CLARENCE VALLEY

Urban Tree Management Strategy

clarence
VALLEY COUNCIL

Contents

Chapter 1

Introduction

1.1 PURPOSE OF THE STRATEGY

The trees of the Clarence Valley are an important asset. The 'Valley Vision 2020' document identifies the vision for the Clarence Valley as;

"A sustainable Clarence Valley; Life in the Clarence Valley", now and in the future, is based on a culture of living sustainability that protects and carefully utilises the natural environment, its beauty and resources, our cultural heritage and unique identity of our valleys and its communities..."

One of the main elements of the 'Valley Vision 2020' is human habitat. A quality built environment and a desire for streetscapes to contribute to social sustainability is a key goal of this vision.

There is a strong community view that the natural environment, a healthier lifestyle and beauty in the local environment are core values according to the 2020 survey.

Trees will contribute to achieving these goals and community values. Trees perform many functions. Culturally, they contribute to the character of an area and add a sense of life and place. They instill a sense of community pride in residents and can even calm and inspire. Environmentally, they provide natural air conditioning, shade, habitat for native wildlife, soil restoration and shelter against noise and wind. Aesthetically, they add natural beauty and provide a necessary softening of the built environment.

To develop how Clarence Valley manages these valuable assets, the Urban Tree Management Strategy and Yamba Street Tree Master Plan will guide future policy on street tree management.

Our urban forest is made-up of a diverse range of species and age groups, planted over a number of historic periods, creating a mosaic of plantings interwoven with remnant locally-indigenous trees. Grafton City alone contains more than 7000 street and park trees. The management of the urban forest over such a large area is a huge task. It takes considerable effort and planning to ensure that trees are maintained properly in order to provide a safe environment for the community. Long-term planning is required to ensure the preservation, enhancement and sustainability of the Urban forest for future generations. This involves making long term decisions about tree planting, maintenance, protection and removal.

Urban trees are living assets that are subject to environmental changes, growing in a highly urbanized environment. Careful management is therefore required to ensure the sustainability of trees in urban environments.

The Urban Tree Management Strategy and Yamba Street Master Plan are in two volumes that are linked through council policy. The Yamba Street Tree Master Plan is a document that can be adapted in principle and applied to all of the Clarence Valley urban centres and towns. This plan helps council develop future individual plans beyond Yamba. The plan will incorporate in-built flexibility and clear objectives that is guided by best practice and current thinking. In the past street tree plans were very prescriptive, had design and theme based goals as their core objectives and were liable to be outdated. Past Street Tree Master Plans risked having goals that were irrelevant for the community. Current thinking for street tree master plans in a changing climate are for adaptability, performance driven objectives and ability to incorporate community input. It is highly desirable for a tree selection 'matrix' to be a live document that can be updated and reviewed regularly.

The key objectives of the Urban Tree Management Strategy are:

- Identify and address all major issues relating to tree management on both public and private land in the Clarence Valley towns within the scope area
- Reflect current 'best practice' in tree management that is appropriate for Clarence Valley Council
- Develop realistic action plans for the key objectives
- Identify community needs throughout the valley through the management of trees and account for future needs, climate change and innovations
- Develop a consultative approach that enables community involvement in the tree management process
- To develop action plans for the tree management strategy for each of the key principles
- Identify priority areas in the key towns for a tree replacement strategy

The Key Objectives of the Yamba Street Tree Master Plan are:

- Provide and audit of Yamba's streets and identify the condition of the urban forest
- Identify key issues at Yamba, and opportunities for developing and managing the urban forest
- Provide a 'blueprint' for the long-term planning and management of street trees to ensure a sustainable tree population that contributes to the amenity and visual character of Yamba
- Identify a hierarchy of streets for future street tree planning that is determined by clear, logical and defensible objectives
- Develop a master plan that can develop guidelines to drive street tree plans for the other key towns in the Clarence Valley

1.2 EXECUTIVE SUMMARY

- There is a strong community view that the natural environment, a healthier lifestyle and beauty in the local environment are core values as determined by the Valley Vision 2020 document. The Urban Tree Management Strategy (UTMS) and Yamba Street Tree Master Plan (YSTMP) are documents that are instrumental in achieving these values
- These two documents are mutually complimentary and are referenced within Councils existing policy documents
- The varied tree cover in the valley can be viewed as an 'urban forest', the collective of trees in private and public property and reserves. The urban forest is best managed holistically using similar principles to timber forestry
- The tree cover across the towns is varied and there are differing issues such as ageing tree population, preservation of views, hazardous trees, limited planting in new developments and constraints with traffic and services. Despite this the trees of the Clarence Valley have been held in high esteem for over 150 years, with a strong cultural and historic precedent
- There is a disparity between the tree cover of the older towns and the recent residential subdivisions
- Currently tree replacement and management is reactive due to limited funds and budget constraints. This is not sustainable for the urban forest in the long term
- Trees are an investment and as with all investments may require intervention management to get the best returns. This teamed with ongoing tree replacement over me longer term gives the best benefits of tree with reduced costs

The UTMS and YSTMP documents will:

- Guide the future tree management process and its goals for the medium to long term
- Allow for a consultative, defensible and flexible approach to tree management that provides options while still achieving the key objectives
- Provides action plans based on priorities for both the Clarence Valley towns,particularly Yamba
- Provide a template for future master plans for other towns
- Provide a tree selection process that is a 'live' document allowing periodic review and updates
- To select, maintain and manage trees to minimise risk and liability and provide a safe urban environment for the community
- Allow for adaptation to climate change with suggestions for dealing with increasing environmental challenges for trees
- Provide a strategy for tree asset management and maintenance
- Ensure on going replacement of suitable trees to provide a sustainable urban forest
- Provide guidance to ensure that the right tree is planted in the right situation, with adequate space for trees to reach their potential
- Recommends the protection and preservation of trees within private property and council owned and managed land in order to control the loss of trees and maintain and enhance amenity
- Provides the framework for Yamba's approach to street tree management, to balance ecological objectives, preservation of iconic views and management of the important Norfolk Island Pine forest (including an audit of health and priority action areas)
- Tree planting objectives and car parking in Yamba, tree planting in public reserves and new subdivisions and a comprehensive tree selection matrix that keys in with a master plan layout

Chapter 2

Background

2.1 OVERVIEW

The former Grafton City Council has a long and proactive association with management of the trees within the Local Government Area (LGA) that began not long after its gazetting in 1859. Council has had an important role in developing the streetscapes of Grafton and to a lesser extent the towns of Maclean, Iluka and Yamba. The patterns of tree management over this time still have an enduring legacy for the benefits of the town and provide many examples that can be continued and improved. This document seeks to guide the continuation of this work and identify current challenges and future opportunities.

Clarence River Valley

The Clarence River Valley is located on the Northern Rivers of NSW and is under the jurisdiction of the Clarence Valley Council (CVC). The Council LGA is large, covering fifty percent of the northern rivers region of New South Wales. The CVC is an amalgamation of the previous smaller councils of Copmanhurst, Grafton, Maclean and Pristine Waters.

The Clarence River has been the primary reason for the development and prosperity of the district. Physically, it is the largest coastal river catchment in New South Wales. Commercially it is important as a consequence of the fertility of the adjacent floodplains and as a navigable trading port. Cedar logging, dairy, sugar cane, fishing and recreation uses are amongst a diverse range of activities that contribute to its historical and contemporary importance. The river and its rich natural resources is also valuable to a strong traditional Aboriginal community, that is a significant proportion of the CVC population.

Amalgamated in 2004, the council now manages major urban townships of Grafton, Maclean, Yamba, and Iluka coastal rural villages and their surrounds. Apart from private landholders, other key land holding stakeholders include the Lands Department, RTA, National Parks and State Forests. The LGA has stewardship over a vast amount of vegetation which includes remnant vegetation, council, streetscapes and coastal reserves. The value of this vegetation, particularly in the towns has been held in high esteem for almost 150 years.

2.2 AREA OF SCOPE

This area of this strategy includes the city of Grafton and the three towns of Maclean, Iluka and Yamba. The urban areas have similar issues and opportunities with their trees, though the nature of the issues differs in each location. Between these four town there are issues and opportunities that are common to management of the urban forest. It is intended that through the Yamba Street Tree Master Plan subsequent master plans for Clarence Valley towns can be developed.

Location plan: The Clarence River Valley. This image clearly shows the pattern of development, agricultural and grazing use along the river. Photo: nearmap 2011.

2.3 CHARACTER OF THE CLARENCE VALLEY URBAN FOREST

All towns have varied issues affecting the trees in the urban forest. Trees in the Clarence River Valley towns are found within the public domain, comprised of streets, public parks and reserves. These are trees that Clarence Valley Council have direct control over and stewardship for. Parks and reserves allow the planting of significant trees, and there are many opportunities for additional planting in the parks to increase the urban forest. The greatest benefit for the community is from trees within the public domain.

Trees in the private domain also make a significant contribution to the vegetation in the landscape. Trees in the backyards of the towns make a significant contribution to the overall canopy cover. This can be illustrated in the urban forest mapping within the strategy. The percentage of canopy cover varies according to the street layout and of course age of the development. Older streets with a larger grid pattern resulted in larger lots and consequently more space. Newer developments with smaller lot sizes have fewer opportunities for planting trees in a limited space. There still are the opportunities for a greater density of street tree planting. However, the newest developments provide fewer opportunities for a generous cover of trees due to tree planting and maintenance constraints, limited developer contributions and a possible negative perception of trees.

Remnant trees are also an important part of the overall urban forest. Maclean, Yamba and Iluka still have large areas of remnant vegetation in public reserves, protection areas and in private enterprises such as caravan parks and golf courses. These remnant stands are important assets for Clarence River Valley.

Yamba Caravan Park: There is a large stand of Norfolk Island pines in the caravan park that provide shade for the park residents. They are also important contributors to the Araucaria forest that characterise the Yamba skyline. A stand of Cottonwoods (Populus deltoides) provide clues that the leeward sheltered slopes can support a greater diversity of large trees.

There is a distinguished history of street tree management particularly in Grafton, that can provide clues to an integrated management of tree canopy in the other towns, formerly administered by other councils. This management strategy was based upon:

- Positive community perception of the benefits of trees in the public domain, including functional (for shade) and 'beautification' for social amenity and tree form and colour
- Support at a state and local level from the NSW Government and the newly formed council
- Historically this was not driven by formal policy or planning instruments, but by the instructions and agenda of individuals, entrepreneurs and institutions
- Trialing and testing of plant material to help achieve street tree planting objectives
- Adequate support and maintenance by both community (positive contribution and civic pride) as well as council
- Optimum growing conditions and space for growing large street trees

These historical attributes are still relevant today, though the number of constraints to increasing the tree canopy cover of the Clarence Valley have increased. The history of cultural tree planting is an important precedent for this strategy. Towns and cities with the fostering of strong values for tree planting historically have benefited from this such as Melbourne, Canberra, Seattle and Paris.

Optimum growing conditions within a streetscape. A wide generous verge with a large available soil volume for sustained tree growth. The best practice for water sensitive urban design emulates what would have been traditional practicality in street drainage. Melbourne's generous street tree grid and street width was utilised for Grafton, a legacy that has been beneficial for the streetscape.

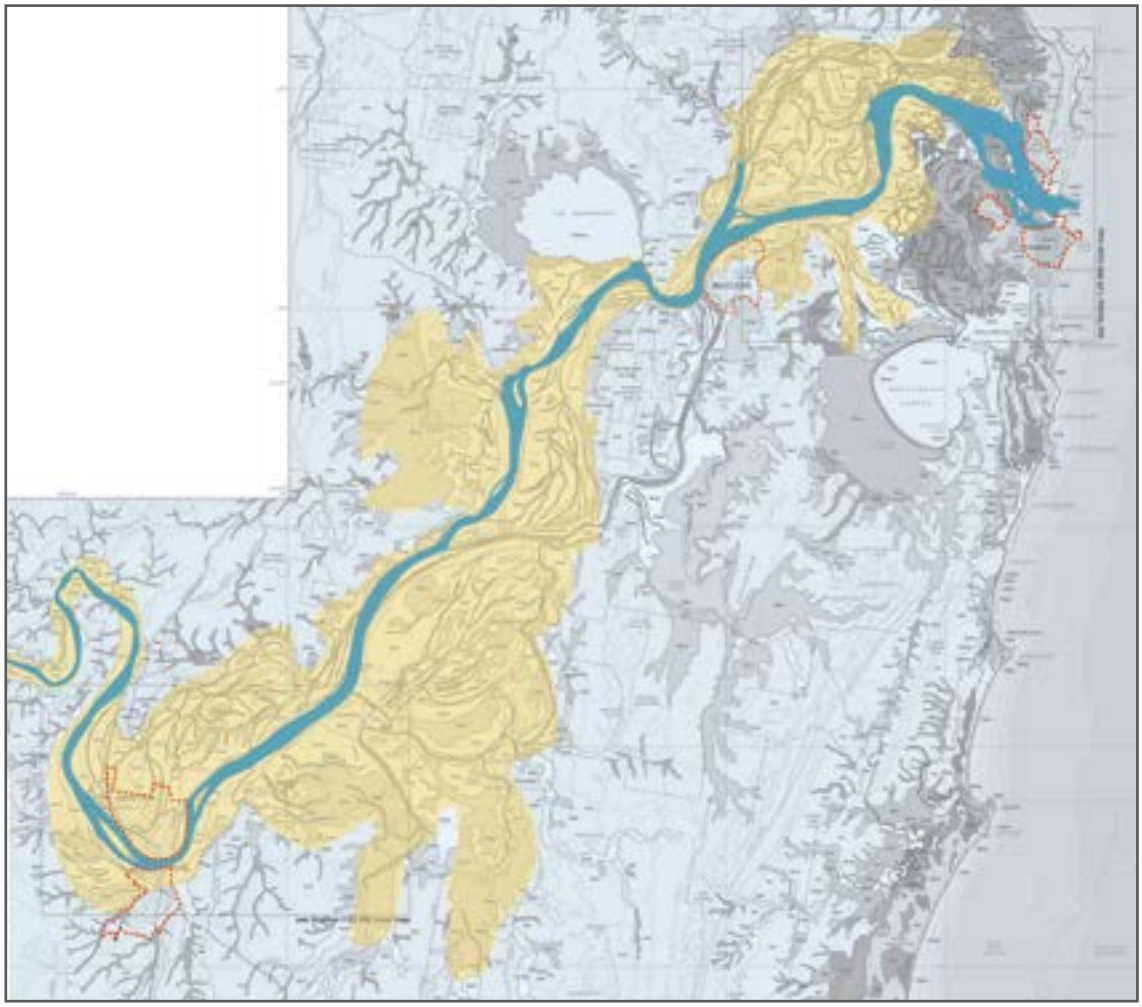
2.4 APPRECIATION OF THE VALLEY AND IDENTIFICATION OF ISSUES

Geomorphology and Climate

The study of geomorphology is important to analyse landscape processes. Translated from Greek, it simply is the study of land forms. Technically it is the study of how geological processes over millennia have influenced hydrological patterns and soil types and aspects. All these factors determine the nature and type of vegetation in the landscape.

The Clarence River Catchment is located within the subtropical zone, though cooler warm conditions are found higher up the catchment in the Gibraltar Ranges and New England Plateau. Year round warm temperatures average 28 degrees in summer and 21 degrees in winter. Rainfall is considered high with an average annual of up to 1500mm in some parts of the district. All the towns in the study are located on the 'Clarence Coast'. As the Clarence River nears the coast at Grafton it broadens out as it flows towards the delta like river outlet at Yamba/Iluka.

The Clarence River as it slows and broadens at Copmanhurst (the tidal limit), upstream of Grafton has created a series of alluvial floodplains. These are relatively wide at north and south Grafton and all the way to the tidal zone at Yamba. These floodplains vary in width according to the steepness of the local terrain. The river bank has been altered in the catchment area with flood protection levees, built at varying periods of history along the river adjacent of the towns.



Clarence Valley Soil Map showing the extent of alluvial and estuarine floodplain. The alluvial floodplain is a key factor in street tree selection and growing opportunities.
Grafton Area Coastal Quaternary Geology 1:100000 and 1:25000.

Alluvial Landscapes

North Grafton and the lower slopes of Maclean in particular are characterised by deep alluviums that supported vast areas of lowland rainforest, part of the 'Big Scrub' that characterised this area. These alluvial soils are up to 30 metres deep in some places. This soil type has allowed the rapid growth of trees in these floodplain areas. Many of the trees planted in these towns grow in these conditions in nature are both native and exotic. The extent of the floodplain and the soil type determines the type and size of trees that can be grown. Fluctuations in the water table in the floodplain also helps hydrate the soil, allowing large dense canopy trees to be grown.

Coastal Estuaries

The Clarence River, closer to the estuary increases in salinity, broadens, slows and as a consequence there are substantial silt drift, channels and islands. The Clarence Esturary has extensive mangrove wetlands and saltmarsh beyond the intertidal zone. On the bay side there are low lying areas beyond the saltmarsh zone that support extensive Melaleuca forest, farm land, light industry, new housing developments, golf courses and infrastructure facilities. West Yamba and its environs are characterised by this low lying landscape type although filled in many areas to raise the development above the flood level. Pilot Hill, Flinders Beach to Dolphin Beach consists of a ridge of underlying sandstone bedrock that creates a very different landscape type - steep slopes, shallow poor soils derived from Siliceous and Calcareous Sands. Coastal wind and salt exposure is the key constraint of this landscape type. Vegetation in this zone needs to be highly resilient to these conditions. The potential of a large diversity of trees is reduced in comparison to the lower, sheltered areas.

The Clarence River alluvial floodplain below Pinnacle Rock, Maclean.

Chapter 3

Project Analysis

3.1 HISTORIC APPRECIATION OF GRAFTON - THE CITY OF TREES

The cultural tree planting of Grafton has a distinguished history relevant to this strategy. Many of the historical objectives of street tree planting are still relevant. The history of Grafton street planting is an important case study that has commonality with many large cities such as Melbourne, Sydney, Washington and Paris. There have been two distinct phases that has resulted in the current tree canopy cover. As Grafton was and continues to be an important regional city, it has had a close link with the state government administration and also the Royal Botanic Gardens (RBG) in Sydney. In the 1860's, the streets of Grafton were cleared of rainforest after the colonial survey grid was laid and roads constructed. This was of course a common practice in towns throughout all westernised colonies. The resultant bare streets were hot open, dusty, muddy in rain periods and ultimately unattractive.

The Botanic Gardens were a place for collecting and trading plant material throughout the globe in newly established colonies and imperial towns. They were also institutions were new native plantings and exotic trees from overseas could be trialled. These institutions had cultural, agricultural and scientific importance. Governments, whether municipal or state required Botanic Gardens to provide plant stock for a variety of public functions, including public parks and gardens, beautification of civic buildings and for streets.(Frawley 121).There was a push for reversing the trend of clearing, that was driven by the Royal Botanic Gardens in Sydney (and consistent with Botanic Gardens in many colonies).

Jodi Frawley et al has described these tree planting phases as being determined by the principle objectives of two successive directors at the RBG. These stages were the 'Diversity' stage of Charles Moore and the 'Uniformity' Stage of Joseph Maiden. Trees from both phases still exist in Grafton and Maclean and the design objectives are easily discerned. These phases are an important study for the future tree planting in Grafton that responds to climate change and tree diversity.

Diversity Phase - 1874-1910

This phase of planting was where a mixture of native and exotic species, collected and propagated in Sydney were sent to Henry Volckers nursery in Grafton. Charles Moore was director of the RBG until 1896. Volckers is pivotal in the re-greening of Grafton and probably the other towns on the Clarence River. He formed a close partnership with both directors at the RBG. Many of the street trees in Grafton that survived would have been grown in his nursery.

Trees were sent to Grafton for planting that represented flora from South America (Jacarandas), Asia (including Camphor Laurels and Banyan), North America (Plane Trees) and Australia (Black Bean, Hoop Pine, Norfolk Island Pine, Silky Oaks, Native Figs and Tulipwood). Many of the Australian species were from the local former riverside stands of rainforest and extending to the Border Ranges.

The supply deliveries from the RBG and the nursery stock list of Volckers did not discriminate or differentiate between native and exotic. This is an important issue currently debated around the world. Trees were viewed purely on their own attributes. Provision of shade was an objective from the RBG, as the merits of greening of streets and barracks in India had demonstrated. The citizens of Grafton with Council were also very receptive and proactive with the regreening of the civic precincts and streets. The people of Grafton also had a propensity towards flowering trees. Shade and colour in the streets become part of the urban aesthetic of Grafton.

The establishment of the urban forest was rapid. By 1900, there were 2000 trees planted in Grafton's streets (approximately half of the current population). As colour, shade and diversity were the planting criteria, the streets had an eclectic character that exists today. There are important principles that can be drawn from this phase.

Historic Ficus street tree planting in Breimba Street

Plane tree planting possibly installed as part of Charles Moore's rural town planting programme.

Uniformity Phase - 1910-1970s

Joseph Maiden became director of the RBG immediately after the retirement of Charles Moore in 1896. He had a stronger focus on providing trees for the streets, previously it was civic building and schools that were the principal recipient of tree plantings in Grafton. In 1906, Maiden visited Grafton and established the professional relationship that was instrumental to how the street tree character of Grafton would now develop. Maiden was a supporter of the global design theory of streets having a consistent character and a strong uniformity. He also knew that implementation of civic street tree improvements need to be carried out by a professional local gardener employed by local council. He understood the importance of implementation and maintenance. A three year contract that employed five people was put in place for the ongoing street tree planting.

The design direction is best described in his own words:

"Let me enunciate an axiom 'one avenue, one tree'/ The finest avenues in the world consist of one kind of tree, as by that means uniformity of growth and general appearance. Which gives the main charm of an avenue, can alone be secured (Knibbs 106)."

In 1910, eighty-four young Jacaranda trees were sent to Grafton from Sydney and from then on the principal tree planted was the Jacaranda. This was the beginning of the establishment of Grafton's identity being synonymous with this tree. It was a tree that Joseph Maiden was fond of and also one the people of Grafton were happy to support in its widespread establishment. Grafton was now developing its current aesthetic of mixed plantings that are characterised by the vivid flowering avenue plantings. By 1935 the effect of this flowering was so widely regarded in New South Wales that the Jacaranda Festival was inaugurated by council. The streetscape of Grafton had been developed by a partnership between the government institution (RBG), the local council, local entrepreneur and technical expert (Henry Volcker) and the citizens of Grafton.

Up until the 1970s Jacarandas were the principal tree planted, but the greater appreciation for native and indigenous flora had resulted in an appreciation for native trees. Without the support from the RBG (which stopped growing trees for streetscapes during the Great Depression), the extensive programme for planting was curtailed. There had been a push to replace the Jacaranda's with native trees, however there is a strong local sentiment and fondness for Jacarandas, particularly as the Jacaranda festival is the largest annual event for Grafton that brings in many visitors and tourists and contributes significantly to the local economy.

Jacaranda street tree planting to achieve a street wide uniformity. The streets of Grafton have consistency of site conditions that allow strong avenues of a same species.

The history of Grafton's street tree planting apart from being interesting gives very strong directions for future street tree planting. The Clarence Valley Urban Tree Management Strategy will provide direction. There are a number of critical considerations affecting the future urban forest, however the history provides a sound precedent. Upmost importance is the partnership and shared objectives of government (in this case the local government, private practice and entrepreneurial drive, technical skill and community support).

3.2 CURRENT APPRECIATION OF GRAFTON - THE CITY OF TREES

The legacy of the historical tree planting still is readily apparent. However there are a number of issues facing Grafton's trees. These include:

- Loss of diversity of tree species and trees over maturing

The original tree planting in Grafton was one for tree diversity. These trees are now over mature having been planted from the late 1800s. Many of these trees are in decline and become more hazardous over time with a high management input required to keep them safe. The Jacaranda avenues represent only one of the 96 tree species that make up Grafton's street tree diversity, (Wrigley 1991). These however, represent 36% of the total canopy cover of Grafton. These trees are of mixed age, but their eventual decline will cause maintenance and management problems of a large scale in future. Fortunately there are no major pests or diseases of Jacarandas. However, having such a large population of trees of one species does create a risk of this population succumbing to new pests or diseases, such as those affecting Plane Trees in Sydney.

Over mature Elm trees in the streets of Melbourne have suffered as a result of the prolonged and harsh drought of 2008/09. The City of Melbourne is faced with replacing the elms as a priority. They contribute to 15% of the urban forest cover or approximately 3500 trees. Fortunately Elm Beetle is managed but is costly.

The plane tree population of Sydney is subject to fungal diseases such as Anthracnose as well as an increasing vulnerability to Sycamore lacebug. The browning of the leaves in March is a feature of the Sydney skyline, long before the trees should 'colour' in autumn.

Disparity Between Established Planting in the Older Parts of Cities and New Release Areas

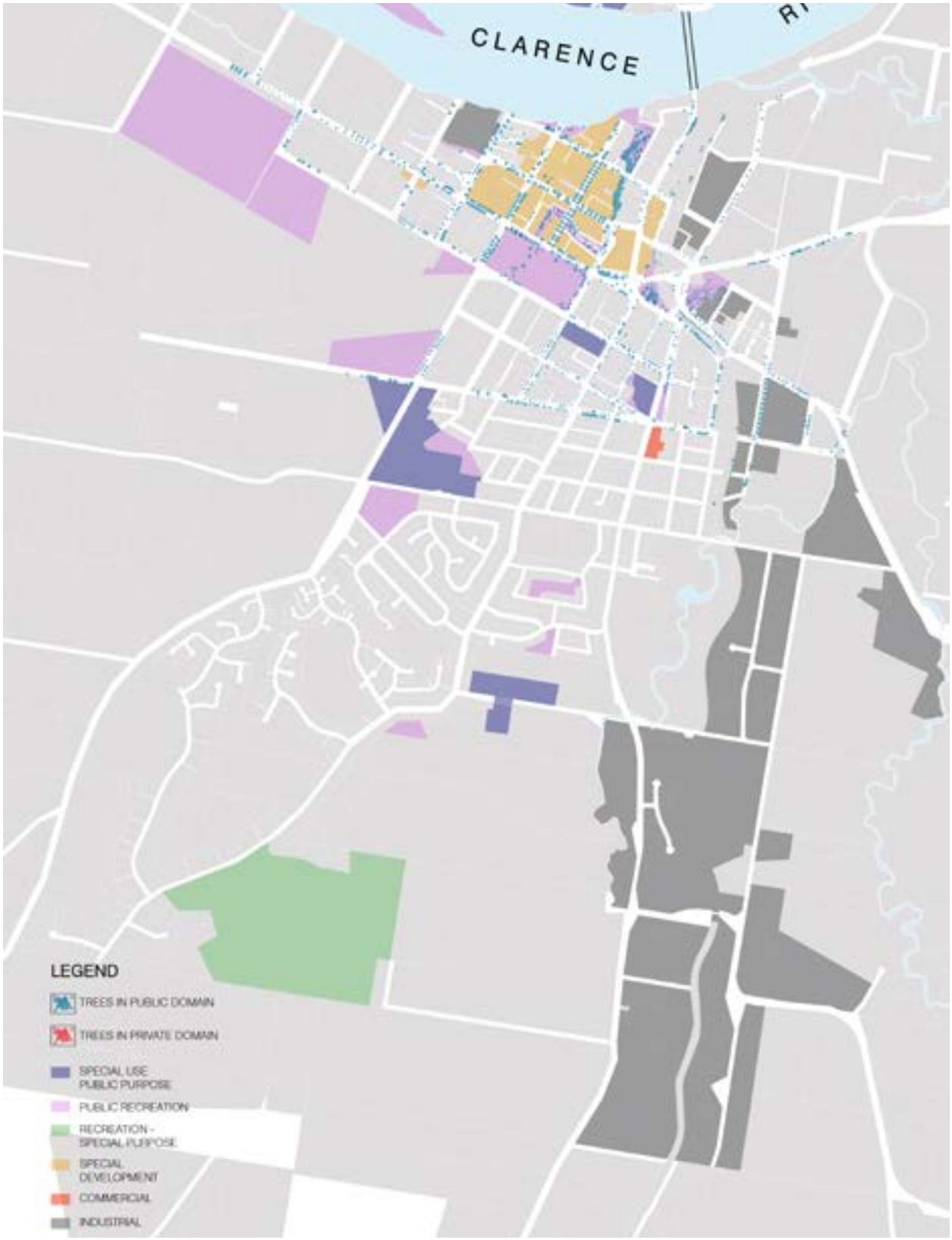
This study has looked at the City of Grafton in its entirety including Grafton and South Grafton. There are new release areas in both areas, with these new subdivisions varying in age.

Grafton Urban Forest

Grafton has a significant tree population in the public domain, notably in the trees of the 'heritage' and civic precinct. These trees have the most canopy cover as illustrated in the diagram, but are also the oldest. There is significant planting in parks. General Douglas Macarthur, Westwar and See Park also contribute significantly to the tree canopy cover.

There are younger, street tree planting in the development areas in the post war areas, that have a canopy size that is not as developed. The private plantings are significant in this zone, particularly in the blocks that have not been subdivided. The eastern riverfront areas are chiefly rural areas with little canopy cover in either the public or private zones. Beyond North Street that fringes the town, the rural land holdings also have little canopy cover, mainly due to agricultural and production objectives.

In comparison to the other Clarence Valley towns the canopy cover within Grafton is significant. The pattern in the other towns is often the reverse where their are fewer tree plantings in the public domain.

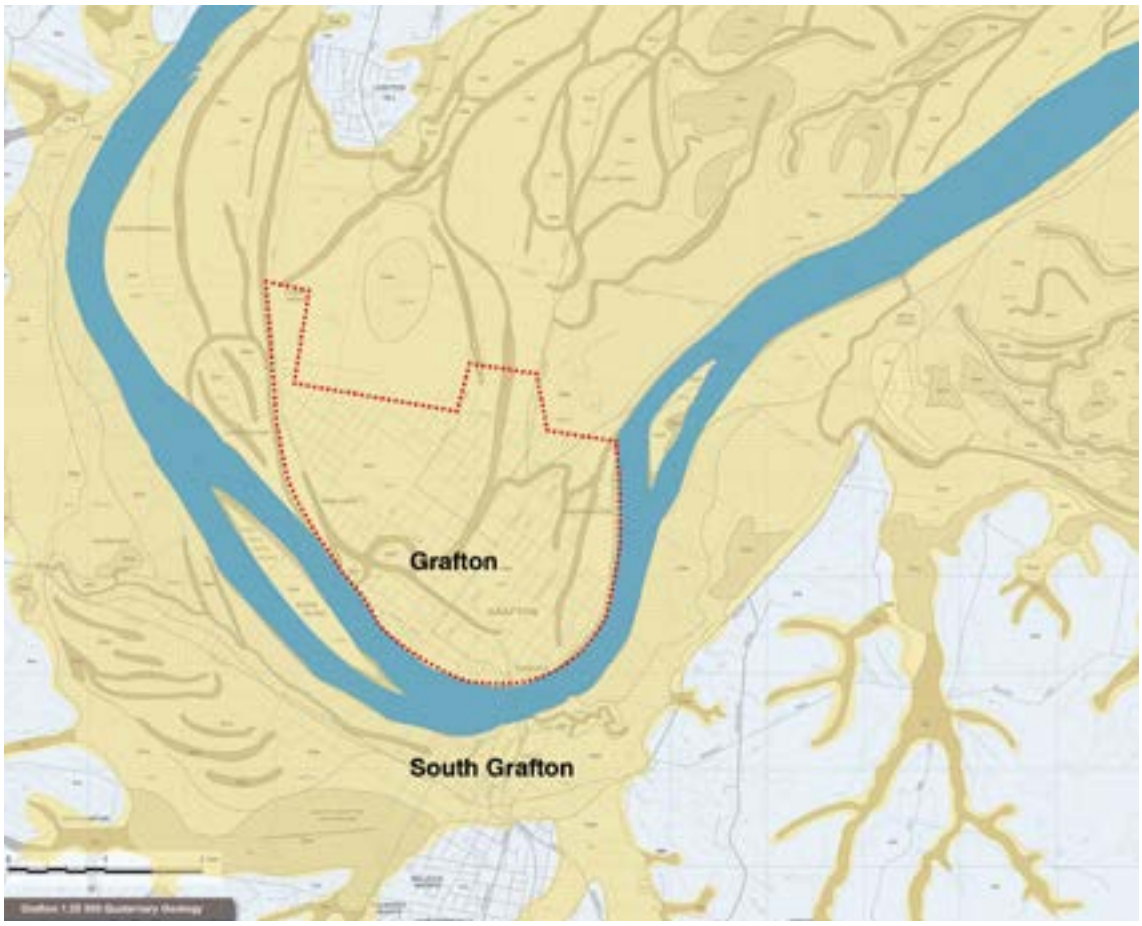


South Grafton has a well developed street tree canopy in the public domain in the older 'heritage' precinct. These trees give a strong character and attractive amenity to this precinct. The post war development that extends south of Vere Street develops the pattern of a more sparse public tree canopy and a reliance on the private domain to provide tree cover. There are many opportunities for tree planting in these zones. The new release areas have little to no tree planting in the streets and limited planting in the private domain. They can be given their own inherent character as well as provide social and amenity benefits.

Geomorphology

Grafton is located on a major bend in the Clarence River. It is located on an alluvial plain where soils have been built up through deposited fluvial sands, silts and clays by flooding events. The alluvial plain accounts for the size of many of Grafton's street trees. The soil is relatively fertile with a high water table allows good growing performance from many species of trees. These conditions are often found growing in similar floodplain environments.

This landscape type is similar for South Grafton, located closer to the river in the heritage precinct. The landform steepens as the alluvial plain is replaced with posolic soils found on the hill crests and mid to upper slopes. These soil types on the rises are lower in fertility.



Geomorphology diagram of Grafton. Grafton Areas Coastal Quartenary Geology Map 1:1000000 and 1:250000.

Original Plantings in Grafton

These trees are generally located within the older parts of town, radiating from the civic precinct on the northern bank of Grafton and on the southern bank of the Clarence River at South Grafton. These trees have reached maturity and have a broad and generous street canopy cover. It is these trees that determine the famous town character of Grafton. These trees were established on streets with very wide verges, with enthusiastic community and council support and in an era before mass motor car transport requirements. Many are now in decline, with parking encroaching on their roots, resulting in compaction and loss of soil porosity problems. There are number of weed species that contribute to the urban forest canopy cover. The Grafton Heritage Tree Survey recommends removal of this tree species (Wrigley 1991) to align with ecological concerns. While this suggestion is adopted by council, the removal would result in the loss of 10% of the canopy cover. Their removal is to be incorporated progressively as part of this strategy.

Post War Subdivisions in Grafton

This street grid is reduced as a result of subdivision of the original lots. Smaller lots and a denser grid pattern has resulted in a different street tree character, with more rows of single species avenues. The earlier plantings in these streets are characterised strongly with Jacaranda planting. These streets have a strong character of ‘shade and colour’.

Recent Subdivisions in Grafton

These more recent subdivisions in South and North Grafton are difficult to discern what the character will be beyond twenty years. The traditional grid survey for layout of lots has been lost in favour of the curved alignment of streets and roads that has characterised Australia and the United States since the mid twentieth century.

These newer streets are narrower, with verges in new release suburbs restricted in width. Street trees have not been planted in many of these new subdivisions. While there are many site constraints, there are still opportunities for street tree planting, as many of the overhead services are underground.

Recent City Planting - Streetscape Upgrades in Grafton

There are a number of infill plantings undertaken recently in the city. Due to the constraints of parking, pedestrian access and changed public perception, the recent plantings are for far smaller trees species, suited to the confined tree growing spaces and restriction in the urban geography.

Original plantings in the older parts of Grafton, planted prior to WW2. The species palette is eclectic and mixed with a focus on specimens as opposed to strong linear avenues of like species.

Post war subdivision areas with grassed verges and a majority of the same species avenues.

Diagram showing Pre World War 2, Post World War 2 and recent subdivisions and recent town centre upgrade

The newer developments in Grafton have very little constraints for providing a generous street treescape. These areas can benefit from new street tree planting and provide future characters.

Recent streetscape improvements take advantage of changes to the street geometry. There are more opportunities for providing sufficient space for tree planting, and ensuring adequate soil volumes for larger trees.

3.3 APPRECIATION OF MACLEAN

The town of Maclean is located on the very narrow floodplain on the southern bank of the Clarence River. The extent of floodplain is limited by a rapid rise in topography up towards the heavily vegetated Pinnacle Rock Reserve that forms the landscape backdrop to the town.

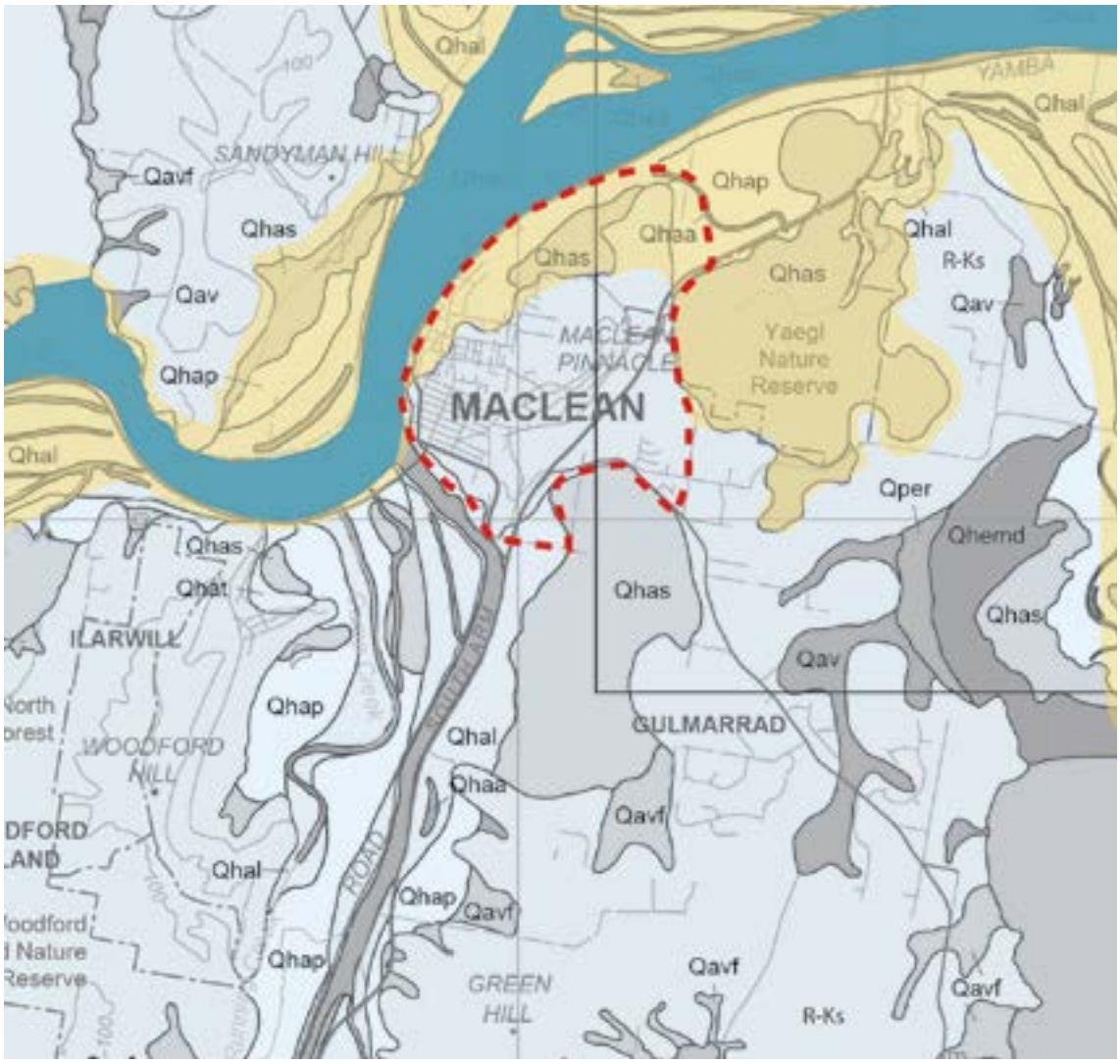
Maclean was also the beneficiary of the early streetscape beautification works from the turn of last century. Being a riverside town with an excellent steamer connection with Grafton, there were opportunities for growing subtropical trees in the town. The same objectives of beautification of the streets were applied to gridded streets up from the riverbank. The town of Maclean itself is very closely developed, with the commercial precinct of two-story businesses and narrow street not allowing for any street tree planting. It does not however provide a memorable and distinct street character.

The tree canopy cover in Maclean is most developed in the older parts of town closer to the river. Their are significant views over the river and Clarence Valley higher up the slope that would limit the desire to plant further trees in the streetscape. Significant tracts of retained vegetation contribute to the character of Maclean.

Geomorphology

The heritage precinct of Maclean is on the alluvial floodplain of the Clarence River. Soils in this zone include brown sandy clays and loams. The land rises steeply towards the Maclean Lookout Reserve. The geology changes to quartz sandstone on soils comprised of yellow and brown kurosols. Textures are influenced by sand, with sandy loam topsoils and sandy clay subsoils being common.

Away from the alluvim, the soil types and aspect support stands of rainforest, wet schlerophyll and ironbark forest. Similarly to Yamba, views would be a constraint to future tree planting higher up the hill.



Geomorphology diagram of Maclean. Grafton Areas Coastal Quarternary Geological Map. 1:100,000 and 1:25,000

Original Plantings in MacLean

There are a number of large individual tree plantings from the early period of European development, centred on civic buildings and the school. The older residential streets are lined with an eclectic mixture of native and exotic trees. These trees follow the local 'fashion' of being grown for their floral display and provision of shade.

Remnant Vegetation

Inconsistent with Grafton, there are still remnant stands of the floodplain rainforest and mixed Eucalypt wet schelerophyll. Not all of this 'scrub' was cleared as the town had no requirement for expansion beyond the river until recent times. These remnant forests are found on the mid to upper slopes and adjacent to the cemetery and high school. Some of these stands are protected in environmental protection zones.

Recent Subdivisions

Maclean has expanded higher up the slope with residential subdivision away from the extent of flooding. In these newer development areas, the views are extensive over Clarence, the northern floodplain to the ranges of the Banyabba State Forest. The combination of narrow verges in these developments and preservation of views has resulted in little to no street trees being planted. Significant amounts of remnant vegetation and eclectic plantings occur in private property.

Roadside/Levee Planting

The Pacific Highway at the northern entry to town and the levee bank built in the 1970s has a distinct vegetation type, consisting of recent entry feature planting of Illawarra Flame Trees that have been of mixed success.

The earlier tree planting in Maclean has established a strong canopy cover that is consistent with Grafton. The wide east west streets such as Wharf Street provide significant opportunities for large tree planting. This is particularly the case on the lower parts where views over the valley are not obstructed.

Remant vegetation is a large component of Macleans urban forest particularly leading up to and including Pinnacle Rock and adjacent to the high school and TAFE.

Newer subdivisions with many tree planting opportunities but constrained by views that results in few street trees.

Levee bank planting at Maclean provides the best 'town centre' treescape. Beyond town, opportunistic and weed trees characterise the levee.

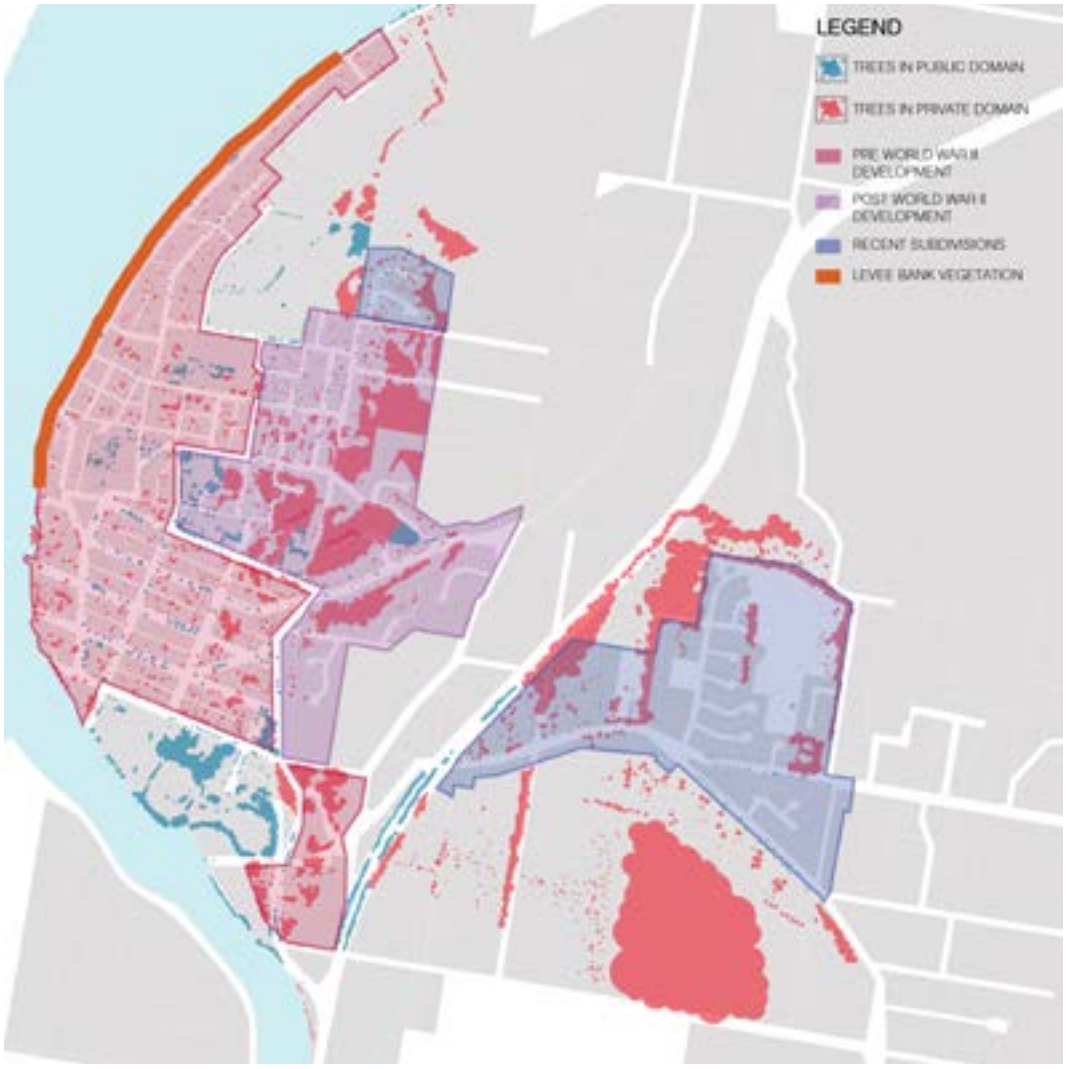


Diagram showing Pre World War 2, Post World War 2 and recent subdivisions and recent planting

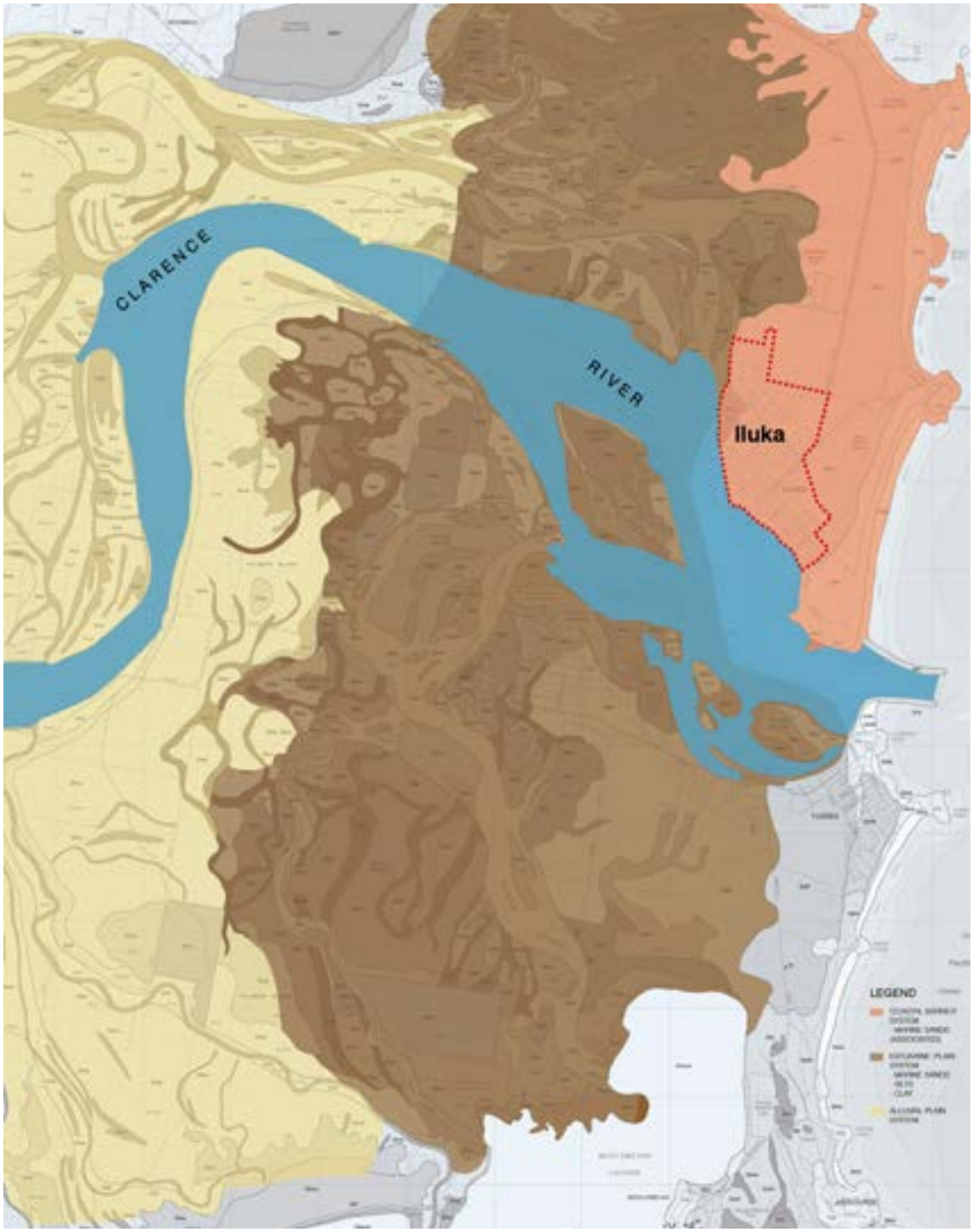
3.4 APPRECIATION OF ILUKA

Iluka is a small fishing/ holiday town on the northern bank of the Clarence River. Opposite Yamba it is on the delta of land at the river mouth entry to the estuary. Iluka would not have been influenced by the planting strategy of Grafton and Maclean that occurred last century. There is no evidence that there was any local council sponsored planting of the streets of Iluka. There is significant tree planting of a similar palette to the other towns, but these occur as isolated or single examples.

The urban forest of Illuka
The proximity of national parks, conservation reserves and remnant trees has resulted in a proportionally lower public domain planting. The impact of laying of sewage in Iluka will be an issue that needs to be addressed.

Geomorphology

Iluka's geomorphology is determined by two distinct underlying soil types. These include the wind blown marine sands that have created a parallel dune barrier system. Most of this dune system is within the Iluka Nature Reserve. The low lying littoral sub tropical rainforest that has determined its world heritage status is found in the parallel troughs in the hind dunes. These sand dunes have extended westward into the Estuarine plain system to the west of the town, where the landscape type is closely associated with the lower areas of Yamba and West Yamba.



Geomorphology diagram of Iluka

Remnant Vegetation

Located backing onto the world heritage listed Iluka Nature Reserve, it is likely that the township of Iluka was also cleared from the littoral rainforest that still exists here today. There are still isolated remnant tree species that are consistent with the vegetation community found in the public streets and on private property. Significant stands of vegetation occur within the two large caravan parks in town. This remnant vegetation contributes significantly to the 'urban forest'. This remnant vegetation includes a mixture of subtropical littoral rainforest and swamp schlerophyll (Boradwater National Park, Bundjalong National Park and Iluka Nature Reserve Plan NSW National Parks and Wildlife Service 1997),

Recent Subdivisions

Iluka has also expanded with new sub division, in a similar strategic pattern and timing to the other major Clarence valley towns. The character and constraints of these areas are similar to Grafton and Maclean, but again there are future opportunities in these subdivisions. Public domain planting is either nonexistent or comprises species that will not provide much future contribution to the urban forest.

Diagram showing Pre World War 2, Post World War 2 and recent subdivisions, remnant and recent plantings

Remnant vegetation adjacent to new development. Callitris collumnaris stands are important and iconic trees with Iluka's landscape.

New development in Iluka
With no tree planting it lacks a street character that does not reference it is adjacent to a world heritage area. Iluka has a strong character that is at risk of becoming homogenised in its new release areas.

Chapter 4

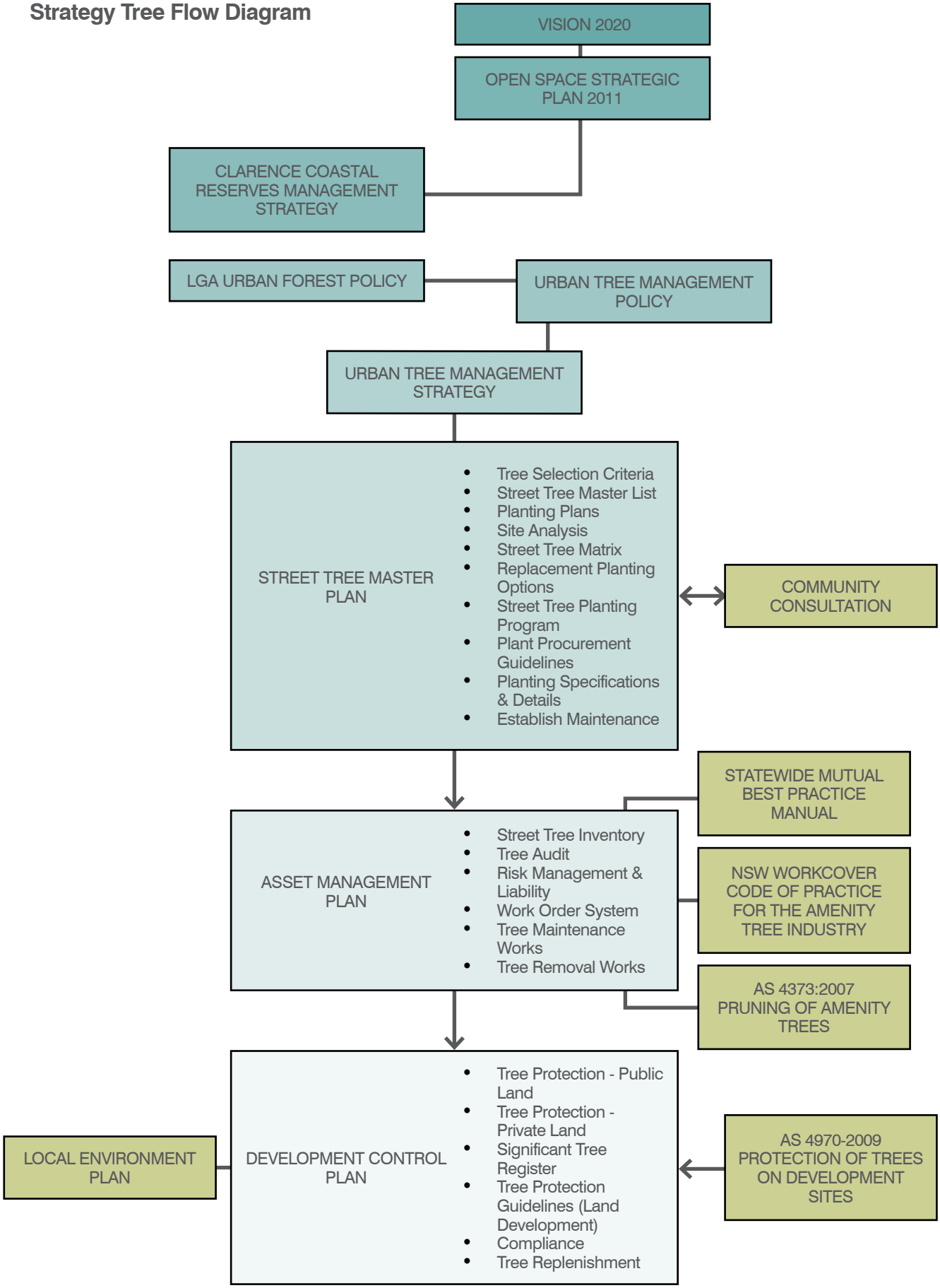
Urban Tree Management Strategy

4.1 PURPOSE

The purpose of this document is to provide strategic direction and a framework to ensure the consistent management of trees within urban areas. This strategy stems from council's broader commitments under the *Open Space Strategic Plan 2011* and council's 'Valley Vision 2020' to preserve environmental quality for the Clarence Valley community. Council also has a Charter under Section 8 of the *Local Government Act 1993 (NSW)* to "properly manage, develop, protect, restore, enhance and conserve the environment of the area for which it is responsible, in a manner that is consistent with and promotes the principles of ecologically sustainable development" and to "engage in long-term strategic planning on behalf of the local community"..

The Local Government Tree Resources Association (LGTRA) has prepared an Urban Forest Policy, endorsed by the Local Government and Shires Association of NSW. This policy promotes a vision for the future of urban forests and provides principles for their management and is intended to ensure a consistent approach to urban forest planning. The principles of this policy have been considered in preparing the CVC Urban Tree Management Strategy.

Strategy Tree Flow Diagram



4.2 STRATEGY OBJECTIVES

The key objectives of the Urban Tree Management Strategy are as follows:

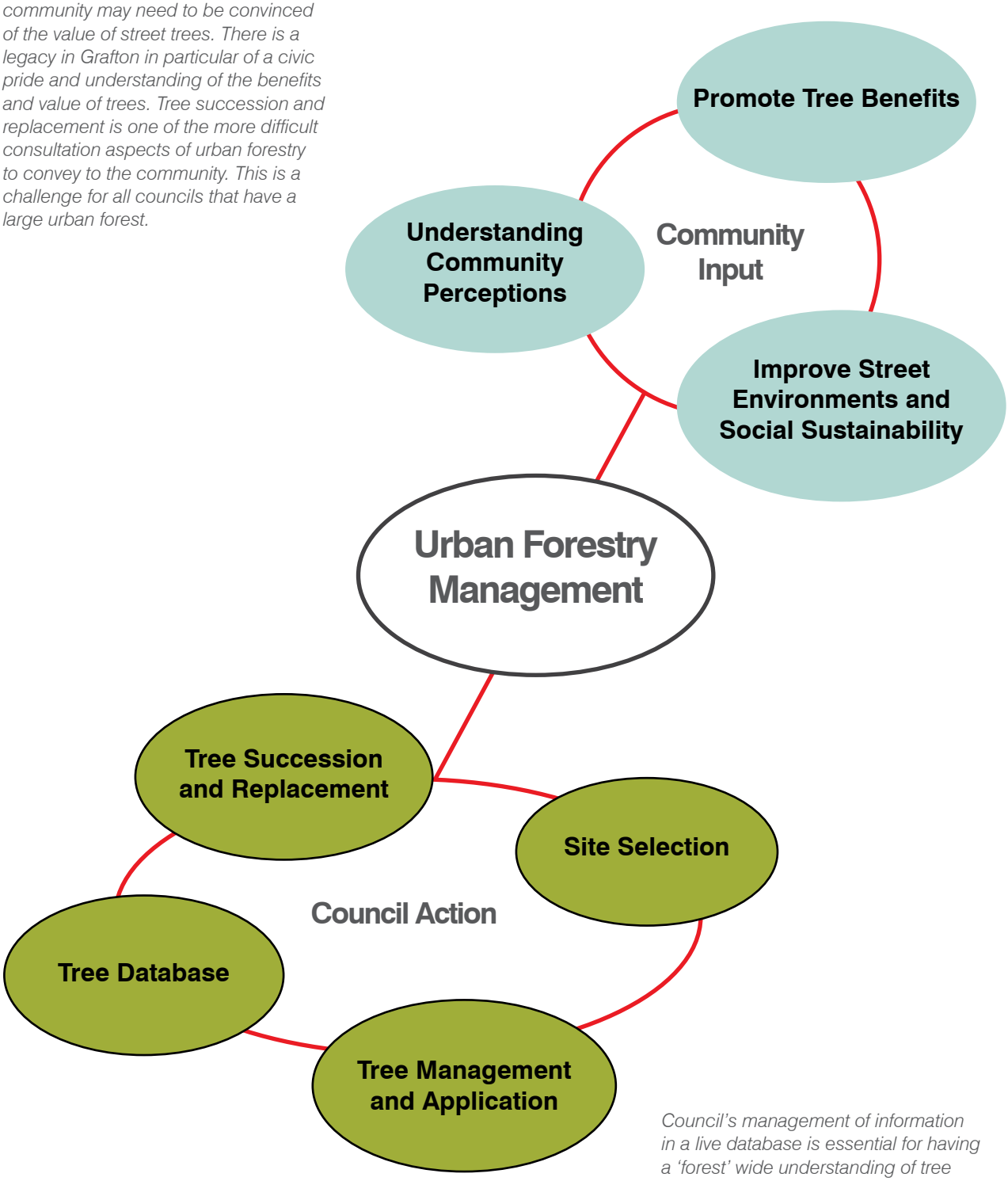
- Canopy cover objectives
- Enhance the quality and quantity of the Urban Forest by maintaining and improving canopy cover
- Whole of life cycle tree management
- Undertake a holistic (whole of life cycle) and proactive approach to the planting, maintenance, management, protection, removal and replacement of urban trees
- Tree selection
- To select, maintain and manage trees to minimise risk and liability and provide a safe urban environment for the community. Selection needs to be flexible, defensive and accommodating
- Community Education
- Provide community education and awareness about the benefits and management of urban trees in order to engender community support
- Tree replacement
- Manage the tree resource in a sustainable way to ensure intergenerational equity, through strategic removal and replacement (continual replenishment)
- Tree protection
- Ensure the protection and preservation of urban trees and the benefits they contribute to the urban and natural environment, particularly in the context of new development and infrastructure projects
- Tree implementation and maintenance
- Minimise conflicts between trees and infrastructure and eliminate the negative aspects of urban trees associated with poor planning and management
- Diversity objectives will assist manage the urban forest by providing options for correct tree siting, adaptation to climate change and achieve amenity goals
- Tree replacement - senescent and inappropriate trees

In order to meet these key objectives, three key plans have been identified to provide a framework for the management of urban trees. These include the following:

- Street Tree Master Plan (STMP) and Park Plans of Management (PPM)
- Asset Management Plan (AMP)
- Development Control Plan (DCP)

An example of the urban forest of Maclean. It is comprised of trees in the public domain- residential, rural and industrial, trees in the private domain, open space reserves, and conservation areas. These areas are managed by a number of stakeholders. Council can influence the management of a majority of the urban forest.

Community input for the management of the urban forest is essential. Particularly in built up areas,the community may need to be convinced of the value of street trees. There is a legacy in Grafton in particular of a civic pride and understanding of the benefits and value of trees. Tree succession and replacement is one of the more difficult consultation aspects of urban forestry to convey to the community. This is a challenge for all councils that have a large urban forest.



Council's management of information in a live database is essential for having a 'forest' wide understanding of tree management programmes. Databases assist in identifying priority replacement areas, hazardous trees, trail planting, and inspection regimes can better qualified. The objectives of the street tree management plan can be more efficiently achieved.

4.3 'THE URBAN FOREST'

The current thinking of management of public tree planting in urban areas and towns is that trees are managed in their entirety using similar principles to those traditionally applied to forestry. Forestry practices aim to best manage collective trees to ensure good health, resistance to disease and pests, longevity and sustained high timber productivity. Urban forestry is a practice that was developed in the United States, where trees in the public domain are viewed in their entirety. Management is undertaken by municipal and commercial arborists, town planners, policy makers, consultants, researchers and community. Communication and collaboration is important.

Trees are best managed as a collective, rather than on a tree by tree or street by street basis. The extent of an urban forest is measured as a canopy cover percentage of the total area of the Local Government Area or municipality. It also aims to have an understanding of total tree numbers and an indication of tree health, species distribution and composition. This information is best managed with a 'live' tree database.

Instead of timber production the aims of urban forestry are:

- To promote the benefits of trees to the public
- To have a demonstrable understanding of community perceptions
- To understand tree succession and tree health
- To understand site constraints, tree growth requirements and tree performance objectives
- To improve the quality of street environments and contribute to social sustainability
- To have an effective practical management of trees and application of arboriculture techniques
- To have a database of individual trees in the tree collective that can be updated and managed as a working tree inventory

While the term urban forestry is a bit of a misnomer, its aims, objectives and application can be applied to trees in any built up area. The trees of Grafton, Maclean and Yamba are a collective of :

- Public domain street and park trees
- Trees in the private domain in residential, rural and industrial land holdings
- Adjacent crown land, reserve and national park trees

These trees represent in combination a significant urban forest. These study areas towns have been mapped to illustrate where the distribution pattern of trees are found. Private and public domain trees are highlighted separately.

The city and towns of Clarence Valley face very similar challenges and opportunities to large cities such as Melbourne, Sydney and global cities. The management of towns in rural and regional areas can be more complex than large cities. The diversity of stakeholders and landowners with jurisdiction of tree covered areas may be larger, as there is usually much of the urban forest within reserves, national parks and private land holdings. Allocation of resources is a challenge, however a stronger 'community' can potentially help contribute to establishing canopy cover.

4.3.1 Amenity Value of Urban Trees

Trees are the dominant visual element in urban areas, providing a strong visual connection and defining the visual character and identity of a town.

Trees make a significant contribution to the aesthetic quality and ambiance of urban areas, making them attractive places to live and work. Trees help define the visual character of an area and contribute to its sense of place. Trees also provide amenity in the form of shade, reducing heat and glare from paved surfaces. They provide shelter from prevailing winds, screening of undesirable views and framing of scenic views. Trees provide seasonal interest throughout the year with their form, texture and colour and provide a visual buffer to built elements. Trees can create a distinctive, identifiable character for our townships and rural areas alike.

4.3.2 Environmental Quality of Urban Trees

Trees provide a myriad of environmental benefits to the community. Trees are the 'green lungs' of urban areas, filtering-out harmful airborne pollutants, soaking up carbon dioxide and producing clean oxygen. Trees reduce soil erosion and protect water catchments. These factors are increasingly important with urban areas, especially in the light of climate change which predicts elevated carbon dioxide levels, increases in temperature, altered rainfall patterns, increased drought events, flood events, more frequent and intensive fire events, and changes to pests and diseases, all of which will have an impact on the management of urban trees and our quality of life. Trees are integral in helping us to deal with the effects of climate change.

The Plane trees of inner Melbourne provide generous shade and a suitable scale for the city. Ironically these trees are under threat from pathogens and climate change.

The row of Corymbia citriodora in Oliver Street Grafton create an identifiable and memorable character.

4.3.3 Ecological Value of Urban Trees

In addition to the contribution trees make to environmental quality for people, urban trees may have special ecological values. They may provide shelter, habitat and food sources for native wildlife and threatened fauna species. They may form part of important linkages between natural islands of native vegetation, providing corridors for wildlife movement. Locally indigenous trees may form part of vulnerable or endangered ecological communities or to threatened or endangered species.

The remnant Callitris stands in Maclean are valuable shelter and habitat trees.

Macleans remnant Eucalypt / rainforest stands provide roosting habitat for flying foxes, however the colonies proximity to the school has resulted in ongoing conflicts.

4.3.4 Social and Economic Value of Urban Trees

Trees also provide significant social benefits including psychological connection between people and nature, reducing stress and anxiety. Well selected and sited trees can improve property values, reduce energy consumption and improve air and water quality. Treed landscapes and streetscapes are considered vitally important in attracting tourism and investment in an area.

The Grafton Jacaranda Festival is an important social and economic event with a long history. It is a good example of how trees have economic value.

Yamba's iconic Araucarias would contribute to it being an important tourist destination.

4.3.5 Cultural and Heritage Value of Urban Trees

Some trees may have special heritage values by virtue of their connection with particular period of history. These may be associated with historic buildings or places, epitomizing a particular era of garden design. Some are important public plantings in our streetscapes and parks or civic spaces. Some of these trees are now fragmented, but originally formed part of previous estates, larger land holdings or former avenues and boundary plantings. Trees may also have special value as commemorative or memorial plantings with reference to important people or historic events. Some species may be horticulturally rare or unusual. Remnant trees may provide links with pre-European history, being representative of the original forest or woodland of an area. They may even have important links to Aboriginal culture, such as scar, shield and lookout trees.

Historic Ficus street tree planting in Breimba Street

Prince Street in Grafton late 1930's.
Prince Street has a history of being the principle commercial and cultural street of the city. These Phoenix were most likely removed soon after when they came in conflict with overhead power lines.

4.4 NEGATIVE IMPACTS OF TREES

Trees of the wrong type, growing in the wrong place, can also have negative impacts on the urban environment, causing nuisance, damage or injury if they are not well selected and maintained. Some species may become environmental weeds, due to their propensity to self-seed and colonise bushland or other sensitive natural areas and suppress native vegetation. They can be declared noxious due to their potential threat to agricultural production or forestry. They may have particularly extensive and damaging root systems causing damage to infrastructure and property. Trees can obstruct views and view corridors in scenic areas. They can interfere with services and create fire hazards. Poorly maintained and defective trees may be potential safety hazards, causing property damage or injury if they fail. Trees or parts of trees can impede pedestrian and vehicle movement, obstruct sightlines and obscure signage.

CVC has a responsibility and a Duty of Care to mitigate and minimise such risks. The potential conflict between trees and other assets must be managed through a process of good plant selection and timely intervention using an integrated approach.

4.5 THREATS TO THE URBAN FOREST

Urban trees are under constant threat of damage or loss due to land development, urban consolidation, actual and perceived risks, infrastructure damage, installation of new infrastructure and services, lack of appropriate planning controls, removal to facilitate views, vandalism, improper pruning, poor maintenance practices and natural attrition. The incremental loss of trees, without planning for replacement, will eventually result in diminished quality of the urban environment.

Street trees are often flourishing in very difficult conditions, resulting in poor growth and development and premature death or at the least, limited useful lifespan. The urban environment does not provide ideal growing conditions. Soils in urban areas are often highly modified, inverted, mixed and compacted. Trees in urban environments are subject to airborne pollutants, low soil fertility, lack of natural nutrient recycling, high temperatures reflected off paved surfaces and buildings, and restricted water infiltration. This leads to reduced life spans when compared with trees growing in natural situations on natural soil profiles.

The areas that street trees grow in are often shared with underground and overhead utilities, roadways, footpaths, driveways stormwater pipes and other infrastructure which may limit their growth and lead to potential conflicts. These conflicts must be carefully managed (and avoided where possible) to ensure that trees remain assets and don't become liabilities.

Carpark works have encroached on the roots of the adjacent Araucaria trees. The trees are now suffering stress from root loss. Wooli Street, Yamba

Provisions of car parking, awnings, narrow verges and services restrict tree planting opportunities. While not necessarily a negative issue for Maclean that has its own unique 'urban' character. If street tree planting was possible, it would improve Maclean's amenity.

4.5.1 Tree Management and Adaptation to Climate Change

The potential effects of climate change on the urban forest are not yet clearly understood and cannot be accurately predicted, but the appropriate selection and management of trees will be a key component of mitigating its effects. Changes may include extended drought, increasing moisture stress and resulting in demise of some species, particularly those growing outside the modified range of climatic conditions. Climatic change may also favour some pest and diseases previously not problematic within the area.

Climate change is expected to result in warmer, wetter winters and warmer drier summers. Higher temperatures will result in greater evapo-transpiration, leading to lower soil moisture levels and increased moisture stress on trees. Extreme weather events are also likely to increase in frequency. These may include, for example storm events, heat waves and heavy rainfall events that may lead to flash flooding. Mechanisms that can capture and detain stormwater, using Water Sustainable Urban Design (WSUD) principles, could mitigate some of the impacts of moisture stress on trees.

Elevated levels of carbon dioxide in the atmosphere will affect photosynthesis. Combined with higher soil and air temperatures, this may result in increased growth rates (if supported by sufficient moisture and nutrients). In the absence of sufficient soil moisture, higher temperatures will lead to moisture stress, resulting in reduced growth, defoliation and dieback, particularly in trees more suitable to cooler climatic conditions, growing outside their preferred range. Species will therefore need to be selected that can adapt and excel in these conditions. A greater diversity of suitable tree species can provide greater selection of adaptable trees.

Passive irrigation for young Corymbias with catch swales

Generally there will be more heat stress on urban trees, due to increased temperatures generated by other urban infrastructure surrounding them (heat island effect). Reduction in paved areas and increase in canopy cover will help reduce the heat generated in urban areas. Large shade trees will obviously have the most impact on mitigating these effects.

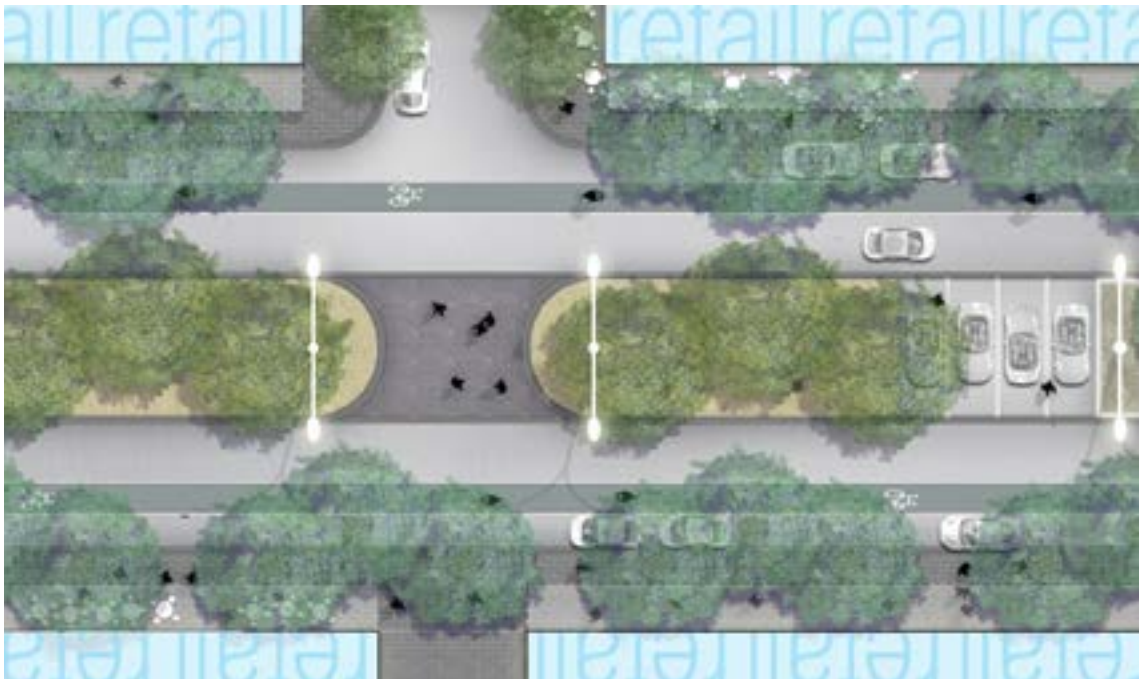
Longer growing seasons may delay or cause premature seasonal changes, such as flowering times, growth flushes and leaf fall. Warmer winters will change the populations of insects, normally controlled by cooler winter temperatures. Without the moderating affect of cooler temperatures on pest populations, pest epidemics could occur due to extended periods for reproduction and lower mortality rates. Extreme infestations could lead to the demise of host species. Planning for a diversity of tree species is therefore important to reduce the potential impacts severe pest infestations, by spreading the risk of potential loss of whole species or genera.

Increased storm events and heavy rainfall may lead to increased canopy damage and tree failures. Selection of trees that have robust branching structure and absence of inherent defects are therefore important. Warmer drier summers are likely to increase fire frequency and severity. Fire hazards will therefore need to be managed, including the possibility of greater asset protection zones and increased risk of fire damage at urban and natural area interfaces.

4.5.2 Canopy Cover Objectives

One way of assessing the health of the urban forest is the percentage of built land that has canopy cover. This can be measured from aerial photos. It is clear that particularly Grafton and Yamba has a healthy canopy cover. An extensive canopy cover results in objectives for a streetscape being achieved such as shading of footpaths and the road, microclimate cooling, habitat for wildlife and green links and the social sustainability that a tree lined streetscape can provide.

By assessing where areas are low in canopy cover such as the new development areas in Clarence Valley this can clearly guide decisions for priority planting. Many councils are aiming to achieve canopy cover goals of 30% canopy cover of the street when viewed in plan.



Anticipated canopy cover for a main street in Melbourne. This canopy cover is slightly greater than 30%. No aerial services, a combination of median, parking lane and footpath planting opportunities, help to realise these goals.

These canopy cover goals vary according to the land use. The City of Seattle has developed canopy cover goals after mapping the private domain space (streetscapes) and then determining the existing percentage of canopy cover. The different street hierarchies have different constraints and therefore different canopy goals that can be achieved. By assessing the current cover of trees per street hierarchy type, they can then determine what the shortfall of trees that are required to meet these canopy cover goals.

Land-use category	Current cover	Current Trees	30-year cover goal	Estimated # of new trees to meet goal
Single-Family	18%	473,300	31%	350,200
Multi-Family	13%	103,400	20%	56,000
Commercial/ Mixed Use	8%	49,700	15%	44,400
Downtown Seattle	9%	9,700	12%	3,800
Industrial	8%	68,100	10%	18,100
Institutional Properties	15%	14,600	20%	5,000
Parks: developed sites	19%	90,000	25%	28,400
Parks: natural areas	64%	568,700	80%	143,200
Citywide	18%	1,377,500	30%	649,100
Transportation Corridors/Street ROW	16%		24%	

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Chapter 5

Street Tree Master Plans

5.1 STREET TREE MASTER PLAN OBJECTIVES

5.1.1 Tree Selection Criteria

In order to achieve consistent and identifiable streetscape character, long term planning is needed for the new and replacement planting. Street Tree Master Plans and Park Plans of Management are designed to provide a 'blueprint' for future planting and replacement to ensure that the tree population is sustainable and is sited in a way to minimise conflicts with street infrastructure. *Refer USDA Forest Service A Guide: Developing a Street and Park Tree Management Plan.*

There is often considerable debate within a community about what types of trees are best suited for use as street plantings. There is no perfect street tree; every selection has some compromise between positive and negative values. Appropriate plant selection must be based on a firm set of principles which establish the function and design intent that the selection should conform to. Then rigorous selection criteria which enable the species with the most desirable and appropriate characteristics to be selected, no matter what their origin or type.

The Street Tree Master Plan (STMP) is intended to ensure the selection of appropriate tree species by determining selection criteria and developing a species list for each main town centre that best fit those criteria. This is done in consideration of the local environmental factors and site conditions (soils, microclimate etc) and the available space for trees (constraints imposed by existing infrastructure, services, building setbacks, verge widths and soil depth). The local character of the town centre is also an important factor in determining the most appropriate species to compliment and reinforce. The selection of appropriate species is critical to successful establishment and uniformity of streetscape areas and important in minimizing any future risk associated with conflicts with other infrastructure. Good plant selection also assists in reducing maintenance costs associated with canopy and root pruning (to control size or interference).

5.1.2 Native Versus Exotic

Inevitably there will be diverse views about native versus exotic trees, the use of locally-indigenous species, evergreen versus deciduous, the use of flowering trees and so on. However, it is imperative that a balanced approach be taken to the selection of tree species. Species are avoided that are weed species or have potential to be future weeds. There are exotic species that pose little to no risk of becoming a nuisance or invasive in the native or urban environments

Tree Selection and Planning	
Objective	**Actions**
Ensure selection of appropriate species, suitable to the site and local conditions	• Develop plant selection criteria for key town centres (right tree, right place) • Develop a master list of trees appropriate to the local conditions within key town centres in line with the selection criteria [Character Statements for key town centres] • Undertake staged and progressive removal of inappropriate street tree species • Review species performance on a regular basis and revise the master list accordingly • Develop planting plans (master plan) for major town centres and parks to enhance & reinforce local character (prepare statements defining local character & key factors in design) • Prepare species profile sheets to demonstrate how the species fits the selection criteria • Provide guideline and conditions for tree planting in public areas associated with new developments

5.2 TREE DIVERSITY AND HEALTH

A diversity of species in the tree population also spreads the risk of loss as a result of disease epidemics. Age diversity also reduces the visual impacts of tree loss as they typically reach maturity and senesce at the same time. These factors must be planned into the selection of species and staging for replacement planting.

5.3 TREE REPLACEMENT STRATEGY

5.3.1 Removal of Inappropriate Street Plantings

Inappropriate tree planting is sometimes undertaken on public land by local residents. As council is ultimately responsible for these plantings, it must reserve the right to remove any inappropriate plantings, especially those that do not comply with the tree selection criteria and may result in potential nuisance, hazards or other problems in the short or long term. Information should be provided to residents to prevent inappropriate plantings and notification should be carried out prior to the removal of any unauthorized plantings, explaining the reasons for the actions being taken. Monitoring the performance of species may also lead to decisions associated with removing and replacing species that are causing excessive problems or are not performing to expectations.

As with other areas of the east coast, the Clarence Valley have some tree species that are now considered undesirable weed species. John Wrigley in his survey from 1991 states that the Camphor Laurel make a significant contribution to Graftons canopy cover in particular. Based on this survey this was 10% of the canopy cover. This will have been reduced slightly since this survey was taken, though the extent of planting is significant in Grafton and South Grafton. It has been a recommendation that these trees be incrementally replaced in this report, though currently some of these trees are at the point of needing removal in the near future.

Camphor Laurels are an undesirable species, particularly on the north coast, these trees were most likely trees that were planted as part of the Royal Botanic Gardens 'beautification scheme' under the direction of Charles Moores.

Grafton and South Grafton have significant areas of Camphor Laurel plantings. While these trees provide character, shade, scale and amenity they are deemed inappropriate and have been priortised for removal.

5.3.2 Replacement Planting

The removal of trees is a highly emotive issue for many people. Trees are generally long-lived and dominant visual elements in the landscape and they make a significant contribution to the amenity of urban areas. Often the largest and oldest trees are those most revered by the community and the decision to remove them often initiates community concern and debate.

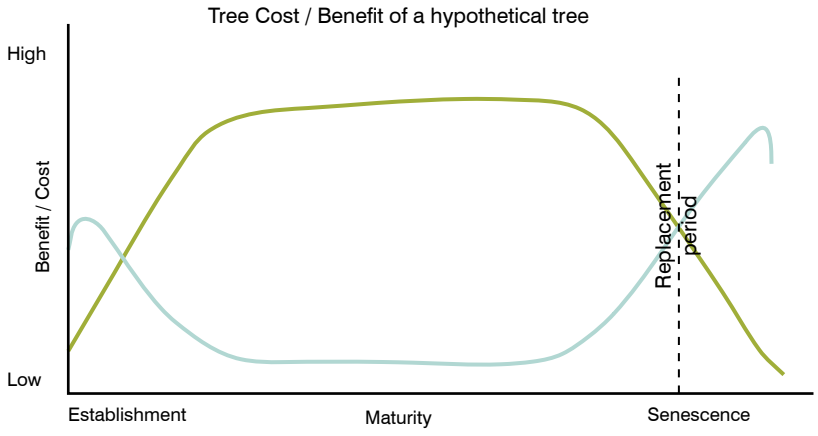
Trees in urban areas are subject to much more stress than in their natural habitat, due to a range of factors, not the least of which is the constant change and development around them. Some trees are very tolerant of these conditions and others are not. In most instances, the lifespan of a tree in a street environment is significantly less than that of the same species in its natural habitat. Trees cannot 'heal' themselves from damage or injury, they can only isolate such injuries. Damage and injuries are therefore cumulative. A significant amount of stress (resulting from the cumulative effects of damage and injury and other environmental factors) may lead to progressive decline, which eventually results in demise.

In order to maintain a reasonably safe urban environment, trees that become hazardous or in an irreversible state of decline may need to be removed before they actually die. The point at which the costs of maintenance (including repairs to infrastructure and liability claims) outweigh the values and the benefits that the tree provides, is the optimum time for removal and replacement. This is the most sensible and pragmatic approach, but it is seldom implemented due to emotive issues, lack of long term planning and lack of detailed information about the tree population. Often the decision to remove and replace street trees is deferred until the point when a crisis occurs.

In many instances, street plantings are even aged stands and species, not only within a street, but often within a whole suburb. Thus, they will generally all start to decline and senesce at about the same time. The wholesale removal of trees at the same time can have a significant impact on local amenity and is generally not supported by the community. However, the decision to remove and replace trees cannot be continually deferred to future generations. It should be recognized that in order to have some inter-generational equity, the removal and replacement of trees must be an ongoing endeavour. To ensure that the replenishment of street trees is accomplished with as little impact on the community as possible, a long-term strategic approach is required. The STMP will identify replacement strategies for important and significant trees.

Safe Useful Life Expectancy (SULE) is a methodology than can be adopted in this process to estimate the remaining lifespan of trees based on an assessment of their current health and condition. This can be undertaken specifically for a town centre or progressively as part of a general tree audit. As part of a broader Asset Management Plan, this is an important tool in planning for new and replacement tree planting in the short and long term. The Asset Management System should have the capability of identifying and recording potential planting sites through records of prior tree removals, community requests, SULE analysis and identification of vacant planting sites. These can then be assessed and prioritized in accordance with available funding.

Tree Replacement Strategy	
Objective	**Actions**
Ensure On-Going Replacement of Suitable Trees to Provide a Sustainable Urban Forest	• Identify opportunities for new planting within parks and streets by undertaking an audit of streetscapes in main town centres • Ensure biological diversity in tree species to minimise losses in the event of disease or pest epidemic • Develop an annual tree planting program to take advantage of seasonal weather conditions which maximise growth and minimise losses • Prepare an associated budget for new and replacement planting as part of the capital works program • Identify trees for removal and replacement by undertaking an assessment of Safe Useful Life Expectancy (SULE) based on Visual Tree Assessment (VTA) procedures • Measure the current extent of canopy cover (as a percentage of total urban area) and set targets for future canopy cover in key town centres in order to work toward optimal levels • Ensure planting of trees in streetscape areas in compliance with the STMP as a condition of Development Approval • Remove inappropriate species that do not comply with the STMP on a staged programmed basis



5.4 STREETSCAPE DESIGN

A STMP specifies details for planting approaches in different situations placement of trees within the road reserve to minimise conflicts with view corridors, sightlines and above and below ground services to ensure a successful outcome in the long term. Trees in a street environment must share available space with many underground and above ground services including water, electricity, stormwater, gas, sewerage and telecommunications cables. Trees are a long term investment; adequate forethought and planning is critical to success. Planning is essential in order to minimise potential conflicts between trees and services and other infrastructure.

Planting styles may vary from formal avenues and rows of single species with regular spacing of trees to informal plantings using a range of species with more random placement, depending on local character, existing constraints and key objectives of the planting. Even within the same street, it may be appropriate to alter the species between one part of a street and another due to existing constraints (e.g. overhead power lines), provision of improved solar access (use of deciduous trees on the south side of east-west aligned streets), existing environmental constraints (exposure to prevailing winds or existing soil conditions) or other factors such as change in land use (transition between residential and commercial or industrial areas). Visual uniformity and cohesion of street plantings can be achieved using a variety of methodologies. The STMP incorporates a palette of species for various options and uses that can be considered following a more detailed site analysis.

The historical precedent of planting in Grafton illustrates the differing objectives of planting styles. Having a diverse selection of species for differing site situations and constraints is a better strategy for future tree planting generally. There is still an argument for heritage avenues of similar species, though the proportion of same species needs to be balanced within the urban forest. The balance of planting style is currently an area of debate and change, particularly with climate change and site constraints in cities and towns.

Streetscape Design
The street trees of Grafton

Streetscape Design

Larger planting spaces and wider verges can minimise these conflicts but they must be planned from the outset. The Landcom publication *Street Tree Design Guidelines* is a useful guideline in the design of new sub-divisions and streetscapes to ensure adequate space for trees. The Roads and Traffic Authority (RTA) has also produced a Landscape Guideline for planting and management of trees within road reserves, which details design considerations for tree placement & selection for urban roadways. This document specifies recommended setback distances from roadways and intersections to provide adequate clearance, sightlines and traffic safety. It is essential that Council liaises with utility authorities and road management authorities when planning and designing new streetscapes.

Given the potential impact of climate change, streetscape design incorporating Water Sustainable Urban Design (WSUD) principles (such as stormwater harvesting mechanisms, retention systems and porous pavements) will become increasingly important to minimise drought stress on street plantings and mitigate the effects of flood events.

Impact that the urban environment has on street trees

5.4.1 Alternatives to Verge Planting

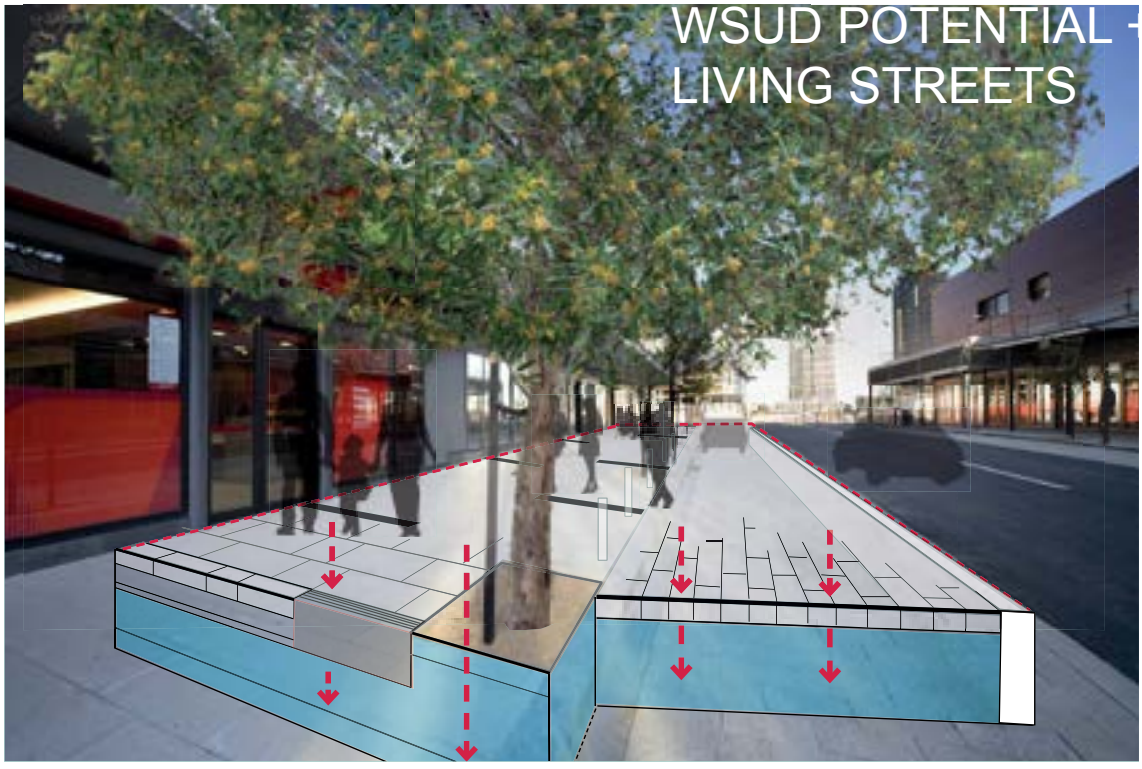
There may be alternatives to planting trees within the footpath/nature strip area. Where road carriageway widths are sufficiently wide, tree planting could be considered within the road carriageway, either in the road median or in spaces between parking bays. The placement of trees within the road carriageway does have a number of implications that need to be considered.

These may include:

- Special soil preparation and planting techniques (which may require considerable capital investment)
- Protection from vehicle damage
- Loss of some on-street parking areas (depending on the parking configuration adopted)
- Relationship to overhead power lines and pruning requirements
- Relationship to underground services
- Sightlines and traffic management

However, there may be advantages in considering these options in some streets, including:

- Allow planting of larger trees, more in scale with the streetscape
- Reduction in footpath damage
- Greater clearances between trees and dwellings (minimizing structural damage, pruning requirements and other nuisance
- On street parking could be increased in some instances by incorporating reverse angle parking or similar configurations
- Reduced conflict with pedestrian corridors, commercial awnings and signage



5.4.2 Tree Plantings in New Developments

The STMP can also be used to specify new tree plantings in streetscape areas associated with new developments. The STMP ensures consistency in street plantings and provides minimum standards for stock quality, installation and establishment maintenance. Compliance with the plan can be enforced through conditions of Development Consent. Where possible, it is desirable to co-ordinate annual planting programs with other capital works programs (including road drainage, kerb and gutter and footpath renewal programs) to minimise conflicts and make efficient use of resources.

Streetscape Design	
Objective	**Actions**
Provide adequate space for trees in the context of new developments and town plans	• Use good planning for siting trees so that they can realise there investment potential • A number of appropriate species are to be used to be able to fit in with varied streetscape conditions • Street tree master plans give a number of species options for appropriate planting to achieve the Street Tree strategy objectives • Use Graftons historic street tree planting strategy (earlier phase) as a future precedent, which gives an number of planting options • Limit same species avenues to where they are essential such as historic precincts, 'higher hierarchy' streets, as they give reduced planning flexibility • Explore options beyond the street verges for tree planting such as parking lanes, reconfigured parking layouts and medians • Design road and nature strip (verge) widths to accommodate trees in scale with the proposed development • Consider alternative pavement treatments (permeable paving) and structural soils for new civic areas • Design streetscapes for adequate soil volumes • Minimise conflicts between services and trees

5.5 EXISTING SERVICES AND CONSTRAINTS

Verge or nature strip widths, existing overhead and services, footpaths and driveway crossovers, other public infrastructure and building setbacks are all significant constraints for existing and new tree planting. Table 4 of the Statewide *Best Practice Manual* details the constraints and associated risks of conflict between trees and other infrastructure. In order to minimise potential conflicts, the existing constraints must be considered to determine the most appropriate planting position for trees. Some streets may be so heavily constrained that planting is simply not practical, especially those with verge widths of less than three metres. The available above and below ground space required for the proper development of the crown and root system may dictate the size of the tree (ultimate dimensions) that can be supported. Heavily constrained streets may dictate smaller trees or absence of trees, or special measures to provide adequate above and below ground space for trees.

Clearances are also required for vehicle access. These may be variable depending on the traffic volume and type predominantly using the roadway. For example State Transit Authority (STA) bus routes and arterial roads may require a greater vertical clearance than local roads. Street tree selection must take into account clearances for sightlines and vertical clearances for vehicular access. In certain situations, the number and type of underground or overhead services may limit tree planting within a street or part of a street. The selected trees must be of an appropriate form and habit to minimise these potential conflicts or be tolerant of an acceptable level of pruning to ensure that these clearances can be maintained without disfiguring or damaging the tree.

The dimensional constraints of the street are a key selection criteria in the Yamba Street Tree Master Plan.

Trees and Services	
Objective	**Actions**
Minimise Potential for Conflict Between Trees and Infrastructure (and operational uses)	• Consider appropriate soil volumes and soil quality to accommodate the ultimate size of the tree • Develop guidelines for the placement of trees within streetscapes in consultation with utility authorities & road management authorities (RTA, STA) [RTA Landscape Guidelines] • Prepare specifications & details for tree planting for a number of different scenarios (grassed areas, pavements etc) • Investigate options for replacement of overhead cables with Aerial Bundle Conductors (ABCs) in key locations • Avoid use of species with known extensive or damaging root systems • Consider use of Structural Soils or Root Control Barriers to mitigate/avoid infrastructure damage • Limit driveway crossover widths to 3 metres for residential properties • Where apprporiate maintain clearances for pedestrian and vehicular thoroughfares, signage and sightlines to ensure public safety • Where apprporiate maintain clearances around overhead electricity cables in accordance with the authorities requirements • Consider alternatives to verge plantings where road carriageways are sufficiently wide

5.6 COMMUNITY CONSULTATION, PERCEPTION AND OPINION

Community consultation is imperative in the development of the Street Tree Master Plan. A plan which is imposed on the community without adequate consultation is more likely to be rejected and therefore unsuccessful. The difficultly with involving the community is the diverse range of views and the difficulty in disseminating information about the program and retrieving information from the community. A range of strategies may be appropriate, including community workshops, use of the internet, public notices and direct mail.

The STMP is a useful educational tool, describing for the community the process and logic behind tree species selection and streetscape design. Inclusion of species profile sheets can also provide information on the characteristics of the species proposed and how they meet the selection criteria. The inclusion of the community in decision making and engendering support is critical to the success of planting programs. Where the community is involved in decision making and aftercare of plantings, there is less risk of loss due to neglect or deliberate vandalism.

Where the decision to remove a mature street tree is made, notifications should be issued to the adjoining property owners. A reasonable notification of intent to remove should be delivered in writing to the closest three properties on either sides of the street. Signs should be placed on Significant Trees that are located in high profile areas. The notifications should state the reasons for removal and any proposed replacement planting to be undertaken. A contact person and number or website address should also be provided to enable further information to be obtained.

Community Consultation Perception and Opinion	
Objective	**Actions**
Ensure and effective strategy for community consultation that serves all stakeholder goals	• Educate the community about the importance of trees and their 'investment' potential • Inform the community with workshops, mail drops, flyers or use of community media • Notify, educate and explain the reasons why senescent trees are required to be replaced

5.7 TREE IMPLEMENTATION, MAINTENANCE AND CARE

Plant Stock Quality

As street tree planting requires a substantial long term investment from council and the Community, selection of quality plant stock is imperative to ensure the best chance of survival, reduce establishment time and reduce the potential for formation of growth defects (especially in the branching structure and root plate). To this end, NATSPEC has produced a guideline for specifying and auditing the quality of plant stock called *"Specifying Trees – A Guide to assessment of Tree Quality"*. This is a useful guide for the specification of tree stock quality for street and park planting for use in supply contracts and for auditing the quality of nursery stock to ensure compliance with reasonable standards. Stock size should be selected in consideration of the planting situation and the underlying soil conditions.

Lead time for the procurement of advance plant stock is also a critical element to success. The further ahead procurement can be planned, the more successful the street planting. Whilst tree stock can be obtained from commercial nurseries via the open market, it is often difficult to source material of the desired species or cultivated variety, size, quality or quantity required. Pre-ordering tree stock and contract growing can be integrated with the Annual Planting Program to ensure

timely delivery of the correct stock at the right size. With this method, plant stock quality can also be monitored throughout the growing process. Ideally planting should be timed to coincide with the highest probability of rainfall, high soil temperatures and relatively cool air temperatures, usually around March and April each year. This will provide lower percentages of plant losses and faster establishment. Procurement of plant stock should tie in with this time frame.

Ensure Use of Quality Plant Stock to Aid in Rapid Establishment and Minimise Maintenance Costs

Guidelines need to be developed for procurement of plant stock and plant stock quality in accordance with the NATSPEC Guidelines Before plant stock is ordered,develop specifications and supplier contracts to ensure availability and adequate lead time for plant supply. Prior to final delivery of stock it is important to undertake testing of plant stock for compliance with NATSPEC Guidelines.

Planting Specifications and Details

Procurement of good quality plant material and proper site preparation and planting are sound investments with long term benefits of reduced losses, faster rates of establishment and few maintenance problems in the long term. Poor plant stock quality and inadequate site preparation and planting techniques are difficult and costly to correct and can lead to long term problems and potential failures. Tree Planting details and specifications provide for a range of planting situations and surface treatments and tree protection mechanisms (Tree Grates and Tree Guards). The STMP will incorporate a range of planting details and specifications to suit a range of streetscape situations. This will provide consistency in tree installation.

Tree litter

All trees will shed litter, leaves, bark, flowers, fruit, at some time during a given growing season. Tree selection will aim to avoid the use of trees that drop excessive litter, particularly fruit, which can cause trip hazards.

Identification and Control of Pests and Diseases

Significant plant pests and pathogens can lead to the decimation of large areas of the urban forest, resulting in substantial costs associated with tree removal, pest control and replacement planting. There may also be substantial short and long term impacts on local amenity. Diseases such as Phytophthora, Dutch Elm Disease, Fusarium Wilt and Armillara Root Rot are just a few that have caused widespread destruction of urban trees. New threats such as Thaumastocorids, Sycamore Lace Bug and Myrtle Rust may also result in significant impacts in Australia. To keep these problems in check, constant vigilance is required. Regular monitoring can assist in the early detection and containment of these types of risks.

Chemical treatments are often impractical control measures for large trees in urban areas. Consideration should therefore be given to an Integrated Pest Management approach using a variety of biological, non-chemical and chemical controls where appropriate. This predicates ongoing monitoring by trained staff to initiate timely and appropriate responses. The Inventory is an integral tool in this process.

Tree Implementation Maintenance and Care	
Objective	**Actions**
Implement quality controls, standards and specifications to ensure street tree procurement, selection and implementation is as effective as possible	• Allow sufficient leadtime to ensure high quality implementation of street trees • Ensure that well trained and prepared staff can respond to outbreaks of plant pathogens and diseases
Ensure use of quality plant stock to aid in rapid establishment and minimise maintenance costs	• Develop guidelines for procurement of plant stock and plant stock quality in accordance with the NATSPEC Guidelines • Develop specifications and supplier contracts to ensure availability and adequate lead time for plant supply • Undertake testing of plant stock for compliance with NATSPEC Guidelines prior to delivery
Ensure successful establishment of new plant stock & minimise risk of vandalism	• Prepare technical specifications and planting details to be used both in-house and externally (landscape contractors) to ensure proper and consistent installation • Undertake consultation with the community to engender support and minimise vandalism of new plantings • Provide information on maintenance of new trees • Prepare specifications for establishment maintenance and ensure adequate establishment maintenance periods • Encourage residents to monitor and water trees following establishment maintenance period • Identify important view corridors, visual elements and landmarks within major town centres and avoid planting that may potentially obstruct views • Protect trees with physical barriers where necessary in high traffic/usage areas

5.8 FUNDING OPTIONS AND WORKS PLAN

There are a number of strategies that various Local Councils around Australia use to secure funding for planting and maintenance of the urban forest. Some of these methods include:

Cost versus Benefit Monetary value of initial and ongoing inputs versus expected returns	• Investing heavily in young trees during establishment • An emphasis on proactive maintenance pruning • Timely replacement of senescent trees to limit extension of maintenance funds when its amenity value declines

Incremental Street Tree Replacement Prioritising street tree replacement to manage a mixed age urban forest	• Avoids large proportions of the urban forest needing replacement at once • Consistent allocation of funding for street tree replacement
Determining Tree Dollar Value Developing a value of the public urban forest to guide allocation of funding	• Analyse and compare tree funding allocation with other Councils such as Coffs Harbour and Lismore • Determine the minimum budget size • Education of the value of street trees e.g the value of Jacaranda festival to help secure tree management funding
Street Tree Planting Beautification Grants	• Supply of selected tree species based on street tree master plan objectives • Giving a limited choice trees to residents for planting and care • Continuing the legacy of civic pride in Grafton to other Clarence towns • Reducing costs of establishment

Carbon Trading and Offsets Potential for (pending) carbon credits being used for tree planting for social sutainability (street tree planting)	• Gives corporations 'something to see' for their carbons credit allocations and offsets • Local input from business for greater social benefit for the Clarence Valley • Potential of concessions for local businesses
State Governments Grants Developing a strategy to pursue grants for local schools, civic precincts and parks based on 'sustainability' grants	• NSW Environmental Trust Restoration and Rehabilitation Grants. Funding for projects that aim to improve the capacity of communities and organisations to protect, restore and enhance the environment • Green Streets Programme for Housing NSW precincts • Open space grants for development of existing reserves

Chapter 6

Asset Management and Maintenance Plan

The urban forest is one component of a complex public infrastructure system, consisting of roads, underground and overhead services, car parks, civic spaces, stormwater systems, footpaths, buildings and other structures. Trees are significant community assets. They may be the most valuable asset within the CVC LGA in monetary terms and require considerable resources to manage them properly.

In order to enhance the positive benefits provided by trees, eliminate the negative aspects associated with poor planning and management and address the key threats, a long term strategic approach to tree management is required. A well conceived Asset Management Plan is aimed at ensuring the best outcome for the community by protecting and enhancing the values and benefits that trees provide, minimizing the negative impacts and reducing or mitigating the threats.

Asset Management is a systematic and coordinated approach to the management of the whole of life cycle of physical assets. A systematic and coordinated approach to the management of trees is essential in establishing works priorities, undertaking programmed preventative maintenance and reducing risk.

The Asset Management Plan is an essential tool for determining appropriate budgets for tree maintenance, planting programs and allocation of resources. There will always be a need for some reactive maintenance activities, particularly in emergency situations and these procedures should be documented as part of the Asset Management Plan. The plan should incorporate systems that permit performance monitoring and review to ensure that the key objectives of the plan are being met.

These young Populus simonii require regular maintenance particularly to clear the tram lines. Carlton, Melbourne

These Ficus microphylla in Rozelle, Sydney have been planted on top of a sandstone escarpment in extremely shallow soil. An inappropriate selection considering the limited soil volume, the roots have severely compromised the footpath.

Clarence Valley Council maintains trees on council managed land to fulfil its legislative and management obligations to residents and visitors to the area. Sustainable urban forests require human intervention in order to maintain them in a safe and aesthetically pleasing manner. The key to maintaining and enhancing the urban forest is ensuring quality tree work. Maintenance work performed on trees aims to manage tree health and enhance the quality of the treed landscape across the city as well as reducing the inherent risks associated with trees in an urban area.

In the Clarence Valley there is a large component of the urban forest within land beyond council's direct jurisdiction. While these trees are not within maintenance programmes of council, good communication is essential between the landholding stakeholders, both private and government.

Council undertakes pruning programs on publicly managed trees to;

- Reduce the risk to public safety
- Reduce the risk of public liability
- Decrease potential damage to property
- Provide clearances for pedestrians, vehicles and sight lines
- Provide clearances around services and utility lines
- Manage tree health
- To formatively shape young trees

Maintenance work on trees will occur in response to unexpected events or emergencies, such as tree or branch failure resulting from severe storms.

Certain trees within the municipality may require specialist maintenance work, for example, topiary trees that require pruning to maintain shape and aesthetics. Palms also require specific maintenance works. Some trees may require specialised tree surgery works.

Australian Standards and known best practice relating to tree management will be implemented and any operation known to be detrimental to long-term tree health is not appropriate.

Tree selection will consider a tree's ability to be pruned in order to meet the above ground site constraints presented by a city. Tree selection will endeavour to utilise tree size and form (shape of the canopy) in order to reduce pruning requirements.

6.1 TREE ASSET MANAGEMENT AND RISK PLAN

Trees are living, biological and structural organisms that grow and adapt to the prevailing environmental conditions in which they grow. All trees have a finite life as other assets do, but they are not as predictable as other engineering structures. There is considerable variation in lifespan depending on the nature of the growing environment and their interaction with other urban infrastructure. Unlike built assets which depreciate over time, tree assets actually appreciate in value as they grow and mature, after which they begin to senesce and depreciate in value.

At some point in time, trees outlive their safe useful lifespan and must be replaced to ensure a sustainable tree population. It has been suggested by some managers that this point occurs before the tree actually dies, when the cost associated with maintenance and the potential risk of damage and injury outweigh the benefits that the tree provides.

6.1.1 Managing Risk and Liability

Trees may pose a risk to safety and can lead to property damage or injury as a result of structural defects, damage and disease. The interaction between trees and other infrastructure can also lead to hazards for pedestrians and damage to private property. Statewide Mutual estimates that about 30% of all liability claims are related to trips, slips and falls resulting from damage attributed to tree roots. Public safety must be a priority in terms of the management of trees in public areas. A range of strategies may be appropriate to manage risks associated with trees.

To minimise the potential risk of harm or damage, trees, like any other asset, must be monitored and managed proactively. Typically, many councils adopt a reactive approach to tree management. A problem is identified or a complaint made, resources are dispatched and the issue is dealt with, often after failure and/or damage has occurred. This method is often an inefficient use of resources and may lead to a higher incidence of liability claims. However, a proactive approach to management ensures that regular monitoring is undertaken and preventative action is taken before failure or damage occurs.

Since the abolition of the non-feasance immunity of councils and other roads authorities by the High Court in 2001 and the introduction of the Civil Liability Amendment (Personal Responsibility) Act 2002 (NSW), Council's have a responsibility for appropriate and proactive management of tree related risks. They must take reasonable steps to manage trees as an asset and abate reasonably foreseeable risks, such as nuisance, damage and potential hazards. A proactive approach to risk management can reduce exposure to liability. An Asset Management Plan provides a system of regular monitoring and inspection, record keeping and programmed maintenance and reactive works to minimise risk to acceptable levels and comply with statutory requirements. Such a plan demonstrates due diligence if properly conceived and implemented. Without such a plan it is very difficult to defend a liability claim related to a tree failure or damage caused by a public tree.

Risk can be managed on a priority basis and assessment made in accordance with AS/NZS 4360:2004 "Risk Management" as part of the Assessment Management Plan. This adopts a process of identifying, analyzing and evaluating risks using a systematic approach. Quantified Tree Risk Assessment (QTRA) is a similar methodology for evaluating risk of harm and establishing priorities for managing risks associated with trees by an assessment of potential targets, probability of failure and impact potential. QTRA has been developed in line with established risk management principles.

The Best Practice Manual – Tree and Tree Root Management prepared by Statewide Mutual (a NSW Local Government mutual organization) provides a comprehensive approach to risk management associated with trees, addressing legal issues, liability, negligence and the responsibility of management authorities. It is also an appropriate management tool for use as part of the Asset Management Plan.

6.1.2 Tree Audit and Inventory Database

A regular audit and systematic visual assessment of trees using the Visual Tree Assessment procedure and the establishment of a Tree Inventory (database) to record the data captured are essential tools in managing the tree assets of the LGA. The frequency of inspections may be dependant on the degree of potential risk and the level of maturity of the planting. A Tree Inventory provides information on the location of the tree assets and their current health and condition. The database can also be interrogated to provide information on the size of the tree population, composition of species and remaining SULE, which then provides useful information for long-term planning, resourcing and budgeting.

The development of a Tree Inventory requires a considerable investment in data collection and computerized databases, but is critical in managing the tree resource effectively and efficiently. Many of these systems are available off-the-shelf and do not require investment in specialized software development. The integration of the database with a spatial mapping system such as Geographic Information Systems (GIS) or aerial photography or other mapping systems provides a powerful analytical and management tool. The performance of trees can then be monitored and the information collected used in determining priorities and programs for replacement planting and maintenance, providing an important link with the Street Tree Master Plan. This facilitates decision making, cost plans and allows proper prioritization and efficient use of available resources.

As there is a considerable investment in time and resources to establish such a database, priorities for audits should focus initially on high use areas where the exposure to public liability will be greatest. A Tree Inventory is not a static database, it must be periodically updated to reflect current status if it is to be an effective asset management tool. This will include changes in status as a result of preventative and reactive maintenance works, new plantings and tree removals. New technologies, such as palm top computers, are improving the efficiency of data collection and storage and should be considered as part of the asset management system. These records are critical for risk management and future planning.

6.1.3 Maintaining Statutory Obligations (clearances etc)

As a result of trees growing in highly urbanized areas, often in close proximity to services and other infrastructure, damage resulting from roots or interference from foliage and branches often occurs.

Under Section 48 of the *Electricity Supply Act 1995,* trees must clear a minimum distance from overhead power lines to prevent electrical failures and fires due to contact between branches and wires. In 2002, due to community concerns regarding trimming of trees beneath power lines, Energy Australia reviewed the minimum safety clearance requirements. The minimum clearance distances vary depending on the voltage of the lines, but generally the minimum clearance is 1.5 metres around non-insulated low voltage overhead wires and 2 metres around power poles in urban areas. A clearance of 0.5 metres around insulated Aerial Bundled Cables (ABCs) must also be maintained. Guidelines for minimum distances between trees and power lines and trees and street lighting are contained in the *Guide to Managing Vegetation near Power Lines (ISSC 2003)*, prepared by the Industry Safety Steering Committee (ISSC) and Energy Australia's *Tree Safety Management Plan (Energy Australia 2002).* The Asset Management Plan must incorporate the statutory requirements for management and pruning of trees.

The replacement of overhead wires with ABCs may be an option in some instances to minimise tree pruning around power lines. Typically the conversion to ABCs costs around $2000-$5000 per span (i.e. between two poles) compared with $56,000-$80,000 per span to replace overhead lines with underground cables (Energy Australia). Energy Australia provides a subsidized program for conversion to ABCs, with Energy Australia contributing up to 50% of the conversion cost per span.

6.1.4 Nuisance and Other Hazards

There are no perfect street trees. In addition to the many benefits they provide, trees sometimes create nuisance and hazards such as obstructing vehicle and pedestrian thoroughfares, signage and sightlines. Trees may also create slip hazards from fallen leaves, fruit or other debris. Tree roots can lead to blockage and damage of pipes, damage to structures and create trip hazards in pavements. Whilst good plant selection can minimise these conflicts, they can never be completely eliminated. The Council has statutory obligations under the *Local Government Act* and more general obligations under Common Law, particularly the torts of Nuisance and Negligence to minimise such risks by taking corrective and preventative maintenance.

6.1.5 Damage to Infrastructure

Trees in public areas may also damage private property. Good plant selection, careful placement and regular maintenance help to minimise these conflicts, but nevertheless, damage cannot be completely mitigated. New town plans and the design of public streets and other public spaces need to carefully consider the above and below ground spatial requirements of trees to minimise these conflicts. Special technologies, such as structural soils and root control barriers can also minimise conflicts.

6.1.6 Pruning Practices

Improper pruning practices can damage and injure trees, resulting in hazards and premature decline. Proper pruning practices extend the SULE of trees and reduce hazards. AS 4373:2007 "Pruning of Amenity Trees" sets out guidelines for the proper pruning of trees and is a useful guideline in preparation of tree pruning and maintenance specifications and ensuring quality control. Pruning may be required to remove defects and dead, dying and diseased branches to improve the health, structure and safety of a tree. In order to minimise the impact of pruning for power line clearance, new trees should be formatively pruned from an early age to promote an acceptable branching habit. A technical manual forming part of the AMP can be a useful mechanism for setting standards and requirements for tree pruning within the LGA.

6.1.7 Staff Skill Levels

As part of the Asset Management Plan, appropriate skill levels of tree management, supervisory and operational staff involved in implementing the Plan should be established in line with the Australian Qualification Framework (AQF). Only appropriately skilled and experienced arborists (AQF Level 5) should undertake Visual Tree Assessments and Tree Hazard Assessments.

Tree workers and contractors employed by council should undertake all tree maintenance operations in accordance with the WorkCover Code of Practice for the Amenity Tree Industry. This will ensure that tree work is carried out safely and professionally at all levels.

6.1.8 Preventative Maintenance

Planned, preventative maintenance is the preferred method of maintaining trees in a safe and healthy condition. Preventative maintenance reduces risk of damage through early detection and rectification of defects and removal of potential hazards, thereby reducing the need for reactive maintenance and avoiding liability associated with tree failure and subsequent damage or injury. Planned maintenance can be used to undertake tree works systematically, particularly in terms of maintaining appropriate clearances from roads, footpaths, street lighting, signage and overhead services.

The frequency and timing of maintenance may vary depending on specific management issues (e.g. harvesting of Bunya Pine Fruit) or the frequency and intensity of use (therefore increased risk) or the age of the tree population (older trees may require more frequent inspection and maintenance). The Asset Management Plan should determine appropriate inspection and maintenance regimes (frequency and timing) for Street and Park Trees as well as standards and levels of service for key areas. This information can be derived from regular inspection and establishment of works priorities generated from the Tree Inventory.

6.1.9 Reactive Maintenance and Emergency Response

Emergency response may need to be undertaken outside the programmed maintenance schedule whenever a tree or tree(s) has been assessed as representing an imminent threat to the health and safety of people and/or public or private property. This may typically occur after severe storm or high wind events or bushfires. Appropriate levels of service should be established in line with council's resources. Procedures for emergency response must be properly documented. Special provisions may apply for trees that are nominated under council's Significant Tree Register or listed as heritage items on the LEP.

6.1.10 Vandalism

Section 629 of the Local Government Act 1979 provides penalties to be imposed on "a person who, without lawful excuse, willfully or negligently injures, damages or unnecessarily disturbs any plant, animal, rock or soil in a public place is guilty of an offence".

6.2 STREET TREE MANAGEMENT ACTIONS PLANS

Tree Asset Management and Risk	
Objective	**Actions**
Ensure a safe street and park environment for the community	• Prepare guidelines for tree hazard assessment in line with the VTA procedure • Analyze risk and determine work priorities in accordance with AS4360:2004 and QTRA • Undertake regular inspection and monitoring of public trees to identify and problems or defects & generate work orders as required • Undertake programmed maintenance and planned remedial action where required • Determine and maintain appropriate clearances for pedestrian footpaths, road corridors, vehicle sight lines, overhead services, street lighting and signage • Prepare guidelines for appropriate clearances from buildings including private residences
Mitigate potential hazards on a priority basis	• Adopt a maintenance management system that permits generation of planned and reactive work orders • Undertake preventative pruning programs • Develop procedures for emergency response in line with State Emergency Services Act (1989), Fire Brigade act (1989), Electricity Act, Roads Act etc

Ensure a systematic and proactive approach to tree management and maintenance	• Develop a Tree Asset Database (inventory) of the tree resource focusing on areas of the highest public liability • Undertake regular inspection and monitoring of street trees and record results in the Tree Asset Database • Prepare budgets for tree maintenance operations in light of identified priorities • Determine appropriate maintenance cycles and service levels in accordance with the available budget • Determine appropriate removal and replacement planting strategies for key areas and streets based on a SULE analysis
Instigate best practice management and maintenance standards to minimise risk	• Prepare specifications for tree pruning and maintenance in line with AS 4373-2007 • Regularly audit contract service providers performance against standards and specifications • Ensure minimum standards and qualifications for assessing officers and tree maintenance staff and contractors in line with the Australian Qualification Framework (AQF) • Undertake tree maintenance operations in accordance with the Statewide Mutual Best Practice Manual and the NSW WorkCover Code of Practice for the Amenity Tree Industry (1998) • Develop guidelines and procedures for the assessment and processing of insurance and liability claims

Trees Implementation Maintenance and Care	
Objective	**Actions**
Ensure use of quality plant stock to aid in rapid establishment and minimise maintenance costs	• Develop guidelines for procurement of plant stock and plant stock quality in accordance with the NATSPEC Guidelines • Develop specifications and supplier contracts to ensure availability and adequate lead time for plant supply • Undertake testing of plant stock for compliance with NATSPEC Guidelines prior to delivery
Ensure successful establishment of new plant stock & minimise risk of vandalism	• Prepare technical specifications and planting details to be used both in-house and externally (landscape contractors) to ensure proper and consistent installation • Undertake consultation with the community to engender support and minimise vandalism of new plantings • Provide information on maintenance of new trees • Prepare specifications for establishment maintenance and ensure adequate establishment maintenance periods • Encourage residents to monitor and water trees following establishment maintenance period • Identify important view corridors, visual elements and landmarks within major town centres and avoid planting that may potentially obstruct views • Protect trees with physical barriers where necessary in high traffic/usage areas

Tree Vandalism	
Objective	**Actions**
Ensure the protection and preservation of trees within private property and council owned and managed land in order control the loss of trees and maintain and enhance amenity	• Develop guidelines and regulations for the removal and pruning of trees within private property including the aspect of pruning for views, using a DCP as a regulatory tool under the provisions of Clause 5.9 of the standard instrument (LEP Template) • Control the removal and pruning of trees on private property by compliance or consent under the DCP • Develop criteria for the assessment of applications for tree removal and pruning to ensure a consistent approach • Develop procedures for review of Tree Works applications that have been refused • Determine appropriate penalties for non-compliance in accordance with the provisions of the EP&A Act (private trees) and Section 629 of the Local Government Act 1993 (public trees) • Educate the community in relation to the values and benefits that trees provide using the council website • Include emergency provisions that encompass bushfire events and severe weather events
Ensure the protection and preservation of trees during land development	• Prepare guidelines for the protection of trees during development works in line with AS 4970:2009 (Protection of Trees on Development Sites) • Provide guidelines for preservation of trees on development sites (DA Guide), including site analysis and site planning • Assess the potential impact of proposed development works on existing trees (through review of Development Applications) • Nominate appropriate conditions of consent to ensure the protection of trees during development
Ensure the protection of trees of special value	• Establish a Significant Tree Register to identify and record the significance of trees of special heritage or other value • List Significant Trees in the Local Environment Plan as Heritage Items
Ensure replacement planting to compensate for losses resulting from land development	• Develop guidelines for replacement planting on new development sites
Ensure the protection and preservation of trees during utility installation and maintenance	• Liaise with relevant utility authorities to ensure the protection of trees during utility installations (e.g. installation of underground cables & conduits) and maintenance (e.g. pruning for overhead power lines) • Lobby for low impact alternatives such as Aerial Bundle Conductors, Directional Boring etc

Chapter 7

Development Control Plan

7.1 TREE PROTECTION, PRESERVATION AND VANDALISM

Where the decision to remove a mature street tree is made, notifications should be issued to the adjoining property owners. A reasonable notification of intent to remove should be delivered in writing to the closest three properties on either sides of the street. Signs should be placed on Significant Trees that are located in high profile areas. The notifications should state the reasons for removal and any proposed replacement planting to be undertaken. A contact person and number or website address should also be provided to enable further information to be obtained.

7.1.1 Local Environment Plan (LEP)

Local Environment Plans (LEPs) guide planning decisions for local government areas. Using zoning and development controls, they allow councils to manage and control the way in which land is used.

In 2006, the NSW Government created a common structure and language for LEPs to simplify the planning system in NSW. This is referred to as the standard instrument for LEPs or the LEP Template. By 2011, it is mandatory that all NSW Councils must create new council-wide LEPs using the LEP Template. The Preservation of Trees or Vegetation is an optional component of this Plan. The Clarence Valley Local Environment Plan (LEP) 2011 has been created in compliance with standard instrument and includes provisions for the preservation of trees and other vegetation.

Clause 5.9 of the Clarence Valley Local Environment Plan (LEP) 2011 made under the provisions of the Environmental Planning and Assessment Act 1979 gives council provision to create a Development Control Plan (DCP) for the purpose of controlling the removal and pruning of trees and other vegetation in order to preserve amenity. Under the provisions of this clause, CVC may prescribe the type (species), size or location of trees (or other manner) to which the DCP applies.

This provision is important, since it gives council power to regulate the removal and pruning of trees on private and public land and the ability to impose penalties under the Environmental Planning and Assessment Act 1979 for undertaking tree works without consent or the deliberate, willful damage to trees or other non-compliance with the DCP. CVC is currently in the process of developing a DCP for the preservation of trees and vegetation (Part E of the DCP) for the whole of the LGA.

7.1.2 Development Control Plan (DCP)

To ensure adequate protection of urban trees, the CVC Residential Zones DCP applies to the following zones; R1 General Residential, R2 Low Density Residential, R3 Medium Density Residential and R5 Large Lot Residential. In addition to protecting desirable vegetation, Psrt E of the Residential Zones DCP Vegetation Controls facilitate the removal of undesirable species, including Noxious Weeds, Nuisance Species, Environmental Weed Species and any tree that is deemed to be an imminent threat to life or property by virtue of structural defects, instability or other identified hazard.

7.1.3 Administration of the DCP

The decision to permit the removal of trees should be weighed up in terms of the current health and condition of the tree and it's Safety Useful Lifespan Expectancy (SULE), together with any negative impacts and the values that the tree contributes from an amenity, heritage and ecological perspective. The assessment criteria for applications should be fully documented in the DCP.

Applications for the removal or pruning of trees are normally made by the owner of the tree. A thorough assessment using the VTA procedure should only be made by qualified and experienced arborist and the results of the assessment adequately documented, as decisions to refuse applications may have liability implications. The International Society of Arboriculture (ISA) produces standard forms that may be used to record VTA assessment and hazard evaluations. Refer to http://www.isa-arbor.com/education/resources/educ_TreeHazardForm.pdf. Alternatively, the applicant can be invited to submit a report from a qualified arborist in support of the application.

7.1.4 Tree Replenishment

Where trees are permitted to be removed, the permit should be conditioned (where appropriate) for replacement planting to be undertaken with suitable species in appropriate locations within the property to compensate for loss of amenity. The number of, and mature dimensions of replacement trees could be based on the overall allotment size, percentage of permissible built-upon area, and available deep soil planting area remaining to support trees. This requirement should follow through to landscape works associated with new land development, so that there is a balance between trees lost to new development and adequate replenishment of tree stock.

7.1.5 Other Legislation

Not withstanding the controls imposed by a DCP, there is a range of other legislation that may take precedence over the DCP or allow certain works to be undertaken without Councils consent. These include the following:

Forestry Act 1916
National Parks and Wildlife Act 1974
Electricity Act
Electricity Supply (Safety Plans) Regulation 1997
Electricity (Tree Preservation) Regulation 1995
Roads Act 1993 (Sections 88, 107, 138, 139
Road Management Act 2004
Noxious Weeds Act 1993
Timber Plantations (Harvest Guarantee) Act 1995
Native Vegetation Conservation Act 1997
Threatened Species Conservation Act 1995
Fire Brigade Act 1989
State Emergency Services Act 1989
State Emergency and Resource Management Act 1989
Water Industry Act 1994 (VIC) Section 67
Gas Industry Act 2001 (Section 148)
Rail Corporations Act 1996 (section 60)

7.1.5.1 Trees (Disputes between Neighbours) Act

The *Trees (Disputes between Neighbours) Act 2006* was instigated to provide the community with a simple, inexpensive and accessible mechanism for the resolution of disputes between neighbours concerning trees. The Act was subsequently reviewed in 2009 and is now amended as *Trees (Disputes between Neighbours) Amendment Act 2010.* This legislation enables applicants who consider that their neighbour's tree is causing, has caused or is likely to cause property damage or personal injury to make an application to the Land and Environment Court. After assessment of the application the court may make orders to remedy, restrain or prevent damage or injury from a tree situated on adjoining land. The court may also order compensation or rectification of damage to the applicant's property caused by trees.

7.1.6 Identification and Conservation of Significant Trees

The special heritage value of trees is not always easily recognized or interpreted, leading to it's potential loss if not well documented and accessible. The establishment of a Significant Tree Register would provide added protection for trees of special value. Many of these trees are already listed as heritage items in the LEP. The Register can be linked to the LEP to ensure that it provides adequate regulatory control (over and above general tree preservation provisions). This is normally achieved by listing specific trees in a schedule attached to the LEP, usually incorporated with heritage items. The Significant Tree Register documents the special value of important trees. These may be trees of significant cultural, heritage, ecological, botanical or amenity value. Assessment of trees for inclusion on the Register is generally made on the basis of guidelines prepared by the Heritage Council in accordance with the Burra Charter. The Planning NSW document *Street Trees in NSW* and the NSW Heritage Office guideline *Assessing Heritage Significance* provides criteria for assessing the value of street trees and discusses the historical context of street plantings in NSW. Significant trees may require special consideration in terms of any new development or infrastructure works that may have a potential adverse impact on them and special consideration in terms of pruning to accommodate overhead services.

7.1.7 Tree Protection During Land Development & Infrastructure Works

Construction activity and development works have the potential to cause significant loss and damage to trees. This is particularly the case with urban consolidation where new developments are placed in existing urban areas with established trees. As such, the DCP should also address the protection of trees during development works.

Under Section 79C (b) of the Environmental Planning and Assessment Act 1979, the consent authority must consider the likely impacts of any proposed development on the natural and built environment as part of the review of a Development Application. This may include loss of amenity resulting from the removal or damage to trees to accommodate new developments. Clear guidelines should be provided to applicants detailing the information to be supplied to council to enable the proper assessment of the impact of the development proposal on existing trees. In addition as well as guidelines for site planning for tree retention and tree protection measures to be adopted during construction. This will minimise the loss and damage to trees resulting from development works. These guidelines should also be applied to in-house infrastructure and capital works projects.

AS4970-2009 "Protection of Trees on Development Sites" provides a framework and process for managing trees in the context of development. The process of protecting trees on construction site begins with the planning process. Trees need adequate space for their growth and development to ensure their long term preservation. The spatial requirements of trees need to be considered as a constraint to development at the very outset of the site analysis. Deferring tree protection to the commencement of construction is seldom successful. If trees are worthy of retention, the development must be designed to provide them with adequate above and below ground space for their long term survival. The Development Control Plan must document the process required to achieve good tree preservation outcomes from the outset of the development process, in line with AS 4970-2009.

In order to protect street trees adjacent to any proposed development, the applicant should provide a dilapidation report and Tree Protection Plan for any public trees which have the potential to be adversely affected by the trees. The Tree Protection Plan should detail site specific tree protection measures to be implemented prior to construction. Where damage occurs as a result of failure to properly protect the tree, Council may consider appropriate penalties or orders for remedial works.

7.1.8 Maintenance of Views and View Corridors

The maintenance of views and view corridors is a complex and often controversial matter. Riverside and coastal views add significantly to property values and there is continual pressure on councils to prune or remove vegetation obscuring these views. Trees can also frame and complement views and are an important element in defining the visual character and aesthetic value of a place. In order to minimise these conflicts and provide a reasonable balance, the STMP should identify important view corridors and avoid plantings that may potentially obstruct them into the future.

Pruning of private trees should only be permitted where it will not result in physical damage to the tree and not destroy its natural shape, form and branching habit or compromise its structural integrity.

Chapter 8

Appendix

8.1 REFERENCES

1. Johnston, Mark (October 2004)
Impacts and Adaptation for Climate Change in Urban Forests
Proceedings of the 6th Canadian Urban Forest Conference
Saskatchewan Research Council, Saskatoon, Canada

2. Landcom NSW in association with JMD Design & Earthscape Horticultural Services (2008)
Street Tree Design Guidelines
Landcom, Sydney, NSW

3. Roads and Traffic Authority (April 2008)
Landscape Guideline – Landscape Design and Maintenance Guidelines to improve the Quality, Saftey and Cost Effectiveness of Road Corrridor Planting and Seeding
RTA, Sydney, NSW

4. Local Government Tree Resources Association and Greening Australia (1993)
NSW Local Government Tree Resources Kit
Local Government Tree Resources Association and Greening Australia, Sydney, NSW

5. Barrell, Jeremy (1996)
Pre-development Tree Assessment
Proceedings of the International Conference on Trees and Building Sites (Chicago)
International Society of Arboriculture, Illinois, USA

6. Clark, Ross (1996)
Specifying Trees – a Guide for Assessment of Tree Quality – Second Edition 2003
Construction Information Systems Australia Pty Ltd/ NATSPEC, Sydney, NSW

7. Ellison, M. J. (2005)
Quantified Tree Risk Assessment Used in the Management of Amenity Trees
Journal of Arboriculture 31:2 57-65
International Society of Arboriculture Savoy, Illinois, USA

8. Statewide Mutual (September 2002)
Best Practice Manual – Trees and Tree Root Management
Statewide Mutual

9. Mattheck, Dr. Claus & Breloer, Helge (1994) – Sixth Edition (2001)
The Body Language of Trees – A Handbook for Failure Analysis
The Stationery Office, London, England

10. Industry Safety Steering Committee (June 2003)
Guide to Managing Vegetation near Powerlines – ISSC 3
Ministry of Energy and Utilities, Sydney, NSW

11. Energy Australia (April 2002)
Tree Safety Management Plan
Energy Australia, Sydney, NSW

12. Energy Australia
Trees & Powerlines – Protecting You and Your Environment
Energy Australia – www.energy.com.au

13. Standards Australia (2007)
Australian Standard 4373-2007 Pruning of Amenity Trees
Standards Australia, Sydney

14. WorkCover NSW (1998)
Code of Practice – Amenity Tree Industry
WorkCover NSW, Sydney, NSW

15. Down, Michael (March 2008)
Council's Liability for Street Trees
DLA Phillips Fox, Sydney, NSW

16. NSW Department of Planning (1990)
Street Trees in NSW – Guidelines for Conservation and Management
Department of Planning, Sydney, NSW

17. NSW Heritage Office ((July 2001)
Assessing Heritage Significance NSW Heritage Manual
Planning NSW, Heritage Office, Parramatta, NSW

18. Council of Standards Australia (August 2009)
AS 4970 – 2009 – Protection of Trees on Development Sites
Standards Australia, Sydney, NSW