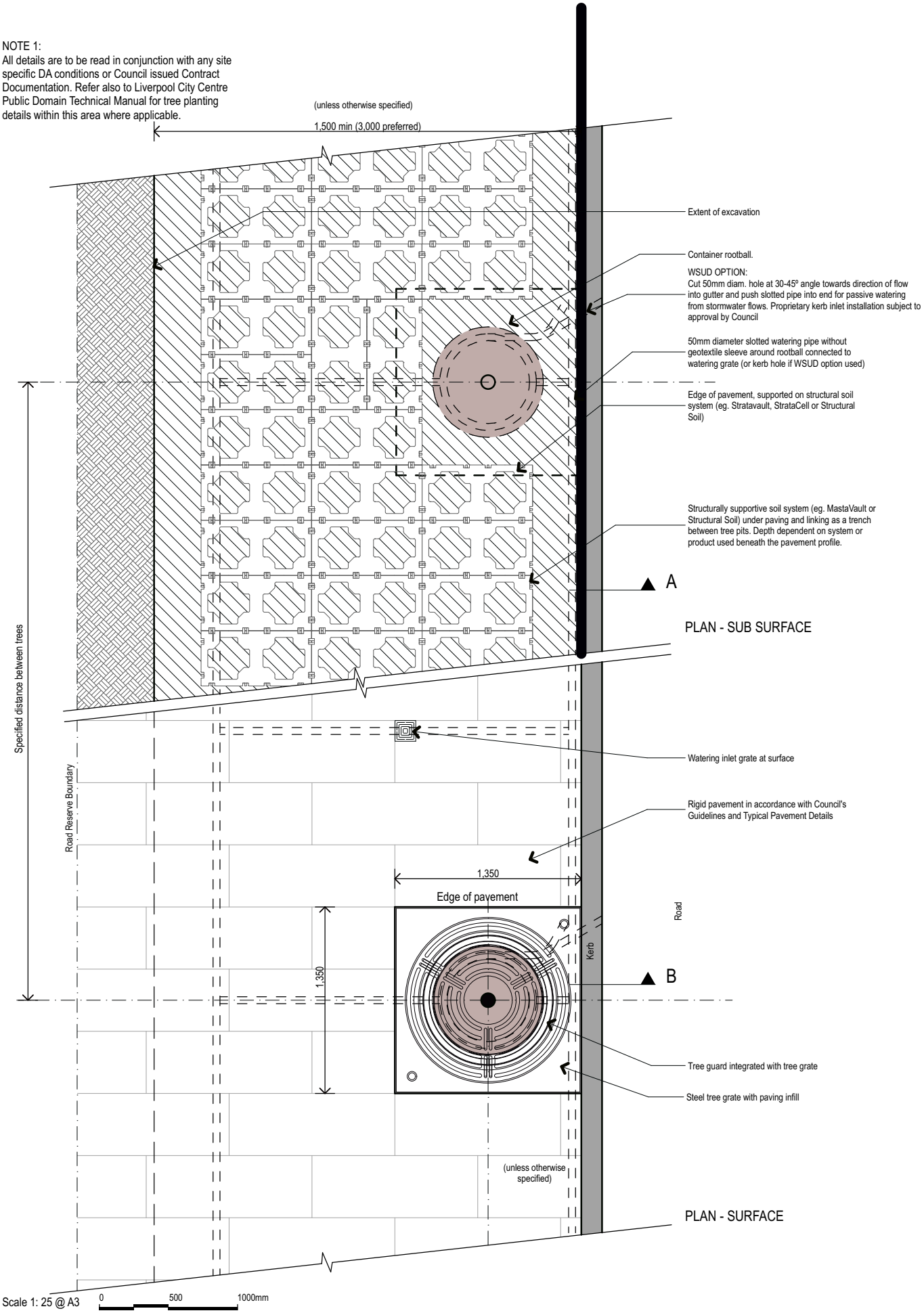


SECTION

Scale 1: 25 @ A3 0 500 1000mm

TYPE 10 - INDICATIVE TREE PLANTING IN-ROAD BLISTER

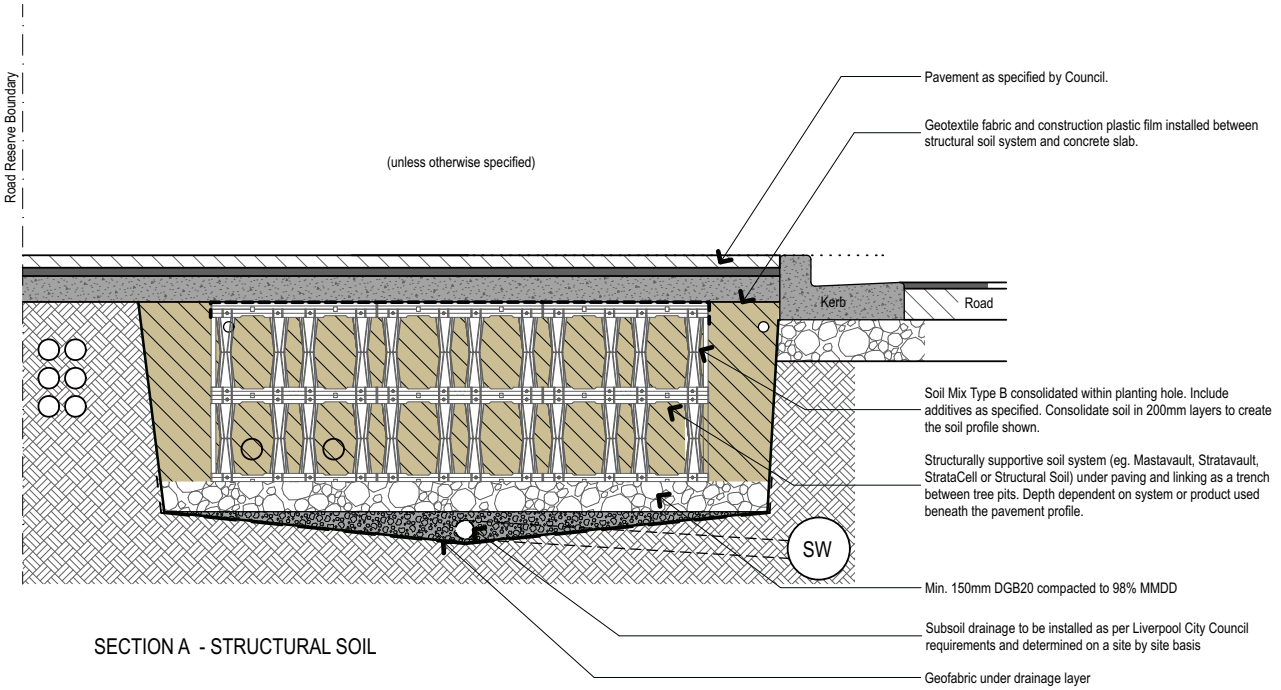
NOTE 1:
All details are to be read in conjunction with any site specific DA conditions or Council issued Contract Documentation. Refer also to Liverpool City Centre Public Domain Technical Manual for tree planting details within this area where applicable.



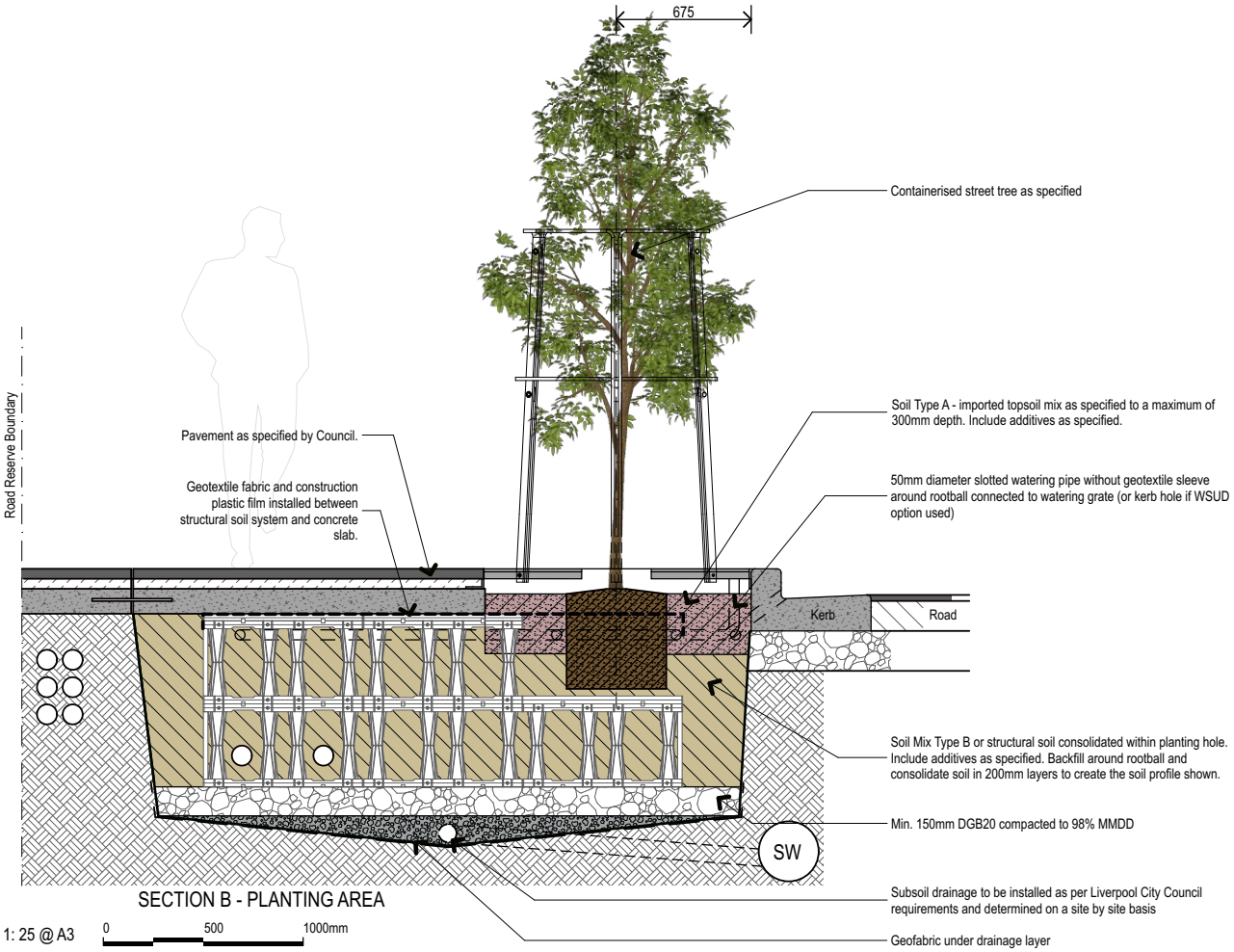
Liverpool City Council

TYPE 11a - INDICATIVE TREE PLANTING WITH STRUCTURAL SUPPORT & CONTINUOUS TRENCH [PLANS]

NOTE 1:
All details are to be read in conjunction with any site specific DA conditions or Council issued Contract Documentation. Refer also to Liverpool City Centre Public Domain Technical Manual for tree planting details within this area where applicable.



SECTION A - STRUCTURAL SOIL



SECTION B - PLANTING AREA

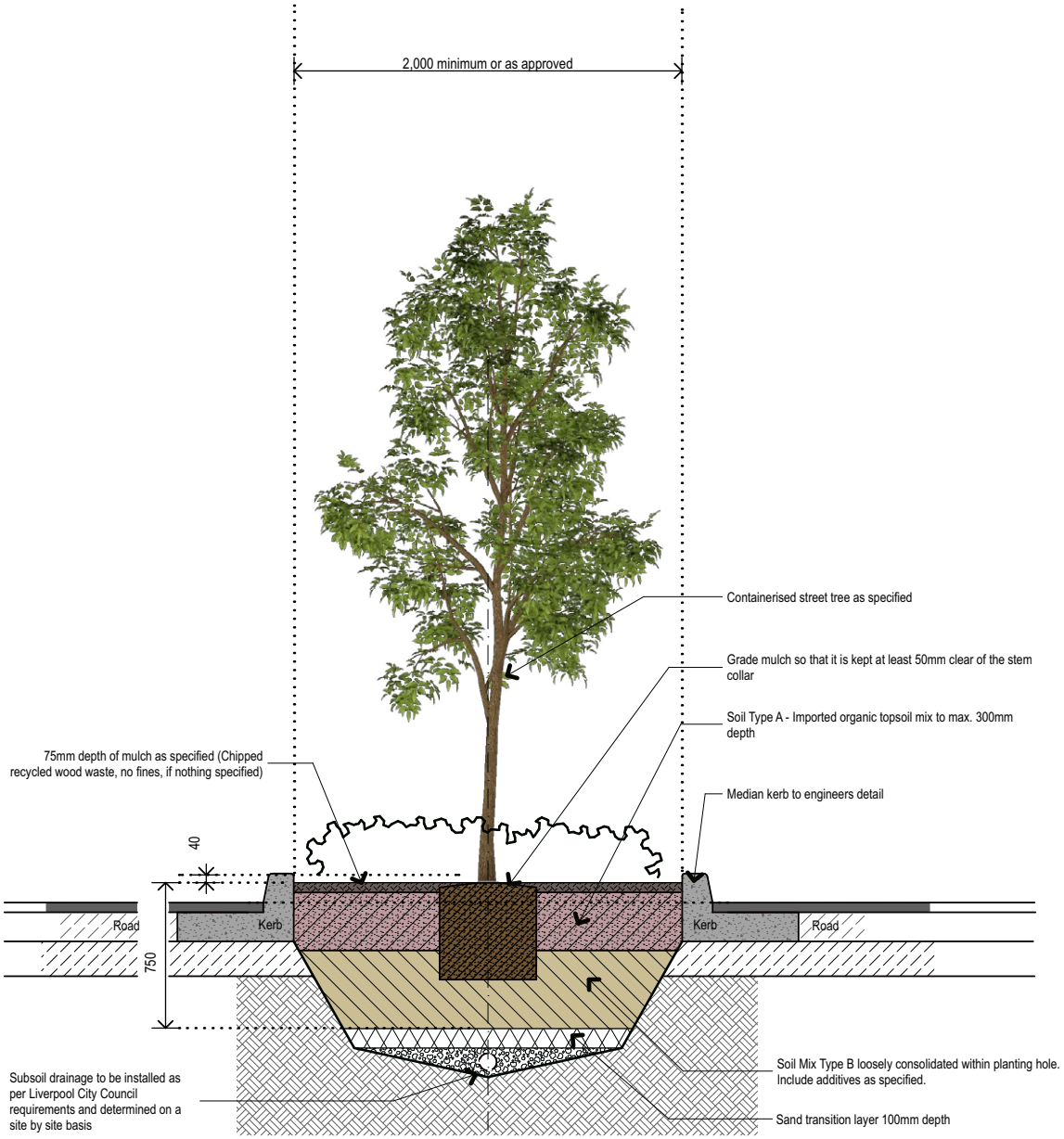
Scale 1: 25 @ A3

0 500 1000mm

TYPE 11b - INDICATIVE TREE PLANTING WITH STRUCTURAL SUPPORT & CONTINUOUS TRENCH [SECTIONS]

NOTE 1:
All details are to be read in conjunction with any site specific DA conditions or Council issued Contract Documentation. Refer also to Liverpool City Centre Public Domain Technical Manual for tree planting details within this area where applicable.

NOTE 2:
All median details are to be verified for adequate drainage and soil depths on a case by case basis.

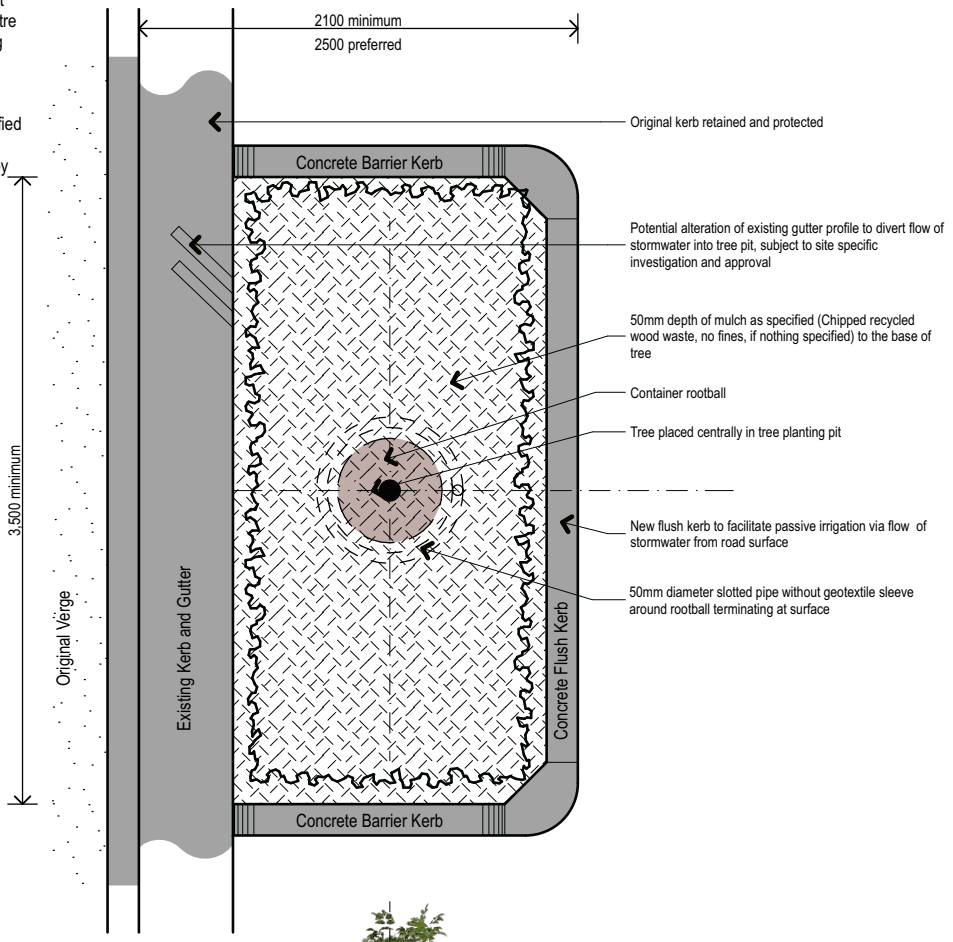


Scale 1: 25 @ A3 0 500 1000mm

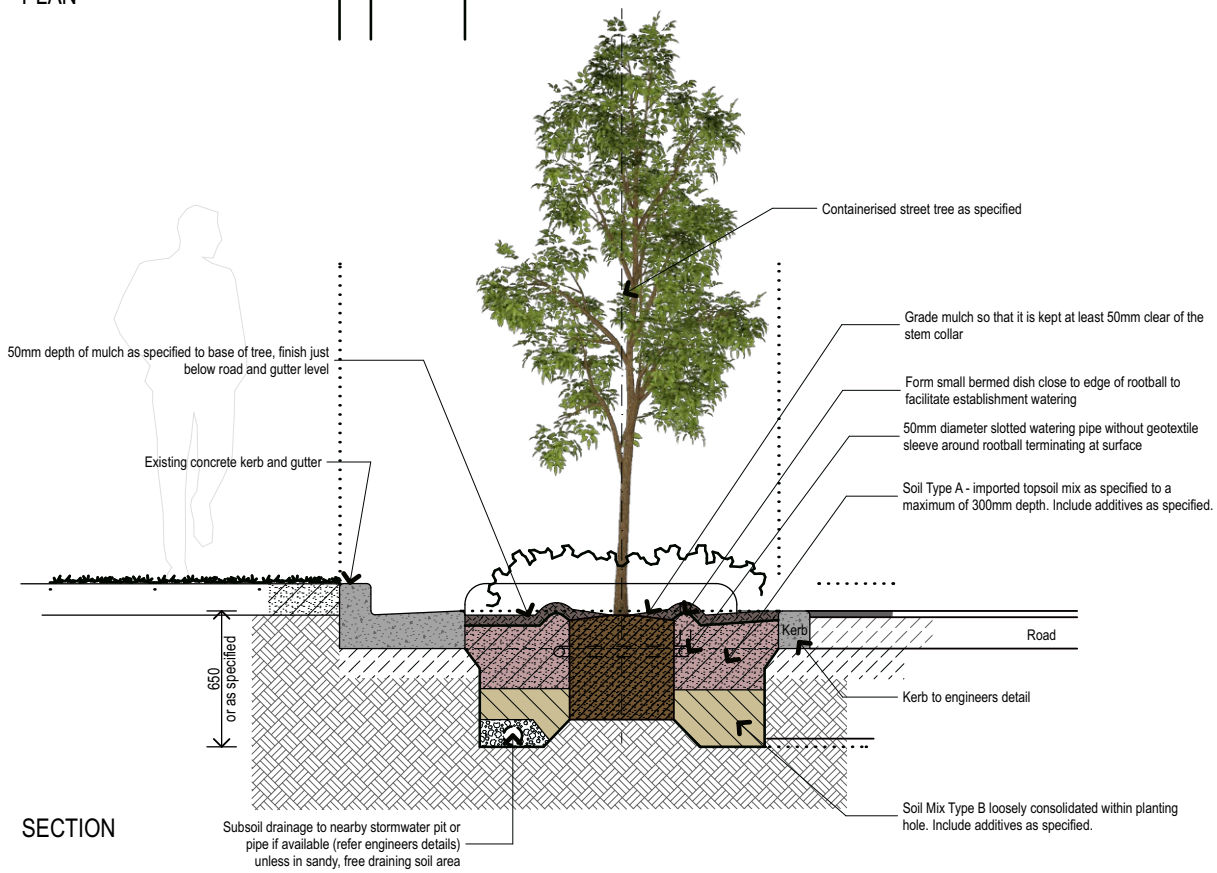
TYPE 12 - INDICATIVE TREE PLANTING IN-ROAD MEDIAN

NOTE 1:
All details are to be read in conjunction with any site specific DA conditions or Council issued Contract Documentation. Refer also to Liverpool City Centre Public Domain Technical Manual for tree planting details within this area where applicable.

NOTE 2:
All in-road blister extension details are to be verified for adequate drainage and existing underground stormwater pipes and other services on a case by case basis.



PLAN

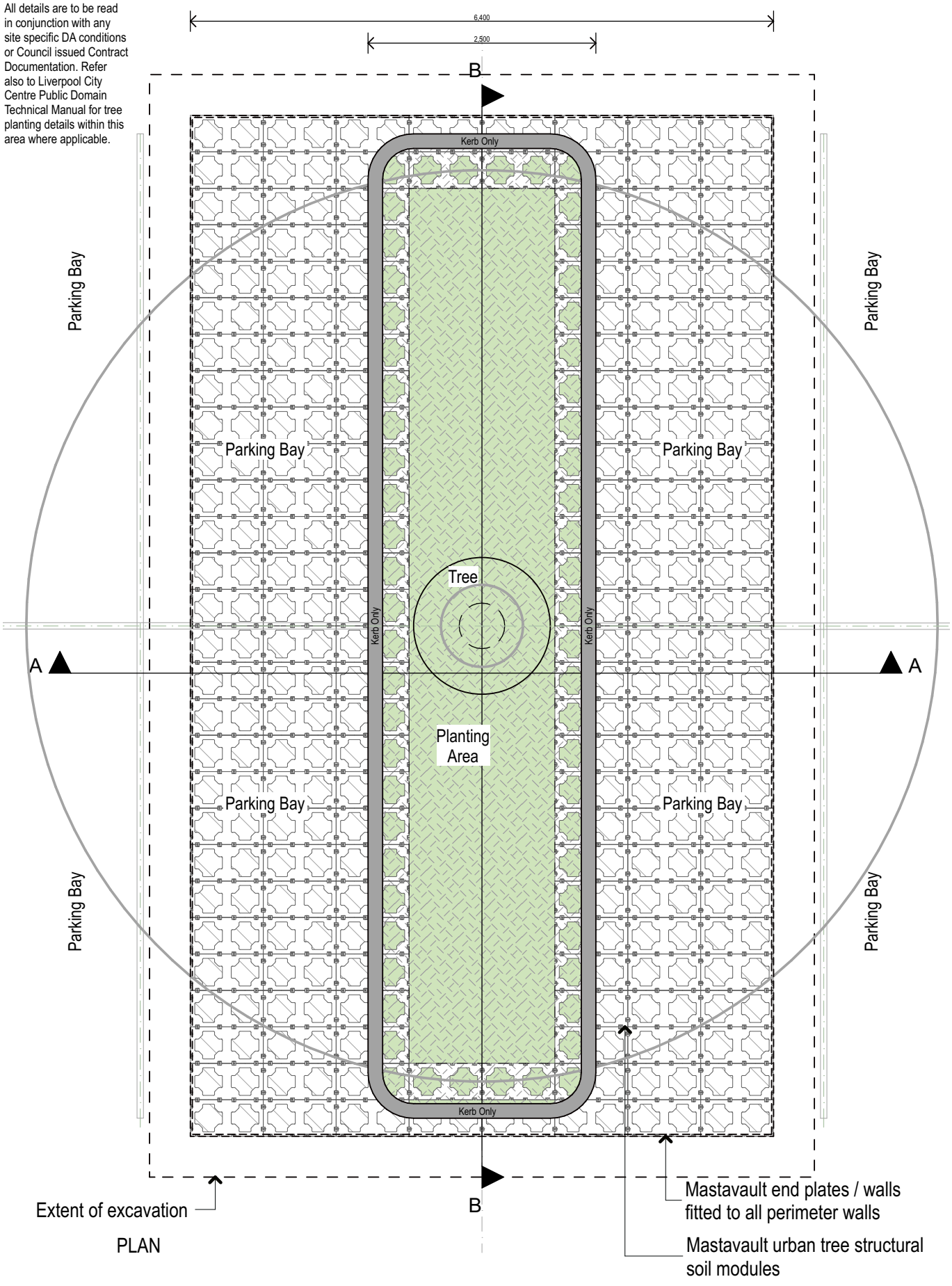


SECTION

Scale 1: 25 @ A3 0 500 1000mm

TYPE 13 - INDICATIVE TREE PLANTING IN-ROAD BLISTER - MAINTAINING GUTTER

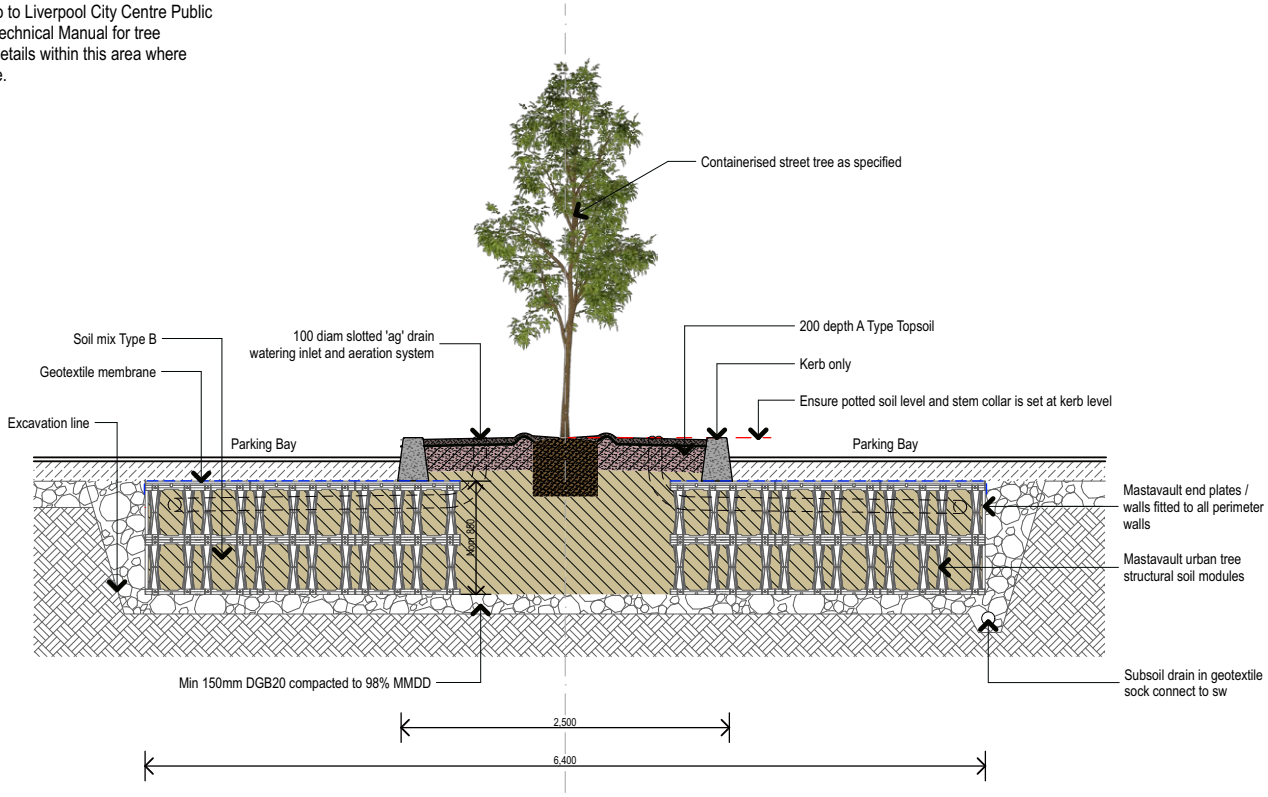
NOTE 1:
All details are to be read in conjunction with any site specific DA conditions or Council issued Contract Documentation. Refer also to Liverpool City Centre Public Domain Technical Manual for tree planting details within this area where applicable.



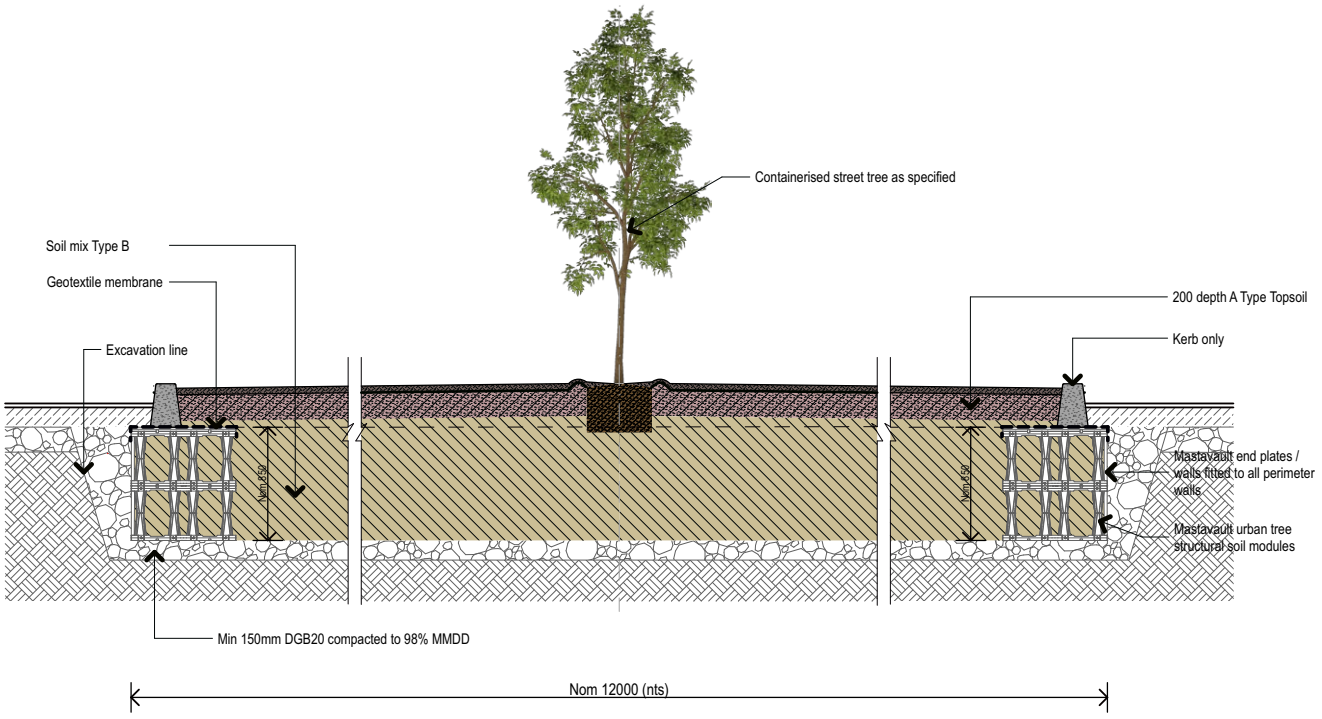
PLAN

Scale 1: 40 @ A3 0 1000 2000mm

NOTE 1:
All details are to be read in conjunction with any site specific DA conditions or Council issued Contract Documentation. Refer also to Liverpool City Centre Public Domain Technical Manual for tree planting details within this area where applicable.



SECTION A



SECTION B

Scale 1: 40 @ A3 0 1000 2000mm

TYPE 14a - INDICATIVE TREE PLANTING IN NEW OR REFURBISHED CAR PARK

5.8 APPENDICES
REFERENCES AND LINKS

IMPORTANT DOCUMENT LINKS

Australian Government - Environmental Protection Biodiversity Conservation Act 1999
https://www.legislation.gov.au/C2004A00485/latest/versions

NSW Government - Heritage Act 1977
https://www.legislation.nsw.gov.au/#/view/act/1977/136

Local Government Act 1993
https://legislation.nsw.gov.au/view/html/inforce/current/act-1993-030

Environmental Planning and Assessment Act 1979
https://legislation.nsw.gov.au/view/html/inforce/current/act-1979-203

Trees (Disputes Between Neighbours) Act 2006
https://legislation.nsw.gov.au/view/html/inforce/current/act-2006-126

NSW Department of Planning and Infrastructure - State Environmental Planning Policy (Infrastructure) 2007
https://www.legislation.nsw.gov.au/#/view/EPI/2007/641/part3/div12

Western Sydney Regional Organisation of Councils (WSROC) Urban Heat Planning Toolkit
https://wsroc.com.au/projects/project-turn-down-the-heat/turn-down-the-heat-resources-2

City of Sydney – Greening Sydney Strategy 2023
https://www.cityofsydney.nsw.gov.au/strategies-action-plans/greening-sydney-strategy

Liverpool Community Strategic Plan 2022-2023
https://www.liverpool.nsw.gov.au/__data/assets/pdf_file/0005/216968/Community-Strategic-Plan-2022-2032.pdf

NSW Biodiversity Conservation Act 2016
https://legislation.nsw.gov.au/view/html/inforce/current/act-2016-063

NSW Weedwise
https://weeds.dpi.nsw.gov.au

5.8 Appendices
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- CoS -Greening Sydney Strategy 2021
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