GREENING THE FRASER COAST

A STRATEGY FOR STREETSCAPES

STRATEGY BACKGROUND

Fraser Coast Regional Council has identified, like most Local Councils across Australia, that our climate is undergoing change and the liveability of our cities is being affected for a variety of reasons.

For spaces to be enjoyed people must be comfortable. This principle applies to all places including cities, parklands, our streets, our workplaces and our homes. If people are not comfortable they do not linger, play, work, meet, gather, socialise and spend. This inevitably has knock on economic effects through a lack of tourism and local spending.

Queensland has long embodied good design principles to deal with the hot tropical and sub-tropical climates that we live in. However, with the densification of our cities and the places within them there is increasing pressure to make these spaces more comfortable for use.

The Greening Fraser Coast Strategy aims to create comfortable places and spaces within our city by Urban Greening; planting trees to shade places and cool our cities and towns.

One key goal of the strategy is to plant 100,000 trees by 2030. These trees are to be planted within the public and private realm including open space parklands, reserves, streetscapes, community precincts and within private properties where partnerships can be formed.

A Strategy for Streetscapes

This report focuses on strategies to maintain and enhance the unique natural environment and lifestyle of Fraser Coast by planting street trees along densely developed commercial, residential and retail areas and greening the streetscapes of the Fraser Coast Local Government Area.

This strategy will act as a guide for sustainable street tree planting and should be read in conjunction with other FCRC tree management and engineering policies regarding the nature strip.

CONTENTS

JFP Urban Consultants have been commissioned by Fraser Coast Regional Council to develop this strategy for streetscapes.

ISSUE	DATE	STATUS	AUTHORS	CHECKED
K	29 SEP 20	FINAL	SJ/ML/ AG/RW	AG

PART A
STREET TREES:
BENEFITS AND CHALLENGES

A1 - WHY GREEN STREETS?

The Queensland climate was hot well before human development. With the increase of residential development that is occurring in our cities and regional towns, the benefits of street trees is becoming more critical in these built environments.

Improvements to air quality, comfortable places to rest and enhanced stormwater management are just some of the many benefits provided by greening our streets.

It has been shown in many studies internationally that the significant lack of street trees creates consequences to the social, economic and environmental aspects of our communities.

This strategy focuses on how to achieve maximum greening to streetscapes.

Streetscapes can be of many different typologies and scales ranging from:

1. City and urban centres, where all roads and footpaths are fully sealed pavement.
2. Major roads and collector streets where there are multiple lanes.
3. Suburban streets, typically just two lanes and narrow width with grassed verges.
4. Rural roads which are typically narrow but may already have trees.

People spend the most time at home or at work and hence the focus of this study is to look at streets within city centres and a typical suburban street.

The two streetscapes are as follows:

1. City centre - Adelaide Street (Ellena to Alice), Maryborough,
2. Suburban streetscape - Urraween subdivision

A. CBD and Urban Centres

C. Suburban streets

B. Major roadways

D. Rural residential streetscapes

FIGURE 1: Common streetscape types

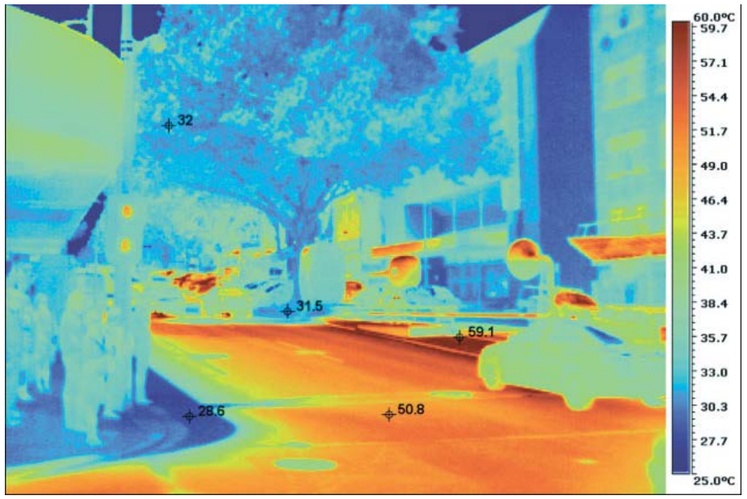


FIGURE 2 : Typical Heat Map of a streetscape showing hot surfaces in warm colours (The Age, 2014)

FIGURE 3 - Pialba 4655 (top) has significantly fewer trees than for example, West End 4101 (bottom); mostly likely due to less backyard area to plant trees and a lack of street trees.

A2 - BENEFITS OF URBAN GREENING

Reducing Heat To Improve Socioeconomics And Livability

Queensland is well known for constant sunshine and experiencing prolonged summer heat. Therefore, it is not uncommon for streetscapes to become heat sinks due to an abundance of hard surfaces such as asphalt and concrete footpaths, paired with limited space and/or allowance for vegetation.

Furthermore, surrounding infrastructure is also affected by the heat, as the street level temperature penetrates building facades where there is nothing to provide shade to these buildings. Hence more energy is being used to keep the interior of the building cool. Streets within a CBD like Adelaide Street, Maryborough that lacks significant shade, combined with large quantities of hardscape, create a “heat island” that will increase the temperature of the CBD at street level.

With the implementation of street trees along CBD streets there will be a significant reduction in heat stress to roads, footpaths and surrounding infrastructure as trees shade these surfaces and absorb the radiant heat. This will reduce the amount of energy needed to cool infrastructure. Furthermore, cool breezes will also minimise the extent and effects of major heat sinks. These factors will reduce the potential of creating a heat island in Maryborough or similar centres.

Increasing shade in streets throughout the Fraser Coast will cause an increase in foot traffic from locals and tourists along store fronts improving the socioeconomics of the area. In some international studies, a reduction in crime rates were discovered due to an increase in foot traffic as a result of more street trees.

OUR CHANGING SUBURBS

The same heat issues that occur within a town’s CBD also occur within the suburbs. Lot sizes in new residential subdivisions are now shallower (around 28-35m front to rear boundary) than those lots found in older suburbs where lots were typically 40m (2 chains) deep. These older suburbs with deeper lots often have less building coverage and more space for backyard trees.

These shade trees to the rear of backyards combined with street trees help cool our suburbs and provide shade to buildings reducing the demand for air-conditioning. Notably, Queensland has one of the largest uptakes of solar panels in the world per dwelling and photo-voltaic cells and the Fraser Coast region has nearly 40% of dwellings with solar PV installations. These PV arrays should not be shaded by large trees to perform at their peak. Hence, tree placement needs to be assessed against its affect to solar rooftops.

An ideal outcome would be the shading of streets to cool the neighbourhood and partial shading of dwellings (western side) to reduce cooling costs.

Energy and water demand is continuing to grow across the planet with population growth, therefore a balanced approach to street tree planting and backyard tree planting needs to be established to achieve quality outcomes (more cooling without loss of energy production).

Fraser Coast Solar Use

Est. dwellings: 48756

Installations: 19686 (approx. 39.5% of dwellings)

Est. installed capacity: 173879 kW

Under 10kW: 67233 kW (installations under 10kW: 19270)

10-100kW: 9109 kW (installations: 416)

Over 100kW: 97537 kW (installations: 10)

Source : APVI.org.au

A3 GROWING GOOD STREET TREES

Trees will grow in constricted space if they have access to water, oxygen and nutrients. However, unless a tree's root system grows in a balanced manner to its canopy the tree may become unstable and create a liability; refer Figure 5.

Streetscapes typically lack space for trees in the modern, urban environment. Above ground there is competition for space between buildings, awnings, lighting, cables, pedestrians and vehicles. Whilst below ground requirements for essential services like power, water, sewers, data, etc. occupy critical space in the streetscape.

The space that remains should be adequate to support a trees' root system giving it space required to establish structural roots and feeder roots without large scale damage to any of the above or below ground infrastructure.

Achieving optimal growing conditions to develop healthy trees is a challenge in more intensive built environments where most services are located below ground and most infrastructure above ground.

Whilst greening the built up areas of our cities will provide immediate benefits in terms of heat reduction and increased amenity, growing large trees is certainly easier in areas where there are fewer constraints, i.e. parks, reserves and within private development sites.

Brisbane City Council mandates that all new commercial developments, other than residential estates, have 10% of area allocated for deep planting. Deep planting is a zone that is at least 4m x 4m in plan and several metres deep, i.e. over natural earth. This zone is for the purpose of growing at least one large tree per development; preferably more. This type of policy is shaping new developments and in turn, the use of new technologies and design thinking to accommodate the deep planting zones has seen a proportionate uptake.

FIGURE 4a and 4b : James Street, Fortitude Valley - Examples of large canopy trees in streetscapes.
Whilst these Ficus sp. trees present a variety of maintenance challenges for Council, the success of this high profile street is underpinned by the canopy cover afforded to shoppers. The social and climate benefits of these trees outweigh the cost of asset management.

FIGURE 5 : Illustrates a healthy, well structured and balanced root system that is optimal for tree growth and stability.
Image Courtesy of Citygreen.

Developers and Councils not wanting to reduce the potential yield of the site have created tree soil zones under roads, carparks and at times, buildings to meet the requirements of the policy.

The result will be more trees than would have otherwise been offerred and appropriate soil zones to establish balanced, healthy trees.

A4 SPATIAL CONSIDERATIONS ON WHERE TO PLANT TREES

Street trees require favourable conditions both above and below ground to optimise their growing potential and development. In the modern streetscape environment setbacks need to be provided so that appropriate distances can be maintained between the growing tree and the existing infrastructure.

At the base of the tree, particularly the first 1.1m-1.5m above the ground the lower branches should not obscure vehicle sight lines to pedestrian crossings and other vehicles. The trunk is typically no more than a column or power pole and shouldn't be considered a visual barrier. A series of standards & regulations regarding typical setbacks is common place within Local Authorities.

Because above ground constraints are easily identified and the design exercise to find suitable tree planting locations is fairly straight-forward, tree species can be selected based on the desired outcomes and management criteria such as; acceptable level of leaf drop to awnings, amount of shade required, traffic calming requirements and so on. The size and type of road vehicles is also a consideration to species selection to best select trees that will require less formative pruning; i.e. species with more upright limbs than horizontal, lateral limbs. Figure 6 illustrates various above ground setbacks desired adjacent roadways and buildings.

Pruning of street trees can become somewhat of a contentious issue in local governments. In a CBD environment, as the tree matures it can pose issues regarding leaf litter in awnings, limb dropping and obscuring business signage. Ways to mitigate this are numerous and can be achieved to the benefit of the entire scheme. Adelaide Street, Brisbane is a great example of this as the trees have been pruned in such a way that signage is visible, leaf litter is manageable and limb drop is negligible as a result of a structurally sound tree and reliable species. Please see case study over.

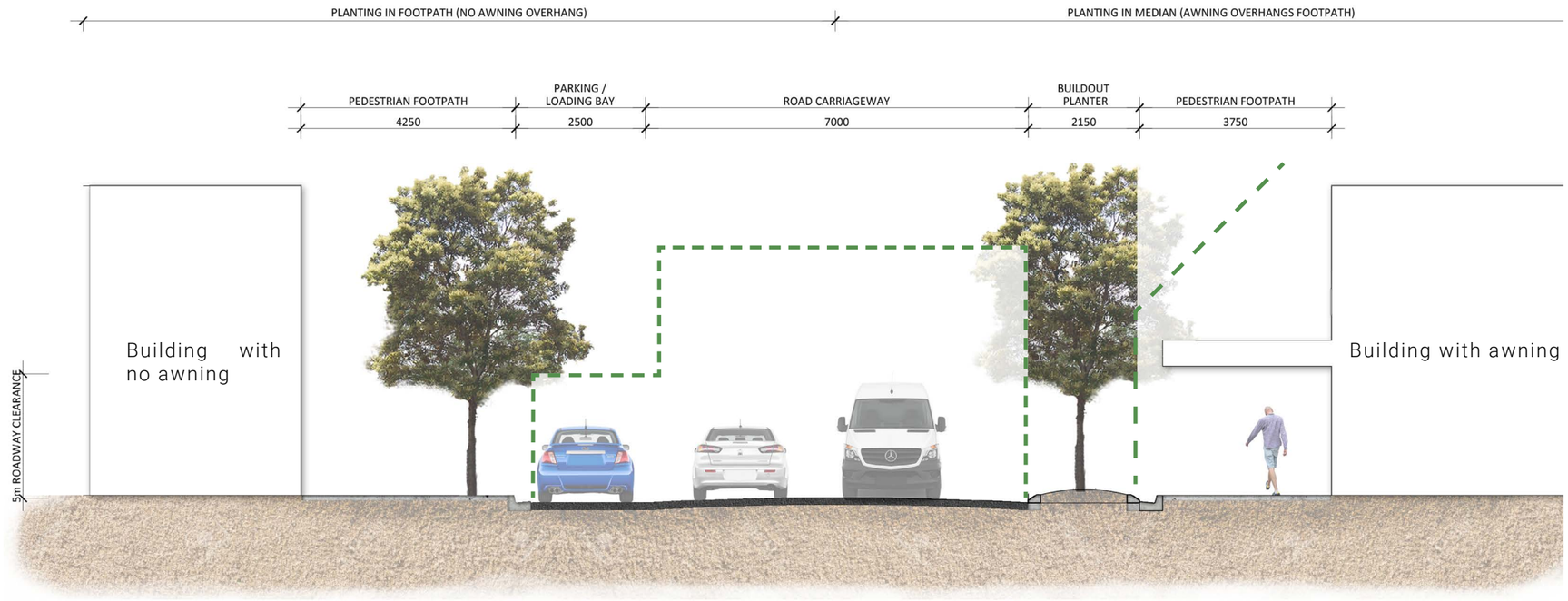


FIGURE 6 : CBD Streetscape section showing pruning setbacks for street trees.
This section is based on a standard two-way street with parallel parking.

Species selection becomes a critical part of the discussion as the varying forms and growth patterns of different trees dictate their suitability for different scenarios. Selecting an appropriate tree, allowing for long term root distribution and a well thought out pruning program will ensure not only the success of the tree, but satisfaction of nearby stakeholders.
Typical setback from buildings for both the tree and edge of canopy will help to mitigate the maintenance concerns raised by trees as they reach maturity. These setbacks may range from 500mm-2500mm based on the form and size of species selected. Angled parking would also influence these setbacks and allow for larger distances between tree trunk and awning. Vertical clearances from edge of roadways should be no less than 2500mm in a CBD setting, with 4500mm clearance where loading zones occur to allow for courier vans and trucks to comfortably unload goods.
Tree setbacks may need to be increased closer to intersections where the two-lane street migrates into a four-lane intersection.

FIGURE 7 : Adelaide Street, Brisbane - Examples of large canopy trees in streetscapes.
Looking closely, these Leopard trees sit adjacent heritage facades, amongst a variety of inground services and still allow clear visibility to shopfronts and sight lines. Formative pruning of the canopy adjacent buildings limits branches overhanging awnings but allows a full canopy over the otherwise hot street. This street represents a 20 year outcome.

UNDER GROUND CONSIDERATIONS

Creating space for tree root systems below ground is more challenging because of the competition for sub-surface space with the various services that exist. Furthermore, road and pedestrian pavements must be well founded to take vehicle loads so as not to become unsafe and compacted sub grades and subbases are required under pavements to achieve this.

With so many constraints to heavily urbanised areas with many in ground services, different construction methods need to be used to create meaningful soil zones for trees to grow. Trees will always continue to grow above ground if they have access to water and nutrients. However, without suitable soil volume and proper root development, trees can outgrow their in ground space within 10-15 years and may cause damage or become unstable where the canopy outweighs the hold of the structural roots. The monetary cost to introduce the construction technologies discussed herein are not small but if the trees planted using these methods last 40-50 years instead of 15 years then the life-cycle cost needs to be considered vs. ongoing replacement costs.

ADELAIDE STREET BOULEVARD, BRISBANE 20 YEARS : A PROJECT SNAPSHOT

Budget: 5% of entire project was street tree installation
Installation: 1999
Depth of Engineered Space : 1.0m
Volume of Engineered Space: Total volume for project approx. 450 cubic metres.
Volume per tree: approx. 9 cubic metres

Drainage Type Under drainage in bottom layer of trench to stormwater inlet (see design detail within attached paper)
Surface Treatment Tree Grates Within Reinforced Concrete

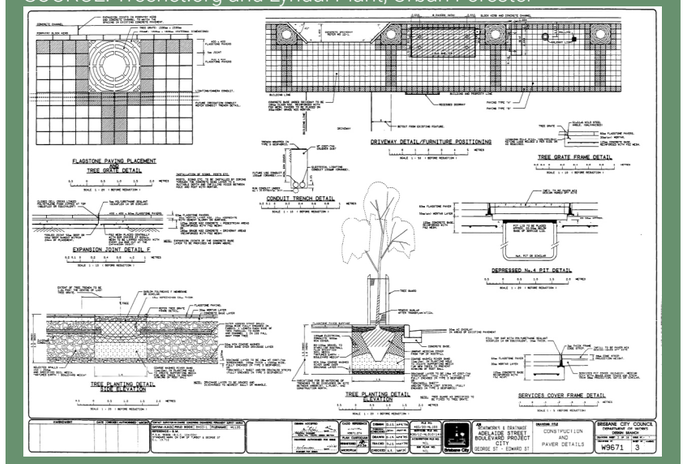
Growing Media Detail
Clay-loam media (filler soil) of calculated void volume (40%) washed in during installation stages, 2 horizons of soil mix used within tree planting sites (see design detail diagram within paper)

Surrounding Site Soil Detail
Geotech core sampling survey done for the project – report not available. Findings were predominantly mixed fill, stiff clay with some portions of sandy loam where existing trees were growing well

Watering Regime Manual watering; no WSUD devices
Maintenance Detail Watering regime is manual for the establishment period of 24 months only

Clearance pruning of trees two yearly to maintain bus, car, truck clearance

SOURCE: Treenet.org and Lyndal Plant, Urban Forester



A5 STRUCTURAL SOILS vs STRUCTURAL SOIL CELLS

Technology to address street tree installation has grown dramatically over recent years and many products have been developed to allow for soil root zones to be created under pavements. Various case studies can be found at Treenet.org on the products available such as those by CityGreen, SilvaCell and other structural soil suppliers.

Structural Soil is a growing medium that can be compacted to pavement design and installation requirements while permitting root growth within its pores that are commonly filled with a clay/loam soil. Typically structural soil is a mixture of 85% gap-graded gravels (typically 63mm nominal or 20-70mm size crushed rock) and 15% clay loam soil (for mineral content and organic content). Ideally both crushed rock and soil can be sourced locally but consulting with a specialist consulting soil scientist is a must. Brisbane City Council has used a premix of recycled concrete (80-100mm diameter) and clay/loam was used around major sewer pipes where large trees exist providing increased pipe stability

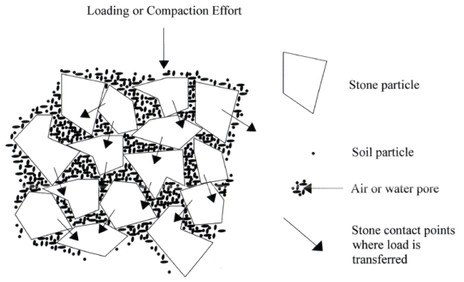


FIGURE 8 : Examples of structural soils (Diagram: Cornell University)

FIGURE 9 : Example of engineered soil cell installed under roadway and footpath pavement. Images Courtesy of Citygreen.

knowing that roots will grow into this space. Various suppliers have different specifications however typcially mixes consist of a blend of crushed aggregates, soil, Deco® -Granite and composted organics. It helps to provide an integrated, root penetrable, high strength pavement system that has the ability also to shift design away from individual tree pits.

Structural Soil Cells are modular proprietary polymer soil cell systems that are an alternative to structural soils. When installed over a compacted subbase, these modular cells provide the same structural support for pavements but allow for a much greater amount of growing media (topsoil) than may be provided within the pores of a rock based structural soil. Proprietary Structural soils (a mixture of rock and loam) typcially provide greater flexibility and cost benefit by working with local soils as opposed to importing specialist mixes. This is good principle of stewardship of the land.

The major benefit of the soil cell systems is the significant increase in growing media for the trees resulting in better root distribution resulting in less risk of roots, for example, lifting pavements. This displacement may still occur if using a structural soil because of the amount of rock present in the mix still results in larger structural roots having less free space to grow and expand over time.

FIGURE 10 : StrataVault system tree trench installed in a roadway, Inverell, NSW 2018. Image courtesy of Citygreen.

This type of trench installation was used in Adelaide Street Brisbane however without the StrataVault product. StrataVault provides greater workability and flexibility when dealing with service crossings and maximising soil media for tree growth.

The greater the extent (depth and lateral spread) of the tree's root system the better the development of the tree. Therefore soil volume becomes a critical part of the process to ensure a tree is healthy and appropriate for the situation.

Structural soils and modular cells both allow for services to traverse the tree pit and various details exist depending on the type and depth of service.

Soil volume calculators are readily available and suggested soil volumes for various scale trees are as follows:

SMALL TREE	5 to 15 cubic metres	e.g, 3 x 3 x 1.5m deep
MEDIUM TREE	20 to 40 cubic metres	e.g, 3 x 9 x 1.5m deep
LARGE TREE	40 to 80 cubic metres	e.g, 7 x 7 x1.5m deep

Source: Quantities as recommended by CityGreen.

A6 OPPORTUNITIES FOR WSUD (WATER SENSITIVE URBAN DESIGN)

Tree planting and water treatment using WSUD devices are mutually beneficial to each other. Trees want water and WSUD devices want plants to uptake nutrients. The Queensland Government's Healthy Waterways best practices for WSUD are well documented and adopted by most Local Governments across the country and are particularly important where catchments enter our waterways and oceans.
With the majority of Australia's population living within close proximity to the coast, this is highly important to maintaining healthy waterways.

Fraser Coasts' climate typically has extended dry months which can lead to drought. It is also accustomed to heavy rainfall and flash flooding during the wet season. Harvesting storm water by using bio-retention and filtration with streetscape plantings is one of the ways that can help slow the water flow and lessen the impacts of flash flooding.

This coupled with hardy, drought resilient tree species will allow for shaded streets that can better suit the extremes of the Queensland climate.

This will also allow opportunity to support other garden beds around these trees. The trees will filter oils, heavy metals and other pollutants from the water which runs off hard surfaces such as roads and footpaths. This reduces impacts on waterways and consequently bio-filtration devices and rainwater detention systems should be part of all projects to treat stormwater; particularly in coastal communities.

FIGURE 11 a & b : King Street, Fortitude Valley is an EDQ project utilising in street bio-filtration devices to treat surface stormwater. Co-located with street buildouts, this installation provides excellant tree growing potential. Bio-filtration areas are divided from pedetrain traffic by low walls that double as street furniture. This could be achieved also with standard street furniture, i.e. seats and bins..

FIGURE 12 a & b : King Street, Fortitude Valley allows street trees to use low flow stormwater whereby water enters the tree pit from the kerb. Higher flows mostly bypass directly to the kerb inlets. Roof water from awnings can also pass through these devices although high flow bypass is required.

A7 WSUD BASINS OR WSUD STREET TREES

Single, large bio-filtration devices are far more economically efficient for new development compared to multiple, smaller bio-filtration devices installed with street trees. That said, the long term maintenance of large basins is a major challenge for Local Government. Street tree bio-filtration devices also present long-term maintenance issues however, the major benefit provided to the community is that street trees will be larger having received passive irrigation.

Over time bio-filtration will work less efficiently due to finer materials filling the pores in filtration sands that creates a bottleneck situation, leading to a lower percentage of filtration occurring. Issues and associated costs of maintaining any bio-filtration device is a significant challenge for Local Authorities and hence few Councils appear to be 'resetting' the bio-filtration after the 10-15 years of their expected life. Healthy Waterways recommends this is the time period a basin can function efficiently before requiring the replacement of filtration sands.

Currently, the vast majority of subdivision bio-basins preclude tree planting within the filtration devices so as to avoid the sands and sub-surface drainage system being compromised by tree root systems. Furthermore, too many trees might shade the grasses and sedges within the basin floor limiting their capacity to absorb nutrients and pollutants which is the basin's primary function. There is provision within the Healthy Waterways guidelines for basins that include trees but this is not generally accepted by most assessing Council engineers.

The benefits of treed bio-filtration basins are exponential, providing additional nutrient uptake and shading to limit weed incursion. Furthermore, basins often look unsightly with litter and debris washed into them and without trees can look somewhat out of character in suburban settings. In recent times it appears many Councils are allowing more 'natural' basins to be constructed where trees are allowed to be established in the basin floor.

The reality is that when a basin needs to be cleaned out and 'reset', all of the sands need to be removed. To do this a long-reach excavator would be required to excavate out all filtration sands approximately 500-900mm down to the drainage system. The scale of this operation is large and costly and if such a large excavator was on site then removing trees within the basin would not present a challenge to such a large machine.

Alternative solutions to create bio-filtration devices within the streetscape are becoming more viable with improvements in technology. Smaller street tree scale bio-filtration devices are becoming far more common within LGA's perhaps because developers do not lose any development yield by achieving the stormwater treatment requirements within the streetscape. Hence, WaterWise Street Tree installations are being developed across the country as highlighted within the publication by Water by Design's Water Wise Street Tree Booklet below.

FIGURE 13 : Taigum, Qld has no trees installed within the bio-filtration device. This basin has temporary turf installed until the sediment risk from undeveloped lots is reduced.

FIGURE 14 : Gumdale, Qld has trees installed within the bio-filtration device. Furthermore, with the consultation of an Arborist, the basin was designed to sit close to existing vegetation so the installation looks part of the natural landscape.

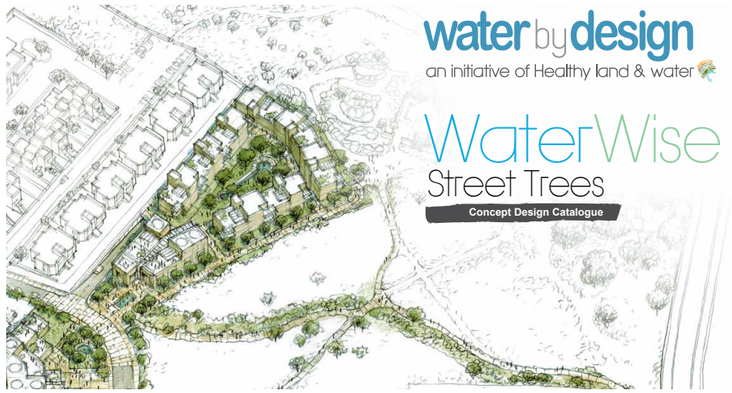


FIGURE 15 :WaterWise Street Trees, an initiative of Healthy Land & Water can be found at :
https://waterbydesign.com.au/news/water-wise-street-tree-booklet

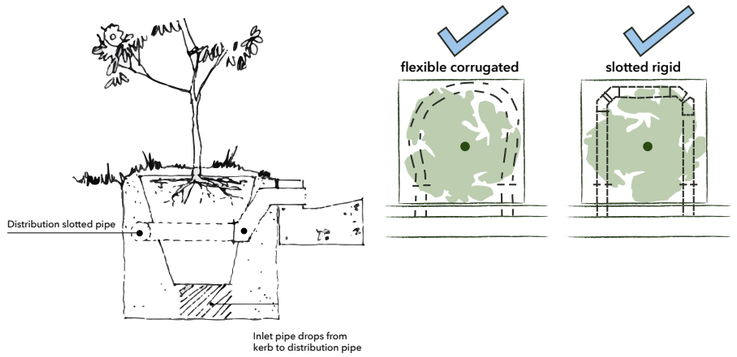


FIGURE 16: Detail for street tree Bio-filtration device from Water by Design where a simple kerb inlet and ag drain provides a water source for the street tree.

Healthy Land and Waters', Water by Design initiative is steering best practice across Australia. This initiative provides Local Authorities with the knowledge and know-how and would be an excellent project partner to take the concepts and recommendations of this Streetscape paper into reality.

A pilot project at Batten St Kedron, investigated the efficancy of retrofitting drainage systems to existing street trees. Pictured to the right, the project installed the drainage system to new planting without the removal of large amounts of kerb. Vacuum excavation was used in order to investigate any sub-surface conditions prior to installation. At approximately $500-$1200 per tree the relatively low cost installation demonstrates the benefits of a considered approach to each new tree planting.

Given the countless factors that contribute to a successful planting, having two near identical planter beds, tree species, light conditions and weather conditions allows for a scientific analysis into the effectiveness of installing such systems. With one simple installation of a drainage system we can begin to see quite clearly the need to consider the conditions in which plantings are placed in order to achieve quality outcomes.

Figure 17: Batten Street, Kedron QLD. Street tree planting trial site for Water by Design's drainage system.
Top Right: Drainage inlet.
Bottom Left: Tree with drainage system installed.
Bottom Right: Tree without drainage system installed.

Comparing the two tree specimens it is clear that the one with drainage installed has grown at an advanced rate and looks as secure (structurally) if not more than that of the specimen without drainage installed. While the results of this installation are yet to be observed over a longer period of time as the tree matures, it seems the results begin to speak for themselves.
While it's clear that the resources provided by this installation are better than none at all, the solutions to address bio-filtration and drainage are numerous.

FIGURE 18 : Sippy Downs, Qld utilises bio-filtration tree pits within the verge to treat run-off.

Sippy Downs, QLD uses tree pits as a form of bio-filtration to treat excess water run-off before it enters the main kerb inlet. Pits require tree grates to cover to finish surface level as there is typically a 200-300mm drop into the pit to allow stormwater to stand and permeate through the media.

This option is usually installed with new builds as it provides a reasonable level of water runoff in environments with masses of concrete and hardscape elements.

A8 - REACTIVE SOILS

Reactive soil is common across much of Australia including areas in Maryborough's CBD. These are soils that expand significantly when wet and contract when dry; causing cracking and erosion.

Trees can compound this issue because the soil they are planted into can affect surrounding reactive soils. Trees pull water out of the soil profile (soil suction) in drier times. This can cause movement within the reactive soils nearby, causing damage to infrastructure. Most trees are capable of causing drying settlement and very little is known by geo-technical engineers about the effects of individual species.

Where many trees are planted close together they compete for air and water and may extend their root systems well beyond standard distances. These root systems can be quite extensive given the right circumstances.

To overcome this issue a consistent moisture regime needs to be established to prevent the soil from moving excessively. Trees with a good water supply (replenished water storage in the soil) should not cause major problems however, over-watering will limit sound, structural development of roots which may cause instability.

One common solution is to separate the two soils (adjacent reactive soil and tree soils) through the use of root barriers or walling to isolate the tree from the surrounding soil. This barrier system should have sufficient drainage to ensure tree pits dry out allowing air to be taken up by the plant.

A second or perhaps, complementary option can be to irrigate the soil profile and monitor the moisture content so the soil moisture level remains consistent. Again drainage should be provided to allow for a stable, natural, wetting and drying process that will promote good tree growth. This option may not be viable if the current soil moisture under building foundations is very dry as introducing water could be damaging.

By following best practices public and private assets can be protected and managed in areas where there are reactive soils and trees present.

Guideline

Assessment of the reactivity of soils should occur within 1.5 to 2 times the distance of proposed trees planting as per AS2870 and Qld Building Code recommendations, e.g. a 10m high tree can affect certain soils up to 15-20m away from the tree. Hence, soils should be tested for the reactivity or sufficient root barrier should be used to reduce potential changes in soil moisture

Most trees will not grow well in an anaerobic soil profile i.e., no air or water-logged soil. Trees grow best in an oxygen and nutrient rich, free-draining soil profile where there is access to both air and water. Any manufactured soil media should be isolated from service trenches, as they are usually back-filled with coarse sand which acts as a highway for root growth. Although generally nutrient deficient, this allows for an unobstructed pathway for roots. Where practical, tree species with less invasive roots should be selected.

On a new residential subdivision locating trees is normally easier to control because there are few services located to the centre of lots, driveways and light poles are also typically aligned to side boundaries. In more urbanised areas services can be in many locations and hence locating trees can be more problematic.

In older suburbs, where Building Approval records exist, site classification will be evident on the strucutral engineers plans and a sample of houses in a street will provide Council with insight on likely reactivity without actual testing.

LOCATING NEW TREES - KEY QUESTIONS

1. Are there overhead wires, awnings, or other trees that should prevent this tree being planted?

2. Are there underground obstructions such as services, pits, walls etc that should prevent this tree being planted?

3. Does the planting pit/location provide sufficient soil volume/ clearance and is it sufficient for long term growth?
If no, is there opportunity for this to be improved ?

4. Is the clearance to the kerb and footpath sufficient? (minimum 900mm to kerb, minimum 700mm to footpath, 3m to 60km travel lane)

5. Is this location adjoining a public reserve or park with more significant trees and therefore a street tree should not be planted?

6. Is the tree likely to cause any sight line issues to traffic lights, signs, driveways or intersections?

7. Are the trees spaced far enough apart?
(4-8 m Small, 7-15m Medium, 15-20m Large)

8. Are the proposed tree plantings near any significant Heritage buildings and if so, what is the soil reactivity for the planting site ?

A9 - TREE SPECIES SELECTION
RIGHT TREE, RIGHT PLACE

Understanding the conditions for tree planting and selecting the appropriate type and form of tree to be planted within a streetscape is a significant decision in urban areas. Knowing how the tree will interact with the surrounding urban environment is important for the tree and its surrounding environment.

For example, the roots of a Fig Tree (Ficus sp.) can be large and strong, which can result in roads and footpaths being lifted out of the ground and cracked.

It is important that the selected tree does not conflict with services, buildings, awnings, footpaths and roads yet produces a sufficient amount of shade and amenity for the streetscape environment.

There are many different approaches to how this can be achieved because every streetscape has different characteristics and levels of risk to consider.

The following street species have been selected because they are well known performers in urban streetscapes in southern Queensland and are suitable for use in the Fraser Coast LGA.


Agathis robusta


Backhousia citriodora


Banksia intergrifolia


Brachychiton acerifolius


Buckinghamia celissima


Cupaniopsis anacradiodes


Elaeocarpus eumundii


Elaeocarpus reticulatus


Flindersia australis


Flindersia schottiana


Grevillea baileyana


Harpullia pendula


Lophostemon confertus


Tabebuia palmeri/ pallida/ rosea


Peltophorum pterocarpum


Waterhousia floribunda

FIGURE 19: Preferred Street Tree species

PROPOSED STREET TREE SPECIES

				HABIT		LOCATION						INFRASTRUCTURE SETBACKS
Botanical Name	Common Name	Size	Best performers in streetscape conditions	Spreading	Columnar (may suit placement near awnings)	Coastal	Medians or Buildout gardens only	CBD Streetscapes	Suburban Streetscapes - Residential streets	Suburban backyards	Major Roads and roundabouts	Street Light Setback
Large Trees 20m+												
Agathis robusta	Queensland Kauri Pine	L			✓		✓	?			✓	>5
Araucaria cookii	Captain Cook's Pine	L			✓	✓	✓				✓	>5
Araucaria cunninghamii	Hoop Pine	L			✓	✓	✓				✓	>5
Araucaria heterophylla	Norfolk Island Pine	L			✓	✓	✓				✓	>5
Ficus sp. E.g fraseri, macrophyla	Fig trees - various	VL		✓	✓	✓	✓				✓	>12
Flindersia schottiana	Bumpy Ash, Silver Ash, Cudgerie	L	✓	✓		✓	✓	✓			✓	>7
Medium Trees 10-20m												
Alphitonia petriei	White Ash, Pink Ash	M	✓	✓								>7
Banksia integrifolia	Coastal Banksia	M	✓	✓		✓	✓	✓	✓			>7
Brachychiton acerifolius	Illawarra Flame Tree	M	✓				✓		✓			>7
Brachychiton populneus	Kurrajong	M		✓			✓		✓			>7
Cryptocarya glaucescens	Jackwood	M		✓			✓		✓			>7
Cryptocarya triplinervis	Three-veined laurel	M		✓			✓		✓			>7
Cupaniopsis anacardioides	Tuckeroo	S	✓			✓	✓	✓		✓		>7
Cupaniopsis parvifolia	Small-leaved Tuckeroo	M		✓			✓	✓	✓			>7
Elaeocarpus eumundi	Eumundi Quandong	M	✓		✓		✓		✓			>5
Flindersia australis	Crows Ash	M	✓	✓			✓		✓	✓		>7
Glochidion ferdinandi	Cheese Tree	M	✓	✓			✓	✓	✓	✓		>7
Harpullia pendula	Tulipwood	M	✓	✓			✓	✓	✓	✓		>7
Lophostemon suaveolens	Swamp Box	M				✓	✓			✓		>7
Peltophorum pterocarpum	Yellow Jacaranda / Poinciana	M	✓	✓			✓		✓	✓		>7
Stenocarpus sinuatus	Firewheel Tree	M			✓		✓		✓	✓		>5
Syzygium australe	Brush Cherry	M	✓		✓	✓			✓	✓		>5
Syzygium smithii	Magenta Lilly Pilly	M	✓	✓		✓	✓		✓	✓		>5
Terminalia catappa syn.arenicola	Beach Almond	M				✓						>7
Tristaniopsis laurina	Water Gum	M	✓	✓		✓	✓	✓		✓		>7
Waterhousia floribunda	Weeping Lilly Pilly	M	✓	✓						✓		>7
Small Trees 5 to 10m												
Acronychia imperforata	Beach Acronychia, Fraser Island Apple	S				✓				✓		>7
Alphitonia excelsa	Red Ash	S		✓		✓				✓		>7
Backhousia citriodora	Lemon-scented Myrtle	S	✓	✓			✓		✓	✓		>7
Backhousia myrtifolia	Carrol, Grey Myrtle	S	✓	✓			✓		✓	✓		>7
Buckinghamia celissima	Ivory Curl Flower	S	✓	✓			✓	✓		✓		>7
Elaeocarpus reticulatus	Blueberry Ash	S	✓		✓		✓		✓			>7
Grevillea baileyana	White oak	S	✓		✓	✓	✓			✓		>7
Hymenosporum flavum	Native Frangipanni	S			✓		✓	✓	✓	✓		>7
Melaleuca (syn. Callistemon) viminalis	Weeping Bottlebrush	S	✓	✓				✓		✓		>4
Meleleuca (syn. Callistemon) saligna	Willow Bottlebrush	S	✓			✓	✓	✓	✓	✓		>7
Syzygium leuhmannii	Riberry, Small-leaved Lilly Pilly	S			✓		✓	✓		✓		>4
Xanthostemon chrysanthus	Golden Penda	S	✓				✓	✓		✓		>4

A11 - STREET TREE PLANTING METHODS

There are many methods to plant a tree and providing adequate resources for a tree to grow is a complex topic. Fundamentally, without adequate growing space, i.e., soil media for root growth, then trees seldom reach their full potential. Hence, many experts favour allocating more of the available budget for a larger excavation and more topsoil rather than spending the budget on larger bag stock. Planting a 25L or 300mm pot at $50 per tree can spread budgets further than if planting 45L ($110) or 100L ($200+). When in the right soil media a tree will achieve these large sizes within the first growing season of 12-18 months.

The cost/benefit analysis may suggest a tipping point in which the cost to install systems to support the growth of the tree become unnecessary to achieve an outcome that fits within budget and provides an acceptable level of shade.

Figure 20 illustrates four different street tree planting installations that increase in complexity and cost. These four installations are commonly used systems in South-East Queensland. Assuming the trees planted are of the same quality the graphic aims to illustrate the potential size variable between the four examples as the tree begins to mature (12-18 months).

Most street trees installed in new residential estates are as per Figure 20a. This installation is the minimum called for by Local Authorities via their planning schemes and hence is the minimum developers have to achieve to satisfy their development approval conditions.

For the provision of the tree (assuming 45lt stock), stakes to support , topsoil and mulch one can expect $150 cost per tree for this planting on a residential estate where generally 30-50 trees are installed over a 1-2 day period. The failures of this detail is that most new developments involve substantial earthworks and the entire site often is compacted to Class1 standards. Consequently very little or no topsoil remains around the actual location for the street tree so its potential to develop to its intended mature height and spread is immediately compromised.

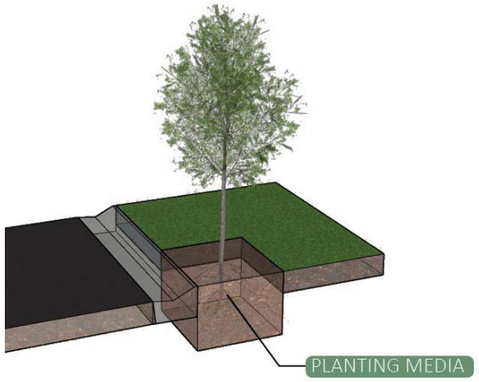
With smaller planting areas and no structural soil systems provided the trees roots will seek to extend into adjacent sub-surfaces (i.e. under roadway, lawns, driveway etc) and either stop, stunting its growth or mature and become potentially destructive (depending on species selected). In many scenarios, given adequate space to grow this is certainly an acceptable solution, however it does have its limitations in densifying the shade in streets and towns.

Figure 20b shows a tree planted with the same principals applied to the tree in Figure 20a, however this time it is given increased growing media, allowing for more space for the roots to develop. This example is one that is still low cost, but in the scenario where space for plantings is provided, this will allow a tree to reach a greater height, with increased stability due to a more even spread of roots.

Figure 20c illustrates the example observed at Batten St. (Section A7). With a kerb cut out in two places to allow excess surface water to permeate through the planting area to passively irrigate the tree.

This option compared to the tree details 20a and 20b will allow the tree to grow at an increased rate, shading the street more efficiently. This planting will treat small volumes of stormwater whilst providing necessary nutrients to the tree.

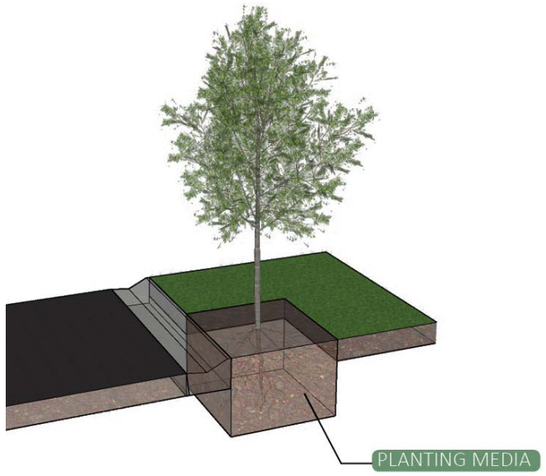
Figure 20d is based on the Brisbane City Council WSUD tree pit detail and allows passive irrigation, water polishing and filtration. One key difference is that this tree detail requires water to pass through the soil media to a drainage pipe that connects to the street's stormwater system. Without this connection to the stormwater system the tree could potentially sit in wet soil and not develop well. Hence, this detail only works where an appropriate stormwater invert connection is available.



20a: **STANDARD STREET TREE PLANTING** to a subdivision typcially involves planting a 45L tree a 450mm auger from an excavator, ripping the sides of the hole. In heavy soils this can create a compacted bucket for the tree to sit within and does not allow for easy development of the root system.

PROBABLE INSTALLATION COSTS
for 30 trees

	Per Tree	
Hole preparation		
Machine /2 staff		$ 1,500
Topsoil per tree	$ 0	
Tree cost 45L	$ 80	
Mulch & Stakes	$ 20	
Total 30 trees		$ 4,500
Per tree		$ 150

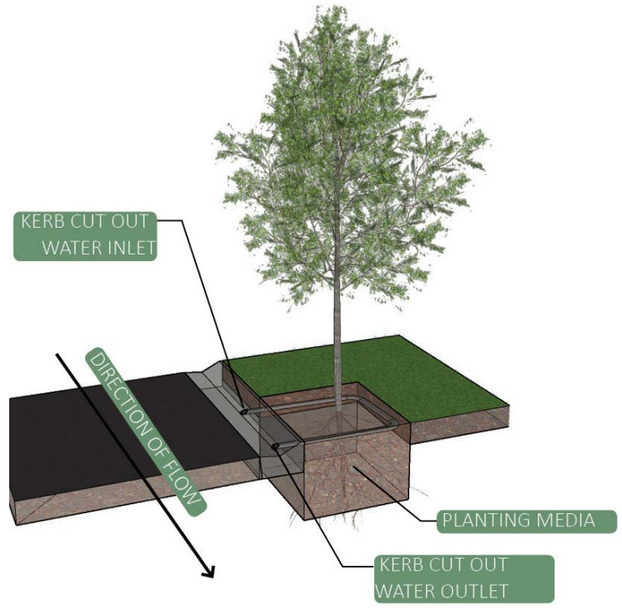


20b: STREET TREE PLANTING WITH ADDITIONAL GROWING MEDIA

This installation involves excavating a larger hole e.g a 2m long 600mm wide trench to 600mm deep - 0.75 cu.m spoil. New topsoil 0.75 cu.m. Topsoil truck stays all day to be progressively unloaded.
Replacement turf and or mulch 2 sqm.

PROBABLE INSTALLATION COSTS
for 30 trees

	Per Tree	
Hole preparation		
Machine /2 staff		$ 1,500
Cart offsite spoil		$ 1,500
Topsoil per tree	$ 60	$ 1,800
Tree cost 45L	$ 80	$ 2,400
Mulch/turf & Stakes	$ 40	$ 1,200
Traffic control		$ 600
Total 30 trees		$ 9,000
Per tree		$ 300

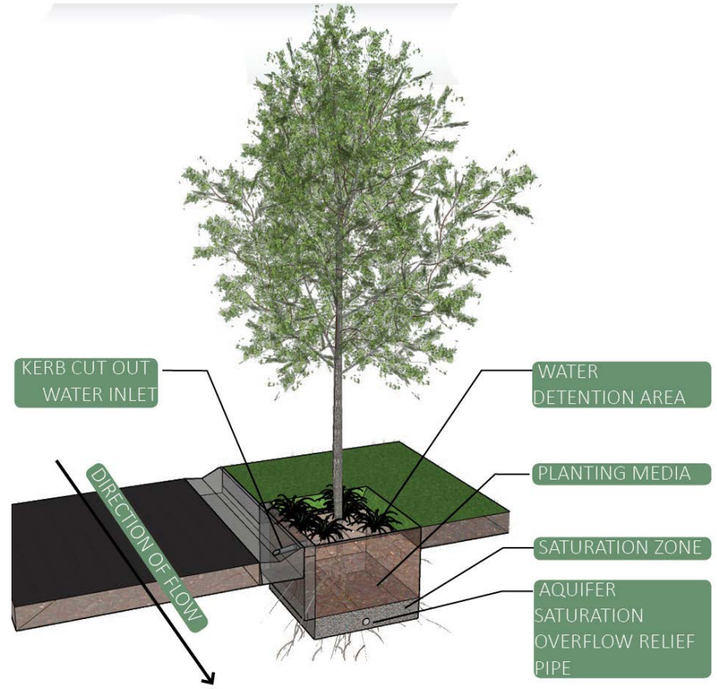


20c: STREET TREE PLANTING WITH ADDITIONAL GROWING MEDIA and passive irrigation

Same as 20b plus installation of kerb adpator drainage inlet and subsoil drainage.

PROBABLE INSTALLATION COSTS
for 30 trees

	Per Tree	
Hole preparation (COST FROM 20b)		
Machine per day /2 staff		$ 1,500
Cart offsite spoil		$ 1,500
Topsoil per tree	$ 60	$ 1,800
Tree cost 45L	$ 80	$ 2,400
Mulch/turf & Stakes	$ 40	$ 1,200
Traffic control		$ 600
Sawcutting for kerb adaptor		$ 1,200
Kerb adapter and subsoil installed during tree pit build incl.. labour		$ 3,600
Total 30 trees		$ 13,800
Per tree		$ 460



20d: STREET TREE PLANTING IN BIO POD PASSIVE IRRIGATION AND WATER STORAGE

Based on the BCC standard design tendered prices range from $4000-5000 to achieve this detail on a new build.

Costs would likely increase again for tree installations in existing streetscapes due to traffic control and managing materials in public areas.

FIGURE 20 : Different methods of street tree installation. Costs are based on planting a minimum of 30+ trees as opposed to individual installations.

A12 - RESOURCING STREET TREE PLANTING PROGRAMS

The complexity and effort to install street trees into different types of streetscapes differs greatly but any type of installation must be well planned and maintained to seek any return for investment. In urban environments the costs to remove pavement and prepare suitable root growing media is expensive but returns a reduced cost long term given maintenence is likely less problematic.

The issues being experienced with street trees in Maryborough's CBD has resulted in many being removed after less than 20 years. Improved planning and a higher level maintenance regime would have seen many of the issues experienced being mitigated. The cost/benefit analysis of street tree programs can be hard for stakeholders to appreciate. Proper resourcing ensures the benefits extend over many decades instead a only 10-20 years.

To achieve the desired benefits and to see results, resourcing needs to occur at many levels to ensure success. A choice has to be made if the current, reactive, tree management process is appropriate and cost effective, or does a more proactive process benefit both the community and meet budgets. A proactive strategy requires extra resources initially but will reduce the financial strain of long-term maintenance. Managing a tree at ground level to undertake formative pruning is far more cost effective than carrying out pruning at height from an elevated work platform.

As part of a proactive approach to tree management there will be need for all stakeholders (community, Council and service providers) to be involved at some stage. A high level of co-ordination and education about the project is ultimately critical for its success. Gone are the days of digging a hole, filling it with a plant, only to check on it when there's a request.

Typical resourcing / task demand is as follows:

Strategic planning & coordination - Project Officer to determine where, when and what to set budgets and lead the rollout. The team leader would be vital in educating and liaising with other Council teams and determining how their projects may affect street tree installations. They would also need to understand what upcoming utilities projects may affect installed works. For example, Ergon or TMR might have planned upcoming projects so understanding their intent will guide when/ where projects are scheduled.

Public relations – Will be vital to the success of the strategy. Having the community and wider public onside by liaising with all stakeholders will allow a more effective rollout. This will ideally avoid conflicts such as the planting team arriving onsite to meet a resident that is either uninformed or uninterested in a tree planting on their nature strip.

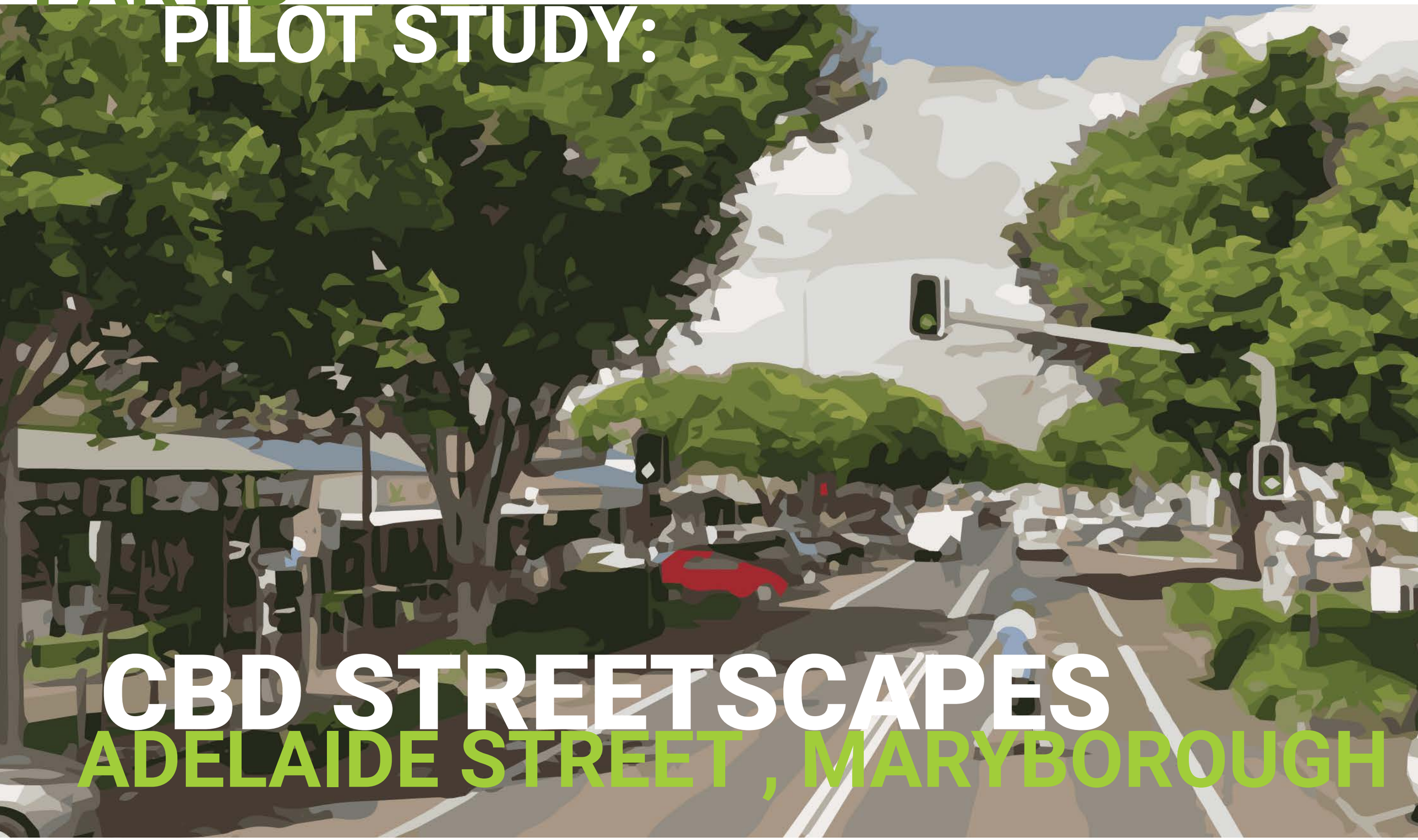
Purchasing vs Growing – Many Councils have their own nurseries to establish trees for their locality. Suppliers and growers need to understand what the tree is for and what will be the growing environment. It is important to be specific about what tree you need. Stock and species selection is as important as maintenance and management so that costs can be controlled. Stock that doesn't meet the required standard needs to be culled and the correct tree planted in the right location.

Establishment Team - Having qualified staff will also contribute to an effective management strategy. Qualified Horticulturists and Arborists in the field with current industry knowledge will ensure a high quality outcome is achieved and the asset (tree stock) is given the best chance of survival. In the establishment phase correct pruning, watering and fertilising will ensure the best chance for the trees' success.

Having appropriately qualified personnel at the establishment and early management stage of planted trees will significantly reduce ongoing maintenance costs as the trees mature. Arboricultural qualifications become increasingly important as the tree grows, therefore reducing the need for a reactive approach to tree pruning and maintenance.

Through investment in a proactive tree establishment and management strategy with a clear set of goals in mind the benefits to the community will be improved. Specifically, increased canopy cover will reduce the heat island effect and this in turn should increase the use of the public realm. Whilst initial costs to establish this scheme are greater than the current reactive approach, the benefits to the community are increased and the overall cost of tree management over its lifetime are reduced.

PART B
PILOT STUDY:



CBD STREETSCAPES
ADELAIDE STREET , MARYBOROUGH

B1 - EXISTING STREET PLANTING

The street trees throughout the Maryborough CBD were planted approximately 15-20 years ago as part of a CBD Revitalisation works. Many of these trees, mostly Peltophorum sp., Xanthostemon sp. and Tabebuia sp. have developed to a moderate size with a Diameter at Breast Height (DBH) in the order of 200-500mm depending on locality. These trees were planted into excavated holes with a root deflector in an attempt to encourage root growth beneath the surrounding kerb, i.e., so as not to lift the kerb.

The existing trees have all developed relatively well which suggests access to air and water has not been problematic. The trees also grew very quickly initially and it was during these early years that formative pruning around awnings would have been required to train the trees around these obstructions.

The Peltophorum sp. in Ellena Street have developed larger trunks and have started to impact nearby pavements but not in any major way to result in the trees needing to be removed. This is likely as a result of less space for lateral root development and hence most roots, structural and feeder roots are concentrated within the limited space of the planter buildout. Lifting pavements is more problematic on streets that have little longitudinal grade because water can sit in the gutter and start to degrade the road pavement in some cases.

Street trees can become contentious amongst adjacent landowners and stakeholders (tenants, businesses etc.) and it is not unusual for there to be a long-term ongoing discussion around whether trees should be provided.

Images across illustrate the evolution of one intersection, Adelaide Street & Ellena Street, in Maryborough adjacent the CBD pilot site.

- No trees existed anywhere along Adelaide Street around year 2000 with the exception of the fig trees at the Town Hall.
- Street trees were installed along both streets around 2000 as part of a CBD Revitalisation project.
- By 2006 trees had become well established and were growing too well.
- Recent CBD works have mostly replaced trees with pre-cast planters that can support very small trees or shrubs.

FIGURE 21a : 2006 Image of Adelaide Street looking north. Street trees (mostly Peltophorum sp.) at approx. 5 years of growth including mid-block tree plantings.

FIGURE 21b : 2018 Image of Adelaide Street looking north. Street trees replaced with pavements, precast planters and some new Agathis sp. in front of the church now offers less shade to pedestrians.

FIGURE 21c : 2018 Image of Ellena Street looking west. Street trees planted in 2002 remain. Trees frame the street and provide shade at corners where people gather. Ellena Street eastern side now bare.

CBD Street trees require adequate budgets for assets teams to ensure long-term management is successful. Species selection is critical when awnings exist and seasonal removal of leaf litter may be required or alternative drainage systems installed.

In Maryborough most awnings fall back towards the building to a box gutter. This scenario can be particularly problematic should leaves obstruct the roof water drain. The use of technology such as 360 cameras (mounted on a staff) or drones are ways some local authorities inspect and manage these issues.

The same scenario of awnings with box gutters occurs in Adelaide Street, Brisbane and Leopard trees also drop a lot of fine leaf and flowers similar to the Peltophorum in Maryborough.

The main difference between these scenarios is that Brisbane has a much larger rates base than that of Maryborough and funds ongoing maintenance. Hence it is not uncommon for smaller Local Authorities to inadequately resource tree management. Resourcing needs to be resolved before street trees are planted because without proper management and funding the trees will likely cause damage and expense.

Guideline

When any street trees are being removed in the future, as part of on going streetscape works or due to tree maintenance concerns, Councils' arborists should inspect the planters to examine the trees' root distribution to better understand how the roots have developed within the current planting scenario. This is best achieved by vacuum excavating the planter to understand what distribution of roots exists. From this Council will better understand whether to incorporate root/moisture barriers and the like. The tree planter details provided in this report are generic and would require further site information e.g., soil types (reactivity and permeability) and invert depths of drainage as a minimum.

B2 - CBD STREETSCAPE PILOT STUDY

Adelaide Street, Maryborough (Ellena Street to Alice Street)

Fraser Coast Council is committed to maintaining a presence in the Maryborough CBD and revitalising the city centre. By enhancing the local character of Adelaide street through the revitalisation project and the Greening Fraser Coast project, it will provide environmental benefits, the capacity to build better communities and assist economic growth.

The pilot study of Adelaide Street will explore the reduction of potential heat island effects, reactive soils within the streetscape, harvesting stormwater, and the impacts on existing infrastructure of providing more shade trees.

Adelaide Street is a two-way CBD street with parallel parking and loading zones. The majority of the footpath is covered by shop awnings that have box gutters or similar along the building line. This scenario is not uncommon throughout Queensland towns and cities. The desired greening outcome, to add more street trees typically results in the reduction of on-street parking. Councils will often offset this reduction by developing new off-street carparks within the precinct that offer better parking efficiency and improved shading and lighting.

FIGURE 22 : Images of Adelaide Street, Peltophorum sp planted approx, 2002 are now well established.

ADELAIDE STREET, MARYBOROUGH

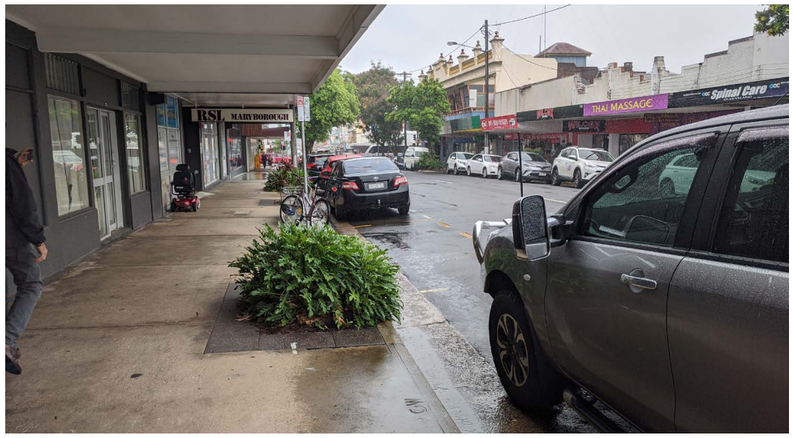
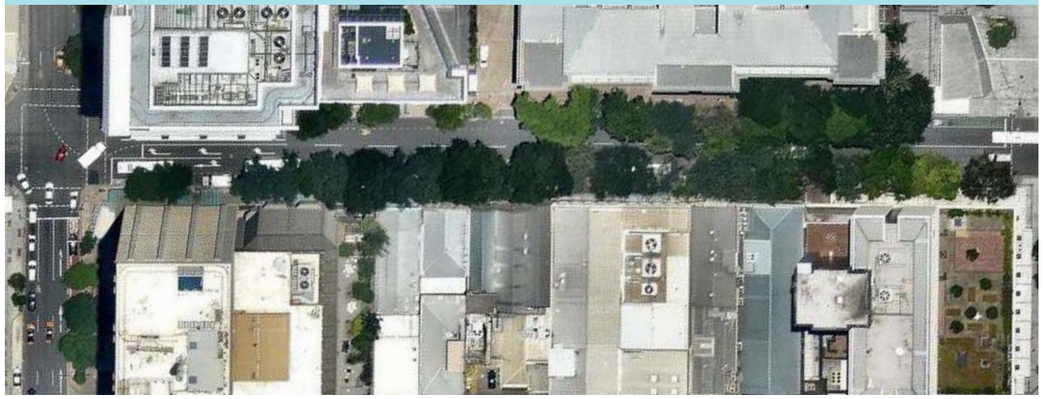


FIGURE 23 : Images of Adelaide Street, Philodendron sp. to under awning planters provide some green relief to otherwise austere footpaths

FIGURE 24 : Images of Adelaide Street, smaller planter buildouts with on the street have shown to allow reasonable growth to smaller species such as Tabebuia sp. or Xanthostemon sp.

ADELAIDE STREET, BRISBANE - An Urban Greening Exempler



B3 - STREET TREE EXEMPLAR: ADELAIDE STREET, BRISBANE

Adelaide Street in Brisbane's CBD is probably one of the best examples of urban greening to CBD streetscapes in the State. Canopies of trees have become inter-connected forming cohesive greenspace above the street.

Proper preparation of sub-surface conditions, planning of service alignments and greater setback of the trunk from the kerb creates space for the trees root plate to establish.

It is essential that a balance between amenity and parking is established within the streetscape so that the common goals and aims of the Greening Fraser Coast project and the Revitalisation of Maryborough projects can both be achieved.

FIGURE 25: Adelaide Street, BRISBANE
Example of large, street trees (Caeselpinea sp.) estbalished to create a continuous canopy over the road and footpath.

Formative pruning reduces the amount of canopy above awnings and show signage is visible. Trunk diameter exceeds 400-500mm with little impact on surrounding infrastructure. Images: Nearmap.

Adelaide Street in Maryborough and Brisbane both had street trees planted approximately 20 years ago.

The main difference between the outcomes achieved is due to structural soil systems and ongoing formative pruning.

B4 - TREE PLANTING COMPARISON - OPTION 1

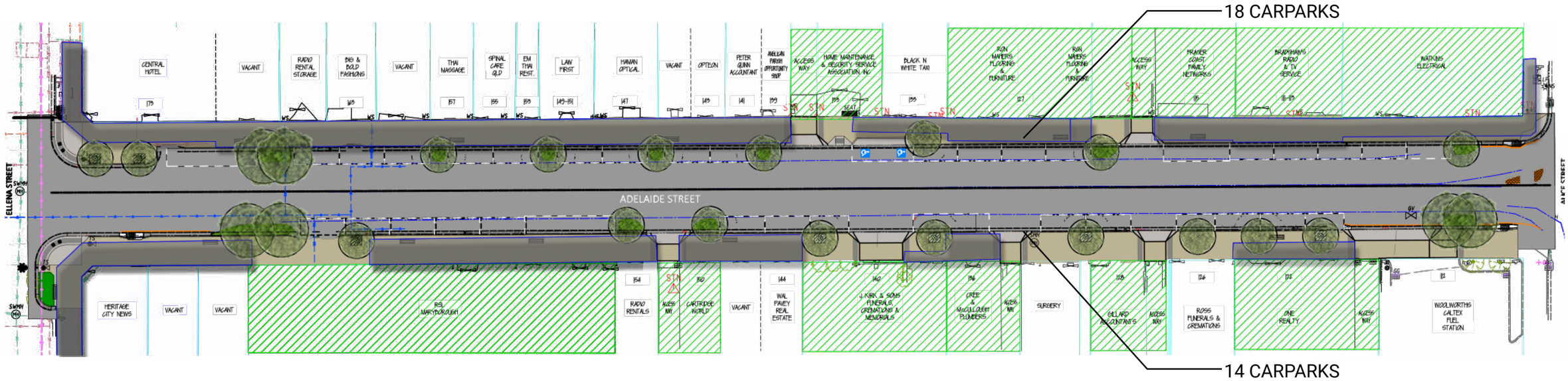
The main aim of Greening the Fraser Coast: Streetscapes is to maximise the canopy cover over the hottest part of the streetscape which is the road and pedestrian pavements. Awnings provide most shading to pedestrian's but tree shading will provide the most cooling because the trees will overhang and shade roads, pavements and awnings.

Over the next few pages various options are explored to illustrate different scenarios for the pilot site that provide different outcomes.

All options will provide improved visual amenity to the streetscape but will achieve differing levels of shading and cooling.

Option 1 below utilises predominantly smaller in-road buildouts along the streetscape with smaller, columnar tree species proposed. Species such as Elaeocarpus sp. or Backhousia sp. for example.

The aim of this option is to minimise conflicts; this being of major concern to Council. This option provides the least shade for cooling. Ideally these street trees have a clear trunk of minimum 2.5m when mature to ensure awning signage maintains visibility. The small buildouts limit the opportunity for larger tree species to be installed safely unless structural soil infrastructure is also adopted. This is because larger species will likely have a more developed root plate and Structural Root Zone (SRZ). The SRZ is the area around the base of a tree required for the tree's stability in the ground. The woody root growth and soil cohesion in this area are necessary to hold the tree upright. These structural roots can lift pavements and kerbs, especially in certain soil types and particularly with larger species e.g. Ficus species.



OPTION 1	Existing	Option 1	Difference
Number of Trees	11	24	+13
Number of 2P Carparks	31	32	+1
Loading zones (Lm)	63.9m	44.8m	-19.1m
Number of in street build-outs	4	11	+7
Number of in path Beds	17	10	-7

Design intent:
Option 1 illustrates what Adelaide St. could look like with MANY, SMALLER TREES.
To maximise parking all areas without awnings were utilised for footpath tree planting.
To achieve street trees on the western side of the road build-outs are required. Locating the build-outs strategically, we are able to significantly increase the number of trees and gain an additional car park compared with existing.

LEGEND

STREET TREE
SPECIES
COMMON NAME

PLANTING AREA
REFER TO SCHEDULE

OFFSTREET ACCESS
BUSINESS WITH OFFSTREET ACCESS

OPTION 1 - MAXIMUM TREES WHILST MAINTAINING CARPARK NUMBERS

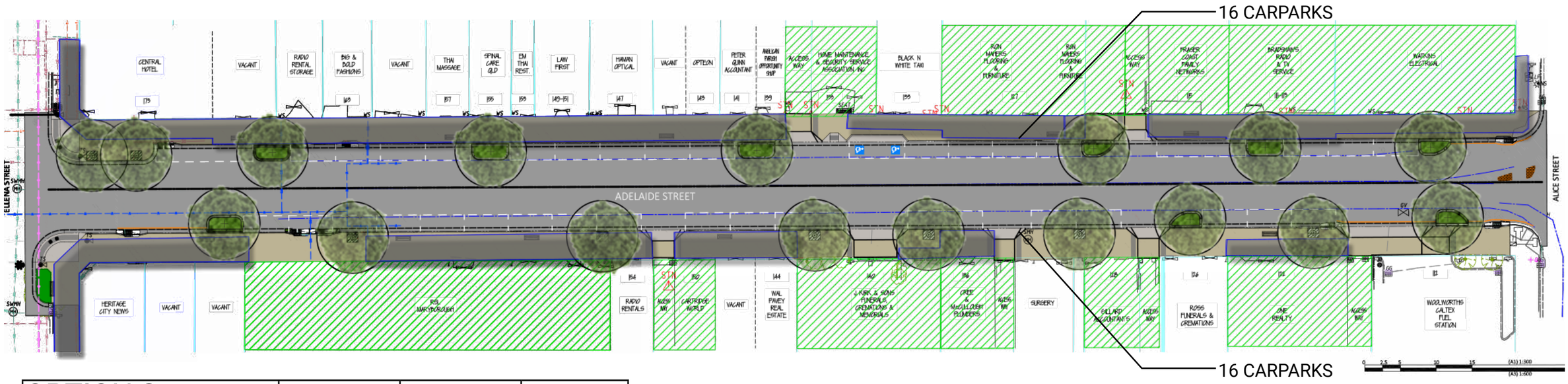
B4 - TREE PLANTING COMPARISON - OPTION 2

Option 2 takes the approach where fewer, larger tree species are located along Adelaide Street. Whilst there are fewer trees, there may be an equivalent amount of shade if larger species were used, i.e. Waterhousia sp. etc.

Larger species can safely be utilised where there is ample planting space be it through larger streetscape buildouts planters or through the use of structural soils; or ideally both.

Given that Maryborough's CBD has heavy clay soils and drainage issues the use of structural soil systems would be encouraged because any tree planting would otherwise be containerised within the excavated clay buildouts provided.

This option has roughly the same surface area for planters as Option 1 but the areas are consolidated into fewer, larger buildouts. Without structural soil systems in place, a more conservative street tree species selection would be required as there is less certainty the root system will develop in balance with the canopy to provide a stable tree.



OPTION 2	Existing	Option 2	Difference
Number of Trees	11	17	+5
Number of 2P Carparks	31	32	+1
Loading zones (Lm)	63.9m	44.9m	-19m
Number of in street build-outs	4	9	+5
Number of in path Beds	17	7	-10

Design intent:

Option 2 illustrates what Adelaide St. could look like with FEWER, LARGER TREES.

To maximise parking, all areas without awnings were utilised for in footpath planting.

Larger build-outs are required to allow for larger species root systems. Whilst fewer trees, we are able to increase canopy coverage and gain an additional carpark when compared with existing.

Both options could utilise structural soil/ cell technologies to improve the quaility of the installation and produce better trees and canopy.

LEGEND

STREET TREE
SPECIES
COMMON NAME

PLANTING AREA
REFER TO SCHEDULE

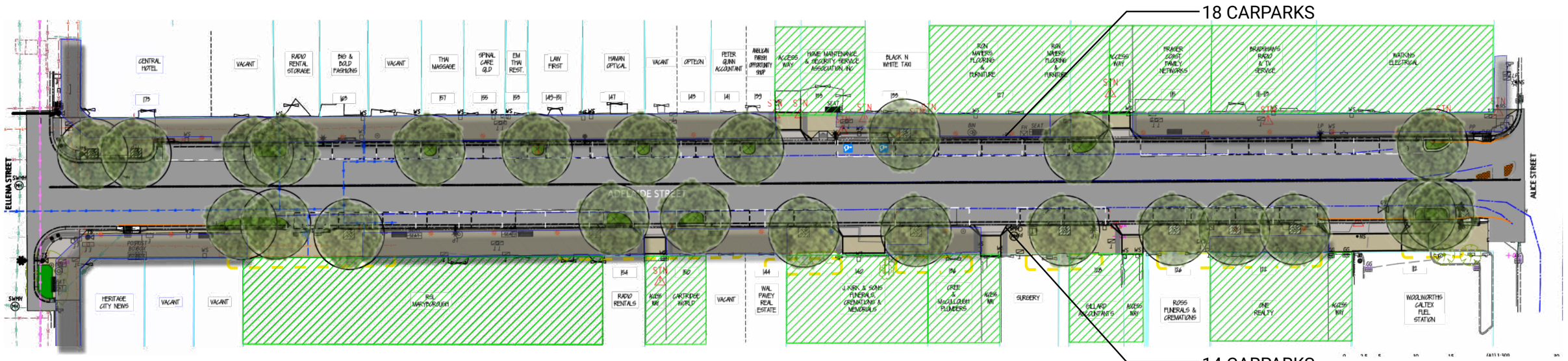
OFFSTREET ACCESS
BUSINESS WITH OFFSTREET ACCESS

OPTION 2 - FEWER, LARGER TREES IN LARGER BUILDOUTS - MAINTAINS CARPARK NUMBERS

B4 - TREE PLANTING COMPARISON - OPTION 3

Option 3 has the same smaller planters of Option 1 but through the addition of a structural soil system larger species can be grown in these 'smaller' surface planters because the trees will develop substantial root systems allowing larger development. Where trees are close enough together these soil cell systems could be made a continuous trench. This is often the most economical way to create enough space to achieve the minimum soil volumes required.

FIGURE x : Example of CityGreen's StrateVault system installed in a continuous tree trench at Inverell, NSW 2018. This is similar to Option 3.



OPTION 3	Existing	Option 2	Difference
Number of Trees	11	24	+13
Number of 2P Carparks	31	32	+1
Loading zones (Lm)	63.9m	44.8m	-19.1m
Number of in street build-outs	4	11	+7
Number of in path Beds	17	10	-7

Design intent:

Option 3 illustrates what Adelaide St. could look like with MORE, LARGER TREES.

This is achieved through the use of structural soil systems. These underground trenches house the trees root systems allowing it to grow larger without limiting street level utilities like carparking. To maximise parking, all areas without awnings were utilised for in footpath planting. From a greening perspective this is the ultimate option as it cools the largest amount of surface area.

LEGEND

- STREET TREE REFER TO SCHEDULE
- PLANTING AREA REFER TO SCHEDULE
- BUSINESS WITH OFFSTREET ACC EG REAR PARKING/LOADING
- OPPORTUNITIES FOR TREE TRENCHES FOR STRUCTURAL SOIL SYSTEMS

OPTION 3 - SAME TREES AS OPTION 1 BUT WITH STRUCTURAL SOIL SYSTEMS INTRODUCED

B5 - SHADOW STUDY 3D MODEL

BIG TREES vs SMALL TREES

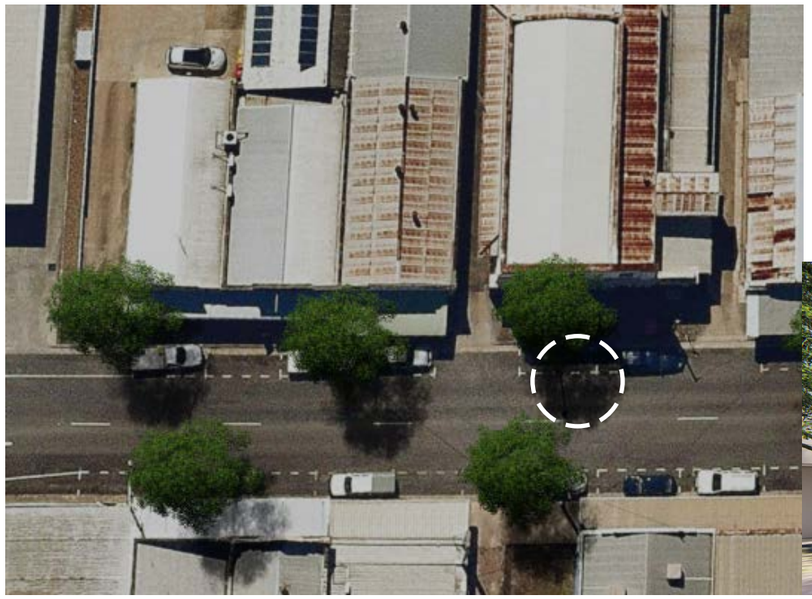
The logistics of planting avenues of trees within built up zones like the Maryborough CBD become numerous as factors like services, awnings, carparking, shade coverage etc are considered. While many options are possible, it must be considered for the prefered option.

Increasing street tree numbers is typically the best way to achieve quality shading results. However, if there are too many physical constraints to achieve many street trees in the street than fewer, larger trees may still provide the desired shading outcomes.

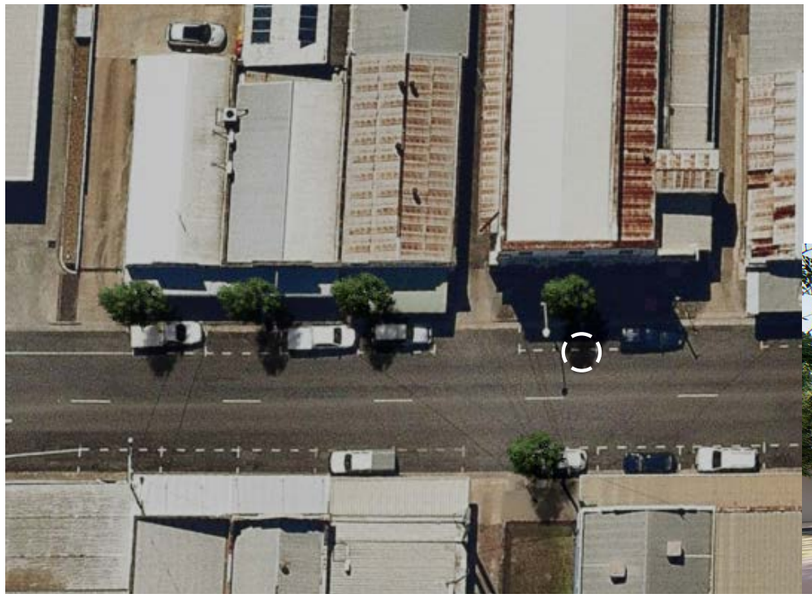
People are more likely to gather or converge to street corners or mid-block crossing points. These locations are also desirable street tree positions to assist in framing views along the street for visual amenity outcomes and to assist with traffic calming outcomes. That said, every street is different and some streets might have areas with no awning or small, public spaces outside specific businesses (e.g. food and beverage outlets). Likewise, street trees in buildouts will occupy carparking spaces at various points along the street and various businesses will have a higher carparking demand than others. So whilst street corners and mid-block crossings are generally priority tree planting zones if only a few tree locations can be achieved within constraints and budget than these placements need assessment to best locate these trees. This will limit carparking issues and maximise cooling of any other key locations. Otherwise, the locations should be evenly dispersed so that the shade created by one tree does not overlap the shade of another tree; there is less cooling benefit if trees shade the same pavement than shading different areas of pavement.

Ideally to achieve best shading outcomes both increasing quantity and quality (larger species) would be the best outcome.

A simple 3D shadow model demonstrates the scale of additional shade that might be achieved using large trees. The model allows height and spread to be taken into account.



LARGE TREES SHADOWS (AT 2PM, MARCH)



SMALL TREES SHADOWS (AT 2PM, MARCH)

FIGURE 26: Diagram showing differences in tree shading outcomes for different sized trees.

Based on the shadows cast at 2pm on a March day we can observe that the option with large trees projects a shadow over 5x the size of that of the small trees, covering 26% of the immediate area (white dashed linework) vs. 4% for the small trees.

If this logic is applied to the trees along the northern street edge for Adelaide St for Option 1 & 2 , Option 1 (9 small trees & 4 large trees along northern edge) provides 10% shade coverage whereas

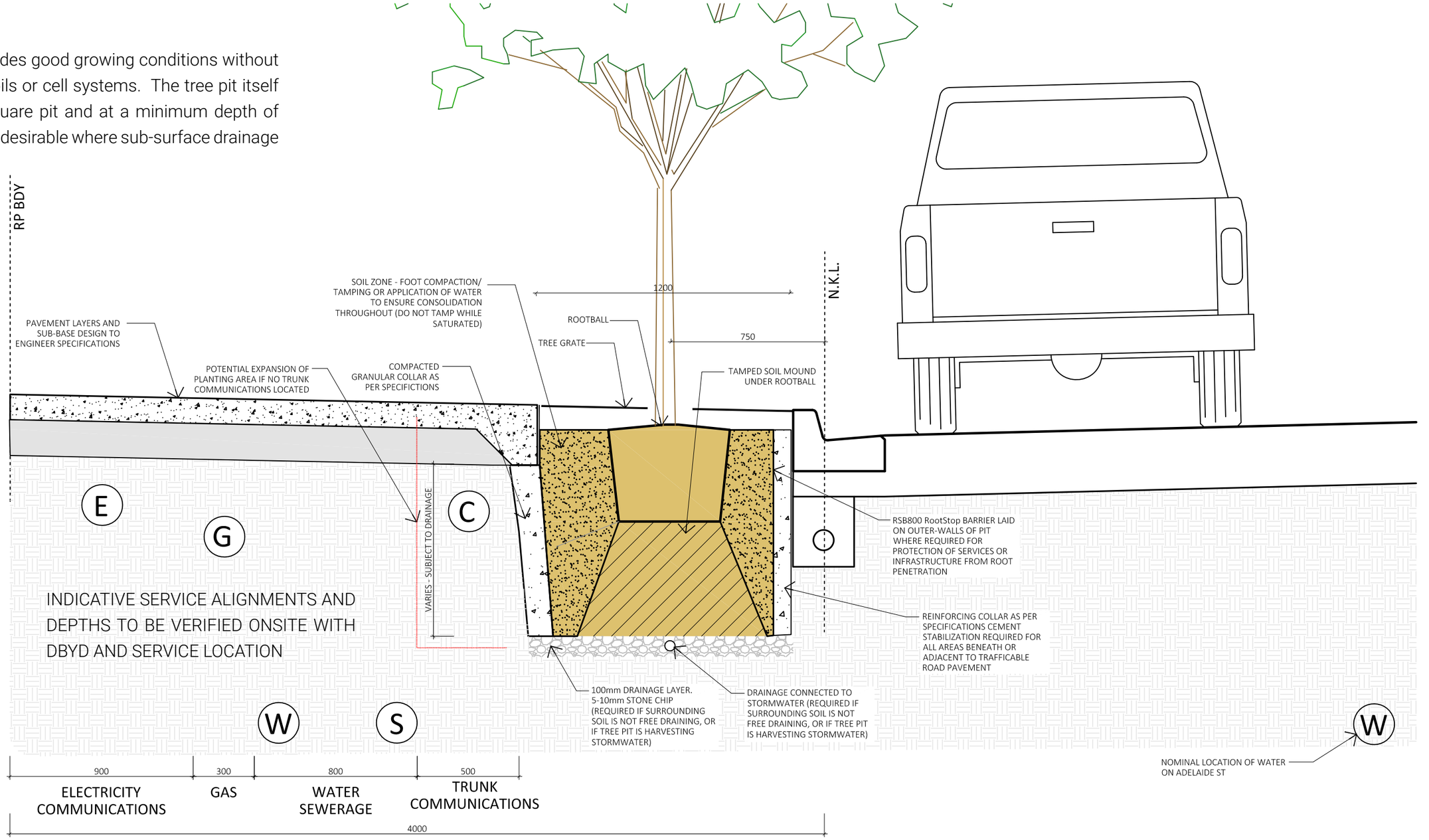
Option 2 (consisting of only 9 large trees along northern edge) provides 17% shade coverage.

These figures are estimates only, however they indicate the effectiveness of fewer quality plantings with sufficient access to nutrients and space to grow (i.e. soil cell systems) versus the placement of many trees with less access to soil.

B6 - TYPICAL DETAILS

The following typical details will provide a variety of tree planting installation methods that increase in complexity and cost.

Notes
The “Standard” tree pit provides good growing conditions without introduction of structural soils or cell systems. The tree pit itself would be a 1200 - 1600 square pit and at a minimum depth of 750mm. Additional depth is desirable where sub-surface drainage can be connected.

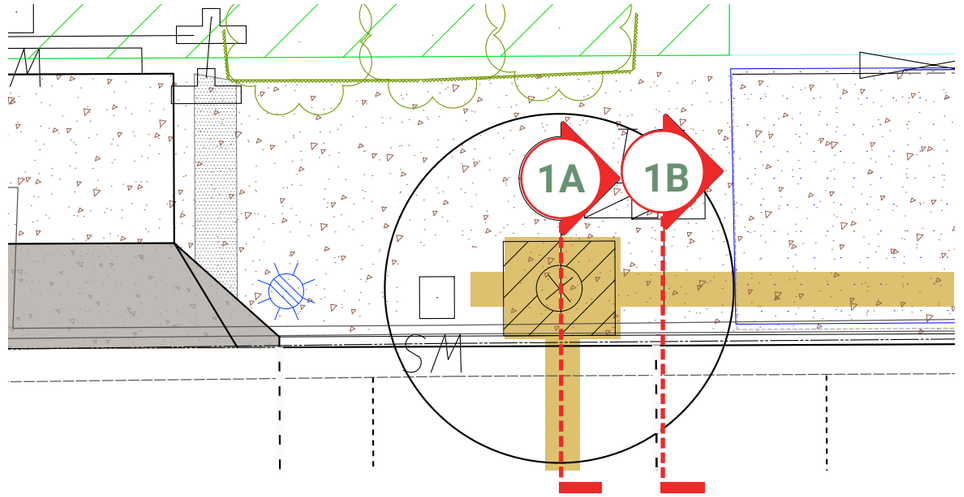


DETAIL 1A - STANDARD TREE PIT

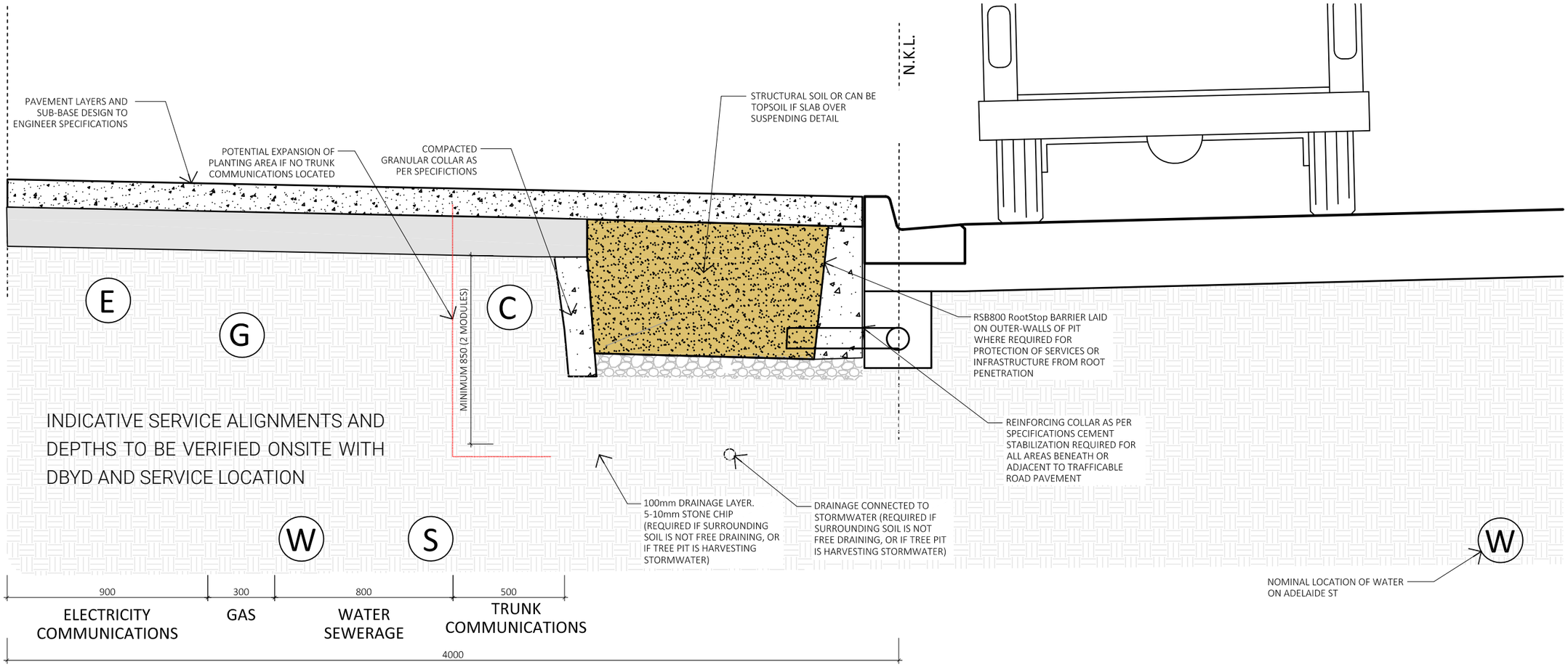
Notes

Narrow tree trenches 600-900mm wide can be easily excavated along footpath adjacent any type of street tree planting detail. This detail relies on the concrete slab to be suspended using additional thickness and reinforcing to engineers requirements. If the sub-surface is not free draining than additional sub-surface drainage should be installed.

Depending on soil reactivity and pavement subbase conditions the use of a cement stabilised reinforcing collar can be used to limit root growth and moisture movement.



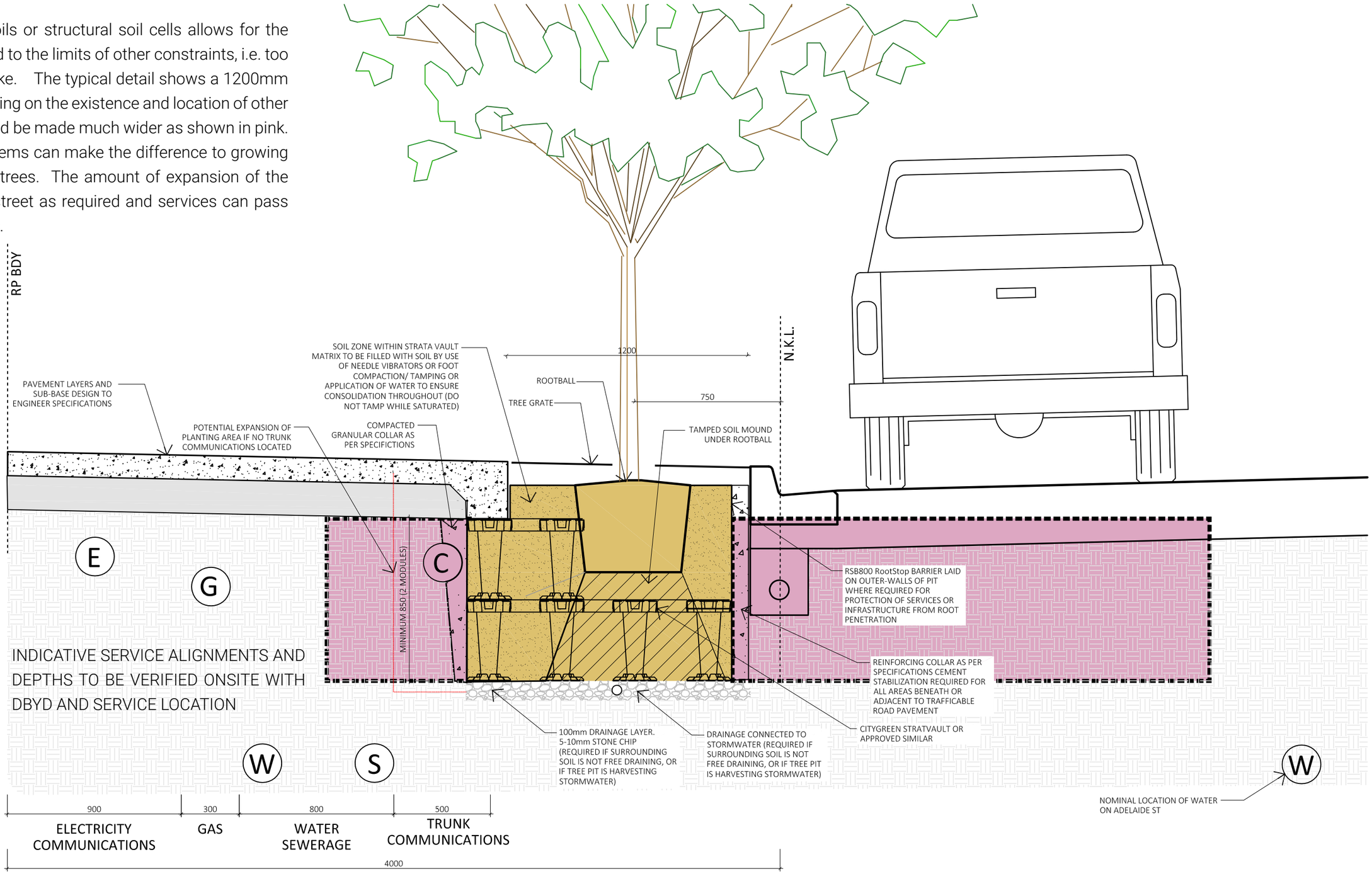
PLAN - STANDARD TREE PIT AND TRENCH



DETAIL 1B - STANDARD TREE TRENCH

Notes

The use of structural soils or structural soil cells allows for the width of the pit to expand to the limits of other constraints, i.e. too many services and the like. The typical detail shows a 1200mm wide pit however depending on the existence and location of other services this tree pit could be made much wider as shown in pink. This is where these systems can make the difference to growing larger, better developed trees. The amount of expansion of the pit may vary along the street as required and services can pass through the cell systems.



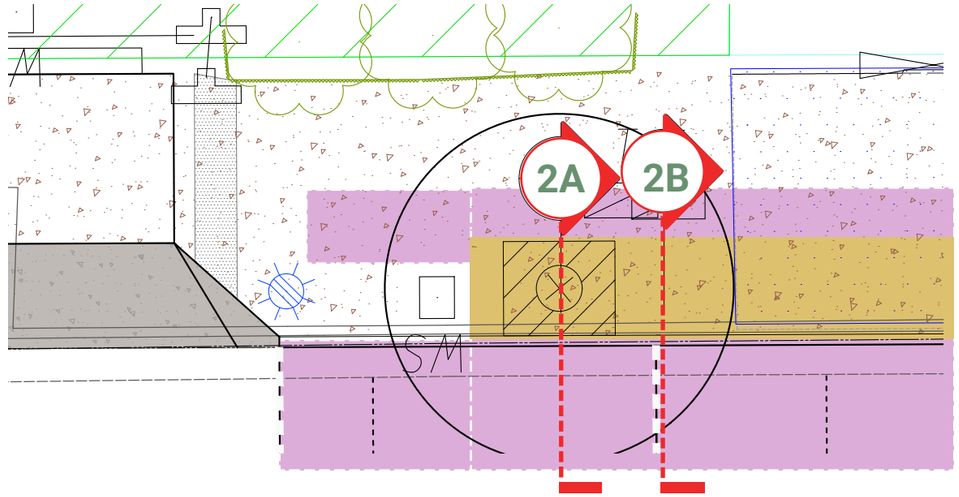
DETAIL 2A - STRUCTURAL SOIL TREE PIT

Notes

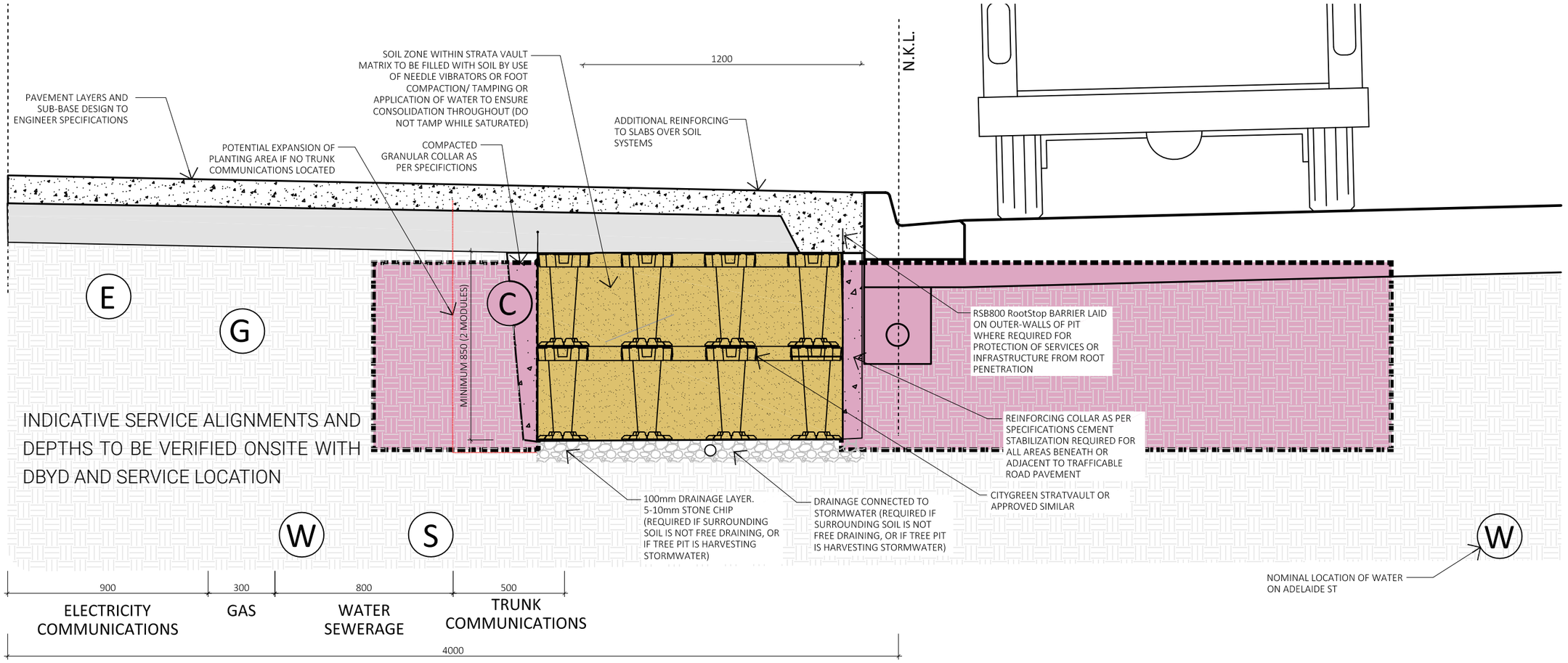
Adjacent to the street tree the tree trench can extend for as long as physically possible and often links each tree pit.

Notes

Whilst services can pass through the cell products, the modular nature of these products (e.g. Stratavault) is that they allow for the tree trenches to be tailored to suit services if Council does not wish services within the trench.



PLAN - STANDARD TREE PIT AND TRENCH



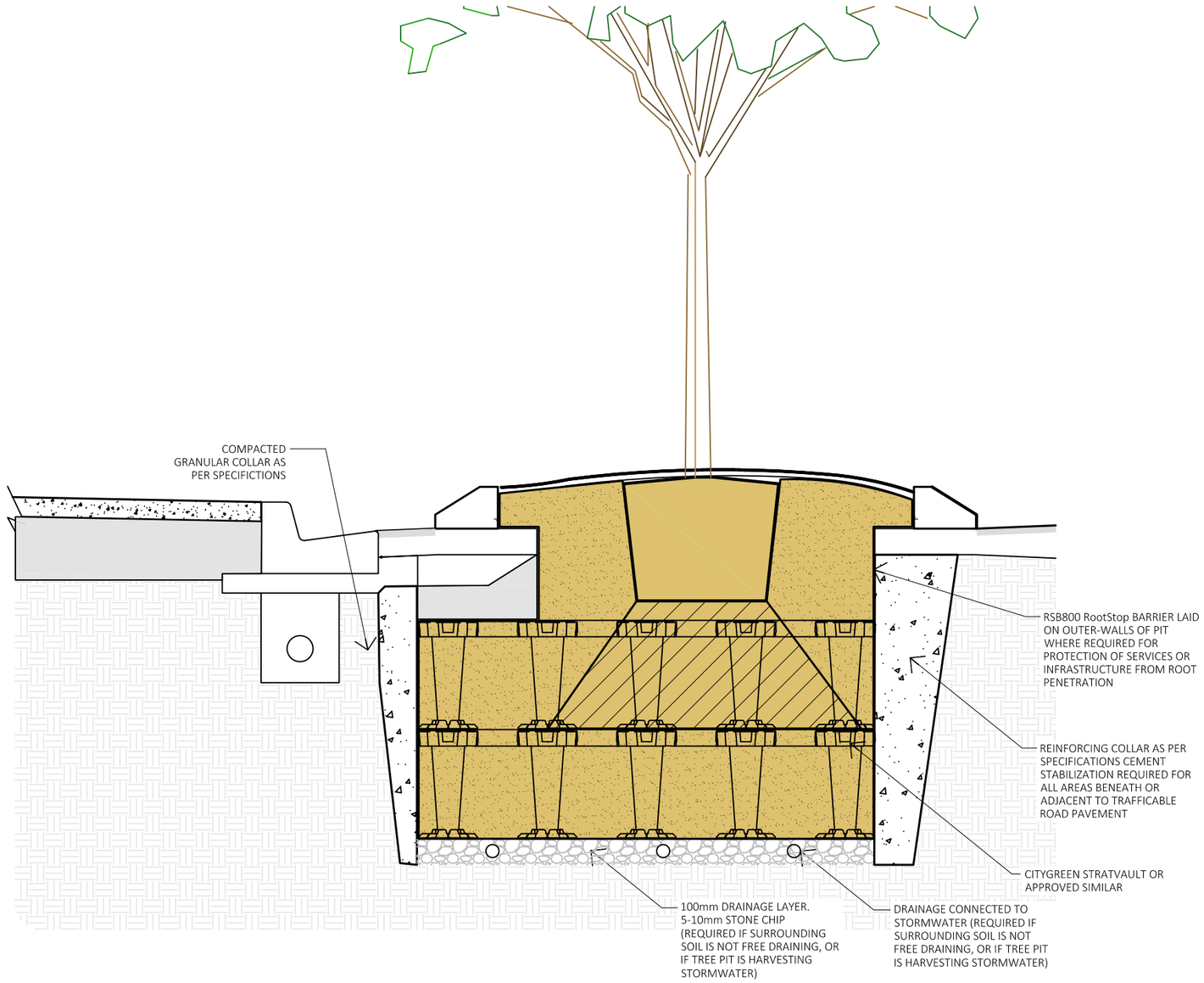
DETAIL 2B - STRUCTURAL SOIL TREE TRENCH

Notes

Maryborough's CBD has already used planter buildouts with some success. These buildouts demonstrated that relatively large trees can be grown in areas of around 10 sqm (5m x 2m). The root systems of these trees has likely expanded where conditions are appropriate

The use of the structural soil cell within buildouts and medians allows for services to cross the planter more effectively and allows for roots to develop into programmed areas. This may not diminish roots seeking nutrients and water beyond the tree installation and an assessment of ground conditions would determine whether additional concrete collars and/or root barrier is used to better attempt to contain the tree. Notably, the use of root barrier in small confined planters can cause risks of the tree roots not developing in proportion to the canopy which may cause stability issues for the tree. Likewise, without moisture being able to soak into surrounding soils drainage within the tree pit is required.

The benefit of the structural soil cells systems is that they can extend both ways along the street from the planter to achieve the recommended soil zones for the species.

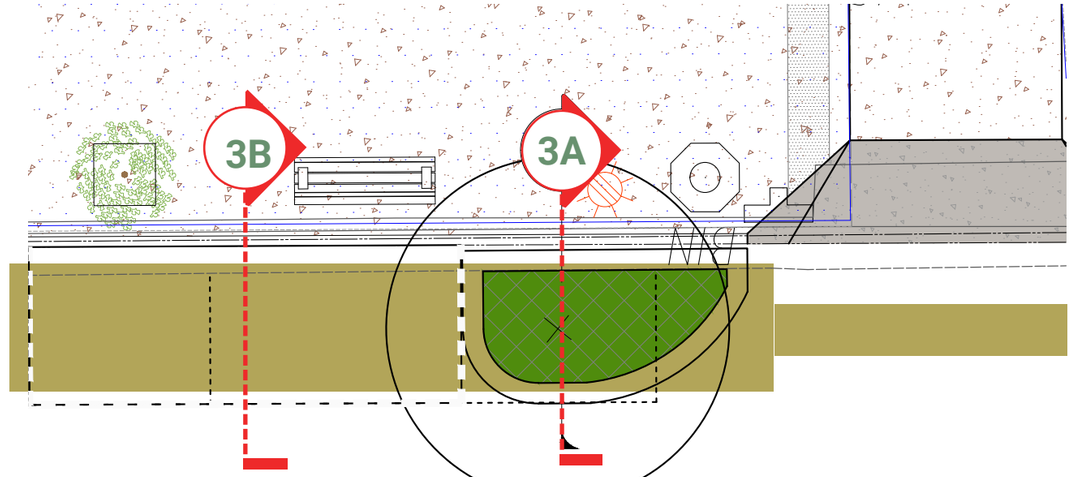


DETAIL 3A - PLANTER BUILDOUTS IN CARPARK ZONE

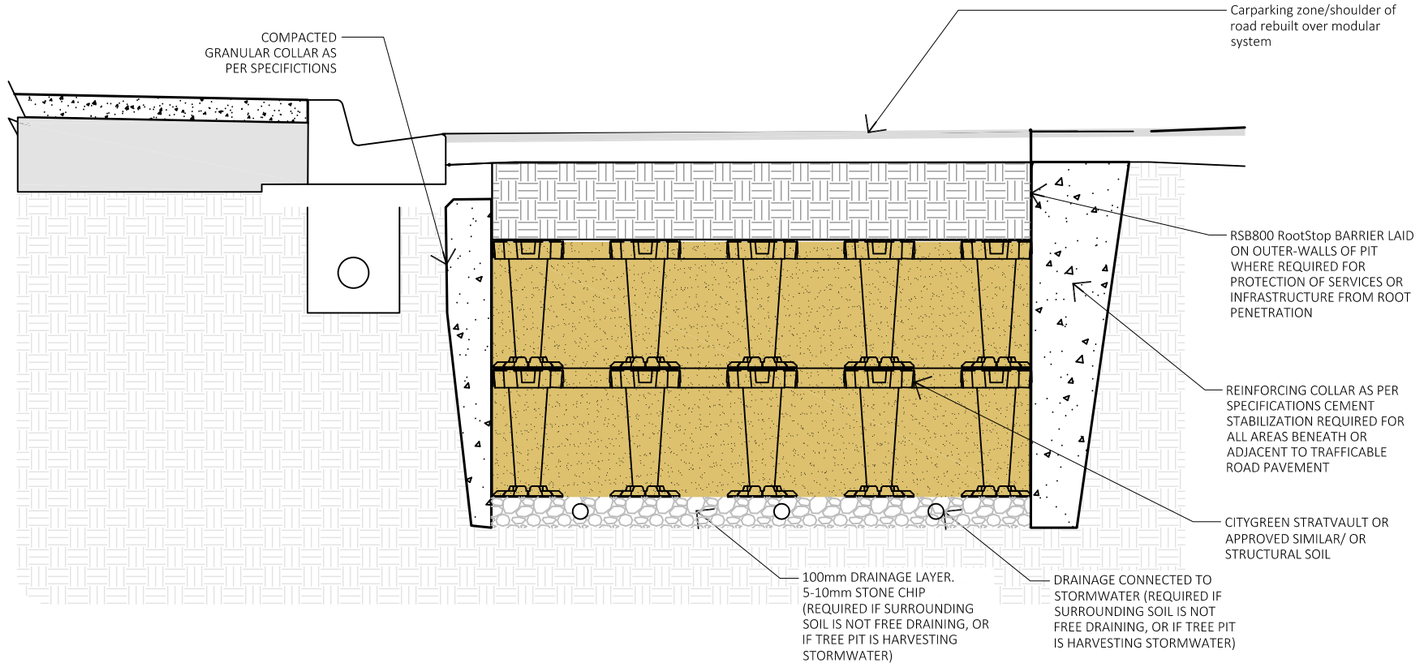
Notes

Example of how the soil cell system can extend beyond the planter buildout under carparking areas. This system can also be extended under roadway however, the desired soil volumes are often achieved in the shoulder and it is easier to manage during construction. Trenches can be continuous along the street with services crossing them as required.

Standard tree trenches using structural soil can also be used as required at areas where there is less space or time for construction, e.g. driveways. Narrower, structural soil trenches can be installed and re-compacted overnight to reduce impacts to businesses.



PLAN - CARPARK BUILDOUT AND TRENCH

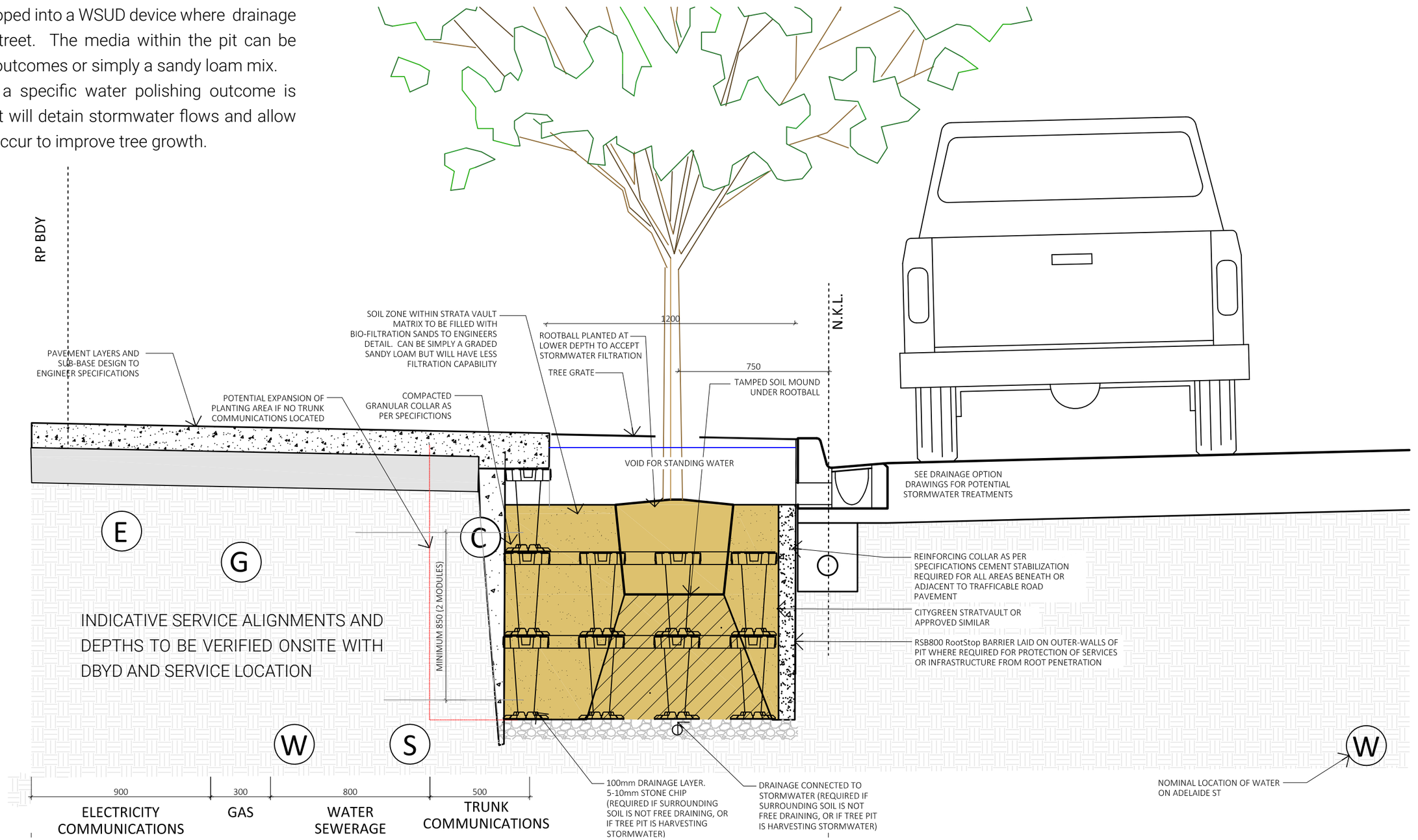


DETAIL 3B - TREE TRENCH IN CARPARK ZONE

B6 - TYPICAL DETAILS continued

Notes

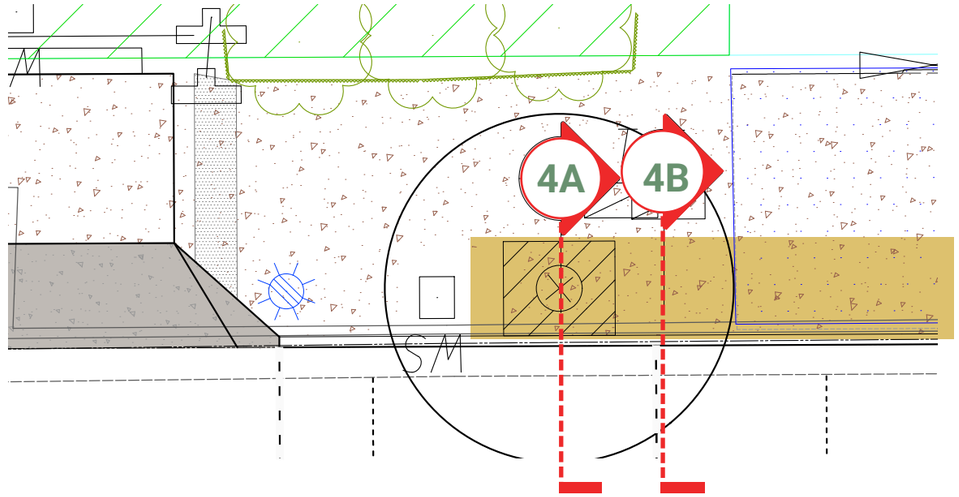
The tree pit can be developed into a WSUD device where drainage is available within the street. The media within the pit can be tailored for bio-filtration outcomes or simply a sandy loam mix. Irrespective of whether a specific water polishing outcome is being sought, the tree pit will detain stormwater flows and allow for passive irrigation to occur to improve tree growth.



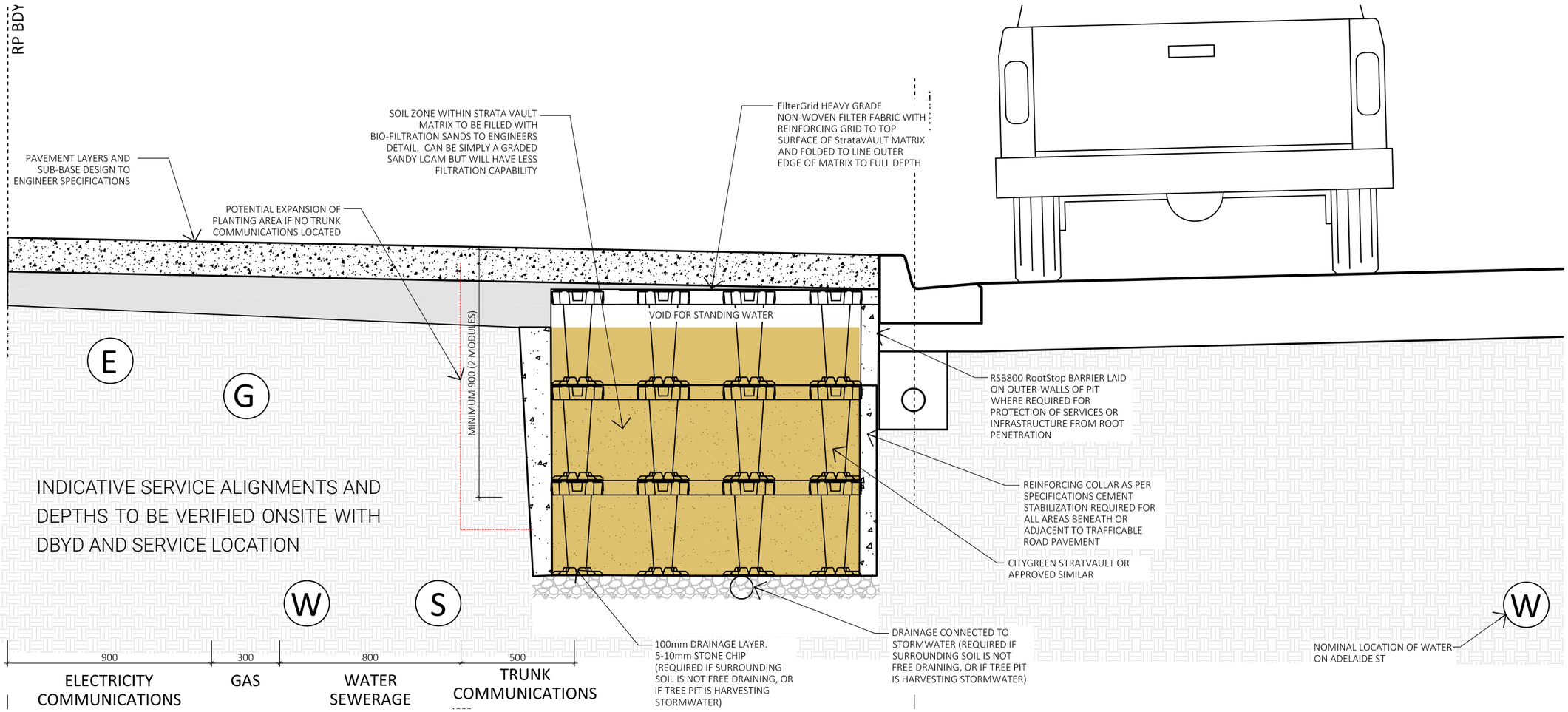
DETAIL 4A - WSUD TREE PIT

Notes

The WSUD TREE TRENCH can extend along, under the footpath as shown with the Citygreen Stratavault product creating a void for water to stand and permeate through the soil media. The length of the device will be limited by the longitudinal grade within the roadway.



PLAN - STANDARD TREE PIT AND TRENCH



DETAIL 4B - WSUD TREE TRENCH

Notes

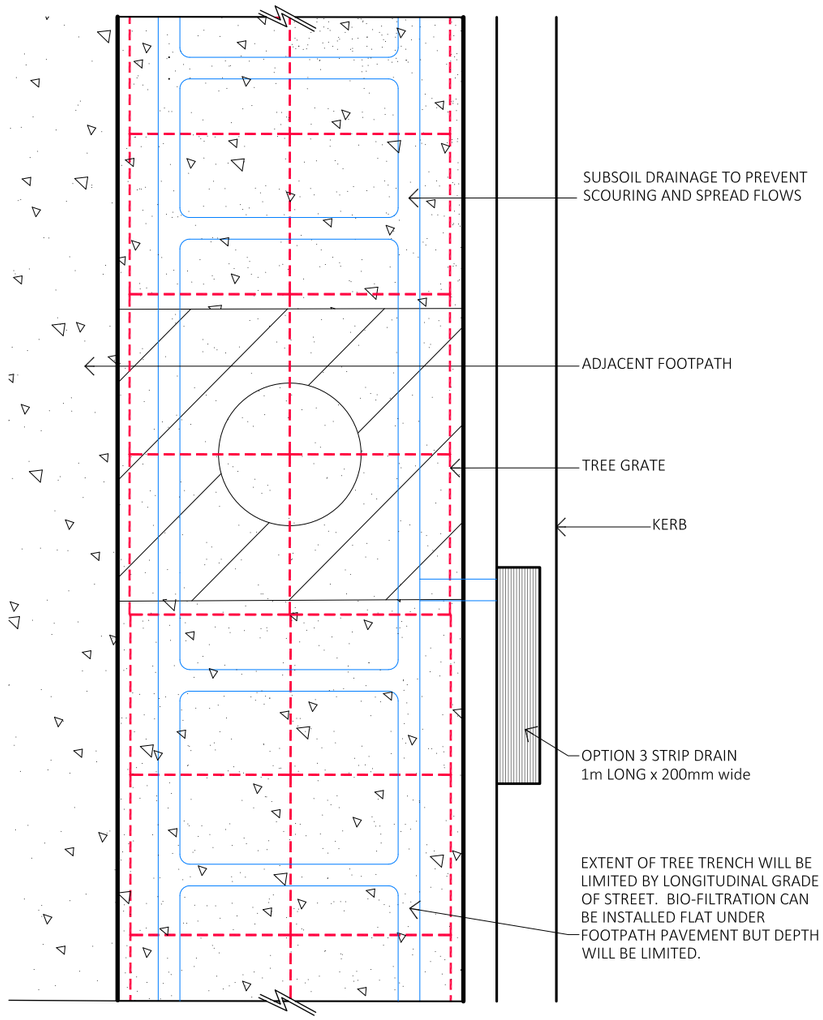
Where passive irrigation or a WSUD device is created stormwater needs to be directed across the entire infiltration area to maximise the system.

The detail across shows two inlet types. Kerbface inlet with grates are common however water intake may be greatly reduced.

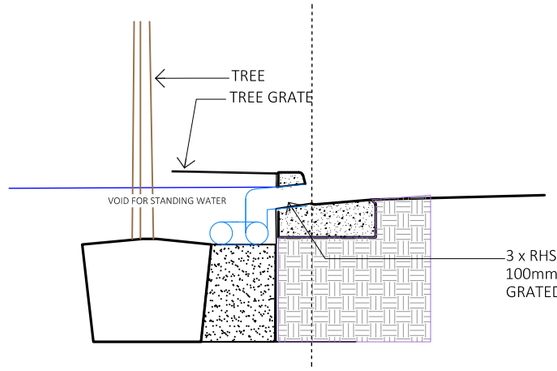
Kerb channel strip drains (with a SS Heelguard grate) could also be used that will ensure a greater amount of water enters the system. If a fine heelguard grate (or perforated metal grate) was used most leaf litter will wash through. Finer material that enters the system can periodically be cleaned by removing the tree grate or the strip drain grate.

Once water enters the system to avoid scour and to promote a more equal distribution of water, an array of subsoil drainage could be utilised as per the detail over.

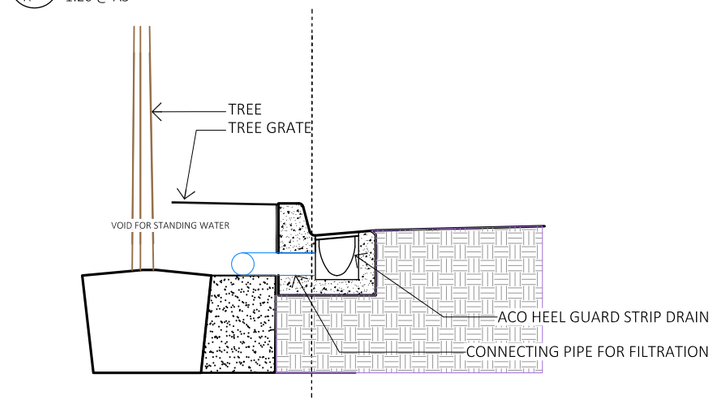
The tree pit is set down to allow for more water to be caught, filtered through the system and StrataVault or Terravault products can be used to create this cavity.



01 A PLAN - SUBSOIL DRAINAGE LAYOUT OVER BIO-FILTRATION AREA
1:20 @ A3



02 A STORMWATER FILTRATION OPTION 1 - RHS INLET
1:20 @ A3



03 A STORMWATER FILTRATION OPTION 2 - STRIP DRAIN
1:20 @ A3

DETAIL 5 - WSUD TREE PIT & TRENCH - STORMWATER SPREADER

If less water was desirable, for more a passive irrigation scenario, then a geogrid product such as Nerocell that stores 85L/sqm would be sufficient. This product would have a geo-textile placed above and below and can support loads.

Once the system is flooded than no more water can enter and water will continue to run down the kerb. This application would be more suitable where there is limited drainage in the street and the sub-soils are not free draining.

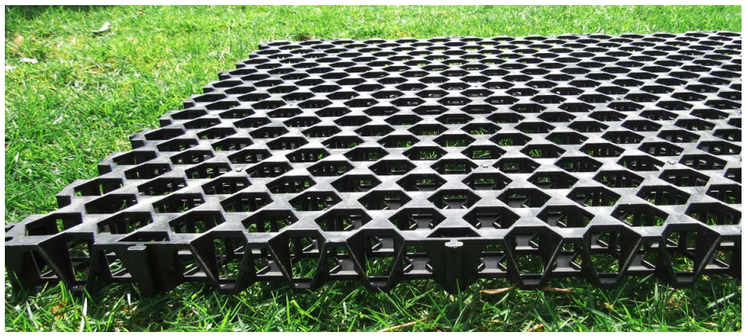
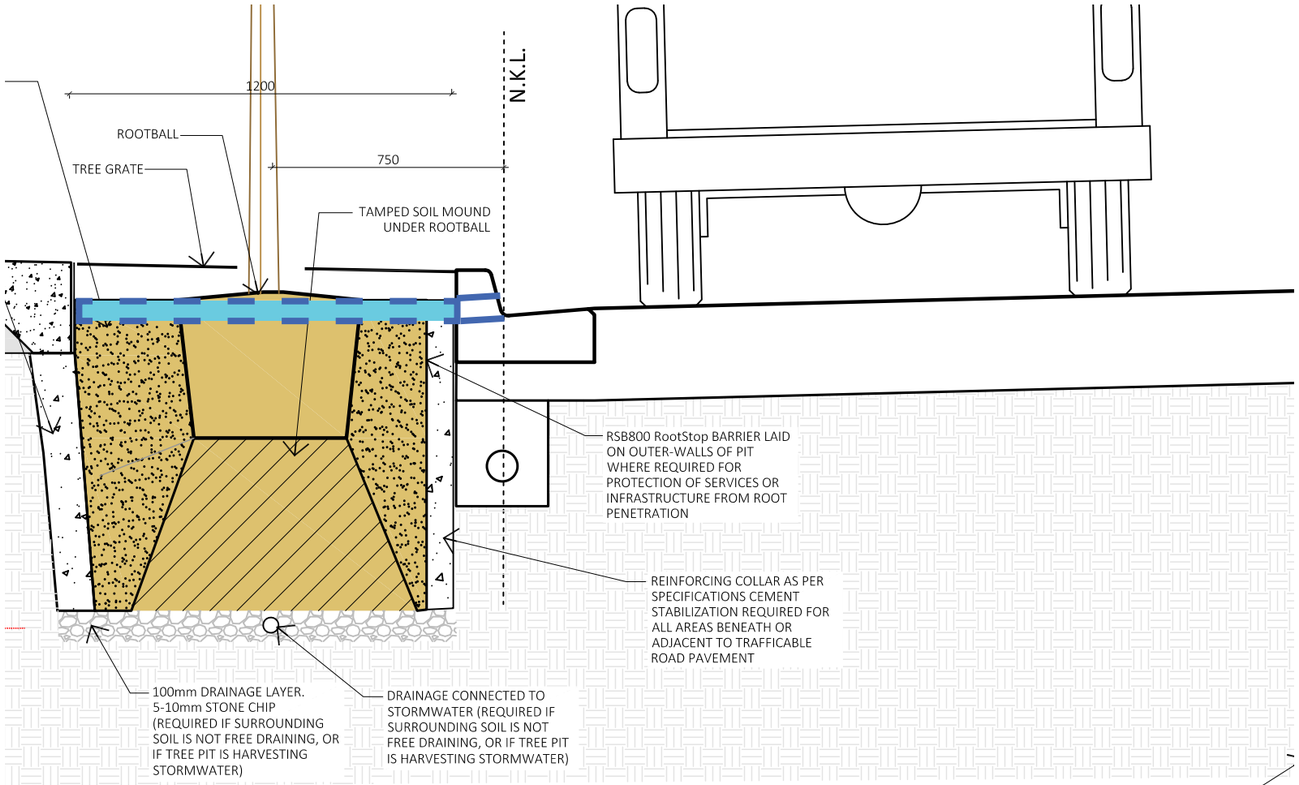


FIGURE 27: Geogrid products like Nerocell by Rainsmart Solutions provides limited water storage but this might be a better option where there is limited in-street drainage depth.

Combining this product's limited amount of storage with a kerbface inlet would reduce the amount of water entering the system also. Regardless of species, all trees want free draining growing conditions and not saturated, anaerobic conditions. Slow water intake needs to be balanced with drainage available.

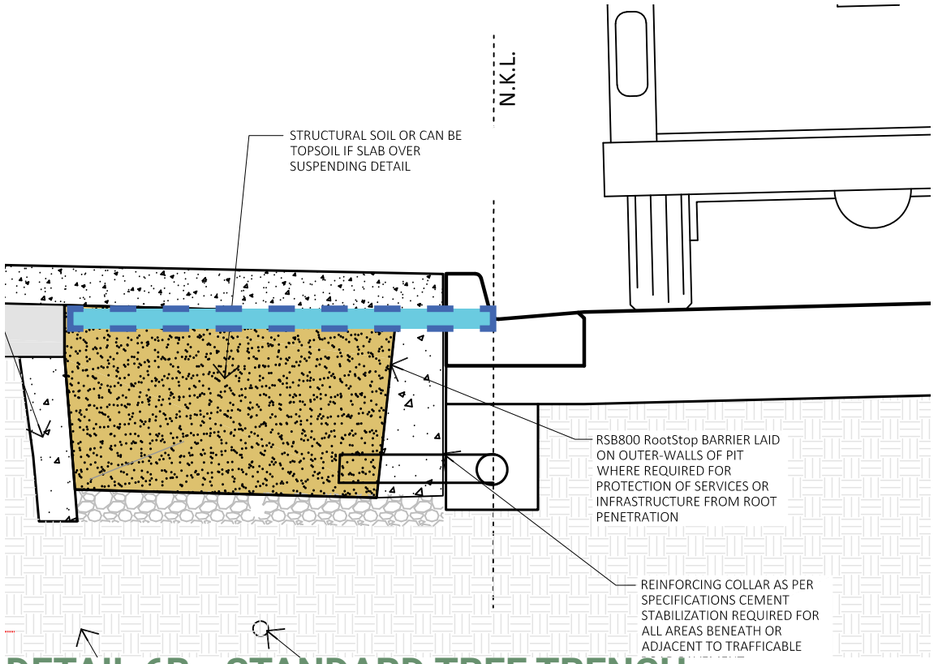
A simple passive irrigation detail is Detail 6A and 6B that uses the same design as Detail 1A and 1B with an inlet added and a geogrid layer (or two) of Nerocell or similar products.

Geogrid Nerocell or similar) layer and grated kerb inlet



DETAIL 6A - STANDARD TREE PIT

Geogrid (Nerocell or similar layer and grated kerb inlet. An outlet can be provided at low end if desired. This product is load bearing but suspended slab over still recommended.



DETAIL 6B - STANDARD TREE TRENCH

PART C
PILOT STUDY:

SUBURBAN STREETSCAPES

URRAWEEN HEIGHTS SUBDIVISION

C1 - INTRODUCTION

Suburban streetscapes are the landscapes where the majority of Australia's residents live. The shape of our suburbs is forever changing due to changes to design and regulatory standards, technology and housing trends.

Over the last decade housing trends in most larger Australian cities have seen new residential lots reduce in size with 10-14m lot frontages becoming more the norm for new estates. Residential lots are rarely 40m deep anymore and are more likely to be around 28 to 33m in depth. 400 sqm lots were considered small some decades ago but are now mid-range lots with new developments typcially allowed to have a proportion of lots as small as 250-330 sqm. Although, Fraser Coast has been slower than most areas in adopting small lots.

Housing design has also undergone a trend where bigger is better and family homes increasingly contain more bedrooms, bathrooms and alternaitive living spaces. At the time of writing this report, the Covid-19 pandemic was forcing many residents across the world to work from home and modern Australian housing is probably more adpatable to providing spaces for working at home than older housing types.

The issue with our new housing model is that the design (spacious, open plan with many rooms) consumes the majority of land on small residential lots leaving very little outdoor space for gardens and trees. One concerning thing with this model is that people in these suburbs can be more isolated from nature and this has been demonstrated through studies on biofilic design to have affects on health and wellbeing.

This housing trend is becoming increasingly common in regional areas despite greater land availability. With the family home remaining the primary investment for so many residents within Australia, a housing industry that promotes bigger is better for resale and investment purposes, this trend is unlikely to change any time soon.

Only with changes to planning and building policy or creating incentives for landowners to build two-storey dwellings on small lots to create green space can this site coverage trend be reversed.

Our streetscapes play a vital role in the public realm as the first green space many people would engage with on a daily basis. Many communities embrace their streetscapes as their local gathering place and first place for recreation outside the home.

The challenges and constraints to installing street trees in the suburbs is not that different to the challenges found within more complex urban areas such as central business districts. The scale of the constriants is typcially much simpler because there are generally fewer services to buildings and these services are usuallly located on more regulated alignments;.

Services might also be distrubuted on alternate sides of the road whereas CBDs often have duplication of water mains etc. due to the higher levels of demad required.

The benefits of street trees remain the same in terms of cooling the road pavement and buildings, providing traffic calming and numerous health and amenity outcomes.

Developers of new housing estates are typically required to install street trees as part of development conditions. Whilst many Councils historically provided the option for developers to pay a constribution in lieu of installing the street trees, most Councils have moved away from this model because the trees may not be installed by Council for various reasons. Councils have either made the contribution a substantial amount of money per tree (e.g. Moreton Bay Regional Council $480 per tree) or flatly refuse to provide this option to the developer as part of development apporval conditions. Instead these Councils stipulate DA conditions for street trees to be installed via an approval process involving the Council's assets team to ensure the right tree is installed in the right locations.

FIGURE 28a &b : New housing, as seen at Pialba 4655 (top) has slightly wider lots (15-20m wide) compared to older housing, West End 4101 (bottom) where lots are mostly 10m wide. New houses are also much larger than older two storey homes. Slab on ground design, being cheaper than two storey homes, means more rooms are spread across a larger footprint than multi-storey homes.

Older estates typcially had 40m depth for various reasons such as older sewer systems. This however has resulted in more green space being made available for residents.
Source : Nearmap.

C1- INSTALLING TREES TO EXISTING SUBURBS

The retrofitting of street trees into an established suburb can be a more complex process because the stakeholder group is the residents and engaging with many individuals has its own complexities. One of the key challenges is convincing residents that the addition of street trees will not cause damage or issues to their property.

People know that trees provide shade but do not necessarily realise that shade on the streets, footpaths and driveways and parts of their homes could make a difference to their power bill or to liveability of their spaces.

Various studies demonstrate that trees can provide economic benefits to householders however this varies depending on the orientation of the street (e.g. north south streets vs. east-west streets) and the opportunities within the streetscape to plant medium (8-10 metres high) to large scale trees (12-20m high). Furthermore, studies have demonstrated that suburbs with well established trees have higher property values which is an added benefit to the aesthetic and health benefits that trees provide to our neighbourhoods. Whilst these findings can be hard to apply or quantify the principles are sound, e.g. a tree shading a building wall will mean less heat passes into the dwelling.

The Urraween Heights subdivision has a typical grid layout with most lots orientated to take advantage of northern light and south easterly breezes. Aerial and streetscape images across, Figure 29a and 29b shows that the house footprints extend close to all boundaries limiting the space for private tree plantings.

Typically the more rectalineal the lot layout the tighter the development footprint for the development. Where the topography is steeper and more varied there is typically more space created for trees due to curved roads that follow the site contours which creates more irregular shaped lots; i.e. trapezoidal lots. Not surprisingly, these development footprints often result in greener suburbs because there is space left over after a rectangular house footprint is constructed; if the lot is sufficiently large.

FIGURE 29a: Uraween Heights subdivision (Pilot site)

FIGURE 29b: Tasman Drive Street frontage shows garages within a 3-6m setback from front boundary.

FIGURE 30a: Render of Tasman Drive street frontage with Waterhousea Floribundas (3-5 year maturity) - subject to soil conditions

FIGURE 30b: Render of Tasman Drive street frontage with Waterhousea Floribundas (10 year maturity) - subject to soil conditions

FIGURE 31 : Aspley Qld streetscapes illustrates how larger species such as Ficus sp., can be incorporated into roundabout and medians as well as trees along the nature strip. Whilst this introduces a different scale of maintenance the resultant streetscape improves visual amenity to this neighbourhood. Trees have been shown in studies to improve property value which would likely be linked to better visual amenity.

The challenge with modern development where cut/fill flat pads are created is that there is limited site topsoil retained at a depth that supports good tree growth.

C2 - EXEMPLAR TREE PLANTINGS IN A RESIDENTIAL SUBDIVISION

Aspley, Qld illustrates a similar, established development layout that has utilised fig trees in roundabouts and has embraced larger street trees to provide a leafy, attractive neighbourhood. Compared to other parts of the same suburb, this neighbourhood is in greater demand as a place to live and increased housing prices reflect this demand.

Experience working with various Local Authorities demonstrates that the public have varied opinions on the values street trees provide to them as individuals and to the wider community. This particular community reaps the benefits of valued street trees. With different plantings clearly maintained (at a property owner level) and cared for, the streets are well shaded and generally feel like a more comfortable place to dwell. This combined with the natural surveillance factors that are evident in areas like this help to passively protect a street from undesirable and illicit activity.

The aim for Councils is to achieve greener suburbs and hence this aim should be targeted at communities as a whole rather than to individuals. Work conducted with Ipswich City Council between 2017-2019 demonstrated community attitude can vary greatly, but as a whole more than 50% of street trees proposed were installed with little community engagement.

This report section will discuss some strategies around community engagement and how this can be targeted on an ‘as needs basis’.

C3 - SHADOW MAPPING - HIGH LEVEL ANALYSIS

To ensure that new street tree plantings are providing quality outcomes it becomes important to visualise the extent of shading each tree location could provide. The diagram to the right illustrates the shadows cast from a mature street tree between the hours of 9am and 3pm on the Summer Solstice (December 21). From this, lots are colour coded based on the amount of potential cooling that a street tree adjacent to each lot will provide at tree maturity. Naturally, this exercise needs to weigh up against the species where tree height and spread could improve outcomes.

The cooling is focusing mainly on reducing the heat island effect in the street and thus a high level of cooling is determined as having above average shade provided to the roadway. Observed in the blown up snapshot of the diagram to the immediate right we see four lots with three levels of cooling provided.

The two lots to the left (Lots A and B) have a dark green hatch to represent a higher level of shading (cooling) as they run North-South and by having two frontages should have two street trees. At this hottest time of the year, these trees along the western boundary cool the road in the morning and the dwelling in the afternoon; if the tree is 6-8m high.

Lots located the east-west streets receive less shade from street trees during the hottest months when the sun is highest.
Nonetheless, In Queensland we can expereince warm days all year around and particularly across the Autumn and Spring days. So when these shadow maps are reviewed, the trees along the east-west streets provide a larger shadow footprint over the duration of the day.

The lot highlighted yellow shows a tree that will shade a small section of road in the morning only.

Whilst the summer solstice is an important time of year from a cooling perspective, as it is typically very hot, Fraser Coast experiences high temperatures nearly year round, therefore it becomes critical to

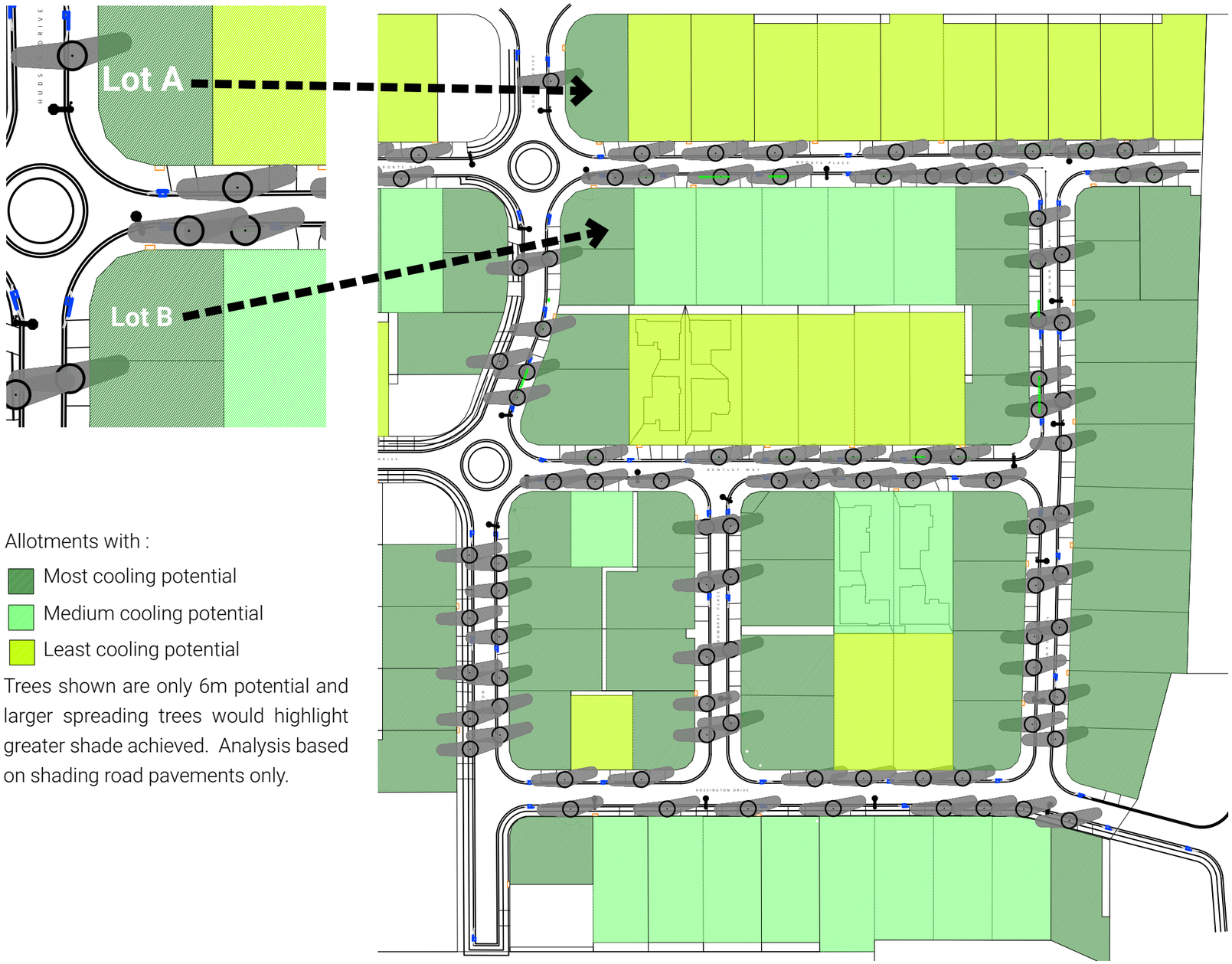


FIGURE 32a: Shadows cast from mature trees between 9am-3pm on the Summer Solstice (December 21st)

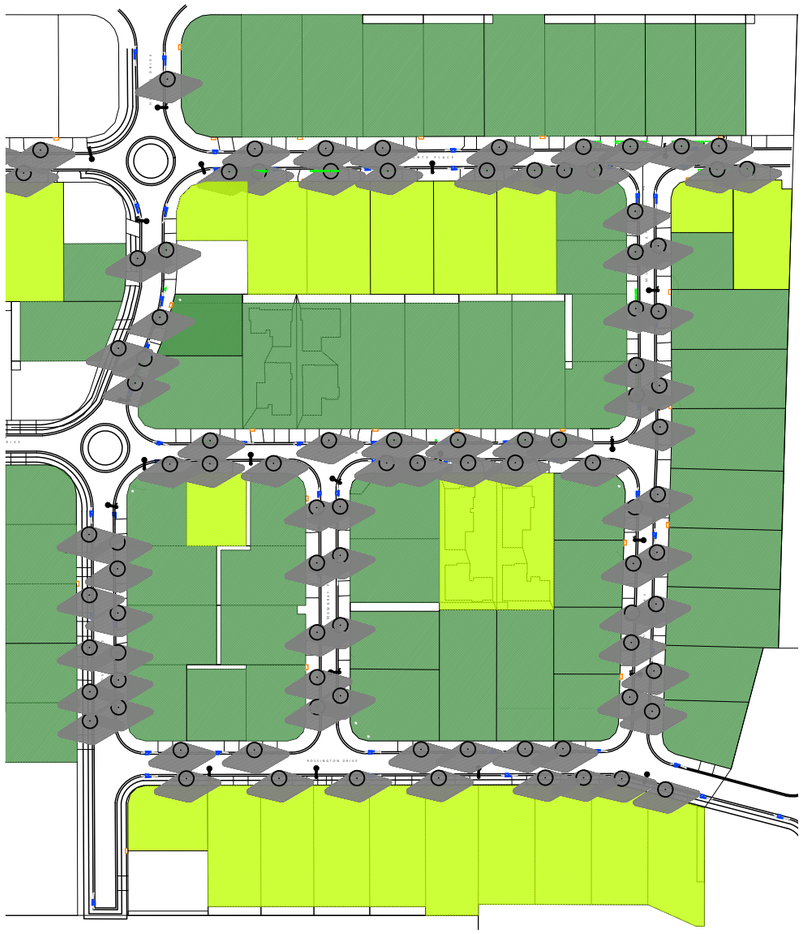


FIGURE 32b: Shadow mapping from 9am-3pm on the March Equinox (March 21st)

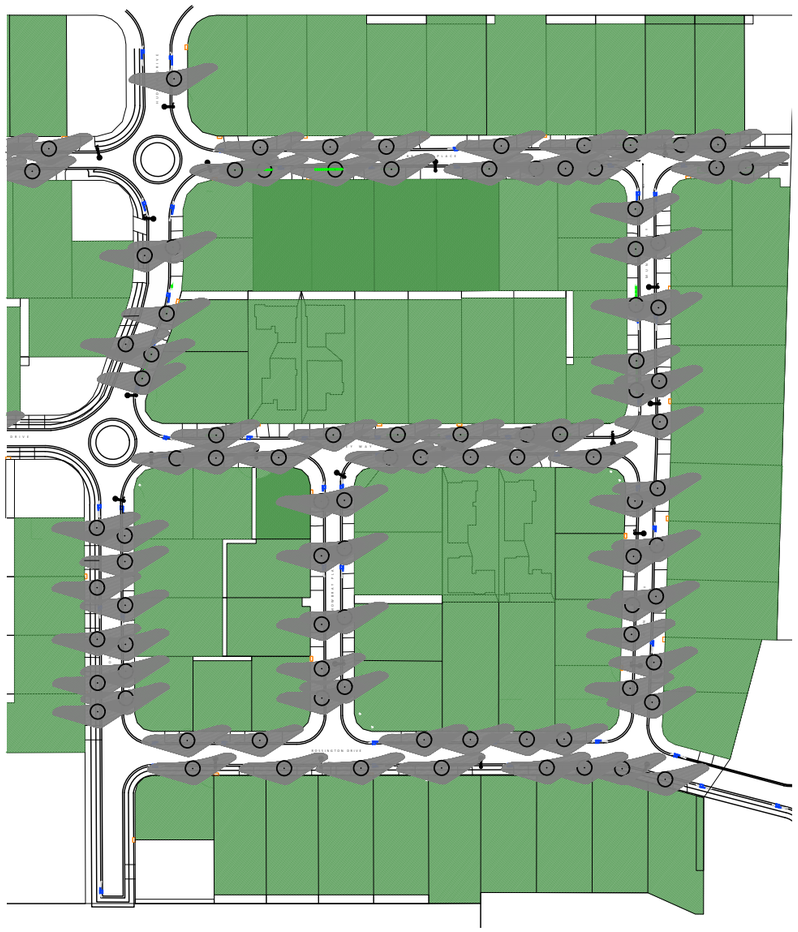


FIGURE 32c: Shadow mapping from 9am-3pm on the September Equinox (September 21st)

analyse the equinoxes (March 21st and September 21st) to understand the patterns provided by the suns path for this locality.

A simple template tool could be created for community engagement purposes to show residents what shadows they could receive at different times of the year based on a variety of tree sizes.

Overlaying the 9am-3pm shadow for both equinoxes as well as the Summer Solstice we can identify areas of the subdivision that would contribute more to a reduction of the heat island effect, and overall creating a more pleasant place to live.

It becomes clear that any lot running along a North-South roadway contributes greatly to providing shade for the streets in the morning and potentially buildings in the afternoon. Taller tree species on the eastern sides of the street would shade dwellings more.

Conversely street trees along East/West running streets typically provide less shade towards the street and more towards the houses during summer and more benefit during the cooler months. Certainly trees on the southern side of an east/west street has more potential shade for buildings and driveways whereas the trees on the northern side will likely only shade road pavements. Building setbacks for each lot will also affect its ability to receive shade.

While there is evidence this may be beneficial for reducing energy bills, it was considered a lower order benefit because the trees are closer to the roads than they are to buildings and hence they shade more surface areas of the hotter, black road surfaces than the lighter, reflective roof surfaces. Street trees on the southern side of an east/west street are more likely to shade the northern side of a dwelling and this is the aspect where most solar panels are installed.
So whilst cooling both types of surfaces (roads and roofs) is important to reducing the heat island, cooling roadways would be a logical priority before dwellings if both cannot be achieved.

It must be stated that these snapshots of different times of year, are exactly that, an insight into typical conditions that may occur along streets based on their orientation. There are other factors that may inhibit this from being consistently true. However the diagrams provide some insight for designers to make an informed decision when determining which streets and lots would benefit more from tree shading than others.

Where the potential shading and cooling of roads and houses is greater, these lot frontages should be prioritised when undertaking tree planting programs. This high level analysis during community engagement could identify where potential tree champions exist because trees planted on their frontages will provide more benefit to those residents and to the wider community as trees along their frontage will shade more road than trees on other lot frontages.

C4 - TREE PLANTING - SPACE LIMITATIONS & OPPORTUNITIES

Residential subdivisions pose numerous limitations to tree planting as there are many services and infrastructure to consider and avoid. Setback from light poles, intersections and driveway, to name a few, create large zones in which planting cannot occur. Narrow or constrained properties will only have a very limited area along their frontage (3000mm x 1000mm for example) that allows for a tree planting. These conditions mean that in some scenarios the opportunity to shade as much of the street as possible is limited. Due to these constraints greater importance needs to be placed on where the opportunity exists for more than one tree to be planted on the nature strip.

Where there are few constraints and there is a large zone that allows tree planting (sometimes multiple trees) these need to be capitalised on in order to 'Green' as much of the street as we can.

For the Greening the Fraser Coast initiative this means identifying lots that have the potential to locate two or three trees or larger street tree species. Again, through community consultation, awareness and acknowledgment of potential "Tree champions" should be promoted.

Furthermore, where a resident does not want a street tree on their immediate frontage some greater importance is created for those around that resident to take on more shading responsibility, i.e. to plant more and larger street trees to offset the shading otherwise lost.

Every resident should firstly be encouraged to accept as large a tree species that is suitable for the location. This species is determined by Council staff as per Council's Tree Management Policy and keeping in mind soil reactivity and types of building construction, e.g. slab on ground vs. pole homes.

Whilst a single tree species might be favoured by some for aesthetic or maintenance reasons, species selection should also be driven by the largest tree species that both Council and the resident are willing to accept. Some residents will only want smaller species, if any, and a smaller tree is better than no tree at all.

The diagram below aims to highlight the maximum potential for new street tree planting to verge. It highlights the zones that can be planted and applies a rule of 3500mm spacings between trees in order to achieve the largest amount of planting that can reasonably be achieved.

The plan should be read in conjunction with Fraser Coast Regional Council Standard Drawing "FC-350-10". The drawing also considers the scenario of a property owner option for two trees when a potential three could be planted on their lot (Lot 80), ensuring that in this situation, decent shading could be provided by two trees.

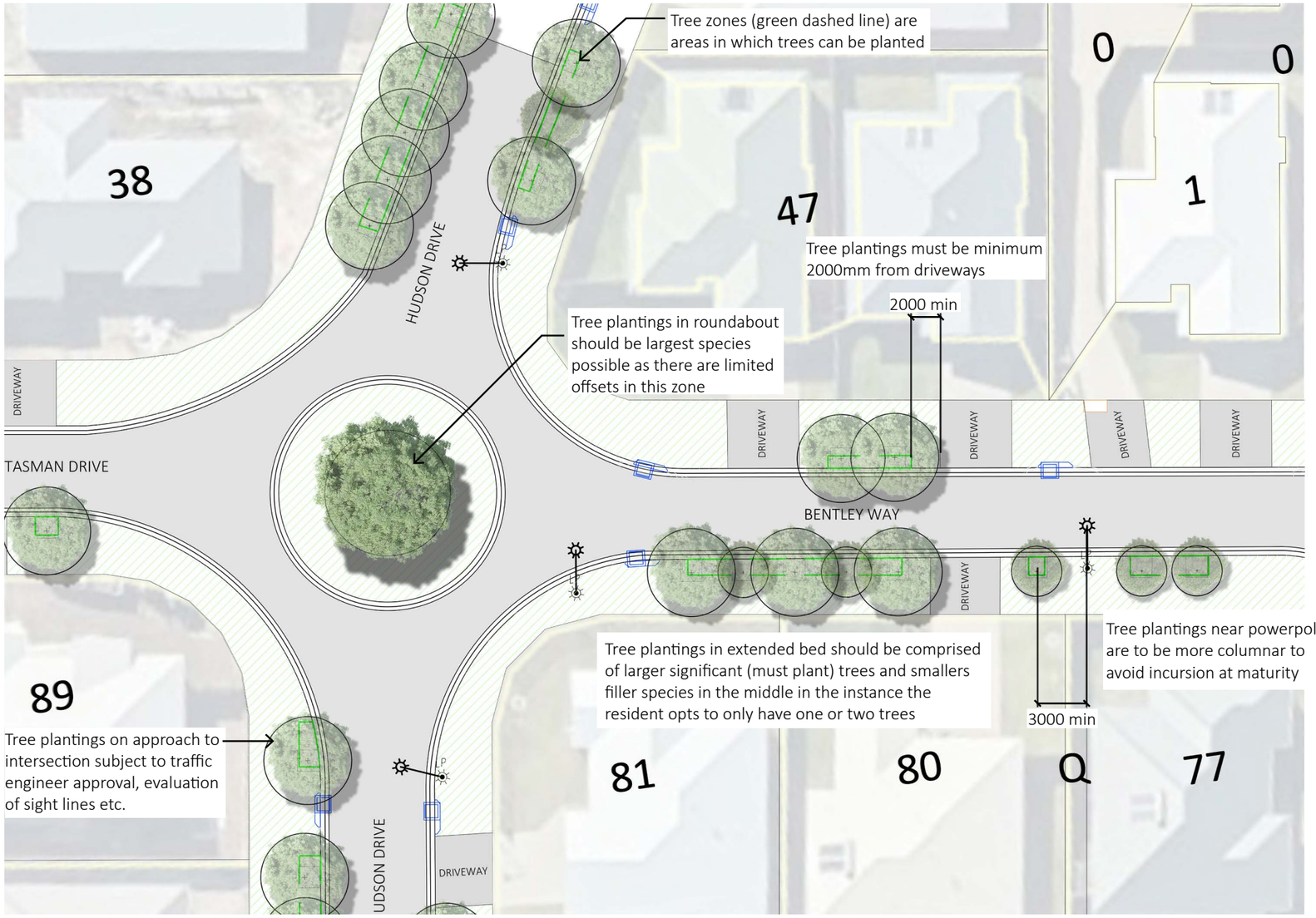
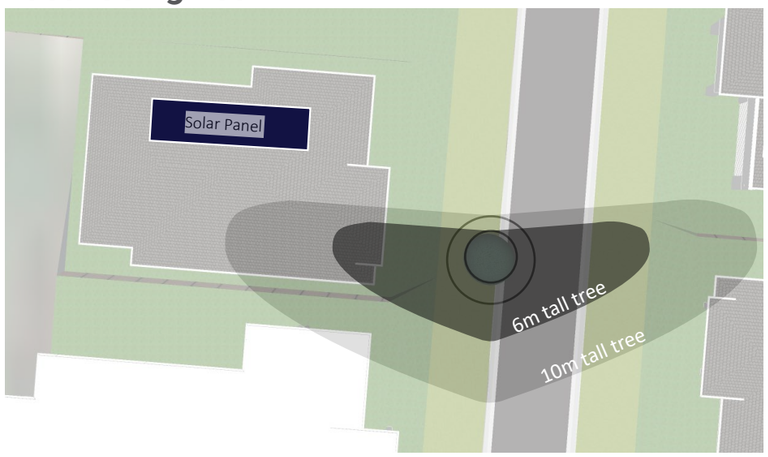


FIGURE 33: Potential tree planting (If all property owners accept most possible planting on their lot)

C5 - SHADOW IMPACTS

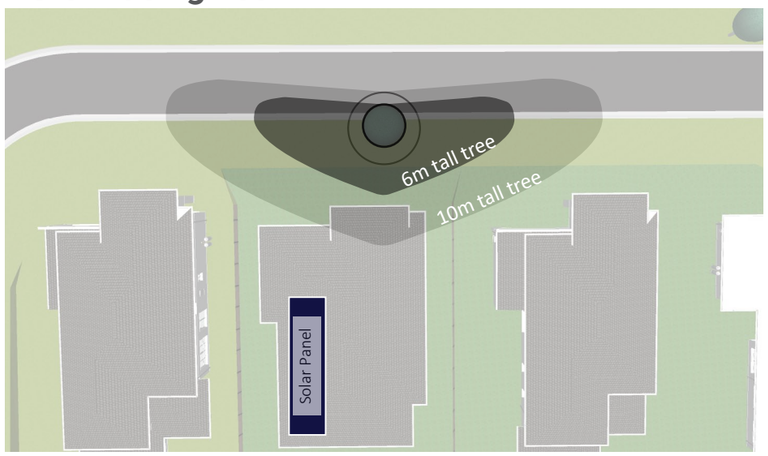
Heavy Shade Some Shade Low Shade No Shade

East Facing Lot



	Road	Lot Frontage	Roof
Small Tree (6m)	✓	✓	✓
Medium Tree (10m)	✓✓	✓✓	✓

North Facing Lot

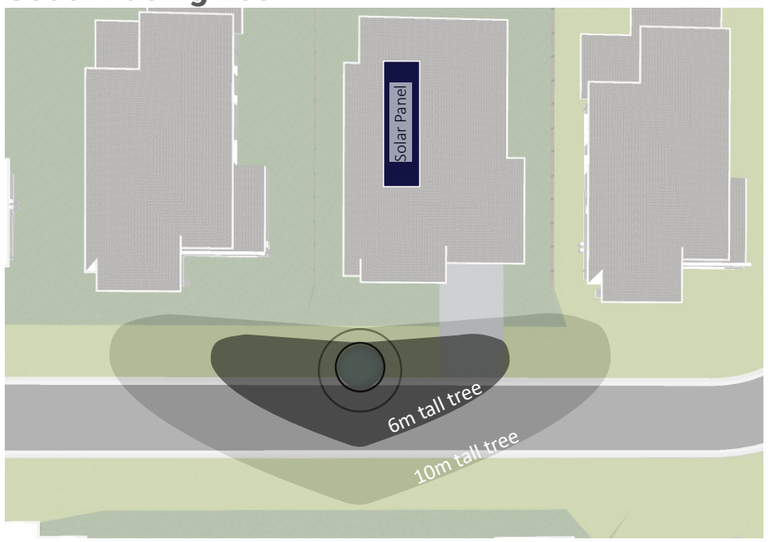


	Road	Lot Frontage	Roof
Small Tree (6m)	✓	✓	✘
Medium Tree (10m)	✓	✓✓	✓

West Facing Lot

	Road	Lot Frontage	Roof
Small Tree (6m)	✓	✓	✓
Medium Tree (10m)	✓✓	✓✓	✓

South Facing Lot

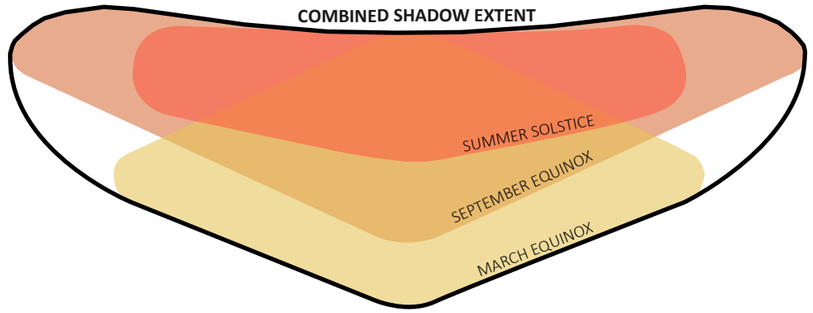


	Road	Lot Frontage	Roof
Small Tree (6m)	✓	✓✓	✘
Medium Tree (10m)	✓✓	✓✓	✘

The diagrams left illustrate the degree to which a tree will shade a lot, adjacent road, solar panels & house depending on size and lot orientation. These diagrams can be shown to homeowners to get a quick understanding of the shading effects that will be provided by a mature tree.

This information may be beneficial to those with concerns around the impacts a tree may have on their solar panels, lot frontages etc. In the example of a South facing lot we can see that their are likely no impacts from the trees shade for the majority of the year even at peak maturity. However a very large tree may begin to shade the lot opposite the road in the summer months.

It is worth noting these diagrams serve as indications of the potential impacts of a tree planting in order to quickly help a resident decide if planting a tree is beneficial to them. This could potentially also help council identify possible “tree champions” based on the orientation of a lot and capacity to house multiple trees.



NORTH

C5 - STREET TREE PLANTING (ACHIEVING QUALITY OUTCOMES)

Retrofitting street trees is a complex process and the perceived imposition that a street tree poses to the property owner is worth considering. Ensuring that the new tree installation is quality and allows for ease of maintenance is critical.

The two images to the right show two types of street tree installation, one to an existing suburb done in an efficient manner, one to a developing subdivision with a more careful approach. Small details such as mulching to back of kerb to avoid mowing challenges posed by the image far right, become crucial in the attitude that property owners may have towards the proposition of a tree planted on their established lawn. These details are the difference in a quality and considered outcome that may persuade some residents that have concerns regarding the maintenance implications of a new tree.

The goal ultimately, is to create a sense of ownership and pride for the new tree planting , by engaging residents in a process that has their best interests at heart. Open and clear communication with property owners regarding the nature of planting and species options may help alleviate anxiety surrounding the incursion onto their lawns. Attention to detail surrounding edging, staking etc should be available in such communications.

Tree Champions

Every resident has the potential to become a tree champion and anecdotal reports with various Councils suggests that more people come onboard once a few have demonstrated that the outcome is positive. The lot by lot analysis to determine where trees can be planted coupled with the high level shadow mapping analysis has the potential to demonstrate which land owners can contribute more than others simply because they have a wider frontage, or fewer constraints (kerb gullies, light poles etc.) and a better street aspect than others. Developing incentives for these individuals to adopt a tree would be of greater community benefit.

FIGURE 34a: Example of a street tree planted as part of a Brisbane residential subdivision.

FIGURE 34b : Example of a street tree planted by Brisbane City Council as part of their Street Tree Program.

Trees are installed by two personnel from a purpose built vehicle in about 10 minutes per tree. The process is as follows: park vehicle with hazard lights on, auger the hole using a hand-held mechanical auger ripping sides of plant hole, install a 25L tree, fertiliser tablets and supporting timber stakes, mulch surrounds and water in.

Trees have a protective ag-drain sleeve that will be removed with stakes within 12-18 months. Whilst small excavators could be utilised to install larger trees or soil volumes, they can damage the lawn on the nature strip and require more time to load/unload. Hence smaller tree installation is typically undertaken by Councils within SE Qld.

C6 - STREET TREE PLANTING PROCESS

The nature strip is part of the road reserve and is Council land. Whilst people understand this reality they also perceive that it is an extension of their front yard; particularly for new housing where the fencing is often adjacent the corner of the house as opposed to along the front boundary. Residents often take pride in the nature strip and provide the same level of maintenance to it as any part of their yard, specifically in lawn management. Hence, whilst Council has a right to plant street trees, this space is inherently contested terrain for many; literally the hallowed turf for some.

It can be difficult to rate the success for a street tree program other than through the number of trees planted. Street tree planting is most efficient when done on mass and over a short period of time. The physical exercise of installation can either be Council staff (or contractors) installation or a collective, community achievement.

Community Tree Planting Days undertaken by the three comparison Councils are typcially held in local parks or reserves because of the logistical and safety issues around working within roadways. For the exercise to occur within local streets we would suggest a more direct level of community engagement to identify Tree Champions for each street where people are happy to use 'their' nature strip for staging of pop up tents etc. This process involves many more Council staff and when each street tree costs as little as $150 installed, many more trees can be installed when Councils simply roll out the trees without intensive engagement. That said, without some momentum more hurdles may be met by Council so it does need to occur at some level based on community feedback received following initial press and the first event.

A successful street tree program by Ipswich City Council has been implented across dozens of suburbs over only a few years. The process undertaken is described within Table 1. This program saw a high number of trees installed; about 60-70 % of those planned to be installed. "Ipswich City Council has embodied their Street Tree Program into their "Beautiful Ipswich" project which is a city wide program to improve all green spaces. Convincing people of the benefits of street trees can not always be easy.

Brisbane City Council has a varied approach to community engagement for new street tree plantings but due to the robustness of the Council it also has the ability to roll out street tree plantings with less direct community consultation. Through their process BCC achieves a higher number of trees in the ground and then they manage any fallout from residents whom do not want a street tree on 'their' frontage. They have a huge rates base and can manage this process. BCC still hold Community Planting Days but these are predominantly held in local parklands.

Table 1: Comparing Street Tree Planting Programs shows some of the different ways various local authorities have taken to rollout their programs.

Hornsby City Council has a process that starts in residents rates notice to make them aware that there areas have been targeted. The aim of this engagement process is to gauge which areas are more receptive to street trees being planted and this is determined by measuring the amount of Opt Out replies an area sends in.

Once areas have been identified Council will then follow up these areas with direct letters indicating that the street tree installation is occurring on certain week, e.g. Week 12-16 May. Prior to this week, spots are marked on the footpath by Council officers reflecting the preferred location. Residents can Opt Out again at this time. Residents who Opt Out are followed up in the future to see whether they have changed their mind once they see street trees installed.

Much can be learnt from different processes and ultimately a hybrid of each might be adopted as a Street Tree Program unfolds. The amount of community favour garnered from the initial process will likely determine the speed of the roll-out and it will evolve over time depending on the characteristics of the neighbourhood. Lessons learnt should expedite roll out of future areas and refine the process and expenditure.

TABLE 1: COMPARING STREET TREE PLANTING PROGRAMS

	IPSWICH CITY COUNCIL'S BEAUTIFUL IPSWICH PROJECT	BRISBANE CITY COUNCIL'S GREENING THE SUBURBS PROJECT	HORNSBY CITY COUNCIL, NSW STREET TREE PROGRAM	FRASER COAST 100,000 TREES PROJECT - GREENING STREETSCAPES
HIGH LEVEL COMMUNITY ENGAGEMENT	Project announced and website is primary source of information after initial press release.	Project announced and website is primary source of information after initial press release	25,000 Trees Project was a Mayoral objective to achieve set number of tree plantings within an already well treed city.	100,000 Trees project announced through Council media and website is primary repository of information after initial press release.
FOCUS	ICC has very much framed their project around Beautifying Ipswich as well as cooling. Being in the western suburbs this locality in known for its lack of cooling breezes and inland heat.	BCC has focussed their campaign around healthy green neighbourhoods and mention cooling streets but does not focus on for example, climate change benefits of shading streets and houses.	Further reinforcement of Hornsby's existing leafy, green suburbs and as a response to climate change.	FCRC current website discusses environmental benefits but does not directly highlight the local advantages to having a green street or neighbourhood and the benefits that would apply to residents. Messages about healthy, green suburbs and cooling need more focus.
COUNCIL WEB LINK	https://www.ipswich.qld.gov.au/about_ipswich/beautiful-ipswich/street-tree-program	https://www.brisbane.qld.gov.au/clean-and-green/natural-environment-and-water/growing-a-greener-brisbane/greener-suburbs-program	http://trees.hornsby.nsw.gov.au/streettrees/	https://www.frasercoast.qld.gov.au/100-000-trees
COMMUNITY ENGAGEMENT	ICC approaches each suburb as a whole and then focuses on one street at a time. These streets might occur on same day or sequential days. ICC provide a simple mail out indicating the week of street tree install.	BCC lists upcoming areas where street tree planting will occur on their website. Mail outs to residents may not necessarily occur and this would be specific to the scale of the planting event, i.e., a few houses and no mailout occurs; a suburb scale project would likely receive a mailout generated by the Local Member.	Following initial announcements a letter is issued with your rates introducing the program and nominating your suburb part of Phase 1. Many suburbs are identified initially and residents are given the opportunity to Opt Out now. Based on responses received Council then targets the suburbs where the fewest Opt Outs were received and start their phased rollout. Suburbs targeted often have fewer existing trees or are located along high profile entry / arterial roads.	Community engagement is proposed initially as a Planting Day to raise wider community awareness mail out to residents. This can be either in a street or an open space nearby. A detailed discussion is provided in part C6 of this report. Where Community planting days are not utilised, the Hornsby process of advising upcoming works in the rates notice and then a 2nd area specific letter closer to the day of installation seems most appropriate for the FCRC.
HOW MUCH DETAIL IS THE PUBLIC PROVIDED ABOUT THE STREET TREE PLANTING	ICC typically provides a detailed planting plan showing exact location plus tree species as part of the mail out for each street.	BCC simply says when the planting is occurring and does not disclose species to residents because they receive too much feedback/ likes flowers/ dislikes colour/ too big etc.. A blue dot is marked on the nature strip but anecdotal feedback suggests residents don't associate that blue dot with the reality of the imminent street tree planting.	Councils website provides a nice snapshot of the types of trees that they are planting as generic information. The 1st rates letter is not too specific. Once areas are targeted a 2nd letter is sent stating that works will occur in the following week and Opt Out opportunity is provided again.	We would suggest adding as much detail on the website as possible with the minimum being: - Upcoming community events, i.e Planting Days - Tree profiles showing preferred trees, their features and benefits (flowering etc.) and likely size in suburban conditions. - General timing, e.g. 2nd Quarter list of suburbs being targeted. - Good images of what installed street trees could look like, i.e before and after images - Links to education resources and further reading for those who want to know more.
OPT-OUT	If residents want to Opt out they do so by contacting the ICC Call Centre.	If residents want to Opt out they do so by contacting the BCC Call Centre.	Two rounds of Opt Out are provided to residents in this process. In Hornsby residents with wide frontages (where more than one tree could be installed) are followed up by Council officers to change their mind.	Two rounds of Opt out are provided in the above process.
OPT-IN : "CAN I DO MORE "	Residents are not provided a clear avenue to communicate to Council but Council does facilitate additional trees on the day of installation; usually trees rejected by others.	BCC does facilitate street trees on a request basis but otherwise no process set up to champion additional plantings of street trees.	HCC does faciliate street trees on an request basis.	Many local authorities have their nurseries or an agreement with a local supplier to stock trees. FCRC does not currently facilitate free street trees but this could be re-established through the website via a WANT TO DO MORE portal.
TREE PLANTING DAY	ICC rolled out their program using a combination of Council staff and private contractors and generally did not involve residents in the tree planting process. They simply start at one end of the street and move along the street planting all trees not challenged by residents, i.e Opt Outs.	BCC holds tree planting days in specific streets and parks to raise the profile of the project and instil some responsibility to residents for the trees. Smaller installations are often just installed during weekdays with residents coming home to a planted tree.	Community tree planting days are provided within open sapces rather than individual streets. This is easier and allows for smaller trees (shovel ready trees) to be planted whereas street trees are typcially larger stock.	Part C6 discusses different apporaches for installation including tree planting days.

Proposed Community Engagement Plan

A SUGGESTED FORMAT FOR THE FRASER COAST REGIONAL COUNCIL

STEP 1. RE-LAUNCH "GREENING THE FRASER COAST" through Council's normal media platforms such as newsletters and website.

Key Messages for the community:
1. Street trees are coming to the suburbs and more information will follow in due course.
2. Reinforce aims of the project: healthy communities, cooler suburbs, better liveability
3. Follow the website for more information

The launch would identify that a Street Tree Program is being undertaken by Council as part of the wider Greening the Fraser Coast' strategy to improve the community.

Communication needs to focus on all benefits to residents. The current website could be expanded and branded appropriately to communicate the program more effectively noting that the website will be the primary source of information moving forward for residents wanting more information without contacting Council directly.

Links should be provided on the Council website providing general time frames around which areas are being included in the program first, similar to the BCC approach. ICC also provided a link for residents to request a street tree so as to expedite the process for their household.

This is also the first opportunity for residents to engage. Ideally it would be good for a whole street of residents to be approached to show some initial support and momentum for the program and the pilot site could be used for this purpose.

WANT TO DO MORE ? A website link promoting ways for residents to be engaged in the process could be a good way to find a Tree Champion within various neighbourhoods and this could generate some mini projects to assist Council with promotion. E.g. a few residents on the same street wanting street trees could become an early project.

STEP 2 - HOW MUCH INFORMATION TO PRESENT TO RESIDENTS ABOUT STREET TREES

First contact is proposed as a letter with Council's rates notice. This high-level notification should advise residents that Councils direction is to plant more street trees and that their suburb is being investigated to be part of early works. Provide an Opt Out contact and identify areas where the least resistance is found.

The saying "A little bit of information can be dangerous" certainly applies when discussing trees because descriptions of trees on the internet vary significantly. The same tree could be described by some as a "forest giant" on one website and by other websites as small, compact trees. Hence we feel it beneficial that Council frames this type of information in a simple, concise way so residents do not search and find the wrong information.

This Council web page could show an image of what street tree planting will look like on a nature strip lawn and ideally a short description and image of 6-10 tree species that Council will likely use. Whilst it is an aim of the Council by adding greater diversity, winning over residents first is it's primary challenge.

Ipswich City Council utilised the design drawings as a mean to communicate to residents exactly where trees are being proposed so as to disclose all information up front.

Pros: People understand what they are getting and Council receives positive/negative feedback early on.

Cons: Unless communicated simply people become nervous and may not engage further.

Ideally, Council builds momentum through a Street Tree Planting Day perhaps on neutral territory, i.e. A local parkland or adjacent a school. This type of event can occur with a local member via a school or community organisation. Promotional imagery gathered from this event can be utilised in community engagement moving forward.

STEP 3. 2nd MAIL OUT / LETTER DROP & ROLLOUT

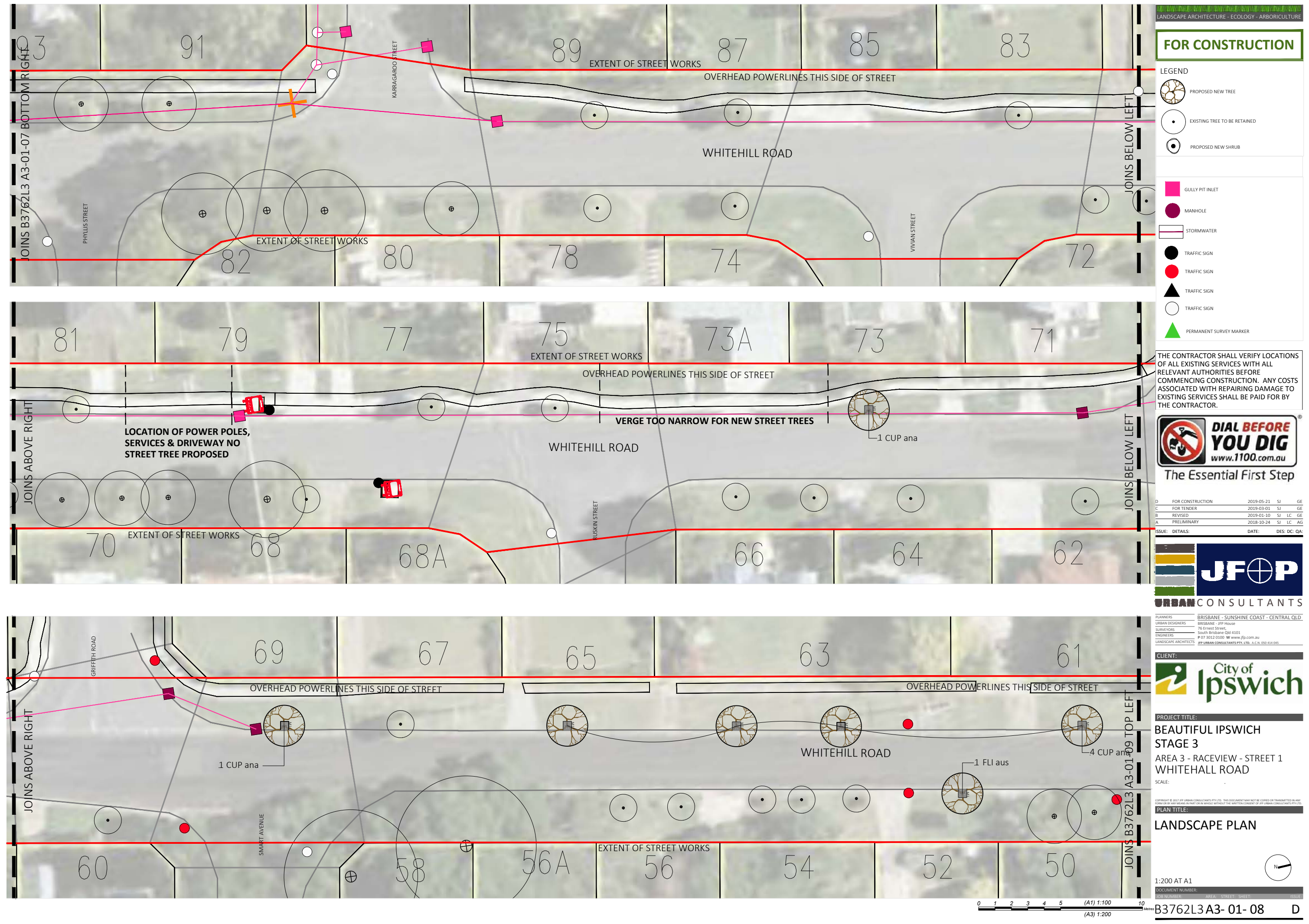
The Street Tree Program rollout can occur at various scales depending on time/budget available.

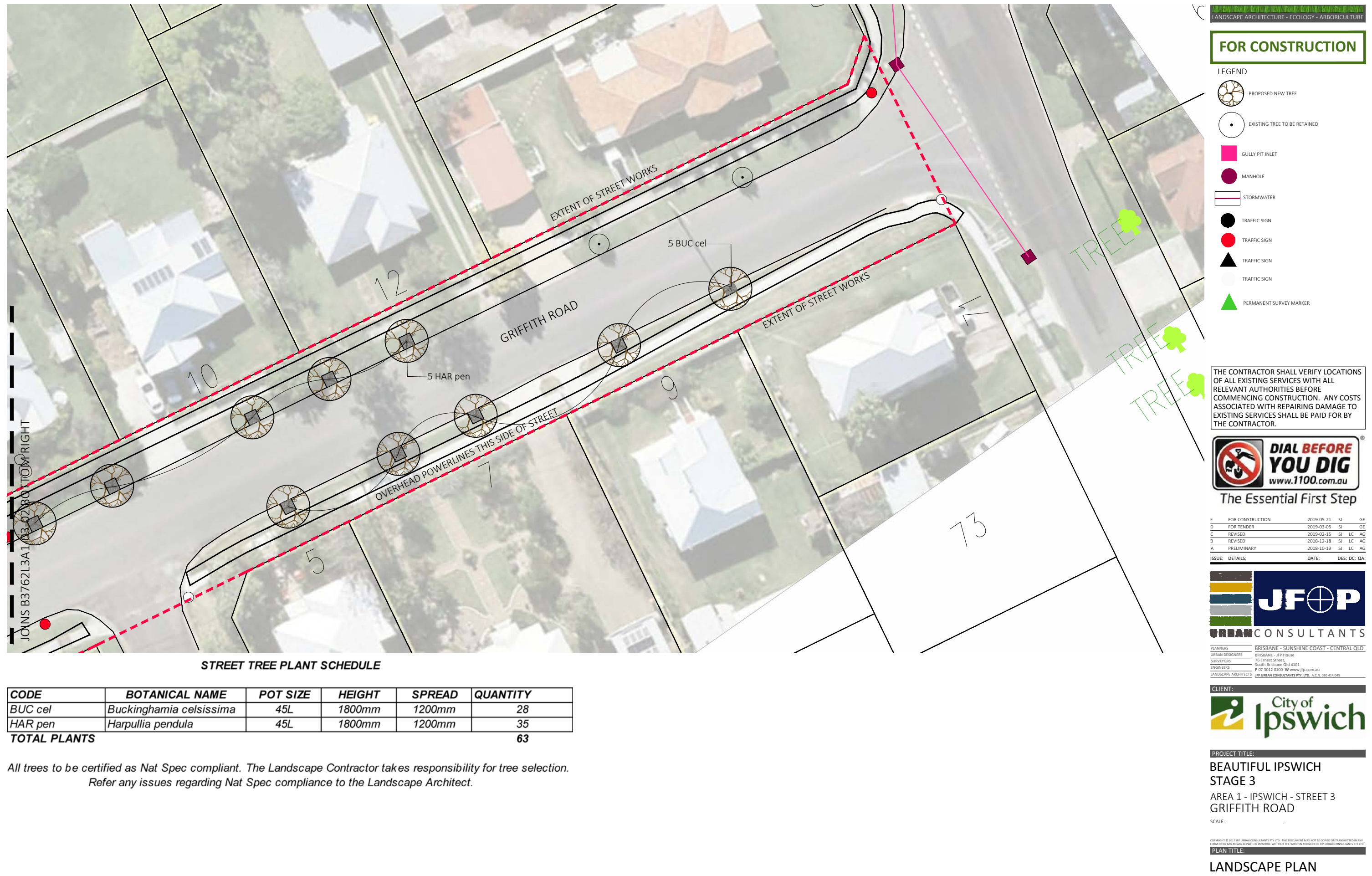
Ipswich City took a suburb-level approach involving multiple streets at a time. This achieved 44km of designed and planted streetscape in two years. Whilst various Councillors might have held street tree planting events as part of their individual budgets the ICC program was generally funded at departmental level. Ipswich found that approximately 10-20% of residents opted out following receipt of the letter drop. A further 10-20% opted out on the day of the installation but overall more than half of the planned street trees were installed.

Whilst a mail out is a simple way to inform and provide a reminder for residents it typically does not allow for any interaction.

WANT TO DO MORE ? A website link so people can register for a street tree and become a tree champion. The benefit of having some willing and able residents is numerous to promote upcoming works. Furthermore, use of their nature strip for a pop-up stall on the day of tree planting will be helpful to ensure a successful engagement.

These Tree Champions might also be willing to get actively involved in street tree planting days in their local neighbourhood and elsewhere. Similarly, prior community engagement with local schools creates a good platform to approach the wider community as a child's enthusiasm often creates more awareness for busy parents. Through colouring competitions and the like the message of street tree planting can be brought home.





STREET TREE PLANT SCHEDULE

CODE	BOTANICAL NAME	POT SIZE	HEIGHT	SPREAD	QUANTITY
BUC cel	Buckinghamia celsissima	45L	1800mm	1200mm	28
HAR pen	Harpullia pendula	45L	1800mm	1200mm	35
TOTAL PLANTS					63

All trees to be certified as Nat Spec compliant. The Landscape Contractor takes responsibility for tree selection. Refer any issues regarding Nat Spec compliance to the Landscape Architect.

FIGURE 35: Examples of street tree plans supplied to residents as part of installation rollout

STREETSCAPE YEAR 1

STREETSCAPE YEAR 5

STREETSCAPE YEAR 10

FIGURE 36: Examples of street tree plans that could be tabled with residents as part of community enagement plan

FIGURE 37: BEFORE AND AFTER RENDERS can be useful to help people visualise what their street could look like.

STEP 4. INSTALLATION DAY : AN EVENT OR A RIGHT

Community Tree Planting Days could occur as a pre-planned, community engagement day including sausage sizzle and the like. For this type of event to occur in a streetscape raises many safety issues as families with young children will be present.

As fore mentioned, finding a local resident to use 'their' nature strip as a spot for a few pop up tents would be ideal or alternatively, finding a street that has a park frontage or wider nature strip to host the stalls. The cost to produce this event will greatly outweigh the cost of the street trees planted but the momentum built on the day creates the platform to create community confidence moving forward.

For the event, we would suggest Council aims at installing 20-30 street trees along one or two streets. Ideally 25L or 45L trees are installed for immediate impact. Extra trees (smaller stock) for residents wanting a second tree and free backyard plants should be made available on the day as well, e.g. lilly pillies.

For the street tree planting to be successful the tree planting still needs some attention to detail and several Council staff will need to supervise works.

To install a 25L or 45L street tree normally a small excavator with an auger is used to drill the installation hole (450mm diameter would be desirable) a utility or trailer to cart topsoil, mulch and the trees. We would suggest these tree holes are dug on the Thursday/ Friday and refilled immediately prior to the Saturday event.
Once the hole is prepared the tree planting is much easier for residents and removes WHS issues associated with machines on site.

A spade cut edge should be installed and residents shown how this can be easily maintained. Ideally, the turf between the tree and kerb (about 500-750mm wide) is removed and the tree mulched neatly around.

Following installation a Tree Care Flyer can be provided to residents about how to maintain the tree, i.e. watering regime, edging, mulching etc. Council should use a water truck to water trees for a few weeks subject to weather.

Council Planting Days
Following the Community Planting Day/s within each suburb (or precinct within a suburb), Council should look to install the balance of the areas street trees during the immediate weeks / months of the event.

Those people who have not opted out may not be home when trees are being planted so spray paint markings of the verge is a common way to alert residents, who may have forgotten, that street trees are coming to their street.

STEP 6. BUILDING MOMENTUM AND MOVING FORWARD

Following the initial pilot planting day Council should reassess the need for further tree planting days. Community days cannot be undervalued as a time for residents to gather and to share common goals.
However, Councils primary goal is to plant as many street trees within a set budget so a balance between events held and tree planting outcomes needs to be achieved.

100 street trees (25L bag stock) would cost $11,000 to install on a new development using a similar installation method as described prior.

100 juvenile street trees (75mm tubes or 140mm stock) could be installed for as little as $1000-2000 because the tree stock cost is significantly less ($5- 10 per tree) and two staff could install these within one day.

The benefit of using small stock is that they can be installed with a shovel / hand held rotary excavator and do not require larger machines to dig holes or cart away excavated soil & bring topsoil to each yard. Only mulch is required and this is lightweight an easy to install from a roadside utility.

However, the issue with small trees is that they are just as easily removed or damaged unless the resident is agreeable to the planting.

So whilst smaller is an easier install than larger stock (25L or 300mm pots), the larger tree tree size (25L) is widely accepted as the norm because it represents a more substantial investment by Council and is more robust.

In order to make a significant impact, Council must provide the foundation by setting achievable goals and resourcing the project; preferably through a team of council employees creating a dedicated tree planting role.

Programming works
Many Councils utilise the cooler months of the year (typically an 8 week period) when mowing and weeding maintenance requirements are typcially lower to program training and annual housekeeping tasks.

During these times members of the maintenance workforce could transition into the tree planting crew. This also allows for the programs' planning/organising team to plan and program which streets are to be tagreted next to facilitate the bulk of the planting undertaken over a short, compressed period to maximise efficiency and reduce costs.

The **Greening Fraser Coast Strategy: Streetscapes** provides Council the opportunity to provide greater employment opportunities within Council whilst achieving improved environmental outcomes for the region.

Fraser Coast
REGIONAL COUNCIL