# AGENDA

## Ordinary Council Meeting
## Tuesday, 31 March 2020

**I hereby give notice that an Ordinary Meeting of Council will be held on:**

**Date:** **Tuesday, 31 March 2020**

**Time:** **5:30 pm**

**Location:** **Council Chambers**
**Level 1, Civic Centre**
**Harry Chan Avenue, Darwin**

**Scott Waters**

**Chief Executive Officer**

**ORDINARY COUNCIL MEMBERS**

The Right Worshipful, the Lord Mayor Kon Vatskalis (Chair)
Alderman Andrew Arthur
Alderman Paul Arnold
Alderman Jimmy Bouhoris
Alderman Justine Glover
Alderman Gary Haslett
Alderman Robin Knox
Alderman George Lambrinidis
Alderman Simon Niblock
Alderman Mick Palmer
Alderman Peter Pangquee
Alderman Rebecca Want de Rowe
Alderman Emma Young

**OFFICERS**

Chief Executive Officer, Scott Waters
General Manager Innovation Growth & Development Services, Joshua Sattler
General Manager Community & Regulatory Services, Polly Banks
A/General Manager Government Relations & External Affairs, Vanessa Green
General Manager Engineering & City Services, Ron Grinsell

**WEBCASTING DISCLAIMER**

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# Order Of Business

# 1 ACKNOWLEDGEMENT OF COUNTRY

# 2 THE LORD'S PRAYER

# 3 MEETING DECLARED OPEN

# 4 APOLOGIES AND LEAVE OF ABSENCE

## 4.1 Apologies

THAT the apology from Alderman Emma Young, be received.

## 4.2 Leave of Absence Granted

## 4.3 Leave of Absence Requested

# 5 ELECTRONIC MEETING ATTENDANCE

## 5.1 Electronic Meeting Attendance Granted

## 5.2 Electronic Meeting Attendance Requested

# 6 DECLARATION OF INTEREST OF MEMBERS AND STAFF

# 7 CONFIRMATION OF PREVIOUS MINUTES

Ordinary Council Meeting - 17 March 2020

# 8 MOVING OF CONFIDENTIAL ITEMS

# 9 MATTERS OF PUBLIC IMPORTANCE / LORD MAYORAL MINUTE

## 9.1 MAYORAL MINUTE - CONDOLENCE MOTION

**Author:** **Lord Mayor**

**Attachments:** **Nil**

Pursuant to By-law 152 of the Council's By-laws, I submit the following minute for consideration by the Council:

**INTRODUCTION**

The City of Darwin wishes to extend its sincerest condolences to the family of Mr Frank Lam.

Mr Frank Lam was a long time Darwin icon, and the proprietor of the Magic Wok in the Westlane Arcade, which was a successful Territory business for over 48 years. Mr Frank Lam was a reliable tenant of the City of Darwin for over 15 years and respected by several generations of Darwinians.

With this is mind I wish to recommend:

**RECOMMENDATIONS**

1. THAT the City of Darwin express its sincere condolences to the family and friends of the late Frank Lam.

**THE HON.KON VATSKALIS**

**LORD MAYOR**

## 10 PUBLIC QUESTION TIME

## 11 PETITIONS

## 12 DEPUTATIONS AND BRIEFINGS

# 13 NOTICES OF MOTION

## 13.1 NOTICE OF MOTION - REQUEST FOR REPORT

**Attachments:** **Nil**

I, Alderman Simon Niblock, give notice that at the next Ordinary Council Meeting on 31 March 2020, I will move the following motion:-

**MOTION**

THAT a report be prepared for Council outlining options to allow both domestic and commercial rate payers to defer payment of their rates. That the report include, but not be limited to, eligibility criteria, time frame for implementation and impact on Council's budget and long term financial plan.

# 14 OFFICERS REPORTS

## 14.1 CITY OF DARWIN SUBMISSION INTO THE SENATE ENQUIRY INTO HOMELESSNESS

**Author:** **Darwin Safer City Program Coordinator**

**Authoriser:** **General Manager Community and Regulatory Services**

**Attachments:**
1. **City of Darwin submission to the Senate Enquiry into Homelessness**
2. **Terms of Reference Homelessness Enquiry**

### SUMMARY

The purpose of this report is to seek endorsement from Council to provide a submission into the House of Representatives Standing Committee on Social Policy and Legal Affairs' enquiry into homelessness in Australia.

### RECOMMENDATIONS

1. THAT the report entitled City of Darwin Submission into the Senate Enquiry into Homelessness be received and noted.
2. THAT Council endorses City of Darwin's submission to the Enquiry **(Attachment 1)**.

### KEY ISSUES

- On 11 February 2020, House of Representatives Standing Committee on Social Policy and Legal Affairs' commenced a new enquiry into homelessness in Australia.
- The Committee will be accepting submissions as per the attached Terms of Reference, with applications closing 9 April, 2020.
- The Terms of Reference are quite extensive. Submissions are not required to address all points, only those with particular relevance to the organisations and/or individuals making submissions to the Enquiry.
- City of Darwin expends significant time and resources addressing issues caused by high levels of people experiencing homelessness in the NT, many of who sleep rough in the Darwin Municipality.
- Formal submission to the Enquiry may require a City of Darwin representative to attend the Enquiry and provide information related to the submission, should the Committee convene in the Northern Territory.

### BACKGROUND

***DECISION NO.21\3191 (14/04/15)***

***National General Assembly of Local Government***

*Report No. 15C0052 KH:kl (14/04/15) Common No. 3031605*
*A. THAT Report Number 15C0052 KH:kl entitled National General Assembly of Local Government, be received and noted.*
*B. THAT Council endorse the following resolution for the 2015 National General Assembly of Local Government:*
*"That the 2015 National General Assembly seek Commonwealth leadership, coordination and resourcing for the development of culturally safe, affordable and accessible housing and shelter in all Australian capital cities including for intrastate and interstate visitors who are transient in and*

*out of urban centres."*

**DISCUSSION**

On 11 February 2020, House of Representatives Standing Committee on Social Policy and Legal Affairs' commenced a new enquiry into homelessness in Australia. The Committee will be accepting submissions as per the Terms of Reference at **Attachment 1**, with applications closing 9 April, 2020.

City of Darwin's submission, prepared by the Coordinator Darwin Safer City Program is at **Attachment 2.**

The submission aims to provide information related to homelessness that is specific to the Northern Territory which directly affects the Darwin Municipality by virtue of the large numbers of people experiencing homelessness and sleeping rough in Darwin. The submission provides commentary on the following points:

- The Northern Territory has the highest rate of homelessness in Australia (NT Shelter estimates over 500 people per 10,000), with the issue disproportionately affecting Aboriginal and Torres Strait Islander people;
- The provision of housing and other resources and programs to address homelessness remains the responsibility of the State/Territory Governments and the Federal Government and is outside of the scope of local government to address;
- Federal Government funding to address the large numbers of people experiencing homelessness in the Northern Territory is inadequate and extremely low when compared to funding received by other States and Territories;
- There are currently extremely long wait times for public and community housing and few options for short and medium term accommodation options required by community visitors to Darwin;
- High numbers of long term homeless and rough sleepers affect Darwin in a myriad of ways and put significant pressure on local service providers, including City of Darwin in the local government area. Operationally, City of Darwin is significantly impacted by large numbers of people residing in Council owned parks and reserves.

**STRATEGIC ENVIRONMENT**

The issues addressed in this Report are in accordance with the following Goals/Strategies as outlined in the 'Darwin 2030 City for People. City of Colour. Strategic Plan':

**Goal**
6 Governance Framework

**Outcome**
6.3 Decision Making and Management

**LEGISLATIVE/POLICY**

Nil.

**CONSULTATION**

This report was considered by the Strategic Direction Group on **17 March 2020** and now referred to **Council** for consideration.

**Internal**

In preparing this report, the following City of Darwin officers were consulted:

Nil.

**External**

- Regional Coordinator for Northern Australia, NT Shelter.

**BUDGET/RESOURCE IMPLICATIONS**

**RISK**

Nil.

**LEGAL**

Nil.

**ARTS, CULTURE & ENVIRONMENT**

Nil.

**City of Darwin submission to the House of Representatives Standing Committee's Enquiry into Homelessness in Australia.**

The Northern Territory has the highest number per of people experiencing homelessness in Australia, with rates estimated to be 12 times the national average. Although homelessness and high levels of people displaced into 'rough sleeping' are national issues, there are specific challenges with regard to high levels of homelessness in the Northern Territory context.

Firstly, the Northern Territory has a very high Indigenous population, with a very large percentage of the population living in regional and remote communities. It is widely recognised there are significant deficits in the provision of housing on both communities and urban centres, as well as chronic overcrowding in existing dwellings, including in 'town camps'. There is also a huge gap in the provision of short to medium term accommodation in urban and regional centres in the NT, including Darwin. The overall shortage of accommodation, including long term housing and accommodation places for those who need it in the short to medium term, (or in times of crisis) puts huge pressure on existing housing across the NT. It also pushes people into a cycle of sleeping rough and puts an inordinate amount of pressure within human service organisations and/or the community sector tasked with addressing homelessness and the complex social issues that go hand in hand with it. A lack of safe accommodation greatly increases the vulnerability experienced by individuals and families and creates further deficits in the interrelated areas of health, social and emotional wellbeing, employment outcomes and education.

Currently, there are few federal programs that specifically support homeless Aboriginal and Torres Strait Islander peoples at risk of experiencing homelessness in the NT and few Territory-based ones either. Services for Aboriginal and Torres Strait Islander people experiencing homelessness remain overwhelmingly 'mainstreamed' and it is clear current services are vastly inadequate and heavily underfunded. With the provision of adequate housing linked to so many aspirational outcomes for Indigenous people (such as those identified in the Closing the Gap strategy) suitable supply of accessible accommodation reflects the most basic of human needs. Without adequate accommodation, improvements to health and other measurements of wellbeing will almost certainly remain an unmet target in Australia. There needs to be immediate recognition that a lack of suitable housing disproportionately affects Aboriginal and Torres Strait Islander people and contributes to very poor outcomes across a range of parameters. Provision of culturally appropriate crisis and early intervention services are required immediately and in the long term whilst more robust accommodation arrangements are planned for and enacted upon. Otherwise, the chronic and unmet need for housing and other shorter term accommodation services for Indigenous people will continue to negatively impact our community, including increased domestic violence, greater deficits in health care, a reduction in mental health outcomes and the ongoing, substantial problem of alcohol and substance misuse.

There is no doubt that a range of factors within communities, including inadequate and overcrowded housing, causes significant displacement of people to Darwin and other centres in the NT.

Darwin and the smaller, regional centres such as Katherine and Alice Springs operate as key service hubs for visitors from remote and regional communities to access health and medical services; employment and training opportunities; participate in community events and leisure activities and to fulfil other requirements, such as shopping. In Darwin especially, high numbers of long term homeless and rough sleepers affect the City in a myriad of ways and put significant pressure on local and Territory Government and human service organisations in the community sector. In the local government area, organisationally and operationally, City of Darwin is impacted by large numbers of people residing in Council owned parks and reserves. For many years, City of Darwin Council has advocated at Territory and Federal level within a number of forums with regard to the issue of homelessness the impact it has in the Municipality. Council regularly identifies the issues experienced by people who travel to Darwin from regional and remote communities who do not, for a host of reasons, have access to suitable shelter. Compromised sanitation, illegal camp sites, public intoxication impacts, litter and peace disturbing conduct continues to challenge our community as a result in the absence of suitable and supported accommodation and housing infrastructure. Ongoing and significant expenditure and/or resources are utilised in an attempt to address the issues that arise from people having little or few options with regard to housing or accommodation in the Municipality. This lack of appropriate accommodation remains a substantial service gap in community infrastructure and cannot be addressed by local Government without a coordinated approach at all levels of Government, and one we recognise, must be led and resourced by the Commonwealth Government.

City of Darwin Council recognises that responding to homelessness and/or addressing the lack of suitable shelter, especially for the highly vulnerable cohort who reside in the NT, is a major undertaking. Similarly, Council understands it is not the responsibility of local government to resource such a response, nor is it possible in terms of provision of the very high levels of funding that is needed to address it. Local governments across the NT however can play a role in affecting change and in advocating for a whole-of-government response to address the overwhelming need of NT residents for the adequate provision of housing and accommodation needed. Multi-faceted approaches are required to address the complex and disproportionate rate of homelessness in the Northern Territory. This includes the provision of new and appropriate housing in remote communities and towns throughout the Territory to meet demand, the provision of better health care in communities and the supply of a variety of short term and low cost accommodation options in Darwin and other centres.

There are literally thousands of academic articles and several previous enquiries into homelessness which clearly outline the many negative impacts inadequate housing has on individuals, families and communities, all of which are easily accessed by this Committee. However there is no doubt what is needed in the first instance to address the high levels of people experiencing homelessness across Australia are significant and sustained investments in infrastructure and associated community programs which address such things as tenancy support. What is needed in the NT is for the manifestly inadequate and unjust level of funding the NT receives from the Federal Government for this issue to immediately and substantially increase. Without adequate funding the current situation will continue, as will the disadvantage and poor outcomes which are intrinsically linked to inadequate provision of housing as a basic human right.

To illustrate this point, in the 2016 Census, it was estimated that the NT had nearly 14,000 estimated homeless (599 people per 10,000) yet received only 1.3% of total funding provided by the National Housing and Homelessness Agreement. Under the Agreement, the NT received a total of $18.9 million from the National funding pool. In comparison, Western Australia, with an estimated rate of 36 homeless per 10,000 received $157 Million in funding and nearly 11% of total pool funding. It is clear that the amount of funding received by the Northern Territory does not and cannot in the future address what would be seen in other parts of the world as a humanitarian crisis; one which is affecting right now the most vulnerable in our society and which includes future generations (and future custodians) of this country.

DEPARTMENT OF THE HOUSE OF REPRESENTATIVES

## Inquiry into homelessness in Australia

*Terms of reference*

The House of Representatives Standing Committee on Social Policy and Legal Affairs will inquire into and report on homelessness in Australia. The inquiry will have particular regard to:

1. the incidence of homelessness in Australia;
2. factors affecting the incidence of homelessness, including housing-market factors;
3. the causes of, and contributing factors to, housing overcrowding;
4. opportunities for early intervention and prevention of homelessness;
5. services to support people who are homeless or at risk of homelessness, including housing assistance, social housing, and specialist homelessness services;
6. support and services for people at particular risk of homelessness, including:
    a. women and children affected by family and domestic violence;
    b. children and young people;
    c. Indigenous Australians;
    d. people experiencing repeat homelessness;
    e. people exiting institutions and other care arrangements;
    f. people aged 55 or older;
    g. people living with disability; and
    h. people living with mental illness;
7. the suitability of mainstream services for people who are homeless or at risk of homelessness;
8. examples of best-practice approaches in Australia and internationally for preventing and addressing homelessness;
9. the adequacy of the collection and publication of housing, homelessness, and housing affordability related data; and
10. governance and funding arrangements in relation to housing and homelessness, particularly as they relate to the responsibility of Local, State, Territory and Federal Governments.

*Adopted 11 February 2020*

**STANDING COMMITTEE ON SOCIAL POLICY AND LEGAL AFFAIRS**
PO Box 6021, Parliament House, Canberra ACT 2600 | Phone: (02) 6277 2358 | Fax: (02) 6277 8594
Email: spla.reps@aph.gov.au | www.aph.gov.au/spla

## 14.2 COMMUNITUY GRANTS 2020/21 COVID-19 RESPONSE

**Author:** **Community Development Officer**

**Authoriser:** **General Manager Community and Regulatory Services**

**Attachments:** **1. COVID-19 Response Grants Program Guidelines**

### SUMMARY

The purpose of this report is to seek Council endorsement of a COVID-19 Response Grants Program, with a total of $150,000 allocated in two rounds, to support community groups or organisations to deliver innovative solutions to meet the changing needs of the community due to COVID-19.

### RECOMMENDATIONS

1. THAT the report entitled Community Grants COVID-19 Response be received and noted.
2. Council endorse the reallocation of current operational funding to open a new grant round of $50,000, for community projects that respond to COVID-19 with innovative solutions to be delivered between from April to 30 June 2020.
3. Council endorse the repurposing of the 2020/21 Community Grants Program budget, to a second round of $100,000, for community projects that respond to COVID-19 with innovative solutions delivered between 1 July and 31 December 2020.
4. Council endorse the COVID-19 Response Grants Program Guidelines, which will apply to both the 19/20 and 20/21 rounds.

### KEY ISSUES

- Round 1 of the 2020/21 Community Grants Program is currently open until 31 March 2020, with $50,000 of funding available from the 2020/21 financial year. Applicants can apply for funding of up to $10,000. There is a separate pool of $50,000 for community-based environment grants.
- The majority of applications submitted are unlikely to meet the changing needs of the community due to the impacts of COVID-19, and therefore the officer recommendation is that the grants program be realigned to focus on projects that ease the burden on the community in the context of a pandemic.
- Each year Council allocates $100,000 to the Community Grants Program in two rounds. It is recommended that Council open a new grant round of $50,000 for community projects that respond to COVID-19 with innovative solutions, with requests up to $10,000, for projects delivered by 30 June 2020. Funding will be sourced from current operational funding that cannot be used due to the COVID-19 response.
- It is recommended that the 2020/21 Community Grants Program budget be repurposed for a second round of $100,000, for community projects that respond to COVID-19 with innovative solutions delivered between 1 July and 31 December 2020.
- A COVID-19 Grants Program Guidelines which outlines eligibility and assessment criteria is at **Attachment 1**.

### BACKGROUND

$100,000 for the Community Grants Program is budgeted for each year and typically distributed across two rounds of $50,000 per round.

### DISCUSSION

**Community Grants Program Overview**

City of Darwin Community Grants Program provides funding of up to $10,000 to community groups and organisations to deliver meaningful activities, programs or events for the Darwin municipality, enhancing Darwin as a safe, liveable and healthy city.

**Current Community Grants Program Round**

The current round of the Community Grants Program was open for applications from 1 to 31 March 2020, with $50,000 of funding available. There is a separate pool of $50,000 for community-based environment grants. Applicants can apply for funding of up to $10,000. The majority of applications received for the Community Grants Program are event-based, and/or have high levels of face-to-face engagement. This indicates that a high proportion of the applications submitted in the current round will unlikely meet the changing needs of the community due to the impacts of COVID-19, and therefore the officer recommendation is that the grants program be realigned to focus on projects that can immediately ease the burden on the community in the context of a pandemic.

**COVID-19 Response Grants Program**

As the country grapples with extended periods of physical distancing and isolation as well as significant job losses, Council and the wider community need to rethink how we operate our day-to-day lives and respond to the changing needs of the community in innovative ways. The purpose of the COVID-19 Response Grants Program is to address this need, and will provide funding to grant applicants that can demonstrate an ability to deliver projects that:

1. Develop resources or services to address the changing needs of the community in a COVID-19 environment;
2. Increase community connection and social inclusion in an environment where physical distancing and isolation measures are in place;
3. Enrich the diversity of cultural, environmental, recreational or social opportunity to Darwin residents in the new and developing COVID-19 environment;
4. Build and strengthen partnerships between community groups and organisations; and
5. Enhance Darwin as a safe, liveable and healthy city in the context of a pandemic.

Examples of potential projects for the COVID-19 Grants Program could include, for example, Foodbank setting up a food delivery service to vulnerable persons in self-isolation; or the development of a live streaming service or online platform to connect artists and audiences.

A COVID-19 Grants Program Guidelines which outlines eligibility and assessment criteria is at **Attachment 1**.

A total of $150,000 will be available for the COVID-19 Response Grants Program allocated in two rounds:

- Round 1 of $50,000 for requests up to $10,000, for projects delivered from April to 30 June 2020.
- Round 2 of $100,000 for requests up to $10,000 for projects delivered between 1 July and 31 December 2020.

**STRATEGIC ENVIRONMENT**

The issues addressed in this Report are in accordance with the following Goals/Strategies as outlined in the ‘Darwin 2030 City for People. City of Colour. Strategic Plan’:

**Goal**
2 A Safe, Liveable and Healthy City

**Outcome**
2.1 By 2030, Darwin will be a safer place to live and visit

## LEGISLATIVE/POLICY

The Community Grants Program is guided by City of Darwin Policy No. 008 Community Inclusion.

## CONSULTATION

### Internal

In preparing this report, the following City of Darwin officers were consulted:

- Community and Cultural Development Coordinator
- General Manager Community and Regulatory Services

### External

- Nil

## BUDGET/RESOURCE IMPLICATIONS

$100,000 for the Community Grants Program is budgeted for each year, allocated in two rounds, this will fund the 20/21 single round of COVID-19 Community Grants.

The 19/20 $50,000 round will be funded from pooling a number of budgets that will be unspent as a result of projects being unable to be delivered in a coronavirus context – such as key community events. $7,000 remains in the 2019/20 Community Grants Program budget. It is proposed that Round 1 of the COVID-19 Response Grants Program of $50,000 be funded with this $7,000 in addition to other current operational funding that cannot be used due to the COVID-19 response. The three budget sources that funding will be redirected from, submitted as part of the 3rd Quarter Budget Review, are:

(a) Safer City budget: $30,000

(b) Indigenous Activities budget: $7,000

(c) Arts Activity budget: $6,000

It is proposed that Round 2 of the COVID-19 Response Grants Program of $100,000 be funded from the 2020/21 Community Grants Program budget.

## RISK

No major risk

## LEGAL

In accordance with COVID-19 Council response.

## ARTS, CULTURE & ENVIRONMENT

The Community Grants Program supports community groups and organisations to deliver meaningful activities, programs or events for the Darwin municipality, to enrich the diversity of cultural, environmental, recreational or social opportunity to Darwin residents and enhance Darwin as a safe, liveable and healthy city.

# COVID-19

## OVERVIEW

City of Darwin's COVID-19
Response Grants Program provides funding of up to $10,000 to community groups or organisations to create and deliver innovative solutions to meet the changing needs of the community due to the impacts of COVID-19.

The first grant round of $50,000 will be for projects delivered by 30 June 2020. The second round of $100,000 will be for projects delivered between 1 July and 31 December 2020.

The program provides funding to:

- Develop resources or services to address the changing needs of the community in a COVID-19 environment;
- Increase community connection and social inclusion in an environment where physical distancing and isolation measures are in place;
- Enrich the diversity of cultural, environmental, recreational or social opportunity to Darwin residents in the new and developing COVID-19 environment;
- Build and strengthen partnerships between community groups and organisations; and
- Enhance Darwin as a safe, livable and healthy city in the context of a pandemic.

## ELIGIBILITY

- Organisations must be incorporated or be auspiced* by an incorporated organisation for the purposes of this application;
- Proposed activities must occur within the timeframe specified for each funding round; and
- Activities must occur within the Darwin municipality.

*Auspice – if you are unincorporated or an individual you will need the support of an incorporated organisation to act as a sponsor, to be an intermediary for financial purposes. If required, please contact us for support in connecting you with a suitable organisation.

**INELIGIBLE APPLICATIONS**

The following proposals will not be considered:

- Applications for individual pursuits;
- Requests for the ongoing core functions of an organisation, such as insurance and utilities costs;
- Requests for commercial or competitive activities;
- Funding for capital funds or improvements on private property;
- School based projects that do not involve the wider community;
- Event or conference sponsorship, prizes or award ceremonies;
- Projects that have already started;
- Applications where an applicant has not fully acquitted a previous City of Darwin grant.

**ASSESSMENT CRITERIA**

Applications will be assessed using the following criteria:

- Feasibility of the project and its potential to meet the objectives of the COVID-19 Response Grants Program;
- Project considers accessibility and the inclusion of the whole community;
- How well the applicant has developed the project's purpose and methods of reaching and working with the target community;
- How comprehensive and realistic the budget is.

**TIMELINE**

**ROUND 1:**


**ROUND 2:**


**APPLICATION PROCESS**

Applications are to be submitted online via the SmartyGrants portal from 6 April, with a closing time of 5.00pm on Monday 27 April.

An assessment panel will assess all applications against assessment criteria and provide recommendations to Council; funding allocation decisions will be made at an Ordinary Council meeting.

**FUNDING REQUIREMENTS**

Successful applicants will be required to sign a service agreement with City of Darwin that details the commitments between the applicant and Council. Successful applicants will require written Council approval to change the agreement, such as changes to major items purchased or the timelines of the project.

Successful applicants will be required to acknowledge the support provided. This can be through the use of City of Darwin's logo on materials produced; a digital copy of the logo will be supplied.

Successful applicants will be required to submit an acquittal online through SmartyGrants within three months of the project's completion.

**CONTACT**

If you require any further information, please contact the Community Development Officer on 08 8930 0645, email darwin@darwin.nt.gov.au or visit the City of Darwin website.

## 14.3 MY DARWIN - ECONOMIC STIMULUS PROPOSAL

**Author:** **Executive Manager Innovation and Information Services**

**Authoriser:** **General Manager Innovation Growth and Development Services**

**Attachments:** **1. My Darwin Concept Proposal**
**2. Statewide Comparison**

### SUMMARY

The purpose of this report is to advise Council on the development of the web application, “my.Darwin” to assist with stimulating the local economy.

### RECOMMENDATIONS

1. THAT the report MY DARWIN – Economic Stimulus Proposal be received and noted.
2. THAT Council endorse the allocation of car parking revenue from the month February 2020 to support the initiative.
3. THAT Council delegate to the CEO to investigate internally restricted parking reserves for the re-appropriation into this financial year’s operating budget.

### KEY ISSUES

- The Darwin economy has been weakening in recent years and may become dire due to the COVID-19 pandemic
- Economic stimulus will be required from all tiers of government to support the rebuilding of the Australian economy
- A digital approach to directly support local business and the Darwin community.

### BACKGROUND

The Darwin economy has been weakening in recent years as the city now transitions from a rapid growth during major construction projects. The Gross State Product has declined, leading to many challenges for the local businesses - **Attachment 1** (slide 2).

In this economic climate, it’s important for the City of Darwin to drive and stimulate the local economy through re-investment, removal of fees, innovative economic activities that create good long-term economic health and reasonable growth.

Based on the recently conducted Place Score study, the community is keen in public events, cultural diversity and local community businesses. Darwinians will support each other and answer the call if incentivised - **Attachment 1** (slide 4).

### DISCUSSION

City of Darwin is to develop a mechanism to stimulate economic growth in unprecedented times, to support local business and the community. The mechanism will be to develop a digital web application that re-invests Council parking revenue to increase spend within the local small business sector, stimulating growth and increase spend across the Darwin municipality.

The re-investment will be transferred directly to financial incentives for the community, where local businesses receive rebates for discounted trade supported by Council. It will increase footfall, participation and activation into the CBD with consumption multipliers (slide 5). It will create synergized marketing and communication efforts across merchant, partners and Council networks and create an ethos for local buy and support, as a legacy outcome to continue for years to come.

Car parking fees from one month of revenue of approximately $350K could be injected into the Darwin economy encouraging the community to spend with local businesses. The development of the application to be completed in approximately 4-5 weeks and could be implemented at a time when social distancing restrictions are eased. Many Darwin small businesses will be struggling and this will be an opportune time to have a program available, where the re-investment will be transferred to financial incentives for the community (slide 5).

This application will create a legacy and re-usable platform for the community and enable a dashboard to highlight how much money is remaining. The end user community member will be able to redeem the discount instantly through the vendor, where the vendor will be reimbursed directly from Council (slide 6).

This project will increase our partnerships with Darwin businesses and other partners and present a united front on the economic crisis caused by the COVID-19 pandemic.

This application can continue to grow and become a more efficient and user friendly platform for some of Council's services. These could be investigated in later phases of the project to include the payment of rates, a booking system (centres, parks, banners), dog registrations, events and have push notifications to inform the end user (slide 14).

Other councils in Australia are initiating economic stimulus programs also, including the City of Melbourne ($10M) and the Gold Coast Council ($3M). **Attachment 2.**

## STRATEGIC ENVIRONMENT

The issues addressed in this Report are in accordance with the following Goals/Strategies as outlined in the 'Darwin 2030 City for People. City of Colour. Strategic Plan':

**Goal**
4 A Smart and Prosperous City

**Outcome**
4.2 By 2030, Darwin will have attracted and retained more residents and will offer sustainable investment opportunities

## LEGISLATIVE/POLICY

Nil

## CONSULTATION

This report was considered by the Strategic Direction Group on 24th March 2020 and now referred to Council for consideration.

### Internal

In preparing this report, the following City of Darwin officers were consulted:

- Members of the Strategic Leadership Group
- Innovation growth and development services teams

### External

- Application development vendors
- Tourism NT, NTG Department of Tourism, Sport and Culture

## BUDGET/RESOURCE IMPLICATIONS

The budget impact of this decision is estimated at $370,000, which includes cost of development ($20,000) and the allowance for the re-investment injection into the local economy ($350,000). The development cost to occur in the 2019/20 financial year and depending on when Council prefer the product be released, the remaining funds would be utilised in either the 2019/20 or 2020/21 financial year. At this stage estimated release of this initiative will be May 2020.

**RISK**

The only risk identified with the decision is The Council's reputation due to disputes in payment to the vendors. Based on the risk matrix this is low. Adequate systems are being built to ensure validation is done both at the vendor and The Council's side. This reduces risk of fraud.

Without providing financial assistance, The Council runs the risk of many businesses failing to survive the pandemic period and the unprecedented economic downturn.

**LEGAL**

There are no direct legal implications as a result of this decision. Any formal complaints from customers or merchants can be addressed to the relevant communication mediums and will be addressed by The Council.

**ARTS, CULTURE & ENVIRONMENT**

There are no direct relation to arts, culture and the environment as a result of this decision.


234 likes
23
4
my.Darwin
A digital approach for economic stimulus directly supporting Darwin businesses and the community
#SMARTDARWIN

# Introduction

The Darwin economy has been weakening in recent years as the city now transitions from a rapid growth during major construction projects. The GSP has declined leading to many challenges for the local businesses.

- NT Gross State Product - declined by 1.5%
- Decline in international tourist arrivals – declined by 16% (compared 2018)
- Reducing population numbers in Darwin – declined by 1.6% (compared 2018)
- Local job growth – declined by 1.3% (2018-19 source: NEIR)
- Rise of closures in CBD based businesses – Only 870 new NT businesses registered in 2019

**COVID-19 will reduce Australian GDP by 0.9% and would amount to $17 Billion Dollars**

**- KPMG**

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# Overview of the proposal

In this economic climate, it's important for the City of Darwin to drive and stimulate the local economy through re-investment, removal of fees, innovative economic activities that create good long term economic health and reasonable growth.

**City of Darwin stimulus activity:**

- Governance and advocacy
- Planning, development and regulation
- Provision of infrastructure, property and community

## Creating the circular economy


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# The voice of the community

Based on the recently conducted **Place Score** study, the community is keen in public events, cultural diversity and local community businesses.

- Evidence of public events happening here (markets, street entertainers etc.)
- Things to do in the evening (shopping, dining, entertainment etc.)
- Culturally diverse businesses (range of ethnicities and interests
- Businesses that reflect the local community and values

This is evidently clear that there is an existing demand for local business encouragement, promotional activities or innovative approaches.

Darwinians will support each other and answer the call if incentivized.

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# Identifying opportunities

The City of Darwin identifies that re-investment of revenue back into the economy through a legacy initiative that will drive demand, activation and potential growth for local businesses. A project to reinvest Parking Revenue back into the community:

- Parking revenue – avg $368,000 pm – a potential uplift of $4M
- Parking occupancy – avg 80% (92,000 sessions pm)

- The re-investment will be transferred to financial incentives for the community, **directly**.
- Local businesses will receive rebates for discounted trade supported by **council $**.
- Increase footfall, participation and activation into the CBD, **consumption multipliers**
- Synergized marketing and communication efforts across merchant and **CoD network**
- Create an ethos for local buy and support as a **legacy** outcome to continue as BAU.

***We are already in the process of activating parklets with planters, providing rent relief on leased properties until June 30 and waiving mobile food vendor fees for 2020-2021.***

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# The solution

## A legacy platform for the community

A new mobile app or PWA (Progressive web application) will be developed and will be made available on all leading app stores or a designated URL – My.Darwin. Live dashboards reflecting the "kitty" will be available to the users and influence discounts available.

## Loaded Credits to the end user

The app will include either Cash credits or Discount vouchers as per popular categories – Food, beverages, restaurants, cafes, retail...

## Reinvestment of Council revenue to the community

The City of Darwin will re-invest its revenue from parking back in to the community in forms of community discounts that will be redeemable at Darwin based local businesses for a defined period – proposed to be 1 month only.

## In Store discount

The user will be able to redeem the discount through the vendor in store. All through the click of a button. Discounts to be scaled depending upon uptake through the month, starting at 10% and changing weekly.

## Rebates to the vendor

The business owners receive a rebate from the Council for the discounts provided in-store

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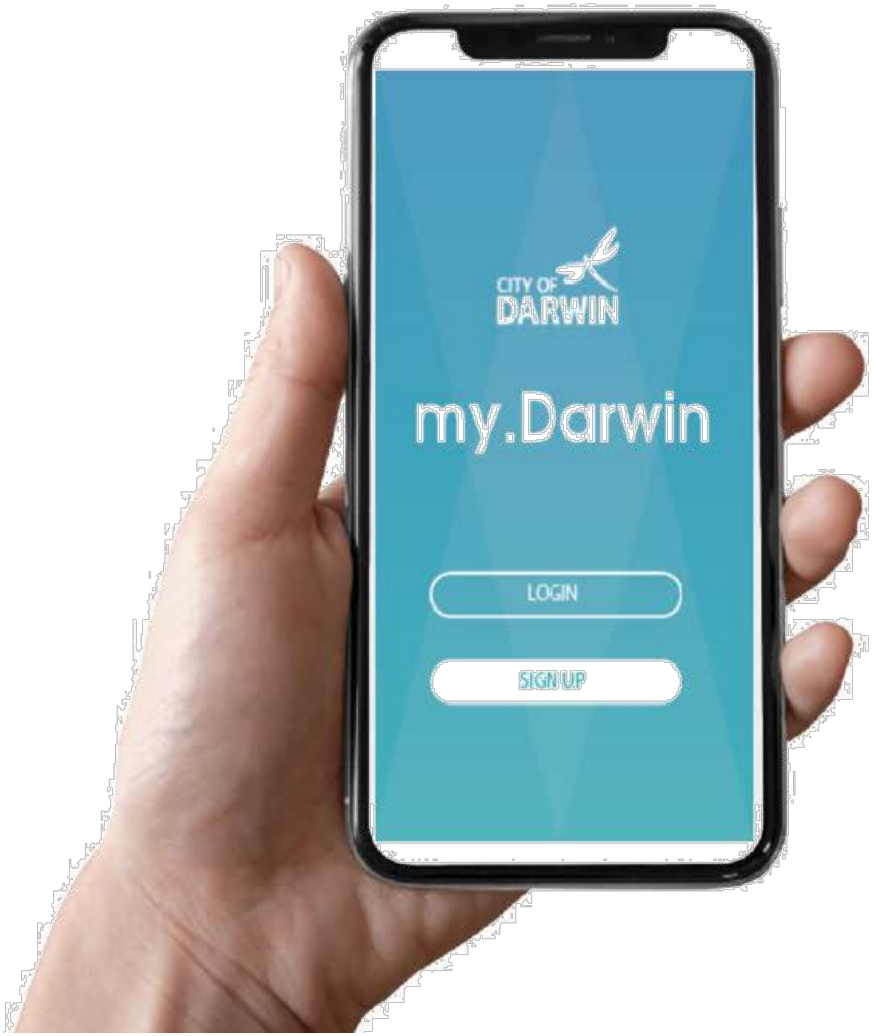
CITY OF DARWIN
my.Darwin
LOGIN
SIGN UP


my.Darwin
Get local, buy local, grow local
Concept idea only
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# The process

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Customer downloads the App

Views Discount Codes,
Vouchers or Credit amount

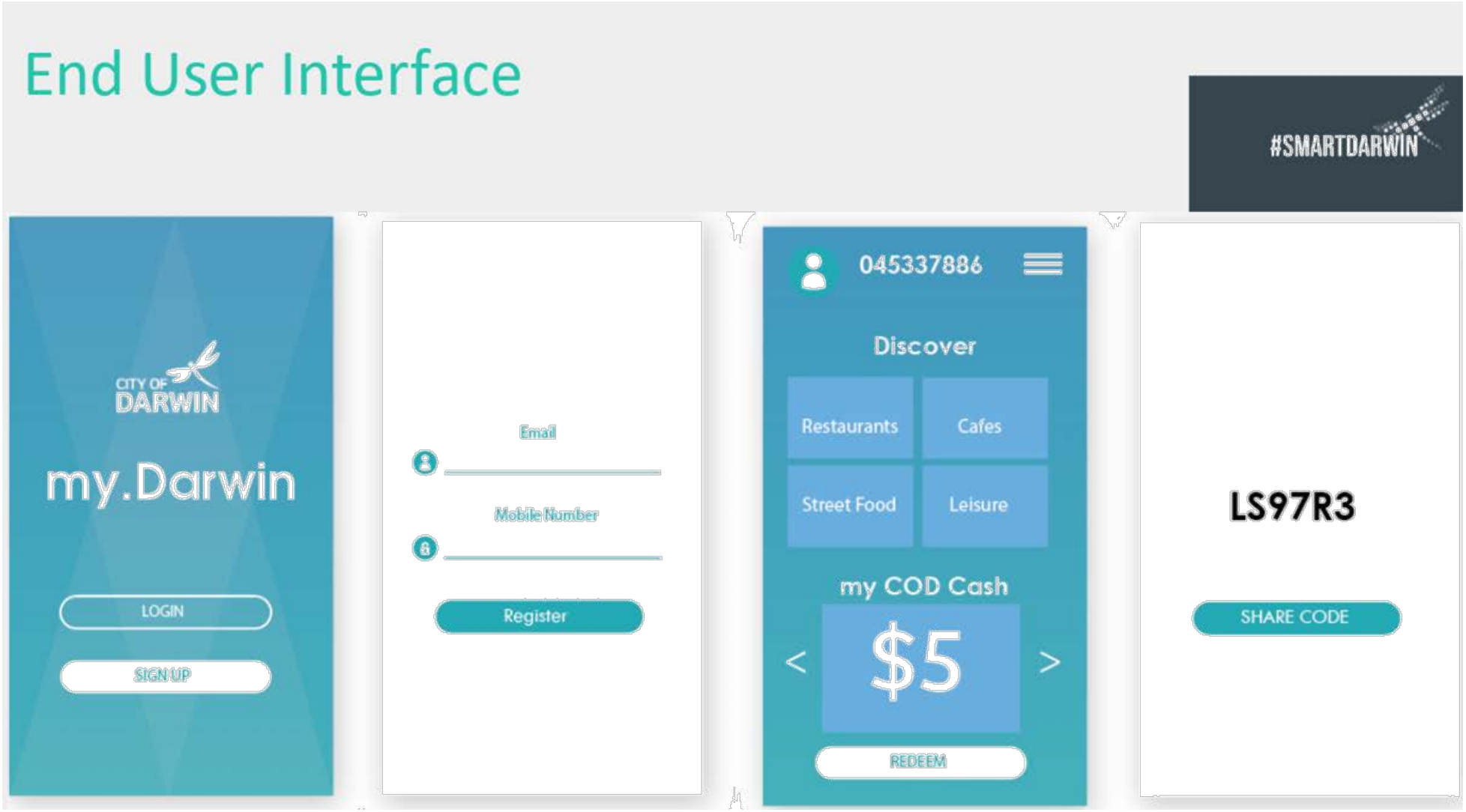
Uses the Code at participating
merchant outlet

Merchant validates code and
provides discount

Merchant sends the list of
approved transactions to CoD

CoD validates with user data and
credits the merchant

# End User Interface




- The app will indicate your Credit balance and Expiry date.
- This will create the FOMO and drives urgency to purchase.

How do we measure?



- A community dashboard to display live information.
- Drive momentum and interest among community and encourage merchants


TIMELINE
Build vs Buy
Look for off the shelf products or players in the same space.
DONE!
Partnerships
Develop agreements with merchants and other partners. Train stakeholders on the process.
In train
Test and review
Examine the process, the technology, the fulfilment process. Review through test phase
4-5 weeks
Launch Beta version
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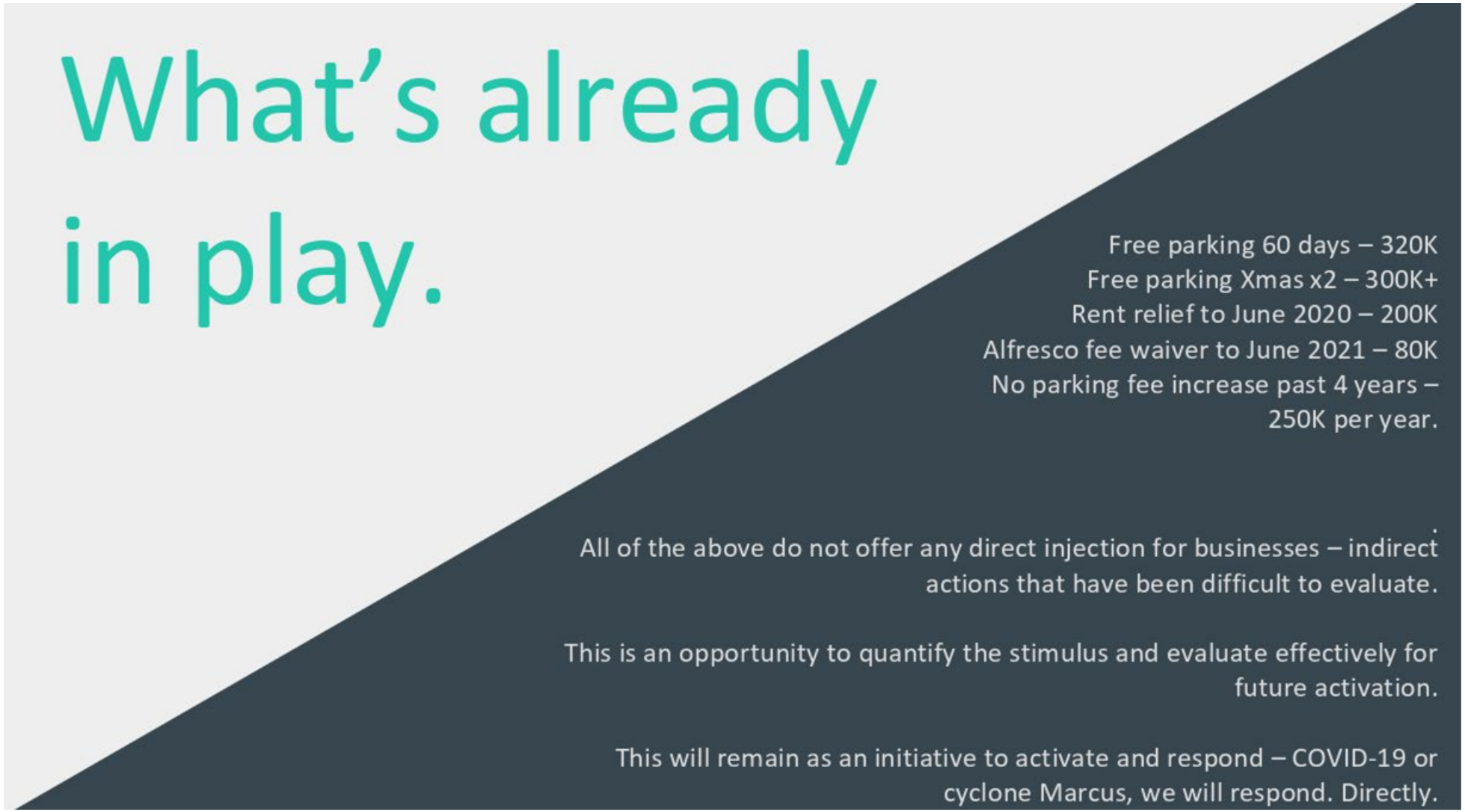
What's already in play.
Free parking 60 days – 320K
Free parking Xmas x2 – 300K+
Rent relief to June 2020 – 200K
Alfresco fee waiver to June 2021 – 80K
No parking fee increase past 4 years – 250K per year.
All of the above do not offer any direct injection for businesses – indirect actions that have been difficult to evaluate.
This is an opportunity to quantify the stimulus and evaluate effectively for future activation.
This will remain as an initiative to activate and respond – COVID-19 or cyclone Marcus, we will respond. Directly.

# Required – act immediately

- A decision from Council to support and re-allocate revenue from car parking to this initiative – to be determined by council but it is proposed to be at least one month of off street revenue approx. **300K**.
- A decision from council to support the future allocation of internally restricted reserves for budget appropriations for the current FY 2019-2020.
- IGDS will commence final build associated with the digital platform in readiness for May 2020 roll out.
- Communications to start immediately to prepare and give the business community belief in continuing/returning to their businesses.
- IGDS to support businesses shoulder to shoulder in launching this initiative.
- This could be a mechanism to support all local governments across the nation in similar circumstance.

# Additional Phases

Investigations into top priority items for the community can be developed into this App in future phases.

- Phase 2: Ability to pay Rates + push notifications
- Phase 3: Add Booking system (centres, parks, banners) + push notifications
- Phase 4: Add Dog registrations + push notifications
- Phase 5: Events module + push notifications
- Phase 6: Integrate/Replace SeeClickFix


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# How are other LGA's responding?

City of Perth

- Free up to one hour on-street parking across the CBD for the next three months to support local business
- A freeze in increases in municipal rates and charges, including sanitation and waste charges
- No fees and charges relating to inspection services for small business for the next three months
- Suspension of lease and rental payments for three months to all City of Perth tenants leasing city owned property, including the relinquishment of bank guarantees
- An express planning service for change of land use and development applications for small businesses with no application fee.
- Accelerated capital works projects and major city maintenance programs
- A full refund on all cancelled bookings at City properties or facilities
- Shorter payment terms for creditors, reduced from 30 days to 15 days
- Debtors experiencing hardship will receive a range of options to assist in payment

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# How are other LGA's responding?

CITY OF MELBOURNE

- grants to develop online and e-services
- one-on-one advice and support through our expanded Business Concierge Service
- halving rent for eligible tenants in Council-owned buildings for three months
- suspending fees for Food Act registrations and street trading permits for three months
- a new Rates Hardship Policy
- a virtual Business Support Summit.

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# How are other LGA's responding?

Brisbane City Council

- Footpath dining (fees) - Waived for the period of 1 March to 30 June 2020
- Outdoor dining (malls) - Credit of prepaid invoices for the period of 1 March to 30 June 2020 and Council will not pursue unpaid invoices
- Advertising (application or license) - No fees for advertising, signs, hoardings and structures for the period of 1 March to 30 June 2020
- Filming (application) - Waive or reduce application fees for filming approval at Council owned or controlled land or assets
- Entertainment venues and events (booking) - Refunds granted for those seeking to cancel their events due to COVID-19 gathering restrictions
- Music venues (booking) - Refunds granted for those seeking to cancel their events due to COVID-19 gathering restrictions
- Food Act 2006 (fees) - Waived or refunded for the period of 1 March to 30 June 2020
- Temporary Food Stalls/Premises (fees) - Waived or refunded for the period of 1 March to 30 June 2020

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# How are other LGA's responding?

Brisbane City Council

- Standing vehicles, stalls booths and stands for commercial or promotional activity - Waived for small business for the period of 1 March to 30 June 2020
- City Hall (booking) - Refunds granted for those seeking to cancel their booking due to COVID-19
- Community Hall (booking) - Refunds granted for those seeking to cancel their booking due to COVID-19
- Commercial leases - Rent relief for the March to June 30 quarter for retail and tourism sector

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# How are other LGA's responding?

CITY OF ADELAIDE

- 100% rent free for three months for lessees of Council-owned buildings (small business operators)
- 100% rent free for three months for community leases of council-owned buildings
- 100% rent free for three months for Adelaide Central Market Tenants
- Waiving of the separate rate for the purpose of managing and marketing the Rundle Mall precinct (Rundle Mall Marketing Levy) for three months
- Establishing a Small Business Task Force to work in collaboration with Business SA and other agencies tasked with the support for city businesses

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## 14.4 DANGEROUS TREES IN THE DARWIN MUNICIPALITY - UPDATE MARCH 2020

**Common No.:** **3777063**

**Author:** **Senior Technical Officer Parks and Reserves**
**Executive Manager Operations**

**Authoriser:** **General Manager Engineering and City Services**

**Attachments:**

1. **Tree Damage and Resilience Assessment**
2. **Council Decision NO 22\1202**
3. **Final Report Parks Survey**
4. **Parks Survey Tree Details Spreadsheet**
5. **Council Decision NO 22\0922**
6. **Tree Management Plan**
7. **Visual Tree Risk Assessment Methodology**
8. **iTree Report CBD**
9. **iTree Report Central**
10. **iTree Report Northern**

### SUMMARY

The purpose of this report is to provide Council with post Cyclone Marcus findings of the inspection of Council parks that identified trees planted in close proximity to private property and/or power lines that have the potential to cause damage and/or injury when they come down.

### RECOMMENDATIONS

1. THAT the report entitled Dangerous Trees in the Darwin Municipality – Update March 2020 be received and noted.
2. THAT Council undertake bi-annual Visual Tree Risk Assessment (VTRA) inspections of the 619 tree assets as identified in this report.
3. THAT Council further consider these issues in broader community terms through the draft Greening Strategy.

### KEY ISSUES

- 201 parks were surveyed.
- 91 parks were found to have no trees which would cause a probable threat to a principal residence or power line during a severe weather event.
- The remaining 110 parks were found to contain a total of 619 trees which may, hypothetically, pose a threat to a principle residence or power line during a severe weather event.
- Of the 619 trees assessed for risk, 588 were found to be As Low As Reasonably Possible (ALARP) and under Council's adopted Tree Management Plan, no further action was required.
- 31 trees were found to be above ALARP status and control measures were enacted either through pruning or removal, in order to bring them back to ALARP status.
- These trees have been placed on the bi-annual tree inspection task list and will continue to be monitored for risk in line with Council's adopted Tree management Plan.
- The issue around removal or retention of large trees such as African Mahoganies with potential to impact private property is of broad community concern and should be further addressed through the draft Greening Strategy.

**BACKGROUND**

At the Ordinary Council meeting held on 27 March 2018, Council put forth a motion as follows:

**20.2 Dangerous Trees in the Darwin Municipality**
Common No. 3777063

(Lord Mayor/Bouhoris)

A. THAT Council considers the issue of potentially dangerous trees that are planted throughout the City of Darwin Municipality, and in particular the trees that have come down during recent significant weather events and develop a plan to manage these trees.

B. THAT the report include but not be limited to:
- A report to be provided to Council regarding the kind of trees that have been damaged /uprooted in recent events ranked by (generic) species.
- Inspection of Council parks to identify trees planted in close proximity to private property and /or powerlines that have the potential to cause damage and /or injury if/when they come down.
- A plan for the removal and possible costing to be provided to Council regarding specifically these trees.
- A review of our parks to identify number and species of trees that may come down in a future weather event as it has happened in the recent past.
- An investigation is undertaken to identify, in consultation with local experts, suitable species of trees mainly native to the top end areas with high rainfall and cyclonic conditions to be used in the future for landscaping.
- A review of the list trees suitable to areas prone to cyclones been undertaken to ensure that all trees that are removed are replaced with suitable trees.
- Potential for salvage from fallen trees
- The issue of maintaining trees to reduce load so that they remain safe in high winds

C. THAT a follow up report from Cyclone Marcus be presented to Council, including consideration of effects on vegetation.

DECISION NO.22\0592 (27/03/18) Carried

ACTION: ACTING GM CITY OPS

**DISCUSSION**

A number of actions were undertaken as directed in Council Decision No.22\0592 following Cyclone Marcus especially the concern of large trees, particularly the African Mahogany species (Khaya senegalensis) falling onto private property.

Very soon after the cyclone, a report entitled '*An assessment of tree damage and resilience in Darwin parks following Tropical Cyclone Marcus March 17th 2018'* **(Attachment 1)** was undertaken across 40 areas of parkland over a period of four weeks. This report was considered as part of a comprehensive undertaking by the Tree Re-Establishment Advisory Committee (TRAC) whose report and recommendations were supported in Council Decision No 22\1202 **(Attachment 2)**.

In late 2018 and early 2019 a project brief and scope of work were formulated, and an inspection of City of Darwin parkland was undertaken through consulting arboreal company Sully Pty Ltd to identify trees planted in close proximity to private property and/or power lines and additionally an approximate costing based on removal of any of these trees. The findings of this can be found in **Attachment 3 and 4.**

Determination as to the level of affected infrastructure to be included in the report was further addressed in Council Decision NO 22\0922 (17/7/18) **(Attachment 5)** whereby:

> *'E. THAT Council endorse the level of infrastructure, other than powerlines, considered for risk management purposes in the proposed survey of Council parks for trees located in close proximity to property and powerlines to be the principal residence of a property'.*

The survey inspected 201 City of Darwin parks of which:

- 91 were found to have no trees which would pose a probable threat to a principal residence or power line during a cyclone or severe weather event;
- The remaining 110 parks were found to contain a total of 619 trees which may, *hypothetically*, pose a threat to a principal residence or power line during a cyclone or severe weather event;
- All 619 trees were inspected under Council's adopted Visual Tree Risk Assessment (VTRA) methodology;
- All trees were measured using a laser range finder for height, diameter breast height (girth) and canopy spread;
- The distance between the tree and principal residence/power line was also measured.

The consultant makes clear that there is no correlation between the results of a VTRA and the 'probable threat' posed by the tree during a cyclone or severe weather event.

Furthermore, the VTRA assesses the current risk under normal weather conditions whereas the 'probable threat' is a hypothetical scenario assuming the tree would fall in the direction of the principal residence. There is no certainty that the tree would:

- Actually fall as a result of severe weather; or
- Fall in the direction of the principal residence/power line.

In the case of power lines, any tree species and any size of tree, even relatively small, could potentially impact power lines. In comparison with the number of trees that are on the road reserve in the immediate vicinity of power lines, the issue of these identified trees in the parks will be dealt with through bi-annual VTRA inspections.

At the centre of this report is dealing with community concerns as to how large trees in close proximity to private property are to be managed, particularly African Mahoganies, in severe weather events.

It is critical to understand that City of Darwin's Tree Management Policy and Visual Tree Risk Assessment methodology **(Attachment 6 and 7)** are based on the professional arboreal assessment of trees under normal weather conditions.

Out of the 619 trees subjected to a VTRA:

- 588 were found to be of the lowest risk category known as ALARP (As Low As Reasonably Possible) and no further action was required;
- 31 trees were found to be above ALARP status and control measures were enacted either through pruning or removal, in order to bring them back to ALARP status.

The situation as to which species of trees and which way trees would fall in a severe weather event is purely hypothetical and does not form the basis of Council's adopted tree risk methodology.

City of Darwin Policy No. 050 - Trees On Verges – Conservation (2010) in so far that it is applied to verges and not parkland, does contains a provision that allows concerned residents/owners to approach Council and lobby for an otherwise ALARP assessed and healthy tree to be removed

Consideration must also be made of the fact that the area surveyed is limited to parkland. It does not cover the 192 kilometres of Council controlled road reserve network where it can be considered that the majority of Council trees assets would be situated.

Any decision made in isolation on these 619 trees, even if the African Mahoganies were singled out, would set a precedent and an unknown outcome if contemplating removing trees on the perceived basis that it would fall over in a severe weather event and could ultimately lead to a significant overall reduction of Darwin's Urban Forest.

In contemplating the removal, in isolation, of healthy trees whose risk rating is considered ALARP, then along with African Mahoganies, consideration would also turn to other species of large trees such as River Red Gums (*Eucalyptus camuldulensis*).

In considering outcomes required to enact a balance between safety and the long-term environmental benefits of such large trees it will be important for Council to develop a risk threshold/risk appetite as to assist in tree risk management decisions.

The Mahogany debate will go on and Council, through the long-term ideals of the Greening Strategy, can look to develop a risk threshold and tree benefits position through scenarios such as assessing:

1. An open grown Mahogany on a golf course - with usual human occupancy rates expected at a golf course.
2. A Mahogany in a park - grass target only.
3. A Mahogany in a park - target kids' playground.
4. A Mahogany in a park - targets including private property buildings.
5. A Mahogany street tree - suburban street.
6. A Mahogany street tree in the CBD – i.e. near McDonalds.

Ultimately, consideration would need to be taken as to storm force winds, and monsoonal rains being part of a normal weather scenario.

Then the individual context will become important and to be able to make management decisions that are robust and set precedents that City of Darwin Council can effectively argue - and that make sense - in each context.

In these scenarios Council may find that the balance for risk and benefit changes depending on the context of each tree/situation.

Sometimes tree benefit will out way risk, as Mahogany trees grow incredibly well in Darwin and sequester carbon and provide shade at a rate that most other species cannot match.

Sometimes tree risk will out way tree benefit, particularly given known failure tendency, high or constant target ratings and the regular and expected monsoonal storm influence that the trees are subject to as part of normal weather exposure in Darwin. Risk. Benefit. Context.

**Attachment 8, 9 and 10** is an assessment of these 619 trees that uses an internationally recognised software program called i-Tree Eco to quantify the structure and environmental effects of urban trees and calculates their value to society. In short, large trees provide a long-term significant contribution to the Darwin community as environmental assets which are quantifiable.

From a cost perspective, retention with intensive crown management is expensive and somewhat disruptive. In certain situations, it may be disproportionate to benefits.

Past, current and future planting programs are addressing the desire to diversify Darwin's urban forest and none more so than when Mahoganies are removed, and which avoid situations where future intensive crown management is burdened upon the tree owner.

Natural attrition and applying best practice tree management techniques, inspections and monitoring over many years have seen Council reduce many unsuitable trees from the community thereby mitigating risk to the general community.

This conservative and considered approach is also the recommended course of action to take regarding these 619 surveyed trees. The approach has been taken to add them to the bi-annual tree inspection task list.

Severe weather events of the past and those of the future will continue to influence Darwin's Urban Forest. The issue of how to mitigate the risk of tree failure and simultaneously provide a shady, cooler and environmentally sustainable municipality is complex. Council's Greening Strategy will provide a pathway and solid foundations upon which to progress further.

## STRATEGIC ENVIRONMENT

The issues addressed in this Report are in accordance with the following Goals/Strategies as outlined in the 'Darwin 2030 City for People. City of Colour. Strategic Plan':

**Goal**
3 A Cool, Clean and Green City

**Outcome**
3.1 By 2030, Darwin will be recognised as a clean and environmentally responsible city

## LEGISLATIVE/POLICY

City of Darwin Policy No. 050 - Trees on Verges – Conservation was adopted in 2010 and still in place. There is no overarching policy on urban forest management encompassing all tree vegetation. The body of work contained within the aforementioned Greening Strategy addresses the long-term approach to a considered range of future policies affecting City of Darwin controlled trees.

## CONSULTATION

### Internal

In preparing this report, the following City of Darwin officers were consulted:

- General Manager E&CS
- Executive Manager Operations
- Executive Manager Corporate
- Co-ordinator Parks and Reserves
- Team Leader Urban Forest Management
- Senior Climate Change and Environment Officer

### External

In preparing this report, the following external parties were consulted:

- Urban Forest Consulting – Urban Forest Planner
- Sully Pty Ltd – Consulting Arborist

## BUDGET/RESOURCE IMPLICATIONS

The additional bi-annual inspection and monitoring of these 619 trees as identified in the study will be achievable through current budgets and resourcing.

## RISK

Council's insurers have expressed an active interest in the actions that will be taken to mitigate risk associated with these 619 trees. A copy of this report will be forwarded to Council's insurance brokers (Marsh) for their review and feedback and that the increased inspection regime will be sufficient to manage the risk and keep Council's insurance premiums reasonable and maintain our risk profile.

**LEGAL**

Council have an endorsed Tree Management Plan and Visual Tree Risk Assessment (VTRA) methodology that was implemented following the coronial inquest into the death of an individual at the Gardens Park Golf Course in 2014.

**ARTS, CULTURE & ENVIRONMENT**

Trees provide great environmental benefits to the Darwin community and trees are assessed, within resourcing and budgeting, for maintenance or removal through a formal tree risk assessment process (VTRA), with the best long-term outcome for the community, including safety and environmental benefits such as:

- Biodiversity and habitat for various fauna species. This is a critical role that established trees play within our urban forest to create refuge and connectivity of habitat.
- Reducing air pollution.
- Carbon abatement.
- Shade and heat mitigation.
- Amenity and sense of place.
- Water disbursement, filtration and soil erosion prevention.

If the precedent were set whereby trees were to be removed based purely on perceived risk of their species and/or proximity to private property principal residences or power lines, there would be potential for a tremendous reduction of Darwin's urban forest tree canopy and the ability to provide shading and cooling across the municipality through tree vegetation would not be replaced for many years, even decades.

AUSTRALIAN VEGETATION MANAGEMENT SERVICES

Greening Australia

# An assessment of tree damage and resilience in Darwin parks following Tropical Cyclone Marcus March 17th 2018

CITY OF DARWIN

# Acknowledgements

The following people and their organisations provided valuable support to the project: Jason Hill, Bart Edmeades and Ross Sinordin from DENR (for providing access to Greater Darwin Land Units spatial data); Sharon Wilson and Paul Munns from the George Brown Botanical Gardens (for palm and exotic species identification); Ian Cowie and Nick Cuff from the Darwin Herbarium (for identification of native plants); Jude Scott and Ian Shepherd from BOM (for supplying TC Marcus information); Chris Bailey and Josh Forner from City of Darwin (project management and provision of Darwin parks maps); and Dr. Greg Calvert for initial survey discussions and review.

Cover Photo: A large uprooted *Khaya senegalensis* (African Mahogany) on the Esplanade in Darwin, March 2018.

This document may be cited as:

Clark, M.J., McGregor, J. & Parsons, B. (2018), *An assessment of tree damage and resilience in Darwin parks following Tropical Cyclone Marcus March 17th 2018*. City of Darwin, Darwin.

**FUNDED BY**

CITY OF DARWIN

# Executive Summary

Trees are an important component of the urban infrastructure. They are often ignored until an event such as a cyclone occurs and then become front and centre of community discussion, decisions, investment and actions. It is hoped that this report provides valuable information for planners, advisors and leaders to make well informed decisions in regards to the future management of vegetation in Darwin.

Tropical Cyclone Marcus passed over Darwin between 9.30 am and 1pm ACST on Saturday the 17th of March 2018. The category 2 cyclone brought with it strong wind gusts of 130km per hour (gale radius of around 100km (BoM 2018)) and brought significant widespread damage to Darwin, Palmerston and the surrounding rural area. It caused major damage to thousands of trees which in turn caused infrastructure damage to houses, vehicles, fences, carports, sheds, footpaths etc. Around 430 powerlines were downed leaving some 26500 customers without power immediately after the cyclone. Fortunately there were no injuries (BoM 2018).

On the 27th March 2018, City of Darwin Council considered dangerous trees in the Darwin municipality, in particular the issue of potentially dangerous trees planted throughout the municipality, the trees that came down during recent significant weather events and the development of a plan to manage these trees (CoD 2018). A decision was carried for amongst other actions, a report to be provided to Council regarding the kind of trees that had been damaged /uprooted in recent events ranked by (generic) species. This report presents the results of the survey and discusses the types and degrees of damage for the different species as well as any trends that relate to the physical environment and management of the trees.

Four weeks after TC Marcus, a survey of parks commenced to record (for all individual trees): damage to trees; tree damage to infrastructure and surrounding landscape information. This was followed by analysis of the 30 plus recorded individual tree parameters and correlations with the degree of cyclone damage to determine and attempt to understand trends in urban tree damage and survival. A data set of individual trees in the surveyed parks was provided to CoD and will be a valuable information layer for Council's GIS.

A total of 2,857 individual trees (all the trees in the parks) from 142 species in 40 parks were surveyed. This represented approximately 20% of the total 200 parks managed by DoC in the municipality. It is important to note that this survey is a snapshot in time of the tree damage in these 40 Darwin parks. The points of discussion and conclusions are based on results with a high sample size (ie high level of confidence) and notable statistics where results varied significantly from the average.

Of the 142 total species, 21 species comprised 68% of the surveyed trees. There were 7 standout dominant species with over 100 surveyed individuals. In order of descending order of tree numbers, they were: African mahogany (*Khaya senegalensis),* Maranthes (*Maranthes corymbosa),* Red gum

*(Eucalyptus camaldulensis),* Yellow flame tree *(Peltophorum pterocarpum),* Black wattle (*Acacia auriculiformis),* Papua New Guinea rosewood *(Pterocarpus indicus)* and Mimusops (*Mimusops elengi).*

Of the species surveyed, the majority were local provenance natives (50%) along with other NT native species (17%), Australian natives (4%), naturalised (2%) and exotic species (27%). As a proportion of all trees surveyed, the majority were local provenance (51.7%), exotic species made up a nearly a quarter (24.7%), NT natives with the next highest number of indiividuals (17.2%) and the remainder made up of Australian natives and naturalised specimens (3.9% and 2.5% respectively).

15.4% of total trees surveyed were uprooted. 8.3% of trees experienced significant branch damage and 3% large branch damage. A small percentage (3.1%) had trunks snapped or split and only 0.4% had a damaged leader. A high proportion of trees had small branch damage (28.8%). There was very little foliage loss recorded (0.4%). 40.5% of trees received no damage at all, although the author suspects that the foliage on alot of the trees had grown back by the time the survey commenced, and therefore were not recorded for foliage loss.

From the analysis of the 21 most abundant species, for all damage categories including minor foliage loss and small branches broken, *Khaya senegalensis* (88.5%), *Acacia auriculiformis* (88.7%), *Maranthes corymbosa* (78.0%) and *Eucalyptus camaldulensis* (75.9%) had the highest tree damage rates. *Maranthes corymbosa,* however, had a very low rate (12.2%) of major damage. Only 5.6% of Carpentaria acuminata were damaged. Other relatively unscathed tree species were *Ficus virens* (46.5%) and *Leptospermum madidum* (47.7%).

From the analysis of those species with 10 or more surveyed individuals, *Khaya senegalensis* (71.5%), *Acacia auriculiformis* (56.5%), *Eucalyptus camaldulensis* (46.6%) and *Peltophorum pterocarpum* (42.6%) had a significantly high rate of major damage (and a large sample size) compared with the average rate for the survey sample (30.2%). *Khaya senegalensis* had a significantly high proportion of uprooted trees (66%). This is over 4 times higher than the average uprooting rate for all trees. Other species which commonly uprooted were *Pterocarpus indicus* (weeping form) (30.6%) and *Acacia* auriculiformis (29.8%). *Delonix regia* (18.9%) and *Eucalyptus camaldulensis* (15.7%) had significantly higher rates of significant branch damage compared to the sample average (8.3%). *Leptospermum madidum,* with a good sample size, had a significantly high rate (12.3%) of snapped or split trunks.

*Carpentaria acuminata* (4.2%) and *Latania lodgesii* (2.9%) had low rates of major damage and a good sample size. *Callophyllum inophyllum* and *Carpentaria acuminata had 0% uprooting.*

The project also looked for correlations between park management and tree damage to determine any trends. This included park classification, irrigation types and tree spacings. Green belt parks had a higher rate of uprooting but lower rates of large and small branches being damaged compared with the majority of smaller neighbourhood parks. This could be due to the greater degree of exposure in the larger parks. Tree spacing was not a good predictor of tree damage. Uprooting appeared to be slightly higher in individuals, but this difference may not be statistically significant.

Manually watered trees had the highest rate of damage, the highest rate of significant branches breaking and the highest rate of uprooting. However, they had no recorded incidences of trunk snapping, possibly due to roots giving way more easily. When analysing the 21 most abundant species, irrigation was associated with a higher rate of tree damage in *Maranthes corymbosa* and *Corymbia bella*. No irrigation was associated with a higher rate of tree damage in *Carpentaria acuminata, Corymbia ptychocarpa* and Mimusops elengi. Manual irrigation was associated with a higher rate of tree damage in Khaya senegalensis. Irrigation was associated with a higher rate of large branch damage to Ficus virens and Khaya senegalensis and significant branches being broken in Maranthes corymbosa. Irrigation was associated with a higher rate of uprooting in Khaya senegalensis.

Tree damage by tree size, origin and health was analysed. Australian Native tree species had the lowest rate of tree damage (20.9%) and the the highest rate of no damage (62.7%). Exotic trees had the highest rate of tree damage (39.7%) and the highest rate of uprooting by a large margin (30.8%). The overall rate for exotic trees included two abundant species, *Khaya senegalensis* and *Pterocarpus indicus* (weeping variety) which had significantly high rates of uprooting. Australian Native and Local Provenance tree species had the lowest rates of uprooting (7.3% and 9.0% respectively). Australian Native tree species had the lowest rate of tree damage (20.9%). Exotic trees had the highest rate of tree damage (39.7%).

Large trees were more likely to be damaged than the general population, and specifically had a far higher rate of uprooting. Small trees were less likely to be damaged than the general population, and this was the case for almost every type of damage. Larger trees have more above ground surface area and mass to offer strong winds whereas smaller trees offer less resistance and usually have quite flexible trunks and branches.

Pre-existing weaknesses did not appear to be a good predictor of the tree being damaged by the cyclone, although pre-existing termite damage was more likely to lead to further damage than other factors. Interestingly, trees with termites present were less likely to be uprooted. This could possibly be due to the fact that it was harder to pick up pre-existing termite presence around an uprooted tree. The termites may, however, be doing something in the soil which is beneficial to the trees.

Tree damage by the physical environment was analysed. Where wind direction was determined, uprooted trees were more likely to have been uprooted by south-westerly or westerly winds than other directions. This correlates well with BoM tracking data which recorded the highest wind speeds from the south west and west.

Surveyed parks were found in flat to gently undulating upland surface, gentle side and lower slopes with low gradients. No obvious trends emerged from the analysis possibly due to the relatively uniform landforms found in the parks.

Leptic Rudosols (shallow gravelly lithosols) had lower rates of major tree damage, and specifically, lower rates of significant branches broken. This is a surprising result as shallow soils underlaid with unweathered rock are often blamed for tree uprooting. Brown kandosol soils (deep gravelly yellow massive earths with minor lithosols) and red kandosols (shallow-moderately deep red massive earths

with minor yellow massive earths) had high rates of uprooting. This could be a result of these deeper soils being more saturated following heavy monsoonal rains previous to the cyclone.

Slope and waterlogging didn't appear to be a significant driver of damage, or any particular type of damage.

Trees were examined for their damage to infrastructure. Of all the trees surveyed 3.3% caused damage to infrastructure. Of all the damaged trees surveyed 5.6% caused damage to infrastructure. Of all the *Khaya senegalensis* surveyed 19.1% caused infrastructure damage. This is far higher than other tree species which were significantly sampled. Of all the uprooted trees, 19.3% caused infrastructure damage (i.e. a falling tree had a 19.3% chance of causing damage), but this accounted for 89.5% of all infrastructure damage (i.e. 89.5% of infrastructure damage was caused by fallen trees). Other types of tree damage were far less likely to result in damage.

Of the 40 surveyed parks tree damage for 6 individual parks with the most individual trees was analysed. Bike Fun Park had high rates of small branch damage compared to the population total percentage (52.1% vs 28.8%) and very low rates of uprooted trees. This was insignificantly biased as approximately 6 trees were removed prior to survey.

Bayfield Park had lower rates of tree damage than the general tree population (50.1% vs 40.5%). It also had lower rates of small branches being damaged than the general tree population (15.0% vs 28.8%). *Khaya senegalensis* at Bayfield Park had a higher rate of uprooting than for its general population (77.2% vs 66.0%). It also had twice the rate of significant branch breaking than for the general population (7.6% vs 3.8%).

In summary and conclusion, a large exotic tree growing in an irrigated Darwin park in saturated deep massive earths with minimal management would have a high chance of being uprooted in a category 2 cyclone. Tropical Cyclone Marcus was an arboreal cleansing process, clearing the parks of many unstable tree species. It was a big wake up call for Darwin and provided an opportunity to develop more climate resilient plantings in parks, streetscapes and other landscaped areas in the municipality. Many of the surveyed parks are now quite open and require well planned plantings of suitable cyclone stable amenity species.

Darwin suffered major damage to thousands of trees in what was only a category 2 cyclone. A large proportion of these trees were made up of a small number of species of which the majority showed susceptibility to major damage in the cyclone. These particular species need to be looked at more thoroughly for future planning and management purposes. For example it would not be recommended to plant a low diversity of these unstable species in the future. Thankfully there were a couple of these abundant species that showed stable traits during the course of TC Marcus. Overall just over 40% of all trees suffered no damage at all (apart from some foliage loss). These are the specimens that require further scrutinization for potential use in the future urban revegetation of Darwin.

To progress from the results and discussion of this survey, the valuable information could be combined with results of previous post cyclone surveys for comprehensive recommended lists of suitable species

list for planting in Darwin and other cyclone prone regions of Australia. It could also be used to come up with species lists of unstable species that should be avoided in these areas. Where physical environment and management trends have emerged both in the positive and negative sense it should warrant further studies for more confident results for further planning and management of future tree planting in Darwin and other cyclone prone areas.

The mapping of individual trees and associated data will be a valuable management tool for the City of Darwin park managers. This could be expanded to include all the CoD parks so that the whole management chain includes valuable information for all trees. This includes information on individuals that are categorised as unstable and are potentially a risk for humans and infrastructure. For future plantings this chain could start at the genetic source, through to propagation, cultivation and eventually the death or end of shelf life and removal of trees. There is iTree software used by municipal councils in South Australia that could be explored for this 'life of the tree' chain (Mr. J. McGregor 2018, pers comm. 12th June).

Recommendations of this report:

- Use results of this survey in conjunction with previous reports to establish a list of preferred species, and a list of plants to be discouraged for use around public infrastructure.
- For species that had high rates of major tree damage, determine where the cut off line is in regard to what is an acceptable level of risk (risk appetite). This process is a precursor to above and will determine the relative level of risk between species.
- Digitise through survey and mapping, all trees in Darwin parks, streetscapes and other landscaped areas. From this determine which species are deemed to be a risk to infrastructure and human safety.
- Consider the gradual phasing out of unstable species and replacement with resilient species. This could occur in stages over a ten year period, giving the newly planted trees time to establish shade cover before removing the next tranche of redundant species.
- Undertake further study of irrigated and non-irrigated plantings to determine the merits of non-irrigated plantings for future revegetation activities.
- Investigate further damage trends of pre-existing weaknesses of trees as a result of genetics, propagation and cultivation.
- Dertermine best practice methods for propagation and cultivation of resilient trees and shrubs.
- Develop a protocol for the planting and maintenance of trees in public areas, including policies, procedures, guidelines and specifications.

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# Abbreviations

| | |
|---|---|
| AVMS | Australian Vegetation Management Services |
| BoM | Bureau of Meteorology |
| CoD | City of Darwin |
| GA | Greening Australia |
| DENR | Department of Environment and Natural Resources |
| GIS | Geographic Information System |
| NT | Northern Territory |
| TC | Tropical Cyclone |
| TIO | Territory Insurance Office |

# 1 Introduction

At the Twelfth Meeting of the Twenty-Second Council on Tuesday, 27 March 2018 (ORD03/36) under General Business, the council considered Dangerous Trees in the Darwin Municipality (Common No. 3777063). The Council considered the issue of potentially dangerous trees planted throughout the City of Darwin Municipality, and in particular the trees that came down during recent significant weather events and develop a plan to manage these trees.

They also agreed that the report include but not be limited to:

- A report to be provided to Council regarding the kind of trees that have been damaged /uprooted in recent events ranked by species.
- Inspection of Council parks to identify trees planted in close proximity to private property and /or powerlines that have the potential to cause damage and /or injury if/when they come down.
- A plan for the removal and possible costing to be provided to Council regarding specifically these trees.
- A review of our parks to identify number and species of trees that may come down in a future weather event as it has happened in the recent past.
- An investigation is undertaken to identify, in consultation with local experts, suitable species of trees mainly native to the top end areas with high rainfall and cyclonic conditions to be used in the future for landscaping.
- A review of the list trees suitable to areas prone to cyclones been undertaken to ensure that all trees that are removed are replaced with suitable trees.
- Potential for salvage from fallen trees
- The issue of maintaining trees to reduce load so that they remain safe in high winds.

They also agree that a follow up report from Cyclone Marcus be presented to Council, including consideration of effects on vegetation. A decision was then carried (NO.22\0592).

This report address the first dot point above.

# 2 Project Aims

The project objectives are to: undertake a survey of parks in the Darwin municipality to record damage to trees, tree damage to infrastructure, surrounding landscape information and resilient trees; and determine trends following analysis of individual tree parameters recorded and correlations with the degree of cyclone damage.

The project goals are to:

- understand trends in urban tree damage and survival following a Category 2 tropical cyclone; determine tree species that suffered major damage in TC Marcus; determine tree species that were resilient to TC Marcus; and understand all the variables that effected trees during TC Marcus.

The project solutions are to provide a comprehensive report presented to City of Council that includes the following:

- an analysis of survey data which includes proportions of tree species and the degree of damage in Darwin parks
- a presentation of tree response trends following analysis of survey data collected
- a presentation of results for use in informed decision making for future vegetation management actions in Darwin.

A data set of individual trees in the surveyed municipality parks will also be provided to CoD, providing a valuable information layer for Council's GIS.

# 3 Background

## 3.1 Cyclone Marcus

The following is an extract from the TC Marcus report on the BoM website.

"Tropical Cyclone Marcus was the strongest tropical cyclone to affect Darwin since Tropical Cyclone Tracy (category 4) in December 1974.
The centre of Tropical Cyclone Marcus made landfall as a category 2 cyclone near Cape Hotham at 9 am ACST on 17 March, then maintained its category 2 strength as it passed directly over Darwin City, Palmerston and surrounding suburbs between 10 am and 11 am ACST. The cyclone crossed Darwin Harbour to pass over Belyuen on the Cox Peninsula between 12 pm and 1 pm ACST and crossed Bynoe Harbour to pass over Dundee Beach between 2 pm to 3 pm ACST. Tropical Cyclone Marcus was downgraded to category 1 at 3 pm ACST about 20 km south of Dundee Beach.
Although Tropical Cyclone Marcus was a small sized cyclone as it passed the Northern Territory, with a gale radius of around 100km, the impacts on Darwin were widespread and significant. Thousands of trees were damaged or brought down. Many trees fell on buildings and cars. Around 430 powerlines were downed leaving some 26500 customers without power immediately after the cyclone. Fortunately there were no injuries. Gales were observed at Darwin Airport between 9:30 am and 1 pm ACST. Initially from the south, gales turned southwest to west then northwest as the destructive core of the tropical cyclone passed. The strongest wind gusts observed were 126 km/h (westerly) at Darwin Airport at 11:00 am ACST and 130 km/h (west-northwesterly) at Darwin Harbour at 11:30 am ACST. The heaviest rainfall was confined to the coasts with 136.4 mm at Gunn Point, 60.0 mm at Darwin Airport and 31.4 mm at The Chase (Palmerston) in the 24 hours to 9 am ACST 18 March. A 90 cm storm surge was recorded at the Darwin tidal gauge as the cyclone passed, although coinciding with low tide, the Highest Astronomical Tide was not exceeded."

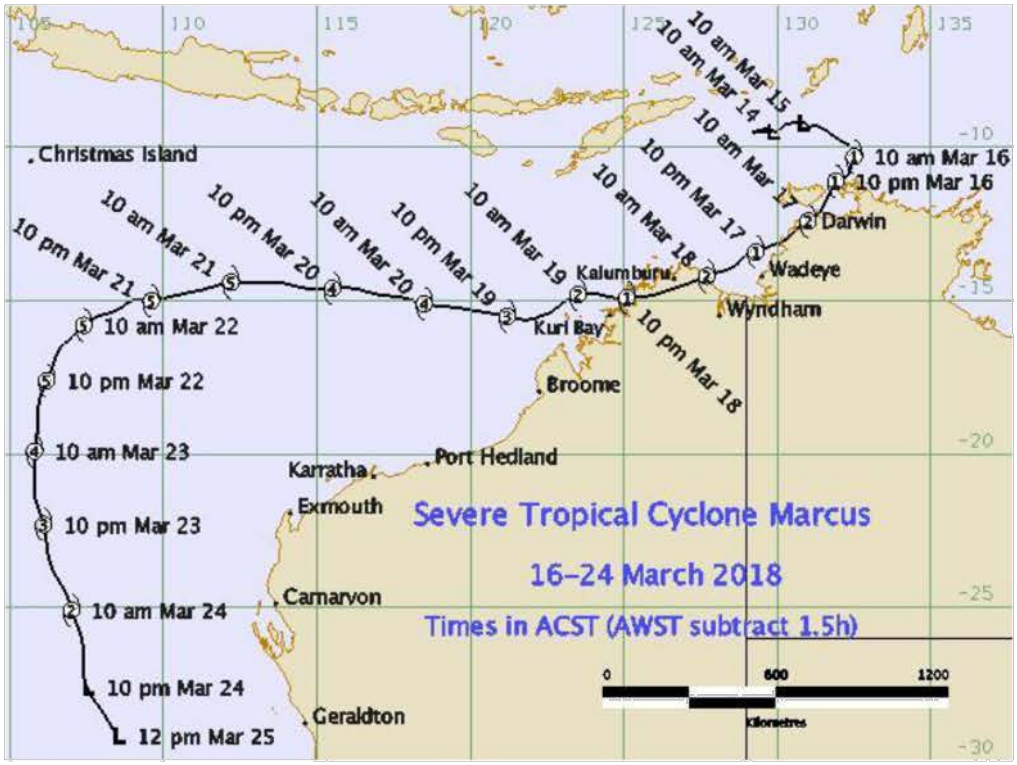



**Figure 1 BoM weather map showing tracking history of TC Marcus**

# 4 Methodology

## 4.1 Limitations

Cyclone Marcus hit Darwin on Saturday 17th March 2018 and the survey commenced a month later on the 17th April 2018. By this time the clearing crews, comprising City of Darwin staff, their contractors and TIO Insurance contractors, were working at an industrial scale to clean up damaged trees in the streets and parks of Darwin and surrounding suburbs. At the time of the survey commencement, all the main roads had been cleared of damaged trees.

In consultation with Council managers and the TIO Insurance contractor supervisor the remaining parks were prioritised for surveying so as to keep in front of the clearing crews and record tree damage as it was immediate post cyclone. This obviously restricted the sample size and timing for the survey. An electronic data collection form using Fulcrum had to be developed and included pre-loaded data and provision for photographs and GPs coordinates. This took a further week and could not be used in the field until the 22nd of April. During the previous week the data was recorded manually using the same Fulcrum categories. The time delay also biased recording of foliage damage which was difficult to determine 4 weeks after the cyclone had passed.

## 4.2 Assumptions

According to TC Marcus data from BoM there were variations in wind speed and direction as well as amounts of rainfall throughout the sample sites. Soil types and landform also varied between and within the surveyed parks. It is also assumed that all the trees surveyed varied in size, shape, health, propagation and cultivation (eg watering regimes, pests and diseases tree maintenance etc) regimes.

## 4.3 Data collection and analysis

This report is based on field observations of all trees in 40 Darwin parks in the aftermath of TC Marcus. Through the recording of these observations, data from an array of 30 parameters for all the trees was collected and then analysed to determine general trends. This was further amended with other datasets such as the Land Units and BoM data to identify further correlations. For example trees surveyed using Fulcrum (1,716 in total) were mapped with soil types derived from the Greater Darwin Land Units (DENR 2000).

### 4.3.1 Data collection

The Survey generated a substantial amount of field data, including an abundance of digital photographs and field data. The data was collected and collated using an electronic in-field data capture method using Greening Australia's Fulcrum database. Data collection tools featured automatic upload to a cloud-based website, which allowed for real time data collation, review, analysis and interpretation in the office. This functionality was of key importance in the timely and accurate reporting for the Project Area.

At each location, the following data was collected: street address; soil type; landscape description (including irrigated/non-irrigated); tree species; tree size; individual/group of trees; major damage type; less damaged type; infrastructure damage; trees posing a future threat to infrastructure; GPS coordinates; wind direction; and photographs. Wind direction was mainly measured by the direction the tree fell as it was uprooted. All data collected on Fulcrum will be linked with CoD Arc Info GIS to provide an information layer.

The majority of species were identified in the field by the author and samples taken for any unidentified specimens. Where possible these were identified by staff at the Darwin Herbarium and the George Brown Botanical Gardens.

City of Darwin provided copies of digital maps of municipal parks, streets and infrastructure for the survey.

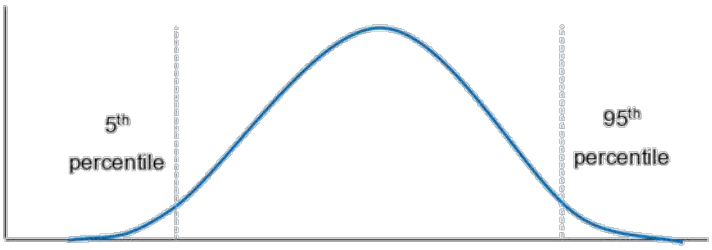
### 4.3.2 The analysis of tree statistics

All individual tree species were analysed for the degree of cyclone damage. The species with the greatest abundance provided a larger sample size for more confident analysis.

In the following tables, particularly notable statistics are highlighted in green (positive) or red (negative). These are results vary significantly from the average and have a comparatively large sample size.

The use of red (performed poorly for that indicator) and green (performed well for that indicator) highlight in cells is intended to highlight potentially significant and notable data. Although a full statistical analysis was not performed this threshold was roughly based around data that:

- May lie in the 5$^{th}$ or 95$^{th}$ percentile for that indicator, and




- There is a large sample size and therefore probably a large confidence margin.

Using the made-up example below:

| Species \ Damage Type | Nil | | Total |
|---|---|---|---|
| | number | % | |
| Khaya senegalensis | 27 | 11.5% | 235 |
| Peltophorum pterocarpum | 1 | 10.0% | 10 |
| Pterocarpus indicus | 61 | 50.0% | 122 |
| Mimusops elengi | 10 | 62.5% | 16 |
| **All Trees** | **1157** | **40.5%** | **2857** |

*Khaya senegalensis* had a very low rate of "Nil" damage (11.5% vs a survey average of 40.5%). Furthermore it had a very large sample size so we can be reasonably confident that the 11.5% is a good reflection of the entire population. This indicates an undesirable result (i.e. we prefer trees with higher levels of Nil damage), therefore the cell is highlighted red. Contrast this with *Peltophorum pterocarpum,* which had a lower rate of "Nil" damage -10%. However, this was only based on a survey of 10 plants so there is very low confidence that the 10% figure accurately reflects the entire population, even though it would be inside the 5th percentile. Therefore it was not highlighted.

*Pterocarpus indicus* had a very high rate of "Nil" damage (50% vs a survey average of 40.5%). Furthermore it had a very large sample size so we can be reasonably confident that the 50% is a good reflection of the entire population. This indicates a desirable result (i.e. we prefer trees with higher levels of Nil damage), therefore the cell is highlighted green. Contrast this with *Mimusops elengi* which had a higher rate of "Nil" damage - 62.5%. However, this was only based on a survey of 16 plants so there is very low confidence that the 62.5% figure accurately reflects the entire population, even though it would be inside the 95th percentile. Therefore it was not highlighted.

### 4.4 Proportions of individual tree species damaged

Proportions of individual tree species damaged was determined by surveying all individual trees in as many parks in the municipality as was possible during the remaining timeframe of the clean up program. By surveying prior to any clean up activities, the sites provided a snapshot of the tree damage immediately following a cyclone.

The following damage categories were recorded for each tree: major damage type (uprooted, trunk/leader snapped/split, significant branch broken); less damaged type (good (no visible damage to the tree apart from loss of foliage); small branches (subjective, but generally a branch comprising only a small proportion of the tree); leaning (plant is laying over but roots are not necessarily exposed) and damage from another tree. The survey used similar damage classifications as previous post cyclone surveys, so that the data base on tree response can build in cyclone prone areas of Australia.

**Plate 1: Examples of tree damage categories. Clockwise from top left corner: uprooted; trunk split; trunk snapped, significant branch broken; small branches broken; tree leaning; tree damaged by other tree; and tree damaged infrastructure.**


**Figure 2: Fulcrum survey sample template**

# 5 Results and Discussion

## 5.1 Survey Locations

During the project period 40 parks from 13 suburbs in the Darwin Municipality were surveyed. This represents close to 20% of the total 200 parks managed by DoC in the municipality (DoC also manages over 70 other landscaped areas). The majority of parks surveyed were in the northern suburbs. By the time the survey commenced, all the parks in Darwin CBD and surrounding 'southern' suburbs had either been cleared or were in the process of being cleared of damaged trees. Chrisp Street and Nakara Ovals included irrigated and non-irrigated sections and Mueller Park was manually irrigated. The surveyed sites included a range of small and large urban parks, greenbelts and ovals, most irrigated and some not. The majority of parks surveyed were neighbourhood parks

**Table 1: Darwin parks surveyed**

| Suburb | Park | Irrigation | Park type | CoD classification |
|---|---|---|---|---|
| Alawa | Bald Park | yes | Small urban | Neighbourhood |
| | Britomart Park | yes | Small urban | Neighbourhood |
| | Stedcombe Park | yes | Small urban | Neighbourhood |
| | Stobo Park | yes | Small urban | Neighbourhood |
| Coconut Grove | Easther Park | yes | Small urban | Neighbourhood |
| | Old Macmillan's Park | yes | Large urban | District |
| Malak | Abbot Park | yes | Small urban | Neighbourhood |
| | Bayfield Park | no | Greenbelt | Neighbourhood |
| | Malak G/belt | no | Greenbelt | District |
| | Malak Oval | yes | Large urban | Sporting Ground |
| | Mueller Park | yes - manually | Large urban | Neighbourhood |
| | Holzerland Green Belt | no | Greenbelt | Neighbourhood |
| Millner | Stokes Park | yes | Small urban | Neighbourhood |
| Moil | Butters Park | yes | Small urban | Neighbourhood |
| | Byrne Park | yes | Small urban | Neighbourhood |
| | Greenwood Park | no | Small urban | Neighbourhood |
| Nakara | Harwood Park | yes | Small urban | Neighbourhood |
| | Kilfoyle Park | yes | Small urban | Neighbourhood |
| | Nakara Oval Park | no | Large urban | Sporting Ground |
| | | yes | Large urban | Sporting Ground |
| Nightcliff | Bill Bell Park | yes | Large urban | Neighbourhood |
| | Grevillea Park | yes | Small urban | Neighbourhood |
| Parap | Worgan Park | yes | Small urban | Neighbourhood |
| Rapid Creek | Bike Fun Park | no | Large urban | Neighbourhood |
| | Chrisp Street Oval Park | no | Large urban | Sporting Ground |
| | | yes | Large urban | Sporting Ground |
| Wagaman | Amsterdam Park | yes | Small urban | Neighbourhood |
| | Colster Park | yes | Small urban | Neighbourhood |
| | Groote Park | yes | Small urban | Neighbourhood |
| | Tasman Park | yes | Small urban | Neighbourhood |
| Wanguri | Kailis Park | yes | Small urban | Neighbourhood |
| | Mazlin Park | yes | Small urban | Neighbourhood |
| | Strele Park | yes | Small urban | Neighbourhood |
| | Wanguri Oval Irrigated | yes | Large urban | Sporting Ground |
| Wulagi | Curlew Park | yes | Small urban | Neighbourhood |
| | Jabiru Park | yes | Small urban | Neighbourhood |
| | Plover Park | yes | Small urban | Neighbourhood |
| | Wulagi Greenbelt | yes | Greenbelt | District |
| Karama | Eaton Park | yes | Small urban | Neighbourhood |
| | Freycinet Park | yes | Small urban | Neighbourhood |
| | Mahogany Park | yes | Large urban | Neighbourhood |
| | Peron Park | yes | Small urban | Neighbourhood |

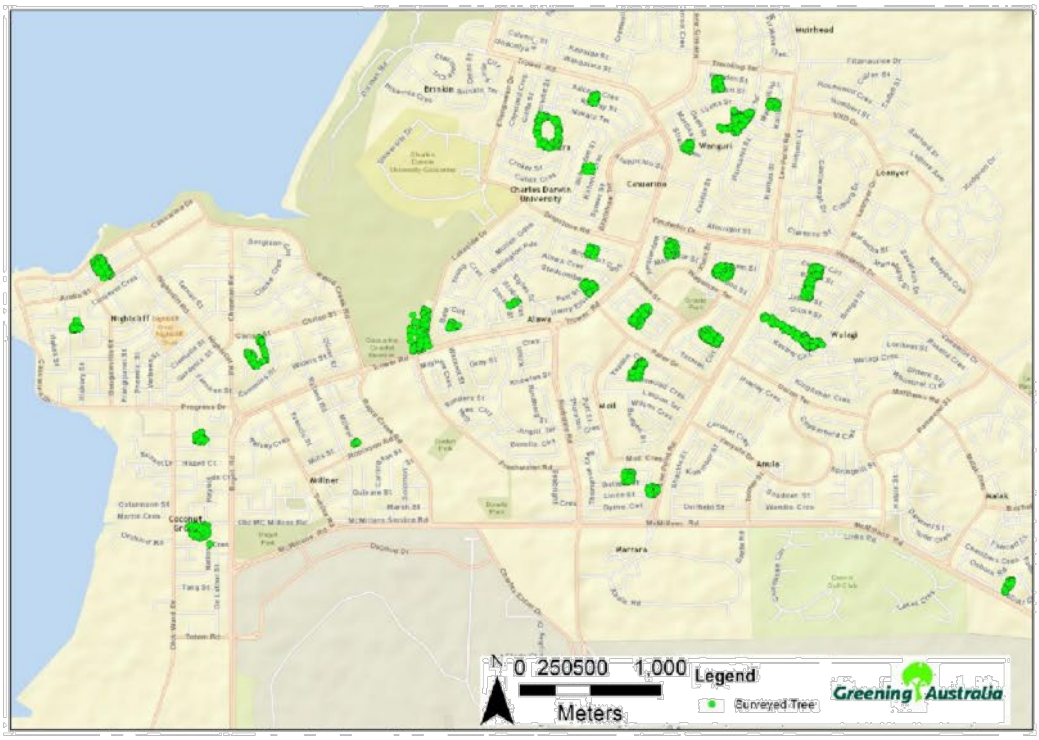



**Figure 3 Map showing locations of surveyed trees in Darwin parks**

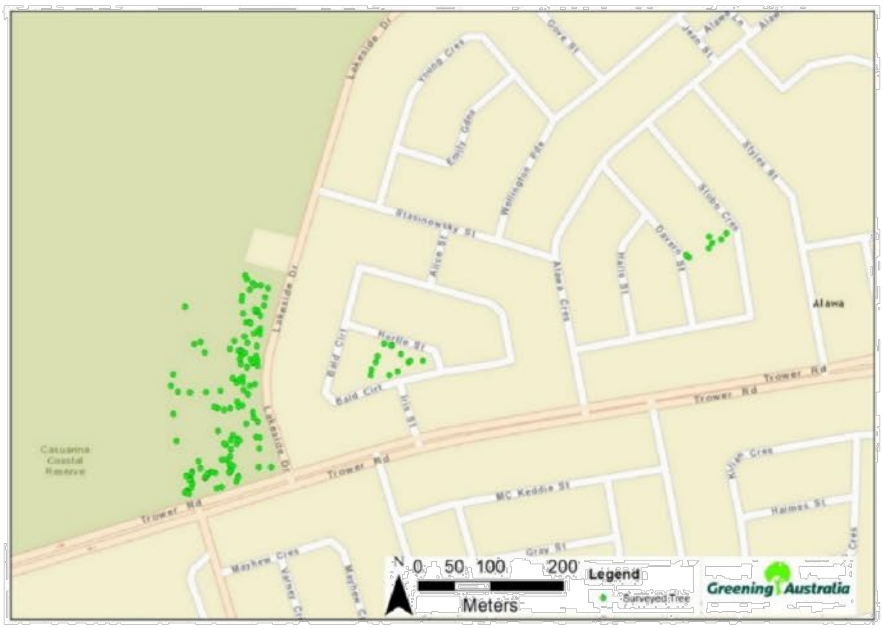



**Figure 4: An example of a close-up map with tree locations in 3 surveyed parks.**


**Figure 5: Example close-up map of the same 3 surveyed parks with aerial image**

## 5.2 Description of park land units, landforms, soils, trees and associated infrastructure

### 5.2.1 Land units

Surveyed parks were found in the following land units as defined by DENR (2000).

Rises

2b1: Gentle side-slopes; gradient 2-5%; moderately deep gravelly yellow massive earths, minor lithosols: Eucalypt Open Woodland to Woodland.

3a: Flat to gently undulating upland surface; gradient 0-2%; deep red massive earths, minor yellow massive earths: Eucalypt Open Forest.

3b: Flat to gently undulating upland surface; gradient 0-2.5%; moderately deep gravelly yellow massive earths, minor red massive earths: Eucalypt Woodland to Open Forest.

3c: Flat to gently undulating upland surface; gradient 1-3%; shallow, gravelly yellow massive earths, minor lateritic lithosols: Eucalypt Woodland, minor Open Woodland.

3d: Flat to gently undulating upland surface; gradient 1-3%; shallow gravelly lithosols: Eucalypt Open Woodland, minor Woodland.

3e: Flat to gently undulating upland surface; gradient 0.5-2%; wet-season water table; hard-setting deep mottled yellow massive earths: Variable Woodland, minor Open Forest.

4c: Gentle lower slopes; gradient 0.5-1.5%; wet-season water table; hard-setting deep mottled yellow massive earths: Mixed species Open Forest, minor Woodland.

9b: Estuarine fringes; gradient negligible, <0.5%; intertidal inundation; saline muds and clays: Low Closed Forest of Mangrove spp.

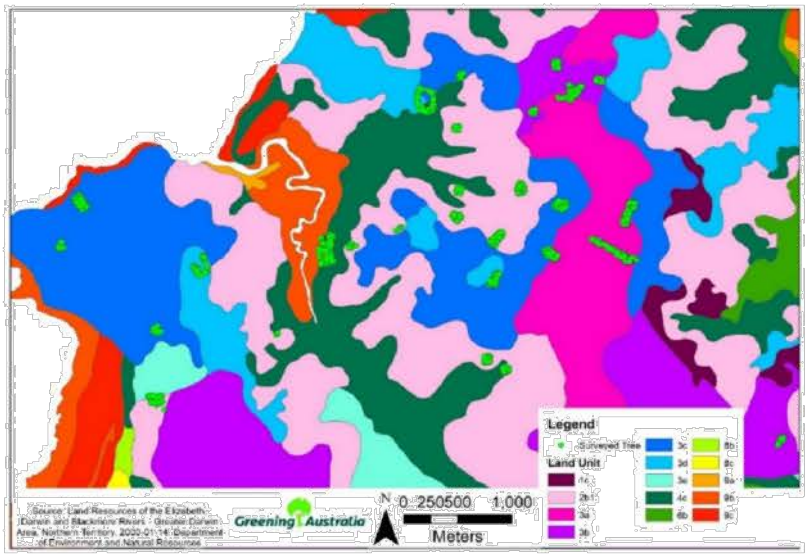



**Figure 6: Map showing trees surveyed using Fulcrum and land units as described by DENR (2000).**

### 5.2.2 Landforms

Surveyed parks were found in the following landforms as defined by DENR (2000) flat to gently undulating upland surface with a gradient ranging from 0-3%; gentle side-slopes with a gradient of 2-5%; and gentle lower slopes with a gradient of 0.5-1.5%.

### 5.2.3 Soils

The 1,716 trees surveyed with Fulcrum occurred in the following soil types: brown kandosol soil (deep gravelly yellow massive earths with minor lithosols), red kandosols (shallow -moderately deep red massive earths with minor yellow massive earths), kandosolic redoxic hydrosols (hardsetting deep mottled yellow massive earths), leptic rudosols (shallow gravelly lithosols). The latter soil type has a shallow (within 0.5m) underlaying of unweathered lateritic rock (CSIRO 2018). Lithosols are any of a group of shallow azonal soils consisting of imperfectly weathered rock fragments (Miriam-Webster 2018).

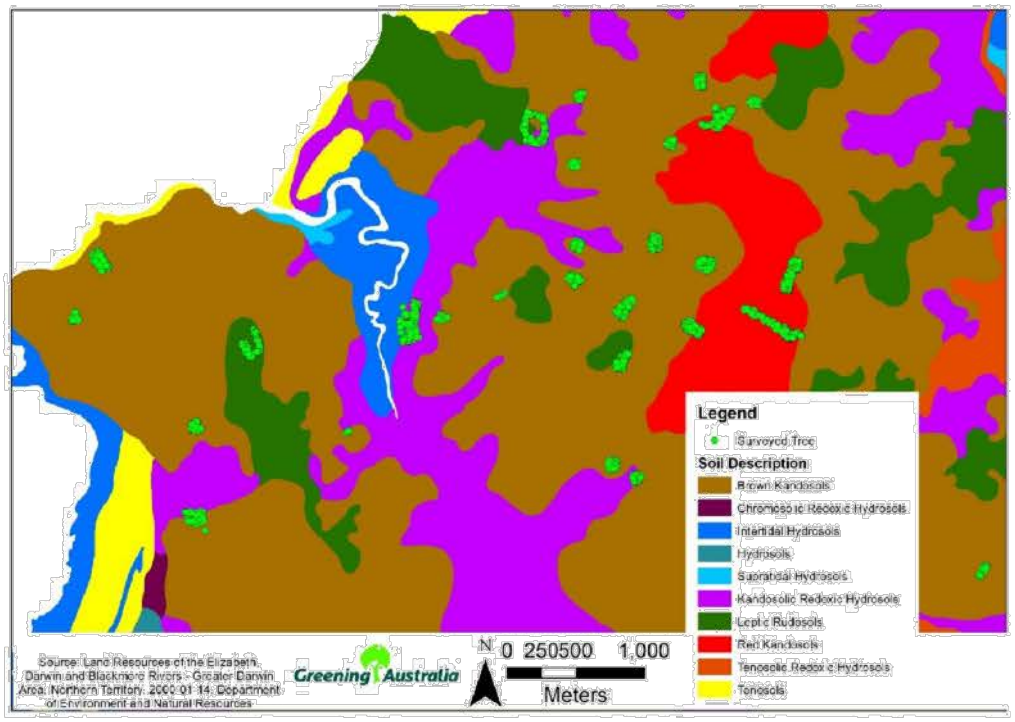



**Figure 7: Map showing trees surveyed using Fulcrum and soil types as described by DENR (2000).**

### 5.2.4 Trees

The majority of the surveyed trees had been cultivated but occasional remnant trees did exist. Many of the larger trees in the surveyed parks were planted post TC Tracy in the late 1970's and early 1980's. A great majority of these trees were grown by the then Conservation Commission of the NT nursery at Berrimah Farm as well as some of the larger nurseries around Darwin. They were planted out by Parks and Gardens crews working for the Forestry Unit. These included a mixture of exotic timber/shade trees such as African mahogany (*Khaya senegalensis*) and local native species such as Black wattle (*Acacia auriculiformis*) and Red gum (*Eucalyptus camaldulensis*). Following on from these original plantings CoD have managed the parks and planted a mixture of local native species, including *Mimusops elengi* and *Maranthes corymbosa* as well as a variety of exotic palms.

### 5.2.5 Associated infrastructure

The small urban (neighbourhood) parks were typically surrounded by housing and associated gardens, and bounded by urban roads on one, two, three or four sides. The larger urban parks and greenbelts (regional, district, sporting ground and neighbourhood parks) were also bounded by housing, roads, schools and shopping centres. All parks had fencing and hard coated pathways. Irrigated parks had piping, meters and solenoids. Some parks had playgrounds, lighting, seating and drinking fountains.

## 5.3 Proportions of tree species

A total of 2,857 individual trees from 142 species in 40 parks were surveyed. Of the species surveyed, the majority were local provenance natives (50%) along with other NT native species (17%), Australian natives (4%), naturalised (2%) and exotic species (27%). As a proportion of all trees surveyed, the majority were local provenance (51.7%), exotic species made up a nearly a quarter (24.7%), NT natives with the next highest number of indiividuals (17.2%) and the remainder made up of Australian Natives and Naturalised specimens (3.9% and 2.5% respectively). There were 7 standout dominant species with over 100 surveyed individuals. They were in order of tree numbers: African mahogany (*Khaya senegalensis),* Maranthes (*Maranthes corymbosa),* Red gum *(Eucalyptus camaldulensis),* Yellow flame tree *(Peltophorum pterocarpum),* Black wattle (*Acacia auriculiformis),* Papua New Guinea rosewood *(Pterocarpus indicus)* and Mimusops (*Mimusops elengi).* Of the 142 species surveyed, 21 species comprised 68% of the surveyed trees.

**Table 2: Tree species surveyed and origin**

| Tree Species | Common Name | Provenance | Total Number |
|---|---|---|---|
| *Khaya senegalensis* | African mahogany | Exotic | 235 |
| *Maranthes corymbosa* | Maranthes | Local provenance | 205 |
| *Eucalyptus camaldulensis* | River red gum | NT Native | 191 |
| *Peltophorum pterocarpum* | Yellow flame tree | Local provenance | 162 |
| *Acacia auriculiformis* | Black wattle | Local provenance | 124 |
| *Pterocarpus indicus* | Papua New Guinea rosewood | Exotic | 122 |
| *Mimusops elengi* | Mimusops | Local provenance | 107 |
| *Ficus virens* | Banyan | Local provenance | 99 |
| *Allosyncarpia ternata* | Allosyncarpia | NT Native | 86 |
| *Eucalyptus bigalerita* | Northern salmon gum | NT Native | 73 |
| *Carpentaria acuminata* | Carpentaria palm | Local provenance | 71 |
| *Corymbia bella* | Ghost gum | Local provenance | 65 |
| *Leptospermum madidum* | Weeping ti-tree | Local provenance | 65 |
| *Pterocarpus indicus (weeping form)* | Weeping rosewood | Exotic | 62 |
| *Corymbia ptychocarpa* | Swamp bloodwood | Local provenance | 55 |
| *Delonix regia* | Poinciana | Naturalised | 48 |
| *Calophyllum inophyllum* | Beauty leaf | Local provenance | 43 |
| *Eucalyptus tetrodonta* | Darwin stringy bark | Local provenance | 36 |
| *Latania lodgesii* | Blue Latan palm | Exotic | 35 |
| *Melaleuca leucadendra* | Weeping paperbark | Local provenance | 32 |
| *Syzygium forte* | Bush apple | Local provenance | 32 |
| *Corymbia polycarpa* | Long-fruited bloodwood | Local provenance | 30 |
| *Callistemon viminalis* | Red bottlebrush | NT Native | 29 |
| *Alstonia actinophylla* | Mikwood | Local provenance | 28 |
| *Tabebuia aurea* | Caribbean trumpet tree | Exotic | 27 |
| *Plumeria obtusa* | Evergreen frangipani | Exotic | 26 |

| | | | |
|---|---|---|---|
| *Albizia lebbeck* | Albizia | Local provenance | 25 |
| *Carallia brachiata* | Freshwater mangrove | Local provenance | 25 |
| *Ficus macrocarpa var. hillii* | Hills weeping fig | Australian Native | 25 |
| *Tamarindus indica* | Tamarind | Naturalised | 24 |
| *Arfuillea arborescens* | Hop tree | Exotic | 23 |
| *Ptychosperma macarthurii* | Macarthur palm | Australian Native | 22 |
| *Eucalyptus miniata* | Darwin woolybutt | Local provenance | 21 |
| *Murraya paniculata* | Murraya | NT Native | 21 |
| *Millettia pinnata* | Millettia | Local provenance | 21 |
| *Alstonia scholaris* | Cheesewood | Australian Native | 20 |
| *Eucalyptus tintinanns* | Salmon gum | NT Native | 20 |
| *Wodyetia bifurcata* | Fox tail palm | Australian Native | 20 |
| *Eucalyptus herbertiana* | Yellow barked mallee | NT Native | 19 |
| *Syzygium armstrongii* | White bush apple | Local provenance | 19 |
| *Myristica insipida* | Native nutmeg | NT Native | 18 |
| *Terminalia melanocarpa* | Black Damson | Australian Native | 16 |
| *Ficus benjamina* | Weeping fig | Local provenance | 15 |
| *Albizia saman* | Raintree | Exotic | 15 |
| *Ficus longifolia* | Narrow leaf fig | Exotic | 14 |
| *Melaleuca bracteata* | Black tea-tree | NT Native | 14 |
| *Terminalia microcarpa* | Terminalia | Local provenance | 14 |
| *Livistona muelleri* | Northern cabbage palm | Exotic | 14 |
| *Livistona benthamii* | Benthams fan palm | Local provenance | 13 |
| *Dypsis lutescens* | Golden cane | Exotic | 13 |
| *Cycas media* | Cycad | Exotic | 13 |
| *Ficus racemosa* | Cluster fig | Local provenance | 12 |
| *Caryota mitis* | Fishtail palm | Exotic | 12 |
| *Mangifera indica* | Mango | Exotic | 11 |
| *Tabebuia pallida* | Pink trumpet tree | Exotic | 11 |
| *Terminalia platyphylla* | Wild plum | Local provenance | 11 |
| *Ganophyllum falcatum* | Ganophyllum | Local provenance | 10 |
| *Melaleuca argentea* | Silver-leaved paperbark | Local provenance | 10 |
| *Cocos nucifera* | Coconut | Exotic | 9 |
| *Corymbia bleeseri* | Smooth - stemmed bloodwood | Local provenance | 9 |
| *Alphitonia excelsa* | Soap-leaf tree | Local provenance | 8 |
| *Azadirachta indica* | Neem tree | Local provenance | 8 |
| *Brachychiton diversifolius* | Northern kurrajong | Local provenance | 8 |
| *Lagerstroemia indica* | Pride of India | Exotic | 8 |
| *Nauclea orientalis* | Leichardt pine | Local provenance | 8 |
| *Polyalthia longifolia* | Indian mast tree | Exotic | 7 |
| *Corymbia jacobsiana* | Stringybark bloodwood | NT Native | 6 |
| *Dodonea platyptera* | Dodonea | Local provenance | 6 |
| *Eucalyptus apodophylla* | White bark | Local provenance | 6 |
| *Livistona humilis* | Sand palm | Local provenance | 6 |

| | | | |
|---|---|---|---|
| *Cassia fistula* | Golden shower tree | Exotic | 5 |
| *Gmelina arborea* | Gmelina | Exotic | 5 |
| *Timonius timon* | Timonius | Local provenance | 5 |
| *Syzygium suborbiculare* | Red bush apple | Local provenance | 5 |
| *Monoon australe* | Polyalthia | Local provenance | 5 |
| *Breynia cernua* | Breynia | Local provenance | 4 |
| *Callitris intratropica* | Northern cypress pine | Local provenance | 4 |
| *Eucalyptus phoenicea* | Scarlet gum | NT Native | 4 |
| *Eucalyptus tectifica* | Darwin box | Local provenance | 4 |
| *Schleichera oleosa* | Ceylon oak | Exotic | 4 |
| *Syzygium nervosum* | Syzygium | Local provenance | 4 |
| *Sterculia sp.* | Sterculia sp. | NT Native | 4 |
| *Melaleuca dealbata* | Melaleuca | Local provenance | 3 |
| *Roystonea regia* | Cuban royal palm | Exotic | 3 |
| *Schefflera actinophylla* | Umbrella tree | Local provenance | 3 |
| *Xanthostemon chrysanthus* | Golden penda | Australian Native | 3 |
| *Pterocarpus sp.* | Rosewood | Exotic | 3 |
| *Cascabela thevetia* | Yellow oleander | Exotic | 3 |
| *Citharexylum spinosum* | Fiddlewood tree | Exotic | 2 |
| *Corymbia confertiflora* | Broad-leaf carbeen | Local provenance | 2 |
| *Exocarpus latifolius* | Native cherry | Local provenance | 2 |
| *Ficus opposita* | Sandpaper fig | Local provenance | 2 |
| *Lophostemon lactifluus* | Lophostemon | Local provenance | 2 |
| *Planchonia careya* | Cocky apple | Local provenance | 2 |
| *Bauhinia purpurea* | Purple Bauhinia | Exotic | 2 |
| *Miliusa brahei* | Miliusa | Local provenance | 2 |
| *Elaeis guineensis* | African oil palm | Exotic | 2 |
| *Caesalpiniacea sp.* | | Exotic | 2 |
| *Asteromyrtus magnifica* | Asteromyrtus | NT Native | 2 |
| *Hyphorbe verschaffeltii* | Spindle palm | Exotic | 2 |
| *Terminalia bellirica* | Bahera | Exotic | 2 |
| *Melaleuca sp.* | Melaleuca | NT Native | 2 |
| *Adenanthera pavonina* | Red bead tree | Local provenance | 1 |
| *Artocarpus heterophylla* | Jackfruit | Exotic | 1 |
| *Barringtonia asiatica* | Fish poison tree | Exotic | 1 |
| *Berrya cordifolia* | Berrya | Local provenance | 1 |
| *Buchanania obovata* | Green plum | Local provenance | 1 |
| *Cyclophyllum schultzii* | Cyclophyllum | Local provenance | 1 |
| *Cassia siamea* | Siamese cassia | Exotic | 1 |
| *Casuarina equisetifolia* | Coastal sheoak | Local provenance | 1 |
| *Citrus latifolia* | Lime tree | Exotic | 1 |
| *Corymbia latifolia - check* | Round-leaf bloodwood | Local provenance | 1 |
| *Corymbia porrecta* | Grey bloodwood | Local provenance | 1 |
| *Croton sp.* | Croton | Exotic | 1 |

| | | | |
|---|---|---|---|
| *Cupaniopsis anacardioides* | Beach tamarind | Local provenance | 1 |
| *Cycas armstrongii* | Cycad | Local provenance | 1 |
| *Diospyros sp.* | Native ebony | Local provenance | 1 |
| *Erythrophleum chlorostachys* | Ironwood | Local provenance | 1 |
| *Hibbertia sp.* | Hibbertia | Exotic | 1 |
| *Lyrata pandurata* | Fiddle leaf fig | Exotic | 1 |
| Tree with 7 leaflets | | NT Native | 1 |
| *Wrightia pubescens* | Wrightia | Local provenance | 1 |
| *Wrightia saligna* | Milk bush | Local provenance | 1 |
| *Melaleuca nervosa* | Fibrebark | Local provenance | 1 |
| *Pleiogynium timoriense* | Burdekin plum | Australian Native | 1 |
| *Psidium guajava* | Guava | Exotic | 1 |
| *Syzygium jambos* | Rose apple | Exotic | 1 |
| *Morinda citrifolia* | Rotten cheesefruit | Local provenance | 1 |
| *Guazuma ulmifolia* | West Indian elm | Exotic | 1 |
| *Veitchia merillii* | Christmas palm | Exotic | 1 |
| *Apocynacea sp.* | | Local provenance | 1 |
| *Bougainvillea spectabilis* | Bougainvillea | Exotic | 1 |
| *Arecacea sp.* | Palm | Exotic | 1 |
| *Horsfieldia australiana* | Horsfieldia | Local provenance | 1 |
| *Syzygium sp. 2* | | Australian Native | 1 |
| *Livistona ramsayii* | Queensland fan palm | Australian Native | 1 |
| *Tabebuia rosea* | | Exotic | 1 |
| *Eucalyptus oligantha* | Broad-leaved box | NT Native | 1 |
| *Syzygium sp.* | | Australian Native | 1 |
| *Diospyros nigra* | Black sapote | Exotic | 1 |
| *Coelospermum reticulatum* | Coelospermum | Local provenance | 1 |
| Unidentified monsoon forest sp. | | NT Native | 1 |
| | | **Total** | **2,857** |

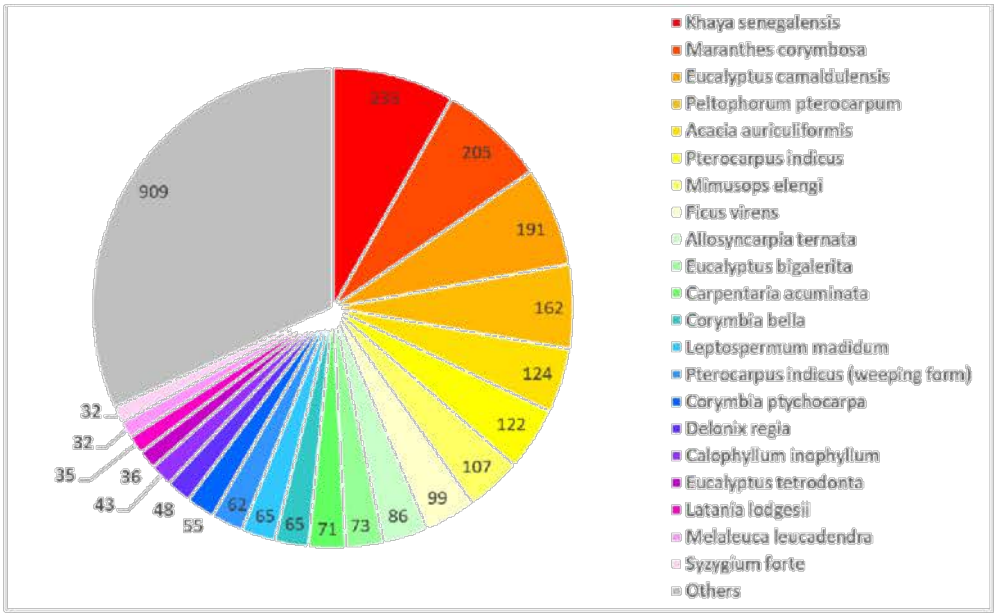



**Figure 8: Top 21 most commonly species represented as a proportion of all sampled species**

**Table 3: Proportion of individual trees surveyed by origin**

| Origin | Survey Proportion |
|---|---|
| Local provenance | 51.7% |
| NT Native | 17.2% |
| Australian Native | 3.9% |
| Naturalised | 2.5% |
| Exotic | 24.7% |

## 5.4 Tree damage type statistics

### 5.4.1 Tree damage statistics of the top 21 most abundant species.

From the analysis of the 21 most abundant species, for all damage categories including minor foliage loss and small branches broken, *Khaya senegalensis* (88.5%), *Acacia auriculiformis* (88.7%),

*Maranthes corymbosa* (78.0%) and *Eucalyptus camaldulensis* (75.9%) had the highest tree damage rates. It is interesting to note that from the above species *Maranthes corymbosa* had a very low rate (12.2%) of major damage.

66% of all surveyed *Khaya senegalensis* were uprooted. Other species which commonly uprooted were *Pterocarpus indicus* (weeping form) (30.6%) and *Acacia auriculiformis* (29.8%).

Only 5.6% of *Carpentaria acuminata* were damaged. Other relatively unscathed tree species were *Ficus virens* (46.5%) and *Leptospermum madidum* (47.7%).

*Delonix regia* had the highest rate of significant branch breaks (18.8%). However, it had no trunk snapping or splitting.

*Leptospermum madidum*) had the highest rate of trunk snapping or splitting (12.3%).

**Plate 2: Two specimens of *Alstonia actinophylla*, a local provenance native species.**

## Table 4: Top 21 most surveyed tree species stratified by tree damage.

**Top 21 most surveyed tree species stratified by tree damage.**

| Damage Type / Species | Nil | | Foliage stripped | | Small branches damaged | | Nil or Minor Damage (as per left) | | Major Damage (as per right) | | Large branches damaged | | Significant branch broken | | Leader snapped or split | | Trunk snapped or split | | Uprooted | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | |
| Khaya senegalensis | 27 | 11.5% | 0 | 0.0% | 40 | 17.0% | 67 | 28.5% | 168 | 71.5% | 4 | 1.7% | 9 | 3.8% | 0 | 0.0% | 0 | 0.0% | 155 | 66.0% | 235 |
| Maranthes corymbosa | 45 | 22.0% | 0 | 0.0% | 135 | 65.9% | 180 | 87.8% | 25 | 12.2% | 4 | 2.0% | 15 | 7.3% | 0 | 0.0% | 2 | 1.0% | 4 | 2.0% | 205 |
| Eucalyptus camaldulensis | 46 | 24.1% | 2 | 1.0% | 54 | 28.3% | 102 | 53.4% | 89 | 46.6% | 6 | 3.1% | 30 | 15.7% | 1 | 0.5% | 12 | 6.3% | 40 | 20.9% | 191 |
| Peltophorum pterocarpum | 46 | 28.4% | 2 | 1.2% | 45 | 27.8% | 93 | 57.4% | 69 | 42.6% | 10 | 6.2% | 23 | 14.2% | 1 | 0.6% | 2 | 1.2% | 33 | 20.4% | 162 |
| Acacia auriculiformis | 14 | 11.3% | 0 | 0.0% | 40 | 32.3% | 54 | 43.5% | 70 | 56.5% | 7 | 5.6% | 16 | 12.9% | 1 | 0.8% | 9 | 7.3% | 37 | 29.8% | 124 |
| Pterocarpus indicus | 61 | 50.0% | 0 | 0.0% | 30 | 24.6% | 91 | 74.6% | 31 | 25.4% | 5 | 4.1% | 7 | 5.7% | 0 | 0.0% | 2 | 1.6% | 17 | 13.9% | 122 |
| Mimusops elengi | 52 | 48.6% | 0 | 0.0% | 35 | 32.7% | 87 | 81.3% | 20 | 18.7% | 1 | 0.9% | 9 | 8.4% | 0 | 0.0% | 2 | 1.9% | 8 | 7.5% | 107 |
| Ficus virens | 53 | 53.5% | 2 | 2.0% | 22 | 22.2% | 77 | 77.8% | 22 | 22.2% | 7 | 7.1% | 13 | 13.1% | 0 | 0.0% | 0 | 0.0% | 2 | 2.0% | 99 |
| Allosyncarpia ternata | 31 | 36.0% | 0 | 0.0% | 37 | 43.0% | 68 | 79.1% | 18 | 20.9% | 1 | 1.2% | 1 | 1.2% | 0 | 0.0% | 4 | 4.7% | 12 | 14.0% | 86 |
| Carpentaria acuminata | 67 | 94.4% | 0 | 0.0% | 1 | 1.4% | 68 | 95.8% | 3 | 4.2% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 3 | 4.2% | 0 | 0.0% | 71 |
| Eucalyptus bigalerita | 29 | 39.7% | 0 | 0.0% | 24 | 32.9% | 53 | 72.6% | 20 | 27.4% | 3 | 4.1% | 3 | 4.1% | 0 | 0.0% | 2 | 2.7% | 12 | 16.4% | 73 |
| Leptospermum madidum | 34 | 52.3% | 0 | 0.0% | 6 | 9.2% | 40 | 61.5% | 25 | 38.5% | 1 | 1.5% | 7 | 10.8% | 0 | 0.0% | 8 | 12.3% | 9 | 13.8% | 65 |
| Corymbia bella | 19 | 29.2% | 0 | 0.0% | 31 | 47.7% | 50 | 76.9% | 15 | 23.1% | 9 | 13.8% | 2 | 3.1% | 0 | 0.0% | 3 | 4.6% | 1 | 1.5% | 65 |
| Pterocarpus indicus (weeping form) | 27 | 43.5% | 0 | 0.0% | 13 | 21.0% | 40 | 64.5% | 22 | 35.5% | 0 | 0.0% | 1 | 1.6% | 0 | 0.0% | 2 | 3.2% | 19 | 30.6% | 62 |
| Corymbia ptychocarpa | 17 | 30.9% | 0 | 0.0% | 24 | 43.6% | 41 | 74.5% | 14 | 25.5% | 3 | 5.5% | 5 | 9.1% | 0 | 0.0% | 2 | 3.6% | 4 | 7.3% | 55 |
| Delonix regia | 13 | 27.1% | 0 | 0.0% | 16 | 33.3% | 29 | 60.4% | 19 | 39.6% | 2 | 4.2% | 9 | 18.8% | 0 | 0.0% | 0 | 0.0% | 8 | 16.7% | 48 |
| Calophyllum inophyllum | 8 | 18.6% | 0 | 0.0% | 25 | 58.1% | 33 | 76.7% | 10 | 23.3% | 1 | 2.3% | 6 | 14.0% | 0 | 0.0% | 3 | 7.0% | 0 | 0.0% | 43 |
| Eucalyptus tetrodonta | 6 | 16.7% | 0 | 0.0% | 15 | 41.7% | 21 | 58.3% | 15 | 41.7% | 4 | 11.1% | 4 | 11.1% | 0 | 0.0% | 4 | 11.1% | 3 | 8.3% | 36 |
| Latania lodgesii | 33 | 94.3% | 0 | 0.0% | 1 | 2.9% | 34 | 97.1% | 1 | 2.9% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 1 | 2.9% | 0 | 0.0% | 35 |
| Melaleuca leucadendra | 16 | 50.0% | 0 | 0.0% | 11 | 34.4% | 27 | 84.4% | 5 | 15.6% | 1 | 3.1% | 1 | 3.1% | 0 | 0.0% | 2 | 6.3% | 1 | 3.1% | 32 |
| Syzygium forte | 15 | 46.9% | 0 | 0.0% | 12 | 37.5% | 27 | 84.4% | 5 | 15.6% | 0 | 0.0% | 1 | 3.1% | 0 | 0.0% | 1 | 3.1% | 3 | 9.4% | 32 |
| Grand Total | 659 | 33.8% | 6 | 0.3% | 617 | 31.7% | 1282 | 65.8% | 666 | 34.2% | 69 | 3.5% | 162 | 8.3% | 3 | 0.2% | 64 | 3.3% | 368 | 18.9% | 1948 |
| All Trees | 1157 | 40.5% | 12 | 0.4% | 824 | 28.8% | 1993 | 69.8% | 864 | 30.2% | 86 | 3.0% | 237 | 8.3% | 12 | 0.4% | 89 | 3.1% | 440 | 15.4% | 2857 |

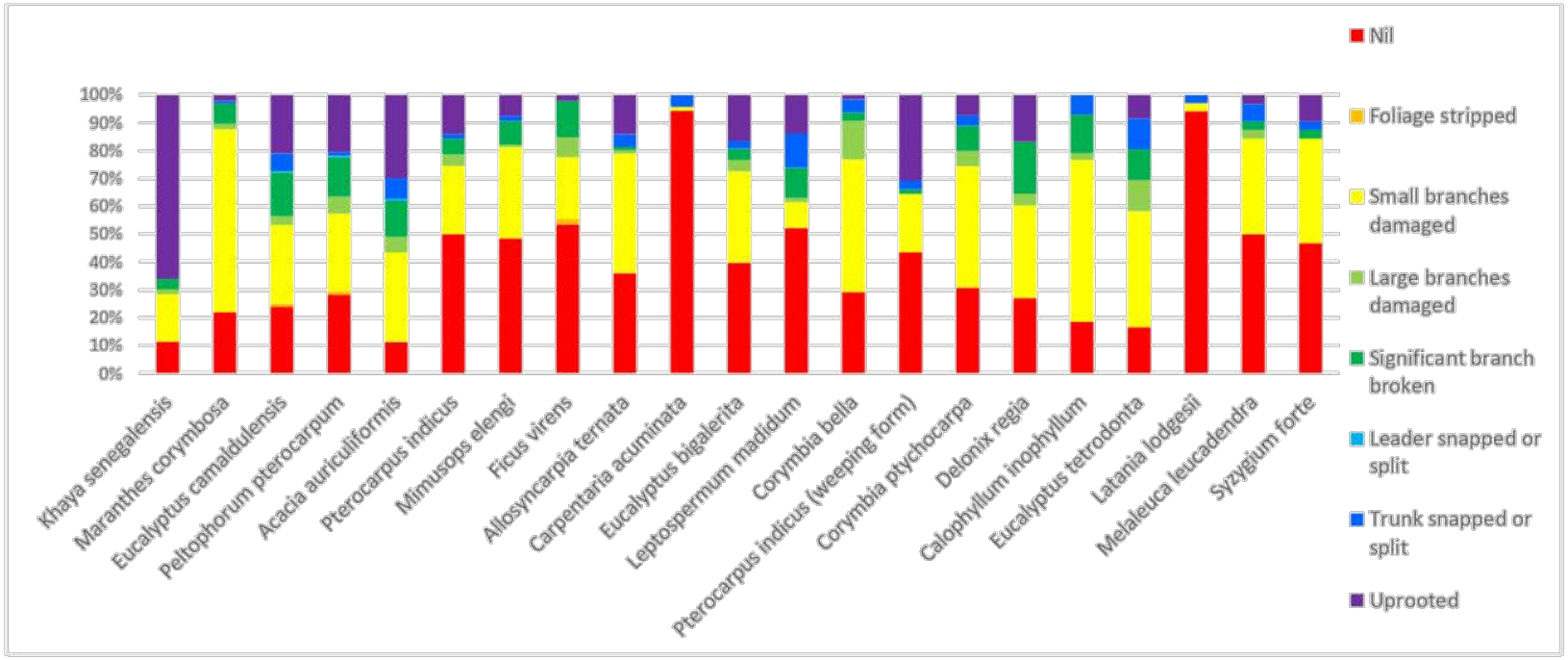



**Figure 9: All tree damage to the top 21 surveyed trees**

### 5.4.2 Tree damage statistics of tree species with 10 or more surveyed individuals

#### *5.4.2.1 Tree species with the lowest rate of major tree damage*

*Carpentaria acuminata* (4.2%) and *Latania lodgesii* (2.9%) had low rates of major damage and a good sample size. *Murraya paniculata, Melaleuca bracteata, Livistona muelleri, Dypsis lutescens, Cycas media* and *Melaleuca argentea* all had 0% major damage, but the sample size was small.

**Table 5: Tree species with 10 or more samples in order of lowest rate of major tree damage**

| Damage Type / Species | Major Damage (as per right) | | Large branches damaged | | Significant branch broken | | Leader snapped or split | | Trunk snapped or split | | Uprooted | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | number | % | number | % | number | % | number | % | number | % | number | % | |
| Murraya paniculata | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 21 |
| Melaleuca bracteata | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 14 |
| Livistona muelleri | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 14 |
| Livistona benthamii | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 13 |
| Dypsis lutescens | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 13 |
| Cycas media | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 13 |
| Melaleuca argentea | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 10 |
| Latania lodgesii | 1 | 2.9% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 1 | 2.9% | 0 | 0.0% | 35 |
| Carpentaria acuminata | 3 | 4.2% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 3 | 4.2% | 0 | 0.0% | 71 |
| Ptychosperma macarthurii | 1 | 4.5% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 1 | 4.5% | 0 | 0.0% | 22 |
| Eucalyptus tindaniana | 1 | 5.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 1 | 5.0% | 20 |
| Plumeria obtusa | 2 | 7.7% | 0 | 0.0% | 1 | 3.8% | 0 | 0.0% | 0 | 0.0% | 1 | 3.8% | 26 |
| Corymbia polycarpa | 3 | 10.0% | 1 | 3.3% | 1 | 3.3% | 1 | 3.3% | 0 | 0.0% | 0 | 0.0% | 30 |
| Alstonia scholaris | 2 | 10.0% | 0 | 0.0% | 2 | 10.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 20 |
| Ganophyllum falcatum | 1 | 10.0% | 1 | 10.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 10 |
| Callistemon viminalis | 3 | 10.3% | 0 | 0.0% | 2 | 6.9% | 0 | 0.0% | 0 | 0.0% | 1 | 3.4% | 29 |
| Eucalyptus herbertiana | 2 | 10.5% | 1 | 5.3% | 1 | 5.3% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 19 |
| Maranthes corymbosa | 25 | 12.2% | 4 | 2.0% | 15 | 7.3% | 0 | 0.0% | 2 | 1.0% | 4 | 2.0% | 205 |
| Tamarindus indica | 3 | 12.5% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 3 | 12.5% | 24 |
| Arfuillea arborescens | 3 | 13.0% | 0 | 0.0% | 2 | 8.7% | 0 | 0.0% | 0 | 0.0% | 1 | 4.3% | 23 |
| Wodyetia bifurcata | 3 | 15.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 3 | 15.0% | 0 | 0.0% | 20 |
| Melaleuca leucadendra | 5 | 15.6% | 1 | 3.1% | 1 | 3.1% | 0 | 0.0% | 2 | 6.3% | 1 | 3.1% | 32 |
| Syzygium forte | 5 | 15.6% | 0 | 0.0% | 1 | 3.1% | 0 | 0.0% | 1 | 3.1% | 3 | 9.4% | 32 |
| Myristica insipida | 3 | 16.7% | 0 | 0.0% | 0 | 0.0% | 2 | 11.1% | 0 | 0.0% | 1 | 5.6% | 18 |
| Alstonia actinophylla | 5 | 17.9% | 1 | 3.6% | 3 | 10.7% | 0 | 0.0% | 1 | 3.6% | 0 | 0.0% | 28 |
| Terminalia platyphylla | 2 | 18.2% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 2 | 18.2% | 11 |
| Mimusops elengi | 20 | 18.7% | 1 | 0.9% | 9 | 8.4% | 0 | 0.0% | 2 | 1.9% | 8 | 7.5% | 107 |
| Allosyncarpia ternata | 18 | 20.9% | 1 | 1.2% | 1 | 1.2% | 0 | 0.0% | 4 | 4.7% | 12 | 14.0% | 86 |
| Ficus virens | 22 | 22.2% | 7 | 7.1% | 13 | 13.1% | 0 | 0.0% | 0 | 0.0% | 2 | 2.0% | 99 |
| Corymbia bella | 15 | 23.1% | 9 | 13.8% | 2 | 3.1% | 0 | 0.0% | 3 | 4.6% | 1 | 1.5% | 65 |
| Calophyllum inophyllum | 10 | 23.3% | 1 | 2.3% | 6 | 14.0% | 0 | 0.0% | 3 | 7.0% | 0 | 0.0% | 43 |
| Millettia pinnata | 5 | 23.8% | 0 | 0.0% | 3 | 14.3% | 1 | 4.8% | 0 | 0.0% | 1 | 4.8% | 21 |
| Pterocarpus indicus | 31 | 25.4% | 5 | 4.1% | 7 | 5.7% | 0 | 0.0% | 2 | 1.6% | 17 | 13.9% | 122 |
| Corymbia ptychocarpa | 14 | 25.5% | 3 | 5.5% | 5 | 9.1% | 0 | 0.0% | 2 | 3.6% | 4 | 7.3% | 55 |
| Syzygium armstrongii | 5 | 26.3% | 1 | 5.3% | 2 | 10.5% | 0 | 0.0% | 1 | 5.3% | 1 | 5.3% | 19 |
| Ficus benjamina | 4 | 26.7% | 1 | 6.7% | 3 | 20.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 15 |
| Eucalyptus bleeseria | 20 | 27.4% | 3 | 4.1% | 3 | 4.1% | 0 | 0.0% | 2 | 2.7% | 12 | 16.4% | 73 |
| Ficus macrocarpa var. hillii | 7 | 28.0% | 2 | 8.0% | 3 | 12.0% | 0 | 0.0% | 0 | 0.0% | 2 | 8.0% | 25 |
| **All Trees** | **864** | **30.2%** | **86** | **3.0%** | **237** | **8.3%** | **12** | **0.4%** | **89** | **3.1%** | **440** | **15.4%** | **2857** |

#### 5.4.2.2 Tree species with the highest rate of major tree damage

*Khaya senegalensis* (71.5%), *Acacia auriculiformis* (56.5%), *Eucalyptus camaldulensis* (46.6%) and *Peltophorum pterocarpum* (42.6%) having a significantly high rate of major damage (and a large sample size) compared with the average rate for all trees (30.2%).

The following species had over 30 individuals sampled and less than 10% uprooting: *Callophyllum inophyllum* (0%), *Carpentaria acuminata* (0%), *Corymbia bella* (1.5%), *Corymbia polycarpa* (0%), *Corymbia ptychocarpa (7.3%), Ficus virens* (2%), *Latania lodgesii* (0%), *Maranthes corymbosa* (2%) , *Melaleuca leucadendra* (3.1%), *Mimusops elengi* (7.5%) and *Syzygium forte* (9.4%).

**Table 6: Tree species with 10 or more samples in order of highest rate of major tree damage**

| Damage Type / Species | Nil | | Foliage stripped | | Small branches damaged | | Nil to Minor Damage (as per left) | | Major Damage (as per right) | | Large branches damaged | | Significant branch broken | | Leader snapped or split | | Trunk snapped or split | | Uprooted | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | |
| Khaya senegalensis | 27 | 11.5% | 0 | 0.0% | 40 | 17.0% | 67 | 28.5% | 168 | 71.5% | 4 | 1.7% | 9 | 3.8% | 0 | 0.0% | 0 | 0.0% | 155 | 66.0% | 235 |
| Tabebuia pallida | 2 | 18.2% | 0 | 0.0% | 2 | 18.2% | 4 | 36.4% | 7 | 63.6% | 2 | 18.2% | 2 | 27.3% | 0 | 0.0% | 1 | 9.1% | 1 | 9.1% | 11 |
| Terminalia muelleri spp. | 1 | 6.3% | 0 | 0.0% | 5 | 31.3% | 6 | 37.5% | 10 | 62.5% | 0 | 0.0% | 1 | 6.3% | 1 | 6.3% | 2 | 12.5% | 6 | 37.5% | 16 |
| Ficus longifolia | 2 | 14.3% | 0 | 0.0% | 4 | 28.6% | 6 | 42.9% | 8 | 57.1% | 0 | 0.0% | 1 | 7.1% | 0 | 0.0% | 0 | 0.0% | 7 | 50.0% | 14 |
| Acacia auriculiformis | 14 | 11.3% | 0 | 0.0% | 40 | 32.3% | 54 | 43.5% | 70 | 56.5% | 7 | 5.6% | 16 | 12.9% | 1 | 0.8% | 9 | 7.3% | 37 | 29.8% | 124 |
| Corymbia bella | 1 | 20.0% | 0 | 0.0% | 4 | 36.4% | 11 | 44.0% | 14 | 56.0% | 0 | 0.0% | 6 | 24.0% | 3 | 12.0% | 1 | 4.0% | 4 | 16.0% | 25 |
| Terminalia microcarpa | 3 | 21.4% | 0 | 0.0% | 4 | 28.6% | 7 | 50.0% | 7 | 50.0% | 1 | 7.1% | 3 | 21.4% | 0 | 0.0% | 0 | 0.0% | 3 | 21.4% | 14 |
| Samanea saman | 5 | 33.3% | 0 | 0.0% | 2 | 20.0% | 8 | 53.3% | 7 | 46.7% | 1 | 6.7% | 4 | 26.7% | 0 | 0.0% | 0 | 0.0% | 2 | 13.3% | 15 |
| Eucalyptus camaldulensis | 66 | 28.1% | 2 | 1.0% | 54 | 26.0% | 122 | 53.4% | 89 | 46.6% | 6 | 3.1% | 20 | 10.2% | 3 | 1.5% | 12 | 6.1% | 60 | 30.6% | 196 |
| Albizia lebbeck | 9 | 26.9% | 0 | 0.0% | 5 | 20.0% | 14 | 56.0% | 11 | 44.0% | 0 | 0.0% | 5 | 20.0% | 0 | 0.0% | 0 | 0.0% | 6 | 24.0% | 25 |
| Eucalyptus miniata | 5 | 23.8% | 0 | 0.0% | 7 | 33.3% | 12 | 57.1% | 9 | 42.9% | 2 | 9.5% | 5 | 23.8% | 0 | 0.0% | 1 | 4.8% | 1 | 4.8% | 21 |
| Peltophorum pterocarpum | 66 | 28.4% | 2 | 0.9% | 65 | 27.9% | 133 | 57.1% | 99 | 42.6% | 20 | 8.7% | 23 | 10.0% | 3 | 0.0% | 2 | 0.9% | 53 | 20.6% | 183 |
| Eucalyptus tetrodonta | 6 | 16.7% | 0 | 0.0% | 15 | 41.7% | 21 | 58.3% | 15 | 41.7% | 3 | 8.3% | 4 | 11.1% | 0 | 0.0% | 0 | 0.0% | 3 | 8.3% | 36 |
| Lophostemon | 7 | 16.3% | 0 | 0.0% | 5 | 11.6% | 7 | 16.3% | 5 | 41.7% | 0 | 0.0% | 3 | 7.0% | 0 | 0.0% | 0 | 0.0% | 2 | 16.7% | 12 |
| Tabebuia alba | 10 | 37.0% | 0 | 0.0% | 6 | 22.2% | 16 | 59.3% | 11 | 40.7% | 0 | 0.0% | 6 | 22.2% | 0 | 0.0% | 1 | 3.7% | 4 | 14.8% | 27 |
| Delonix regia | 13 | 27.1% | 0 | 0.0% | 15 | 31.3% | 28 | 58.4% | 19 | 39.6% | 2 | 4.2% | 9 | 18.8% | 0 | 0.0% | 0 | 0.0% | 8 | 16.7% | 48 |
| Heterospermum maidenii | 14 | 57.1% | 0 | 0.0% | 6 | 9.7% | 20 | 81.5% | 25 | 38.5% | 1 | 1.4% | 7 | 10.8% | 0 | 0.0% | 8 | 12.3% | 9 | 13.8% | 65 |
| Mangifera indica | 6 | 54.5% | 0 | 0.0% | 1 | 9.1% | 7 | 63.6% | 4 | 36.4% | 0 | 0.0% | 1 | 9.1% | 0 | 0.0% | 0 | 0.0% | 3 | 27.3% | 11 |
| Pterocarpus indicus (weeping form) | 27 | 43.5% | 0 | 0.0% | 13 | 21.0% | 40 | 64.5% | 22 | 35.5% | 0 | 0.0% | 1 | 1.6% | 0 | 0.0% | 2 | 3.2% | 19 | 30.6% | 62 |
| Corypha utan | 6 | 66.7% | 0 | 0.0% | 0 | 0.0% | 6 | 66.7% | 4 | 33.3% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 2 | 16.7% | 2 | 16.7% | 12 |
| Livistona decipiens var. blue | 19 | 60.0% | 0 | 0.0% | 3 | 10.0% | 19 | 72.0% | 7 | 28.0% | 2 | 8.0% | 3 | 12.0% | 0 | 0.0% | 0 | 0.0% | 2 | 8.0% | 25 |
| Eucalyptus bleeseria | 29 | 39.2% | 0 | 0.0% | 24 | 32.4% | 53 | 72.6% | 20 | 27.4% | 3 | 4.1% | 9 | 4.1% | 0 | 0.0% | 2 | 2.7% | 12 | 16.4% | 73 |
| Ficus benjamina | 9 | 60.0% | 0 | 0.0% | 2 | 13.3% | 11 | 73.3% | 4 | 26.7% | 1 | 6.7% | 3 | 20.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 15 |
| Syzygium forte spp. | 8 | 42.1% | 0 | 0.0% | 6 | 31.6% | 14 | 73.7% | 5 | 26.3% | 1 | 5.3% | 2 | 10.5% | 0 | 0.0% | 1 | 5.3% | 1 | 5.3% | 19 |
| Corymbia ptychocarpa | 17 | 70.8% | 0 | 0.0% | 24 | 61.5% | 41 | 70.7% | 14 | 29.3% | 3 | 6.5% | 5 | 9.8% | 0 | 0.0% | 2 | 3.4% | 4 | 7.3% | 55 |
| Pterocarpus indicus | 51 | 50.0% | 0 | 0.0% | 20 | 24.5% | 71 | 74.6% | 21 | 25.4% | 5 | 4.2% | 7 | 5.4% | 0 | 0.0% | 2 | 2.5% | 17 | 13.2% | 129 |
| Mitrella pinata | 5 | 23.8% | 0 | 0.0% | 11 | 57.1% | 16 | 76.2% | 5 | 23.8% | 0 | 0.0% | 2 | 10.3% | 1 | 4.3% | 0 | 0.0% | 1 | 4.8% | 21 |
| Calophyllum inophyllum | 8 | 38.5% | 0 | 0.0% | 25 | 56.1% | 33 | 76.7% | 10 | 23.3% | 3 | 7.0% | 6 | 19.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 43 |
| Corypha lecomtei | 17 | 77.2% | 0 | 0.0% | 11 | 66.7% | 50 | 76.1% | 15 | 23.1% | 0 | 33.3% | 2 | 10.5% | 0 | 0.0% | 0 | 0.0% | 1 | 3.5% | 65 |
| Ficus virens | 53 | 53.0% | 2 | 2.0% | 22 | 22.2% | 77 | 77.8% | 22 | 22.2% | 7 | 7.1% | 13 | 13.1% | 0 | 0.0% | 0 | 0.0% | 2 | 2.0% | 99 |
| Alstonia actinophylla | 31 | 80.0% | 0 | 0.0% | 37 | 43.0% | 68 | 79.1% | 18 | 20.9% | 1 | 1.2% | 1 | 1.2% | 0 | 0.0% | 0 | 0.0% | 17 | 19.8% | 86 |
| Mimusops elengi | 59 | 48.4% | 0 | 0.0% | 39 | 37.7% | 87 | 81.3% | 20 | 18.7% | 3 | 2.8% | 5 | 4.4% | 0 | 0.0% | 0 | 0.0% | 8 | 7.5% | 107 |
| Terminalia platyphylla | 6 | 54.5% | 0 | 0.0% | 3 | 27.3% | 9 | 81.8% | 2 | 18.2% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 2 | 18.2% | 11 |
| Adenia actinophylla | 17 | 60.7% | 0 | 0.0% | 6 | 21.4% | 23 | 82.1% | 5 | 17.9% | 1 | 3.6% | 3 | 10.7% | 0 | 0.0% | 1 | 3.6% | 0 | 0.0% | 28 |
| Mystica insipida | 9 | 50.0% | 0 | 0.0% | 0 | 33.3% | 15 | 83.3% | 3 | 16.7% | 0 | 0.0% | 0 | 0.0% | 2 | 10.5% | 0 | 0.0% | 1 | 5.6% | 18 |
| Melaleuca leucadendra | 16 | 50.0% | 0 | 0.0% | 11 | 34.4% | 27 | 84.4% | 5 | 15.6% | 1 | 3.1% | 1 | 3.1% | 0 | 0.0% | 2 | 6.1% | 1 | 3.1% | 32 |
| Syzygium forte | 15 | 46.9% | 0 | 0.0% | 12 | 37.5% | 27 | 84.4% | 5 | 15.6% | 0 | 0.0% | 1 | 3.1% | 0 | 0.0% | 1 | 3.1% | 3 | 9.4% | 32 |
| Wodyetia bifurcata | 15 | 75.0% | 0 | 0.0% | 2 | 10.0% | 17 | 85.0% | 3 | 15.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 20 |
| All trees | 1157 | 48.0% | 17 | 0.7% | 829 | 29.8% | 1943 | 69.8% | 864 | 30.2% | 86 | 3.0% | 237 | 8.3% | 32 | 1.1% | 89 | 3.1% | 440 | 15.4% | 2861 |

#### 5.4.2.3 Trees with species with more than 10% rate of uprooting.

*Khaya senegalensis* had a significantly high proportion of uprooted trees (66%). This is over 4 times higher than the overall uprooting rate of 15.4% for all 440 trees that were uprooted.

**Plate 3 : An uprooted Khaya senegalensis**

**Table 7: Tree species with 10 or more samples with more than 10% rate of uprooting.**

| Species \ Damage Type | Major Damage (as per right) | | Large branches damaged | | Significant branch broken | | Leader snapped or split | | Trunk snapped or split | | Uprooted | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | number | % | number | % | number | % | number | % | number | % | number | % | |
| Khaya senegalensis | 158 | 71.5% | 4 | 1.7% | 9 | 3.8% | 0 | 0.0% | 0 | 0.0% | 155 | 66.0% | 235 |
| Ficus longifolia | 8 | 57.1% | 0 | 0.0% | 1 | 7.1% | 0 | 0.0% | 0 | 0.0% | 7 | 50.0% | 14 |
| Terminalia melanocarpa | 10 | 62.5% | 0 | 0.0% | 1 | 6.3% | 1 | 6.3% | 2 | 12.5% | 6 | 37.5% | 16 |
| Pterocarpus indicus (weeping form) | 22 | 35.5% | 0 | 0.0% | 1 | 1.6% | 0 | 0.0% | 2 | 3.2% | 19 | 30.6% | 62 |
| Acacia auriculiformis | 70 | 56.5% | 7 | 5.6% | 16 | 12.9% | 1 | 0.8% | 9 | 7.3% | 37 | 29.8% | 124 |
| Mangifera indica | 4 | 36.4% | 0 | 0.0% | 1 | 9.1% | 0 | 0.0% | 0 | 0.0% | 3 | 27.3% | 11 |
| Albizia lebbeck | 11 | 44.0% | 0 | 0.0% | 5 | 20.0% | 0 | 0.0% | 0 | 0.0% | 6 | 24.0% | 25 |
| Terminalia microcarpa | 7 | 50.0% | 1 | 7.1% | 3 | 21.4% | 0 | 0.0% | 0 | 0.0% | 3 | 21.4% | 14 |
| Eucalyptus camaldulensis | 89 | 46.6% | 6 | 3.1% | 30 | 15.7% | 1 | 0.5% | 12 | 6.3% | 40 | 20.9% | 191 |
| Peltophorum pterocarpum | 69 | 42.6% | 10 | 6.2% | 23 | 14.2% | 1 | 0.6% | 2 | 1.2% | 33 | 20.4% | 162 |
| Terminalia platyphylla | 2 | 18.2% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 2 | 18.2% | 11 |
| Ficus racemosa | 5 | 41.7% | 0 | 0.0% | 3 | 25.0% | 0 | 0.0% | 0 | 0.0% | 2 | 16.7% | 12 |
| Delonix regia | 19 | 39.6% | 2 | 4.2% | 9 | 18.8% | 0 | 0.0% | 0 | 0.0% | 8 | 16.7% | 48 |
| Caryota mitis | 4 | 33.3% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 2 | 16.7% | 2 | 16.7% | 12 |
| Eucalyptus tigalerita | 20 | 27.4% | 3 | 4.1% | 3 | 4.1% | 0 | 0.0% | 2 | 2.7% | 12 | 16.4% | 73 |
| Caralia brachiata | 14 | 56.0% | 0 | 0.0% | 6 | 24.0% | 3 | 12.0% | 1 | 4.0% | 4 | 16.0% | 25 |
| Tabebuia aurea | 11 | 40.7% | 0 | 0.0% | 6 | 22.2% | 0 | 0.0% | 1 | 3.7% | 4 | 14.8% | 27 |
| Allosyncarpia ternata | 18 | 20.9% | 1 | 1.2% | 1 | 1.2% | 0 | 0.0% | 4 | 4.7% | 12 | 14.0% | 86 |
| Pterocarpus indicus | 31 | 25.4% | 5 | 4.1% | 7 | 5.7% | 0 | 0.0% | 2 | 1.6% | 17 | 13.9% | 122 |
| Leptospermum madidum | 25 | 38.5% | 1 | 1.5% | 7 | 10.8% | 0 | 0.0% | 8 | 12.3% | 9 | 13.8% | 65 |
| Samanea saman | 7 | 46.7% | 1 | 6.7% | 4 | 26.7% | 0 | 0.0% | 0 | 0.0% | 2 | 13.3% | 15 |
| Tamarindus indica | 3 | 12.5% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 3 | 12.5% | 24 |
| **All Trees** | **864** | **30.2%** | **86** | **3.0%** | **237** | **8.3%** | **12** | **0.4%** | **89** | **3.1%** | **440** | **15.4%** | **2857** |

#### *5.4.2.4 Tree species with a 0% rate of uprooting*

Out of the species with 0% uprooting, *Callophyllum inophyllum* and *Carpentaria acuminata* were represented by a good sample size. 18 species recorded nil uprooting compared with the overall uprooting rate of 15.4% for all trees.

**Table 8: Tree species with 10 or more samples with a 0% rate of uprooting.**

| Species \ Damage Type | Major Damage (as per right) | | Large branches damaged | | Significant branch broken | | Leader snapped or split | | Trunk snapped or split | | Uprooted | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | number | % | number | % | number | % | number | % | number | % | number | % | |
| Ficus benjamina | 4 | 26.7% | 1 | 6.7% | 3 | 20.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 15 |
| Calophyllum inophyllum | 10 | 23.3% | 1 | 2.3% | 6 | 14.0% | 0 | 0.0% | 3 | 7.0% | 0 | 0.0% | 43 |
| Alstonia actinophylla | 5 | 17.9% | 1 | 3.6% | 3 | 10.7% | 0 | 0.0% | 1 | 3.6% | 0 | 0.0% | 28 |
| Wodyetia bifurcata | 3 | 15.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 3 | 15.0% | 0 | 0.0% | 20 |
| Eucalyptus herbertiana | 2 | 10.5% | 1 | 5.3% | 1 | 5.3% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 19 |
| Corymbia polycarpa | 3 | 10.0% | 1 | 3.3% | 1 | 3.3% | 1 | 3.3% | 0 | 0.0% | 0 | 0.0% | 30 |
| Alstonia scholaris | 2 | 10.0% | 0 | 0.0% | 2 | 10.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 20 |
| Ganophyllum falcatum | 1 | 10.0% | 1 | 10.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 10 |
| Ptychosperma macarthurii | 1 | 4.5% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 1 | 4.5% | 0 | 0.0% | 22 |
| Carpentaria acuminata | 3 | 4.2% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 3 | 4.2% | 0 | 0.0% | 71 |
| Latania lodgesii | 1 | 2.9% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 1 | 2.9% | 0 | 0.0% | 35 |
| Murraya paniculata | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 21 |
| Melaleuca bracteata | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 14 |
| Livistona muelleri | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 14 |
| Livistona benthamii | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 13 |
| Dypsis lutescens | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 13 |
| Cycas media | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 13 |
| Melaleuca argentea | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 10 |
| **All Trees** | **864** | **30.2%** | **86** | **3.0%** | **237** | **8.3%** | **12** | **0.4%** | **89** | **3.1%** | **440** | **15.4%** | **2857** |

### 5.4.2.5 *Tree species with more than 5% rate of snapped or split trunks*

*Leptospermum madidum*, with a good sample size, had a significantly high rate (12.3%) of snapped or split trunks, 4 times higher than the average of 3.1% for all trees surveyed.

**Table 9: Tree species with 10 or more samples with more than 5% rate of snapped or split trunks.**

| Species \ Damage Type | Major Damage (as per right) | | Large branches damaged | | Significant branch broken | | Leader snapped or split | | Trunk snapped or split | | Uprooted | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | number | % | number | % | number | % | number | % | number | % | number | % | |
| Caryota mitis | 4 | 33.3% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 2 | 16.7% | 2 | 16.7% | 12 |
| Wodyetia bifurcata | 3 | 15.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 3 | 15.0% | 0 | 0.0% | 20 |
| Terminalia melanocarpa | 10 | 62.5% | 0 | 0.0% | 1 | 6.3% | 1 | 6.3% | 2 | 12.5% | 6 | 37.5% | 16 |
| Leptospermum madidum | 25 | 38.5% | 1 | 1.5% | 7 | 10.8% | 0 | 0.0% | 8 | 12.3% | 9 | 13.8% | 65 |
| Eucalyptus tetrodonta | 15 | 41.7% | 4 | 11.1% | 4 | 11.1% | 0 | 0.0% | 4 | 11.1% | 3 | 8.3% | 36 |
| Tabebuia pallida | 7 | 63.6% | 2 | 18.2% | 3 | 27.3% | 0 | 0.0% | 1 | 9.1% | 1 | 9.1% | 11 |
| Acacia auriculiformis | 70 | 56.5% | 7 | 5.6% | 16 | 12.9% | 1 | 0.8% | 9 | 7.3% | 37 | 29.8% | 124 |
| Calophyllum inophyllum | 10 | 23.3% | 1 | 2.3% | 6 | 14.0% | 0 | 0.0% | 3 | 7.0% | 0 | 0.0% | 43 |
| Eucalyptus camaldulensis | 89 | 46.6% | 6 | 3.1% | 30 | 15.7% | 1 | 0.5% | 12 | 6.3% | 40 | 20.9% | 191 |
| Melaleuca leucadendra | 5 | 15.6% | 1 | 3.1% | 1 | 3.1% | 0 | 0.0% | 2 | 6.3% | 1 | 3.1% | 32 |
| Syzygium armstrongii | 5 | 26.3% | 1 | 5.3% | 2 | 10.5% | 0 | 0.0% | 1 | 5.3% | 1 | 5.3% | 19 |
| **All Trees** | **864** | **30.2%** | **86** | **3.0%** | **237** | **8.3%** | **12** | **0.4%** | **89** | **3.1%** | **440** | **15.4%** | **2857** |

### 5.4.2.6 *Tree species with a 0% rate of snapped or split trunks*

*Delonix regia*, *Ficus virens* and *Khaya senegalensis* all had a large sample size and 0% snapped or split trunks. It is worthy to note that these species did experience other types of major damage, for example *K. senegalensis* with 66% uprooting.

**Plate 4: Some species with strong trunks were damaged in other ways**

**Table 10: Tree species with 10 or more samples with a 0% rate of snapped or split trunks.**

| Damage Type / Species | Major Damage (as per right) | | Large branches damaged | | Significant branch broken | | Leader snapped or split | | Trunk snapped or split | | Uprooted | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | number | % | number | % | number | % | number | % | number | % | number | % | |
| Albizia lebbeck | 11 | 44.0% | 0 | 0.0% | 5 | 20.0% | 0 | 0.0% | 0 | 0.0% | 6 | 24.0% | 25 |
| Alstonia scholaris | 2 | 10.0% | 0 | 0.0% | 2 | 10.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 20 |
| Arfuillea arborescens | 3 | 13.0% | 0 | 0.0% | 2 | 8.7% | 0 | 0.0% | 0 | 0.0% | 1 | 4.3% | 23 |
| Callistemon viminalis | 3 | 10.3% | 0 | 0.0% | 2 | 6.9% | 0 | 0.0% | 0 | 0.0% | 1 | 3.4% | 29 |
| Cycas media | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 13 |
| Delonix regia | 19 | 39.6% | 2 | 4.2% | 9 | 18.8% | 0 | 0.0% | 0 | 0.0% | 8 | 16.7% | 48 |
| Dypsis lutescens | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 13 |
| Eucalyptus herbertiana | 2 | 10.5% | 1 | 5.3% | 1 | 5.3% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 19 |
| Eucalyptus tintinarrs | 1 | 5.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 1 | 5.0% | 20 |
| Ficus benjamina | 4 | 26.7% | 1 | 6.7% | 3 | 20.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 15 |
| Ficus lengifolia | 8 | 57.1% | 0 | 0.0% | 1 | 7.1% | 0 | 0.0% | 0 | 0.0% | 7 | 50.0% | 14 |
| Ficus macrocarpa var. hillii | 7 | 28.0% | 2 | 8.0% | 3 | 12.0% | 0 | 0.0% | 0 | 0.0% | 2 | 8.0% | 25 |
| Ficus racemosa | 5 | 41.7% | 0 | 0.0% | 3 | 25.0% | 0 | 0.0% | 0 | 0.0% | 2 | 16.7% | 12 |
| Ficus virens | 22 | 22.2% | 7 | 7.1% | 13 | 13.1% | 0 | 0.0% | 0 | 0.0% | 2 | 2.0% | 99 |
| Myristica insipida | 3 | 16.7% | 0 | 0.0% | 0 | 0.0% | 2 | 11.1% | 0 | 0.0% | 1 | 5.6% | 18 |
| Ganophyllum falcatum | 1 | 10.0% | 1 | 10.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 10 |
| Khaya senegalensis | 168 | 71.5% | 4 | 1.7% | 9 | 3.8% | 0 | 0.0% | 0 | 0.0% | 155 | 66.0% | 235 |
| Millettia pinnata | 5 | 23.8% | 0 | 0.0% | 3 | 14.3% | 1 | 4.8% | 0 | 0.0% | 1 | 4.8% | 21 |
| Livistona benthamii | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 13 |
| Livistona muelleri | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 14 |
| Mangifera indica | 4 | 36.4% | 0 | 0.0% | 1 | 9.1% | 0 | 0.0% | 0 | 0.0% | 3 | 27.3% | 11 |
| Melaleuca argentea | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 10 |
| Melaleuca bracteata | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 14 |
| Murraya paniculata | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 21 |
| Plumeria obtusa | 2 | 7.7% | 0 | 0.0% | 1 | 3.8% | 0 | 0.0% | 0 | 0.0% | 1 | 3.8% | 26 |
| Corymbia polycarpa | 3 | 10.0% | 1 | 3.3% | 1 | 3.3% | 1 | 3.3% | 0 | 0.0% | 0 | 0.0% | 30 |
| Samanea saman | 7 | 46.7% | 1 | 6.7% | 4 | 26.7% | 0 | 0.0% | 0 | 0.0% | 2 | 13.3% | 15 |
| Tamarindus indica | 3 | 12.5% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 3 | 12.5% | 24 |
| Terminalia microcarpa | 7 | 50.0% | 1 | 7.1% | 3 | 21.4% | 0 | 0.0% | 0 | 0.0% | 3 | 21.4% | 14 |
| Terminalia platyphylla | 2 | 18.2% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 2 | 18.2% | 11 |
| **All Trees** | **864** | **30.2%** | **86** | **3.0%** | **237** | **8.3%** | **12** | **0.4%** | **89** | **3.1%** | **440** | **15.4%** | **2857** |

#### 5.4.2.7 Tree species with leader snapped or split

Overall trees had a very low rate of snapped or split leaders (0.4%). *Carallia brachiata* (12%) and *Myristica insipida* (11.1%) had higher rates of damaged leaders but the sample size was relatively small. The author notes that he has observed this type of damage for these species outside of the survey area.

**Table 11: Tree species with 10 or more samples with a leader snapped or split.**

| Damage Type / Species | Major Damage (as per right) | | Large branches damaged | | Significant branch broken | | Leader snapped or split | | Trunk snapped or split | | Uprooted | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | number | % | number | % | number | % | number | % | number | % | number | % | |
| Acacia auriculiformis | 70 | 56.5% | 7 | 5.6% | 16 | 12.9% | 1 | 0.8% | 9 | 7.3% | 37 | 29.8% | 124 |
| Carallia brachiata | 14 | 56.0% | 0 | 0.0% | 6 | 24.0% | 3 | 12.0% | 1 | 4.0% | 4 | 16.0% | 25 |
| Corymbia polycarpa | 3 | 10.0% | 1 | 3.3% | 1 | 3.3% | 1 | 3.3% | 0 | 0.0% | 0 | 0.0% | 30 |
| Eucalyptus camaldulensis | 89 | 46.6% | 6 | 3.1% | 30 | 15.7% | 1 | 0.5% | 12 | 6.3% | 40 | 20.9% | 191 |
| Millettia pinnata | 5 | 23.8% | 0 | 0.0% | 3 | 14.3% | 1 | 4.8% | 0 | 0.0% | 1 | 4.8% | 21 |
| Myristica insipida | 3 | 16.7% | 0 | 0.0% | 0 | 0.0% | 2 | 11.1% | 0 | 0.0% | 1 | 5.6% | 18 |
| Peltophorum pterocarpum | 69 | 42.6% | 10 | 6.2% | 23 | 14.2% | 1 | 0.6% | 2 | 1.2% | 33 | 20.4% | 162 |
| Terminalia melanocarpa | 10 | 62.5% | 0 | 0.0% | 1 | 6.3% | 1 | 6.3% | 2 | 12.5% | 6 | 37.5% | 16 |
| **All Trees** | **864** | **30.2%** | **86** | **3.0%** | **237** | **8.3%** | **12** | **0.4%** | **89** | **3.1%** | **440** | **15.4%** | **2857** |

#### 5.4.2.8 Tree species with more than 10% rate of significant branches broken

*Delonix regia* (18.9%) and *Eucalyptus camaldulensis* (15.7%) had a significantly higher rates of significant branch damage compared to the sample average (8.3%).

**Table 12: Tree species with 10 or more samples with more than 10% rate of significant branches broken.**

| Damage Type / Species | Major Damage (as per right) | | Large branches damaged | | Significant branch broken | | Leader snapped or split | | Trunk snapped or split | | Uprooted | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | number | % | number | % | number | % | number | % | number | % | number | % | |
| Tabebuia pallida | 7 | 63.6% | 2 | 18.2% | 3 | 27.3% | 0 | 0.0% | 1 | 9.1% | 1 | 9.1% | 11 |
| Samanea saman | 7 | 46.7% | 1 | 6.7% | 4 | 26.7% | 0 | 0.0% | 0 | 0.0% | 2 | 13.3% | 15 |
| Ficus racemosa | 5 | 41.7% | 0 | 0.0% | 3 | 25.0% | 0 | 0.0% | 0 | 0.0% | 2 | 16.7% | 12 |
| Carallia brachiata | 14 | 56.0% | 0 | 0.0% | 6 | 24.0% | 3 | 12.0% | 1 | 4.0% | 4 | 16.0% | 25 |
| Eucalyptus miniata | 9 | 42.9% | 2 | 9.5% | 5 | 23.8% | 0 | 0.0% | 1 | 4.8% | 1 | 4.8% | 21 |
| Tabebuia aurea | 11 | 40.7% | 0 | 0.0% | 6 | 22.2% | 0 | 0.0% | 1 | 3.7% | 4 | 14.8% | 27 |
| Terminalia microcarpa | 7 | 50.0% | 1 | 7.1% | 3 | 21.4% | 0 | 0.0% | 0 | 0.0% | 3 | 21.4% | 14 |
| Albizia lebbeck | 11 | 44.0% | 0 | 0.0% | 5 | 20.0% | 0 | 0.0% | 0 | 0.0% | 6 | 24.0% | 25 |
| Ficus benjamina | 4 | 26.7% | 1 | 6.7% | 3 | 20.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 15 |
| Delonix regia | 19 | 39.6% | 2 | 4.2% | 9 | 18.8% | 0 | 0.0% | 0 | 0.0% | 8 | 16.7% | 48 |
| Eucalyptus camaldulensis | 89 | 46.6% | 6 | 3.1% | 30 | 15.7% | 1 | 0.5% | 12 | 6.3% | 40 | 20.9% | 191 |
| Millettia pinnata | 5 | 23.8% | 0 | 0.0% | 3 | 14.3% | 1 | 4.8% | 0 | 0.0% | 1 | 4.8% | 21 |
| Peltophorum pterocarpum | 69 | 42.6% | 10 | 6.2% | 23 | 14.2% | 1 | 0.6% | 2 | 1.2% | 33 | 20.4% | 162 |
| Calophyllum inophyllum | 10 | 23.3% | 1 | 2.3% | 6 | 14.0% | 0 | 0.0% | 3 | 7.0% | 0 | 0.0% | 43 |
| Ficus virens | 22 | 22.2% | 7 | 7.1% | 13 | 13.1% | 0 | 0.0% | 0 | 0.0% | 2 | 2.0% | 99 |
| Acacia auriculiformis | 70 | 56.5% | 7 | 5.6% | 16 | 12.9% | 1 | 0.8% | 9 | 7.3% | 37 | 29.8% | 124 |
| Ficus macrocarpa var. hillii | 7 | 28.0% | 2 | 8.0% | 3 | 12.0% | 0 | 0.0% | 0 | 0.0% | 2 | 8.0% | 25 |
| Eucalyptus tetrodonta | 15 | 41.7% | 4 | 11.1% | 4 | 11.1% | 0 | 0.0% | 4 | 11.1% | 3 | 8.3% | 36 |
| Leptospermum madidum | 25 | 38.5% | 1 | 1.5% | 7 | 10.8% | 0 | 0.0% | 8 | 12.3% | 9 | 13.8% | 65 |
| Alstonia actinophylla | 5 | 17.9% | 1 | 3.6% | 3 | 10.7% | 0 | 0.0% | 1 | 3.6% | 0 | 0.0% | 28 |
| Syzygium armstrongii | 5 | 26.3% | 1 | 5.3% | 2 | 10.5% | 0 | 0.0% | 1 | 5.3% | 1 | 5.3% | 19 |
| **All Trees** | **864** | **30.2%** | **86** | **3.0%** | **237** | **8.3%** | **12** | **0.4%** | **89** | **3.1%** | **440** | **15.4%** | **2857** |

#### 5.4.2.9 Tree species with a 0% rate of significant branches broken

*Carpentaria acuminata* and several other species of palms and a cycad were amongst the group that had no significant branch damage. These species do not have branches so the result is biased. *Eucalyptus tintinnans*, *Murraya paniculata* and *Tamarindus indica* also had 0% significant branch damage but a smaller sample size than *Carpentaria acuminata*.

**Table 13: Tree species with 10 or more samples with a 0% rate of significant branches broken.**

| Damage Type / Species | Major Damage (as per right) | | Large branches damaged | | Significant branch broken | | Leader snapped or split | | Trunk snapped or split | | Uprooted | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | number | % | number | % | number | % | number | % | number | % | number | % | |
| Carpentaria acuminata | 3 | 4.2% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 3 | 4.2% | 0 | 0.0% | 71 |
| Caryota mitis | 4 | 33.3% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 2 | 16.7% | 2 | 16.7% | 12 |
| Cycas media | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 13 |
| Dypsis lutescens | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 13 |
| Eucalyptus tintinanns | 1 | 5.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 1 | 5.0% | 20 |
| Ganophyllum falcatum | 1 | 10.0% | 1 | 10.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 10 |
| Latania lodgesi | 1 | 2.9% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 1 | 2.9% | 0 | 0.0% | 35 |
| Livistona benthamii | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 13 |
| Livistona muelleri | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 14 |
| Melaleuca argentea | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 10 |
| Melaleuca bracteata | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 14 |
| Murraya paniculata | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 21 |
| Myristica insipida | 3 | 16.7% | 0 | 0.0% | 0 | 0.0% | 2 | 11.1% | 0 | 0.0% | 1 | 5.6% | 18 |
| Ptychosperma macarthurii | 1 | 4.5% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 1 | 4.5% | 0 | 0.0% | 22 |
| Tamarindus indica | 3 | 12.5% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 3 | 12.5% | 24 |
| Terminalia platyphylla | 2 | 18.2% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 2 | 18.2% | 11 |
| Wodyetia bifurcata | 3 | 15.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 3 | 15.0% | 0 | 0.0% | 20 |
| **All Trees** | **864** | **30.2%** | **86** | **3.0%** | **237** | **8.3%** | **12** | **0.4%** | **89** | **3.1%** | **440** | **15.4%** | **2857** |

**Plate 5: An example of a tree with significant branch damage**

#### 5.4.2.10 Root movement by species

*Khaya senegalensis* (62.1%), *Acacia auriculiformis* (32.3%) and *Pterocarpus indicus* - weeping form (27.4%) had significantly high rates of root movement with the majority haven fallen.

*Maranthes corymbosa* (96.6%) and *Ficus virens* (97%) had significantly high rates of no root movement.

**Table 14: Root movement by species with more than 10 samples**

| Lean Category / Species | No Lean or Natural Lean | | Root Movement (see right) | | Lean | | Fallen | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | number | % | number | % | number | % | number | % | |
| Khaya senegalensis | 89 | 37.9% | 145 | 62.1% | 6 | 2.6% | 140 | 59.6% | 235 |
| Terminalia melanocarpa | 9 | 56.3% | 7 | 43.8% | 0 | 0.0% | 7 | 43.8% | 16 |
| Ficus leng folia | 9 | 64.3% | 5 | 35.7% | 2 | 14.3% | 3 | 21.4% | 14 |
| Acacia auriculiformis | 84 | 67.7% | 40 | 32.3% | 3 | 2.4% | 37 | 29.8% | 124 |
| Albizia lebbeck | 18 | 72.0% | 7 | 28.0% | 1 | 4.0% | 6 | 24.0% | 25 |
| Pterocarpus indicus (weeping form) | 45 | 72.6% | 17 | 27.4% | 1 | 1.6% | 16 | 25.8% | 62 |
| Mangifera indica | 8 | 72.7% | 3 | 27.3% | 0 | 0.0% | 3 | 27.3% | 11 |
| Tabebuia aurea | 20 | 74.1% | 7 | 25.9% | 3 | 11.1% | 4 | 14.8% | 27 |
| Terminalia microcarpa | 11 | 78.6% | 3 | 21.4% | 0 | 0.0% | 3 | 21.4% | 14 |
| Eucalyptus camaldulensis | 153 | 80.1% | 38 | 19.9% | 2 | 1.0% | 36 | 18.8% | 191 |
| Peltophorum pteracarpum | 130 | 80.2% | 32 | 19.8% | 3 | 1.9% | 29 | 17.9% | 162 |
| Eucalyptus bigalerita | 59 | 80.8% | 14 | 19.2% | 2 | 2.7% | 12 | 16.4% | 73 |
| Terminalia platyphylla | 9 | 81.8% | 2 | 18.2% | 0 | 0.0% | 2 | 18.2% | 11 |
| Allosmocarpia ternata | 71 | 82.6% | 15 | 17.4% | 2 | 2.3% | 13 | 15.1% | 86 |
| Tamarindus indica | 20 | 83.3% | 4 | 16.7% | 2 | 8.3% | 2 | 8.3% | 24 |
| Caryota mitis | 10 | 83.3% | 2 | 16.7% | 1 | 8.3% | 1 | 8.3% | 12 |
| Caratia brachiata | 21 | 84.0% | 4 | 16.0% | 0 | 0.0% | 4 | 16.0% | 25 |
| Leptospermum madidum | 55 | 84.6% | 10 | 15.4% | 1 | 1.5% | 9 | 13.8% | 65 |
| Delonix regia | 41 | 85.4% | 7 | 14.6% | 0 | 0.0% | 7 | 14.6% | 48 |
| Samanea saman | 13 | 86.7% | 2 | 13.3% | 1 | 6.7% | 1 | 6.7% | 15 |
| Eucalyptus tetrodonta | 32 | 88.9% | 4 | 11.1% | 0 | 0.0% | 4 | 11.1% | 36 |
| Pterocarpus indicus | 109 | 89.3% | 13 | 10.7% | 0 | 0.0% | 13 | 10.7% | 122 |
| Eucalyptus miniata | 19 | 90.5% | 2 | 9.5% | 1 | 4.8% | 1 | 4.8% | 21 |
| Syzygium forte | 29 | 90.6% | 3 | 9.4% | 0 | 0.0% | 3 | 9.4% | 32 |
| Tabebuia pallida | 10 | 90.9% | 1 | 9.1% | 0 | 0.0% | 1 | 9.1% | 11 |
| Mimusops elengi | 98 | 91.6% | 9 | 8.4% | 2 | 1.9% | 7 | 6.5% | 107 |
| Ficus racemosa | 11 | 91.7% | 1 | 8.3% | 0 | 0.0% | 1 | 8.3% | 12 |
| Ficus macrocarpa var. hillii | 23 | 92.0% | 2 | 8.0% | 0 | 0.0% | 2 | 8.0% | 25 |
| Dypsis lutescens | 12 | 92.3% | 1 | 7.7% | 1 | 7.7% | 0 | 0.0% | 13 |
| Livistona benthamii | 12 | 92.3% | 1 | 7.7% | 1 | 7.7% | 0 | 0.0% | 13 |
| Corymbia ptychocarpa | 51 | 92.7% | 4 | 7.3% | 0 | 0.0% | 4 | 7.3% | 55 |
| Callistemon viminalis | 37 | 93.1% | 2 | 6.9% | 2 | 6.9% | 0 | 0.0% | 29 |
| Melaleuca leucadendra | 30 | 93.8% | 2 | 6.3% | 0 | 0.0% | 2 | 6.3% | 32 |
| Millettia pinnata | 17 | 94.4% | 1 | 5.6% | 0 | 0.0% | 1 | 5.6% | 18 |
| Myristica insipida | 17 | 94.4% | 1 | 5.6% | 0 | 0.0% | 1 | 5.6% | 18 |
| Syzygium angustrocyz | 18 | 94.7% | 1 | 5.3% | 0 | 0.0% | 1 | 5.3% | 19 |
| Eucalyptus tintinarra | 19 | 95.0% | 1 | 5.0% | 0 | 0.0% | 1 | 5.0% | 20 |
| Acmena acopsecena | 22 | 95.7% | 1 | 4.3% | 0 | 0.0% | 1 | 4.3% | 23 |
| Plumeria obtusa | 25 | 96.2% | 1 | 3.8% | 0 | 0.0% | 1 | 3.8% | 26 |
| Maranthes corymbosa | 198 | 99.6% | 7 | 3.4% | 4 | 2.0% | 3 | 1.5% | 205 |
| Ficus virens | 96 | 97.0% | 3 | 3.0% | 2 | 2.0% | 1 | 1.0% | 99 |
| Latania loddigesii | 33 | 97.1% | 1 | 2.9% | 0 | 0.0% | 1 | 2.9% | 34 |
| Corymbia bella | 64 | 98.5% | 1 | 1.5% | 0 | 0.0% | 1 | 1.5% | 65 |
| Carpentaria acuminata | 70 | 98.6% | 1 | 1.4% | 1 | 1.4% | 0 | 0.0% | 71 |
| Alstonia actinophylla | 28 | 100.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 28 |
| Alstonia scholaris | 20 | 100.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 20 |
| Calophyllum inophyllum | 43 | 100.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 43 |
| Corymbia polycarpa | 30 | 100.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 30 |
| Cycas media | 13 | 100.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 13 |
| Eucalyptus hebertiana | 19 | 100.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 19 |
| Ficus benjamina | 15 | 100.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 15 |
| Garcophyllum falcatum | 10 | 100.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 10 |
| Livistona muelleri | 14 | 100.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 14 |
| Melaleuca argentea | 10 | 100.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 10 |
| Melaleuca bracteata | 14 | 100.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 14 |
| Murraya paniculata | 21 | 100.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 21 |
| Ptychosperma macarthurii | 22 | 100.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 22 |
| Wodyetia bifurcata | 20 | 100.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 20 |
| **All Trees** | **2411** | **84.4%** | **446** | **15.6%** | **47** | **1.6%** | **399** | **14.0%** | **2857** |

Plate 6: Examples of root movement in trees – leaning and fallen

## 5.5 Damage to trees by management.

### 5.5.1 Damage to trees by park classification

Green belt parks had a higher rate of uprooting but lower rates of large and small branches being damaged.

Smaller urban (neighbourhood) parks could have a higher degree of protection from surrounding housing and associated gardens. These parks are bounded by urban roads on one, two, three or four sides, where a degree of exposure may have an effect on tree response to the cyclone. The larger urban parks (neighbourhood, regional or district) could have greater exposure due to the larger lengths of road boundaries and in some cases associated ovals. Narrower shaped parks could also have a greater degree of protection from surrounding urban infrastructure.

Table 15: Tree damage by park classification

| Damage Type / Park Category | Nil | | Foliage stripped | | Small branches damaged | | Nil or Minor Damage (as per left) | | Major Damage (as per right) | | Large branches damaged | | Significant branch broken | | Leader snapped or split | | Trunk snapped or split | | Uprooted | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | |
| Green belt | 456 | 47.6% | 0 | 0.0% | 190 | 19.9% | 646 | 67.5% | 311 | 32.5% | 3 | 0.3% | 75 | 7.8% | 3 | 0.3% | 40 | 4.2% | 127 | 13.3% | 957 |
| Large urban | 290 | 34.5% | 8 | 1.0% | 357 | 42.5% | 647 | 77.0% | 193 | 23.0% | 31 | 3.7% | 70 | 8.3% | 4 | 0.5% | 15 | 1.8% | 175 | 20.8% | 841 |
| Small urban | 411 | 39.8% | 3 | 0.3% | 277 | 26.8% | 688 | 66.6% | 345 | 33.4% | 52 | 5.0% | 92 | 8.9% | 5 | 0.5% | 29 | 2.8% | 138 | 13.4% | 1033 |
| Grand Total | 1157 | 40.5% | 12 | 0.4% | 824 | 28.8% | 1993 | 69.8% | 864 | 30.2% | 86 | 3.0% | 237 | 8.3% | 12 | 0.4% | 89 | 3.1% | 440 | 15.4% | 2857 |

### 5.5.2 Damage to trees by density

Density was not a good predictor of tree damage.

Uprooting appears to be slightly higher in individuals, but this difference may not be statistically significant.

Table 16: Damage to trees by tree density

| Damage Type / Grouping | Nil | | Foliage stripped | | Small branches damaged | | Nil or Minor Damage (as per left) | | Major Damage (as per right) | | Large branches damaged | | Significant branch broken | | Leader snapped or split | | Trunk snapped or split | | Uprooted | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | |
| Group | 852 | 40.5% | 8 | 0.4% | 644 | 30.6% | 1502 | 71.4% | 598 | 28.4% | 82 | 3.9% | 160 | 7.6% | 11 | 0.5% | 64 | 3.1% | 281 | 13.4% | 2098 |
| Individual | 192 | 49.1% | 4 | 1.0% | 76 | 19.4% | 272 | 69.1% | 118 | 30.0% | 4 | 1.0% | 27 | 6.9% | 1 | 0.3% | 12 | 3.0% | 78 | 19.8% | 401 |
| Not Recorded | 113 | 50.7% | 0 | 0.0% | 104 | 29.0% | 219 | 59.8% | 148 | 40.2% | 0 | 0.0% | 50 | 14.0% | 0 | 0.0% | 13 | 3.6% | 81 | 22.6% | 358 |
| Grand Total | 1157 | 40.5% | 12 | 0.4% | 824 | 28.8% | 1993 | 69.8% | 864 | 30.2% | 86 | 3.0% | 237 | 8.3% | 12 | 0.4% | 89 | 3.1% | 440 | 15.4% | 2857 |

### 5.5.3 Damage to trees by irrigation type

When analysing all the tree species, manually watered trees had the highest rate of damage, the highest rate of significant branches breaking and the highest rate of uprooting. However, they had no recorded incidences of trunk snapping, possibly due to roots giving way more easily.

When analysing the 21 most abundant species, irrigation was associated with a higher rate of tree damage in *Maranthes corymbosa* and *Corymbia bella*. No irrigation was associated with a higher rate of tree damage in *Carpentaria acuminata, Corymbia ptychocarpa* and *Mimusops elengi*. Manual irrigation was associated with a higher rate of tree damage in *Khaya senegalensis*.

Irrigation was associated with a higher rate of large branch damage to *Ficus virens* and *Khaya senegalensis*.

Irrigation was associated with a higher rate of significant branches being broken in *Maranthes corymbosa*.

Irrigation was associated with a higher rate of uprooting in *Khaya senegalensis*.

**Table 17: Damage to trees by irrigation type.**

| Damage type / Irrigation Regime | Nil | | Foliage stripped | | Small branches damaged | | Nil or Minor Damage (as per left) | | Major Damage (as per right) | | Large branches damaged | | Significant branch broken | | Leader snapped or split | | Trunk snapped or split | | Uprooted | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | |
| no | 473 | 43.5% | 6 | 0.6% | 269 | 24.7% | 748 | 68.8% | 340 | 31.3% | 14 | 1.3% | 85 | 7.8% | 4 | 0.4% | 45 | 4.1% | 192 | 17.6% | 1088 |
| yes - manually | 20 | 12.5% | 0 | 0.0% | 30 | 18.8% | 50 | 31.3% | 49 | 30.6% | 0 | 0.0% | 11 | 6.9% | 0 | 0.0% | 0 | 0.0% | 58 | 36.3% | 160 |
| yes | 664 | 39.2% | 6 | 0.4% | 535 | 31.6% | 1205 | 71.2% | 475 | 28.1% | 72 | 4.3% | 141 | 8.4% | 8 | 0.5% | 44 | 2.6% | 210 | 12.5% | 1680 |
| Grand Total | 1157 | 40.5% | 12 | 0.4% | 834 | 29.2% | 1993 | 69.8% | 864 | 30.2% | 86 | 3.0% | 237 | 8.3% | 12 | 0.4% | 89 | 3.1% | 440 | 15.4% | 2857 |

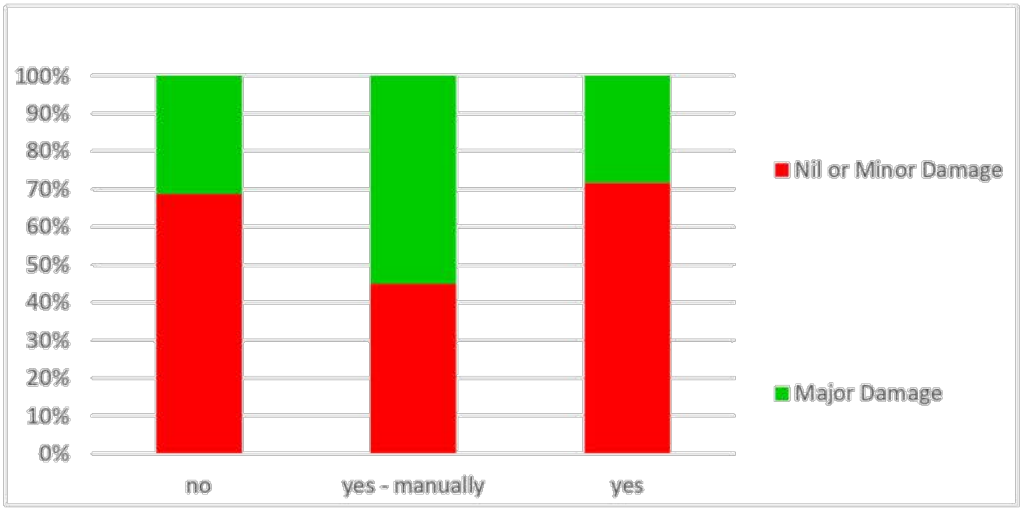
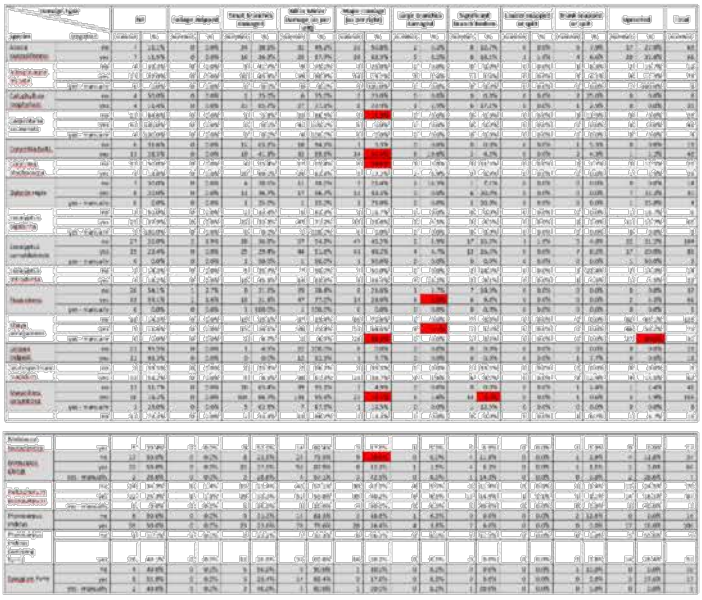



**Figure 10: Tree damage by irrigation type**

**Table 18: Top 21 recorded tree species by irrigation type and damage.**



## 5.6 Damage to trees by size, origin and condition of trees

### 5.6.1 Damage to trees by tree size

Large trees were more likely to be damaged than the general population, and specifically had a far higher rate of uprooting.

Small trees were less likely to be damaged than the general population, and this was the case for almost every type of damage.

**Table 19: Damage to trees by tree size**

| Damage Type / Tree Size | Nil | | Foliage stripped | | Small branches damaged | | Nil or Minor Damage (as per left) | | Major Damage (as per right) | | Large branches damaged | | Significant branch broken | | Leader snapped or split | | Trunk snapped or split | | Uprooted | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | |
| Large (>10 m) | 383 | 11.9% | 4 | 0.9% | 471 | 34.5% | 858 | 62.8% | 508 | 37.2% | 68 | 5.0% | 105 | 7.8% | 41 | 3.0% | 31 | 2.3% | 299 | 21.9% | 1365 |
| Medium (5–10 m) | 451 | 50.3% | 6 | 0.7% | 338 | 24.5% | 695 | 77.5% | 202 | 22.5% | 18 | 2.0% | 75 | 8.5% | 81 | 9.0% | 39 | 4.3% | 61 | 6.8% | 897 |
| Small (<5 m) | 324 | 85.5% | 2 | 0.8% | 19 | 7.3% | 245 | 93.5% | 17 | 6.5% | 0 | 0.0% | 8 | 3.1% | 0 | 0.0% | 7 | 2.7% | 2 | 0.8% | 263 |
| Not Recorded | 99 | 29.8% | 0 | 0.0% | 96 | 28.9% | 195 | 58.7% | 137 | 41.3% | 0 | 0.0% | 49 | 14.7% | 0 | 0.0% | 22 | 6.6% | 78 | 23.5% | 332 |
| Grand Total | 1157 | 40.1% | 12 | 0.4% | 824 | 28.6% | 1993 | 69.1% | 864 | 30.2% | 86 | 3.0% | 237 | 8.3% | 122 | 4.3% | 99 | 3.1% | 440 | 15.4% | 2857 |

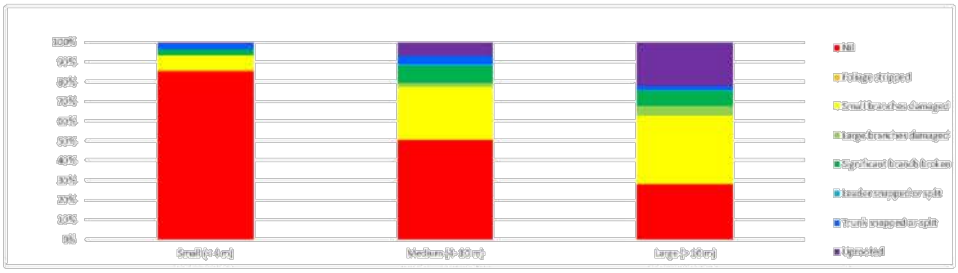



**Figure 11: Damage to trees by tree size**

### 5.6.2 Damage to trees by their origin

Australian Native tree species had the lowest rate of tree damage (20.9%). Exotic trees had the highest rate of tree damage (39.7%).

Australian Native and Local Provenance tree species had the lowest rates of uprooting (7.3% and 9.0% respectively). Exotic tree species had the highest rate of uprooting by a large margin (30.8%). The overall rate for exotic trees included two abundant species, *Khaya senegalensis* and *Pterocarpus indicus* (weeping variety) which had significantly high rates of uprooting.

Australian Natives had the highest rate of no damage (62.7%).

**Table 20: Damage to trees by tree origin.**

| Damage Type / Provenance | Nil | | Foliage stripped | | Small branches damaged | | Nil or Minor Damage (as per left) | | Major Damage (as per right) | | Large branches damaged | | Significant branch broken | | Leader snapped or split | | Trunk snapped or split | | Uprooted | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | |
| Local provenance | 556 | 37.2% | 6 | 0.5% | 558 | 34.6% | 1078 | 72.3% | 368 | 27.7% | 58 | 3.9% | 144 | 10.0% | 7 | 0.5% | 50 | 3.8% | 133 | 9.0% | 1494 |
| NT Native | 201 | 41.3% | 2 | 0.4% | 147 | 29.9% | 351 | 71.9% | 140 | 28.9% | 11 | 2.3% | 57 | 11.8% | 3 | 0.6% | 19 | 3.9% | 35 | 7.3% | 487 |
| Australian Native | 89 | 62.2% | 1 | 0.9% | 17 | 15.5% | 87 | 79.1% | 23 | 20.9% | 2 | 1.8% | 6 | 5.5% | 2 | 1.8% | 6 | 5.5% | 8 | 7.3% | 110 |
| Naturalised | 15 | 49.8% | 0 | 0.0% | 12 | 23.6% | 58 | 59.4% | 72 | 30.6% | 2 | 2.8% | 5 | 12.5% | 0 | 0.0% | 0 | 0.0% | 13 | 19.1% | 72 |
| Exotic | 296 | 51.9% | 3 | 0.6% | 125 | 18.2% | 424 | 50.8% | 261 | 49.2% | 13 | 1.8% | 30 | 5.4% | 5 | 0.9% | 13 | 2.3% | 238 | 30.8% | 570 |
| Grand Total | 1157 | 40.5% | 12 | 0.4% | 824 | 28.8% | 1993 | 69.8% | 864 | 30.2% | 86 | 3.0% | 237 | 8.3% | 12 | 0.4% | 89 | 3.1% | 440 | 15.4% | 2857 |

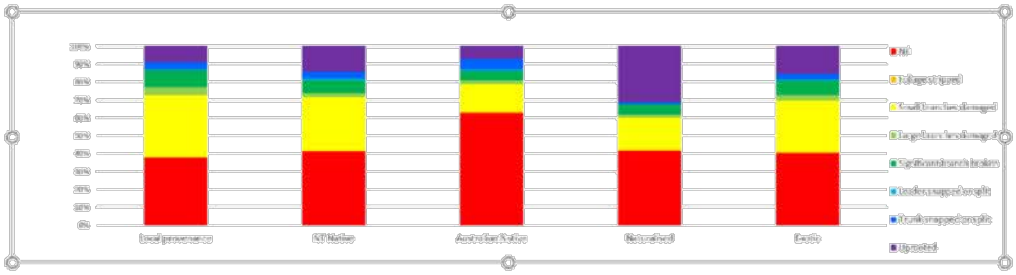



**Figure 12: Tree damage by tree origin**

### 5.6.3 Damage to trees by pre-exisiting weaknesses

Pre-existing weaknesses did not appear to be a good predictor of the tree being damaged by the cyclone. Although pre-existing termite damage was more likely to lead to further damage than other factors.

Trees with termites present were more likely to have small branches damaged.

Trees with termites present were less likely to be uprooted. Note - it was possibly just harder to pick up pre-existing termite presence around an uprooted tree. Although they may be doing something in the soil which is beneficial.

Although not commonly observed, there was evidence of root curl in some of the uprooted trees. This was in the form of either a large curled root or the remains of the curled roots in the original pot shape (see Plate 5 below).

**Plate 7: An uprooted tree with curled roots in the shape of the original planting pot**

**Table 21: Damage to trees by pre-existing weaknesses**

| Damage Type / Weakness | Nil | | Foliage stripped | | Small branches damaged | | Nil or Minor Damage (as per left) | | Major Damage (as per right) | | Large branches damaged | | Significant branch broken | | Leader snapped or split | | Trunk snapped or split | | Uprooted | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | |
| Already Weakened | 73 | 19.9% | 2 | 1.6% | 66 | 26.2% | 141 | 27.2% | 41 | 22.4% | 10 | 9.5% | 11 | 6.0% | 0 | 0.0% | 7 | 8.8% | 11 | 7.1% | 183 |
| ...by Termites | 52 | 19.9% | 2 | 3.4% | 58 | 46.0% | 112 | 29.4% | 29 | 22.6% | 10 | 7.1% | 9 | 6.4% | 0 | 0.0% | 5 | 8.5% | 5 | 2.5% | 141 |
| ...by other factor | 21 | 20.0% | 0 | 0.0% | 8 | 19.0% | 30 | 71.4% | 12 | 28.6% | 0 | 0.0% | 2 | 4.8% | 0 | 0.0% | 2 | 4.8% | 6 | 14.0% | 42 |
| Not Weakened | 1084 | 40.5% | 9 | 0.3% | 756 | 28.3% | 1851 | 69.2% | 825 | 30.8% | 75 | 2.8% | 226 | 8.5% | 12 | 0.4% | 83 | 3.1% | 427 | 16.0% | 2674 |
| Grand Total | 1157 | 40.5% | 12 | 0.4% | 824 | 28.8% | 1992 | 69.8% | 866 | 30.2% | 86 | 3.0% | 237 | 8.3% | 12 | 0.4% | 91 | 3.1% | 440 | 15.4% | 2857 |

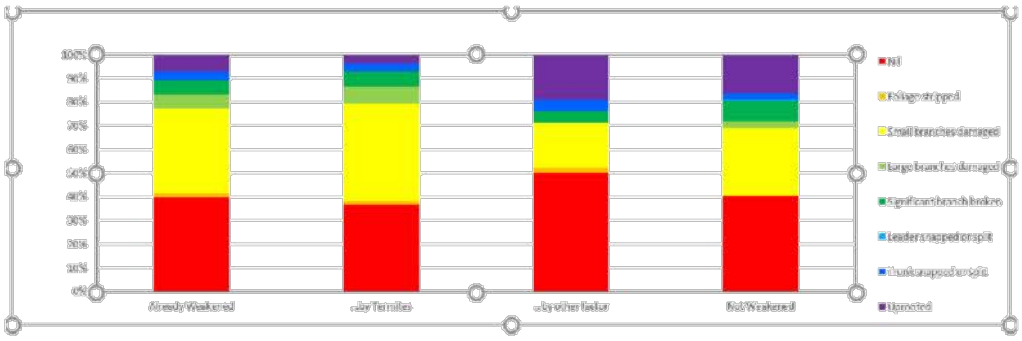



**Figure 13: Tree damage by pre-existing weaknesses**

## 5.7 Tree damage by the physical environment

### 5.7.1 Tree damage by wind direction

Wind direction was mainly measured by the direction the tree fell as it was uprooted, so most trees with a wind direction were uprooted (biased data).

Where wind direction was determined, uprooted trees were more likely to have been pushed by south-westerly or westerly winds than other directions. This correlates well with BoM tracking data (see Table 23 & 24 below) which recorded the highest wind speeds when the winds were coming from the south west and west.

**Table 22: Uprooting by wind direction**

| | Uprooted | |
|---|---|---|
| Wind Orientation | number | % |
| Indeterminate | 160 | 36.4% |
| South-westerly | 119 | 27.0% |
| Westerly | 111 | 25.2% |
| Southerly | 43 | 9.8% |
| South-easterly | 5 | 1.1% |
| South South-easterly | 1 | 0.2% |
| Easterly | 1 | 0.2% |
| **Grand Total** | **440** | **100.0%** |

**Table 23: Wind orientation by uprooting**

| | Uprooted | |
|---|---|---|
| Wind Orientation | number | % |
| Indeterminate | 160 | 6.3% |
| South-westerly | 119 | 96.7% |
| Westerly | 111 | 93.3% |
| Southerly | 43 | 86.0% |
| South-easterly | 5 | 100.0% |
| South South-easterly | 1 | 100.0% |
| Easterly | 1 | 100.0% |
| **Grand Total** | **440** | **15.4%** |

**Plate 8: Many trees were uprooted along the Esplanade, near where wind gusts reached 130kph**

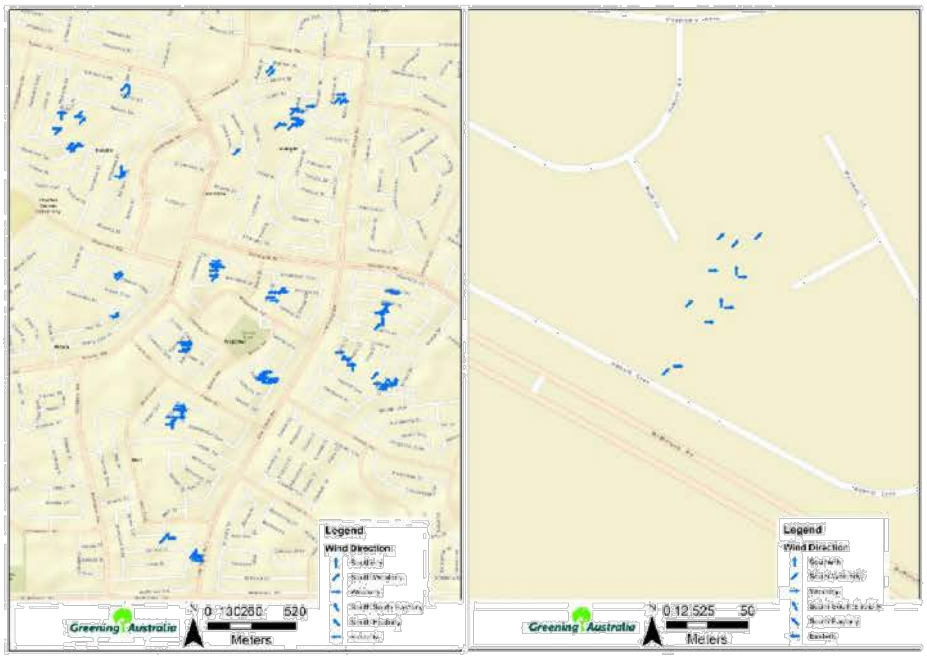




**Figure 14 : Three maps showing direction that uprooted trees had fallen**

The following is a summary of wind speed and direction of TC Marcus provided by Bom specifically for this report:

"The attached track of the centre of the cyclone shows that the northern suburbs and Darwin city were affected by the western side of the cyclone with strongest winds blowing from SSW to WNW as the core of the cyclone passed further inland during the late morning on 17 March 2018. This is consistent with the direction of fallen trees in much of your survey area. As we discussed, areas (including Palmerston) located to the east of the path of the cyclone centre appeared to experience weaker winds and less damage due to the asymmetric rainfall distribution and the longer distance that the wind had to travel overland.

The Bureau's automatic weather stations at Darwin Airport and at Stokes Hill Wharf provide a useful record of the damaging wind gusts during the cyclone which would have caused much of the tree damage. The strongest winds from each location on 17 March are listed below – there are three quantities listed, the wind direction (the direction from which the wind blows), the 10-minute average wind and the 3-second wind gust at each time. These measurements are taken at 10 metre height above ground level at the airport and near that height above water at the wharf, depending on the tide level" .

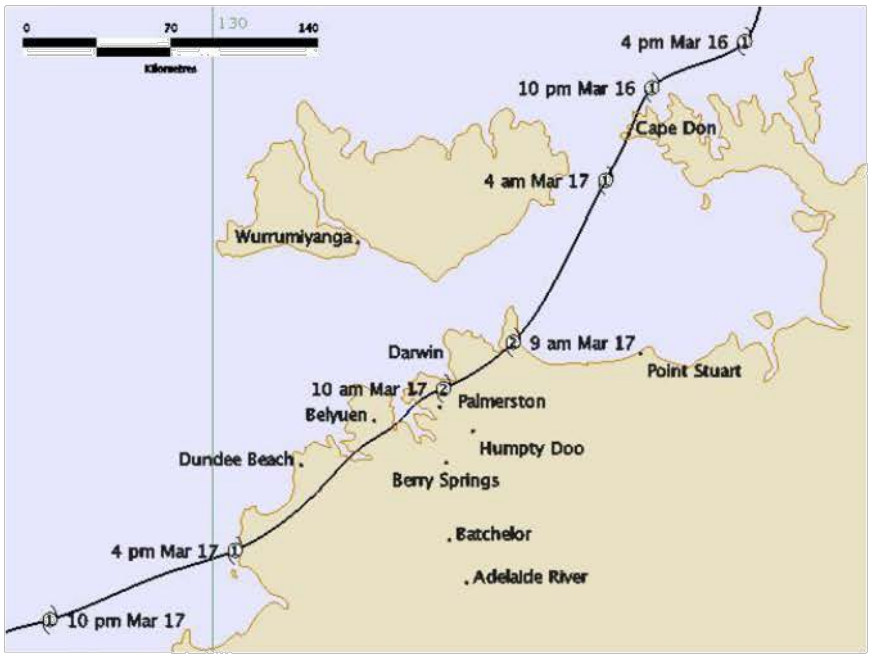



**Figure 15: BoM track of TC Marcus centre over Darwin and surrounds**

**Table 24: TC Marcus wind direction and speed for Darwin Airport (highest recordings highlighted)**

| Time (CST) | Direction | 10-min average (km/h) | 3-sec gust (km/h) |
|---|---|---|---|
| 0819 | S | 42 | 52 |
| 0919 | S | 63 | 72 |
| 0931 | S | 61 | 93 |
| 0943 | SSW | 76 | 104 |
| 1002 | SSW | 83 | 122 |
| 1012 | SSW | 89 | 111 |
| 1033 | SW | 85 | 115 |
| 1051 | W | 98 | 126 |
| 1110 | WNW | 89 | 120 |
| 1126 | WNW | 91 | 109 |
| 1158 | WNW | 81 | 102 |
| 1216 | NW | 85 | 85 |

**Table 25: TC Marcus wind direction and speed for Stokes Hill Wharf (highest recordings highlighted)**

| Time (CST) | Direction | 10-min average (km/h) | 3-sec gust (km/h) |
|---|---|---|---|
| 0838 | S | 65 | 76 |
| 0914 | SSW | 68 | 92 |
| 0937 | SSW | 75 | 94 |
| 1001 | SSW | 88 | 112 |
| 1016 | SSW | 102 | 120 |
| 1033 | SSW | 98 | 125 |

| | | | |
|---|---|---|---|
| 1051 | SSW | 103 | 130 |
| 1115 | W | 99 | 121 |
| 1124 | WNW | 92 | 130 |
| 1142 | WNW | 69 | 104 |
| 1158 | WNW | 64 | 89 |
| 1230 | NW | 56 | 92 |

### 5.7.2 Damage to trees by other tree(s)

Trees damaged by other tree(s) were almost twice as likely as those not damaged by other tree(s) to have major damage and were around 5 times more likely to have a significant broken branch and 6 times more likely to suffer a snapped or split trunk.

On the face of it trees not damaged by other tree(s) were more likely to be uprooted, however, this could partly be a result of a sampling error, where uprooted trees laying flat on the ground were less obvious to damage from other trees (damage other than uprooting). Obviously this was not the case if another tree was laying on top of the tree being surveyed.

**Table 26: Damage to trees by other tree(s).**

| Damage Type / Damaged by Other Tree(s) | Nil | | Foliage stripped | | Small branches damaged | | Nil or Minor Damage (as per left) | | Major Damage (as per right) | | Large branches damaged | | Significant branch broken | | Leader snapped or split | | Trunk snapped or split | | Uprooted | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | |
| No | 1144 | 43.5% | 10 | 0.5% | 730 | 27.6% | 1884 | 71.4% | 750 | 28.4% | 73 | 2.8% | 171 | 6.5% | 10 | 0.4% | 49 | 1.9% | 434 | 16.4% | 2641 |
| Yes | 3 | 1.3% | 0 | 0.0% | 94 | 43.5% | 102 | 47.2% | 114 | 52.8% | 13 | 6.0% | 66 | 30.6% | 2 | 0.9% | 37 | 17.1% | 6 | 2.8% | 216 |
| Grand Total | 1157 | 40.5% | 12 | 0.4% | 824 | 28.8% | 1093 | 69.8% | 864 | 30.2% | 86 | 3.0% | 237 | 8.3% | 12 | 0.4% | 89 | 3.1% | 440 | 15.4% | 2857 |

### 5.7.3 Damage to trees by soil type

Leptic Rudosols (shallow gravelly lithosols) had lower rates of major tree damage, and specifically, lower rates of significant branches broken. This is a surprising result as shallow soils with an underlay of unweathered rock is often blamed for uprooting of trees.

Brown kandosol soils (deep gravelly yellow massive earths with minor lithosols) and red kandosols (shallow -moderately deep red massive earths with minor yellow massive earths) had high rates of uprooting. This could be a result of these deeper soils being saturated following heavy monsoonal rains previous to the cyclone.

**Table 27: Damage to trees by soil type**

| Damage Type / Soil Type | Nil | | Foliage stripped | | Small branches damaged | | Nil or Minor Damage (as per left) | | Major Damage (as per right) | | Large branches damaged | | Significant branch broken | | Leader snapped or split | | Trunk snapped or split | | Uprooted | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | |
| Brown Kandosols | 415 | 39.3% | 6 | 0.6% | 348 | 33.0% | 269 | 25.5% | 287 | 27.2% | 56 | 5.3% | 80 | 7.6% | 9 | 0.9% | 20 | 1.9% | 170 | 16.1% | 1056 |
| Intertidal Hydrosols | 4 | 44.4% | 0 | 0.0% | 5 | 55.6% | 9 | 100.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 9 |
| Kandosols; Redoxic Hydrosols | 62 | 31.2% | 4 | 2.0% | 87 | 43.7% | 153 | 76.9% | 46 | 23.1% | 13 | 6.5% | 13 | 6.5% | 2 | 1.0% | 2 | 1.0% | 16 | 8.0% | 199 |
| Leptic Rudosols | 64 | 49.2% | 1 | 0.8% | 41 | 31.5% | 107 | 82.3% | 23 | 17.7% | 5 | 3.8% | 4 | 3.1% | 0 | 0.0% | 3 | 2.3% | 11 | 8.5% | 130 |
| Rudosols | 352 | 85.0% | 0 | 0.0% | 86 | 20.8% | 253 | 61.1% | 161 | 38.9% | 10 | 2.4% | 24 | 5.8% | 1 | 0.2% | 11 | 2.7% | 40 | 9.7% | 414 |
| Grand Total | 892 | 40.3% | 12 | 0.7% | 567 | 33.0% | 1271 | 74.1% | 445 | 25.9% | 86 | 5.0% | 122 | 7.1% | 12 | 0.7% | 36 | 2.1% | 189 | 11.0% | 1716 |

### 5.7.4 Damage to trees by slope

Slope didn't appear to be a significant driver of damage, or any particular type of damage.

**Table 28: Damage to trees by slope (as per land resources layer)**

| Damage Type / Slope | Nil | | Foliage stripped | | Small branches damaged | | Nil or Minor Damage (as per left) | | Major Damage (as per right) | | Large branches damaged | | Significant branch broken | | Leader snapped or split | | Trunk snapped or split | | Uprooted | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | |
| <0.5% | 4 | 44.4% | 0 | 0.0% | 5 | 55.6% | 9 | 100.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 9 |
| 0.5 - 1.5% | 53 | 31.0% | 2 | 1.8% | 79 | 46.2% | 135 | 78.9% | 36 | 21.1% | 10 | 5.8% | 11 | 6.4% | 2 | 1.2% | 2 | 1.2% | 11 | 6.4% | 171 |
| 0.5 - 2% | 156 | 44.6% | 2 | 0.6% | 96 | 26.5% | 251 | 71.8% | 99 | 28.3% | 13 | 3.7% | 27 | 7.7% | 3 | 0.9% | 11 | 3.1% | 47 | 13.4% | 350 |
| 0.5 - 2.5% | 80 | 39.4% | 2 | 0.9% | 69 | 33.5% | 147 | 72.4% | 56 | 27.6% | 13 | 7.9% | 10 | 4.9% | 2 | 1.0% | 6 | 3.0% | 22 | 10.8% | 203 |
| 1 - 5% | 243 | 49.4% | 7 | 0.5% | 190 | 37.4% | 445 | 75.3% | 146 | 24.7% | 30 | 5.1% | 44 | 7.4% | 5 | 0.8% | 19 | 3.2% | 59 | 10.0% | 591 |
| 2 - 5% | 147 | 37.5% | 4 | 1.0% | 133 | 33.9% | 284 | 72.4% | 108 | 27.6% | 17 | 4.3% | 30 | 7.7% | 4 | 1.0% | 7 | 1.8% | 50 | 12.8% | 392 |
| Grand Total | 692 | 40.3% | 12 | 0.7% | 567 | 33.0% | 1271 | 74.1% | 445 | 25.9% | 86 | 5.0% | 122 | 7.1% | 12 | 0.7% | 36 | 2.1% | 189 | 11.0% | 1716 |

### 5.7.5 Damage to trees by waterlogging

Waterlogging didn't appear to be a significant driver of damage, or any particular type of damage.

**Table 29: Damage to trees by waterlogging (as per land resources layer)**

| Damage Type / Waterlogging | Nil | | Foliage stripped | | Small branches damaged | | Nil or Minor Damage (as per left) | | Major Damage (as per right) | | Large branches damaged | | Significant branch broken | | Leader snapped or split | | Trunk snapped or split | | Uprooted | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | |
| Moderate to High Level of Seasonal Soil Waterlogging | 62 | 31.2% | 4 | 2.0% | 87 | 43.7% | 153 | 76.9% | 46 | 23.1% | 13 | 6.5% | 13 | 6.5% | 2 | 1.0% | 2 | 1.0% | 16 | 8.0% | 199 |
| Nil to Low Level of Seasonal Soil Waterlogging | 626 | 41.5% | 8 | 0.5% | 475 | 31.5% | 1109 | 73.5% | 399 | 26.5% | 73 | 4.8% | 109 | 7.2% | 10 | 0.7% | 34 | 2.3% | 173 | 11.5% | 1508 |
| Severe Level of Seasonal Soil Waterlogging or Inundation for Extended Periods | 4 | 44.4% | 0 | 0.0% | 5 | 55.6% | 9 | 100.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 9 |
| Grand Total | 692 | 40.3% | 12 | 0.7% | 567 | 33.0% | 1271 | 74.1% | 445 | 25.9% | 86 | 5.0% | 122 | 7.1% | 12 | 0.7% | 36 | 2.1% | 189 | 11.0% | 1716 |

### 5.7.6 Damage to trees by land unit

Trees were less frequently uprooted in 9b than other land units. The author suspects this could be a land unit mapping accuracy issue related to scale, as the only 9b land unit observed in the survey was on the periphery of Bike Fun Park. No trees were recorded in the 9b land unit during the survey.

Trees were less likely to have broken branches in 3d than other land units.

Surveyed parks were found in flat to gently undulating upland surface, gentle side and lower slopes with low gradients. No obvious trends emerged from the analysis possibly due to the relatively uniform landforms found in the parks.

**Table 30: Damage to trees by land unit (as per land resources layer)**

| Damage Type / Land Unit | Nil | | Foliage stripped | | Small branches damaged | | Nil or Minor Damage (as per left) | | Major Damage (as per right) | | Large branches damaged | | Significant branch broken | | Leader snapped or split | | Trunk snapped or split | | Uprooted | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | |
| 2b1 | 142 | 37.5% | 4 | 1.0% | 121 | 31.9% | 267 | 70.4% | 86 | 22.6% | 17 | 4.5% | 10 | 2.6% | 4 | 1.0% | 2 | 0.5% | 20 | 5.2% | 379 |
| 3a | 142 | 45.7% | 0 | 0.0% | 86 | 26.7% | 228 | 72.4% | 69 | 22.6% | 10 | 3.1% | 25 | 7.8% | 1 | 0.3% | 11 | 3.4% | 42 | 13.0% | 322 |
| 3b | 80 | 39.4% | 1 | 0.5% | 66 | 32.5% | 147 | 72.4% | 56 | 27.6% | 16 | 7.9% | 19 | 9.4% | 2 | 1.0% | 6 | 3.0% | 22 | 10.8% | 203 |
| 3c | 188 | 40.9% | 1 | 0.2% | 140 | 32.9% | 328 | 73.3% | 123 | 26.7% | 25 | 5.4% | 40 | 8.7% | 3 | 0.7% | 7 | 1.5% | 48 | 10.4% | 461 |
| 3d | 64 | 49.2% | 0 | 0.0% | 41 | 31.5% | 105 | 80.5% | 25 | 19.2% | 5 | 3.8% | 4 | 3.1% | 0 | 0.0% | 1 | 0.8% | 11 | 8.5% | 130 |
| 3e | 9 | 32.1% | 1 | 3.6% | 8 | 28.6% | 18 | 64.2% | 10 | 35.7% | 2 | 7.1% | 2 | 7.1% | 0 | 0.0% | 0 | 0.0% | 5 | 17.9% | 28 |
| 4c | 55 | 33.9% | 0 | 0.0% | 36 | 44.7% | 135 | 78.5% | 36 | 21.1% | 10 | 5.8% | 11 | 6.4% | 0 | 0.0% | 2 | 1.2% | 11 | 6.4% | 171 |
| 9a | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 |
| **Grand Total** | **692** | **40.3%** | **12** | **0.7%** | **567** | **33.0%** | **1271** | **74.1%** | **465** | **25.9%** | **86** | **5.0%** | **122** | **7.1%** | **12** | **0.7%** | **36** | **2.1%** | **189** | **11.0%** | **1716** |

### 5.7.7 Tree root movement by soil type

Red Kandosols had a very high rate of fallen trees (13%)

**Table 31: Root movement by species with more than 10 samples and more than 10% movement.**

| Lean Category / Species | No Lean or Natural Lean | | Root Movement (see right) | | Lean | | Fallen | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | number | % | number | % | number | % | number | % | |
| Brown Kandosols | 942 | 89.2% | 119 | 11.3% | 22 | 2.1% | 97 | 9.2% | 1056 |
| Intertidal Hydrosols | 9 | 100.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 9 |
| Kandosolic Redoxic Hydrosols | 182 | 91.5% | 17 | 8.5% | 4 | 2.0% | 13 | 6.5% | 199 |
| Leptic Rudosols | 120 | 92.3% | 10 | 7.7% | 4 | 3.1% | 6 | 4.6% | 130 |
| Red Kandosols | 277 | 86.0% | 45 | 14.0% | 3 | 0.9% | 42 | 13.0% | 322 |
| **Grand Total** | **1525** | **88.9%** | **191** | **11.1%** | **33** | **1.9%** | **158** | **9.2%** | **1716** |

## 5.8 Infrastructure Damage Statistics

Of all the trees surveyed 3.3% caused damage to infrastructure.

Of all the damaged trees surveyed 5.6% caused damage to infrastructure.

Of all the *Khaya senegalensis* surveyed 19.1% caused infrastructure damage. This is far higher than other tree species which were significantly sampled.

Of the uprooted trees surveyed, 19.3% caused infrastructure damage (i.e. a falling tree had a 19.3% chance of causing damage), but this accounted for 89.5% of all infrastructure damage (i.e. 89.5% of infrastructure damage was caused by falling trees). Other types of tree damage were far less likely to result in damage.

**Table 32: Infrastructure damage rates for all trees**

| | All Trees | |
|---|---|---|
| | number | % |
| Caused damage | 95 | 3.3% |
| Didn't cause damage | 2762 | 96.7% |

**Table 33: Infrastructure damage rates of damaged trees**

| | Damaged Trees | |
|---|---|---|
| | number | % |
| Caused damage | 95 | 5.6% |
| Didn't cause damage | 1605 | 94.4% |

**Table 34: Infrastructure damaging tree species**

| | Infrastructure Damaged | | | | Total |
|---|---|---|---|---|---|
| | No | | Yes | | |
| **Tree Species** | number | % | number | % | |
| Cascabela thevetia | 2 | 66.7% | 1 | 33.3% | 3 |
| Terminalia melanocarpa | 12 | 75.0% | 4 | 25.0% | 16 |
| Khaya senegalensis | 190 | 80.9% | 45 | 19.1% | 235 |
| Mangifera indica | 9 | 81.8% | 2 | 18.2% | 11 |
| Eucalyptus apodophylla | 5 | 83.3% | 1 | 16.7% | 6 |
| Albizia lebbeck | 22 | 88.0% | 3 | 12.0% | 25 |
| Tabebuia pallida | 10 | 90.9% | 1 | 9.1% | 11 |
| Peltophorum pterocarpum | 150 | 92.6% | 12 | 7.4% | 162 |
| Ficus benjamina | 14 | 93.3% | 1 | 6.7% | 15 |
| Samanea saman | 14 | 93.3% | 1 | 6.7% | 15 |
| Eucalyptus tetrodonta | 34 | 94.4% | 2 | 5.6% | 36 |
| Eucalyptus camaldulensis | 181 | 94.8% | 10 | 5.2% | 191 |
| Eucalyptus miniata | 20 | 95.2% | 1 | 4.8% | 21 |
| Calophyllum inophyllum | 41 | 95.3% | 2 | 4.7% | 43 |

| | | | | | |
|---|---|---|---|---|---|
| Ficus macrocarpa var. hillii | 24 | 96.0% | 1 | 4.0% | 25 |
| Pterocarpus indicus | 119 | 97.5% | 3 | 2.5% | 122 |
| Acacia auriculiformis | 121 | 97.6% | 3 | 2.4% | 124 |
| Leptospermum madidum | 64 | 98.5% | 1 | 1.5% | 65 |
| Maranthes corymbosa | 204 | 99.5% | 1 | 0.5% | 205 |
| **All Trees** | **2762** | **96.7%** | **95** | **3.3%** | **2857** |

**Plate 9: A fence badly damaged by a fallen *Eucalyptus camaldulensis***

**Table 35: Infrastructure damage by tree damage type**

| | Infrastructure Damaged | | | | Total |
|---|---|---|---|---|---|
| | No | | Yes | | |
| **Tree Damage** | number | % | number | % | |
| Nil | 1157 | 100.0% | 0 | 0.0% | 1157 |
| Foliage stripped | 12 | 100.0% | 0 | 0.0% | 12 |
| Small branches damaged | 823 | 99.9% | 1 | 0.1% | 824 |
| Large branches damaged | 86 | 100.0% | 0 | 0.0% | 86 |
| Significant branch broken | 231 | 97.5% | 6 | 2.5% | 237 |
| Leader snapped or split | 12 | 100.0% | 0 | 0.0% | 12 |
| Trunk snapped or split | 86 | 96.6% | 3 | 3.4% | 89 |
| Uprooted | 355 | 80.7% | 85 | 19.3% | 440 |
| **All trees** | **2762** | **96.7%** | **95** | **3.3%** | **2857** |

**Table 36: Infrastructure damage by tree damage type**

| Damage Type / Infrastructure Damage | Nil | | Foliage stripped | | Small branches Damaged | | Nil or Minor Damage (as per left) | | Major Damage (as per right) | | Large branches damaged | | Significant branch broken | | Leader snapped or split | | Trunk snapped or split | | Uprooted | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | number | % | |
| Yes | 3157 | 43.6% | 37 | 0.5% | 829 | 28.8% | 1040 | 27.1% | 799 | 27.9% | 84 | 10.1% | 221 | 8.4% | 12 | 0.5% | 88 | 3.1% | 855 | 32.4% | 2763 |
| Not | 0 | 0.0% | 0 | 0.0% | 1 | 0.1% | 4 | 0.1% | 24 | 0.8% | 0 | 0.0% | 6 | 0.3% | 0 | 0.0% | 1 | 0.1% | 85 | 4.8% | 95 |
| All trees | 3157 | 40.5% | 37 | 0.5% | 830 | 28.8% | 1044 | 27.2% | 823 | 28.8% | 84 | 10.0% | 227 | 8.1% | 12 | 0.5% | 89 | 3.1% | 940 | 15.5% | 2858 |

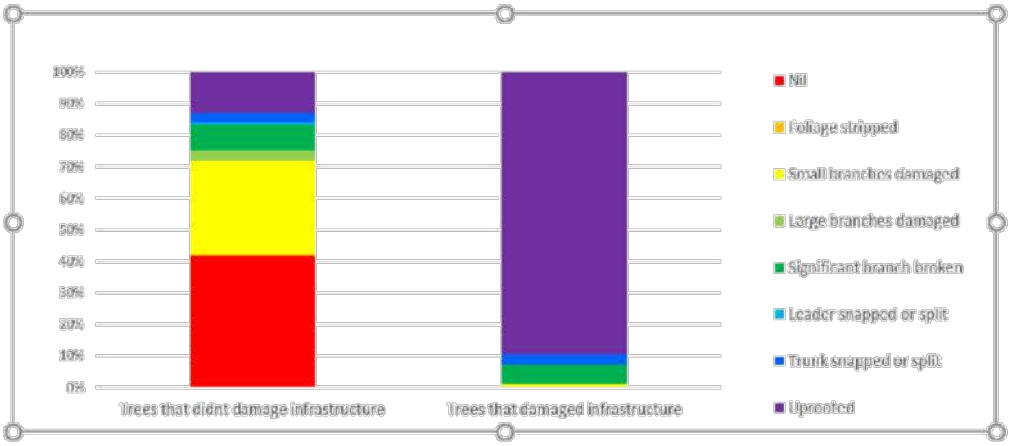



**Figure 16: Tree damage to infrastructure by damage type**

## 5.9 Park statistics

Of the 40 surveyed parks tree damage for 6 individual parks with the most individual trees was analysed. Bike Fun Park had high rates of small branch damage compared to the population total percentage (52.1% vs 28.8%).

Bike Fun Park had very low rates of uprooted trees. 4-6 trees were removed prior to survey.

Bayfield Park had lower rates of tree damage than the general tree population (50.1% vs 40.5%). It also had lower rates of small branches being damaged than the general tree population (15.0% vs 28.8%).

*Khaya senegalensis* at Bayfield Park had a higher rate of uprooting than for its general population (77.2% vs 66.0%). It also had twice the rate of significant branch breaking than for the general population (7.6% vs 3.8%).

**Plate 10: Bayfield Park with fallen specimens of *Khaya sengalensis***

**Table 37: Mahogany Park Tree Damage (for species with more than 10 trees)**

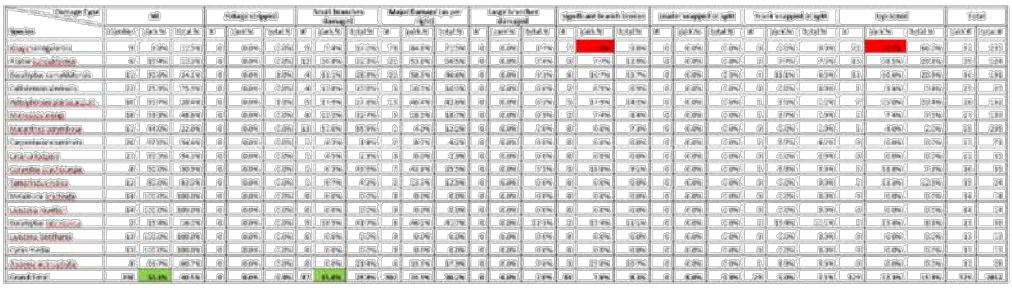
**Table 38: Wanguri Oval Tree Damage (for species with more than 10 trees)**

**Table 39: Bike Fun Park Tree Damage (for species with more than 10 trees)**

**Table 40: Holzerland Park Tree Damage (for species with more than 10 trees)**

**Table 41: Wulagi Green Belt Tree Damage (for species with more than 10 trees)**

**Table 42: Bayfield Park Tree Damage (for species with more than 10 trees)**



# 6 Summary and conclusions

A large exotic tree growing in an irrigated Darwin park in saturated deep massive earths with minimal management would have a high chance of being uprooted in a category 2 cyclone. Tropical Cyclone Marcus was an arboreal cleansing process, clearing the parks of many unstable tree species. It was a big wake up call for Darwin and provided an opportunity to develop more climate resilient plantings in parks, streetscapes and other landscaped areas in the municipality. Many of the surveyed parks are now quite open and require well planned plantings of suitable cyclone stable amenity species.

Darwin suffered major damage to thousands of trees in what was only a category 2 cyclone. A large proportion of these trees were made up of a small number of species of which the majority showed susceptibility to major damage in the cyclone. These particular species need to be looked at more thoroughly for future planning and management purposes. For example it would not be recommended to plant a low diversity of these unstable species in the future. Thankfully there were a couple of these abundant species that showed stable traits during the course of TC Marcus. Overall just over 40% of all trees suffered no damage at all (apart from some foliage loss). These are the specimens that require further scrutinization for potential use in the future urban revegetation of Darwin.

Exotic trees made up 24.7% of the all trees surveyed in the parks, had the highest rate of tree damage (39.7%) and the highest rate of uprooting by a large margin (30.8%). Of these exotic species, *Khaya senegalensis* had the highest rate of major damage (71.5%) and of these, 66% were uprooted. Uprooting was the major cause of infrastructure damage so *Khaya senegalensis*, coupled with its large size was one of the species that presented a high risk to this type of damage, the possibility of human harm and the enormous removal costs. Serious consideration should be given to the cessation of future planting of species in this category, as they present too high a risk. The surviving individuals should be surveyed further to determine the scope of potential future damage and costs of removal.

In contrast Australian Native and Local Provenance tree species had the lowest rates of uprooting (7.3% and 9.0% respectively) and should be looked at more closely for future plantings. Not all native plant species were resilient however, with a couple of the most abundant species showing high rates of major

damage. Once again these latter species need to be looked at more thoroughly from a risk adversity point of view.

Council managers need to determine where the cut off line is in regard to what is an acceptable level of risk. For example, trees that suffered greater than 20% uprooting (determined from a large sample size) may be deemed unsuitable for any future plantings. This would include the following: *Acacia auriculiformis, Eucalyptus camaldulensis, Khaya senegalensis, Peltophorum pterocarpum and Pterocarpus indicus* (weeping form).

There were no surprises with the direction of tree fall in the parks. It correlated well with the BoM wind direction and speed records for TC Marcus. The relatively uniform landforms found in the parks resulted in no obvious damage trends emerging. Slope and waterlogging didn't appear to have a significant effect on tree damage.

Interestingly, trees growing in shallow soils underlaid with unweathered rock suffered the least amount of major damage. The deeper massive earths with greater moisture holding capacity were likely more saturated than the aforementioned soils and provided less resistance for the roots to hang on in the category 2 cyclone.

In regard to management parameters, irrigated parks generally had a higher rate of tree damage including uprooting and significant branch damage. This could be due to more shallow root development resulting in easier uprooting and faster tree growth which produces weaker branches. With Darwin's limited water supply and climate change pointing towards more intense cyclones, further study of irrigated and non-irrigated plantings is warranted. Pre-existing weaknesses did not appear to be a good predictor of the tree damage although presence of termites had negative and positive results (more damage overall, but less uprooting respectively). The author did observe indicators of bad cultivation with the occasional signs of root curling in uprooted trees. This warrants further investigation, including collation of tree records from TC Marcus tree clearing and maintenance crews.

# 7 Recommendations

- Use results of this survey in conjunction with previous reports to establish a list of preferred species, and a list of plants to be discouraged for use around public infrastructure.
- For species that had high rates of major tree damage, determine where the cut off line is in regard to what is an acceptable level of risk (risk appetite). This process is a precursor to above and will determine the relative level of risk between species.
- Digitise through survey and mapping, all trees in Darwin parks, streetscapes and other landscaped areas. From this determine which species are deemed to be a risk to infrastructure and human safety.

- Consider the gradual phasing out of unstable species and replacement with resilient species. This could occur in stages over a ten year period, giving the newly planted trees time to establish shade cover before removing the next tranche of redundant species.
- Undertake further study of irrigated and non-irrigated plantings to determine the merits of non-irrigated plantings for future revegetation activities.
- Investigate further damage trends of pre-existing weaknesses of trees as a result of genetics, propagation and cultivation.
- Dertermine best practice methods for propagation and cultivation of resilient trees and shrubs.
- Develop a protocol for the planting and maintenance of trees in public areas, including policies, procedures, guidelines and specifications.

# 8 References

BoM, TC Marcus information for City of Darwin post cyclone tree survey, provided by BoM 5th June 2018.

BoM Website http://www.bom.gov.au/announcements/sevwx/nt/nttc20180316.shtml Accessed 23rd May 2018

City of Darwin Council: Twelfth Meeting of the Twenty-Second Council on Tuesday, 27 March 2018 (ORD03/36) under General Business, the council considered Dangerous Trees in the Darwin Municipality (Common No. 3777063) March 2018.

Department of Environment and Natural Resources (2000), The Land Resources of the Elizabeth, Darwin and Blackmore Rivers – Greater Darwin Area, NT.

Fogarty, P.J. Lynch, B. and Wood, B. (1984) The Land Resources of the Elizabeth, Darwin and Blackmore Rivers, Land Conservation Unit, Conservation Commission of the Northern Territory.

Merriam-Webster Dictionary: https://www.merriam-webster.com/dictionary/lithosol Accessed 30th May 2018.

CSIRO The Australian Soil Classification: www.clw.csiro.au/aclep/asc_re_on_line/ru/rudosols.htm Accessed 30th May 2018.

Reports, recommendations and supporting documentation can be accessed via the City of Darwin Council Website at www.darwin.nt.gov.au, at Council Public Libraries or contact the Committee Administrator on (08) 8930 0670.

TWENTY-SEVENTH ORDINARY COUNCIL MEETING – OPEN SECTION
TUESDAY, 13 NOVEMBER 2018 ORD11/9

**14.1 OFFICERS REPORTS (ACTION REQUIRED)**

**14.1.3 Establishing a Resilient Urban Forest for Darwin**
Report No. 18CO0050 CB:jh (13/11/18) Common No. 3777063

*With the consent of the Council, this item was moved from the Confidential Section into the Open Section.*

(Bouhoris/Cullen)

A. THAT Report Number 18CO0050 CB:jh entitled Establishing a Resilient Urban Forest for Darwin, be received and noted.

B. THAT Council note and thank the members of the Tree Re-establishment Advisory Committee.

C. THAT Council endorse the 'Preferred Trees for Darwin' as listed in Appendix A within **Attachment B** to Report Number 18CO0050 CB:jh entitled Establishing a Resilient Urban Forest for Darwin, for use in its future replanting programs.

D. THAT Council endorse the 'Trees Recommended Not To Be Planted' as listed in Appendix B within **Attachment B** to Report Number 18CO0050 CB:jh entitled Establishing a Resilient Urban Forest for Darwin, and that these would not be used in its future replanting programs.

E. THAT Council endorse the development of an Urban Forest Strategy that incorporates, where applicable, the best practise recommendations of the Tree Re-establishment Advisory Committee and is presented to Council in a further report at the 1st Ordinary Council Meeting in April 2019.

F. THAT the report, attachments and decision be moved into Open.

DECISION NO.22\1202 (13/11/18) Carried unanimously

ACTION: MANAGER INFRASTRUCTURE MAINTENANCE
NOTE: GENERAL MANAGER ENGINEERING

8 May 2019

## City of Darwin – Parks Survey.
## Final Report.

As per the Scope of Works, all stages (Stage 1 to Stage 5) have been completed including the Spreadsheet detailing the Tree attributes, cost per park of tree removal and the total cost of those removals were they to be undertaken.

Individual reports were submitted on each stage as it was completed.

A Variation to the SoW was agreed to between the Consultant and the City of Darwin represented by Ron Quinn and Chris Bailey.

1. Parks Surveyed:

A total of 201 parks were surveyed;

- 91 parks were found to have no trees which would pose a probable threat to a Principal Residence or Power Line during a cyclone or severe weather event.
- The remaining 110 parks were found to contain a total of 619 trees which may, hypothetically, pose a threat to a Principal Residence or Power Line during a cyclone or severe weather event.

All of those 619 trees were entered into the Nemus **Darwin Parkssurvey** Data Base. Each of those trees had a White Identification Tag attached. The tags were numbered from 00001 to 00619.

- All 619 trees were subjected to a rigorous Visual Tree Risk Assessment (VTRA)*
- All numbered trees were measured using a Laser Range Finder for Height, DBH & Canopy Spread
- The distance between the tree and the Target (Principal Residence/Power Line) was also measured so that the percentage of the tree likely to impact on the target can be calculated.

*Please note: there is no correlation between the result of a Visual Tree Risk Assessment and the "Probable Threat" posed by the tree during a cyclone or severe weather event. The VTRA assesses the current risk under normal weather conditions whereas the "probable threat" is a hypothetical scenario assuming the tree were to fall in the direction of the Principal Residence. There is no certainty that the tree would;

a. Actually fall as a result of severe weather; or
b. Fall in the direction of the target.

2. Principal Residence:

The term Principal Residence does not include external structures such as car ports, garden sheds or swimming pools but does include verandahs either wholly or partially surrounding the house.

3. Results of the Visual Tree Risk Assessment.

Of the 619 trees subjected to a VTRA, 31 were assessed as being above ALARP status and Control Measures were recommended. These Control Measures required either complete removal or remedial measures such as pruning or removal of dead wood and a time frame for the Control Measures to be implemented was also recommended.

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As each stage or Precinct was completed the list of trees requiring either removal or remedial works was sent to UFM.

As at the 8th May 2019 the Consultant has been notified that 15 of those trees have had works completed and the Consultant has visually confirmed that the required removal/remedial work has been completed. These 15 trees have been Archived on the Nemus data base and the Spreadsheet adjusted accordingly.

The remaining tree work has been passed onto Council's Urban Forest Management Team to complete.

I consider that my obligations under the Scope of Works has been fulfilled and subsequently will submit an invoice for final payment.

4. Potential Threats v Tree Species

It should be noted that, as mentioned above the "potential threat" is hypothetical there is a difference in the "potential damage" that may be caused by different species of trees simply because of their physical make up. Examples below:

- A River Red Gum (Eucalyptus *camaldulensis)* is a tall upright tree with sparse foliage and hard brittle wood. The most likely part to impact onto a building would be solid wood.
- A Maranthes *corymbose* has heavy dense foliage and this heavy foliage may cushion the impact onto a building.

These are just 2 examples which should be taken into account when assessing the "potential damage" to a Principal Residence.

In the case of a tree impacting onto power lines any species of tree could potentially cause damage as even a small tree falling onto power lines could cause electrical failure and possible live wires onto the ground or roadway.

The Spreadsheet containing the relevant data is attached in Word Version so Council can adjust when the remaining Risk Control Measures are supplied by UFM.

*Bill Sullivan*
*Adv.Dip.Arboriculture.*

*PO Box 237, Nooramah, Northern Territory, Australia, 0837. Mobile: +61 0407 188 659, Email: bill@nscontracting.com.au*

| Date | Park Name CBD PRECINCT | Nemus ID Tag Number | Risk Assessment | Tree Common Name | Tree DBH (mm) | Tree Height (m) | Distance to Principal Residence | Distance to Power Line | Cost of removal Incl. Stump Grinding | TOTAL COST FOR PARK |
|---|---|---|---|---|---|---|---|---|---|---|
| 22/01/2019 | **Qantas Park** | 00477 | ALARP | Burmese Rosewood/Paduk | 450 | 13.2 | | 8 | $ 1,910.00 | $ 1,910.00 |
| | | 00478 | ALARP | Burmese Rosewood/Paduk | 480 | 16.2 | | 10.5 | $ 3,150.00 | $ 5,060.00 |
| | | 00479 | ALARP | Burmese Rosewood/Paduk | 400 | 16.2 | | 10.5 | $ 1,365.00 | $ 6,425.00 |
| | | 00480 | ALARP | Burmese Rosewood/Paduk | 590 | 16.2 | | 10.5 | $ 3,150.00 | $ 9,575.00 |
| | | 00481 | ALARP | Burmese Rosewood/Paduk | 400 | 16.2 | | 10.5 | $ 1,365.00 | $ 10,940.00 |
| | | 00482 | ALARP | Boab | 760 | 10.6 | | 1x5,1x8 | $ 2,235.00 | $ 13,175.00 |
| | | 00483 | ALARP | Burmese Rosewood/Paduk | 420/310/420 (1150) | 16.2 | | 14.5 | $ 3,475.00 | **$ 16,650.00** |
| | | | | | | | | | | |
| 23/01/2019 | **Giles Park** | 00484 | ALARP | Northern Cypress Pine | 330/230 (560) | 15.4 | 12 | | $ 3,150.00 | $ 3,150.00 |
| | | 00485 | ALARP | Northern Cypress Pine | 310 | 14.4 | 12.5 | | $ 490.00 | $ 3,640.00 |
| | | 00486 | ALARP | Northern Cypress Pine | 480 | 17 | 4 | | $ 3,150.00 | $ 6,790.00 |
| | | 00487 | ALARP | Northern Cypress Pine | 250 | 17 | 4 | | $ 1,365.00 | $ 8,155.00 |
| | | 00488 | ALARP | Black Wattle | 570 | 17.6 | 5 | | $ 3,150.00 | $ 11,305.00 |
| | | 00489 | ALARP | Tamarind | 300/240 (540) | 11.8 | 11 | | $ 1,910.00 | $ 13,215.00 |
| | | 00490 | ALARP | Northern Cypress Pine | 310 | 14.8 | 11.5 | | $ 490.00 | $ 13,705.00 |
| | | 00491 | ALARP | Northern Cypress Pine | 300 | 15.6 | 14 | | $ 1,365.00 | **$ 15,070.00** |
| | | | | | | | | | | |
| 23/01/2019 | **Allen Park** | 00492 | ALARP | Coastal Casuarina | 540 | 16.8 | | 7 | $ 3,150.00 | $ 3,150.00 |
| | | 00493 | ALARP | Coastal Casuarina | 650 | 14.4 | | 4 | $ 2,235.00 | $ 5,385.00 |
| | | 00494 | ALARP | Coastal Casuarina | 500 | 14.8 | | 12 | $ 1,910.00 | $ 7,295.00 |
| | | 00495 | ALARP | White Bark | 400 | 13.8 | | 4 | $ 1,910.00 | **$ 9,205.00** |
| | | | | | | | | | | |
| 23/01/2019 | **Sommerville Park** | 00496 | High 1 | Poinciana | 450/450 (900) | 12 | 10 | | $ 2,235.00 | $ 2,235.00 |
| | | 00497 | ALARP | Cheese Wood | 310/1780/340 (850) | 12.8 | 12 | | $ 2,235.00 | $ 4,470.00 |
| | | 00498 | ALARP | Poinciana | 780 | 10.2 | | 9 | $ 2,235.00 | $ 6,705.00 |
| | | 00499 | ALARP | Burmese Rosewood/Paduk | 540 | 16.8 | | 14.5 | $ 3,150.00 | $ 9,855.00 |
| | | 00500 | ALARP | River Red Gum | 490 | 17.4 | 11.5 | | $ 3,150.00 | $ 13,005.00 |
| | | 00501 | ALARP | Mimusops | 190/180 (370) | 10.2 | 7 | | $ 1,848.00 | $ 14,853.00 |
| | | 00502 | ALARP | Leichardt Pine | 300 | 13.6 | 9 | | $ 490.00 | $ 15,343.00 |
| | | 00503 | ALARP | Burmese Rosewood/Paduk | 520 | 14.4 | | 13.5 | $ 1,910.00 | $ 17,253.00 |
| | | 00504 | ALARP | Black Wattle | 420 | 13.8 | 8 | | $ 1,910.00 | $ 19,163.00 |
| | | 00505 | ALARP | Leichardt Pine | 300/290 (590) | 12.4 | 10.5 | 8 | $ 1,910.00 | $ 21,073.00 |
| | | 00506 | ALARP | Burmese Rosewood/Paduk | 540 | 15 | | 13.5 | $ 3,150.00 | $ 24,223.00 |
| | | 00507 | ALARP | Leichardt Pine | 300 | 12.6 | | 12 | $ 490.00 | $ 24,713.00 |
| | | 00508 | ALARP | Mananthes | 280/270 (550) | 10 | | 5.5 | $ 1,910.00 | $ 26,623.00 |
| | | 00509 | ALARP | Burmese Rosewood/Paduk | 490 | 13.6 | | 13 | $ 1,910.00 | $ 28,533.00 |

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|---|---|---|---|---|---|---|---|---|---|---|
| | | 00510 | ALARP | Mananthes | 540 | 8.8 | | 8 | $ 1,910.00 | $ 30,443.00 |
| | | 00511 | ALARP | Burmese Rosewood/Paduk | 400 | 15 | | 13 | $ 1,427.00 | $ 31,870.00 |
| | | 00512 | ALARP | Banyan | 3m+ | 10.6 | | 5 | $ 2,235.00 | $ 34,105.00 |
| | | 00513 | ALARP | White Bark | 370/260/290 (920) | 16.8 | | 11.5 | $ 3,475.00 | $ 37,580.00 |
| | | 00514 | ALARP | Burmese Rosewood/Paduk | 1100 | 12.8 | | 8 | $ 2,235.00 | **$ 39,815.00** |
| | | | | | | | | | | |
| 23/01/2019 | **Dwyer Park** | 00515 | ALARP | Rain Tree | 1800 | 19.4 | 20 | | $ 3,475.00 | $ 3,475.00 |
| | | 00516 | ALARP | Tararind | 500 | 9 | | 5 | $ 1,910.00 | $ 5,385.00 |
| | | 00517 | ALARP | Tararind | 500 | 8.2 | | 4 | $ 1,910.00 | **$ 7,295.00** |
| | | | | | | | | | | |
| 23/01/2019 | **Anne Park** | 00518 | ALARP | Pink Trumpet Tree | 500 | 8 | 6.5 | 6 | $ 490.00 | **$ 490.00** |
| | | | | | | | | | | |
| 25/01/2019 | **Que Noy Park** | 00519 | ALARP | Hills Fig | 3m+ | 16.2 | 14 | 3 | $ 3,475.00 | $ 3,475.00 |
| | | 00520 | ALARP | White Gum | 280 | 11.6 | | 5 | $ 490.00 | $ 3,965.00 |
| | | 00521 | ALARP | Hills Fig | 3m+ | 16.2 | 13 | 10 | $ 3,475.00 | $ 7,440.00 |
| | | 00522 | ALARP | Hills Fig | 3m+ | 16.2 | 11 | | $ 3,475.00 | $ 10,915.00 |
| | | 00523 | ALARP | Hills Fig | 4m+ | 16.2 | 10 | | $ 3,475.00 | $ 14,390.00 |
| | | 00524 | ALARP | Hills Fig | 3m+ | 16.2 | 8 | | $ 3,475.00 | $ 17,865.00 |
| | | 00525 | ALARP | Hills Fig | 4m+ | 16.2 | 10 | | $ 3,475.00 | $ 21,340.00 |
| | | 00526 | ALARP | Hills Fig | 2m | 16.2 | 10 | | $ 3,475.00 | $ 24,815.00 |
| | | 00527 | ALARP | Rain Tree | 940 | 16 | 11.5 | | $ 3,475.00 | $ 28,290.00 |
| | | 00528 | ALARP | Cheese Wood | 900 | 16.8 | 9.5 | | $ 3,475.00 | $ 31,765.00 |
| | | 00529 | ALARP | Poinciana | 570 | 16.5 | 9 | | $ 3,150.00 | $ 34,915.00 |
| | | 00530 | ALARP | African Tulip | 510 | 17.4 | 9 | | $ 3,150.00 | $ 38,065.00 |
| | | 00531 | ALARP | Coastal Casuarina | 340/390 (730) | 17.6 | 14 | | $ 3,475.00 | $ 41,540.00 |
| | | 00532 | ALARP | Rain Tree | 1900 | 16 | 19.5 | | $ 3,475.00 | $ 45,015.00 |
| | | 00533 | ALARP | Damson Plum | 420 | 18.8 | 9 | | $ 3,150.00 | $ 48,165.00 |
| | | 00534 | ALARP | Rain Tree | 1520 | 19.2 | 13.5 | | $ 3,475.00 | $ 51,640.00 |
| | | 00535 | ALARP | Damson Plum | 200 | 12.8 | 8.5 | | $ 490.00 | $ 52,130.00 |
| | | 00536 | ALARP | Corymbia Bella | 460 | 17 | 1x14.5,1x12 | | $ 3,150.00 | $ 55,280.00 |
| | | 00537 | ALARP | Mimusops | 340 | 15.8 | 9.5 | | $ 1,427.00 | $ 56,707.00 |
| | | 00538 | ALARP | African Tulip | 240 | 11.6 | 8 | | $ 490.00 | $ 57,197.00 |
| | | 00539 | ALARP | African Tulip | 300 | 11.6 | 9.5 | | $ 490.00 | $ 57,687.00 |
| | | 00540 | ALARP | African Tulip | 260 | 12.6 | 10.5 | | $ 490.00 | $ 58,177.00 |
| | | 00541 | ALARP | Black Wattle | 180 | 15.2 | 11.5 | 12 | $ 1,365.00 | $ 59,542.00 |
| | | 00542 | ALARP | Black Wattle | 200 | 12.2 | | 9 | $ 490.00 | **$ 60,032.00** |
| | | | | | | | | | | |
| 01/02/2019 | **Meigs Park** | 00543 | Medium | Hills Fig | 3m+ | 16.2 | 11.5 | 13.5 | $ 3,475.00 | $ 3,475.00 |
| | | 00544 | ALARP | Hills Fig | 3m+ | 16.2 | 12 | | $ 3,475.00 | $ 6,950.00 |
| | | 00545 | ALARP | Hills Fig | 3m+ | 18.8 | 6.5 | | $ 3,475.00 | $ 10,425.00 |
| | | 00546 | ALARP | Hills Fig | 3m+ | 20.4 | 1x14,1x18 | | $ 4,475.00 | $ 14,900.00 |

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|---|---|---|---|---|---|---|---|---|---|---|
| | | 00547 | ALARP | River Red Gum | 780 | 24.8 | 7 | | $ 4,475.00 | **$ 19,375.00** |
| | | | | | | | | | | |
| 01/02/2019 | **Bill Sullivan Park** | 00548 | ALARP | Burmese Rosewood/Paduk | 530 | 13.4 | | 10.5 | $ 1,910.00 | $ 1,910.00 |
| | | 00549 | ALARP | Banyan | 1000 | 8.6 | | 7 | $ 2,235.00 | $ 4,145.00 |
| | | 00550 | ALARP | Poinciana | 1.5m | 9.2 | | 7 | $ 2,235.00 | **$ 6,380.00** |
| | | | | | | | | | | |
| 01/02/2019 | **Brian Chong Wee Park** | 00551 | ALARP | Mananthes | 340 | 9.2 | 4.5 | | $ 490.00 | $ 490.00 |
| | | 00552 | ALARP | Mananthes | 150/150/140 (440) | 7.2 | 3 | | $ 552.00 | **$ 1,042.00** |
| | | | | | | | | | | |
| 01/02/2019 | **Stoddard Park** | 00553 | ALARP | Red Beach Hibiscus | 250 | 8.8 | 5 | | $ 490.00 | $ 490.00 |
| | | 00554 | ALARP | Red Beach Hibiscus | 250 | 8.8 | 5 | | $ 490.00 | $ 980.00 |
| | | 00555 | ALARP | Red Beach Hibiscus | 250 | 8.8 | 5 | | $ 490.00 | **$ 1,470.00** |
| | | | | | | | | | | |
| 01/02/2019 | **Seawall Park** | 00556 | ALARP | Leichardt Pine | 300/390 (690) | 12 | 7 | | $ 1,910.00 | **$ 1,910.00** |
| | | | | | | | | | | |
| 01/02/2019 | **Latrobe Park** | 00557 | ALARP | Red Beach Hibiscus | 500 | 6 | 3.5 | | $ 326.00 | $ 326.00 |
| | | 00558 | ALARP | Red Beach Hibiscus | 370 | 6.5 | 3.5 | | $ 264.00 | **$ 590.00** |
| | | | | | | | | | | |
| 01/02/2019 | **Dashwood Park** | 00559 | ALARP | Burmese Rosewood/Paduk | 500 | 17 | | 1x11.5,1x15.5 | $ 3,150.00 | $ 3,150.00 |
| | | 00560 | ALARP | Burmese Rosewood/Paduk | 580 | 18.2 | | 1x5,1x18 | $ 3,150.00 | $ 6,300.00 |
| | | 00561 | ALARP | Burmese Rosewood/Paduk | 560 | 18.6 | 15 | 15 | $ 3,150.00 | **$ 9,450.00** |
| | | | | | | | | | | |
| 04/02/2019 | **Mindal Beach** | 00562 | ALARP | Banyan | 1500 | 10 | | 2 | $ 2,235.00 | $ 2,235.00 |
| | | 00563 | ALARP | Banyan | 2m | 10.8 | | 2 | $ 2,235.00 | $ 4,470.00 |
| | | 00564 | ALARP | Mango | 1000 | 9.2 | | 6 | $ 2,235.00 | $ 6,705.00 |
| | | 00565 | ALARP | Mango | 290/280 (570) | 9.6 | | 5.5 | $ 1,910.00 | $ 8,615.00 |
| | | 00566 | ALARP | Banyan | 2m | 8.6 | | 2 | $ 2,235.00 | $ 10,850.00 |
| | | 00567 | ALARP | Banyan | 165/180/170/175 (690) | 5.6 | | 2 | $ 326.00 | $ 11,176.00 |
| | | 00568 | ALARP | Mango | 840 | 8.2 | | 3.5 | $ 2,235.00 | $ 13,411.00 |
| | | 00569 | ALARP | Banyan | 300/250 (550) | 7 | | 2 | $ 552.00 | $ 13,963.00 |
| | | 00570 | ALARP | Mango | 1200 | 8.6 | | 2.5 | $ 2,235.00 | $ 16,198.00 |
| | | 00571 | ALARP | Hills Fig | 1200 | 8 | | 2 | $ 2,235.00 | $ 18,433.00 |
| | | 00572 | ALARP | Mango | 320/260/500 (1080) | 8.4 | | 2 | $ 2,235.00 | $ 20,668.00 |
| | | 00573 | ALARP | Mango | 1020 | 9 | | 2 | $ 2,235.00 | $ 22,903.00 |
| | | 00574 | ALARP | Mango | 990 | 7.4 | | 1.5 | $ 2,235.00 | $ 25,138.00 |
| | | 00575 | ALARP | Banyan | 215/210/220/180 (825) | 7.8 | | 2.5 | $ 2,235.00 | $ 27,373.00 |
| | | 00576 | ALARP | Banyan | 3m+ | 13.4 | | 12 | $ 2,235.00 | **$ 29,608.00** |
| | | | | | | | | | | |
| 04/02/2019 | **Gardens Road Cemete** | 00577 | ALARP | Mango | 720 | 9.8 | | 8 | $ 2,235.00 | $ 2,235.00 |
| | | 00578 | ALARP | Mango | 580 | 10.4 | | 9.5 | $ 1,910.00 | $ 4,145.00 |
| | | 00579 | ALARP | Mango | 930 | 11.2 | | 10.5 | $ 2,235.00 | $ 6,380.00 |

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|---|---|---|---|---|---|---|---|---|---|---|
| | | 00580 | ALARP | Mango | 580 | 11.2 | | 11 | $ 1,910.00 | $ 8,290.00 |
| | | 00581 | ALARP | Mango | 1500 | 11.6 | | 1x8,1x10 | $ 2,235.00 | $ 10,525.00 |
| | | 00582 | ALARP | Mango | 900 | 12.2 | | 5 | $ 2,235.00 | $ 12,760.00 |
| | | 00583 | ALARP | Mango | 550 | 12.2 | | 5 | $ 1,910.00 | $ 14,670.00 |
| | | 00584 | ALARP | Mango | 600 | 12.2 | | 5.5 | $ 1,910.00 | $ 16,580.00 |
| | | 00585 | ALARP | Mango | 2m | 12.2 | | 5.5 | $ 2,235.00 | **$ 18,815.00** |
| | | | | | | | | | | |
| 05/02/2019 | **Kahlin Oval** | 00586 | ALARP | Beauty Leaf | 450/300/290 (1040) | 12 | | 7 | $ 2,235.00 | $ 2,235.00 |
| | | 00587 | ALARP | Weeping Fig | 3m | 11.8 | | 12 | $ 2,235.00 | $ 4,470.00 |
| | | 00588 | ALARP | Beauty Leaf | 500/350/400/400 (1650) | 15 | | 7 | $ 3,475.00 | $ 7,945.00 |
| | | 00589 | ALARP | Beauty Leaf | 340/470/420/310/400 (1940) | 13.4 | | 7 | $ 2,235.00 | $ 10,180.00 |
| | | 00590 | ALARP | Beauty Leaf | 300/300/330 (930) | 7.8 | | 7 | $ 552.00 | $ 10,732.00 |
| | | 00591 | ALARP | River Red Gum | 800 | 18.8 | 19 | 9 | $ 3,475.00 | $ 14,207.00 |
| | | 00592 | ALARP | Corymbia Bella | 360 | 13 | | 8 | $ 1,848.00 | $ 16,055.00 |
| | | 00593 | ALARP | Corymbia Bella | 970 | 16.4 | | 7 | $ 3,475.00 | $ 19,530.00 |
| | | 00594 | ALARP | Corymbia Bella | 650 | 16.4 | | 7.5 | $ 3,150.00 | **$ 22,680.00** |
| | | | | | | | | | | |
| 05/02/2019 | **Malabar Park** | 00595 | ALARP | River Red Gum | 600 | 17.8 | | 6 | $ 3,150.00 | $ 3,150.00 |
| | | 00596 | ALARP | Allosyncarpia | 300 | 9.4 | | 5 | $ 490.00 | $ 3,640.00 |
| | | 00597 | ALARP | River Red Gum | 600 | 14.8 | | 11.5 | $ 1,910.00 | $ 5,550.00 |
| | | 00598 | ALARP | River Red Gum | 470 | 18.6 | | 9 | $ 3,150.00 | $ 8,700.00 |
| | | 00599 | ALARP | Melville Island Bloodwood | 370 | 16.4 | | 14.5 | $ 1,365.00 | $ 10,065.00 |
| | | 00600 | ALARP | Yellow Flame Tree/Pelto | 300 | 11.6 | | 10.5 | $ 490.00 | **$ 10,555.00** |
| | | | | | | | | | | |
| 05/02/2019 | **Palmerston Park** | 00601 | ALARP | Rain Tree | 2300 | 16.8 | | 11 | $ 3,475.00 | $ 3,475.00 |
| | | 00602 | ALARP | Rain Tree | 3m+ | 17.8 | | 10 | $ 3,475.00 | $ 6,950.00 |
| | | 00603 | ALARP | Rain Tree | 1900 | 17.8 | | 10 | $ 3,475.00 | $ 10,425.00 |
| | | 00604 | ALARP | Rain Tree | 2030 | 17.8 | | 12 | $ 3,475.00 | $ 13,900.00 |
| | | 00605 | ALARP | Rain Tree | 2250 | 17.8 | | 14 | $ 3,475.00 | $ 17,375.00 |
| | | 00606 | ALARP | Rain Tree | 1840 | 17.8 | | 18 | $ 3,475.00 | $ 20,850.00 |
| | | 00607 | ALARP | Rain Tree | 2m+ | 17.8 | | 17 | $ 3,475.00 | **$ 24,325.00** |
| | | | | | | | | | | |
| 06/02/2019 | **Frances Park** | 00608 | ALARP | Mananthes | 200/300 (500) | 10.4 | 9.8 | | $ 1,910.00 | $ 1,910.00 |
| | | 00609 | ALARP | Mananthes | 180/140/200/180 (700) | 10.4 | 8 | | $ 1,910.00 | $ 3,820.00 |
| | | 00610 | ALARP | Mananthes | 470/200 (670) | 10.4 | 8 | | $ 1,910.00 | $ 5,730.00 |
| | | 00611 | ALARP | Mananthes | 240/220/270/230 (960) | 10.4 | 9 | | $ 2,235.00 | **$ 7,965.00** |
| | | | | | | | | | | |
| 06/02/2019 | **Dinah Beach Oval** | 00612 | ALARP | Weeping Fig | 2m | 14.2 | | 8 | $ 2,235.00 | $ 2,235.00 |
| | | 00613 | ALARP | Rain Tree | 2m | 12 | | 11.5 | $ 2,235.00 | $ 4,470.00 |
| | | 00614 | ALARP | Paperbark | 550 | 11.6 | | 4 | $ 1,910.00 | $ 6,380.00 |

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|---|---|---|---|---|---|---|---|---|---|---|
| | | 00615 | ALARP | Paperbark | 500 | 10.8 | | 7 | $ 1,910.00 | $ 8,290.00 |
| | | 00616 | ALARP | Burmese Rosewood/Paduk | 500 | 12.6 | | 11.5 | $ 1,910.00 | $ 10,200.00 |
| | | 00617 | ALARP | River Red Gum | 420 | 16.8 | | 13.5 | $ 3,150.00 | $ 13,350.00 |
| | | 00618 | ALARP | Yellow Flame Tree/Pelto | 310/650/820 (1780) | 12.8 | | 4 | $ 2,235.00 | $ 15,585.00 |
| | | 00619 | ALARP | River Red Gum | 530 | 19 | | 14 | $ 3,150.00 | **$ 18,735.00** |
| | | | | | | | | | | |
| | | | | | | | | | | **$ 321,457.00** |
| | | | | | | | | | | |
| | **Amphitheatre** | | | | | | | | | |
| | **Bennet Park** | | | | | | | | | |
| | **Bicentennial Park** | | | | | | | | | |
| | **Chinese Cemetery** | | | | | | | | | |
| | **Civic Park** | | | | | | | | | |
| | **Duke St. Reserve** | | | | | | | | | |
| | **Fannie Bay Foreshore** | | | | | | | | | |
| | **Frog Hollow Park** | | | | | | | | | |
| | **Half Moon Park** | | | | | | | | | |
| | **Harriet Park** | | | | | | | | | |
| | **Heritage Park** | | | | | | | | | |
| | **Pioneer Park & Cemetery** | | | | | | | | | |
| | **Seascape Park** | | | | | | | | | |
| | **Survivors Lookout** | | | | | | | | | |
| | **Tamarind Park** | | | | | | | | | |
| | **Vestys Beach** | | | | | | | | | |
| | **Anthony Park** | | | | | | | | | |
| | **Frances Park Walkway #1** | | | | | | | | | |
| | **Frances Park Walkway #2** | | | | | | | | | |
| | **Doctors Gully** | | | | | | | | | |
| | **Gardens Oval** | | | | | | | | | |
| | **Spillet Park** | | | | | | | | | |
| | **Raintree Park** | | | | | | | | | |
| | **Travellers Walk** | | | | | | | | | |
| | **The Mall** | | | | | | | | | |
| | **Warrego Park** | | | | | | | | | |
| | **Wood Street Park** | | | | | | | | | |

| Date | Park Name CENTRAL PRECINCT | Nemus ID Tag Number | Risk Assessment | Tree Common Name | Tree DBH (mm) | Tree Height (m) | Distance to Principal Residence | Distance to Power Line | Cost of removal Incl. Stump Grinding | TOTAL COST FOR PARK |
|---|---|---|---|---|---|---|---|---|---|---|
| 07/01/2019 | **Ellengowan Park** | 00322 | ALARP | Paper Bark | 500 | 17.4 | 15.5 | | $ 3,150.00 | $ 3,150.00 |
| | | 00323 | ALARP | Black Wattle | 340 | 12.8 | 10 | | $ 490.00 | **$ 3,640.00** |
| | | | | | | | | | | |
| 07/01/2019 | **Edinburgh Park** | 00324 | ALARP | African Mahogany | 1000 | 20.4 | 16.5 | | $ 4,475.00 | **$ 4,475.00** |
| | | | | | | | | | | |
| 07/01/2019 | **Cahill Greenbelt** | 00325 | ALARP | Red Bead Tree | 280 | 11.2 | 8 | | $ 490.00 | **$ 490.00** |
| | | | | | | | | | | |
| 07/01/2019 | **Cahill Park** | 00326 | ALARP | Ghost Gum | 370 | 13.2 | 10 | | $ 1,848.00 | $ 1,848.00 |
| | | 00327 | ALARP | Leichardt Pine | 550 | 14 | 9 | | $ 1,910.00 | $ 3,758.00 |
| | | 00328 | ALARP | Ghost Gum | 260 | 11 | | 6 | $ 490.00 | $ 4,248.00 |
| | | 00329 | ALARP | Ghost Gum | 240 | 12.4 | 10.5 | | $ 490.00 | $ 4,738.00 |
| | | 00330 | ALARP | Leichardt Pine | 310 | 11.4 | | 6 | $ 490.00 | $ 5,228.00 |
| | | 00331 | ALARP | Leichardt Pine | 330 | 7.6 | | 2.5 | $ 490.00 | **$ 5,718.00** |
| | | | | | | | | | | |
| 07/01/2019 | **Hardwood Park** | 00332 | ALARP | Allosyncarpia | 600 | 13.6 | 11.5 | 9 | $ 552.00 | $ 552.00 |
| | | 00333 | ALARP | Mimusops | 220 | 10.8 | 9 | | $ 490.00 | $ 1,042.00 |
| | | 00334 | ALARP | Allosyncarpia | 640 | 13 | 7 | | $ 552.00 | $ 1,594.00 |
| | | 00335 | ALARP | Allosyncarpia | 240 | 12.2 | 10 | | $ 490.00 | $ 2,084.00 |
| | | 00336 | ALARP | Pink Trumpet Tree | 300 | 9 | | 7 | $ 490.00 | $ 2,574.00 |
| | | 00337 | ALARP | Mananthes | 450 | 11 | | 4 | $ 1,910.00 | $ 4,484.00 |
| | | 00338 | ALARP | Mananthes | 510 | 11.2 | | 4 | $ 1,910.00 | **$ 6,394.00** |
| | | | | | | | | | | |
| 07/01/2019 | **Johnson Park** | 00339 | ALARP | African Mahogany | 800 | 214 | 16 | | $ 4,475.00 | $ 4,475.00 |
| | | 00340 | ALARP | African Mahogany | 800 | 21 | 11.5 | | $ 4,475.00 | $ 8,950.00 |
| | | 00341 | ALARP | Mananthes | 590 | 9 | | 6 | $ 1,910.00 | **$ 10,860.00** |
| | | | | | | | | | | |
| 07/01/2019 | **Nakara Oval** | 00342 | ALARP | Weeping Rosewood | 340 | 9.4 | | 7 | $ 490.00 | $ 490.00 |
| | | 00343 | ALARP | Black Wattle | 430 | 13.2 | | 6 | $ 1,910.00 | $ 2,400.00 |
| | | 00344 | ALARP | Broad Leaf Carbeen | 220 | 12.8 | | 7 | $ 490.00 | $ 2,890.00 |
| | | 00345 | ALARP | Corymbia Bella | 290 | 9.2 | | 7 | $ 490.00 | $ 3,380.00 |
| | | 00346 | ALARP | Black Wattle | 210 | 9.6 | | 9 | $ 490.00 | $ 3,870.00 |
| | | 00347 | ALARP | River Red Gum | 600 | 14.2 | | 10 | $ 1,910.00 | $ 5,780.00 |
| | | 00348 | ALARP | River Red Gum | 200 | 11.8 | | 5 | $ 490.00 | $ 6,270.00 |
| | | 00349 | ALARP | Black Wattle | 250 | 12.4 | | 5 | $ 490.00 | $ 6,760.00 |
| | | 00350 | ALARP | Yellow Flame Tree/Pelto | 1050 | 9.6 | | 6.5 | $ 2,235.00 | $ 8,995.00 |
| | | 00351 | ALARP | River Red Gum | 440 | 18.2 | | 7 | $ 3,150.00 | $ 12,145.00 |
| | | 00352 | ALARP | Hills Fig | 3m+ | 11.8 | | 7 | $ 2,235.00 | $ 14,380.00 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 08/01/2019 | | 00358 | ALARP | Salmon Gum | 200 | 8.6 | | 3 | $ 490.00 | $ 14,870.00 |
| | | 00359 | High 2 | African Mahogany | 1500 | 23.8 | | 18.5 | $ 4,475.00 | $ 19,345.00 |
| | | 00360 | ALARP | African Mahogany | 680 | 19.8 | | 14 | $ 3,150.00 | $ 22,495.00 |
| | | 00361 | ALARP | African Mahogany | 760 | 18.8 | | 12.5 | $ 3,475.00 | $ 25,970.00 |
| | | 00362 | ALARP | African Mahogany | 400 | 17 | | 15 | $ 1,427.00 | **$ 27,397.00** |
| | | | | | | | | | | |
| 08/01/2019 | **Kelsey Park** | 00353 | ALARP | Paper Bark | 1000 | 14.4 | 9.5 | | $ 2,235.00 | $ 2,235.00 |
| | | 00354 | ALARP | Swamp Bloodwood | 430 | 11.8 | 7 | | $ 1,910.00 | $ 4,145.00 |
| | | 00355 | ALARP | Burmese Rosewood/Paduk | 470 | 15.2 | 11 | | $ 3,150.00 | **$ 7,295.00** |
| | | | | | | | | | | |
| 08/01/2019 | **Harris Park** | 00356 | ALARP | Black Wattle | 660 | 15 | 13 | | $ 3,150.00 | **$ 3,150.00** |
| | | | | | | | | | | |
| 08/01/2019 | **Gulner Park** | 00357 | ALARP | Gmelina | 1000 | 15.2 | 11 | | $ 3,475.00 | **$ 3,475.00** |
| | | | | | | | | | | |
| 08/01/2019 | **Britomart Park** | 00363 | ALARP | Black Wattle | 1000 | 15 | 12 | | $ 3,475.00 | $ 3,475.00 |
| | | 00364 | ALARP | Banyan | 4m+ | 13.4 | 10 | | $ 3,475.00 | $ 6,950.00 |
| | | 00365 | ALARP | Burmese Rosewood/Paduk | 420 | 14.6 | 11.5 | | $ 1,910.00 | **$ 8,860.00** |
| | | | | | | | | | | |
| 08/01/2019 | **Steadcombe Park** | 00366 | High 1 | African Mahogany | 1500 | 25 | | 18 | $ 4,475.00 | $ 4,475.00 |
| | | 00367 | ALARP | | 280 | 14.2 | | 10.5 | $ 490.00 | $ 4,965.00 |
| | | 00368 | ALARP | Native Nutmeg | 450 | 8 | | 5 | $ 1,910.00 | $ 6,875.00 |
| | | 00369 | ALARP | Weeping Rosewood | 630 | 11.2 | | 3 | $ 1,910.00 | **$ 8,785.00** |
| | | | | | | | | | | |
| 08/01/2019 | **Alawa Park** | 00370 | ALARP | Yellow Flame Tree/Pelto | 700 | 8.4 | | 2 | $ 1,910.00 | $ 1,910.00 |
| | | 00371 | ALARP | Yellow Flame Tree/Pelto | 500 | 9.8 | | 4.5 | $ 1,910.00 | **$ 3,820.00** |
| | | | | | | | | | | |
| 08/01/2019 | **Mullen Park** | 00372 | High 1 | African Mahogany | 1500 | 26.4 | 25 | 15 | $ 4,475.00 | $ 4,475.00 |
| | | 00373 | ALARP | Banyan | 2m+ | 14.6 | 12.5 | | $ 2,235.00 | $ 6,710.00 |
| | | 00374 | ALARP | Mango | 1000 | 10.8 | 9.5 | | $ 2,235.00 | $ 8,945.00 |
| | | 00375 | ALARP | Hills Fig | 3m+ | 12.6 | | 4.5 | $ 2,235.00 | **$ 11,180.00** |
| | | | | | | | | | | |
| 09/01/2019 | **Bald Park** | 00376 | ALARP | Ghost Gum | 270 | 13.8 | | 13 | $ 490.00 | **$ 490.00** |
| | | | | | | | | | | |
| 09/01/2019 | **Young Park** | 00377 | ALARP | Rain Tree | 1000 | 14.4 | 8 | | $ 2,235.00 | $ 2,235.00 |
| | | 00378 | ALARP | Paper Bark | 340 | 13.6 | 12 | | $ 490.00 | $ 2,725.00 |
| | | 00379 | ALARP | Rain Tree | 700 | 15.2 | 10.5 | | $ 3,475.00 | **$ 6,200.00** |
| | | | | | | | | | | |
| 09/01/2019 | **Alawa Oval** | 00380 | ALARP | River Red Gum | 530 | 15.8 | | 7 | $ 3,150.00 | $ 3,150.00 |
| | | 00381 | ALARP | African Mahogany | 900 | 16.2 | | 11.5 | $ 3,475.00 | **$ 6,625.00** |
| | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| 09/01/2019 | **Crisp Park** | 00382 | ALARP | River Red Gum | 720 | 18.4 | 13 | | $ 3,475.00 | **$ 3,475.00** |
| | | | | | | | | | | |
| 09/01/2019 | **Becker Park** | 00383 | ARCHIVED | Cheese Wood | 320 | 13 | 5 | | | $ - |
| | | 00384 | ALARP | Banyan | 2m+ | 12.4 | 6 | | $ 2,235.00 | **$ 2,235.00** |
| | | | | | | | | | | |
| 09/01/2019 | **Dudley Park** | 00385 | ALARP | Milkwood | 380 | 11.2 | 6 | | $ 1,848.00 | **$ 1,848.00** |
| | | | | | | | | | | |
| 09/01/2019 | **Ternau Park** | 00386 | ALARP | Red Bead Tree | 1000 | 17 | 15.5 | | $ 3,475.00 | **$ 3,475.00** |
| | | | | | | | | | | |
| 09/01/2019 | **Bill Bell Park** | 00387 | ALARP | Weeping Fig | 2m+ | 14.4 | 5 | | $ 2,235.00 | $ 2,235.00 |
| | | 00388 | ALARP | Weeping Fig | 1m+ | 15.2 | 5 | | $ 3,475.00 | **$ 5,710.00** |
| | | | | | | | | | | |
| 09/01/2019 | **Sunset Park** | 00389 | ALARP | Beauty Leaf | 1m+ | 14 | 10 | | $ 2,235.00 | **$ 2,235.00** |
| | | | | | | | | | | |
| 09/01/2019 | **Grevillia Park** | 00390 | ALARP | Black Wattle | 550 | 17.2 | 15 | | $ 3,150.00 | $ 3,150.00 |
| | | 00391 | ALARP | Ceylon Oak | 420 | 10.8 | 5 | | $ 1,910.00 | $ 5,060.00 |
| | | 00392 | ALARP | Ganaphyllum | 600 | 12.2 | 10 | | $ 1,910.00 | $ 6,970.00 |
| | | 00393 | ALARP | Ganaphyllum | 530 | 13.2 | 10 | | $ 1,910.00 | $ 8,880.00 |
| 10/01/2019 | | 00394 | ALARP | Banyan | 4M+ | 9.2 | 8 | | $ 2,235.00 | $ 11,115.00 |
| | | 00395 | ARCHIVED | Mananthes | 330 | 15 | 5 | | | $ 11,115.00 |
| | | | | | | | | | | |
| 10/01/2019 | **Kurrajong Park** | 00396 | ALARP | Bush Current | 320 | 10 | 5 | | $ 490.00 | $ 490.00 |
| | | 00397 | ALARP | Mananthes | 520 | 20.2 | 2.5 | | $ 4,150.00 | $ 4,640.00 |
| | | 00398 | ALARP | Mananthes | 600 | 20.2 | 2.5 | | $ 4,150.00 | $ 8,790.00 |
| | | 00399 | ALARP | Mananthes | 130 | 20.2 | 12 | | $ 4,088.00 | $ 12,878.00 |
| | | 00400 | ALARP | Mananthes | 125 | 20.2 | 14 | | $ 4,088.00 | $ 16,966.00 |
| | | 00401 | ALARP | Mananthes | 350 | 20.2 | 18 | | $ 4,088.00 | $ 21,054.00 |
| | | 00402 | ALARP | Maranthes | 280 | 20.2 | 13 | | $ 4,088.00 | $ 25,142.00 |
| | | 00403 | ALARP | Mananthes | 380 | 20.2 | 13.5 | | $ 4,088.00 | $ 29,230.00 |
| | | 00404 | ALARP | Mananthes | 250 | 20.2 | 12.5 | | $ 4,088.00 | $ 33,318.00 |
| | | 00405 | ALARP | Mananthes | 280 | 20.2 | 14 | | $ 4,088.00 | $ 37,406.00 |
| | | 00406 | ALARP | Terminallia | 260 | 20.2 | 10 | | $ 4,088.00 | **$ 41,494.00** |
| | | | | | | | | | | |
| 10/01/2019 | **Alf Blaser Park** | 00407 | ALARP | Mananthes | 1m+ | 19.4 | 10 | | $ 3,475.00 | $ 3,475.00 |
| | | 00408 | ALARP | Mananthes | 900 | 19.4 | 11.5 | | $ 3,475.00 | $ 6,950.00 |
| | | 00409 | ALARP | Cluster Fig | 1000 | 13.6 | 10.5 | | $ 2,235.00 | $ 9,185.00 |
| | | 00410 | ALARP | Cluster Fig | 1000 | 13.6 | 12 | | $ 2,235.00 | **$ 11,420.00** |
| | | | | | | | | | | |
| 10/01/2019 | **Easther Park** | 00411 | ALARP | Cheese Wood | 290 | 11 | 8.5 | 5.5 | $ 490.00 | $ 490.00 |
| | | 00412 | ALARP | Paper Bark | 360 | 8.6 | | 4.5 | $ 1,848.00 | $ 2,338.00 |
| | | 00413 | ALARP | Beauty Leaf | 240 | 13.2 | 12 | | $ 490.00 | $ 2,828.00 |

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|---|---|---|---|---|---|---|---|---|---|---|
| | | 00414 | ALARP | Cluster Fig | 570 | 10.2 | 8 | | $ 1,910.00 | $ 4,738.00 |
| | | 00415 | ALARP | Terminallia | 290 | 13.4 | 5 | | $ 490.00 | $ 5,228.00 |
| | | 00416 | ALARP | Wild Plum | 290 | 12.6 | | 11.5 | $ 490.00 | **$ 5,718.00** |
| | | | | | | | | | | |
| 10/01/2019 | **Renolds Park** | 00417 | ALARP | Salmon Gum | 470 | 14 | 10 | | $ 1,910.00 | $ 1,910.00 |
| | | 00418 | High 2 | River Red Gum | 400 | 14.4 | 14 | | $ 1,910.00 | **$ 3,820.00** |
| | | | | | | | | | | |
| 10/01/2019 | **Tudawali Park** | 00419 | ALARP | Black Wattle | 250 | 13.2 | 11 | | $ 490.00 | **$ 490.00** |
| | | | | | | | | | | |
| 10/01/2019 | **Mosec Park** | 00420 | ALARP | Banyan | 4m+ | 14 | | 5 | $ 3,475.00 | **$ 3,475.00** |
| | | | | | | | | | | |
| 11/01/2019 | **Nation Crescent Park** | 00421 | ALARP | Terminallia | 430 | 13.2 | | 10.5 | $ 1,910.00 | $ 1,910.00 |
| | | 00422 | ALARP | Coastal Casuarina | 400 | 15.6 | | 10.5 | $ 1,427.00 | $ 3,337.00 |
| | | 00423 | High 1 | Burmese Rosewood/Paduk | 550 | 20.4 | | 10 | $ 4,150.00 | $ 7,487.00 |
| | | 00424 | ALARP | Yellow Flame Tree/Pelto | 1000 | 9.2 | | 8 | $ 2,235.00 | $ 9,722.00 |
| | | 00425 | ALARP | Yellow Flame Tree/Pelto | 400 | 9.6 | | 6 | $ 1,910.00 | $ 11,632.00 |
| | | 00426 | ALARP | Ghost Gum | 260 | 13.6 | | 12 | $ 490.00 | $ 12,122.00 |
| | | 00427 | ALARP | Yellow Flame Tree/Pelto | 1000 | 11.6 | | 2.5 | $ 2,235.00 | $ 14,357.00 |
| | | 00428 | ALARP | Wild Plum | 330 | 8.4 | | 7 | $ 490.00 | $ 14,847.00 |
| | | 00429 | ALARP | Cluster Fig | 1000 | 13.5 | 11.5 | | $ 2,235.00 | $ 17,082.00 |
| | | 00430 | ALARP | Beauty Leaf | 1600 | 13.2 | 12.5 | | $ 2,235.00 | **$ 19,317.00** |
| | | | | | | | | | | |
| 11/01/2019 | **Osterman Park** | 00431 | ALARP | Paperbark | 950 | 16.4 | 13 | 15.5 | $ 3,475.00 | $ 3,475.00 |
| | | 00432 | ALARP | Wild Plum | 550 | 17 | 10.5 | | $ 3,150.00 | $ 6,625.00 |
| | | 00433 | ALARP | Wild Plum | 350 | 15.6 | 14 | | $ 1,365.00 | $ 7,990.00 |
| | | 00434 | ALARP | Wild Plum | 490 | 14 | 4 | | $ 1,910.00 | $ 9,900.00 |
| | | 00435 | High 1 | Cluster Fig | 2m+ | 19.2 | 14.5 | | $ 3,475.00 | $ 13,375.00 |
| | | 00436 | High 2 | Rain Tree | 2m+ | 19.8 | 10.5 | 18 | $ 3,475.00 | **$ 16,850.00** |
| | | | | | | | | | | |
| 11/01/2019 | **Worgan Park** | 00437 | ALARP | Rain Tree | 2m+ | 17.8 | 15 | | $ 3,475.00 | **$ 3,475.00** |
| | | | | | | | | | | |
| 11/01/2019 | **Clancy Park** | 00438 | ALARP | Rain Tree | 1m+ | 14.8 | 11.5 | | $ 2,235.00 | **$ 2,235.00** |
| | | | | | | | | | | |
| 11/01/2019 | **Weddell Park** | 00439 | ALARP | African Mahogany | 1m | 20.2 | 19 | | $ 4,475.00 | $ 4,475.00 |
| | | 00440 | ALARP | Black Wattle | 350 | 15.6 | 9 | | $ 1,365.00 | $ 5,840.00 |
| | | 00441 | High 1 | Cheese Wood | 600 | 13.8 | 9 | | $ 1,910.00 | $ 7,750.00 |
| | | 00442 | ALARP | Beauty Leaf | 1m+ | 13.8 | 9 | | $ 2,235.00 | $ 9,985.00 |
| | | 00443 | ALARP | Allosyncarpia | 190 | 13 | | 9 | $ 490.00 | $ 10,475.00 |
| | | 00444 | ALARP | Allosyncarpia | 300 | 11.2 | | 9 | $ 490.00 | $ 10,965.00 |
| | | 00445 | ALARP | Mananthes | 670 | 12.2 | | 6 | $ 1,910.00 | **$ 12,875.00** |
| | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| 21/01/2019 | **Bayview Park** | 00446 | ALARP | Poinciana | 500 | 11.8 | 11.5 | | $ 552.00 | $ 552.00 |
| | | 00447 | ALARP | Terminallia | 560 | 15.4 | 8 | | $ 3,150.00 | $ 3,702.00 |
| | | 00448 | ALARP | Rain Tree | 2m | 16.2 | 17.5 | | $ 3,475.00 | $ 7,177.00 |
| | | 00449 | ALARP | Tamarind | 830 | 14.6 | 8.5 | | $ 2,235.00 | $ 9,412.00 |
| | | 00450 | ALARP | Tamarind | 770 | 14.6 | 13.5 | | $ 2,235.00 | **$ 11,647.00** |
| | | | | | | | | | | |
| 21/01/2019 | **Georges Park** | 00451 | ALARP | Mango | 650 | 11.6 | 11 | | $ 1,910.00 | $ 1,910.00 |
| | | 00452 | ALARP | Rain Tree | 800 | 15.4 | 14.5 | | $ 3,475.00 | $ 5,385.00 |
| | | 00453 | ALARP | Weeping Fig | 1335 | 14.4 | 7.5 | | $ 2,235.00 | $ 7,620.00 |
| | | 00454 | ALARP | Rain Tree | 720 | 14.4 | 13.4 | | $ 2,235.00 | $ 9,855.00 |
| | | 00455 | ALARP | Beauty Leaf | 2.5m | 14.4 | 1x8.5,1x12 | | $ 2,235.00 | $ 12,090.00 |
| | | 00456 | ALARP | Banyan | 4m+ | 12.8 | 8 | | $ 2,335.00 | $ 14,425.00 |
| | | 00457 | ALARP | Terminallia | 600 | 11 | | 6 | $ 1,910.00 | $ 16,335.00 |
| | | 00458 | ALARP | Mimusops | 350 | 9.6 | | 8 | $ 490.00 | **$ 16,825.00** |
| | | | | | | | | | | |
| 21/01/2019 | **Hinkler Park** | 00459 | ALARP | Banyan | 4m+ | 11.8 | 8 | | $ 2,235.00 | $ 2,235.00 |
| | | 00460 | ALARP | Unidentified | 310 | 14.4 | 12 | | $ 490.00 | $ 2,725.00 |
| | | 00461 | ALARP | Unidentified | 310 | 14.4 | 12 | | $ 490.00 | $ 3,215.00 |
| | | 00462 | ALARP | Mango | 1370 | 14.4 | 13 | | $ 2,235.00 | $ 5,450.00 |
| | | 00463 | ALARP | Mimusops | 330 | 13.2 | 10 | | $ 490.00 | $ 5,940.00 |
| | | 00464 | ALARP | Cheese Wood | 900 | 14.2 | 11.8 | | $ 2,235.00 | $ 8,175.00 |
| | | 00465 | ALARP | African Mahogany | 900 | 15.6 | 12.8 | | $ 3,475.00 | $ 11,650.00 |
| | | 00466 | ALARP | Cheese Wood | 600 | 13 | 6.5 | | $ 1,910.00 | $ 13,560.00 |
| | | 00467 | ALARP | Weeping Fig | 2m | 13.2 | 10 | | $ 2,235.00 | **$ 15,795.00** |
| | | | | | | | | | | |
| 21/01/2019 | **Stokes Park** | 00468 | ALARP | Yellow Flame Tree/Pelto | 800 | 9.4 | | 5 | $ 2,235.00 | $ 2,235.00 |
| | | 00469 | ALARP | Bush Apple | 335 | 11.6 | | 4 | $ 490.00 | $ 2,725.00 |
| | | 00470 | ALARP | Teak Tree | 340 | 9.6 | | 7 | $ 490.00 | $ 3,215.00 |
| | | 00471 | ALARP | Northern Cypress Pine | 330/210 (540 | 14.4 | 8 | | $ 1,910.00 | $ 5,125.00 |
| | | 00472 | ALARP | Northern Cypress Pine | 290 | 8.8 | 9.5 | | $ 490.00 | $ 5,615.00 |
| | | 00473 | ALARP | Northern Cypress Pine | 300 | 14.8 | 5.5 | | $ 490.00 | $ 6,105.00 |
| | | 00474 | ALARP | Northern Cypress Pine | 250 | 12.2 | 9.5 | | $ 490.00 | $ 6,595.00 |
| | | 00475 | ALARP | Paper Bark | 260 | 9.4 | | 6 | $ 490.00 | $ 7,085.00 |
| | | 00476 | ALARP | Teak Tree | 700 | 15 | | 12 | $ 3,150.00 | **$ 10,235.00** |
| | | | | | | | | | | |
| | | | | | | | | | | **$ 324,618.00** |
| | **Airlie Park** | | | | | | | | | |
| | **Buchanan Park** | | | | | | | | | |
| | **Croker Park** | | | | | | | | | |
| | **Copeland Park** | | | | | | | | | |
| | **Bagot Veledrome** | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| | Bagot Oval & Surrounds | | | | | | | | | |
| | Tong Luck Park | | | | | | | | | |
| | Wellington Park | | | | | | | | | |
| | Stobo Park | | | | | | | | | |
| | Clark Park | | | | | | | | | |
| | Bike Fun Park | | | | | | | | | |
| | Sunset Cove Park | | | | | | | | | |
| | Athanasiou Park | | | | | | | | | |
| | Aviators Park | | | | | | | | | |
| | Bagot Oval | | | | | | | | | |
| | Bagot Park | | | | | | | | | |
| | Fannie Bay Oval | | | | | | | | | |
| | Nightcliff Foreshore | | | | | | | | | |
| | Nightcliff Oval | | | | | | | | | |

| Date | Park Name NORTHERN PRECINCT | Nemus ID Tag Number | Risk Assessment | Tree Common Name | Tree DBH (mm) | Tree Height (m) | Distance to Principal Residence | Distance to Power Line | Cost of removal Incl. Stump | TOTAL COST FOR PARK |
|---|---|---|---|---|---|---|---|---|---|---|
| 19/11/2018 | Lee Point Buffer Zone | 00001 | ALARP | Yellow Flame Tree/Pelto | 200/300 (500) | 12.5 | 9.8 | | $ 552.00 | $ 552.00 |
| | | 00002 | ALARP | Yellow Flame Tree/Pelto | 200/340 (540) | 13 | 8.8 | | $ 552.00 | $ 1,104.00 |
| | | 00003 | ALARP | Yellow Flame Tree/Pelto | 460/260/230 (950) | 13.4 | 14.5 | | $ 2,235.00 | $ 3,339.00 |
| | | 00004 | ALARP | Black Wattle | 360/31 (670) | 14.4 | 13 | | $ 2,235.00 | $ 5,574.00 |
| | | 00005 | ARCHIVED | Black Wattle | 330/360 (690) | 14.5 | 12.5 | | | $ 5,574.00 |
| | | 00006 | ALARP | Yellow Flame Tree/Pelto | 350 | 12.2 | 11.8 | | $ 552.00 | $ 6,126.00 |
| 20/11/2018 | | 00007 | ALARP | Yellow Flame Tree/Pelto | 200/250/200/180/200 (1003) | 11.8 | 10.8 | | $ 2,235.00 | $ 8,361.00 |
| | | 00008 | Medium | Yellow Flame Tree/Pelto | 230 | 8.4 | 9 | | $ 552.00 | $ 8,913.00 |
| | | 00009 | ALARP | Yellow Flame Tree/Pelto | 570 | 15.2 | 10.5 | | $ 1,752.00 | $ 10,665.00 |
| | | 00010 | ALARP | African Mahogany | 380 | 18.9 | 10.7 | | $ 1,427.00 | $ 12,092.00 |
| | | 00011 | ALARP | Yellow Flame Tree/Pelto | 260/140/180/ (580) | 11.6 | 11 | | $ 877.00 | $ 12,969.00 |
| | | 00012 | ALARP | River Red Gum | 400 | 21.1 | 20 | | $ 2,235.00 | $ 15,204.00 |
| | | 00013 | ALARP | Yellow Flame Tree/Pelto | 290/320 (610) | 12.1 | 12 | | $ 2,235.00 | $ 17,439.00 |
| | | 00014 | ALARP | Yellow Flame Tree/Pelto | 330/260 (590) | 11.6 | 10.3 | | $ 877.00 | $ 18,316.00 |
| | | 00015 | ALARP | Black Wattle | 200/200/180 (680) | 13.4 | 9.9 | | $ 2,235.00 | $ 20,551.00 |
| | | 00016 | ALARP | River Red Gum | 520 | 23.6 | 21.5 | | $ 4,475.00 | $ 25,026.00 |
| | | 00017 | ALARP | Black Wattle | 400/300 (700) | 16.2 | 14 | | $ 2,235.00 | $ 27,261.00 |
| | | 00018 | ALARP | River Red Gum | 360 | 21 | 19.5 | | $ 4,150.00 | $ 31,411.00 |
| | | 00019 | ALARP | Mananthes | 370 | 11.8 | 9.7 | | $ 552.00 | $ 31,963.00 |
| | | 00020 | ALARP | Mananthes | 550 | 17 | 13.4 | | $ 1,752.00 | $ 33,715.00 |
| | | 00021 | ARCHIVED | African Mahogany | 880 | 24.4 | 20 | | | $ 33,715.00 |
| | | 00022 | ALARP | River Red Gum | 400 | 21.6 | 17.4 | | $ 4,150.00 | $ 37,865.00 |
| | | 00023 | ALARP | River Red Gum | 350 | 20.5 | 16.5 | | $ 4,150.00 | $ 42,015.00 |
| | | 00024 | ALARP | River Red Gum | 430 | 22 | 20 | | $ 4,150.00 | $ 46,165.00 |
| | | 00025 | ALARP | Yellow Flame Tree/Pelto | 310/390 (700) | 14.7 | 10.1 | | $ 2,235.00 | $ 48,400.00 |
| | | 00026 | ALARP | River Red Gum | 450 | 22.2 | 14.8 | | $ 4,150.00 | $ 52,550.00 |
| | | 00027 | ALARP | River Red Gum | 300 | 16.9 | 14.5 | | $ 1,427.00 | $ 53,977.00 |
| | | 00028 | ALARP | River Red Gum | 450/140 (590) | 20.7 | 16.5 | | $ 4,475.00 | $ 58,452.00 |
| | | 00029 | ALARP | Yellow Flame Tree/Pelto | 240/360/300 (900) | 13.8 | 8.6 | | $ 2,235.00 | $ 60,687.00 |
| | | 00030 | ALARP | River Red Gum | 490 | 15.1 | 8 | | $ 1,752.00 | $ 62,439.00 |
| | | 00031 | ALARP | Mananthes | 600 | 12.8 | 10 | | $ 2,235.00 | $ 64,674.00 |
| | | 00032 | ALARP | Mananthes | 360 | 11.5 | 10 | | $ 552.00 | $ 65,226.00 |
| | | 00033 | ALARP | Black Wattle | 250/340 (590) | 10.9 | 9.8 | | $ 552.00 | $ 65,778.00 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 00034 | ALARP | Poincinia | 120/140/200/120 | 11 | 9.9 | | $ 552.00 | $ 66,330.00 |
| | | 00035 | ALARP | Fiddlewood | 80/80/80/180 (420) | 8.1 | 3.2 | | $ 490.00 | $ 66,820.00 |
| | | 00036 | ALARP | Fiddlewood | ? | 8 | 3.6 | | $ 490.00 | $ 67,310.00 |
| | | 00037 | ALARP | Fiddlewood | ? | 8.2 | 4.4 | | $ 552.00 | $ 67,862.00 |
| | | 00038 | ARCHIVED | Woolly Butt | 760 | 16.9 | 15 | | | $ 67,862.00 |
| | | 00039 | ALARP | Gmelina | 200/220/200/100 (720) | 15.23 | 11.5 | | $ 1,752.00 | $ 69,614.00 |
| | | 00040 | ALARP | Yellow Flame Tree/Pelto | 500 | 14.8 | 13.4 | | $ 877.00 | $ 70,491.00 |
| | | 00041 | ALARP | Gmelina | 160/200/200/200/100 (860) | 13.7 | 8.9 | | $ 2,235.00 | $ 72,726.00 |
| 21/11/2018 | | 00042 | ALARP | Stringy Bark | 370 | 15.2 | 12.4 | | $ 1,427.00 | $ 74,153.00 |
| | | 00043 | ALARP | Corymbia Bella | 500 | 19.2 | 13.1 | | $ 1,427.00 | $ 75,580.00 |
| | | 00044 | ALARP | Corymbia Bella | 340 | 14.5 | 13.7 | | $ 877.00 | $ 76,457.00 |
| | | 00045 | ALARP | Banyan | 800 | 13.1 | 11.5 | | $ 2,235.00 | $ 78,692.00 |
| | | 00046 | ALARP | River Red Gum | 600 | 20.3 | 18.9 | | $ 4,475.00 | $ 83,167.00 |
| | | 00047 | ALARP | Yellow Flame Tree/Pelto | 700 | 14.5 | 8.2 | | $ 2,235.00 | $ 85,402.00 |
| | | 00048 | ARCHIVED | Black Wattle | 460 | 10.8 | 7.6 | | | $ 85,402.00 |
| | | 00049 | ALARP | Banyan | 1200 | 9 | 7.5 | | $ 2,235.00 | $ 87,637.00 |
| | | 00050 | ALARP | Mananthes | 170/230 (400) | 9.6 | 7.6 | | $ 490.00 | $ 88,127.00 |
| | | 00051 | ALARP | Mananthes | 680 | 13.4 | 10 | | $ 2,235.00 | $ 90,362.00 |
| | | 00052 | ALARP | Mananthes | 700 | 13.4 | 10 | | $ 2,235.00 | $ 92,597.00 |
| | | 00053 | ALARP | Mananthes | 460 | 13.5 | 11.2 | | $ 1,910.00 | $ 94,507.00 |
| | | 00054 | ALARP | Mananthes | 470 | 14.4 | 13.4 | | $ 490.00 | $ 94,997.00 |
| | | 00055 | ALARP | Mananthes | 400 | 12.1 | 11 | | $ 1,910.00 | $ 96,907.00 |
| | | 00056 | ALARP | Woolly Butt | 1200/1400 (2600) | 16.2 | 14 | | $ 3,475.00 | $ 100,382.00 |
| | | 00057 | ALARP | Mananthes | 340 | 10.2 | 8.2 | | $ 552.00 | $ 100,934.00 |
| | | 00058 | ALARP | Mananthes | 400 | 10.8 | 7 | | $ 552.00 | $ 101,486.00 |
| | | 00059 | ALARP | Mananthes | 400/150 (550) | 8 | 7.2 | | $ 877.00 | $ 102,363.00 |
| | | 00060 | ALARP | Mananthes | 320 | 8.1 | 6.9 | | $ 552.00 | $ 102,915.00 |
| | | 00061 | ALARP | Black Wattle | 760 | 16.1 | 15.6 | | $ 1,752.00 | $ 104,667.00 |
| | | 00062 | ALARP | Northern Cypress Pine | 180/200 (380) | 9.8 | 7 | | $ 552.00 | $ 105,219.00 |
| | | 00063 | ALARP | Northern Cypress Pine | 200 | 9.6 | 7 | | $ 490.00 | $ 105,709.00 |
| | | 00064 | ALARP | Northern Cypress Pine | 220 | 10.1 | 7 | | $ 490.00 | $ 106,199.00 |
| | | 00065 | ALARP | Northern Cypress Pine | 240 | 8 | 7 | | $ 490.00 | $ 106,689.00 |
| | | 00066 | ALARP | Mananthes | 300 | 9.4 | 8.1 | | $ 490.00 | $ 107,179.00 |
| | | 00067 | ALARP | Mananthes | 320 | 10.1 | 7.9 | | $ 552.00 | $ 107,731.00 |
| | | 00068 | ALARP | Mananthes | 500/400 (900) | 12 | 10.1 | | $ 2,235.00 | $ 109,966.00 |
| | | 00069 | ALARP | Mananthes | 440 | 10 | 7.5 | | $ 552.00 | $ 110,518.00 |
| | | 00070 | ALARP | Mananthes | 400 | 10.2 | 7.5 | | $ 552.00 | $ 111,070.00 |
| | | 00071 | ALARP | Banyan | 800 | 9.8 | 7.6 | | $ 2,235.00 | **$ 113,305.00** |
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|---|---|---|---|---|---|---|---|---|---|---|
| 22/11/2018 | **Armstrong Park** | 00072 | ALARP | Yellow Flame Tree/Pelto | 280 | 12 | 10.5 | | $ 490.00 | $ 490.00 |
| | | 00073 | ALARP | Yellow Flame Tree/Pelto | 400 | 11.7 | 9.6 | | $ 552.00 | $ 1,042.00 |
| | | 00074 | ALARP | Poinciana | 620 | 12.4 | 10.8 | | $ 2,235.00 | $ 3,277.00 |
| | | 00075 | Medium | Yellow Flame Tree/Pelto | 340/200/36 (900) | 12 | 11.2 | | $ 2,235.00 | $ 5,512.00 |
| | | 00076 | ALARP | Golden Shower | 480 | 14.6 | 6.5 | | $ 552.00 | $ 6,064.00 |
| | | 00077 | ALARP | Yellow Flame Tree/Pelto | 180 | 7.6 | 5 | | $ 490.00 | $ 6,554.00 |
| | | 00078 | ALARP | Yellow Flame Tree/Pelto | 300/380/420 (110) | 12.2 | 6.6 | | $ 2,235.00 | $ 8,789.00 |
| | | 00079 | ALARP | Yellow Flame Tree/Pelto | 400 | 11.3 | 10 | | $ 552.00 | $ 9,341.00 |
| | | 00080 | ALARP | Black Wattle | 320/400/360/380 (1460) | 11.6 | 9.8 | | $ 552.00 | $ 9,893.00 |
| | | 00081 | ALARP | Poinciana | 780 | 15 | 13.5 | | $ 1,752.00 | $ 11,645.00 |
| | | 00082 | ALARP | Poinciana | 800 | 14.9 | 13.4 | | $ 2,235.00 | **$ 13,880.00** |
| | | | | | | | | | | |
| 22/11/2018 | **Cadell Park** | 00083 | ALARP | Mananthes | 390 | 15.2 | 10 | | $ 1,427.00 | $ 1,427.00 |
| | | 00084 | ALARP | Pongamia | 220 | 9 | 8 | | $ 552.00 | $ 1,979.00 |
| | | 00085 | ALARP | Mananthes | 480 | 13.8 | 7.9 | | $ 552.00 | $ 2,531.00 |
| | | 00086 | ALARP | Mananthes | 420 | 17.6 | 14.5 | | $ 1,427.00 | $ 3,958.00 |
| | | 00087 | ALARP | Mananthes | 340 | 13.6 | 11 | | $ 552.00 | $ 4,510.00 |
| | | 00088 | ALARP | Mananthes | 380 | 14 | 11 | | $ 552.00 | $ 5,062.00 |
| | | 00089 | ALARP | Mananthes | 250 | 14.1 | 10.5 | | $ 490.00 | $ 5,552.00 |
| | | 00090 | ALARP | Allosyncarpia | 450 | 14.8 | 11.2 | | $ 2,235.00 | $ 7,787.00 |
| | | 00091 | ALARP | Native Mast Tree | 200 | 11.2 | 10 | | $ 490.00 | $ 8,277.00 |
| | | 00092 | ALARP | Native Nutmeg | 220 | 11.3 | 10 | | $ 490.00 | $ 8,767.00 |
| | | 00093 | ALARP | Allosyncarpia | 600 | 14.3 | 10.1 | | $ 2,235.00 | $ 11,002.00 |
| | | 00094 | ALARP | Native Mast Tree | 200 | 10 | 8 | | $ 490.00 | $ 11,492.00 |
| | | 00095 | ALARP | Mananthes | 380/300 (680) | 13.6 | 11 | | $ 2,235.00 | $ 13,727.00 |
| | | 00096 | ALARP | Mananthes | 500 | 13.4 | 10.2 | | $ 877.00 | **$ 14,604.00** |
| | | | | | | | | | | |
| 22/11/2018 | **Parkside Park** | 00097 | ALARP | African Mahogany | 600 | 21.5 | 13.5 | | $ 4,475.00 | $ 4,475.00 |
| | | 00098 | ALARP | Unidentified | 200/300 (500) | 7.8 | 6.8 | | $ 552.00 | **$ 5,027.00** |
| | | | | | | | | | | |
| 22/11/2018 | **Grasslands Park** | 00099 | ALARP | Wild Plum | 300 | 9.1 | 8 | | $ 490.00 | $ 490.00 |
| | | 00100 | ALARP | Wild Plum | 280 | 9 | 7.6 | | $ 490.00 | **$ 980.00** |
| | | | | | | | | | | |
| 03/12/2018 | **Peace Park** | 00101 | ALARP | African Mahogany | 600 | 19.4 | 17.5 | | $ 3,150.00 | $ 3,150.00 |
| | | 00102 | ALARP | Terminallia | 500 | 13 | 7.2 | | $ 1,910.00 | $ 5,060.00 |
| | | 00103 | ALARP | Black Wattle | 200/400 (600) | 15.4 | 9 | | $ 3,150.00 | **$ 8,210.00** |
| | | | | | | | | | | |
| | **Strele Park** | 00104 | ALARP | Stringy Bark | 400 | 14 | 10.5 | | $ 1,910.00 | **$ 1,910.00** |
| | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| | **Glencoe Park** | 00105 | ALARP | Coastal Casuarina | 400 | 16 | 12 | | $ 1,427.00 | $ 1,427.00 |
| | | 00106 | **ARCHIVED** | Coastal Casuarina | 300/280 (580) | 16 | 12 | | | **$ 1,427.00** |
| | | | | | | | | | | |
| | **Kapalga Park** | 00107 | ALARP | River Red Gum | 400 | 14.6 | 8 | | $ 1,910.00 | $ 1,910.00 |
| | | 00108 | ALARP | Weeping Rosewood | 335 | 10.4 | 8 | | $ 490.00 | **$ 2,400.00** |
| | | | | | | | | | | |
| 05/12/2018 | **Dorisvale Park** | 00109 | ALARP | Poinciana | 300/250 (550) | 8.4 | 6 | | $ 2,235.00 | $ 2,235.00 |
| | | 00110 | ALARP | Allosyncarpia | 225 | 11 | 6 | | $ 490.00 | $ 2,725.00 |
| | | 00111 | ALARP | African Mahogany | 800 | 18.8 | 13.5 | | $ 3,475.00 | $ 6,200.00 |
| | | 00112 | ALARP | African Mahogany | 700 | 18 | 10.5 | | $ 3,475.00 | **$ 9,675.00** |
| | | | | | | | | | | |
| | **Mazlin Park** | 00113 | ALARP | Stringy Bark | 500 | 17.4 | 15.5 | | $ 3,475.00 | $ 3,475.00 |
| | | 00114 | ALARP | Woolly Butt | 580 | 15 | 13 | | $ 1,910.00 | **$ 5,385.00** |
| | | | | | | | | | | |
| | **Kailis Park** | 00115 | ALARP | African Mahogany | 900 | 22.8 | 17.5 | | $ 4,475.00 | **$ 4,475.00** |
| | | | | | | | | | | |
| | **Haritos Park** | 00116 | ALARP | African Mahogany | 900 | 20.6 | 18 | | $ 4,475.00 | **$ 4,475.00** |
| | | | | | | | | | | |
| | **Harmanis Park** | 00117 | ALARP | Yellow Flame Tree/Pelto | 350/400/500 (1250) | 15.2 | 12.5 | | $ 3,475.00 | **$ 3,475.00** |
| | | | | | | | | | | |
| | **Anula Greenbelt** | 00118 | ALARP | African Mahogany | 850 | 25.2 | 18 | | $ 4,475.00 | $ 4,475.00 |
| | | 00119 | ALARP | African Mahogany | 850 | 25.2 | 18 | | $ 4,475.00 | $ 8,950.00 |
| | | 00120 | ALARP | African Mahogany | 800 | 23.4 | 19 | | $ 4,475.00 | $ 13,425.00 |
| | | 00121 | ALARP | African Mahogany | 600 | 23.4 | 19 | | $ 4,475.00 | $ 17,900.00 |
| | | 00122 | ALARP | River Red Gum | 600 | 19.2 | 15.5 | | $ 3,475.00 | $ 21,375.00 |
| | | 00123 | ALARP | African Mahogany | 1000 | 19.6 | 18 | | $ 3,475.00 | $ 24,850.00 |
| | | 00124 | ALARP | Mananthes | 400 | 14.4 | 7 | | $ 1,910.00 | $ 26,760.00 |
| | | 00125 | ALARP | Mananthes | 200/100/227 (527) | 16.6 | 14 | | $ 3,150.00 | $ 29,910.00 |
| | | 00126 | ALARP | Mananthes | 300 | 13.4 | 12.5 | | $ 490.00 | $ 30,400.00 |
| | | 00127 | ALARP | Mananthes | 300 | 13.4 | 12 | | $ 490.00 | $ 30,890.00 |
| | | 00128 | ALARP | Yellow Flame Tree/Pelto | 500/260 (760) | 13 | 12 | | $ 1,910.00 | **$ 32,800.00** |
| | | | | | | | | | | |
| 06/12/2018 | **Driffield Park** | 00129 | ALARP | Bush Apple | 350 | 11.4 | 8.5 | | $ 490.00 | $ 490.00 |
| | | 00130 | ALARP | Red Bead Tree | 300/300 (600) | 13.2 | 10.5 | | $ 1,427.00 | $ 1,917.00 |
| | | 00131 | ALARP | River Red Gum | 700 | 16.4 | 11.5 | | $ 3,475.00 | $ 5,392.00 |
| | | 00132 | **High 2** | African Mahogany | 730 | 17.4 | 16 | | $ 3,475.00 | $ 8,867.00 |
| | | 00133 | ALARP | Cheese Wood | 550 | 12.6 | 8 | | $ 1,910.00 | $ 10,777.00 |
| | | 00134 | ALARP | Bush Apple | 300 | 13 | 9 | | $ 490.00 | **$ 11,267.00** |
| | | | | | | | | | | |
| | **McMillans Greenbelt** | 00135 | ALARP | Terminallia | 450 | 10.2 | 8.5 | | $ 1,848.00 | $ 1,848.00 |
| | | 00136 | ALARP | Black Wattle | 450 | 10.2 | 8.5 | | $ 1,848.00 | $ 3,696.00 |

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|---|---|---|---|---|---|---|---|---|---|---|
| | | 00137 | ALARP | Hills Fig | 2500 | 12.2 | 8.5 | | $ 2,235.00 | **$ 5,931.00** |
| | | | | | | | | | | |
| | **Yanyula Greenbelt** | 00138 | ALARP | African Mahogany | 1300 | 24.8 | 16 | | $ 4,475.00 | $ 4,475.00 |
| | | 00139 | ALARP | African Mahogany | 950 | 24.2 | 20 | | $ 4,475.00 | **$ 8,950.00** |
| | | | | | | | | | | |
| 07/12/2018 | **Wulagi Greenbelt** | 00140 | ALARP | Corymbia Bella | 650 | 16.8 | 15 | | $ 3,475.00 | $ 3,475.00 |
| | | 00141 | ALARP | Corymbia Bella | 600 | 15.6 | 12.5 | | $ 3,475.00 | $ 6,950.00 |
| | | 00142 | ALARP | Cheese Wood | 400 | 15.4 | 15 | | $ 1,427.00 | $ 8,377.00 |
| | | 00143 | ALARP | Cheese Wood | 600 | 15.4 | 7 | | $ 1,910.00 | $ 10,287.00 |
| | | 00144 | ALARP | Cheese Wood | 750 | 15.4 | 7 | | $ 1,910.00 | $ 12,197.00 |
| | | 00145 | ALARP | Yellow Flame Tree/Pelto | 700 | 13.6 | 8.5 | | $ 3,475.00 | $ 15,672.00 |
| | | 00146 | ALARP | Corymbia Bella | 550 | 12.8 | 10 | | $ 3,475.00 | $ 19,147.00 |
| | | 00147 | ALARP | Black Wattle | 500 | 14.2 | 11 | | $ 1,910.00 | $ 21,057.00 |
| | | 00148 | ALARP | Corymbia Bella | 500 | 23 | 16 | | $ 3,475.00 | $ 24,532.00 |
| | | 00149 | ALARP | Corymbia Bella | 500 | 20 | 16 | | $ 3,475.00 | **$ 28,007.00** |
| | | | | | | | | | | |
| **13/12/2018** | **Wulagi GB West** | 00150 | ALARP | Corymbia Bella | 400 | 15.2 | 11.5 | | $ 1,427.00 | $ 1,427.00 |
| | | 00151 | ALARP | Corymbia Bella | 333 | 18.6 | 14.5 | | $ 1,427.00 | $ 2,854.00 |
| | | 00152 | ALARP | Corymbia Bella | 400 | 16.6 | 10 | | $ 1,427.00 | $ 4,281.00 |
| | | 00153 | ALARP | Corymbia Bella | 400 | 11.6 | 8 | | $ 1,277.00 | **$ 5,558.00** |
| | | | | | | | | | | |
| **13/12/2018** | **Wulagi Park** | 00154 | ALARP | African Mahogany | 900 | 18.2 | 10 | | $ 3,475.00 | **$ 3,475.00** |
| | | | | | | | | | | |
| **13/12/2018** | **Wulagi GB #2/Mathews Park** | 00155 | ARCHIVED | River Red Gum | 450 | 18.2 | 12 | | | $ - |
| | | 00156 | ALARP | River Red Gum | 300 | 14 | 11 | | $ 552.00 | $ 552.00 |
| | | 00157 | ALARP | River Red Gum | 350 | 17.6 | 10 | | $ 1,427.00 | $ 1,979.00 |
| | | 00158 | ALARP | Woolly Butt | 300 | 11.2 | 8 | | $ 490.00 | **$ 2,469.00** |
| | | | | | | | | | | |
| **14/12/2018** | **Malak Greenbelt** | 00159 | ALARP | Unidentified | 400 | 13.2 | 7 | | $ 1,910.00 | $ 1,910.00 |
| | | 00160 | ALARP | Sil | 320 | 11 | 8 | | $ 490.00 | $ 2,400.00 |
| | | 00161 | ALARP | River Red Gum | 480 | 13.4 | 10.5 | | $ 1,910.00 | $ 4,310.00 |
| | | 00162 | ALARP | Ghost Gum | 320 | 10.8 | 8 | | $ 490.00 | $ 4,800.00 |
| | | 00163 | ALARP | Ghost Gum | 223 | 10.6 | 7 | | $ 490.00 | $ 5,290.00 |
| | | 00164 | ALARP | Ghost Gum | 300 | 15.5 | 7 | | $ 490.00 | $ 5,780.00 |
| | | 00165 | ALARP | Ghost Gum | 260 | 10.2 | 7 | | $ 490.00 | $ 6,270.00 |
| | | 00166 | ALARP | Milkwood | 336 | 11.4 | 7 | | $ 490.00 | **$ 6,760.00** |
| | | | | | | | | | | |
| **17/12/2018** | **Dalwood Park** | 00167 | ALARP | African Mahogany | 1100 | 19.5 | 14 | | $ 3,475.00 | $ 3,475.00 |
| | | 00168 | ALARP | Yellow Flame Tree/Pelto | 360 | 11.8 | 8 | | $ 1,910.00 | $ 5,385.00 |
| | | 00169 | ALARP | Allosyncarpia | 560 | 15.4 | 12 | | $ 1,910.00 | $ 7,295.00 |

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|---|---|---|---|---|---|---|---|---|---|---|
| | | 00170 | ALARP | Cheese Wood | 530/200 (730) | 12.4 | 9 | | $ 1,910.00 | $ 9,205.00 |
| | | 00171 | ALARP | Weeping Fig | 1800 | 10.6 | 10.5 | | $ 1,910.00 | $ 11,115.00 |
| | | 00172 | ALARP | Black Wattle | 530 | 14.8 | 12 | | $ 1,910.00 | **$ 13,025.00** |
| | | | | | | | | | | |
| **17/12/2018** | **Holzerland Greenbelt** | 00173 | ALARP | African Mahogany | 1090 | 16.6 | 11 | | $ 3,475.00 | $ 3,475.00 |
| | | 00174 | ALARP | Mananthes | 920 | 14.2 | 7 | | $ 1,910.00 | $ 5,385.00 |
| | | 00175 | ALARP | Silver Leaf Paper Bark | 350 | 16.8 | 8.5 | | $ 490.00 | $ 5,875.00 |
| | | 00176 | ALARP | Cheese Wood | 760 | 14.4 | 6 | | $ 1,910.00 | $ 7,785.00 |
| | | 00177 | ALARP | Silver Leaf Paper Bark | 220 | 15.4 | 10 | | $ 490.00 | $ 8,275.00 |
| | | 00178 | ALARP | Mananthes | 540 | 15 | 6 | | $ 1,910.00 | $ 10,185.00 |
| | | 00179 | ALARP | Allosyncarpia | 650 | 17 | 13.5 | | $ 3,475.00 | $ 13,660.00 |
| | | 00180 | ALARP | Indian Mast Tree | 400 | 8.2 | 6 | | $ 490.00 | $ 14,150.00 |
| | | 00181 | ALARP | River Red Gum | 560 | 19 | 10.5 | | $ 3,475.00 | $ 17,625.00 |
| | | 00182 | ALARP | River Red Gum | 510 | 18 | 11.5 | | $ 3,475.00 | $ 21,100.00 |
| | | 00183 | ALARP | Mananthes | 380 | 13.6 | 10 | | $ 1,910.00 | $ 23,010.00 |
| | | 00184 | ARCHIVED | Cheese Wood | 290/360 (650) | 11.8 | 10 | | | $ 23,010.00 |
| | | 00185 | ALARP | Black Wattle | 460 | 13.6 | 6 | | $ 1,910.00 | $ 24,920.00 |
| | | 00186 | ALARP | Cheese Wood | 290 | 12.2 | 5.5 | | $ 490.00 | $ 25,410.00 |
| | | 00187 | ALARP | River Red Gum | 730 | 22 | 8 | | $ 3,475.00 | $ 28,885.00 |
| | | 00188 | ALARP | River Red Gum | 540 | 17.8 | 16 | | $ 3,475.00 | **$ 32,360.00** |
| | | | | | | | | | | |
| **18/12/2018** | **Curlew Park** | 00189 | ALARP | Yellow Flame Tree/Pelto | 200/200 (400) | 14 | 8.5 | | $ 1,848.00 | $ 1,848.00 |
| | | 00190 | ALARP | Ghost Gum | 250 | 12.4 | 9 | | $ 490.00 | $ 2,338.00 |
| | | 00191 | ALARP | Ghost Gum | 250 | 12.4 | 9 | | $ 490.00 | **$ 2,828.00** |
| | | | | | | | | | | |
| **18/12/2018** | **Kestrel Park** | 00192 | ALARP | African Mahogany | 1020 | 26.4 | 12 | | $ 4,150.00 | $ 4,150.00 |
| | | 00193 | ALARP | African Mahogany | 1010 | 23.2 | 13.5 | | $ 4,150.00 | $ 8,300.00 |
| | | 00194 | ALARP | African Mahogany | 1190 | 22.8 | 14 | | $ 4,150.00 | $ 12,450.00 |
| | | 00195 | ALARP | African Mahogany | 1040 | 23 | 18 | | $ 4,150.00 | **$ 16,600.00** |
| | | | | | | | | | | |
| **18/12/2018** | **Abbott Park** | 00196 | ALARP | Yellow Flame Tree/Pelto | 990 | 10.4 | 7.5 | | $ 1,910.00 | **$ 1,910.00** |
| | | | | | | | | | | |
| **18/12/2018** | **Mahogany Park** | 00197 | ALARP | River Red Gum | 510 | 18 | 13.5 | | $ 3,150.00 | $ 3,150.00 |
| | | 00198 | ALARP | Allosyncarpia | 570 | 15.6 | 12.5 | | $ 3,150.00 | $ 6,300.00 |
| | | 00199 | ARCHIVED | River Red Gum | 570 | 23.4 | 12.5 | | | **$ 6,300.00** |
| | | | | | | | | | | |
| **18/12/2018** | **Dickenson Park** | 00200 | ARCHIVED | River Red Gum | 450 | 17 | 12 | | | $ - |
| | | 00201 | ALARP | Black Wattle | 490 | 17 | 6 | | $ 3,150.00 | **$ 3,150.00** |
| | | | | | | | | | | |
| **18/12/2018** | **Hayball Park** | 00202 | ALARP | Silver Leaf Paper Bark | 300 | 12.4 | 8 | | $ 490.00 | $ 490.00 |
| | | 00203 | ALARP | Silver Leaf Paper Bark | 290 | 11 | 10 | | $ 490.00 | **$ 980.00** |

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|---|---|---|---|---|---|---|---|---|---|---|
| **18/12/2018** | **Whittle Park** | 00204 | ALARP | River Red Gum | 510 | 16.4 | 9 | | $ 3,150.00 | $ 3,150.00 |
| | | 00205 | ALARP | River Red Gum | 420 | 15.2 | 11.5 | | $ 1,365.00 | $ 4,515.00 |
| | | 00206 | ALARP | River Red Gum | 340 | 15.4 | 8 | | $ 1,365.00 | **$ 5,880.00** |
| | | | | | | | | | | |
| **18/12/2018** | **Robyn Lesley Park** | 00207 | ALARP | Black Wattle | 360 | 13.2 | 10 | | $ 490.00 | $ 490.00 |
| | | 00208 | ALARP | Ghost Gum | 440 | 13 | 8.5 | | $ 1,910.00 | **$ 2,400.00** |
| | | | | | | | | | | |
| **18/12/2018** | **Manunda Park** | 00209 | ALARP | Paper Bark | 290 | 15.8 | 12 | | $ 1,365.00 | $ 1,365.00 |
| | | 00210 | ALARP | Paper Bark | 410 | 18.4 | 15 | | $ 1,427.00 | $ 2,792.00 |
| | | 00211 | ALARP | Paper Bark | 650 | 13.8 | 8 | | $ 1,910.00 | **$ 4,702.00** |
| | | | | | | | | | | |
| **19/12/2018** | **Eaton Park** | 00212 | ALARP | Weeping Tea Tree | 1000 | 9 | 3 | | $ 1,910.00 | $ 1,910.00 |
| | | 00213 | ALARP | Bladder Nut | 410 | 9.2 | 8.5 | | $ 1,910.00 | **$ 3,820.00** |
| | | | | | | | | | | |
| **19/12/2018** | **Freycinet Park** | 00214 | ALARP | River Red Gum | 480 | 15.4 | 10 | | $ 3,150.00 | **$ 3,150.00** |
| | | | | | | | | | | |
| **19/12/2018** | **Peron Park** | 00215 | ALARP | River Red Gum | 530 | 16.4 | 12.5 | | $ 3,150.00 | **$ 3,150.00** |
| | | | | | | | | | | |
| **19/12/2018** | **Jingili Water Park** | 00216 | ALARP | Rain Tree | 920 | 13.8 | 8 | | $ 2,235.00 | $ 2,235.00 |
| | | 00217 | ALARP | Melville Island Bloodwood | 510 | 19.2 | 14 | | $ 3,150.00 | **$ 5,385.00** |
| | | | | | | | | | | |
| **19/12/2018** | **Cameron Park** | 00218 | ALARP | Black Wattle | 730 | 13 | 10 | | $ 1,910.00 | **$ 1,910.00** |
| | | | | | | | | | | |
| **19/12/2018** | **Borella Park** | 00219 | ALARP | African Mahogany | 1010 | 19.2 | 15.5 | 18 | $ 3,475.00 | $ 3,475.00 |
| | | 00220 | ALARP | Weeping Rosewood | 490 | 8.8 | 5 | | $ 1,910.00 | **$ 5,385.00** |
| | | | | | | | | | | |
| **19/12/2018** | **Killian Park** | 00221 | ALARP | River Red Gum | 450 | 12.2 | 10 | | $ 1,910.00 | **$ 1,910.00** |
| | | | | | | | | | | |
| **19/12/2018** | **Jingili Oval** | 00222 | ALARP | River Red Gum | 550 | 15.8 | | 5 | $ 1,910.00 | $ 1,910.00 |
| | | 00223 | ALARP | Hills Fig | 3m + | 13.6 | | 5 | $ 877.00 | $ 2,787.00 |
| | | 00224 | ALARP | River Red Gum | 620 | 20 | | 15.5 | $ 4,150.00 | $ 6,937.00 |
| | | 00225 | ALARP | River Red Gum | 390 | 15.4 | | 14 | $ 1,848.00 | $ 8,785.00 |
| | | 00226 | ALARP | Hills Fig | 3m + | 11.8 | | 6 | $ 877.00 | $ 9,662.00 |
| | | 00227 | ALARP | River Red Gum | 460 | 15.6 | | 11 | $ 3,150.00 | $ 12,812.00 |
| | | 00228 | ALARP | Hills Fig | 3m + | 9.6 | | 6 | $ 877.00 | **$ 13,689.00** |
| | | | | | | | | | | |
| **19/12/2018** | **Darwin General Cemetary** | 00229 | ALARP | African Mahogany | 540 | 14 | | 3.5 | $ 1,910.00 | $ 1,910.00 |
| | | 00230 | ALARP | Black Wattle | 620 | 9.4 | | 3.5 | $ 1,910.00 | $ 3,820.00 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 00231 | ALARP | African Mahogany | 880 | 16.2 | | 3.5 | $ 3,475.00 | $ 7,295.00 |
| | | 00232 | ALARP | African Mahogany | 600 | 16 | | 3.5 | $ 3,150.00 | $ 10,445.00 |
| | | 00233 | ALARP | African Mahogany | 620 | 17.2 | | 3.5 | $ 3,150.00 | $ 13,595.00 |
| | | 00234 | ALARP | African Mahogany | 470 | 14 | | 3.5 | $ 1,910.00 | $ 15,505.00 |
| | | 00235 | ALARP | African Mahogany | 760 | 20.2 | | 3.5 | $ 4,475.00 | $ 19,980.00 |
| | | 00236 | ALARP | African Mahogany | 590 | 17.6 | | 3.5 | $ 3,150.00 | $ 23,130.00 |
| | | 00237 | ALARP | African Mahogany | 550 | 17 | | 3.5 | $ 3,150.00 | $ 26,280.00 |
| | | 00238 | ALARP | African Mahogany | 770 | 20.8 | | 3.5 | $ 4,475.00 | $ 30,755.00 |
| | | 00239 | ALARP | African Mahogany | 800 | 21.6 | | 18.5 | $ 4,475.00 | $ 35,230.00 |
| **20/12/2018** | | 00240 | ALARP | Ghost Gum | 350/340 (690) | 12.4 | | 5.75 | $ 1,910.00 | $ 37,140.00 |
| | | 00241 | ALARP | Ghost Gum | 500/350/280 (1130) | 12.4 | | 11.5 | $ 2,235.00 | $ 39,375.00 |
| | | 00242 | ALARP | River Red Gum | 510 | 14.6 | | 11.5 | $ 1,910.00 | $ 41,285.00 |
| | | 00243 | Medium | River Red Gum | 680 | 16.2 | | 11.5 | $ 3,150.00 | $ 44,435.00 |
| | | 00244 | ALARP | River Red Gum | 540 | 15.8 | | 11.5 | $ 3,150.00 | $ 47,585.00 |
| | | 00245 | ALARP | River Red Gum | 480 | 16 | | 11.5 | $ 3,150.00 | $ 50,735.00 |
| | | 00246 | ALARP | River Red Gum | 420 | 19.4 | | 12 | $ 3,150.00 | **$ 53,885.00** |
| | | | | | | | | | | |
| **20/12/2018** | **Byrne Park** | 00247 | ALARP | Mananthes | 360 | 12.8 | 8 | | $ 490.00 | $ 490.00 |
| | | 00248 | ALARP | Mananthes | 390 | 10 | 8 | | $ 1,848.00 | **$ 2,338.00** |
| | | | | | | | | | | |
| **20/12/2018** | **Wilson Park** | 00249 | ALARP | Burmese Rosewood/Paduk | 440 | 11.6 | 9.5 | | $ 1,910.00 | $ 1,910.00 |
| | | 00250 | ALARP | Hills Fig | 3m + | 12 | 10 | | $ 2,235.00 | **$ 4,145.00** |
| | | | | | | | | | | |
| **20/12/2018** | **Thornton Park** | 00251 | ALARP | African Mahogany | 1190 | 20.4 | 13.5 | 8 | $ 3,475.00 | **$ 3,475.00** |
| | | | | | | | | | | |
| **20/12/2018** | **Greenwood Park** | 00252 | ALARP | Yellow Flame Tree/Pelto | 480 | 9.6 | | 6 | $ 1,910.00 | $ 1,910.00 |
| | | 00253 | ALARP | Mananthes | 240/230 (470) | 11.6 | | 5 | $ 1,910.00 | $ 3,820.00 |
| | | 00254 | ALARP | Bladder Nut | 200 | 8.4 | | 6 | $ 490.00 | $ 4,310.00 |
| | | 00255 | ALARP | Mananthes | 290 | 9.6 | | 5.5 | $ 490.00 | $ 4,800.00 |
| | | 00256 | ALARP | Allosyncarpia | 290 | 12 | | 4 | $ 490.00 | $ 5,290.00 |
| | | 00257 | ALARP | Banyan | 2000 | 9.4 | | 5 | $ 2,235.00 | $ 7,525.00 |
| | | 00258 | ALARP | Black Wattle | 300 | 13.8 | | 10.5 | $ 490.00 | $ 8,015.00 |
| | | 00259 | ALARP | Black Wattle | 610 | 13.8 | | 6.5 | $ 1,910.00 | $ 9,925.00 |
| | | 00260 | ALARP | Mimusops | 190 | 6.6 | | 5 | $ 264.00 | $ 10,189.00 |
| | | 00261 | ALARP | Long Leaf Fig | 2000 | 11.4 | | 5 | $ 2,235.00 | $ 12,424.00 |
| | | 00262 | ALARP | Yellow Flame Tree/Pelto | 600 | 9.2 | | 6 | $ 1,910.00 | $ 14,334.00 |
| | | 00263 | ALARP | Poinciana | 620 | 11 | | 5 | $ 1,910.00 | $ 16,244.00 |
| | | 00264 | ALARP | Bladder Nut | 230 | 11.4 | | 9.5 | $ 490.00 | $ 16,734.00 |
| | | 00265 | ALARP | Black Wattle | 580 | 13.5 | | 5 | $ 1,910.00 | **$ 18,644.00** |
| | | | | | | | | | | |
| **20/12/2018** | **Moil Oval** | 00266 | ALARP | River Red Gum | 200 | 11.6 | | 4 | $ 490.00 | $ 490.00 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 00267 | ALARP | River Red Gum | 410/380 (790) | 16.2 | | 8.5 | $ 3,475.00 | $ 3,965.00 |
| | | 00268 | ALARP | Burmese Rosewood/Paduk | 470 | 15.6 | | 11 | $ 3,150.00 | $ 7,115.00 |
| | | 00269 | ALARP | Yellow Flame Tree/Pelto | 340/200 (540) | 11.8 | | 8 | $ 1,910.00 | $ 9,025.00 |
| | | 00270 | ALARP | Northern Cypress Pine | 600 | 13.4 | | 10 | $ 1,910.00 | **$ 10,935.00** |
| | | | | | | | | | | |
| | **Killupa Park** | 00271 | **ARCHIVED** | Corymbia Bella | 230/230 (450) | 12.8 | 10 | | $ 1,910.00 | |
| | | | | | | | | | | |
| **21/12/2018** | **Groote Park** | 00272 | ALARP | | 250 | 9.4 | | 6 | $ 490.00 | $ 490.00 |
| | | 00273 | ALARP | Stringy Bark | 460 | 14.6 | | 12.5 | $ 1,910.00 | $ 2,400.00 |
| | | 00274 | ALARP | Allosyncarpia | 150/210 (360) | 9.4 | | 3 | $ 490.00 | $ 2,890.00 |
| | | 00275 | ALARP | Allosyncarpia | 250 | 9.4 | | 2.5 | $ 490.00 | $ 3,380.00 |
| | | 00276 | ALARP | Weeping Rosewood | 280 | 7.2 | | 4.5 | $ 490.00 | $ 3,870.00 |
| | | 00277 | ALARP | Weeping Rosewood | 430 | 7.2 | | 6 | $ 1,910.00 | $ 5,780.00 |
| | | 00278 | ALARP | Black Wattle | 230/240 (470) | 8.6 | | 7 | $ 1,910.00 | $ 7,690.00 |
| | | 00279 | ALARP | Woolly Butt | 280 | 9.6 | | 4 | $ 490.00 | $ 8,180.00 |
| | | 00280 | ALARP | Banyan | 1500 | 7.6 | | 4.5 | $ 2,235.00 | $ 10,415.00 |
| | | 00281 | ALARP | Kath. Gorge Bloodwood | 220 | 11.4 | | 8 | $ 490.00 | $ 10,905.00 |
| | | 00282 | ALARP | Black Wattle | 230/230(460) | 7.2 | | 3.5 | $ 1,910.00 | $ 12,815.00 |
| | | 00283 | ALARP | Allosyncarpia | 280 | 11.4 | | 8 | $ 490.00 | $ 13,305.00 |
| | | 00284 | ALARP | Stringy Bark | 350 | 15.6 | | 1.5 | $ 1,365.00 | $ 14,670.00 |
| | | 00285 | ALARP | Stringy Bark | 240 | 13.6 | | 8 | $ 490.00 | $ 15,160.00 |
| | | 00286 | ALARP | Bloodwood | 210 | 10.6 | | 8 | $ 490.00 | $ 15,650.00 |
| | | 00287 | ALARP | Blood Wood | 140 | 10.8 | | 8 | $ 490.00 | $ 16,140.00 |
| | | 00288 | ALARP | E. Polycarpa | 290 | 11.4 | | 7.5 | $ 490.00 | $ 16,630.00 |
| | | 00289 | ALARP | Yellow Flame Tree/Pelto | 230 | 7.4 | | 4 | $ 490.00 | **$ 17,120.00** |
| | | | | | | | | | | |
| **21/12/2018** | **Wagaman Oval Surround** | 00290 | ALARP | Mananthes | 360 | 7.4 | | 4.5 | $ 490.00 | $ 490.00 |
| | | 00291 | ALARP | River Red Gum | 320 | 14 | | 8.5 | $ 490.00 | **$ 980.00** |
| | | | | | | | | | | |
| **21/12/2018** | **Colster Park, Wagaman** | 00292 | ALARP | Allosyncarpia | 450 | 13.6 | | 8 | $ 1,848.00 | $ 1,848.00 |
| | | 00293 | ALARP | Terminallia | 260 | 8.6 | | 2.5 | $ 490.00 | $ 2,338.00 |
| | | 00294 | ALARP | River Red Gum | 200 | 9 | | 3 | $ 490.00 | $ 2,828.00 |
| | | 00295 | ALARP | Beauty Leaf | 260/240 (500) | 10.2 | | 4 | $ 1,910.00 | $ 4,738.00 |
| | | 00296 | ALARP | Poinciana | 310/300 (610) | 10.4 | | 4 | $ 1,910.00 | $ 6,648.00 |
| | | 00297 | **ARCHIVED** | Weeping Rosewood | 260/360 (620) | 10.6 | | 6 | | $ 6,648.00 |
| | | 00298 | ALARP | Corymbia Bella | 180 | 8.2 | | 4 | $ 490.00 | $ 7,138.00 |
| | | 00299 | ALARP | Weeping Rosewood | 260/230 (490) | 9.2 | | 5 | $ 1,910.00 | $ 9,048.00 |
| | | 00300 | ALARP | Mananthes | 260 | 8.4 | | 6 | $ 490.00 | $ 9,538.00 |
| | | 00301 | ALARP | Mananthes | 280 | 10.4 | | 9.5 | $ 490.00 | $ 10,028.00 |
| | | 00302 | ALARP | Yellow Flame Tree/Pelto | 320/120 (440) | 10.2 | | 3 | $ 1,910.00 | $ 11,938.00 |
| | | 00303 | ALARP | Corymbia Bella | 190/160 (350) | 10.4 | | 7 | $ 490.00 | $ 12,428.00 |

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|---|---|---|---|---|---|---|---|---|---|---|
| | | 00304 | ALARP | Banyan | 1000 | 8.8 | | 7 | $ 2,235.00 | $ 14,663.00 |
| | | 00305 | ALARP | Mananthes | 300 | 10.2 | | 7 | $ 490.00 | $ 15,153.00 |
| | | 00306 | ARCHIVED | Black Wattle | 600 | 11.4 | | 3 | | $ 15,153.00 |
| | | 00307 | ALARP | Allosyncarpia | 370 | 12.2 | | 9 | $ 1,848.00 | $ 17,001.00 |
| | | 00308 | ALARP | Beauty Leaf | 230 | 6.4 | | 2.5 | $ 264.00 | **$ 17,265.00** |
| | | | | | | | | | | |
| **21/12/2018** | **Amsterdam Park** | 00309 | ALARP | Cheese Wood | 640 | 10.4 | 5 | | $ 2,235.00 | $ 2,235.00 |
| | | 00310 | ALARP | African Mahogany | 620 | 17.2 | 16 | | $ 3,475.00 | $ 5,710.00 |
| | | 00311 | ALARP | Allosyncarpia | 320 | 11.8 | | 9 | $ 490.00 | $ 6,200.00 |
| | | 00312 | ALARP | Weeping Rosewood | 480 | 10.4 | | 7.5 | $ 1,910.00 | $ 8,110.00 |
| | | 00313 | ALARP | Allosyncarpia | 310 | 9.8 | | 7.5 | $ 490.00 | **$ 8,600.00** |
| | | | | | | | | | | |
| **21/12/2018** | **Tasman Park** | 00314 | ALARP | Mananthes | 320 | 11 | | 6 | $ 490.00 | $ 490.00 |
| | | 00315 | ALARP | Burmese Rosewood/Paduk | 350 | 14 | | 12 | $ 490.00 | $ 980.00 |
| | | 00316 | ALARP | Neem Tree | 800 | 7.8 | | 4 | $ 1,910.00 | $ 2,890.00 |
| | | 00317 | ALARP | Poinciana | 1000 | 9.4 | | 6 | $ 1,910.00 | $ 4,800.00 |
| | | 00318 | ALARP | Mananthes | 290 | 9.8 | | 6 | $ 552.00 | $ 5,352.00 |
| | | 00319 | ALARP | Ghost Gum | 280/250 (530) | 14 | | 7 | $ 2,235.00 | $ 7,587.00 |
| | | 00320 | ALARP | River Red Gum | 230 | 11.4 | | 5.5 | $ 490.00 | $ 8,077.00 |
| | | 00321 | ALARP | Mimusops | 280 | 11.4 | | 9.5 | $ 490.00 | **$ 8,567.00** |
| | | | | | | | | | | |
| | | | | | | | | | | **$ 570,843.00** |
| | **Fong Park** | | | | | | | | | |
| | **Wanguri Park** | | | | | | | | | |
| | **Calvert Park** | | | | | | | | | |
| | **Tiwi Oval/Park** | | | | | | | | | |
| | **Koolpinyah Park** | | | | | | | | | |
| | **Savannah Park** | | | | | | | | | |
| | **Wanguri Oval/Park** | | | | | | | | | |
| | **Abala Road Reserve** | | | | | | | | | |
| | **Anula Oval** | | | | | | | | | |
| | **Marrakai Park** | | | | | | | | | |
| | **Lioness Park** | | | | | | | | | |
| | **Grebe Park** | | | | | | | | | |
| | **Holzerland Park** | | | | | | | | | |
| | **Rosella Park** | | | | | | | | | |
| | **Garanmunuk Park** | | | | | | | | | |
| | **Marrabala Park** | | | | | | | | | |
| | **William Forster Park** | | | | | | | | | |
| | **Dawarra Park** | | | | | | | | | |
| | **Matia Park** | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| | Dangoerra Park | | | | | | | | | |
| | Juliet Shields Park | | | | | | | | | |
| | Ted Rowe Park | | | | | | | | | |
| | Tommy Lyons Park | | | | | | | | | |
| | Colin Street Parkland/Muirhead Water Park | | | | | | | | | |
| | Bilinga Park | | | | | | | | | |
| | Philpott Street Parkland | | | | | | | | | |
| | Changsha Crescent Parkland | | | | | | | | | |
| | Bailey Circ Park | | | | | | | | | |
| | Blackburn Street Park | | | | | | | | | |
| | Muirhead Dog Park | | | | | | | | | |
| | Withnall Street Park | | | | | | | | | |
| | Bowditch Street Park | | | | | | | | | |
| | Wulagi Oval | | | | | | | | | |
| | Malak Oval | | | | | | | | | |
| | Holzerland Park | | | | | | | | | |
| | Bayfield Park | | | | | | | | | |
| | Jabiru Park | | | | | | | | | |
| | Plover Park | | | | | | | | | |
| | Mueller Park | | | | | | | | | |
| | Creber Park | | | | | | | | | |
| | Linde Park | | | | | | | | | |
| | Butters Park | | | | | | | | | |
| | Bains St. Buffers | | | | | | | | | |
| | Lippia Ct | | | | | | | | | |
| | | | | | | | | | | |

Reports, recommendations and supporting documentation can be accessed via the City of Darwin Council Website at www.darwin.nt.gov.au, at Council Public Libraries or contact the Committee Administrator on (08) 8930 0670.

NINETEENTH ORDINARY COUNCIL MEETING – OPEN SECTION
TUESDAY, 17 JULY 2018 ORD07/7

**14.1 OFFICERS REPORTS (ACTION REQUIRED)**

**14.1.2 Trees in the Darwin Municipality - Update July 2018**
Report No. 18CO0039 CB:jw (17/07/18) Common No. 3777063

(Pangquee/Palmer)

A. THAT Report Number 18CO0039 CB:jw entitled Trees in the Darwin Municipality - Update July 2018, be received and noted.

B. THAT Council, pursuant to Sections 54 and 55 of the Local Government Act, establish the Tree Re-establishment Advisory Committee.

C. THAT Council endorse the Terms of Reference for the Tree Re-establishment Advisory Committee at **Attachment B**, as amended to include:

- An Elected Member as a member
- Other experts as required
- A timeframe of 12 weeks
- Public distribution of business papers

to Report Number 18CO0039 CB:jw entitled Trees in the Darwin Municipality - Update July 2018.

D. THAT a further report be presented to Council to appoint members of the Tree Re-establishment Advisory Committee in accordance with the Local Government Act.

E. THAT Council endorse the level of infrastructure, other than powerlines, considered for risk management purposes in the proposed survey of Council parks for trees located in close proximity to property and powerlines to be the principal residence of a property.

DECISION NO.22\0922 (17/07/18) Carried 9/3

ACTION: ACTING GENERAL MANAGER CITY OPERATIONS

# DRAFT

# TREE MANAGEMENT PLAN 2017

*The best time to plant a tree was 20 years ago. The second best time is now.*

Prepared for the City of Darwin by:

bill sullivan
consulting arborist



Contractors Edition V1.

| CITY OF DARWIN | | TREE MANAGEMENT PLAN<br><br>Contractors Edition | Document number | 0000000 |
|---|---|---|---|---|
| | | | Date of Initial Issue | 00/00/2017 |
| | | | Current Version Issue | V 1. |
| Author | Bill Sullivan | | Issue status | Released |
| Approved By | Manager, Infrastructure | | Next Review Date | 01/07/2018 |
| Process | Consultative | | Reviewed by | |

The TMP will cover in sequential order, the following;

a) Protocols for site and species selection
b) List of preferred Tree Species
c) Nursery Stock selection
d) Planting and establishment techniques
e) Tree pruning techniques
f) Visual Tree risk Assessment including;
    - Level 1 Visual Tree Risk Inspection
    - Level 2 Visual Tree Risk Assessment
    - Level 3 Visual Tree Risk Assessment
g) Protocols for tree removal
h) Arborist Qualifications

# TREE MANAGEMENT PLAN.

## Foreword.

**Trees can survive in in a built environment but only if the system by which the tree lives is not impaired by the development that it is supposed to enhance.**

Definition of Forest: A large area dominated by trees (Wikipedia)

A forest is a complex, biodiverse system that is:

- Regenerative
- Self sustaining
- Unregulated
- Resilient
- Inter-dependent – plants, insects, microbes, mycorrhiza, invertebrates, birds and animals

Definition of Urban Forest: A densely wooded area located in a city (Oxford Dictionary)

Within the City of Darwin there are a limited number of parks and some suburban streets that may qualify as an "Urban Forest". Mostly, the tree-scapes in Darwin are limited to individual trees planted at various intervals along the street verges and in some median strips.

In recent times, the tree plantings of the more upright species have been preferred with the result that canopy cover is restricted and does not extend across streets or footpaths so that much of the benefits associated with an "Urban Forest" is lost in that the trees are not assisting in lowering the heat island effect and are more ornamental than functional. Whereas, they should be both.

The conventional practice of over pruning to "manage" tree health and public safety is also reducing the canopy effect and reducing trees useful life expectancy (ULE).

With the introduction of the NEMUS Tree Management System all of the individual trees within the City precincts can be identified and monitored, with all new plantings recorded at planting and monitored throughout their life time.

With access to reliable, retrievable, long term data, good design and planning of tree placement the City of Darwin will not only be better able to manage its present tree stocks but ensure that the "Urban Forest" concept with all of the associated benefits can be a reality in the future.

*"Trees are one of the most cost-effective means to reduce urban heat island effects and transform our urban environments to create prosperous, livable cities. However, in less than two decades, Darwin will have lost one in two street trees due to age and natural decline. On top of this, new developments and increased population densities will result in major tree losses from private land. When considering this in combination with our tropical climate, forecast temperature increases and the known heat island effect, we can expect the maximum temperature in the CBD by two to five degrees within thirty years. The energy cost associated with such a temperature increase would be significant.*

*The role of trees in controlling the microclimate and reversing this effect is recognized as a cost-effective approach. But to be most effective, it requires a complete re-think of how trees are viewed in Darwin and particularly central Darwin. For example, instead of seeing trees as ornaments, we need to see them as critical infrastructure. Rather than thinking of them as having no monetary worth, we need to recognize their economic value. We need to focus on overall tree canopies rather than individual trees." (extract from Cooling a Tropical City by Tony Cox and Lawrence Nield)*

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TREE MANAGEMENT PLAN.

Introduction.
The costs, financial and social of not managing trees correctly can be high. Trees, just like any other infrastructure, need to be managed to maximize their benefits, minimize any adverse effects and control the costs. Trees are biological assets which do not always behave in the way man would necessarily like, are prone to many factors outside the control of the tree owner, their life cycle can vary enormously, cannot be accurately predicted and requires on-going evaluation.

Trees take many years to reach maturity and provide maximum benefits to the community and the local ecology. The retention and protection of mature trees in particular is vital in an expanding and ever changing urban environment as they cannot be easily replaced.
The overall tree asset is made up of thousands of individual components, each of which behaves very differently.

The greening of Darwin commenced in 1975 after the city was devastated by Cyclone Tracy. The Darwin Reconstruction Commission, in conjunction with the NT Government, City of Darwin and various community groups planted many thousands of trees throughout Darwin, especially in the northern suburbs. Many unsuitable tree species were planted and this continued in an ad hoc manner throughout the 1970's and 80's with the result that the City of Darwin has now for some time been dealing with the resultant problems including;

- Damage caused by root systems to footpaths, roads, driveways, fences, buildings and underground services
- Limb failure causing damage to cars, homes and other infrastructure
- Whole tree failure due to inadequate or incorrect planting techniques
- Large trees planted under aerial service infrastructure, including power lines
- Over planting in parks causing phototropism
- Structural defects in trees caused by lack of formative pruning.

Management (or lack of) of the tree asset was, for many years generally detrimental to the long term health and structure of the trees due in a large part to the acute shortage of qualified Arborists in Darwin and a general lack of understanding and/or knowledge of the need for proper arboricultural techniques to be used when managing trees.

The cost of not correctly managing a large tree asset can be significant.

Many tree management practices in the past have been based on short term goals and "people needs" rather than "tree needs". This is changing and Arboriculture as a science has progressed significantly in recent years and the City of Darwin is embracing this change by employing and training Arborists up to Diploma Level. There is now a scientific basis and understanding of tree physiology, branch and trunk structure, wound response, root growth and correct pruning and maintenance techniques.

There is insufficient detailed information on the total number, species and condition of the tree population in Darwin. While some data on the councils trees has been collected and recorded it is not readily retrievable and not at all in the field. This is inefficient and steps are being taken to rectify the problem.

An asset cannot be effectively managed if the manager does not have detailed information on the asset. An inventory of all trees including location, size, species, condition, defect profile and site conditions provides the basis for making informed decisions. It is also essential to be able to interrogate the data and keep the information up to date.

In 2016 the City of Darwin, engaged the services of Arboricultural Consultant, Bill Sullivan, to review the Council's procedures, strategies, and work practices and to develop a comprehensive Tree Management Plan from planting to maturity and beyond

One of the key findings of the review was that Council did not have an effective tree data base from which data could be entered and retrieved in the field. This deficiency meant that Council Arborists had no historical

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data to assist with managing tree stocks and when assessing trees during regular inspections the Arborist had to re-enter all relevant data at every inspection. This was time consuming but this lack of historical data was also deficient in informing the Arborist of any previous problems or hazard reduction work on a particular tree.

Investigations by the Consultant into several off-the-shelf Tree Management Software systems, discounted most of these as being too inflexible and not suitable for the result desired by the City of Darwin. The reasons for this were discussed in a Report presented to the City of Darwin.

The NEMUS Tree Management Software, however was considered to be the most suitable as it consisted of a basic program which could then be tailor made to the Council's specific requirements and therefore this program was selected by Council to be the most suitable to meet its' needs into the future.

A period of consultation between Asset Edge (Developer of NEMUS) the Urban Forest Management Team and the Consultant and a 3 month trial period, ensured that all of the requirements were identified prior to introducing the NEMUS program into everyday use.

The use of NEMUS by council Arborists and Contractors means that not only can existing trees be entered into an easily retrievable data base at their initial assessment but that all work carried performed on individual trees is now recorded, all new plantings are entered and there is then the ability to record the lifetime history of these trees.

The City of Darwin commenced using the NEMUS Tree Management System (NEMUS) as its tree management tool in November, 2017.

The NEMUS Tree Management System is comprised of two distinct but linked components. Viz;

1. A Tablet based system for the collection and retrieval of data in the field, and
2. A Web based system that holds all data collected from which a variety of Reports can be generated

- All information is held in a secure website dedicated to the City of Darwin with multi-level security.
- Reports can be generated in Microsoft Word, PDF or Excell. Multiple images of each tree can be captured and stored.
- GPS coordinates are automatically logged for each tree entered, coordinates also appear on the tree photo/s thus creating a permanent location for each tree.
- A ***Tracking*** system on Nemus ensures that the subject tree is in the correct location on the map/satellite image.
- All Tree Risk Assessments are logged and stored on NEMUS using ***THE MATRIX©*** VISUAL TREE RISK ASSESSMENT SYSTEM thus creating a permanent history of each individual tree.

***The Matrix ©*** Visual Tree Risk Assessment System was developed by Bill Sullivan and has been specifically tailored for use with the Nemus Tree Management System.

This Risk Assessment System relies on the knowledge, skills and training of the Assessing Arborist using a simple Risk Matrix compatible with ISO 31000-2009, which is the International Standard for Risk Management.

The lowest level of risk under both ISO 3100 and The Matrix VTRA is ALARP (As Low As Reasonably Possible)

There are two levels of Inspection/Assessment plus a Follow Up Assessment ;

- Level 1 – a basic tree inspection that identifies a possible hazardous tree and requests a full Level 3 Assessment by a Qualified Diploma Level Arborist

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- Level 3 – A comprehensive Visual Tree Risk Assessment (VTRA) by an Arborist holding as a minimum, a Diploma of Arboriculture.
- Follow Up Assessment which must be performed by a Diploma Level Arborist and ascertains that the control measures identified by the Level 3 Assessment have been completed to the required standard (AS 4373- 2007) and the Risk Status of the tree is then designated as ALARP.

***The Matrix©*** VTRA is the only risk assessment method that has a Follow Up Assessment. This assessment is mandatory and a tree previously designated as hazardous cannot be returned to ALARP status until the Follow Up Assessment is completed.

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**1. The Benefits of Trees:**

Trees are an essential part of the urban landscape, they are just as important as other infrastructure such as roads, footpaths and bus stops. They provide significant economic, social and ecological benefits and in many cases their care and maintenance may be considered more important than built infrastructure as they are not as easily replaced. You can build a footpath in days; a tree takes years.

A well-managed Urban Forest has significant benefits including;

a. Improved property values
b. Provide a pleasant softening effect on the built environment
c. Enhance architecture – buildings look better in the company of suitable trees
d. Decrease the heat island effect by shading roads and car parks, reducing bitumen temperatures by up to 13° Celsius thus reducing the costs of road maintenance
e. Create more desirable spaces for movement and recreation
f. Trap carbon and produce oxygen
g. Ameliorate extremes of noise, wind, sunlight, temperature and air pollution
h. Help to screen out traffic noise
i. Provide the opportunity to establish distinct neighborhood character
j. Provide habitat and food for wildlife
k. Form corridors for the movement and refuge of wildlife
l. Reduce the impacts of rainfall runoff and reduce erosion

**2. Scope.**

This Tree Management Plan (TMP) will effectively guide the City of Darwin and its' Urban Forest Management (UFM) team in all aspects of Tree Management into the future. As with all management plans it should remain a "live" document subject to reviews on a least a biennial occurrence, particularly with regard to technological advances in information technology.

The TMP will cover in sequential order, the following;

i) Scope and use of Nemus Tree Management System
j) Protocols for site and species selection
k) List of preferred Tree Species
l) Nursery Stock selection
m) Planting and establishment techniques
n) Tree pruning techniques
o) Quarterly Inspections and Assessments
p) Bi-annual Inspections and Assessments
q) Visual Tree risk Assessment including;
    - Level 1 Visual Tree Risk Inspection
    - Level 3 Visual Tree Risk Assessment
r) Protocols for tree removal
s) List of Significant and Heritage Trees
t) Heritage, Significant and Veteran Tree Management
u) Protection of Trees on Development Sites
v) Arborist Qualifications
w) Land Use planning
x) Co-ordination with other Service Providers

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## 3. Nemus Tree Management System.

### 3.1 Scope.

The Nemus Tree Management System is a Web based system that has been developed in Australia by AssetEdge and designed specifically for Councils and other tree managers with large tree inventories.

The software is designed to record and manage all of the Council's Tree Data by utilizing both web and android interfaces to provide onsite data collection and analysis as well as office desktop planning and reporting.

This is achieved by collecting data on site by smart phone or tablet with simple "drop down" pick lists and key entry. All information including date, time, images, GPS coordinates and risk assessment is stored on the device then synchronized to a central server using the mobile phone network or wireless networks.

All inspection records, risk analysis and tree data can then be viewed, analyzed and managed from any desk top computer that has an internet connection. The tree data and the last inspection report are also retrievable by Arborists in the field.

Each user has a secure login and password to ensure security of the data. Only personnel with Administrator access can make changes to the system. The benefits of using Nemus include:

- Secure website dedicated to City of Darwin with multi-level security
- User defined attributes for specific asset and inspection data collection
- On-site access and data retrieval
- Individual tree search by species, characteristics or location
- Automatic cross reference from common name to Genus, species etc.
- Cost effective
- Mapping tools
- Enables Council to record & store individual tree data from planting to senescence or removal
- From January 2018 there will be a separate data base dedicated to new tree plantings. This will enable Council to plan it's planting program and to plan and monitor it's watering and pruning program of all new plantings until they are transferred onto the main data base.

### 3.2 Use of Nemus

Nemus will be used by all Council Arborists and accredited Council contractors; the Risk Assessment system incorporated into Nemus is based on ISO 31000-2009, which is the overarching generic Risk Assessment Standard from the International Organization for Standardization (ISO)

*The Matrix©* Visual Tree Risk Assessment referred to in this TMP was developed by Consulting Arborist, Bill Sullivan using ISO 31000-2009 as the baseline.

**The Nemus Tree Management System and *THE MATRIX©* Visual Tree Risk Assessment System referred to above are the only systems to be used when assessing risk and recording data on Council trees. Both of these management tools have been endorsed by the City of Darwin.**

It will be many years into the future before all trees managed by the Council are recorded on Nemus, due to the large amount of trees on Council land. However, from the implementation of this TMP every tree planted by Council will be recorded, every tree inspected or assessed by a Council Arborist or contractor will be recorded on the system with any changes to the tree's characteristics recorded at each subsequent inspection. Each Risk Assessment and any hazard reduction work will also be recorded.

Over time this will give Council Officers a complete history of individual trees, of the suitability of different species in different situations. It will also greatly assist with future management planning including the possibility of a species specific disease outbreak whereby all trees of a similar species can be identified by location and appropriate measures can be actioned to prevent the spread of the disease.

**4. Protocols for Site and Species Selection.**

In any Forest, but particularly the Urban Forest, diversity is the key to long term sustainability of that forest. This diversity is relevant to the percentage of single family, genus and species planted and the percentage of similar age trees not only in the overall tree population but in individual suburbs.

The planning of new and replacement trees in Darwin must take a long term view given that the Useful Life Expectancy of a tree from planting to senescence could be in excess of 50 years.

**4.1 Species Diversity.**

Having a large representation of one particular family, genus or species leaves the Urban Forest vulnerable to both pest and disease outbreak that is family, genus or species specific. For this reason in particular, it is important to avoid planting suburban monocultures.

For example, the pathogen Myrtle Rust (*Puccinia psidii)* was discovered on Melville Island in 2015 and is believed to have spread to the mainland around Darwin. All of the family *Myrtaceae* including all *Eucalypts, Callistemon, Melaleuca, Leptospermum and Syziggium* are susceptible to this disease. *Fusarium* fungal disease has devastated the Weeping Rosewood population in the Top End.

Frequently quoted, although not scientifically based, the rule of thumb in the United States and in Australia's major cities suggest the Urban Forest should be made up of no more than;

- 30% of a Family
- 20% of a Genus
- 10% of a Species

Although nothing can be done regarding existing percentages, planning for the future should be taking into account the dangers of putting all of the eggs in one basket, so to speak. However, species diversity may be constrained by the size and availability of planting sites particularly for large trees on streets.

Species diversity is also an important consideration for adding colour and contrast to the city. A mix of both native and exotic species will add colour as mostly they will flower during different seasons. Northern Territory natives do not, as a rule produce vibrantly coloured flowers, so adding exotic, flowering species adds colour diversity to the urban forest.

**4.2 Age Diversity.**

Good age diversity is essential to future population stability. Species that have proven adaptability to the Darwin environment and soil types should be stabilized by ensuring that the population of that species has a broad age range. In street trees, populations depend primarily on the longevity of individual trees and sufficient numbers of successfully planted replacements.

On an economic level, age diversity means that maintaining the Urban Forest becomes a more evenly paced process. For instance, mass tree removal caused by the impending senescence of a large number of trees is avoided thereby reducing strain on that year's budget.

Avoiding large numbers of removals in the one year also lessens the impact those removals will have on the overall appearance of the Urban Forest and also on the public's response to those removals.

**4.3 Size.**

Size and structure of trees in the Urban forest will be dictated by a number of things;

- Location
- Available space
- Soil types
- Park or street tree
- Purpose
- Proximity of either underground and overhead services

- Tree selection must be appropriate for the space available and the purpose required.
- The species selected should be the largest, longest living species available for a particular site.
- Upright growing species are preferable for sites with limited space whilst larger areas, roadways and wider streets should preference large spreading species to cast wider shade patterns.

A large, strategically located tree has a bigger impact on conserving energy and mitigating the urban heat island effect than a number of smaller trees. Larger trees cast more shade for longer periods and therefore project a more salubrious outlook as well as longer periods of heat reduction.

Larger trees do more to;

- Reduce storm water runoff
- Extend the life of street surfaces
- Improve local air, soil and water quality
- Reduce atmospheric carbon dioxide
- Provide wildlife habitat
- Increase property values
- Enhance the attractiveness of the local area
- The bigger the tree the larger the benefits

**5. Planting sites**

An optimal planting site allows space for uninhibited root development (in volume, surface area and shape of surface area) provides un-compacted soil, good solar access, provides sufficient space away from adjacent infrastructure and vehicular traffic and not limited by overhead service wires etc.

Selection of an appropriate planting site is a crucial factor in determining the long-term viability and cost effectiveness of a street tree. A poorly positioned tree has the potential to diminish the visual appeal of a streetscape, cause structural damage, become hazardous or require excessive spending on pruning and maintenance.

Darwin has a wide variety of soils including many rocky areas particularly along the foreshore cliff. Where planting is planned in these areas extra-large holes need to be provided to allow the structural roots to expand naturally, otherwise root girdling will occur within the hole or roots will be either on the surface or shallow.

In normal planting situations a planting hole at least 3 times larger (in diameter) than the root ball and at least as deep as the root ball (if deeper it must be back filled) must be provided. This hole must not be drilled with a round auger as this will cause circling roots, restricting the trees ability to grow.

When planting on concrete footpaths, median strips, bitumen car parks and in paved areas such as the Darwin Mall, tree pits must be provided in order to facilitate good root development and tree growth. There are several tree pit products commercially available, such as the examples below.

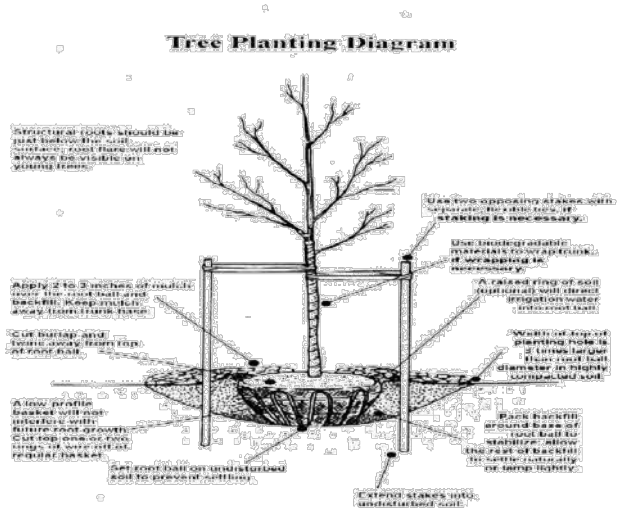
Planting trees in the CBD streets, car parks or other concrete/bitumen area without Tree Pits of a minimum $20^2$ metres is really a waste of time and money. Permanent irrigation in these areas is also essential as is storm water drainage.

*A quality tree install utilizing an appropriate sized tree pit and irrigation for a large shade tree that is anticipated to provide $80^2$ of shade within 6 – 7 years will cost $5,000 - $10,000. A cost of $62.50 - $125.00 per square metre of shade. A similar sized awning would cost $800.00 - $1,200.00 per square metre. (Source: Clouston Associates)*

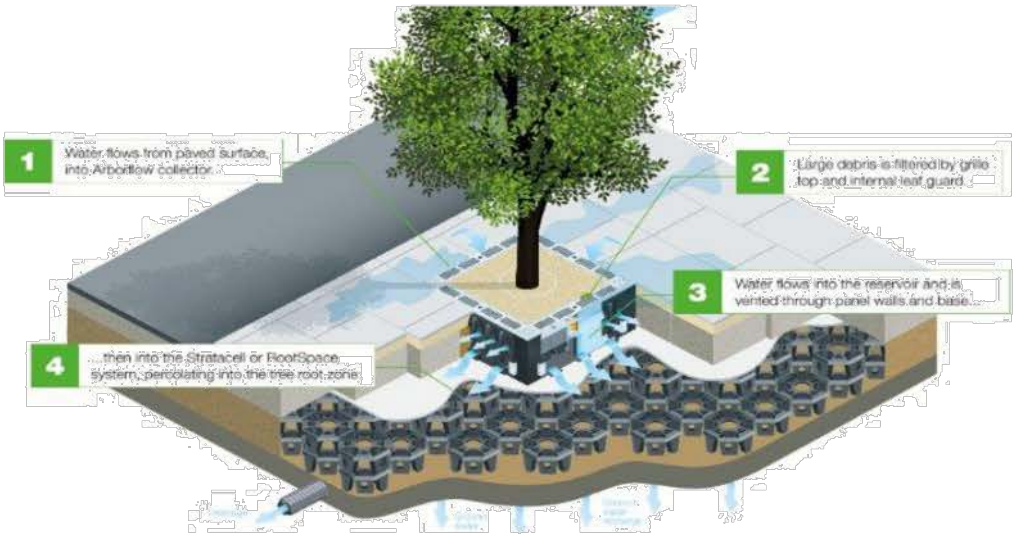
Where underground services make planting difficult and expensive on footpaths, consideration should be given to planting on roadways adjacent the footpath. Properly designed planting pits will easily carry the weight of parked vehicles so the loss of parking space is actually less than 1 sq. metre per tree.

**5.1 An example of tree planting procedures.**




Tree Pit Examples below.

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**5.2 Clearances from infrastructure to new tree planting.**

| Site Constraint | Nominal Clearance |
|---|---|
| Street intersection | 10 metres from intersection of kerb line |
| Driveway | 3 metres from edge of driveway |
| Street light pole | 4 metres from centre of pole |
| Storm water inlet | 2 metres from edge of inlet |
| Major underground service junction | 3 metres from edge of junction box |
| Bus stops | 18 metres on the approach & 3 metres on the departure |
| Traffic Lights | 10 metres from the pole of traffic lights |
| Kerb & gutter | 0.6 metres from the back of kerb |

**6. List of Preferred Tree Species.**

It should be noted that the City of Darwin has many constraints on and requirements of its trees. No one tree can manage all of those constraints and meet all of the requirements. There is no one perfect urban tree.

Basic issues relating to urban tree selection are summarized below;

a. Biological requirements relate to the tree's ability to tolerate urban conditions including the ability to sustain vigorous growth in relation to the root space available with minimal management inputs.
b. Functional and spatial issues include the tree's ability to tolerate pruning to provide required clearances, and a root system that will not adversely impact on adjacent infrastructure but still support the tree.

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c. Aesthetic issues include the tree's ability to enhance the visual or other amenity of the streetscape or park.
d. Tree longevity, the longer a tree is able to grow and thrive the greater the benefits and the greater return on the initial investment.
e. Litter drop of leaves, fruit, or flowers can have nuisance value; species that have excessive litter drop should be avoided on streets but may be acceptable in parks.
f. Certain native species produce flowers and fruit that attract bats and Torres Strait Pidgeons and are not suitable for urban planting.
g. Any species that is a Declared Weed is not to be considered.

Adaptability to urban conditions is paramount and some species have proved more adaptable than others. It is also important for Urban Forest planners to consider that whilst Darwin is now a relatively small city, a tree planted in 2017 is expected to still be around in 40 or 50 years when the city will look entirely different and allowances must be made for this.

There are 10 base criteria to be considered when selecting preferred tree species;

1. Drought tolerance – surviving the Dry Season without irrigation.
2. Heat tolerance.
3. Water logging tolerance.
4. Longevity
5. Pollution tolerance
6. Pathogen and insect tolerance (or resistance)
7. Does not produce allergens
8. Shade area
9. Low maintenance
10. Low litter drop.

A list of preferred tree species is being prepared and will be included in the final draft of the Tree Management Plan.

**7. Nursery Stock Selection.**

Good quality plant stock is imperative to ensure the optimal chance of survival, reduce establishment time, and reduce the potential for formation of growth defects as the tree develops.

To ensure the best chance of survival and good development tree planting stock must;

- Be true to type
- Have appropriate height and caliper
- Be healthy with adequate crown density, good cover & form, leaf colour & size, absence of epicormic shoots and no evidence of die-back
- Good crown symmetry
- Have appropriate stem taper
- Be self supporting
- Have good branching off a strong central leader
- Be formatively pruned with no signs of included bark
- Have healthy root-balls that show no signs of suckering or girdling
- Be propagated as per AS 2303-2015

Full details of the requirements for Nursery stock selection can be found in the Tree Selection for Streets, Parks and Verges in the Appendix and in the separate booklet.

The City of Darwin may opt to either grow its' own planting stock or contract approved nurseries to supply or alternatively contract a particular nursery to propagate its' tree stock.

A Period Contract for 3 years would seem to be the most logical and cost effective process as this will allow the CoD to dictate the terms and conditions of supply and also ensure that the plant stock is produced to the specification required.

Historically, nurseries have dictated what species are available but by introducing a Period Contract with a list of required species and standards, the Council will be able to plan what trees it wishes to plant where and when.

The contracted nursery will be required to comply with Australian Standard 2303-2015, Tree Stock for Landscape Use.

**8. Planting and establishment Protocols.**

a. All tree planting stock must comply with the selection criteria outlined in Section 7.
b. The CoD may use contractors for the planting and establishment of new trees
c. Species selection must match the available space. Trees should not be planted if there is not sufficient root space to accommodate the mature tree
d. Trees should not be planted where there is insufficient soil or the soil is contaminated
e. Providing adequate root growth space is essential to growing healthy trees
f. All plantings will be recorded onto the NEMUS Tree Management System at time of planting.

**9. Tree Pruning Techniques**

Trees are living mechanical structures that have evolved to cope with the conditions under which they grow.

Intervention with the tree's self- management should be done only as a last resort as such intervention has ramifications for the tree's ability to regulate its own systems.

Urban trees grow under artificial or contrived conditions and therefore the tree's own self-regulatory system may often be compromised, requiring intervention.

The most common form of intervention is pruning. However, it must be noted that most pruning is done for "people reasons" not "tree reasons". The most common reason for pruning is to make the tree "safe" or to conform to the available space around other spaces such as buildings or to provide sufficient height clearance for pedestrian and vehicular traffic.

Whilst young growing trees will require formative pruning, mature trees should never be pruned unless it is necessary for the safety of people or infrastructure or to assist the tree in overcoming a pest or disease attack.

Over pruning of mature trees is a common practice by tree managers who think a tree should be regularly pruned. The terms *"thinning"* and *"weight reduction"* are still used by Council and contracted tree crews and often results in the removal of photosynthetic material for no good structural or biological reason with the result that many large mature trees in Darwin are over pruned, to the detriment of the tree.

The over pruning of trees can have both short and long term detrimental effects on the safety, health and ULE of the tree. Significant loss of foliage created by excessive pruning may weaken the tree by reducing its ability to adequately photosynthesize, leading to premature decline or predisposition to branch failure or disease, creating potential hazards.

An over pruned tree will have changed wind dynamics within the canopy and limbs will be increasingly subjected to increased strain that may result in limb failures. In some cases, whole tree failure can be attributed to changed wind dynamics caused by over pruning.

Over pruning during the "build up" namely October, November and December can often result in severe sunburn as limbs which have been shaded for years are suddenly exposed to harsh sunlight.

Over-pruning also results in the reduction of canopy cover, thus reducing the effect trees have on cooling bitumen and concrete. As a consequence, the benefits of a tree in reducing road maintenance costs is reduced.

 

Correct pruning practices respect the natural form and branching habit of the tree and work with the tree's natural defense mechanisms against disease and to avoid damage and injury to the tree.

The extent of any pruning should take into account;

- the condition and significance of the tree
- any detrimental effect the pruning may have on the tree
- the location of the tree
- Any potential impact on pedestrians and vehicular traffic

All pruning of trees within the City of Darwin will be done to the highest standard of Arboricultural practice in accordance with Australian Standard 4373-2007 and will be undertaken to ensure the following;

- The general health and structural integrity of the tree
- The general safety of people and infrastructure
- Safe access for pedestrians and vehicles
- Safe visibility for both pedestrians and vehicles
- Suitable clearance under overhead power lines
- Aesthetics and amenity value of the tree, street and surrounding area
- Retain, where possible, the canopy cover over roads, streets and car parks etc.
- Continuing healthy growth of the tree
- Repair any physical damage to the tree

Generally, pruning should be as minimal as possible to achieve the desired aim and should not remove any more the 10% of the foliage at any one time and all *"reduction"* pruning must be done from the distal end of limbs and branches back towards the trunk.

Correct *"Natural Target Pruning"* techniques as defined in AS 4373-2007 strictly prohibit the following practices;

- Lion tailing of scaffold limbs
- Lopping or topping of trunks or branches
- Excessive removal of foliage or *"cleaning out"* of the canopy
- Flush cutting

All pruning of trees within the City of Darwin must be undertaken by a person qualified to at least Level Three in Arboriculture from an Approved Training Provider.

**10. Visual Tree Risk Assessment including;**

**Level 1 – Limited Visual or Drive-by Inspection:** A Drive-by or walk-by Inspection can be carried out by a Horticultural worker or Arborist and can be used in most situations as an initial assessment tool. A limited visual inspection is not a complete 360 degree assessment and is used to identify possible high risk targets & suspect trees which are then referred for a Level 3 Assessment. A Drive-by Inspection can also be used to identify trees or groups of trees that do not require a risk assessment but require other work such as pruning, canopy uplift for traffic clearance etc. Drive-by inspections are also useful post cyclone or severe storms when a drive by can identify fallen trees, trees on houses, windblown tops etc. A Level 1 Inspection is not classed as a **VTRA** or a **VTA.** It is purely a method of identifying a tree that requires a Visual Tree Risk Assessment.

Level 1 Inspections may also be done by park horticultural staff who wish to refer a suspect tree to a Level 5 Arborist for a Level 3 Assessment.

**Level 3 – Advanced Assessment:** An advanced assessment which may involve an aerial inspection, will include all tree data including height, DBH, Crown spread, live crown ratio, crown class, structure, form, vigor, suitability to site, all defects, decay detection, disease, wind load assessment, root damage, targets, failure potential etc. and is usually reserved for higher risk areas where quarterly or bi-annual Tree Risk Assessments are Council policy or trees referred from a Level 1 Inspection.

**Follow-Up Assessment:**

A Follow-Up Assessment is required as soon as possible following the completion of recommended Control Measures or Hazard Reduction. This is to confirm that the recommended work has been carried out to the required standard and satisfaction of the Assessing Arborist and return the tree to ALARP status. Follow Up Assessments must be done by a Diploma Level Arborist except for Medium Risk trees which may be done by the Level 3 Arborist who performed the work (further details see Chapter 15; Risk Assessment Methods)

### 10.1 Visual Tree Risk Assessment (VTRA) vs Visual Tree Assessment (VTA)

For the purposes of this Tree Management Plan it is important to recognize the differences between a Visual Tree Risk Assessment (VTRA) and a Visual Tree Assessment (VTA). A VTRA is only performed where there is an identified **Hazard Tree** and an identified **Risk Target** and is used for the sole purpose of assessing the degree of risk and recommending control measures to mitigate that risk.

A Visual Tree Assessment (VTA) is a comprehensive Visual Assessment of a tree for a variety of reasons including, determining the health of the tree, recommending treatment for pests or disease, suitability to the site, Significant Tree or Heritage listing, Tree protection or valuation etc. Essentially, a VTA is a Level 3 Assessment performed on a tree where the risk is already at ALARP status and no risk assessment is required.

### 10.2 Current Assessment Periods:

The City of Darwin currently carries out Quarterly Risk Assessments on what it has determined as high risk areas. These areas or locations include primary schools, high schools, high use parks and road reserves.

Other areas, including those leased to private business of not-for-profit organizations are inspected and assessed on a bi-annual basis.

Other Risk Assessments are carried out based on customer requests and/or reports from horticultural staff or as the need arises.

### 10.3 Defining Acceptable levels of Risk

Any tree that may impact on a target presents some degree of risk. The nature and quantity of the target will define the level of risk.

Where there are high value targets, ie. schools, CBD, high voltage power lines, hospitals etc the level of risk should be ALARP, (As Low As Reasonably Possible) but a medium level of risk may be acceptable elsewhere, for example, in a park where there is no play equipment and little activity.

High levels of risk should not be tolerated in any situation.

Therefore, any tree within a quarterly inspection zone or a bi-annual inspection zone must be at the ALARP level either during the inspection or as soon after as possible.

### 10.4 Quarterly Assessments

The City of Darwin will continue its quarterly inspections as per the quarterly inspection list.

Quarter 1 Inspection: January and prior to school returning after holidays on 29 January. This is a full Level 3 Inspection of individual trees.

Quarter 2 Inspection: April and Level 3 Inspection of individual trees. This is the "*end of the wet*" inspection and considered the most critical as trees start to dry out and the prevailing south east winds commence.

Quarter 3 Inspection: July and is a full Level 3 Inspection of individual trees.

Quarter 4 Inspection: October, Level 3 Inspection of individual trees

Level 1 Inspections will also be performed by Parks staff during their normal work routine. In that way suspected hazard trees will be identified and referred to an Arborist for a higher level of assessment.

Note: A Level 1 Inspection is as much about eliminating 'safe' trees from a detailed risk assessment as it is about identifying trees which require a more rigorous assessment. A level 1 inspection is more cost effective without compromising the integrity of the assessment process.

Instructions to Assessors must be clear that, if during a Level 1 inspection a tree is thought to be in a hazardous condition within a target zone, then a higher level of assessment must be done. If the Assessor is not appropriately qualified (Level 5 Arborist or above) for a higher level of inspection then his/her report must recommend that the tree immediately assessed by the appropriately qualified Arborist.

Level 1 Inspections should also be carried out in selected locations following community reports of damaged trees, severe storms, cyclones, or traffic accidents involving trees.

**10.5 Bi-annual Assessments.**

Bi-annual Assessments will be carried out by qualified Diploma Level Arborists on all of Council's Leased Properties. All Assessments will be at Level 3.

**Upgrading Assessments.**

With the introduction of the Nemus Tree Management System the City of Darwin has the ability to acquire, store and retrieve data in an efficient way, then by using those data it will be able to compare the historical data collected and review the sites listed for Quarterly Inspections with the intent, that where a certain site has remained at ALARP level over an appropriate number of Assessments, then the periodic inspection time can be extended to a bi-annual inspection.

Similarly, bi-annual inspections and assessments on Leased Properties can, after an appropriate number of ALARP assessment results some properties can by placed on an annual inspection/assessment regime.

All current Quarterly and Biannual Assessment sites will be mapped and divided into zones depending on the appropriate Risk Target Rating.

The Table below summarizes the colour coded mapping zones:

**Council Property:**

| | |
|---|---|
| | All trees have a Quarterly Level 3 Assessment. This zone will include any tree where a failure or partial failure would impact on a Target Zone with a Risk Target Rating of *High Constant Use, Constant Use or Frequent Use.* All Assessments must be by a person qualified to Level 5 or above. |
| | All trees have a Bi-annual Level 3 Assessment. This zone will include any tree where a failure or partial failure would impact on a Target Zone with a Risk Target Rating of *Intermittent Use*. All Assessments must be by a person qualified to Level 5 or above. |
| | This is an *Occasional Use* zone and is subject to a walk through/drive through annual inspection with individual trees only subject to a Level 3 Assessment when requested from a Level 1 Inspection or from a Customer Action Request. The walk through/drive through Inspection may be performed by a suitably trained person below Level 5. |
| | Excluded Zones. These zones are areas which are considered very low or zero use, are impractical to assess due to the size and/or location and include for example: Native bushland at East point where thick vegetation makes human access either impractical or impossible, foreshore cliffs etc. |

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**Leased Properties:**

| | |
|---|---|
| | All trees have a Bi-annual Level 3 Assessment. This zone will include any tree where a failure or partial failure would impact on a Target Zone with a Risk Target Rating of *High Constant Use, Constant Use or Frequent Use.*<br>All Assessments must be by a person qualified to Level 5 or above. |
| | This is an *Occasional or Intermittent Use* zone and is subject to a walk through/drive through annual inspection with individual trees only subject to a Level 3 Assessment when requested from a Level 1 Inspection or from a Customer Action Request. The walk through/drive through Inspection may be performed by a suitably trained person below Level 5. |
| | Excluded Zones. These zones are areas which are considered very low or zero use, are impractical to assess due to the size and/or location and include for example: Native bushland at East point where thick vegetation makes human access either impractical or impossible, foreshore cliffs etc. |

The following Risk Management Procedures are also produced as a separate Procedures Manual for use by City of Darwin Arborists and Contractors.

**11. Tree Risk Management Procedures.**

a. ISO 31000 – 2009 Risk Management

ISO 31000-2009 is the International Standard for Risk Management. It has superseded AS/NZS 4360-2004. The following is a brief description of the relevant sections of that Standard as it appertains to this Manual.

b. Risk Management Policy:

A policy statement defines a general commitment, direction, or intention. A *Risk Management Policy* statement expresses an organization's commitment to risk management and clarifies its general direction or intention.

c. Risk Management Plan:

An organization's *Risk Management Plan* describes how it intends to manage risk. It describes the management components, the approach and the resources that will be used to manage risk.
Typical management components include procedures, practices, responsibilities and activities, including their sequence and timing.

d. Risk Identification:

*Risk Identification* is a process that involves finding, recognizing and describing the risks that could affect the achievement of an organization's objective.

e. Risk Assessment:

Risk Assessment is a process that is in turn, made up of three processes: *risk identification, risk analysis and risk evaluation.*

- *Risk Identification* is a process that is used to find, recognize and describe the risks that could affect the achievement of objectives. It also includes the identification of possible causes and potential consequences. You can use historical data, theoretical analysis, informed opinion and expert advice to identify risk.
- *Risk Analysis* is a process that is used to understand the nature, sources and causes of the risks you have identified and to estimate the level of risk. It is also used to study impacts and consequences and to examine any controls that already exist.
- *Risk Evaluation* is a process that is used to compare risk analysis results with risk criteria in order to determine whether or not a specified level of risk is acceptable or tolerable.

f. Risk Treatment:

*Risk Treatment* is a risk modification process. It involves selecting and implementing one or more treatment options. Once a treatment has been implemented it becomes a control or it modifies existing controls. There are many treatment options;

- Avoid the risk

- Reduce the risk
- Remove the source of the risk
- Modify the consequences (remove/reduce the target)
- Retain the risk as acceptable (As Low As Reasonably Possible)

g. Controls:

*A Control* is any measure or action that modifies risk. Controls include any new policy, procedure, process, practice technique, method or device that modifies or manages risk. Risk Treatments become controls, or modify existing controls one they have been implemented.

h. Residual Risk:

*Residual Risk* is the risk left over after the implementation of a risk treatment option. It is the risk remaining after the reduction of the risk, removal of the risk, changed the probabilities, modification of the consequences, transferring the risk or retaining the risk

i. Review:

*A Review* is an activity which is carried out in order to determine whether something is a suitable, adequate and effective way of achieving established objectives. In general ISO 31000 expects an organization to regularly review its risk management framework and risk management process. It specifically expects an organization to review its risk management policy and risk management plans as well as its risk criteria and risk assessment process.

**12. Introduction to Visual Tree Risk Assessment.**

Risk management is a well-established concept in the management of public space but identifying and managing risk associated with trees is still a subjective process although the scientific understanding of trees and how they grow and fail has increased dramatically in recent times. Experienced and suitably qualified Arborists are now adopting a systematic and documented approach to rating hazardous trees and assessing the risk associated with those trees.

All trees have a risk of failure and every tree will eventually fail. As trees increase in size, mass and maturity, the risk of failure increases. Trees with serious defects are unpredictable and can fail at any time. Evolved traits play a significant role in defect profiles. Unpredictable branch sheds are an example as trees which evolved in dense forests learned to shed their branches.

The Visual Tree Risk Assessment also details the health of the subject trees. The current health of a tree and it's susceptibility to fungal and/or insect attack is also a factor in ascertaining any future risk that may be posed by the tree.

Tree Risk Assessment requires three components;

- a tree with the potential to fail
- an environment that may contribute to that failure
- Persons or objects that would be injured or damaged (i.e. the Risk Target).

By definition a dangerous situation requires the presence of both a defective tree and a target.

Danger is defined as "*exposure to harm*"; Risk is defined as the "*statistical odds of danger*"; If a tree is assessed as dangerous it is the degree of risk that increases or decreases, depending on the potential number of Risk Targets.

As a result, risk assessment is not limited to evaluating the failure potential of a tree. Risk Assessment must consider the potential presence of a Risk Target. If there is no Risk Target, there is no risk and therefore a dangerous situation cannot exist.

Visual Tree Risk Assessments are fundamentally based on a simply methodology;

1. is there a hazard/defect and how or when is it likely to fail
2. is there a Risk Target and how long is it in the impact zone
3. how much damage will it cause

There are at least 23 different Tree Risk Assessment Methods identified by Martin Norris in a study of this subject in 2007. 15 were chosen for further study and a wide range of variables were found when results were analyzed.

Most Methods rely on mathematical calculations to arrive at a result with huge differences in the assessments of the same trees using different methods.

The method below is based on ISO 31000-2009 with a simple matrix used to arrive at a Risk Rating. This method relies on the Assessor's training, knowledge and experience to assess the tree and the Risk Target. The Matrix will merely ensure the consistency of the terminology used so that the Assessment Report can be understood by third parties who may have little or no arboricultural knowledge.

**13. Risk Assessment Terminology.**

**a. Risk:**

Risk is simply the chance of a specific undesired event occurring within a specified period. Risk = Likelihood x Consequences (Standards Australia 2004) or as it relates to **Visual Tree Risk Assessment; Failure Potential x Risk Target Rating = Risk Assessment.**
The assessment period is critical as it allows an evaluation of likelihood to be undertaken. All tree risk assessments must be defined by a timeframe. (Norris 2007).

**b. Hazard:**

Australian Standards define "Hazard" as a *source of potential harm,* this definition is derived from an International Standard (ISO 3534:1993). A tree related hazard will generally be aligned to the defect or defects identified during the assessment.

**c. Risk Target:**

It has been suggested in some tree risk literature (Lonsdale 1999) that the term "target" is not appropriate as it suggests something that is aimed for.
Therefore the term "Risk Target" overcomes this issue and should be used to describe people or property that may be affected by the hazard (Norris 2007)
Risk Target will be used in this Assessment Guide to describe anything or anyone who may be affected by a hazard.

**d. Defect:**

A defect is an identifiable fault in a tree, whether structural or otherwise. Defects and causes or symptoms are not the same; a hollow in a tree is a defect but termite infestation is the cause of the defect, not the defect. Decay is a defect, a fungal fruiting body is a symptom of the decay, not a defect.

Trees may have multiple defects ranging from minor dead wood to co-dominant trunks with included bark. Small dead wood is more likely to fail than a large co-dominant trunk but the co-dominant trunk would most likely pose the higher risk.

**e. Size of Part:**

The size of the part most likely to fail can be considered by the assessor when assessing the likely damage or consequence as should be the height above ground of the part. However, the size of the part will only have a limited relationship to the potential consequences depending on the Risk Target, eg: compare the consequences of the same part impacting a person, a house, a car or a footpath.

**f. Failure Potential or Likelihood of Failure:**

This is the term used to describe the possibility that a defective part may fail within the Risk Assessment period.

This is not a difficult concept, however it is the most uncertain part of the assessment and it is impossible to do more than give an expert opinion or assessment. An Assessor may be certain that a defective part will fail, however predicting when is impossible and will depend on a wide variation of circumstances. Also it may never happen.

**g. Risk Target Rating :**

The possibility that something of value may occupy the Risk Target Zone at the time of failure.
A building under the defective part has a Risk Target Rating of 100%, or High Constant Use, whereas a person spending 5 seconds walking under the tree once a day occupies the Risk Target Zone for 1/17,280 of a day, 50 people passing under the tree is a likelihood of 1/345, therefore the likelihood of harm is much higher.

This category is often misunderstood with Assessors assigning the Risk Target Rating based on the assumed value of the target. Example: A playground in a park may be assigned a high value despite the fact that it may only be used by less than a dozen children for one hour on Sunday morning and therefore should have a relatively low Risk Target Rating.

**h. Risk Rating:**

The Risk Rating score is determined after assessing the Failure Potential and the Risk Target Rating of an identified hazard tree. The Risk Matrix is used to determine the level of risk.
**Failure Potential x Risk Target Rating = Risk Assessment.**
The determination of these calculations will indicate the priority and course of action when recommending the control measures to be undertaken.

The risk Rating will range from **As Low as reasonably possible (ALARP) to High 3 (failure imminent, high Risk Target Rating)**

**i. Acceptable Risk:**

Acceptable risk is a point where the overall risk is considered to be at a level where no intervention or action is warranted. (Norris 2007). However, in Australia, particularly in tree risk assessment no such point is set.

From the Assessor's point of view, acceptable risk is not within their purview as this must be set by the tree's owner or responsible body, in this case the City of Darwin.

No tree is "safe"; no one can define a tree as "safe" or "unsafe" without some qualification of acceptable risk. Therefore the Assessor, when describing a tree with a very low risk factor with no control measures required, will use the term ALARP (As Low As Reasonably Possible) to describe the risk.

**14. Qualifications of Assessors:**

In keeping with the Australian Qualifications Framework, the recommendations of the NT Coroner, (para 92, page 30 of the Coroner's Report into the death of William Brown), nationally recognized Arborist's associations and the City of Darwin policy, all Assessments must be performed by Qualified Arborists holding at least a Diploma in Horticulture (Arboriculture) from a recognized Training Provider.

**15. Risk Assessment Methods:**

The City of Darwin has adopted 3 distinct methods of Tree Risk Assessment;

**Level 1 – Limited Visual or Drive-by/Walk-by Inspection:** A Drive-by Inspection can be carried out by a Horticultural worker or Arborist and can be used in most situations as an initial assessment tool. A limited visual inspection is not a complete 360 degree assessment and is used to identify possible high risk targets & suspect trees which are then referred for a Level 3 Assessment. A Drive-by Inspection can also be used to identify trees or groups of trees that do not require a risk assessment but require other work such as pruning, canopy uplift for traffic clearance etc. Drive-by inspections are also useful post cyclone or severe storms when a drive by can identify fallen trees, trees on houses, windblown tops etc. A Level 1 Inspection is not classed as a **VTRA** or a **VTA.** It is purely a method of identifying a tree that requires a Visual Tree Risk Assessment.

Level 1 Inspections may also be done by park horticultural staff who wish to refer a suspect tree to a Level 5 Arborist for a Level 3 Assessment.

**Level 3 – Advanced Assessment:** An advanced assessment which may involve an aerial inspection, will include all tree data including height, DBH, Crown spread, live crown ratio, crown class, structure, form, vigor, suitability to site, all defects, decay detection, disease, wind load assessment, root damage, targets, failure potential etc. and is usually reserved for higher risk areas where quarterly or bi-annual Tree Risk Assessments are Council policy or trees referred from a Level 1 Inspection.

**Follow Up Assessment:** A Follow Up Assessment is used to determine that the Control Measures (Hazard Reduction) recommended in the Report from a Level 3 Assessment have been carried out to the required standard and that the tree can safely be returned to ALARP status.

A Follow Up Assessment should be done no later than the date set at the time of the previous Level 3 Assessment. If the Follow Up Assessment is not completed and entered onto NEMUS then the tree will remain at its previous Risk Level until the Follow Up is completed regardless of whether the work has been completed or not.

Follow Up Assessments of Medium Risk Trees may be done by a Level 3 Arborist at the discretion of the Senior Arborist. (See above – Qualification of Assessors)

Follow Up Assessments on trees with a Risk Rating of High 1 and above must be performed by a Level 5 Arborist or above. AQF Levels and their application is contained in the Table below.

**16. Visual Tree Risk Assessment (VTRA) v Visual Tree Assessment (VTA)**

For the purposes of this Manual it is important to recognize the differences between a Visual Tree Risk Assessment (VTRA) and a Visual Tree Assessment (VTA). A VTRA is only performed where there is an identified **Hazard Tree** and an identified **Risk Target** and is used for the sole purpose of assessing the degree of risk and recommending control measures to mitigate that risk.

A Visual Tree Assessment (VTA) is a comprehensive Visual Assessment of a tree for a variety of reasons including, determining the health of the tree, recommending treatment for pests or disease, suitability to the site, Significant Tree or Heritage listing, Tree protection or valuation etc. Essentially, a VTA is a Level 3 Assessment performed on a tree where the risk is already at ALARP status and no risk assessment is required.

**17. Risk Assessment Procedures.**

Risk Assessment Procedures are contained in the accompanying Manual;

*A GUIDE TO VISUAL TREE RISK ASSESSMENT. Contractors Edition V1.*

**18. Protocols for Pruning &Tree Removal**

Trees under the management of the City of Darwin will only be removed in accordance with the Council Policy on Tree Removal.

All pruning works will be performed according to AS 4373-2007 – Pruning of Amenity Trees. Practices such as over pruning, lion tailing and lopping of trees are prohibited under this standard.

**19. Quality Assurance.**

Quality Assurance Audits are a management tool for the Supervisor to track all legations, standards and performance are compliant with the contract between the council and the contractor. The City of Darwin will conduct Audits of contractor's work at its' own discretion to ensure that the works has been performed to AS 4373-2007 and the Risk Assessment of the tree after the works have been completed is at ALARP status without compromising the health or structural integrity of the tree.

 

**20. Arborist Qualifications**

The City of Darwin will pursue a policy of employing Qualified Arborists up to Diploma Level ( AQF Level 5) or above for all Supervisors and Tree Assessors. Contract Arborists and tree maintenance companies will be expected to adhere to this policy as well. AQF Qualifications or equivalent from recognized overseas institutions are the only qualifications recognized by the City of Darwin. "Qualifications" issued by ISA, QTRA and similar organizations are not recognized as legitimate qualifications in Australia.

The Australian Qualifications Framework (AQF) is the national policy for regulated qualifications in Australian education and training. It incorporates the qualifications from each education and training sector into a single comprehensive national qualifications framework.

All tree crews will have, as a minimum, a Level 111 Arborist as the Leading Hand. All tree crews including ground crew should receive sufficient training to ensure safety, efficiency and correct Arboricultural practices are used at all times. Chain Saw and Wood Chipper training is essential for all crew.

The relevant AQF Levels are summarized below:

| | AQF Level 3 | AQF Level 4 | AQF Level 5 |
|---|---|---|---|
| Summary | Graduates will have theoretical and practical knowledge & skills for work | Graduates will have theoretical & practical knowledge & skills for specialized and/or skilled work | Graduates will have specialized knowledge & skills for skilled and/or paraprofessional work. |
| Knowledge | Graduates will have factual, technical & some theoretical knowledge of specific areas of work | Graduates will have broad factual, technical & some theoretical knowledge of specific areas or a broad field of work | Graduates will have broad factual, technical & some theoretical knowledge of specific areas or a broad field of work |
| Skills | Graduates will have a range of cognitive, technical & communication skills to select and apply a specialized range of methods, tools & information to complete routine activities & provide and transmit solutions to problems | Graduates will have a range of cognitive, technical & communication skills to select and apply a specialized range of methods, tools & information to complete routine & non routine activities & provide and transmit solutions to both predictable & unpredictable problems | Graduates will have a range of cognitive, technical & communication skills to select and apply a specialized range of methods, tools & information to complete routine & non-routine activities & provide and transmit solutions to both predictable & unpredictable problems. Transmit knowledge and skills to others. |
| Application | Graduates will apply knowledge & skills to demonstrate autonomy & judgement & take limited responsibility within known parameters. | Graduates will apply knowledge & skills to demonstrate autonomy & judgement & take limited responsibility within known parameters. | Graduates will apply knowledge & skills to demonstrate autonomy & judgement & defined responsibility in known or changing contexts & within broad but established parameters. |

**21. Protection of Trees on Development Sites**

The protection of valuable trees during development and/or construction sites is an important part of the City of Darwin's Tree Management Plan and is produced as a separate Manual.

All council staff and contractors should read this Manual in conjunction with this TMP.

 

**22. Key Performance Indicators.**

It is essential that, for any activity to be successful that it be measurable against a number of operational criteria or Key Performance Indicators (KPIs).

The Chart below is an example of how Key Performance Indicators are recorded, their use as management tool to record the accuracy or otherwise of estimated hours against actual hours, a historical record of human resources used, WHS requirements and outcomes.

Data is simply entered at the end of each day into a pre-existing table on a Tablet and emailed to the UFM at the end of each month. Totals are automatically generated

 

**22.1 Example of KPI chart.**

| SITE | Date | JOB or PO NUMBER | PERSONNEL ON SITE FOR THIS DAY | | | | | | RISK MANAGEMENT | | | | INCIDENTS | | JOB COMPLETED | | Estimated Hours | Actual Hours |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Level 5 | Level 3 | Labourers | Traffic Controllers | TOTAL | Other | Traffic Plan | JSA | SWMS | Toolbox | Serious | Non-Serious | Yes | No | | |
| Freshwater Road | 12/05/17 | 123 | 1 | 1 | 4 | 2 | 8 | | 1 | 1 | 1 | 1 | 0 | 0 | Yes | | 6 | 6 |
| Gardens Road | 15/05/17 | 124 | 0 | 1 | 2 | 2 | 5 | | 1 | 1 | 1 | 1 | 0 | 0 | Yes | | 8 | 7 |
| Darwin Mall | 20/05/17 | 125 | 1 | 1 | 4 | 2 | 8 | | 1 | 1 | 1 | 1 | 0 | 0 | Yes | | 5 | 7 |
| Anula Walkway | 28/05/17 | 126 | 1 | 1 | 4 | 0 | 6 | | 0 | 1 | 1 | 1 | 0 | 0 | | No | 12 | 8 |
| Anula Walkway | 29/05/17 | 126 | 1 | 1 | 4 | 0 | 6 | | 0 | 0 | 0 | 1 | 0 | 1 | Yes | Yes | 0 | 4 |
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| TOTALS FOR MONTH | | | 4 | 5 | 18 | 6 | 33 | | 3 | 4 | 4 | 5 | 0 | 1 | | | 31 | 32 |

# A GUIDE TO VISUAL TREE RISK ASSESSMENT.

Including Procedures for the use of NEMUS Tree Management System.

Prepared for the City of Darwin by:

bill sullivan
consulting arborist

# *THE MATRIX*
# VISUAL TREE RISK ASSESSMENT SYSTEM

## PREFACE:

**ISO 31000 – 2009 RISK MANAGEMENT**

ISO 31000-2009 is the International Standard for Risk Management. It has superseded AS/NZS 4360-2004. The following is a brief description of the relevant sections of that Standard as it appertains to this Manual.

a. Risk Management Policy:

A policy statement defines a general commitment, direction, or intention. A *Risk Management Policy* statement expresses an organization's commitment to risk management and clarifies its general direction or intention.

b. Risk Management Plan:

An organizations *Risk Management Plan* describes how it intends to manage risk. It describes the management components, the approach and the resources that will be used to manage risk.
Typical management components include procedures, practices, responsibilities and activities, including their sequence and timing.

c. Risk Identification:

*Risk Identification* is a process that involves finding, recognizing and describing the risks that could affect the achievement of an organization's objective.

d. Risk Assessment:

Risk Assessment is a process that is in turn, made up of three processes: *risk identification, risk analysis and risk evaluation.*

- *Risk Identification* is a process that is used to find, recognize and describe the risks that could affect the achievement of objectives. It also includes the identification of possible causes and potential consequences. You can use historical data, theoretical analysis, informed opinion and expert advice to identify risk.
- *Risk Analysis* is a process that is used to understand the nature, sources and causes of the risks you have identified and to estimate the level of risk. It is also used to study impacts and consequences and to examine any controls that already exist.
- *Risk Evaluation* is a process that is used to compare risk analysis results with risk criteria in order to determine whether or not a specified level of risk is acceptable or tolerable.

e. Risk Treatment:

*Risk Treatment* is a risk modification process. It involves selecting and implementing one or more treatment options. Once a treatment has been implemented it becomes a control or it modifies existing controls.
There are many treatment options;

- Avoid the risk
- Reduce the risk
- Remove the source of the risk
- Modify the consequences (remove/reduce the target)
- Retain the risk as acceptable (as low as reasonably possible)

f. Controls:

*A Control* is any measure or action that modifies risk. Controls include any new policy, procedure, process, practice technique, method or device that modifies or manages risk. Risk Treatments become controls, or modify existing controls one they have been implemented. Controls are also call Hazard Reduction.

g. Residual Risk:

*Residual Risk* is the risk left over after the implementation of a risk treatment option. It is the risk remaining after the reduction of the risk, removal of the risk, changed the probabilities, modification of the consequences, transferring the risk or retaining the risk

h. Review:

*A Review* is an activity which is carried out in order to determine whether something is a suitable, adequate and effective way of achieving established objectives. In general ISO 31000 expects an organization to regularly review its risk management framework and risk management process. It specifically expects an organization to review its risk management policy and risk management plans as well as its risk criteria and risk assessment process.

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Risk management is a well-established concept in the management of public space but identifying and managing risk associated with trees is still a subjective process although the scientific understanding of trees and how they grow and fail has increased dramatically in recent times. Experienced and suitably qualified Arborists are now adopting a systematic and documented approach to rating hazardous trees and assessing the risk associated with those trees.

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The Visual Tree Risk Assessment also details the health of the subject trees. The current health of a tree and it's susceptibility to fungal and/or insect attack is also a factor in ascertaining any future risk that may be posed by the tree.

Tree Risk Assessment requires three components;

- a tree with the potential to fail
- an environment that may contribute to that failure
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By definition a dangerous situation requires the presence of both a defective tree and a target.

Danger is defined as "*exposure to harm*"; Risk is defined as the "*statistical odds of danger*"; If a tree is assessed as dangerous it is the degree of risk that increases or decreases, depending on the potential number of Risk Targets.

As a result, risk assessment is not limited to evaluating the failure potential of a tree. Risk Assessment must consider the potential presence of a Risk Target. If there is no Risk Target, there is no risk and therefore a dangerous situation cannot exist.

Visual Tree Risk Assessments are fundamentally based on a simply methodology;

1. is there a hazard/defect and how or when is it likely to fail
2. is there a Risk Target and how long is it in the impact zone
3. how much damage will it cause

There are at least 23 different Tree Risk Assessment Methods identified by Martin Norris in a study of this subject in 2007. 15 were chosen for further study and a wide range of variables were found when results were analyzed.

Most Methods rely on mathematical calculations to arrive at a result with huge differences in the assessments of the same trees using different methods.

The method below is based on ISO 31000-2009 with a simple matrix used to arrive at a Risk Rating. This method relies on the Assessor's training, knowledge and experience to assess the tree and the Risk Target. The Matrix will merely ensure the consistency of the terminology used so that the Assessment Report can be understood by third parties who may have little or no arboricultural knowledge.

**2. Risk Assessment Terminology.**

**a. Risk:**

Risk is simply the chance of a specific undesired event occurring within a specified period. Risk = Likelihood x Consequences (Standards Australia 2004) or as it relates to **Visual Tree Risk Assessment; Failure Potential x Risk Target Rating = Risk Assessment.**

The assessment period is critical as it allows an evaluation of likelihood to be undertaken. All tree risk assessments must be defined by a timeframe. (Norris 2007).

**b. Hazard:**

Australian Standards define "Hazard" as a *source of potential harm,* this definition is derived from an International Standard (ISO 3534:1993). A tree related hazard will generally be aligned to the defect or defects identified during the assessment.

**c. Risk Target:**

It has been suggested in some tree risk literature (Lonsdale 1999) that the term "target" is not appropriate as it suggests something that is aimed for.

Therefore the term "Risk Target" overcomes this issue and should be used to describe people or property that may be affected by the hazard (Norris 2007)

Risk Target will be used in this Assessment Guide to describe anything or anyone who may be affected by a hazard.

**d. Defect:**

A defect is an identifiable fault in a tree, whether structural or otherwise. Defects and causes or symptoms are not the same; a hollow in a tree is a defect but termite infestation is the cause of the defect, not the defect. Decay is a defect, a fungal fruiting body is a symptom of the decay, not the defect.

Trees may have multiple defects ranging from minor dead wood to co-dominant trunks with included bark. Small dead wood is more likely to fail than a large co-dominant trunk but the co-dominant trunk would most likely pose the higher risk.

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The size of the part most likely to fail can be considered by the assessor when assessing the likely damage or consequence as should be the height above ground of the part. However, the size of the part will only have a limited relationship to the potential consequences depending on the Risk Target, eg: compare the consequences of the same part impacting a person, a house, a car or a footpath.

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This is the term used to describe the possibility that a defective part may fail within the Risk Assessment period. This is not a difficult concept, however it is the most uncertain part of the assessment and it is impossible to do more than give an expert opinion or assessment. An Assessor may be certain that a defective part will fail, however predicting when is impossible and will depend on a wide variation of circumstances. Also it may never happen.

**g. Risk Target Rating :**

The possibility that something of value may occupy the Risk Target Zone at the time of failure.

A building under the defective part has a Risk Target Rating of 100%, or High Constant Use, whereas a person spending 5 seconds walking under the tree once a day occupies the Risk Target Zone for 1/17,280 of a day, 50 people passing under the tree is a likelihood of 1/345, therefore the likelihood of harm is much higher.

This category is often misunderstood with Assessors assigning the Risk Target Rating based on the assumed value of the target. Example: A playground in a park may be assigned a high value despite the fact that it may only be used by less than a dozen children for one hour on Sunday morning.

**h. Risk Rating:**

The Risk Rating score is determined after assessing the Failure Potential and the Risk Target Rating of an identified hazard tree. The Risk Matrix is used to determine the level of risk.

**Failure Potential x Risk Target Rating = Risk Assessment.**

The determination of these calculations will indicate the priority and course of action when recommending the control measures to be undertaken.

The risk Rating will range from **As Low as reasonably possible (ALARP) to High 3 (failure imminent, high Risk Target Rating)**

**i. Acceptable Risk:**

Acceptable risk is a point where the overall risk is considered to be at a level where no intervention or action is warranted. (Norris 2007). However, in Australia, particularly in tree risk assessment no such point is set.

From the Assessor's point of view, acceptable risk is not within their purview as this must be set by the tree's owner or responsible body, in this case the City of Darwin.

No tree is "safe"; no one can define a tree as "safe" or "unsafe" without some qualification of acceptable risk. Therefore the Assessor, when describing a tree with a very low risk factor with no control measures required, will use the term ALARP (As Low As Reasonably Possible) to describe the risk.

**3. Qualifications of Assessors:**

In keeping with the Australian Qualifications Framework, the recommendations of the NT Coroner, (para 92, page 30 of the Coroner's Report into the death of William Brown), nationally recognized Arborist's associations and the City of Darwin policy, all Assessments must be performed by Qualified Arborists holding at least a Diploma in Horticulture (Arboriculture) from a recognized Training Provider.

An exception to this policy may be made at the discretion of the Senior Arborist to allow a Level 3 Arborist with sufficient practical experience to undertake a Follow Up Assessment where a tree has a Risk Rating of medium and where the Level 3 Arborist has carried out the Hazard Reduction work (implemented Control Measures) on that particular tree. Trees assessed as Medium Risk will usually have a low Risk Target Rating ie. Occasional, Intermittent or Frequent Use.

**4. Risk Assessment Methods:**

The City of Darwin has adopted 3 distinct methods of Tree Risk Assessment;

**Level 1 – Limited Visual or Drive-by Inspection:** A Drive-by Inspection can be carried out by a horticultural worker or Arborist and can be used in most situations as an initial assessment tool. A limited visual inspection is not a complete 360 degree assessment and is used to identify possible high risk targets & suspect trees which are then referred for Level 3 Assessment. A Drive-by Inspection can also be used to identify trees or groups of trees that do not require a risk assessment but require other work such as pruning, canopy uplift for traffic clearance etc. Drive-by inspections are also useful post cyclone or severe storms when a drive by can identify fallen trees, trees on houses, windblown tops etc. A Level 1 Inspection is not classed as a **VTRA** or a **VTA.** It is purely a method of identifying a tree that requires a Visual Tree Risk Assessment.

**Level 3 – Advanced Assessment:** An advanced assessment which may involve an aerial inspection, will include all tree data including height, BDH, Crown spread, live crown ratio, crown class, structure, form, vigor, suitability to site, all defects, decay detection, disease, wind load assessment, root damage, targets, failure potential etc. and is usually reserved for trees within the Quarterly Assessment Zones, Leased Properties, Customer Action Request or trees referred from a Level 1 Inspection.

**Follow Up Assessment:** A Follow Up Assessment is used to determine that the Control Measures (Hazard Reduction) recommended in the Report from a Level 3 Assessment have been carried out to the required standard and that the tree can safely be returned to ALARP status.

A Follow Up Assessment should be done no later than the date set at the time of the previous Level 3 Assessment. If the Follow Up Assessment is not completed and entered onto NEMUS then the tree will remain at its previous Risk Level until the Follow Up is completed regardless of whether the work has been completed or not.

Follow Up Assessments of Medium Risk Trees may be done by a Level 3 Arborist at the discretion of the Senior Arborist. (See above – Qualification of Assessors)

Follow Up Assessments on trees with a Risk Rating of High 1 and above must be performed by a Level 5 Arborist or above. AQF Levels and their application is contained in the Table below.

| | AQF Level 3 | AQF Level 4 | AQF Level 5 |
|---|---|---|---|
| Summary | Graduates will have theoretical and practical knowledge & skills for work | Graduates will have theoretical & practical knowledge & skills for specialized and/or skilled work | Graduates will have specialized knowledge & skills for skilled and/or paraprofessional work. |
| Knowledge | Graduates will have factual, technical & some theoretical knowledge of specific areas of work | Graduates will have broad factual, technical & some theoretical knowledge of specific areas or a broad field of work | Graduates will have broad factual, technical & some theoretical knowledge of specific areas or a broad field of work |
| Skills | Graduates will have a range of cognitive, technical & communication skills to select and apply a specialized range of methods, tools & information to complete routine activities & provide and transmit solutions to problems | Graduates will have a range of cognitive, technical & communication skills to select and apply a specialized range of methods, tools & information to complete routine & non routine activities & provide and transmit solutions to both predictable & unpredictable problems | Graduates will have a range of cognitive, technical & communication skills to select and apply a specialized range of methods, tools & information to complete routine & non-routine activities & provide and transmit solutions to both predictable & unpredictable problems. Transmit knowledge and skills to others. |
| Application | Graduates will apply knowledge & skills to demonstrate autonomy & judgement & take limited responsibility within known parameters. | Graduates will apply knowledge & skills to demonstrate autonomy & judgement & take limited responsibility within known parameters. | Graduates will apply knowledge & skills to demonstrate autonomy & judgement & defined responsibility in known or changing contexts & within broad but established parameters. |

### 5. Visual Tree Risk Assessment (VTRA) v Visual Tree Assessment (VTA)

For the purposes of this Manual it is important to recognize the differences between a Visual Tree Risk Assessment (VTRA) and a Visual Tree Assessment (VTA). A VTRA is only performed where there is an identified **Hazard Tree** and an identified **Risk Target** and is used for the sole purpose of assessing the degree of risk and recommending control measures to mitigate that risk.

A Visual Tree Assessment (VTA) is a comprehensive Visual Assessment of a tree for a variety of reasons including, determining the health of the tree, recommending treatment for pests or disease, suitability to

the site, Significant Tree or Heritage listing, Tree protection or valuation etc. Essentially, a VTA is a Level 3 Assessment performed on a tree where the risk is already at ALARP status or the risk is known and accepted.

**6. NEMUS Tree Management System.**

The City of Darwin has adopted the NEMUS Tree Management Software System as its preferred method of capturing, recording and storing tree data.

NEMUS is a Smartphone/Web software program developed by Asset Edge to manage Council trees by allowing field officers to capture, retrieve and store data in the field using a Smartphone or Tablet.

NEMUS has the following attributes:

- Paperless system with Smartphone technology to capture GPS location
- User defined attributes for specific asset and inspection data collection
- Secure website dedicated to the City of Darwin
- Reports available by Microsoft Word or Adobe PDF
- Mapping tools with "follow me' technology
- All relevant tree data & last inspection data is able to be retrieved in the field

Using NEMUS, tree data is captured in the field using a Smartphone or Tablet with simple "drop down" boxes and key entry. All information including date, GPS co-ordinates, tree characteristics, defects, risk assessment and risk controls are stored on the device and is then synchronized to a central server using mobile phone or wireless networks.

NEMUS also schedules future tree inspections and assessments, alerts council officers to overdue inspections, colour codes trees according to their risk rating.

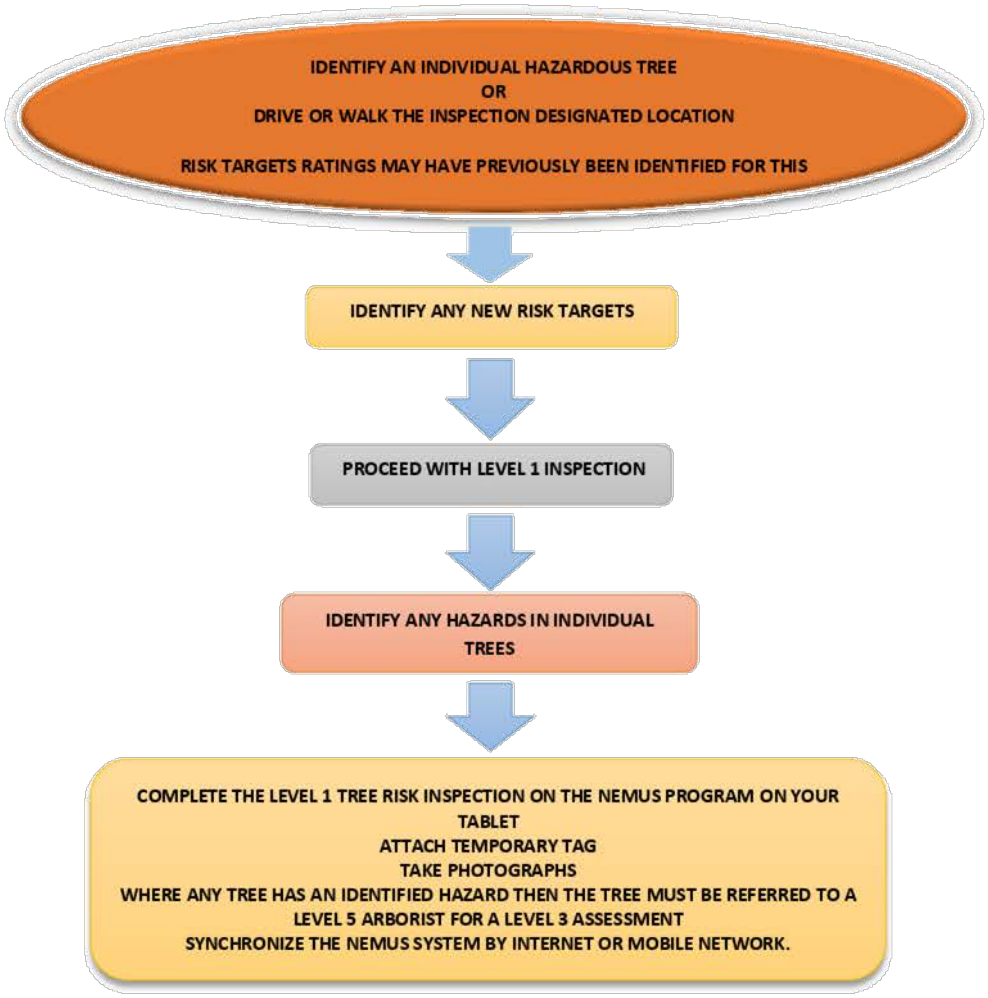
Procedures for the use of NENUS are contained in this document at Page 10.

7. **Risk Assessment Procedures.**

**LEVEL 1 VISUAL TREE RISK INSPECTION (VTRI) PROCEDURE.**

**THIS PROCEDURE IS NOT A RISK ASSESSMENT AND IS ONLY TO BE USED AS THE INITIAL TOOL TO IDENTIFY INDIVIDUAL HAZARDOUS TREES REQUIRING A LEVEL 3 VISUAL TREE RISK ASSESSMENT.**

**AT LEAST ONE QUARTERLY INSPECTION PER YEAR MUST BE DONE BY A MINIMUM LEVEL 5 ARBORIST AT EACH SITE.**




Note:
A Level 1 or drive-by inspection is also potentially useful after severe weather events to initially pin point downed or damaged trees in order to prioritize cleanup work. These inspections are to be treated as "one off" and do not replace scheduled Quarterly Inspections.

## Tree Risk Assessment Matrix©

This Tree Risk Matrix is to be used to determine the Risk Level associated with a tree which was subject to a rigorous Level Three Visual Tree Risk Assessment (VTRA). It is not to be used in conjunction with a Level One Inspection which is not a Risk Assessment but purely an Inspection to determine if a Visual Tree Risk Assessment is required.

| | | Risk Target Rating | | | | |
|---|---|---|---|---|---|---|
| | | Occasional Use | Intermittent Use | Frequent Use | Constant Use | High Constant Use |
| Failure Potential | ***Very Likely*** Almost certain to occur in most circumstances | Medium | High 1. | High 1. | High 2. | High 3. |
| | ***Likely*** May occur frequently | Medium | Medium | High 1. | High 2. | High 3. |
| | ***Somewhat Likely.*** Possible and likely to occur at some time | ALARP | Medium | High 1. | High 1. | High 2. |
| | ***Unlikely*** Not likely to occur but could happen | ALARP | ALARP | Medium | Medium | Medium |
| | ***Highly Unlikely*** May occur in rare and exceptional circumstances | ALARP | ALARP | ALARP | ALARP | ALARP |

©

The risk rating score is determined after assessing the Failure Potential and Target Rating of an identified hazard tree. The determination of these calculations will indicate a priority and course of action when implementing the hazard reduction measures.

**Failure Potential x Target Rating = Risk Assessment**

Legend:

Failure Potential:

Very Likely: Partial or whole tree failure is imminent; egg. cavity in excess of 50% of trunk, major bark inclusions, dead limbs, leaning tree with lifting root plate, roots/trunk decayed or damaged etc.

Likely: Defects that could cause structural failure of the tree within the next 6 months

Somewhat Likely: Defects present that could cause portions of the tree to fail

Unlikely: Defects are minor and not likely to cause significant failure

Highly Unlikely: Tree is healthy with no obvious defects. Status is ALARP

Target Rating:

Occasional use: Suburban Park or quiet street etc.

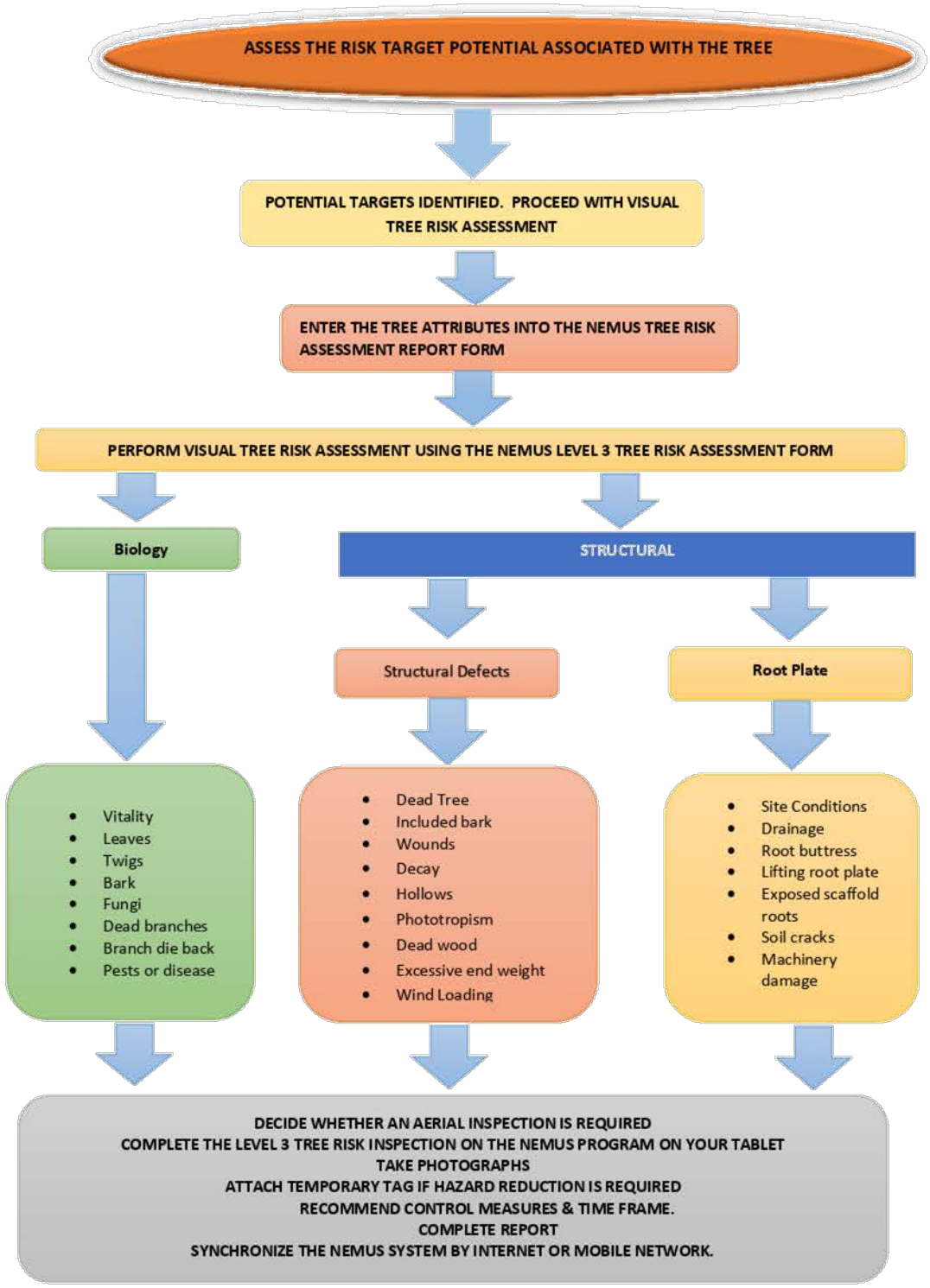
Intermittent use: Parking lot, bus stop, play area in park, etc.

Frequent use: Busy Street, school yard, child care centre, public pool etc.

Constant use: Occupied building, residence, CBD, etc.

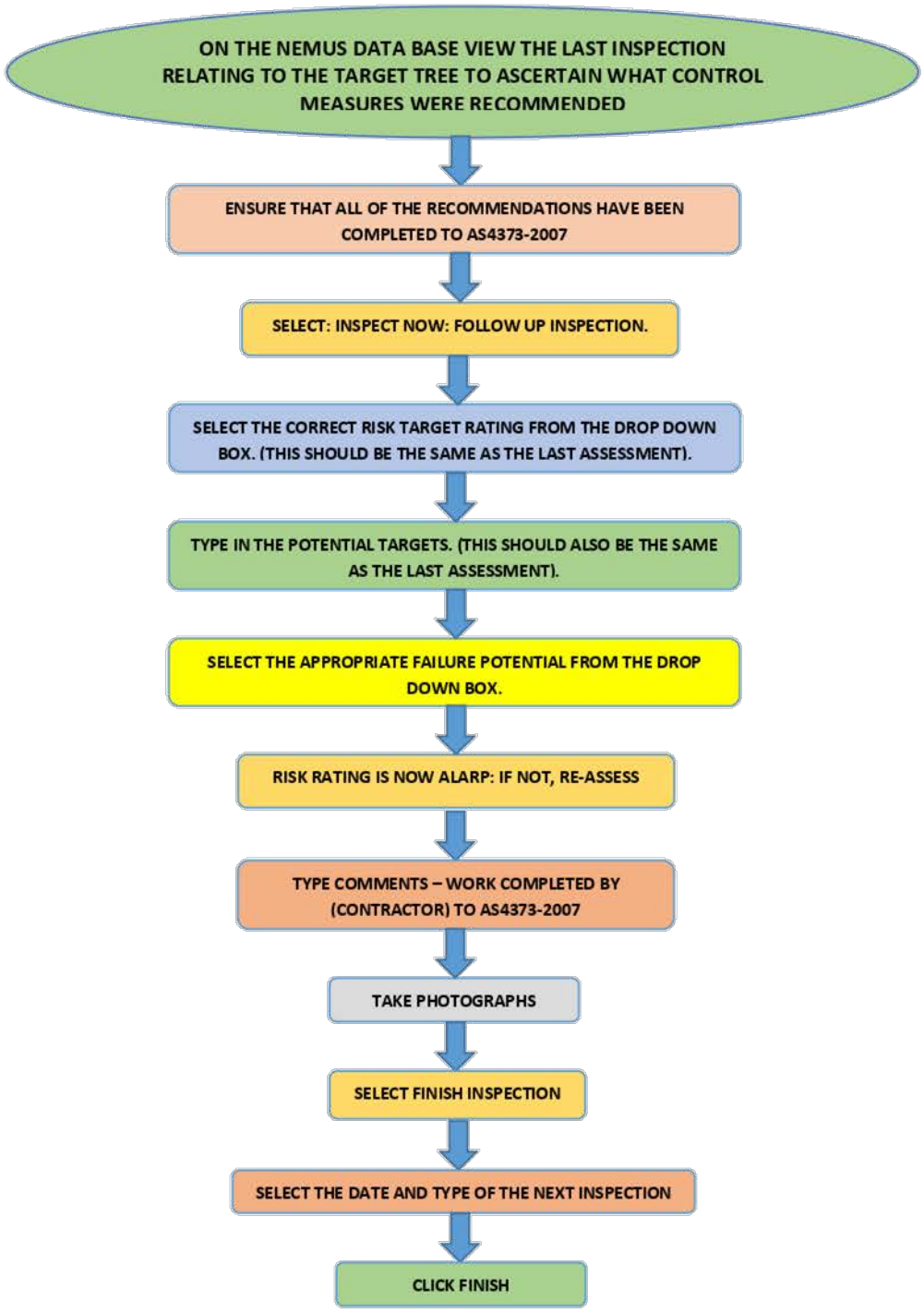
High Constant use: Hospitals, emergency services locations, High Voltage Power Lines, busy highway traffic lights etc.

**LEVEL 3 VISUAL TREE RISK ASSESSMENT (VTRA) PROCEDURE.**
**THIS PROCEDURE IS THE HIGHEST LEVEL OF TREE RISK ASSESSSMENT USED BY THE CITY OF DARWIN AND MUST BE PERFORMED BY A LEVEL 5 ARBORIST.**



**Follow Up Assessment Procedure.**

This Assessment is required to return the tree to ALARP Status within NEMUS after the implementation of the Control Measures (Hazard Reduction). Follow Up Assessments on trees of Medium Risk may be, at the discretion of the Senior Arborist, performed by a Level 3 Arborist. Follow Up Assessments on all other Risk Assessment Ratings must be done by a Level 5 Arborist or above.



**PROCEDURES FOR USING NEMUS IN THE FIELD. ANDROID TABLET.**

1. **Accessing NEMUS.**

1 Turn Tablet on
2 Tap NEMUS icon
3 Log in - Enter User Name & Password
4 Screen will show;

| | |
|---|---|
| CBD Precinct | Download |
| Centrals Precinct | Download |
| Darwin NEMUS | Download |
| Northern Precinct | Download |

5 Tap the Download button for DARWIN NEMUS, wait for it to download then hit OK
6 NEMUS Version 2017.8.1A is now active.

Please Note: The PRECINCT data bases are to be used to search only. All data entries are to be logged using DARWIN NEMUS.

7 In order to ensure that data entered onto the Tablet is saved on the Web it is essential to SYCHRONIZE your Tablet every morning and afternoon and regularly during the day. You must have either Wi-Fi or phone coverage to do this.

1. To sychronize: On the NEMUS home page tap the ⇅ Icon in the top right hand side of the screen and press OK when prompted. If you LOG OUT without sychronizing your Tablet then all data entered since the last synchronization will be lost.

8

9 The other Icons on the Home Screened include. ⋮ Tapping this Icon will bring up the following.

a. **Data Base Manager:** Allows you to download Precinct data bases for easier searching. Shows which data base is active. Shows the last date synchronized.
b. Settings – not to be used by unauthorized personnel
c. Configure Menu - not to be used by unauthorized personnel
d. **About:** Contains a 1300 help line number – tap the number to call. Also tap the email icon to send email.
e. **Logout**: logs you out of the system; be sure to synchonize before logging out or you will lose your data.

**Note: The Data Base Manager also contains a TRASH symbol; DO NOT USE THIS UNDER ANY CIRCUMSTANCES.**

2. **Trees:**

Tapping the **Trees icon** will open up the the Google Map of Darwin. Expanding this map will bring up the **Tree Icons** for every tree that has been entered into NEMUS. Each tree will show up as a different colour on the map, according to it's Risk Assessment.

- White with green outline = ALARP

- All green = Medium
- Yellow with green outline = High 1
- Orange with green outline = High 2
- Red with green outline = High 3.

Note: Any tree that has been entered onto the data base without a completed Risk Assessment will also show Red with Green outline. This is confusing so all trees entered should have a VTRA completed.

To enter **Tree Data** and **Risk Assessment Data** follow the instruction below. Please note that Tree Data and Risk Assessment Data are on two different "pages" on the Tablet. Tree data must be entered first.

The NEMUS program has a "**Find Me" – "Follow Me"** capability. This is enabled by turning on the **Tracking Device** located in the top right hand corner of the map. This will automatically pinpoint you location. When searching for a tree this facility can be turned off to make it simplier to manipulate the screen.

The top of the **Tree Screen** shows fom left to right –

- Nemus Logo
- Map (00) List (00)
- + = Creates a new entry – a black circle which you place over the target tree.
- = Copy Last Tree; Copies the attributes of the last tree entered. Used when you have multiple s of the same species to enter.
- Funnel = Select Filters – Show all Trees; Show non-plantable sites only; Show plantable sites only.
- "Eye" or Symbol. The "Eye" is overhead view, Arrowhead is street view.
- This function has 3 different uses;

1. Display Type = Use Hybrid. This is a combination of Street & Satellite. House numbers are displayed.
2. Settings = Track my location
3. Tracking = Can be used to turn Tracking on or off.

- This Symbol is in the top Right Hand side of the screen and also turns Tracking on & off
- + & - in the bottom right corner are used to expand or decrease the view.

**3. To add a Tree to the Data Base:**

1. Tap + which will bring up the Black Circle to place over the Target Tree. You can manipulate this to ensure you have the correct tree.
2. With the Black Circle held over the target tree tap ADD TREE at the bottom of the screen. This will automatically find the address, allocate a TR (Tree number) The Tree Attributes Screen will also automatically appear.
3. The "Lookup" lists are accessed by touching the empty grey box under the field name. Some of these are automatically cross referenced. Eg. if you touch the "Common Name" field then tap "African Mahogany" the attributes for Family; Genus; Botanical Name will automatically appear.
4. The Precinct Field is mandatory.
5. Other fields have drop down lists to choose from
6. Tick the Quarterly or Biannual Inspection Box as appropriate
7. The Risk Rating Box is left empty. This is automatically generated when the VTRA is completed.
8. Tick the Non-Plantable Box or leave empty as appropriate.
9. Check map/satellite screen to ensure the tree is in the correct location. If not touch & hold the screen to move the tree to its correct location.

**4. To complete the Inspection/Assessment**

2. Tap INSPECT NOW at the bottom of the screen. Then select the type of Insepction/Assessment you wish to conduct. This will activate the screen for your selected Assessment.
3. Most defect attributes are simply "tick-a-box". Tap the box to tick. These boxes are to be left blank where the particular attribute/defect is not present.
4. Where there is a TYPE IN LINE simply touch it to bring up the keyboard. Do not leave these lines blank. Eg. "pests or diseases visible" if there are no obvious pests or diseases type in NONE VISIBLE; this informs the next Assessor that any diseases have arrived since the last inspection.
5. The grey "lookup" list are accessed by touching them. The RISK ASSESSMENT will generate automatically once the RISK TARGET RATING & FAILURE POTENTIAL fields are populated.
6. Touch the CAMERA icon to to photograph he tree. Multiple images can be added. Point, shoot & save.
7. Touch the FINISH INSPECTION at the bottom of the screen.
8. In the new window select the NEXT INSPECTION TYPE.
9. Touch the DATE field to bring up the Calendar
10. Enter the DATE of the next inspection then OK
11. Tap the FINISH button
12. Tap CLOSE at the botton of the screen.
13. If you are only doing one tree it is recommended you SYNCHRONIZE your Tablet immediately to ensure the data is saved. The NEMUS system is designed so that the Tree Data can be changed at any time due to growth or other changes to the tree. The Assessment Data cannot be changed once the Assessment is completed and the data is sychronized.

Where there are multiple Tablets being used simultaneously, TR (Tree) numbers will sometimes be the same on several trees. However, once the data is synchronized the Server will automatically re-issue individual TR numbers usually within 15 minutes.

**5. Accessing Inspections.**

1. On the NEMUS Home Page two headings appear. **Trees & Inspections.**
2. Tapping the **Inspections icon** will bring up the INSPECTIONS page. Tapping the **FUNNEL ICON** in the top right hand corner will filter the Inspections.
    a. To view all OVERDUE INSPECTIONS tick Show Past Inspections - Done
    b. To view all PAST INSPECTIONS tick Show Past Inspections & Show Completed Inspections – Done
    c. To view all FUTURE INSPECTIONS tick Show Future Inspections – Done
    d. To view all SCHEDULED INSPECTIONS tick Show Future Inspections & Show Scheduled Inspections – Done
    e. To view all COMPLETED INSPECTIONS tick Show Past Inspections & Show Completed Inspections – Done
    f. An update of a; b; c; d; e is being introduced by AssetEdge in the near future and this Section will be updated in due course.

# PROCEDURES FOR USING NEMUS – WEB VERSION

The Darwin NEMUS program is designed to do two things;

- capture and store tree data
- Store VTRA results

The major usage will be in Visual Tree Risk Assessments and Tree Management Officers will be able to manage all tree inspections/assessments, allocate work and re-assign risk after work is completed.

**6. Accessing NEMUS**

1. Access the Web & Welcome to NEMUS
2. Login with User Name & password
3. The Nemus home page will appear

The quickest, simplest method of finding recently completed Assessments in order to programme works is below.

a. Click on INSPECTIONS at the top of the Home Page
b. A Search Inspections window will appear with a number of fields
c. Click on Inspection Type required
    1. Level 3 Assessment
    2. Followup Assessment
    3. Level 1 Inspection
d. Date Raised:
From [ ] To [ ]

e. Inspector:
[ Select ]

f. Click SEARCH.

The screen will then show:

| Insp. Number | Assett Id | Details | Type | Dates | Inspector | Status | |
|---|---|---|---|---|---|---|---|
| xxxxx | xxxxxx | Location/address | Inspection level | Raised<br>Target<br>Completed<br>(Dates) | xxxxxxx | Completed<br>Pending<br>Scheduled | VIEW<br>Pdf<br>Word<br>Excell |

Click on the appropriate View, PDF, Work Excell Icon.

The full Tree data and Assessment Report can then be either viewed or printed in PDF, Word or Excell including photos.

Using the WORD version will allow you to manipulate the photos – enlarge them, use arrows to indicate particular parts of the tree, write instructions or more clearly indicacte required works.

Normal Council procedures can then be followed to program hazard reduction or other works.

Another simple method of determining priorities is to access tha data base each morning, go to Find Tree by Attribute and find by Risk.

To Find a Tree by Attribute follow the instructions below.

a. A list of Overdue Inspections
b. A Calendar
c. QUICK LINKS

4. The quickest way to find a tree is Find a Tree by Attribute.
5. In the Search Trees Window click the drop down list
6. Select whichever Risk Level you require
7. Click the Search button. The screen will display all trees currently at your chosen Risk Level
8. Choose the tree you wish to view, Click the Inspection button
9. A Select Inspection Window will appear with Inspection Numbers eg IN00001
10. Select the Inspection you wish to view by either number or date and click it.
11. The Inspection Details Window will appear with the Tree Data visible
12. Click onto the Result button on the right hand side
13. The Assessment Results will appear
14. Scroll to the bottom and click the Save Result button
15. Click the Photos button to access the photos.
16. Click the **W** **button** and a Microsoft Word File will appear in the bottom left hand corner of the main screen.
17. Click on this and a full report, location map and photos is now available for printing

**APPENDIX 1.**


## WIND LOADING & THE EFFECTS OF OSCILLATION DAMPING ON TREES.

### Issues to be considered during Visual Tree Risk Assessment.

When loads increase at a point on a tree, adaptive growth occurs at that point and the tree attempts to relieve the stress at that point. The largest loads on trees are dynamic loads caused by winds. Tree adaption to wind loading takes place over a long period of time and during storms only passive damping mechanisms can reduce the impact of the wind on the trunk, limbs and roots.

Oscillation damping is of vital importance for trees to withstand strong gusty winds. Structural damping which is associated with the conspicuous movement of the branches relative to the trunk is of particular importance.

Recent studies of trees using complex models and multi-modal analysis have indicated that the morphology of a tree and the dynamic interaction of branches can influence the damping response in winds. Branches on a tree act as coupled masses and in winds develop a mass damping effect which helps distribute, reduce and dissipate the wind energy.

The sway motion of trees is damped because of three main components:

1. Interference of branches with those of neighbouring branches
2. Aerodynamic drag on foliage
3. Damping in the trunk

The branches of a tree sway in a complex fashion that prevents large, dangerous sway oscillations being generated in the main trunk structure thereby acting as mass dampers in the dynamic motion of a tree. It is a survival mechanism developed to ensure that a harmonic or pendulum-like sway is never developed.

Testing by Moore & Maguire (2004) was carried out on a tree with large branches and recorded damping ratios of 10.6% when the tree still had all branches attached. As branches were progressively removed the damping ratio decreased until the lowest damping ratio of 1.3% was recorded when only one bare branch was left. In other words removing the branches removed 93.3% of the damping effect on the tree.

Over pruning, excessive cleaning out and lion tailing of large trees alter the dynamic motion of the tree from wind loading and actually increases the probability of failure of either large scaffold branches or the entire tree.

A large urban tree has spent many decades adapting to wind loading and interfering with the tree's natural survival mechanisms by excessive pruning is actually increasing the risk of tree failure.

Arborists performing VTRA and/or pruning trees need to be aware of the detrimental effects of over pruning.

*References: Branches and damping on trees in wind – KR James & N Haritos 2014*
*Moore & Maguire 2004*
*Milne 1991*

*Bill Sullivan is a Consulting Arborist with an Advanced Diploma in Horticulture/Arboriculture.*

**Appendix 2.**

**ABSTRACT: The Tree as a living System:**

This section has been included is to provide important information as to how a tree actually functions, the environment and elements which are needed for the tree to develop and grow to its' full potential.

*Photosynthesis:* The process by which trees use energy from sunlight to produce carbohydrates (for food) from carbon dioxide and water. Sunlight energy is captured in the leaves by molecules of chlorophyll in organelles called chloroplasts. An important part of photosynthesis is how trees absorb carbon dioxide from the atmosphere, store it as carbon (for food) and release oxygen back into the atmosphere.

*Respiration:* The process by which cells release energy stored in carbohydrates in order to drive the chemical reactions of metabolism in which substances are broken down to yield energy for vital processes while other substances are synthesized for other uses within the tree.

*Absorption:* This is the process in which one substance permeates another. In trees this involves osmosis, diffusion, water potential and pressure potential and is how a tree obtains water and soil-borne elements essential for growth.

*Compartmentalisation:* The trees dynamic defence process that forms boundaries that resist the spread of pathogens.

*Translocation:* The movement of substances (water & nutrients) in the vascular system (phloem & xylem) from roots to leaves and leaves to roots.

*Optimisation:* Trees are self optimising structures that discern load bearing stress via the cambium and strengthen themselves by the growth of reaction wood and wound wood.

*Storage:* Trees have the capacity to store energy in living cells in 8 or more growth increments, energy can also be stored in sapwood in the crown and in the roots.

*Transpiration:* the process of upward movement of sap in the xylem due to the water potential gradient caused by evaporation of water from the leaves.

*Vigour:* The capacity to resist strain; a genetic factor, a potential force against any threats to survival.

*Vitality:* The ability to grow under the conditions present; dynamic action.

*The root system:* Contrary to popular belief, trees generally have their root systems in the first 40cm of soil although in the monsoon tropics many trees only have roots within the top 15cm of soil and in many cases on top of the ground. The way in which trees anchor themselves and obtain nutrients from the soil is in many cases dependent on soil types but the most important factor is that roots do not suffer continual or large scale damage. In an urban environment the most usual causes of root damage are digging, trenching, lawn mowers and soil compaction. Soil compaction over the root zone will cut off the oxygen supply to the roots and the translocation process will decline.

Each of the above components are like pieces of a jig-saw with each playing a vital role and together with a compatible growing environment will produce a healthy tree. It is worth noting that trees evolved in a forest system where trees interconnected with each other and with many other organisms so as to ensure the survival of all members of the forest. The genetic codes for tree survival came from trees growing in a forest. When a forest-coded tree is brought into an urban environment it loses the group protection and group defence and the factors that affect the trees' vitality become extremely important.

***Trees can survive and flourish in a built environment but only if the system by which the tree lives is not impaired by the development that is supposed to enhance.***

**APPENDIX 3. Definitions of Technical Terms.**

| | |
|---|---|
| Apical control: | Relative superiority of the central leader to lateral branches. Excurrent trees have a strong apical control as the central leader is superior in size to all other limbs. |
| Adventitious shoot: | Vegetative tissue that develops from newly organized meristems rather than latent buds; frequently associated with poorly sited pruning wounds. |
| Branch collar; | Over-lapping trunk and branch tissue forming a swelling around the base of many branches and containing defensive chemicals. |
| Branch attachment; | The structural linkage of branch to stem |
| Brown Rot: | Form of decay where cellulose is digested |
| Bleeding; | Flow of sap from wounds or cracks, bleeding from branch junctions. Usually indicates decay. |
| Butt rot; | Decay in the lower trunk or root crown area |
| Buttress wood: | Wood under tension, in a structurally critically portion of the trunk or branch, also known as "holding wood" or "reaction wood". |
| Cambium; | Cylindrical layer of cells in plant roots and trunks that produces the new tissue responsible for increased girth, particularly the sap conducting tissues, xylem and phloem. |
| Canker; | Localised area of dead tissue on a trunk or branch, caused by fungal or bacterial organisms |
| Cavity: | An open wound, characterized by the presence of extensive decay resulting in a hollow |
| Chlorotic; | Lacking in chlorophyll, typically yellow in colour |
| Conk; | Fruiting or spore producing body of wood decaying fungi, forming on the external surface of the trunk or branch |
| Co-dominant trunks; | Stems or trunks of about the same size originating from the same position from the main trunk |
| Crown; | Portion of the tree consisting of branches and leaves and any part of the trunk from which branches arise. |
| Crown Class: | Relative size of individual trees in relation to others in the same stand; usually designated as – dominant, co-dominant, intermediate or suppressed. |
| Crown Lifting; | Removal of the lower branches |
| Crown modification; | Pruning that changes the form and habit of the tree. |
| Crown thinning; | Selective removal of branches that does not alter the overall size of the tree |
| Cross over; | Two branches crossing over in contact with each other (see friction wound) |
| Dead-wooding; | Removal of dead branches |
| Decay; | The process of degradation of woody tissue by fungi and bacteria through the de-composition of cellulose and lignin. |
| De-current; | Crowns which consist of co-dominant scaffold branches lacking a central leader. |
| Die-back; | Death of shoots and branches, usually from tip to base |

| | |
|---|---|
| End weight; | The concentration of foliage at the distal ends of branches |
| Epicormic Bud; | Latent or adventitious bud located at the cambium |
| Epicormic shoot; | Shoots produced from epicormic buds at the cambium of trunks or branches |
| Extruded bark; | Outwardly formed bark at the junction of branches or co-dominant trunks |
| Excurrent: | Crown form where a strong central leader is present; opposite to de-current. |
| Flush cut ; | A pruning cut that damages or removes the branch collar or removes branch and stem tissue allowing disease and/or decay causing pathogens to enter the tree. |
| Formative pruning; | Pruning young trees to direct plant growth with the aim of developing a sound structure |
| Friction wound; | Wound caused by two branches/trunks rubbing together creating a weak spot |
| Gall; | An abnormal, localised growth generally seen a knobby growth on branches or trunks caused by bacteria or fungi. |
| Girdling root; | Root which circles and constricts the trunk or roots causing the death of the phoelm and/or cambium tissue. |
| Ganaderma: | Fungi found all over the world but particularly in the tropics. Kills the host tree and there is no known cure. Acacia *spp.* are particularly vulnerable. |
| Growth crack: | Longitudinal crack in the bark due to normal expansion of the cambium and xylen; this is not regarded as a defect. |
| Hangers; | Unattached and/or broken branches hanging in the canopy |
| Heart rot; | Decay in the centre (heart wood) of the tree |
| Included bark; | Inwardly turned bark within the junctions of branches or co-dominant trunks. One of the major causes of structural failure of trees with co-dominant trunks |
| Lean; | Departure of the trunk from the vertical |
| Lignin; | Complex polymer in plant cell walls and is the major component of wood |
| Live Crown Ratio: | The relative proportion of green crown to the overall tree height. |
| Lion Tailing | Pruning of internal foliage and branches leaving foliage concentrated at the distal ends of branches or limbs. This practice is contrary to AS 4373-2007 and is a major cause of limb failure in large trees. |
| Lopping; | The practice of cutting branches or trunks between branch unions or internodes. Also called topping this practice is unacceptable under AS 4373-2007 as it will increase the rate of shoot production with the resulting regrowth being weakly attached and prone to failure or collapse. It also predisposes the tree to fungal and insect attack and reduces the lifespan of the tree. |
| Necrotic; | Dead |
| Pathogen; | A disease-causing organism |
| Phloem; | Nutrient carrying tissue of a plant |
| Phototropism; | The tendency of a tree to grow towards light particularly when over shadowed by a larger tree or building. |

| | |
|---|---|
| Reduction pruning; | Removal of ends of branches to lower the internal lateral branches in order to reduce the height and/or spread of the tree. |
| Remedial pruning; | Removal of damaged, diseased or lopped branches back to undamaged tissue in order to induce the production of shoots from latent or adventitious buds from which a new crown will be established. |
| Saprot; | Sapwood decayed by fungus |
| Saprophyte; | An organism that obtains its' nutrients from dead organic matter |
| Scaffold Limb: | Primary structural branch of the crown. |
| Seam: | Callus ridge formed by included bark at branch junctions; also formed when two edges of callus/woundwood meet at the centre of a wound. |
| Split: | Longitudinal breakage in a limb or branch, affecting bark, cambium and xylem. |
| Sudden limb drop; | Sudden failure of a branch in warm, still weather |
| Structural defect: | Internal or external points of weakness which reduce the stability of the tree. |
| Target; | People or property potentially affected by tree failure |
| Tension wood: limbs | Reaction wood produced by broad leaf trees which forms on the upper side of branches and |
| Trunk; | The main stem of a tree |
| Vigour: | Overall health of a tree; capacity to grow and resist physiological stress. |
| Wound; | An opening that is created when the bark and/or vascular layer is cut, removed or damaged. Even a pruning cut creates a wound but a correctly made pruning cut stimulates the growth of wound wood to cover the cut. The most common wounds on amenity trees are made by poor pruning cuts and careless use of machinery including lawn mowers, slashers, etc. |
| Wind Loading: | The largest loads on trees are dynamic loads caused by winds. Tree adaption to wind loading takes place over a long period of time and during storms only passive damping mechanisms can reduce the impact of the wind on the trunk, limbs and roots. |
| Woundwood; | Lignified, partially differentiated tissue which develops from the callus associated with wounds |
| Xylem; | Woody supportive tissue that carries water and dissolved minerals from the roots through the trunk and leaves. |

**Appendix 4. Photographs of common defects in Top End Trees.**

Photo # 1. Branch failure on large African Mahogany limb with clearly defined Seam (Callus ridge) between live and dead tissue visible. Failure was caused by a combination of over pruning (lion tailing) resulting in excessive end weight and decay with the limb failing at its' weakest point.

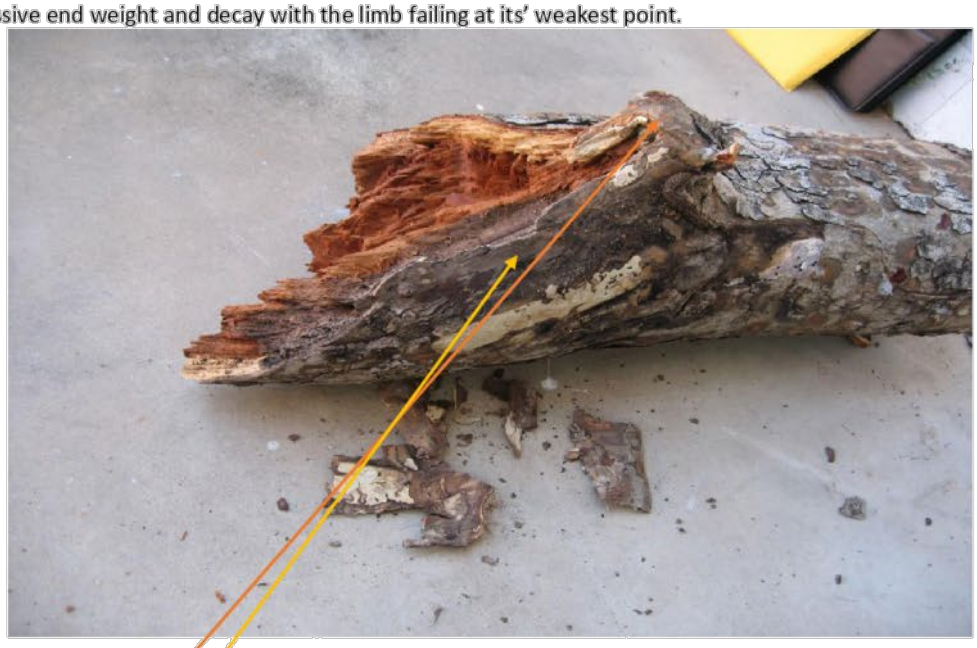


Photo # 2 showing entry point for the decay causing pathogen. This was either and old pruning wound or the site of a discarded epicormic shoot. Water has entered via the wound before it was covered by woundwood. Saprot is visible.

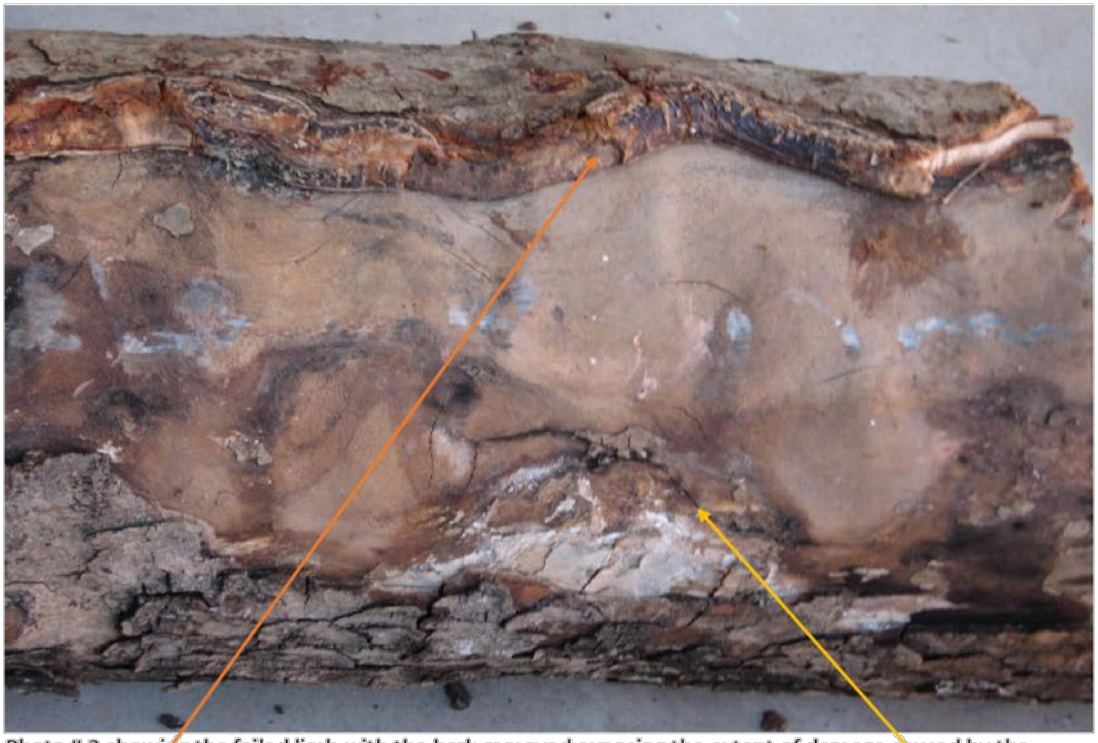


Photo # 3 showing the failed limb with the bark removed exposing the extent of damage caused by the saprot. Callus ridge is the tree's defense mechanism attempting to repair the damage. Stress cracks are visible in the wood.

Photo # 4 Showing Callus ridge on Rain Tree branch with dead tissue.

Photo #5 showing Termite nest on Rain Tree. These termites will not harm the living tree but indicate that there is copious amounts of dead wood available for consumption.

Photo # 6 showing extensive decay and termite damage on Raintree. The living tree is trying to grow callus tissue around the dead portion.

Photo # 7 showing extensive deadwood on Casuarina. This is not just dead wood but die back. Although the tree appears to be healthy it is actually declining.

Photo # 8 showing cavity in the trunk of an Albizia. This cavity will act as a water collector which in turn has encouraged serious decay within the trunk. Termites have also been active on the right hand trunk.

Photo # 9 showing a landscaper's best effort to kill a Raintree or destroy the deck. The tree was given a new lease of life by making the hole bigger.

Photo # 10. Rows of African Mahoganies possible 25 to 30 years old. These trees were planted in hard rocky ground, without adequate sized holes, consequently most scaffold roots are on the surface. The size and structure of the trees for their age is not exactly a tribute to whoever planted them.

Photo # 18. African Mahogany Trees showing good structure and form as a result of correct planting and pruning protocols. They were planted in 2004 in hard rocky ground and irrigated until the first wet season.

Photo # 11 showing adventitious roots on an Albizia. The tree has produced new roots in an attempt to bridge the gap in the cambium layer caused by termite attack.

Photo # 12 showing dead section of the trunk of an Acacia caused by previous poor pruning cut and then attacked by borers.

Photo # 13 showing Raintree damaging a roof.

Photo # 14 showing roots from a Melaleuca damaging infrastructure.

Photo # 15 showing an example of a Eucalypt planted in hard rocky ground without an adequately sized planting hole.

Photo # 16 showing examples of poor pruning cuts.

Photo # 17 This tree has a Live Crown Ratio of around 60%

Photo # 19: Allosyncarpia with approximately 60% Live Crown Ratio, good form and correct pruning protocols. The structure of this species is naturally poor with bark inclusions normal. See next photo.

Photo # 20: Typical bark inclusion on an Allosyncarpia. The tree failure rate from this defect in Allosyncarpia is actually fairly low until trees are post mature age when the failure rate increases.

Photo # 21 showing an African Mahogany tree which has re-grown around a dead tree. The dead tree is the center circle.

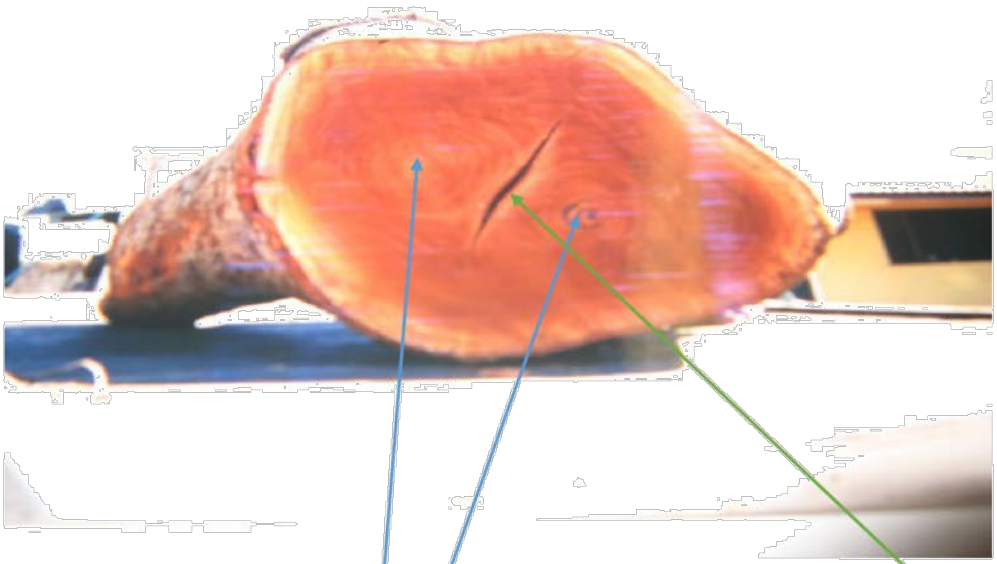


Photo # 22 showing an African Mahogany log in excess of 1.5 metre diameter with a bark inclusion from ground level to 3 metres. Two separate original trees are clearly visible.

Photo 23 showing early stages of Termite (Mastodermes *Darwiniensis)* attack on an African Mahogany.

Photo 24 showing the results of "tree lopping" with the tree attempting to callus over the original wound.

Photo 20. Typical example of an over pruned tree with excessive end weight and changed wind dynamics in the canopy. The tree may have an elevated Risk Level due to the over pruning.

## Benefits Summary of Trees by Species

Location: Darwin, Darwin City Council, Northern Territory, Australia
Project: CBD, Series: 1, Year: 2020
Generated: 10/03/2020


| Species | Trees | Carbon Storage | | Gross Carbon Sequestration | | Avoided Runoff | | Pollution Removal | | Structural Value |
|---|---|---|---|---|---|---|---|---|---|---|
| | Number | (metric ton) | (A$) | (metric ton/yr) | (A$/yr) | ($m^3$/yr) | (A$/yr) | (metric ton/yr) | (A$/yr) | (A$) |
| Acacia auriculaeformis | 4 | 1.93 | 43.90 | 0.07 | 1.65 | 3.43 | 7.77 | 0.00 | 2.32 | 11,507.17 |
| Adansonia gregorii | 1 | 2.20 | 50.09 | 0.05 | 1.18 | 1.98 | 4.49 | 0.00 | 1.34 | 13,384.19 |
| Allosyncarpia | 1 | 0.24 | 5.47 | 0.01 | 0.32 | 0.50 | 1.12 | 0.00 | 0.34 | 1,830.21 |
| Alstonia scholaris | 2 | 4.16 | 94.74 | 0.09 | 2.16 | 1.32 | 2.98 | 0.00 | 0.89 | 23,547.18 |
| Casuarina equisetifolia | 4 | 2.27 | 51.74 | 0.06 | 1.44 | 10.51 | 23.78 | 0.00 | 7.10 | 35,188.19 |
| Callitris intratropica | 6 | 2.07 | 47.20 | 0.10 | 2.29 | 1.88 | 4.24 | 0.00 | 1.27 | 15,646.91 |
| Corymbia bella | 4 | 6.68 | 152.31 | 0.16 | 3.64 | 9.76 | 22.08 | 0.00 | 6.59 | 47,547.09 |
| Corymbia nesophila | 1 | 0.40 | 9.11 | 0.02 | 0.43 | 0.94 | 2.13 | 0.00 | 0.64 | 3,661.12 |
| Delonix regia | 4 | 12.42 | 283.08 | 0.15 | 3.43 | 5.68 | 12.85 | 0.00 | 3.83 | 65,961.87 |
| Eucalyptus | 2 | 1.48 | 33.78 | 0.05 | 1.21 | 2.41 | 5.44 | 0.00 | 1.62 | 12,570.76 |
| Eucalyptus alba australasica | 1 | 0.21 | 4.72 | 0.01 | 0.29 | 0.41 | 0.94 | 0.00 | 0.28 | 1,904.61 |
| Eucalyptus camaldulensis ovata | 8 | 10.69 | 243.63 | 0.30 | 6.73 | 16.63 | 37.61 | 0.00 | 11.23 | 82,310.47 |
| Ficus microcarpa v. hillii | 14 | 103.80 | 2,366.71 | 0.26 | 5.86 | 19.65 | 44.45 | 0.01 | 13.27 | 819,749.17 |
| Ficus virens | 9 | 42.92 | 978.65 | 0.22 | 5.06 | 11.29 | 25.53 | 0.00 | 7.62 | 318,507.53 |
| Harpephyllum caffrum | 2 | 0.61 | 13.85 | 0.03 | 0.68 | 0.22 | 0.50 | 0.00 | 0.15 | 4,522.93 |
| Hibiscus tiliaceus v. rubra | 5 | 1.65 | 37.73 | 0.08 | 1.80 | 3.57 | 8.08 | 0.00 | 2.41 | 12,098.77 |
| Maranthes corymbosa | 8 | 4.26 | 97.03 | 0.17 | 3.93 | 7.39 | 16.72 | 0.00 | 4.99 | 30,048.54 |
| Mangifera indica | 16 | 52.34 | 1,193.42 | 0.77 | 17.63 | 1.91 | 4.32 | 0.00 | 1.29 | 281,397.36 |
| Melaleuca leucadendra | 2 | 1.85 | 42.28 | 0.06 | 1.41 | 2.83 | 6.40 | 0.00 | 1.91 | 12,313.89 |
| Mimusops elengi | 2 | 0.51 | 11.62 | 0.03 | 0.65 | 1.87 | 4.23 | 0.00 | 1.26 | 3,757.57 |
| Nauclea orientalis | 4 | 1.76 | 40.03 | 0.08 | 1.76 | 2.32 | 5.24 | 0.00 | 1.56 | 12,917.73 |
| Peltophorum pterocarpum | 2 | 5.62 | 128.06 | 0.08 | 1.91 | 2.21 | 5.00 | 0.00 | 1.49 | 26,288.61 |
| Pinopsida | 4 | 3.69 | 84.12 | 0.08 | 1.90 | 8.17 | 18.47 | 0.00 | 5.51 | 45,017.96 |
| Pterocarpus macrocarpus | 17 | 19.66 | 448.26 | 0.55 | 12.57 | 22.76 | 51.47 | 0.01 | 15.36 | 120,227.54 |
| Samanea tubulosa | 12 | 86.38 | 1,969.37 | 0.24 | 5.50 | 17.10 | 38.67 | 0.00 | 11.54 | 500,489.96 |

## Benefits Summary of Trees by Species

Location: Darwin, Darwin City Council, Northern Territory, Australia
Project: CBD, Series: 1, Year: 2020
Generated: 10/03/2020

| Species | Trees | Carbon Storage | | Gross Carbon Sequestration | | Avoided Runoff | | Pollution Removal | | Structural Value |
|---|---|---|---|---|---|---|---|---|---|---|
| | Number | (metric ton) | (A$) | (metric ton/yr) | (A$/yr) | ($m^3$/yr) | (A$/yr) | (metric ton/yr) | (A$/yr) | (A$) |
| Spathodea campanulata | 4 | 1.41 | 32.24 | 0.07 | 1.48 | 3.39 | 7.67 | 0.00 | 2.29 | 10,052.93 |
| Tabebuia impetiginosa | 1 | 0.81 | 18.40 | 0.03 | 0.66 | 1.32 | 2.99 | 0.00 | 0.89 | 5,621.51 |
| Tamarindus indica | 3 | 2.11 | 48.04 | 0.08 | 1.78 | 3.78 | 8.55 | 0.00 | 2.55 | 14,438.08 |
| **Total** | **143** | **374.10** | **8,529.56** | **3.92** | **89.34** | **165.22** | **373.70** | **0.05** | **111.55** | **2,532,509.84** |

Carbon storage and gross carbon sequestration value is calculated based on the price of A$22.80 per metric ton.
Due to limits of available models, i-Tree Eco will limit carbon storage to a maximum of 7,500 kg (16,534.7 lbs) and not estimate additional storage for any tree beyond a diameter of 254 cm (100 in). Whichever limit results in lower carbon storage is used.
Avoided runoff value is calculated by the price A$2.262/$m^3$. The user-designated weather station reported 61.1 centimeters of total annual precipitation. Eco will always use the hourly measurements that have the greatest total rainfall or user-submitted rainfall if provided.
Pollution removal value is calculated based on the prices of A$23.00 per metric ton (CO), A$2,549.30 per metric ton (O3), A$379.81 per metric ton (NO2), A$138.20 per metric ton (SO2), A$0.00 per metric ton (PM2.5).
Structural value is the estimated local cost of having to replace a tree with a similar tree.
A value of zero may indicate that ancillary data (pollution, weather, energy, etc.) is not available for this location or that the reported amounts are too small to be shown.

## Benefits Summary of Trees by Species

Location: Darwin, Darwin City Council, Northern Territory, Australia
Project: Central Precinct, Series: 1, Year: 2020
Generated: 10/03/2020


| Species | Trees | Carbon Storage | | Gross Carbon Sequestration | | Avoided Runoff | | Pollution Removal | | Structural Value |
|---|---|---|---|---|---|---|---|---|---|---|
| | Number | (metric ton) | (A$) | (metric ton/yr) | (A$/yr) | ($m^3$/yr) | (A$/yr) | (metric ton/yr) | (A$/yr) | (A$) |
| Acacia auriculaeformis | 9 | 8.92 | 203.31 | 0.24 | 5.52 | 9.27 | 20.98 | 0.00 | 6.16 | 46,624.78 |
| Adenanthera pavonina | 2 | 4.62 | 105.37 | 0.09 | 2.08 | 2.19 | 4.96 | 0.00 | 1.46 | 23,094.03 |
| Allosyncarpia | 5 | 3.23 | 73.58 | 0.11 | 2.50 | 5.18 | 11.72 | 0.00 | 3.44 | 21,077.04 |
| Alstonia actinophylla | 1 | 0.41 | 9.42 | 0.02 | 0.44 | 0.57 | 1.30 | 0.00 | 0.38 | 3,119.25 |
| Alstonia scholaris | 5 | 6.38 | 145.54 | 0.17 | 3.86 | 2.87 | 6.50 | 0.00 | 1.91 | 38,418.89 |
| Carallia brachiata | 1 | 0.28 | 6.37 | 0.02 | 0.35 | 0.73 | 1.65 | 0.00 | 0.48 | 2,124.03 |
| Casuarina equisetifolia | 1 | 0.28 | 6.35 | 0.01 | 0.24 | 2.22 | 5.03 | 0.00 | 1.48 | 4,354.72 |
| Callitris intratropica | 4 | 0.88 | 20.12 | 0.05 | 1.21 | 0.97 | 2.20 | 0.00 | 0.65 | 6,977.24 |
| Corymbia bella | 6 | 1.29 | 29.31 | 0.08 | 1.76 | 2.70 | 6.12 | 0.00 | 1.80 | 11,917.05 |
| Corymbia confertiflora | 1 | 0.11 | 2.58 | 0.01 | 0.21 | 0.20 | 0.45 | 0.00 | 0.13 | 1,003.83 |
| Corymbia ptychocarpa | 1 | 0.57 | 12.99 | 0.02 | 0.53 | 0.92 | 2.08 | 0.00 | 0.61 | 5,102.36 |
| Delonix regia | 1 | 0.82 | 18.69 | 0.03 | 0.66 | 1.39 | 3.14 | 0.00 | 0.92 | 5,621.50 |
| Eucalyptus bigalerita | 2 | 0.81 | 18.49 | 0.03 | 0.79 | 1.34 | 3.03 | 0.00 | 0.89 | 6,934.90 |
| Eucalyptus camaldulensis ovata | 6 | 5.47 | 124.82 | 0.17 | 3.89 | 8.95 | 20.24 | 0.00 | 5.95 | 43,930.65 |
| Ficus microcarpa v. hillii | 6 | 41.19 | 939.10 | 0.18 | 4.06 | 8.68 | 19.63 | 0.00 | 5.77 | 301,282.68 |
| Ficus racemosa | 5 | 21.54 | 491.10 | 0.28 | 6.42 | 7.10 | 16.06 | 0.00 | 4.72 | 147,084.07 |
| Ficus virens | 7 | 52.59 | 1,198.96 | 0.11 | 2.45 | 10.15 | 22.97 | 0.00 | 6.75 | 417,879.85 |
| Gmelina arborea | 1 | 4.31 | 98.18 | 0.08 | 1.76 | 0.86 | 1.95 | 0.00 | 0.57 | 21,538.69 |
| Harpephyllum caffrum | 4 | 1.59 | 36.34 | 0.07 | 1.67 | 0.49 | 1.11 | 0.00 | 0.33 | 11,955.69 |
| Khaya | 12 | 47.51 | 1,083.25 | 0.58 | 13.30 | 23.52 | 53.20 | 0.01 | 15.63 | 242,387.67 |
| Magnoliopsida | 4 | 2.71 | 61.89 | 0.10 | 2.24 | 4.23 | 9.58 | 0.00 | 2.81 | 18,531.22 |
| Maranthes corymbosa | 16 | 15.83 | 360.98 | 0.44 | 10.07 | 14.81 | 33.50 | 0.00 | 9.84 | 95,190.91 |
| Mangifera indica | 3 | 12.93 | 294.91 | 0.16 | 3.54 | 0.37 | 0.83 | 0.00 | 0.24 | 63,572.80 |
| Melaleuca leucadendra | 6 | 9.77 | 222.72 | 0.22 | 4.97 | 14.08 | 31.84 | 0.00 | 9.35 | 51,334.38 |
| Mimusops elengi | 3 | 0.78 | 17.86 | 0.04 | 0.97 | 2.90 | 6.55 | 0.00 | 1.93 | 5,722.84 |

## Benefits Summary of Trees by Species

Location: Darwin, Darwin City Council, Northern Territory, Australia
Project: Central Precinct, Series: 1, Year: 2020
Generated: 10/03/2020

| Species | Trees | Carbon Storage | | Gross Carbon Sequestration | | Avoided Runoff | | Pollution Removal | | Structural Value |
|---|---|---|---|---|---|---|---|---|---|---|
| | Number | (metric ton) | (A$) | (metric ton/yr) | (A$/yr) | ($m^3$/yr) | (A$/yr) | (metric ton/yr) | (A$/yr) | (A$) |
| Myristica insipida | 1 | 0.67 | 15.22 | 0.03 | 0.58 | 1.37 | 3.10 | 0.00 | 0.91 | 4,495.96 |
| Nauclea orientalis | 3 | 1.56 | 35.48 | 0.06 | 1.43 | 1.82 | 4.11 | 0.00 | 1.21 | 11,118.33 |
| Peltophorum pterocarpum | 8 | 20.02 | 456.46 | 0.42 | 9.66 | 11.32 | 25.60 | 0.00 | 7.52 | 106,456.45 |
| Pinopsida | 5 | 16.49 | 375.95 | 0.13 | 3.08 | 9.49 | 21.47 | 0.00 | 6.30 | 130,770.82 |
| Pterocarpus indicus | 5 | 4.04 | 92.00 | 0.14 | 3.19 | 6.53 | 14.77 | 0.00 | 4.34 | 27,214.20 |
| Samanea tubulosa | 8 | 37.87 | 863.32 | 0.36 | 8.11 | 11.70 | 26.47 | 0.00 | 7.77 | 213,894.55 |
| Schleichera oleosa | 1 | 0.55 | 12.56 | 0.02 | 0.52 | 1.37 | 3.10 | 0.00 | 0.91 | 3,877.51 |
| Syzygium fibrosum | 1 | 0.31 | 7.15 | 0.02 | 0.37 | 0.72 | 1.63 | 0.00 | 0.48 | 2,920.23 |
| Tabebuia impetiginosa | 1 | 0.23 | 5.33 | 0.01 | 0.32 | 0.80 | 1.81 | 0.00 | 0.53 | 1,830.21 |
| Tamarindus indica | 2 | 5.18 | 118.06 | 0.11 | 2.60 | 2.93 | 6.63 | 0.00 | 1.95 | 29,093.80 |
| Tectona grandis | 2 | 2.11 | 48.20 | 0.06 | 1.42 | 1.40 | 3.17 | 0.00 | 0.93 | 13,745.27 |
| Terminalia microcarpa | 5 | 3.23 | 73.64 | 0.12 | 2.69 | 4.13 | 9.34 | 0.00 | 2.74 | 22,425.32 |
| **Total** | **154** | **337.09** | **7,685.59** | **4.80** | **109.49** | **180.31** | **407.84** | **0.05** | **119.78** | **2,164,623.71** |

Carbon storage and gross carbon sequestration value is calculated based on the price of A$22.80 per metric ton.
Due to limits of available models, i-Tree Eco will limit carbon storage to a maximum of 7,500 kg (16,534.7 lbs) and not estimate additional storage for any tree beyond a diameter of 254 cm (100 in). Whichever limit results in lower carbon storage is used.
Avoided runoff value is calculated by the price A$2.262/$m^3$. The user-designated weather station reported 61.1 centimeters of total annual precipitation. Eco will always use the hourly measurements that have the greatest total rainfall or user-submitted rainfall if provided.
Pollution removal value is calculated based on the prices of A$23.00 per metric ton (CO), A$2,555.06 per metric ton (O3), A$380.67 per metric ton (NO2), A$138.52 per metric ton (SO2), A$0.00 per metric ton (PM2.5).
Structural value is the estimated local cost of having to replace a tree with a similar tree.
A value of zero may indicate that ancillary data (pollution, weather, energy, etc.) is not available for this location or that the reported amounts are too small to be shown.

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## Benefits Summary of Trees by Species

Location: Darwin, Darwin City Council, Northern Territory, Australia
Project: Northern Precint, Series: 1, Year: 2020
Generated: 10/03/2020

| Species | Trees | Carbon Storage | | Gross Carbon Sequestration | | Avoided Runoff | | Pollution Removal | | Structural Value |
|---|---|---|---|---|---|---|---|---|---|---|
| | Number | (metric ton) | (A$) | (metric ton/yr) | (A$/yr) | ($m^3$/yr) | (A$/yr) | (metric ton/yr) | (A$/yr) | (A$) |
| Acacia auriculaeformis | 23 | 27.24 | 621.05 | 0.66 | 14.95 | 31.10 | 70.35 | 0.01 | 20.49 | 148,661.15 |
| Adenanthera pavonina | 1 | 0.55 | 12.54 | 0.02 | 0.52 | 1.27 | 2.88 | 0.00 | 0.84 | 3,962.81 |
| Allosyncarpia | 14 | 8.32 | 189.75 | 0.31 | 7.08 | 14.95 | 33.82 | 0.00 | 9.85 | 56,638.10 |
| Alstonia actinophylla | 1 | 0.32 | 7.20 | 0.02 | 0.37 | 0.51 | 1.14 | 0.00 | 0.33 | 2,436.82 |
| Alstonia scholaris | 9 | 10.58 | 241.18 | 0.31 | 7.02 | 6.00 | 13.58 | 0.00 | 3.95 | 68,149.65 |
| Azadirachta indica | 1 | 2.59 | 59.02 | 0.06 | 1.30 | 1.69 | 3.82 | 0.00 | 1.11 | 14,556.00 |
| Casuarina equisetifolia | 2 | 0.57 | 13.07 | 0.02 | 0.49 | 4.69 | 10.61 | 0.00 | 3.09 | 8,961.65 |
| Cassia fistula | 1 | 0.74 | 16.92 | 0.03 | 0.63 | 1.41 | 3.19 | 0.00 | 0.93 | 5,157.07 |
| Callitris intratropica | 5 | 1.98 | 45.14 | 0.08 | 1.88 | 1.66 | 3.76 | 0.00 | 1.10 | 13,899.64 |
| Citharexylum spinosum | 1 | 0.05 | 1.15 | 0.01 | 0.13 | 0.21 | 0.49 | 0.00 | 0.14 | 304.21 |
| Corymbia arnhemensis | 1 | 0.11 | 2.58 | 0.01 | 0.21 | 0.21 | 0.47 | 0.00 | 0.14 | 1,003.83 |
| Corymbia bella | 24 | 13.50 | 307.80 | 0.51 | 11.73 | 25.10 | 56.78 | 0.01 | 16.54 | 115,346.59 |
| Corymbia eximia | 2 | 0.14 | 3.18 | 0.01 | 0.30 | 0.24 | 0.54 | 0.00 | 0.16 | 1,063.04 |
| Corymbia nesophila | 1 | 0.86 | 19.64 | 0.03 | 0.68 | 1.44 | 3.26 | 0.00 | 0.95 | 7,360.31 |
| Corymbia polycarpa | 1 | 0.22 | 5.04 | 0.01 | 0.30 | 0.48 | 1.09 | 0.00 | 0.32 | 2,075.75 |
| Delonix regia | 8 | 14.37 | 327.66 | 0.35 | 7.98 | 11.85 | 26.80 | 0.00 | 7.81 | 82,607.71 |
| Eucalyptus | 6 | 2.91 | 66.45 | 0.12 | 2.79 | 5.77 | 13.05 | 0.00 | 3.80 | 25,485.76 |
| Eucalyptus camaldulensis ovata | 45 | 34.72 | 791.60 | 1.19 | 27.14 | 61.53 | 139.18 | 0.02 | 40.54 | 288,093.78 |
| Eucalyptus longifolia | 5 | 12.20 | 278.20 | 0.13 | 2.97 | 56.68 | 128.20 | 0.02 | 37.34 | 91,829.42 |
| Ficus microcarpa v. hillii | 6 | 45.00 | 1,026.08 | 0.09 | 2.10 | 9.03 | 20.43 | 0.00 | 5.95 | 357,848.91 |
| Ficus virens | 6 | 30.26 | 689.82 | 0.29 | 6.57 | 9.07 | 20.52 | 0.00 | 5.98 | 199,996.29 |
| Gmelina arborea | 2 | 3.37 | 76.73 | 0.08 | 1.84 | 1.52 | 3.45 | 0.00 | 1.00 | 19,712.78 |
| Harpephyllum caffrum | 2 | 0.43 | 9.71 | 0.03 | 0.60 | 0.26 | 0.58 | 0.00 | 0.17 | 3,385.55 |
| Khaya | 36 | 108.45 | 2,472.64 | 1.98 | 45.23 | 71.69 | 162.15 | 0.02 | 47.23 | 560,870.23 |
| Leptospermum madidum | 1 | 4.40 | 100.29 | 0.08 | 1.77 | 6.21 | 14.03 | 0.00 | 4.09 | 21,231.27 |

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## Benefits Summary of Trees by Species

Location: Darwin, Darwin City Council, Northern Territory, Australia
Project: Northern Precint, Series: 1, Year: 2020
Generated: 10/03/2020

| Species | Trees | Carbon Storage | | Gross Carbon Sequestration | | Avoided Runoff | | Pollution Removal | | Structural Value |
|---|---|---|---|---|---|---|---|---|---|---|
| | Number | (metric ton) | (A$) | (metric ton/yr) | (A$/yr) | ($m^3$/yr) | (A$/yr) | (metric ton/yr) | (A$/yr) | (A$) |
| Magnoliopsida | 3 | 8.34 | 190.22 | 0.05 | 1.24 | 3.79 | 8.58 | 0.00 | 2.50 | 50,590.72 |
| Maranthes corymbosa | 44 | 26.71 | 608.92 | 0.99 | 22.54 | 43.02 | 97.30 | 0.01 | 28.34 | 180,836.41 |
| Melaleuca dealbata | 5 | 1.20 | 27.46 | 0.07 | 1.57 | 2.74 | 6.19 | 0.00 | 1.80 | 8,976.08 |
| Melaleuca leucadendra | 3 | 2.28 | 51.93 | 0.08 | 1.75 | 3.81 | 8.63 | 0.00 | 2.51 | 14,873.23 |
| Mimusops elengi | 2 | 0.29 | 6.62 | 0.02 | 0.46 | 1.38 | 3.12 | 0.00 | 0.91 | 2,108.35 |
| Myristica insipida | 1 | 0.12 | 2.77 | 0.01 | 0.21 | 0.68 | 1.55 | 0.00 | 0.45 | 844.47 |
| Peltophorum pterocarpum | 31 | 26.50 | 604.13 | 0.85 | 19.33 | 38.14 | 86.26 | 0.01 | 25.12 | 169,312.24 |
| Pinopsida | 2 | 0.28 | 6.29 | 0.01 | 0.31 | 1.62 | 3.66 | 0.00 | 1.07 | 3,636.23 |
| Polyalthia australis | 3 | 0.70 | 15.94 | 0.04 | 0.86 | 2.69 | 6.08 | 0.00 | 1.77 | 4,779.75 |
| Pterocarpus indicus | 10 | 5.20 | 118.45 | 0.22 | 4.98 | 11.94 | 27.01 | 0.00 | 7.87 | 37,196.96 |
| Samanea tubulosa | 1 | 3.62 | 82.59 | 0.07 | 1.59 | 1.53 | 3.46 | 0.00 | 1.01 | 18,842.65 |
| Staphylea | 3 | 0.72 | 16.47 | 0.04 | 0.90 | 2.70 | 6.11 | 0.00 | 1.78 | 5,277.36 |
| Syzygium fibrosum | 2 | 0.59 | 13.43 | 0.03 | 0.71 | 1.39 | 3.15 | 0.00 | 0.92 | 5,481.65 |
| Terminalia microcarpa | 3 | 1.58 | 36.11 | 0.06 | 1.47 | 2.25 | 5.08 | 0.00 | 1.48 | 11,416.90 |
| **Total** | **317** | **402.01** | **9,165.78** | **8.97** | **204.50** | **442.27** | **1,000.34** | **0.12** | **291.36** | **2,614,811.32** |

Carbon storage and gross carbon sequestration value is calculated based on the price of A$22.80 per metric ton.
Due to limits of available models, i-Tree Eco will limit carbon storage to a maximum of 7,500 kg (16,534.7 lbs) and not estimate additional storage for any tree beyond a diameter of 254 cm (100 in). Whichever limit results in lower carbon storage is used.
Avoided runoff value is calculated by the price A$2.262/$m^3$. The user-designated weather station reported 61.1 centimeters of total annual precipitation. Eco will always use the hourly measurements that have the greatest total rainfall or user-submitted rainfall if provided.
Pollution removal value is calculated based on the prices of A$23.00 per metric ton (CO), A$2,555.06 per metric ton (O3), A$380.67 per metric ton (NO2), A$138.52 per metric ton (SO2), A$0.00 per metric ton (PM2.5).
Structural value is the estimated local cost of having to replace a tree with a similar tree.
A value of zero may indicate that ancillary data (pollution, weather, energy, etc.) is not available for this location or that the reported amounts are too small to be shown.

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## 14.5 BY-ELECTION LYONS WARD - NORTHERN TERRITORY ELECTORAL COMMISSION REPORT

**Author:** **Governance and Legislation Advisor**

**Authoriser:** **Acting General Manager Government Relations & External Affairs**

**Attachments:** **1. 2020 City of Darwin Lyons Ward by-election report**

### SUMMARY

The purpose of this report is to inform Council of the outcome of the By-Election Lyons ward, and present the report from the Northern Territory Electoral Commission.

### RECOMMENDATIONS

1. THAT the report entitled By-Election Lyons Ward - Northern Territory Electoral Commission Report be received and noted.
2. THAT Council does not engage the NT Electoral Commission to pursue the sending of infringement notices to the non-voters who failed to vote at the Lyons ward By-Election 2020.

### KEY ISSUES

- Alderman Sherry Cullen, City of Darwin Lyons Ward, submitted her resignation to the Chief Executive Officer on Tuesday 12 November 2019, effective Friday 15 November 2019.
- The Northern Territory Electoral Commission was appointed the Returning Officer to conduct the Lyons Ward By-Election on 29 February 2020 including attendance and voting at polling places for the Lyons Ward By-Election.
- The Election was held on 29 February 2020
- The NTEC formally declared Paul Arnold as elected to the position of Alderman on Monday 9 March 2020.

### BACKGROUND

Alderman Cullen provided her resignation as an Elected Member of the City of Darwin to the Chief Executive Officer on 12 November 2019.

Section 39(5)(a) of the Local Government Act provides that, *if a casual vacancy occurs more than 18 months before the next general election, a by-election is to be held to fill the vacancy.*

Council resolved at their 10 December 2020 meeting to appoint NTEC as the Returning Officer to Administer the Election.

### *RESOLUTION ORD001/19*

*Moved: Alderman Rebecca Want de Rowe*
*Seconded: Alderman Simon Niblock*

*1. THAT the report entitled By-Election Lyons Ward – 29 February 2020, be received and noted.*

*2. THAT in accordance with Section 86 (9)(b) of the Local Government Act 2008, the NT Electoral Commission is appointed as the Returning Officer to conduct the Lyons Ward By-Election on 29 February 2020 including attendance and voting at polling places for the Lyons Ward By-Election.*

*3. THAT Council agrees to the election timetable provided at Attachment 1 to this report.*

4. *THAT in accordance with the Local Government Act 2008 and Local Government (Electoral) Regulations 2008, Council endorses the following method of voting in the Lyons Ward By-Election on 29 February 2020 as follows:*

   *(a) By attending and voting at one of two (2) polling booths which will be located at the Darwin Entertainment Centre and Parap Primary School; or*

   *(b) By attending and voting at one of two (2) early voting centres located at the Civic Centre, Darwin or the Darwin office of the Northern Territory Electoral Commission.*

5. *THAT in accordance with Council's procedures for conducting by-elections, a candidate information session will be held on Thursday 30 January 2020, time and location to be confirmed.*

6. *THAT there is only pre-polling one week before election.*

*CARRIED 12/0*

**DISCUSSION**

The Northern Territory Electoral Commission was appointed the Returning Officer to conduct the Lyons Ward By-Election on 29 February 2020 including attendance and voting at polling places for the Lyons Ward By-Election.

The Election was held on 29 February 2020. Paul Arnold was formally declared to the position of Alderman of Lyons Ward by the NTEC on Monday 9 March 2020.

The NTEC has submitted a report to the Chief Executive Officer which details all aspects of the Election, **Attachment 1.**

The Northern Territory Electoral Commission has written to the City of Darwin and advised that due to Covid-19 the NTEC will not pursing non-voters for the Johnston LA by-election that was conducted concurrently with Lyons. Whilst the NTEC would usually pursue non-voters in an urban election in this case they have decided not to do so for the following reasons:

- A number of non-voters would attend the office to pay the fine in cash or EFTPOS and given the directive on social distancing the Commissioner's preference is that the public don't attend this office in person,
- The economic impact of the virus is going to be significant and issuing discretionary fines is likely to cause disquiet and receive adverse media commentary. Whilst the Commissioner is totally support the issuing of non-voter fines for compulsory elections the social disruption as a consequence of the virus justifies a more lenient approach in this instance,
- In regards to the Lyons by-election common feedback, due to running both by-election concurrently, was that many Lyons electors were not aware of the by-election as the media focussed on the Johnston by-election; and
- This NTEC is preparing to run the Territory election in August which will be complicated by the virus and pursing non-voters will be an added workload and unnecessary distraction at a busy time.

**IMPLICATIONS**

Council officers will review the 2020 Lyons By-Election, and ensure processes are improved where necessary for the 2021 General Election.

CITY OF DARWIN

# 2020 Lyons Ward By-Election Report

Northern Territory Electoral Commission

# INDEX

# TIMETABLE

| | | |
|---|---|---|
| Friday 7 February | | Nominations open |
| Tuesday 11 February | 5:00 pm | Electoral roll closes |
| Thursday 13 February | 12:00 noon | Nominations close |
| | 1:00 pm | Declaration of nominations, draw for position on ballot papers |
| Friday 14 February | | Postal vote mail-out commences |
| Monday 17 February | 8:00 am | Early voting commences |
| | 9:00 am | Mobile voting commences |
| Tuesday 25 February | 6:00 pm | Overseas postal voting despatches cease |
| Thursday 27 February | 6:00 pm | All postal voting despatches cease |
| Friday 28 February | 6:00 pm | Early voting ceases |
| **Saturday 29 February** | | **Election day** |
| | 8:00 am | Election day voting commences |
| | 6:00 pm | Election day voting ceases |
| | | Mobile voting ceases |
| | | Primary counts of ordinary, postal and early votes commence |
| | | Primary counts of postal, mobile and early votes commence |
| Monday 2 March | 9:00 am | Declaration vote verification checks, commence recheck of all counts |
| Thursday 5 March | 9:00 am | Primary counts of accepted declaration votes, further postal counts |
| Friday 6 March | 12:00 noon | Deadline for receipt of postal votes |
| | | Final counts of postal votes commence |
| | | Distribution of preferences |
| Monday 9 March | 10:00 am | Declaration of the election result |

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## BACKGROUND

### Election

- A by-election in the City of Darwin, Lyons Ward was caused by the resignation of one alderman. The by-election was conducted in accordance with part 8.2 of the *Local Government Act 2008* (the Act).
- In accordance with section 39(4)(d)(i) of the Act, the City of Darwin Chief Executive Officer, Mr Scott Waters, advised the Northern Territory Electoral Commission (NTEC) on 12 November 2019 that the resignation would take effect as at 15 November 2019.
- The NTEC Electoral Commissioner is the returning officer for local government elections, including by-elections.
- Susan Whyte was appointed as the deputy returning officer for the by-election.
- An electronic mark-off system (eLAPPS) was used at all voting centres.
- A service level agreement (SLA) between the City of Darwin and the NTEC was entered into on 19 December 2019. This outlined both organisations' roles, responsibilities, election services and estimated costs.

### Council

The City of Darwin consists of four wards: Chan, Lyons, Richardson and Waters.
The council comprises one elected Lord Mayor and 12 elected aldermen; three aldermen per ward.

As per the SLA, City of Darwin provided/undertook the following for the 2020 by-election.

- A candidate information session
- Council office space in Darwin for the provision of early voting
- Promoting the election via its social media outlets and front counter rolling message service
- Identify and sign-post a disabled parking spot at the Parap Primary School and the Darwin Entertainment Centre voting centres
- Provide car parking at the Civic Centre for the early voting centre staff

### Boundary changes

There were no *Gazetted* changes to the boundaries or the council ward structure from the 2015 review of electoral representation.

### Enrolment

At the close of the electoral roll at 5:00 pm on Tuesday, 11 February there was a total of 14,147 electors enrolled in the City of Darwin, Lyons Ward. This was a decrease of 1.7 per cent from the 2017 NT Council elections where enrolment was at 14,404.

## PUBLIC AWARENESS

### Campaign

The public awareness campaign for the Lyons by-election was rolled out primarily across social media channels and print media. Sponsored social media posts on Facebook, Instagram and Twitter focused on enrolment and voting information (early, postal and Election Day). The social media campaign included five location targeted posts across Facebook and Instagram which achieved an audience reach of more than 60,000 and post engagement level of almost 9,000. These posts were supported by further organic posts focusing on areas such as election result updates.

### Advertising – newspaper

Statutory print advertising providing specific voting information was published in the NT News. Advertisements placed included, a call for nominations from potential candidates; a list of candidates nominated; early and Election Day voting centre information and the election result.

The statutory advertisements were also augmented through the placement of two front-page pointer advertisements in the NT News.

### Website

The 2020 City of Darwin, Lyons Ward by-election website was launched on Monday, 3 February 2020. The dedicated election site provided comprehensive information for candidates and voters including information on nominating, voting centre locations and how to complete a ballot paper. The site also hosted an election results page that was updated accordingly throughout the count/s.

### Newsletter

An election newsletter was emailed to stakeholders, including City of Darwin, candidates and the media. Newsletters were published on 6, 20 and 27 February. The newsletters were available on the NTEC website with links shared on Facebook.

### Candidate information session

A candidate information session was conducted on Thursday, 30 January 2020 at City of Darwin chambers. The session provided relevant information to potential candidates with representatives from the NTEC, City of Darwin, and the Local Government Association of the Northern Territory (LGANT) speaking.

### Email and SMS

Email and SMS was used to contact City of Darwin, Lyons ward electors, whom had provided these details on their enrolment form. Three emails were sent at different stages of the campaign with adjustments in the totals sent based on replies and whether or not electors had already voted. A total of 6,916 were sent to electors informing them when the electoral roll would close; 6,297 were sent providing early voting centre information and 4,950 were sent providing information on Election Day voting centres.

The SMS campaign comprised three messages sent to voters who had supplied their mobile phone numbers. A total of 7,980 texts were sent to electors informing them when the electoral roll would close; 7,534 messages providing early voting information and at 10:00 am on Election Day a voting reminder SMS was sent to 5,368 electors who had not yet voted.

***Voters that received election information via SMS/email compared with voters who did not***

| All Lyons Ward electors | % | Lyons Ward electors aged 18-34 | % |
|---|---|---|---|
| Total number of voters | 53.4 | Total number of voters | 41.0 |
| Voters who received SMS/email and voted | 60.0 | Voters who received SMS/email and voted | 50.8 |
| Voters who did not receive SMS/email and voted | 45.1 | Voters who did not receive SMS/email and voted | 25.0 |

*NOTE: Postal votes not included*

### Letter box drop

Residents in the suburb of Lyons and residents of the Darwin Waterfront were contacted directly via a flyer informing them that they were not required to vote.

The suburbs of Stuart Park, Woolner and Bayview were also 'flyer' dropped prior to Election Day, providing information on the location of their nearest voting centres. This measure was undertaken due to the fact that Stuart Park Primary School was not an Election Day voting centre for the by-election as it has been historically for elections involving the area.

## VOTING SERVICES

### Nominations

Nominations opened on Friday, 7 February 2020 and closed at 12:00 noon on Thursday, 13 February 2020. There were a total of 12 received and accepted nominations for the position of alderman.

The declaration of nominations took place at the NTEC office in Darwin on Thursday, 13 February 2020. The event was attended by the general public, nominees, council representatives and the media. A random number generator selected the ballot paper position for each candidate.

***Summary of nominations in ballot paper order***

| Vacancy | Candidate |
|---|---|
| Alderman<br>One position | Eric WITHNALL |
| | Amye UN |
| | Sara ALEXOPOULOS |
| | Trevor JENKINS |
| | Jack C HENDERSON |
| | Paul ARNOLD |
| | Cheryl WATSON |
| | David MAGEEAN |
| | Carolyn Jane REYNOLDS |
| | Pete HAYES |
| | Carol PHAYER |
| | Robin LAWRENCE |

### Electronic voter mark-off

An electronic voter mark-off system, that records when someone has voted, was used for the by-election.

The system alleviates the necessity to use paper certified lists and in turn improves the time taken to find a voter on the electoral roll.

### Early voting centres (EVCs)

Legislative changes made in 2015 allows all electors the option to vote before Election Day without the need to meet any eligibility criteria. Overall there is a trend towards voting early across the Northern Territory and Australia. Early voting services were provided at the NTEC office from Monday, 17 February and at the City of Darwin council office from Monday, 24 February 2020.

A by-election, which was called for the Legislative Assembly division of Johnston, was conducted simultaneously to the Lyons by-election with both elections called for Saturday, 29 February 2020. Therefore early voting centres located at Casuarina Square and Rapid Creek shopping centres, which were established for the Johnston by-election, were also used for the Lyons by-election.

***Votes issued at early voting centres: 2020, 2017 and 2015 elections***

| Ward | 2020 by-election | 2017 NT Council elections | 2015 by-election |
|---|---|---|---|
| Lyons | 2,177 | 3,439 | 1,496 |

### Postal voting

Legislative changes made in 2015 allows all electors the option to apply for a postal vote without the need to meet any eligibility criteria.

Although there was a decrease in postal votes for this election compared to the 2017 NT Council elections, it is becoming a preferred voting option for electors.

***Postal votes issued / admitted to the count: 2020 and 2017 elections***

| 2020 by-election | | 2017 NT Council elections | |
|---|---|---|---|
| Votes issued | Votes admitted to count | Vote issued | Votes admitted to count |
| 554 | 349 | 719 | 465 |

### Urban institution voting (Hospitals and prisons)

A mobile voting team visited the Darwin Private and Royal Darwin Hospitals. Electors in Darwin prison voted by post.

***Votes issued: urban institutions***

| Ward | Votes issued |
|---|---|
| Lyons | 8 |

### Declaration voting

Declaration votes are issued to electors who claim to be enrolled in the electorate but cannot be located on the electoral roll or have already been marked-off as having voted. Declaration vote scrutinies are undertaken following the election to determine if these votes are admitted to the count or rejected.
A total of eleven declaration votes were issued during the by-election with three admitted to the count.

### Election Day voting centres

Election Day was Saturday, 29 February 2020 with voting centres open from 8:00 am to 6:00 pm.

***Locations***

| |
|---|
| **Darwin Entertainment Centre**: Mitchell St, Darwin City |
| **Parap Primary School**: Urquhart St |

The number of Election Day voting centres decreased by one compared to the 2017 NT Council elections. The reduction is due to the growing trend of electors choosing to vote early. The decrease in Election Day voting centres was requested by the City of Darwin with details outlined in the SLA.

***Votes issued at Election Day voting centres***

| Location | 2020 by-election | 2017 NT Council elections |
|---|---|---|
| Darwin City | 2,175 | 1,873 |
| Parap Primary School | 2,483 | 1,772 |
| Stuart Park Primary School | N/A | 1,172 |
| Larrakeyah Primary School | N/A | 385 |
| **TOTALS** | **4,658** | **5,202** |

## ELECTION

### Voting

The voting system used is full preferential voting where the voter must mark a number '1' on the ballot paper next to their most preferred candidate, and the numbers '2', '3' and so on against all the other candidates on the ballot paper until all the squares have been numbered in order of the voter's choice.

### Counting

- First preference votes for each candidate on formal ballot papers are counted, then a quota is calculated.
- The quota is calculated using the following formula:

  (total number of formal ballot papers divided by the number of vacancies) + 1.
- The candidates with votes equal to or greater than the quota are elected. If all vacancies are filled, the election is complete.
- If not, preferences are distributed to the other candidates until all vacancies have been filled.

### Counting votes on election night

A count of first preference votes was undertaken immediately after the close of voting at 6:00 pm on Election Day. The count of first preference votes was conducted in each of the two Election Day voting centres and the count of first preference votes for early and postal votes was conducted at the scrutiny centre in Darwin.

### Post-election night scrutinies

A fresh scrutiny (recheck) of all votes counted on Election Day commenced from Monday, 2 March 2020.

The fresh scrutiny of postal votes including urban and admitted declaration votes was conducted on Wednesday 4 March 2020.

Voters that applied for a postal vote were to complete their ballot papers by 6:00 pm on Election Day and return their ballot papers to the NTEC by 12:00 noon on Friday, 6 March 2020. A final count of all postal votes was conducted after 12:00 noon.

The determination of the quota and distribution of preferences took place after all votes had been counted. Election results were made available as soon as possible on the results page of the website.

### Election outcomes

At the close of nominations there were 12 candidates. An election was duly held and the first preference votes are recorded in the adjacent table.

As a consequence, under the proportional representation voting system, the quota of votes required for election was 3,682.

Following the distribution of preferences and in accordance with Schedule 1 of the Local Government (Electoral) Regulations the result is as follows:

| Candidate | First preferences |
|---|---|
| Eric WITHNALL | 1,330 |
| Amye UN | 796 |
| Sara ALEXOPOULOS | 1,382 |
| Trevor JENKINS | 269 |
| Jack C HENDERSON | 58 |
| Paul ARNOLD | 1,854 |
| Cheryl WATSON | 501 |
| David MAGEEAN | 82 |
| Carolyn Jane REYNOLDS | 110 |
| Pete HAYES | 97 |
| Carol PHAYER | 752 |
| Robin LAWRENCE | 131 |
| **Total** | **7,362** |

**Paul Arnold** received quota at count number ten and was duly elected.

**Declaration of the election result**

Declaration of the election result took place at the City of Darwin, Council Chambers at 2:00pm on Monday, 9 March 2020.

**Election costs**

The SLA estimated the cost for the City of Darwin by-election as $80,551.85 (GST inclusive). Due to running the by-election in conjunction with the Legislative Assembly division of Johnston by-election, costs savings were identified and put in place.

***Summary of election costs***

| Election area | Costs |
|---|---|
| Public awareness | $8,610.75 |
| Staffing wages | $32,964.69 |
| Premises | $3,845.45 |
| Information technology | $1,818.18 |
| Vehicle hire | $340.91 |
| Operational/material/postage costs | $7,652.23 |
| Corporate overhead | $8,284.83 |
| *GST* | *$6,351.70* |
| **TOTAL** | **$69,868.74** |

## ISSUES OF NOTE

### Informality

- The NT Electoral Commission conducted a survey of informal ballot papers and a total of 562 informal votes were received. During the informality survey it was identified that 53 per cent of the informal votes (300) were considered intentionally informal. The remaining 47 per cent (262) were considered unintentionally informal. Of the informal ballot papers 59 contained duplicate numbers and 126 were incomplete.

### Election Day voting centres

- This election saw a reduction in the number of Election Day voting centres with only two in operation.
- In the 2017 NT Council elections it was observed that voters were taking longer than average to complete their ballot paper due to the large number of candidates. As this by-election had 12 candidates, the NTEC ensured that each voting centre had a sufficient number of voting screens to improve voter flow.

### Early voting centres

- Campaigning at early voting centres was permitted in two forms depending on what property owners allowed at each location. Some locations allowed campaigning in person whilst other locations only allowed campaign material to be displayed (i.e. no campaign workers present).
- It became evident during the early voting period that some campaign workers and candidates were not taking the premises owners' requests seriously when instructed not to campaign in person.

  Where a table was provided for material, some candidates/campaign workers took it upon themselves to visit the voting centre on numerous occasions to check the voting material stocks even though they had been instructed to hand their how-to-vote material to the officer in charge of the voting centre before voting began. Some campaign workers even wore campaign matter as they restocked their materials (i.e. shirts, caps etc.).
- NTEC will consider producing a document in which a candidate must declare that they (and their workers) will adhere to the rules stipulated around campaigning at early voting centres.

### Complaints

- No formal complaints were received for this by-election.
- Informally, the NTEC received several calls about incorrect authorisation or complaints about the removal of some candidate's campaign materials.

The Commission would like to extend our thanks for the support received from the City of Darwin CEO and his staff for their assistance during the conduct and delivery of this event.

## 14.6 DEPUTY LORD MAYOR

**Author:** **Governance and Legislation Advisor**

**Authoriser:** **Acting General Manager Government Relations & External Affairs**

**Attachments:** **Nil**

### SUMMARY

The purpose of this report is to provide information to Council, and appoint a Deputy Lord Mayor.

### RECOMMENDATIONS

1. THAT the report entitled Deputy Lord Mayor be received and noted.
2. THAT _____ be appointed as Deputy Lord Mayor for the period 1 May 2020 to 31 August 2020.

### KEY ISSUES

- The *Local Government Act* requires for the appointment of a Deputy Lord Mayor.
- City of Darwin policy 015: Deputy Lord Mayor, calls for an appointment Deputy Lord Mayor for a period of four months, and that each Alderman will have this appointment throughout the term of Council.
- Alderman George Lambrinidis is current appointed as Deputy Lord Mayor until 30 April 2020.

### BACKGROUND

City of Darwin policy 015: Deputy Lord Mayor acknowledges that the Lord Mayor will, at various times, not be able to perform his/her duties and that the Deputy Lord Mayor will be required to act in the position.

For the period following the 2017 General Election, to the declaration of the 2021 general election, the Council has determined that each of the 12 Alderman be elected as Deputy Lord Mayor for a period of four months during the term of the 22nd Council.

The current deputy Lord Mayor is Alderman George Lambrinidis, who was appointed at the 12 November 2020 Ordinary Council meeting.

***RESOLUTION ORD001/19***

*Moved: Alderman Jimmy Bouhoris*
*Seconded: Lord Mayor Kon Vatskalis*

*THAT in accordance with Part 4.3 of the Local Government Act, Alderman George Lambrinidis be appointed as Deputy Lord Mayor for the period 2 January 2020 to 30 April 2020.*

***CARRIED 10/0***

### DISCUSSION

Section 43 of the Local Government act sets out the role and function for the position:

The role of the deputy principal member of a council is to carry out any of the principal member's functions when the principal member:

(a) delegates the functions to the deputy; or

(b) is absent from official duties because of illness or for some other pressing reason; or

(c) is on leave. Section 43(3) of the Act also provides that: If the principal member is absent from official duties on leave or for some other reason, and there is no deputy principal member or the deputy is not available to act in the principal member's position, the council may, by resolution, appoint some other member of the council to act in the principal member's position for a specified period or until the principal member resumes official duties.

The following elected members have not yet been appointed as Deputy Lord Mayor during the 22nd term of Council.

- Alderman Palmer
- Alderman Pangquee
- Alderman Arnold
- Alderman Glover
- Alderman Arnold

## STRATEGIC ENVIRONMENT

The issues addressed in this Report are in accordance with the following Goals/Strategies as outlined in the 'Darwin 2030 City for People. City of Colour. Strategic Plan':

**Goal**
6 Governance Framework

**Outcome**
6.3 Decision Making and Management

## LEGISLATIVE/POLICY

Policy 015: Deputy Lord Mayor.

Local Government Act: Section 43(2) of the Local Government Act establishes the role of the Deputy Lord Mayor. This Section must be read in conjunction with Section 35 (Role of Elected Members) and Section 42 (Role of Mayor). Section 45(2)(b) requires the Council to appoint one of its Members as Deputy Lord Mayor at the first meeting held after each General Election. The Ministerial Guidelines dealing with Elected Member Allowances make provision for the Deputy Mayor.

## CONSULTATION

### Internal

In preparing this report, the following City of Darwin officers were consulted:

- Chief Executive Officer
- Acting General Manager Government Relations & External Affairs

### External

Not applicable

## BUDGET/RESOURCE IMPLICATIONS

There are no budget or resource implications for this matter.

## RISK

There is a risk that should a Deputy Lord Mayor not be appointed that the City of Darwin will not meet Section 43 of the Local Government Act.

## LEGAL

There are no legal risks identified with this matter.

**ARTS, CULTURE & ENVIRONMENT**

Not applicable

# 15 RECEIVE & NOTE REPORTS

## 15.1 MONTHLY FINANCIAL REPORT - FEBRUARY 2020

**Common No.:** **2476534**

**Author:** **Financial Accountant**

**Authoriser:** **Executive Manager Finance**

**Attachments:** **1. Monthly Financial Report -February 2020**

### SUMMARY

The purpose of this report is to provide a comparison of income and expenditure against the budget for the period ended 29 February 2020. It also provides details of cash, investments and debtors at 29 February 2020 in accordance with the Local Government (Accounting) Regulations 2008.

### RECOMMENDATIONS

That the report entitled Monthly Financial Report – February 2020 is received and noted.

### KEY ISSUES

- For the first eight months of the year; Income is above budget, expenses are below budget, together producing a considerably higher operating result than budget of $4.5M.
- The key liquidity ratio is 2.8 (showing current assets cover total liabilities 2.8 times).
- Capital expenditure is low in comparison to the full year's budget, actual expenditure for eight months is $12.7M compared to $41M full annual budget.
- The Monthly Financial Report complies with the Local Government (Accounting) Regulations 2008 in respect of the issues reported.

### BACKGROUND

The monthly finance report income statement compares the actual income and expenditure to budget at two levels, firstly the full year's budget and secondly the budget for the eight months year to date (YTD).

Comparatives to full year are relevant if the income or expenditure is linear, at the end of February 2020, the pro-rata percentage that would be achieved if income and expenditure were to occur in a linear pattern is 66.67%. For this reason the reference to YTD budgets is provided. Examples of where this is most relevant include, Rates which are brought in as income at the commencement of the year, general insurances and some licences are paid in full when received.

Ideally the YTD budget is structured so that the amount allocated in each month should match the same pattern as actual income is incurred and expenditure is made.

### DISCUSSION

There is a YTD positive variance actual to budget of $4.5M at the Operating Result level.

Income is running at 93% overall, this is much higher than pro-rata largely because Rates and annual charges are levied at the start of the year which materially distorts the overall percentage for income.

Expenditure is running at 63% overall which appears to be a favourable position. In the case of Materials and Services, which has a lot of component expenses combined together, the overall position can mask issues within some expense items being over and some under.

An analysis of income and expenditure categories as presented in the attachments to this report follow:

Income Items:

- Rates and Charges 99.6%
- User Charges, Fees & Other 69.4%
- Interest & Investments Revenue 78.6%
- Grants & Contributions – Operating 117.7%

There is a small growth factor built into the Rates budget, which given the current economic climate of Darwin may not now be achieved this year.

Grants are higher because of the unbudgeted $1.4M funds received from Northern Territory Government (NTG) relating to Cyclone Marcus.

Expenditure Items:

- Employee costs have a $36M annual budget and are running at 64%. As employee costs are such a large area it is important to see them within budget parameters. Currently there is a positive variance to budget, due to vacancies, but offset by temporary labour services (categorised in Materials and Services).
- Borrowing costs are significantly under budget at 26%. This is primarily due to the loan for Shoal Bay waste remediation not being drawn down as planned and therefore the costs of servicing the loan not being incurred.
- Materials and Services is a $50M annual budget which covers a large number of expenditure types. Overall this is running just below pro-rata at 64% but there are many variations at the component level, of these the following are highlighted:
    1. Utilities /Rates is a $6M annual budget and is running at 84% primarily as a result of electricity charges associated with street lighting and higher than anticipated water charges over a long period without rain. However, due to recent rain it is now expected the large overspend will reduce. Savings in electricity are planned too, but the switching to LED programme is not being achieved as planned with the replacement program still ongoing.
    2. Advertising & photocopying are showing savings to budget that are a mix of more efficient work practises and tighter contract pricing.
    3. Subscriptions and licences are still running over but there may be timing involved and the trend should rectify as has occurred with donations/sponsorship and travel and accommodation.
    4. Temporary Staff is running at 195% of full year's budget but this spend is balanced by underspends in salaries and wages, which is the reason for the overspend.
- Depreciation has a $33M annual budget. The depreciation shown in actual is calculated by the Council asset system (at $21.2M or 64%). The amount is under budget due to a large number of assets not yet capitalised.
- Capital Expenditure is expected to increase with the onset of the dry season and due to following project advancement. The $4.5M Urban Oval Lights Project contract has been awarded and a contract has been awarded for the delivery of 3 public amenities for City of Darwin. The streetscape beautification program commenced with two projects currently under construction:

- Daly Street
- Wagaman Shopping Centre

Of the eight identified projects five will be delivered in house. The remaining three projects have been put out to public tender. A media launch for the streetscape beautification was held on Tuesday 10 March 2020.

Treasury Comment

The RBA held the cash rate at 0.75% following the Board meeting in early February. Data released during the month was largely negative for the outlook for the domestic economy.

While the RBA is sticking to its GDP growth forecasts and forward indicators suggest annual GDP growth of around 2.25%, the recent bushfires and COVID-19 developments have caused some leading economists to predict close to 0% GDP growth in the first quarter of the year. The RBA is expected to reduce the cash rate if unemployment continues to rise, GDP growth stalls or as was occurring towards the end of the month financial markets begin to fall precipitously. February finished at a point of high uncertainty as to whether the spread of COVID-19 could be contained and if not what would be the full economic impact of the global economy.

Accounts Receivable Report

This report details Rates receipt collection, outstanding General Debtors, and performance on Rates recovery compared to the previous year. The report also includes additional information on infringement debtors, Rates arrears, Rates struck and Rates outstanding. Whilst there has been success in reducing the level of historical outstanding Rates, the level of current Rates in arrears is increasing.

## IMPLICATIONS

The financial report is as at 29 February 2020. The preparation of this report requires a detailed process of reconciliation and journals to ensure the accounts conform to accrual accounting and enable an accurate comparative to budget.

## POLICY IMPLICATIONS

Nil

## BUDGET AND RESOURCE IMPLICATIONS

Nil

## RISK/LEGAL/LEGISLATIVE IMPLICATIONS

Part 8 of the Local Government (Accounting) Regulations 2008 require that a monthly financial report is presented to Council.

Regulation 18 states:

1. The CEO must, in each month, lay before a meeting of the council a report, in a form approved by the Council, setting out:
   a) The actual income and expenditure of the council for the period from the commencement of the financial year to the end of the previous month; and
   b) The forecast income and expenditure for the whole of the financial year
2. The report must include:

a) Details of all cash and investments held by the Council (including money held in trust); and

b) A statement on the debts owed to the Council including the aggregate amount owed under each category with a general indication of the age of the debts; and

c) Other information required by the Council.

1. If a Council does not hold a meeting in a particular month, the report is to be laid before the Council committee performing the council's financial functions for the particular month.

This report is considered to a higher level of statutory compliance as outlined above.

## Income Statement
**For the Period Ended 29/02/2020**

| | 2019/20 | | | | | | 2018/19 | |
|---|---|---|---|---|---|---|---|---|
| | Full Original Budget $'000 | Full Amended Budget $'000 | YTD Budget $'000 | YTD Actual $'000 | YTD v FAB % | | YTD v FAB % | LY Actual $'000 |
| % of year elapsed | | | | | 67% | | | |
| **Income from Continuing Operations** | | | | | | Comment | | |
| Rates & Annual Charges | 74,568 | 74,568 | 74,568 | 74,262 | 100% | No issues | 100% | 72,013 |
| User Charges, Fees & Other | 25,096 | 25,076 | 17,118 | 17,405 | 69% | No issues | 67% | 16,404 |
| Interest & Investment Revenue | 2,226 | 2,226 | 1,513 | 1,749 | 79% | No issues | 98% | 1,866 |
| Grants & Contributions - Operating | 5,543 | 3,713 | 3,000 | 4,372 | 118% | No issues | 83% | 3,010 |
| **Total Income from Continuing Operations** | **107,433** | **105,583** | **96,199** | **97,789** | **93%** | | 92% | **93,293** |
| **Less Expenses from Continuing Operations** | | | | | | | | |
| Employee Costs | 35,527 | 35,531 | 23,962 | 22,719 | 64% | No issues | 63% | 21,300 |
| Borrowing Costs | 1,534 | 947 | 198 | 249 | 26% | No issues | 23% | 184 |
| Materials and Services | 50,443 | 51,318 | 35,250 | 32,658 | 64% | No issues | 69% | 33,837 |
| Depreciation and Amortisation | 33,357 | 33,357 | 22,238 | 21,203 | 64% | No issues | 67% | 20,878 |
| **Total Expenses from Continuing Operations** | **120,861** | **121,154** | **81,648** | **76,828** | **63%** | | 66% | **76,199** |
| **Operating Result - Continuing Operations** | **(13,428)** | **(15,571)** | **14,551** | **20,961** | | | | **17,094** |
| **Grants & Contributions - Capital** | 6,748 | 11,745 | 10,609 | 8,701 | 74% | No issues | 0% | 36 |
| **Net Operating Result For the Year** | **(6,680)** | **(3,826)** | **25,160** | **29,661** | | | | **17,130** |

**Income Statement**

**Explanation of Columns:** "Full Original Budget" and "Full Amended Budget" are annual amounts. YTD Actual is year to date. YTD v FAB is the % of actuals achieved against the full year amended budget.

**Outlines** income and operating expenses. Capital expenditure has been excluded however depreciation expense has been recognised. The net operating surplus or deficit for the reporting period is a measure of Council's financial performance. This figure is determined by deducting total operating expenses including depreciation from total operating revenue.

**Operating income:** Rates represents the revenue being struck for the full year hence 100% achieved. Grants & Contributions is exceeding target YTD with receipt of General Purpose and Roads Grant for 1st, 2nd and 3rd quarter grant monies, in addition receipt of Library grant and Funbus. NDRRA final grant payment also received from Department of Local Government, Housing & Community Development for Cyclone Marcus which is not budgeted. .

**Operating expenses:** Overall expenditure appears reasonable for this 8th month of the financial year. With 67% of the year elapsed, employee costs is slightly below expectation at 64%. Underspent of $700k in Salaries and Wages due vacancies are fully offset by overspent in temporary labour services (categorised in Materials & Services). The other $500k underspent in Employee Costs is due to the timing of employee entitlements. Borrowing expenses paid last November 2019 and the next scheduled payments are in March and in May 2020. Borrowing expenses is significantly different from budget because of loans for Shoal Bay waste remediation not being drawn down as planned and therefore the costs of servicing the loan not being incurred. Materials and Services is slightly below target at 64%. Net Underspent Variation is at $2.6M due to many significant contributing factors that will be later on detailed in Management Report to Council Meeting. Depreciation expense is slightly below target and is largely due to major projects being incomplete. There has also been very little asset additions year to date.

**Capital income:** $8M recognised reclassified Velodrome grant funds received 18/19 from NTG DIPL due to Council Decision to retain funds in 19/20; R2R 1st quarter grant for $600k received. Additional $55k grant received for Project Collaboration per Memorandum of Understanding between Varitey the Children's Charity and $30k received for Contribution to Jingili Public Art Collaboration.

## Statement of Cash Flows
**For the Period Ended 29/02/2020**

| | Full Original Budget $'000 | Full Amended Budget $'000 | 2019/20 YTD Actual $'000 | YTD v FAB % |
|---|---|---|---|---|
| **% of year elapsed** | | | | **67%** |
| **Funds From Operating Activities** | | | | |
| Net Operating Result From Above | (6,680) | (3,826) | 29,661 | |
| Add back depreciation (not cash) | 33,357 | 33,357 | 21,203 | 64% |
| Add back Other Non Cash Items | 581 | 581 | - | 0% |
| **Net Funds Provided (or used in) Operating Activitie** | **27,258** | **30,112** | **50,864** | |
| **Funds From Investing activities** | | | | |
| Sale of Infrastructure, Property, Plant & Equipment | 731 | 731 | 12 | 2% |
| Sale of Land | - | - | 9 | 0% |
| Purchase of Infrastructure, Property, Plant & Equipmer | (53,074) | (41,134) | (12,716) | 31% |
| **Net Funds Provided (or used in) Investing Activities** | **(52,343)** | **(40,403)** | **(12,695)** | |
| **Funds From Financing Activities** | | | | |
| Proceeds from borrowings & advances | 19,500 | 1,300 | - | 0% |
| Repayment of borrowings & advances | (1,331) | (698) | (345) | 49% |
| **Net Funds Provided (or used in) Financing Activitie** | **18,169** | **602** | **(345)** | |
| **Net Increase (-Decrease) in Funds Before Transfers** | **(6,916)** | **(9,689)** | **37,824** | |
| Transfers from (-to) Reserves | 6,916 | 9,689 | (1,128) | |
| **Net Increase (-Decrease) in Funds After Transfers** | **-** | **-** | **36,696** | |

**Municipal Plan Summary**

**Outlines** This statement outlines Councils entire budget in accordance with the published municipal plan. It shows the effect on General Funds (original budget - break even/nil). It groups items into operating, investing and financing and has a very close relationship to cash flows, which is why it is presented in the same international format. It eliminates the depreciation calculation and discloses totals for asset sales and purchases as well as loan raising and repayments. Finally it discloses the transfers to & from cash backed reserves which are detailed in the quarterly budget review reports.

**Full Amended Budget:** Includes carry forwards from 2018/19.

**Net funds provided by operating activities:** These will reduce throughout the year to equate more closely to budget as the rates struck are expended.

**Sale of Plant & Equipment:** Nothing appears yet. This should increase once fleet purchases are achieved.

**Purchase of Infrastructure, property etc.** This is 31% spent compared to 67% of year elpased.

**Transfers from (-to) reserves:** This discloses the transfers to & from cash backed reserves.

**Manager Finance:** There are no overall concerns in relation to the budgets.

## Statement of Financial Position
**For the Period Ended 29/02/2020**

| 2018-19 Audited Actual $'000 | | Full Original Budget $'000 | 2019/20 Full Amended Budget $'000 | YTD Actual $'000 |
|---|---|---|---|---|
| | **Current Assets** | | | |
| 32,659 | Cash at Bank & Investments | 14,403 | 15,564 | 27,171 |
| 51,210 | Cash at Bank & Investments - externally restricted | 39,863 | 51,364 | 58,401 |
| 27,369 | Cash at Bank & Investments - internally restricted | 10,581 | 17,525 | 21,308 |
| 12,535 | Receivables | 9,210 | 12,535 | 20,440 |
| 185 | Inventories | 100 | 185 | 245 |
| - | Other | - | - | - |
| 123,958 | | 74,157 | 97,173 | 127,565 |
| | **Non-Current Assets** | | | |
| 984,012 | Infrastructure, Property, Plant and Equipment | 1,024,635 | 991,058 | 975,503 |
| - | Financial Assets (FRN) | - | | 4,000 |
| 984,012 | | 1,024,635 | 991,058 | 979,503 |
| **1,107,970** | **TOTAL ASSETS** | **1,098,792** | **1,088,231** | **1,107,068** |
| | **Current Liabilities** | | | |
| 36,663 | Payables | 15,064 | 15,064 | 6,453 |
| 699 | Borrowings | 1,908 | 841 | 354 |
| 6,584 | Provisions & Other Liabilities | 7,472 | 7,472 | 6,577 |
| 43,946 | | 24,444 | 23,377 | 13,384 |
| | **Non-Current Liabilities** | | | |
| 6,924 | Borrowings | 23,885 | 7,385 | 6,925 |
| 25,296 | Provisions | 29,491 | 29,491 | 25,296 |
| 32,220 | | 53,376 | 36,876 | 32,221 |
| **76,166** | **TOTAL LIABILITIES** | **77,820** | **60,253** | **45,604** |
| **1,031,804** | **NET ASSETS** | **1,020,972** | **1,027,978** | **1,061,464** |
| | **Equity** | | | |
| 600,552 | Asset Revaluation Reserve | 600,552 | 600,552 | 600,552 |
| 431,252 | Retained Surplus | 420,420 | 427,426 | 460,912 |
| **1,031,804** | **TOTAL EQUITY** | **1,020,972** | **1,027,978** | **1,061,464** |

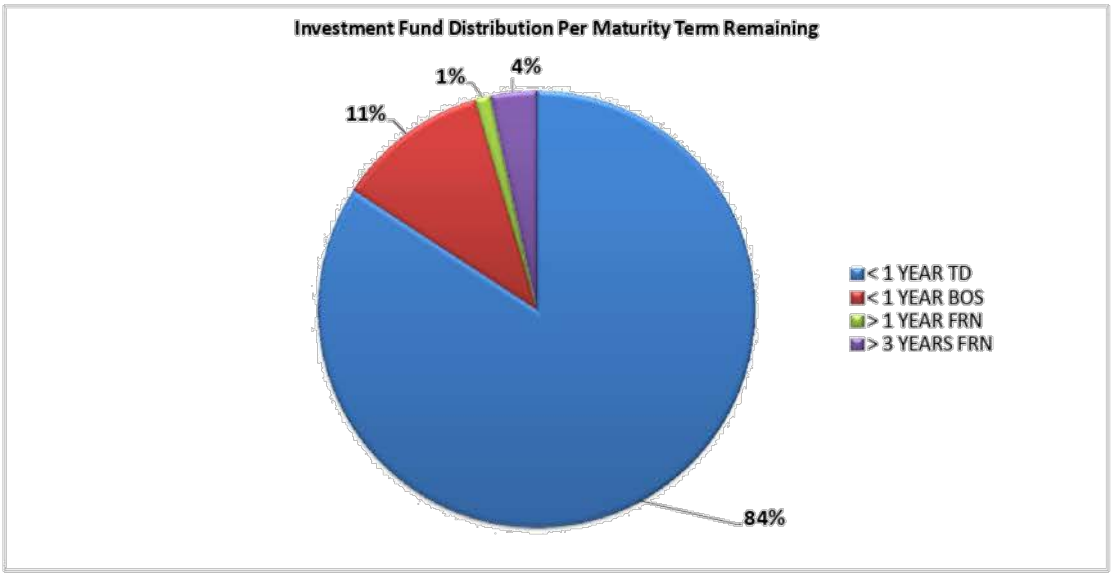
**Statement of Financial Position Comments:**

The Statement of Financial Position outlines what Council owns (assets) and what it owes (liabilities) at a point in time. Council's net worth is determined by deducting total liabilities from total assets - the larger the net equity, the stronger the financial position.

**Manager Finance:** There are no concerns in relation to the original budgets at this stage. Note that the full original budget is as published in the adopted Municipal Plan 2019/20. The full amended budget column is based on the audited closing balances as at 30/6/2019 plus Council approved amendments, the YTD Actual column is based on audited actual closing balances as at 30/6/2019 and adjustment of actual movements since.

**INVESTMENTS REPORT TO COUNCIL**
**AS AT**
**29 February 2020**

## Portfolio vs Investment Policy




### Investment Portfolio Term to Maturity Remaining Policy Limit

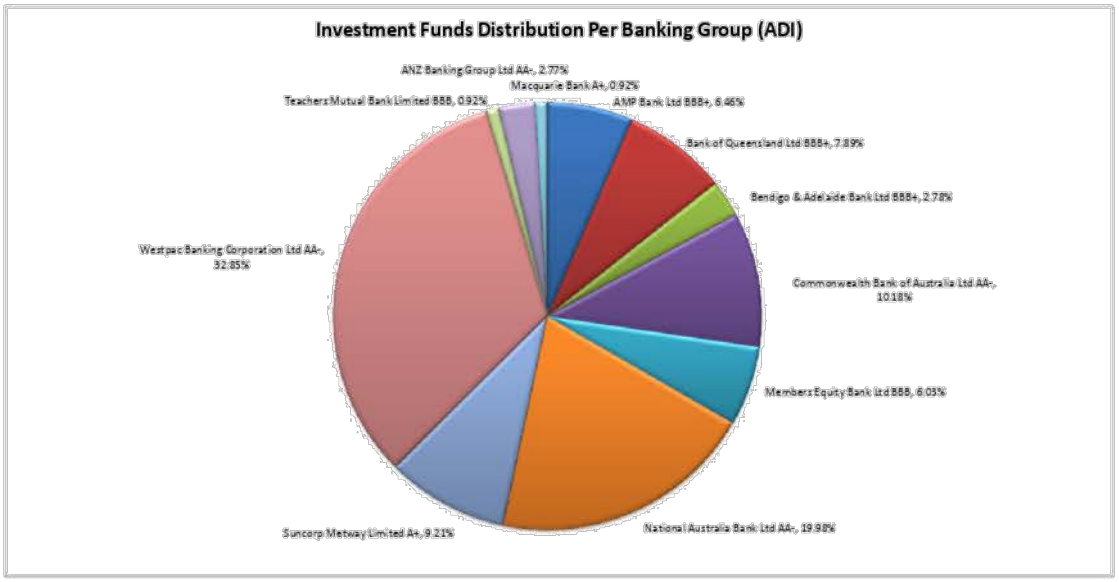
| Term to Maturity Category | Term to Maturity (Policy Min.) | Term to Maturity (Policy Max.) | % of Total Portfolio |
|---|---|---|---|
| < 1 YEAR | 30% | 100% | 95.23% |
| > 1 YEAR | 0% | 50% | 1.19% |
| > 3 YEARS | 0% | 30% | 3.58% |
| Grand Total | | | 100.00% |

### Investment Portfolio Term to Maturity Remaining by Banking Group

| Term to Maturity Category | Inv Type | ADI | % of Total Portfolio |
|---|---|---|---|
| < 1 YEAR | TD | AMP Bank Ltd | 6.46% |
| | | Bank of Queensland Ltd | 7.89% |
| | | Bendigo & Adelaide Bank Ltd | 2.78% |
| | | Members Equity Bank Ltd | 6.03% |
| | | National Australia Bank Ltd | 19.98% |
| | | Suncorp Metway Limited | 9.21% |
| | | Westpac Banking Corporation Ltd | 31.93% |
| | | ANZ Banking Group Ltd | 2.77% |
| | BOS | Commonwealth Bank of Australia Ltd | 9.26% |
| < 1 YEAR Total | | | 96.31% |
| > 1 YEAR | FRN | Teachers Mutual Bank Limited | 0.92% |
| > 1 YEAR Total | | | 0.92% |
| > 3 YEARS | FRN | Commonwealth Bank of Australia Ltd | 0.92% |
| | | Westpac Banking Corporation Ltd | 0.92% |
| | | Macquarie Bank | 0.92% |
| > 3 YEARS Total | | | 2.76% |
| Grand Total | | | 100.00% |

**INVESTMENTS REPORT TO COUNCIL**
**AS AT**
**29 February 2020**

## Portfolio vs Investment Policy




| Credit Rating | Policy Limit | % of Total Portfolio |
|---|---|---|
| AAA to AA- | 100.00% | 65.78% |
| A+ to A- | 45.00% | 10.14% |
| BBB+ to BBB | 10.00% | 24.08% |
| BBB- | 0.00% | 0.00% |
| Grand Total | | 100.00% |

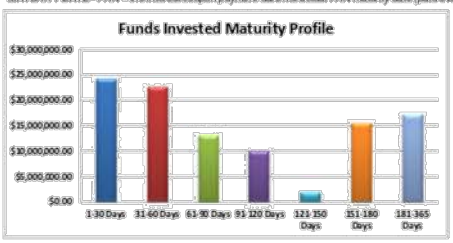
| Row Labels | ADI | Individual Counterparty Limits of Total Investments | % of Total Portfolio |
|---|---|---|---|
| AA- | Commonwealth Bank of Australia Ltd | | |
| | Commonwealth Bank of Australia Ltd | 50.00% | 10.18% |
| | Commonwealth Bank of Australia Ltd Sum | | 10.18% |
| | National Australia Bank Ltd | | |
| | National Australia Bank Ltd | 50.00% | 19.98% |
| | National Australia Bank Ltd Sum | | 19.98% |
| | Westpac Banking Corporation Ltd | | |
| | BankSA | 50.00% | 15.68% |
| | Westpac Banking Corporation Ltd | 50.00% | 17.17% |
| | Westpac Banking Corporation Ltd Sum | | 32.85% |
| | ANZ Banking Group Ltd | | |
| | ANZ Banking Group Ltd | 50.00% | 2.77% |
| | ANZ Banking Group Ltd Sum | | 2.77% |
| A+ | Suncorp Metway Limited | | |
| | Suncorp Bank | 30.00% | 9.21% |
| | Suncorp Metway Limited Sum | | 9.21% |
| | Macquarie Bank | | |
| | Macquarie Bank | 30.00% | 0.92% |
| | Macquarie Bank Sum | | 0.92% |
| BBB+ | AMP Bank Ltd | | |
| | AMP Bank Ltd | 10.00% | 6.46% |
| | AMP Bank Ltd Sum | | 6.46% |
| | Bank of Queensland Ltd | | |
| | Bank of Queensland Ltd | 10.00% | 7.89% |
| | Bank of Queensland Ltd Sum | | 7.89% |
| | Bendigo & Adelaide Bank Ltd | | |
| | Bendigo & Adelaide Bank Ltd | 10.00% | 2.78% |
| | Bendigo & Adelaide Bank Ltd Sum | | 2.78% |
| BBB | Members Equity Bank Ltd | | |
| | Members Equity Bank Ltd | 10.00% | 6.03% |
| | Members Equity Bank Ltd Sum | | 6.03% |
| | Teachers Mutual Bank Limited | | |
| | Teachers Mutual Bank Limited | 10.00% | 0.92% |
| | Teachers Mutual Bank Limited Sum | | 0.92% |
| Grand Total | | | 100.00% |

## INVESTMENT REPORT TO COUNCIL
## AS AT
## 29 February 2020

CITY OF DARWIN

| Institution Category | Inv Type | Credit Rating (ST) | Credit Rating (LT) | Counterparty | Maturity Date | Interest Rate | FRN ONLY (Maturity Date +last pmt) | Values Principal $ | % of Total Portfolio |
|---|---|---|---|---|---|---|---|---|---|
| MAJOR BANK | | | | | | | | $71,390,207 | 61.19% |
| | TD | A1+ | AA- | BankSA | | | | $17,019,233 | 16.42% |
| | | | | | 11 August 2020 | 1.58% | | $2,000,000 | 1.49% |
| | | | | | 15 September 2020 | 1.58% | | $3,019,233 | 2.99% |
| | | | | | 4 August 2020 | 1.58% | | $1,500,000 | 1.49% |
| | | | | | 18 August 2020 | 1.63% | | $3,000,000 | 2.99% |
| | | | | | 8 September 2020 | 1.63% | | $1,500,000 | 1.49% |
| | | | | | 22 September 2020 | 1.63% | | $1,500,000 | 1.49% |
| | | | | | 25 August 2020 | 1.63% | | $1,500,000 | 1.49% |
| | | | | | 27 October 2020 | 1.63% | | $1,500,000 | 1.49% |
| | | | | | 1 December 2020 | 1.58% | | $1,500,000 | 1.49% |
| | | | | National Australia Bank Ltd | | | | $21,688,883 | 22.39% |
| | | | | | 10 March 2020 | 1.98% | | $1,500,000 | 1.49% |
| | | | | | 24 March 2020 | 1.98% | | $1,500,000 | 1.49% |
| | | | | | 24 March 2020 | 1.67% | | $2,551,887 | 2.99% |
| | | | | | 3 March 2020 | 1.93% | | $1,500,000 | 1.49% |
| | | | | | 17 March 2020 | 1.93% | | $1,500,000 | 1.49% |
| | | | | | 17 March 2020 | 1.75% | | $1,034,194 | 1.49% |
| | | | | | 31 March 2020 | 1.67% | | $1,500,000 | 1.49% |
| | | | | | 31 March 2020 | 1.59% | | $1,513,494 | 1.49% |
| | | | | | 14 April 2020 | 1.66% | | $1,500,000 | 1.49% |
| | | | | | 28 April 2020 | 1.65% | | $1,500,000 | 1.49% |
| | | | | | 28 April 2020 | 1.62% | | $2,000,000 | 1.49% |
| | | | | | 7 April 2020 | 1.57% | | $1,054,238 | 1.49% |
| | | | | | 23 June 2020 | 1.55% | | $3,035,070 | 2.99% |
| | | | | Westpac Banking Corporation Ltd | | | | $17,629,523 | 14.93% |
| | | | | | 10 March 2020 | 2.50% | | $2,000,000 | 1.49% |
| | | | | | 3 March 2020 | 1.90% | | $1,511,185 | 1.49% |
| | | | | | 26 May 2020 | 1.64% | | $1,526,408 | 1.49% |
| | | | | | 5 May 2020 | 1.58% | | $2,591,930 | 2.99% |
| | | | | | 28 April 2020 | 1.64% | | $2,000,000 | 1.49% |
| | | | | | 19 May 2020 | 1.61% | | $2,000,000 | 1.49% |
| | | | | | 12 May 2020 | 1.59% | | $2,000,000 | 1.49% |
| | | | | | 2 June 2020 | 1.65% | | $2,000,000 | 1.49% |
| | | | | | 9 June 2020 | 1.64% | | $2,000,000 | 1.49% |
| | | | | ANZ Banking Group Ltd | | | | $3,005,984 | 2.99% |
| | | | | | 26 May 2020 | 1.60% | | $1,505,984 | 1.49% |
| | | | | | 11 August 2020 | 1.62% | | $1,500,000 | 1.49% |
| | FRN | A1+ | AA- | Commonwealth Bank of Australia Ltd | | | | $1,000,000 | 1.49% |
| | | | | | 13 April 2020 | 2.03% | 11/01/2024 | $1,000,000 | 1.49% |
| | | | | Westpac Banking Corporation Ltd | | | | $1,000,000 | 1.49% |
| | | | | | 24 April 2020 | 2.03% | 24/04/2024 | $1,000,000 | 1.49% |
| | BOS | A1+ | AA- | Commonwealth Bank of Australia Ltd | | | | $10,046,584 | 1.49% |
| | | | | | 6 March 2020 | 1.10% | | $10,046,584 | 1.49% |
| OTHER | | | | | | | | $37,139,061 | 38.81% |
| | TD | A1 | A+ | Suncorp Bank | | | | $10,000,000 | 19.45% |
| | | | | | 17 March 2020 | 1.70% | | $1,500,000 | 1.49% |
| | | | | | 5 May 2020 | 1.65% | | $1,500,000 | 1.49% |
| | | | | | 14 April 2020 | 1.65% | | $1,500,000 | 1.49% |
| | | | | | 28 April 2020 | 1.65% | | $1,500,000 | 1.49% |
| | | | | | 21 April 2020 | 1.65% | | $1,500,000 | 1.49% |
| | | | | | 21 April 2020 | 1.60% | | $1,500,000 | 1.49% |
| | | | | | 7 April 2020 | 1.60% | | $1,500,000 | 1.49% |
| | | A2 | BBB+ | AMP Bank Ltd | | | | $7,009,973 | 7.46% |
| | | | | | 31 March 2020 | 1.75% | | $2,000,000 | 1.49% |
| | | | | | 7 April 2020 | 1.70% | | $2,000,000 | 1.49% |
| | | | | | 12 May 2020 | 1.80% | | $1,000,000 | 1.49% |
| | | | | | 25 August 2020 | 1.90% | | $1,000,000 | 1.49% |
| | | | | | 25 August 2020 | 1.85% | | $1,009,973 | 1.49% |
| | | | | Bank of Queensland Ltd | | | | $8,566,119 | 8.90% |
| | | | | | 26 May 2020 | 1.65% | | $1,011,967 | 1.49% |
| | | | | | 29 September 2020 | 1.65% | | $1,500,000 | 1.49% |
| | | | | | 16 June 2020 | 1.60% | | $1,500,000 | 1.49% |
| | | | | | 22 September 2020 | 1.60% | | $1,035,684 | 1.49% |
| | | | | | 25 August 2020 | 1.60% | | $2,000,000 | 1.49% |
| | | | | | 1 September 2020 | 1.60% | | $1,518,468 | 1.49% |
| | | | | Bendigo & Adelaide Bank Ltd | | | | $3,022,518 | 2.99% |
| | | | | | 16 June 2020 | 1.55% | | $1,509,857 | 1.49% |
| | | | | | 3 November 2020 | 1.50% | | $1,512,662 | 1.49% |
| | | | BBB | Members Equity Bank Ltd | | | | $6,540,451 | 5.97% |
| | | | | | 14 July 2020 | 1.60% | | $2,000,000 | 1.49% |
| | | | | | 22 September 2020 | 1.60% | | $1,507,338 | 1.49% |
| | | | | | 25 August 2020 | 1.60% | | $2,000,000 | 1.49% |
| | | | | | 1 September 2020 | 1.60% | | $1,033,115 | 1.49% |
| | FRN | A1 | A+ | Macquarie Bank | | | | $1,000,000 | 1.49% |
| | | | | | 12 May 2020 | 1.78% | 06/02/2025 | $1,000,000 | 1.49% |
| | | A2 | BBB | Teachers Mutual Bank Limited | | | | $1,000,000 | 1.49% |
| | | | | | 28 April 2020 | 1.78% | 28/10/2022 | $1,000,000 | 1.49% |
| Grand Total | | | | | | | | $108,529,267 | 100.00% |

N.B.
*"INV TYPE"- FRN = interest rate is the "Coupon Margin" established on issue date, this plus 3M BBSW provides the yield for the current coupon period.*
*"MATURITY DATE"- FRN = the interest coupon payment date not actual FRN maturity date (paid every 91 days).*

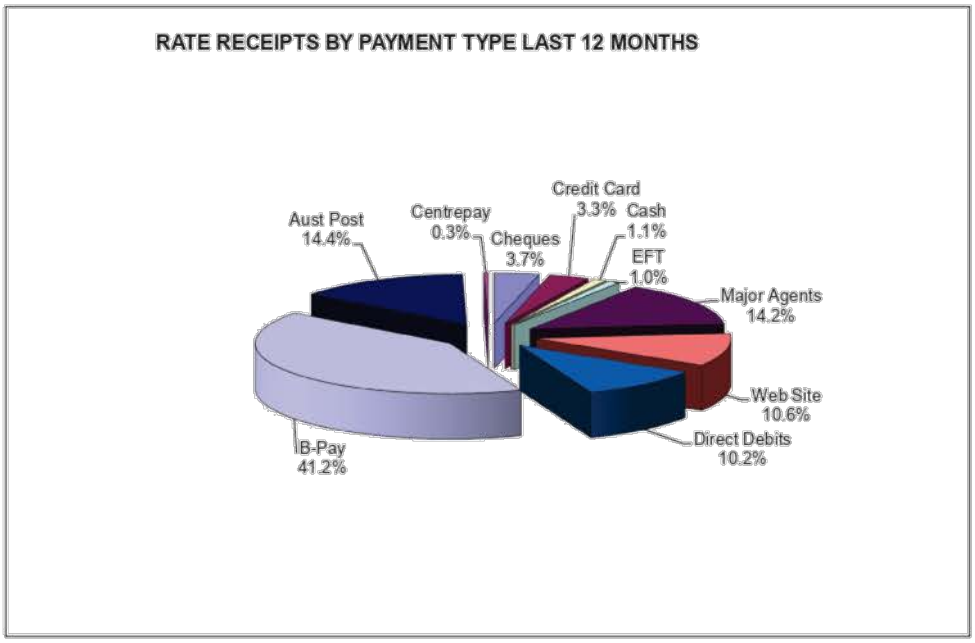


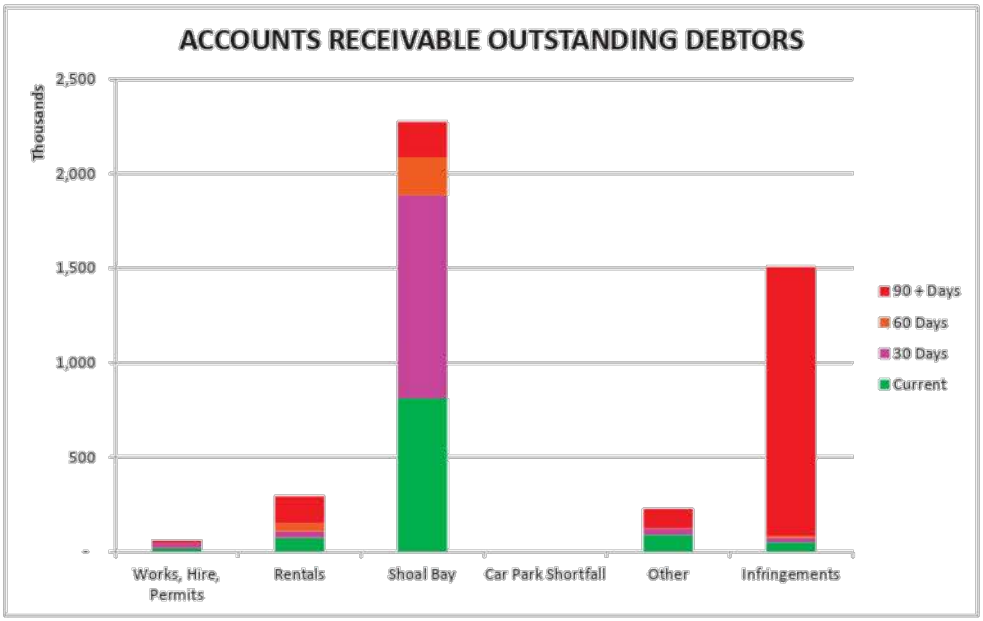

| | |
|---|---|
| General Bank Funds | $2,224,705 |
| Total Funds | $110,753,972 |
| Total Budgeted Investment Earnings | $1,746,278 |
| Year to Date Investment Earnings | $1,322,087 |
| Weighted Ave Rate | 1.63% |
| BBSW 90 Day Rate | 0.81% |
| Bloomberg AusBond (Bank Bill Index) | 0.98% |

*Council has an arrangement with its financial institution the Commonwealth Bank of Australia to offset Council's overdraft facility against pooled funds held in Council's Trust Account and General Account*

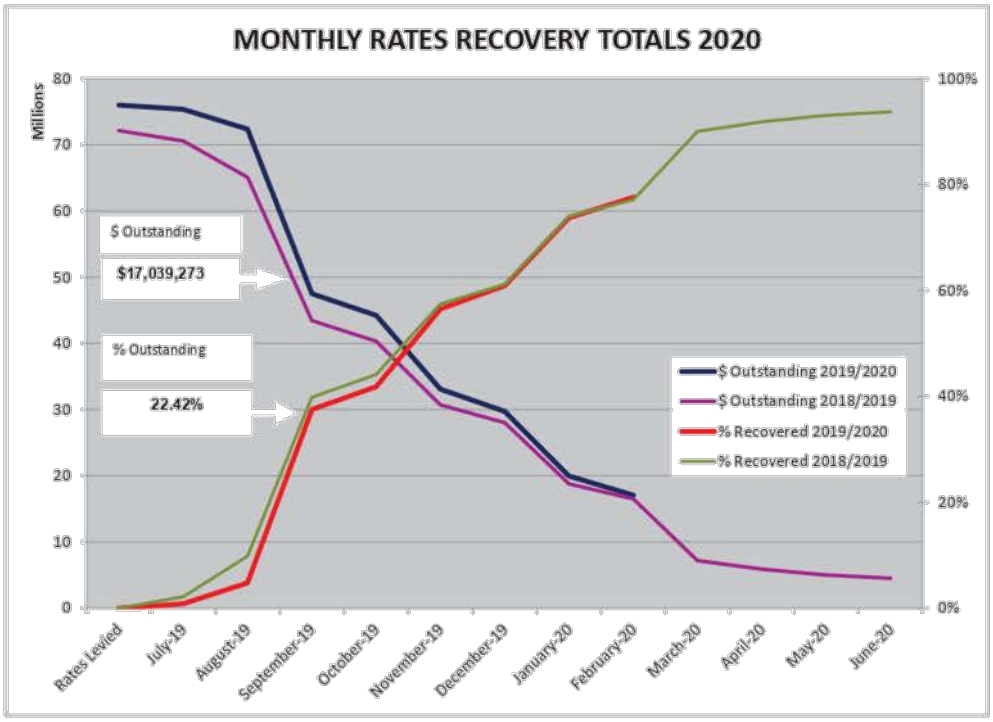
| | |
|---|---|
| Trust Bank Account | $461,989 |

**FINANCE DEPARTMENT**
**SERVICE LEVEL REPORT TO COUNCIL**
**FOR THE MONTH OF FEBRUARY 2020**

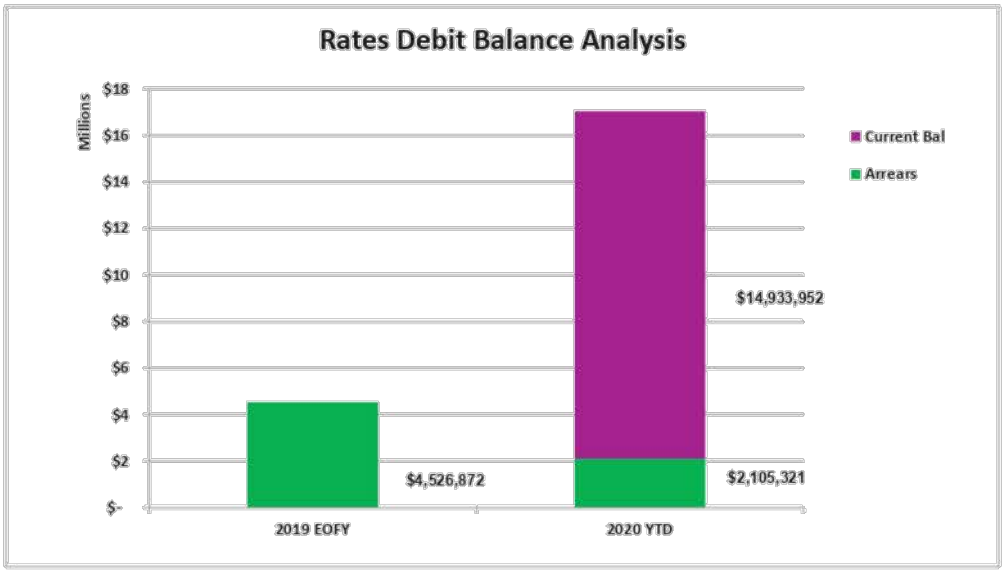



Pursuant to Local Government (Accounting) Regulations Sec 18(2)(b) the chart labelled "Accounts Receivable Outstanding Debtors" represents sundry debts owed to Council on an "aged" basis




The chart labelled "Monthly Rates Recovery Totals" represents the amounts currently outstanding in Rates to Council, rates are either due or overdue and no further "ageing" is possible.



## 15.2 CITY OF DARWIN AND NORTHERN TERRITORY GOVERNMENT SECURITY PATROL PARTNERSHIP

**Author:** **Chief Executive Officer**

**Authoriser:** **Acting General Manager Government Relations & External Affairs**

**Attachments:** **Nil**

### SUMMARY

The purpose of this report is to advise the Council of Security Patrol Arrangements in response to the COVID-19 Pandemic

### RECOMMENDATIONS

1. THAT the report be received and noted.
2. THAT Council receive the advice of an agreed partnership between the City of Darwin and the Northern Territory Government in relation to a security patrol partnership until 30 September 2020

### KEY ISSUES

- The COVID-19 Pandemic has created significant concern within the Darwin CBD businesses community and it is anticipated that reduced resources due to business closures will be unable to ensure full security coverage of the CBD
- It is further anticipated that the reduction in business operations and private security in the Darwin CBD may lead to an increase in Anti-Social Behaviour as well as break and enter offences.
- The Northern Territory Government Department of Chief Minister and the Northern Territory Police Fire and Emergency Services have requested specific security patrol support from the City of Darwin to help address this issue
- Support is provided from the City of Darwin by way of funding and direction
- The partnership has commenced and will run until 30 September 2020
- The primary objective of the partnership is to provide additional resources from 4pm until 6am

### BACKGROUND

The Department of Chief Minister through the Departments Chief Executive has requested Council support in relation to the current COVID-19 pandemic event. This specific request for support is to provide security patrols throughout the Darwin CBD to protect businesses during an unprecedented time of closure and vulnerability. The request for support has also been endorsed by the Police Commissioner and Chief Executive of Police Fire and Emergency Services.

### DISCUSSION

During the COVID-19 Pandemic Response it is vital that the City of Darwin respond to requests for support from other levels of Government and vice versa. Ensuring that from a partnership perspective we are united in our service delivery to our community and in this instance keeping our City safe.

The unprecedented closure of licensed and other businesses have seen the removal of security guards which were employed by those businesses. As such there is concern that these businesses will become a target at a time when they least need it. It is anticipated that already

limited resources will be further stretched over the coming weeks and months. The focus of the patrols will be to deliver social order, active crime deterrence and anti-social behaviour enforcement. In this changing time, with limited commercial activity, a visual and active security presence in the CBD is essential. Cross-cultural appropriate discussions and de-escalation methods will continue to be a core element of the patrol's service delivery.

The area for the patrols will be the entire core CBD, from Daly Street to the Waterfront Boundary.

Council has been requested to fund the program at $50 000 per month over the next 6 months, total of $300 000.00. This cost is within current operational delegations and has been accommodated within existing operational budgets. The Northern Territory Government will invoice the City of Darwin on a monthly basis.

The Security Patrols will commence at 4pm and conclude at 6am each morning operating in 3 teams of two and working closely with the Northern Territory Police, to protect vital areas and businesses within the CBD.

**IMPLICATIONS**

Council is a supporting partner of the Northern Territory Government and Northern Territory Police Service in this and many other elements of the ongoing COVID-19 response. Operational budgets have been pooled and redistributed to fund the City of Darwin partnership and have no material impact on Council services or operations.

## 16 REPORTS OF REPRESENTATIVES

## 17 QUESTIONS BY MEMBERS

## 18 GENERAL BUSINESS

## 19 DATE, TIME AND PLACE OF NEXT ORDINARY COUNCIL MEETING

THAT the next Ordinary Meeting of Council be held on Tuesday, 14 April 2020, at 5:30pm (Open Section followed by the Confidential Section), Council Chambers, Level 1, Civic Centre, Harry Chan Avenue, Darwin.

## 20 CLOSURE OF MEETING TO THE PUBLIC

THAT pursuant to Section 65 (2) of the Local Government Act and Regulation 8 of the Local Government (Administration) Regulations the meeting be closed to the public to consider the Confidential Items of the Agenda.

**RECOMMENDATIONS**

That Council considers the confidential report(s) listed below in a meeting closed to the public in accordance with Section 65(2) of the Local Government Act:

**26.1 Rent Relief as a result of COVID - 19**

This matter is considered to be confidential under Section 65(2) - 8(c)(i) of the Local Government Act, and the Council is satisfied that discussion of this matter in an open meeting would, on balance, be contrary to the public interest as it deals with information that would, if publicly disclosed, be likely to cause commercial prejudice to, or confer an unfair commercial advantage on any person.

**26.2 Proposal for an Artist Assistance Fund**

This matter is considered to be confidential under Section 65(2) - 8(c)(iv) of the Local Government Act, and the Council is satisfied that discussion of this matter in an open meeting would, on balance, be contrary to the public interest as it deals with information that would, if publicly disclosed, be likely to prejudice the interests of council or some other person.

**26.3 Darwin City Deal Update - March**

This matter is considered to be confidential under Section 65(2) - 8(d) of the Local Government Act, and the Council is satisfied that discussion of this matter in an open meeting would, on balance, be contrary to the public interest as it deals with information subject to an obligation of confidentiality at law, or in equity.

## 21 ADJOURNMENT OF MEETING AND MEDIA LIAISON

# MINUTES

## Ordinary Council Meeting
## Tuesday, 17 March 2020

Reports, recommendations and supporting documentation can be accessed via the City of Darwin Council Website at www.darwin.nt.gov.au, at Council Public Libraries or contact the Committee Administrator on (08) 8930 0670.

**MINUTES OF CITY OF DARWIN**
**ORDINARY COUNCIL MEETING**
**HELD AT THE COUNCIL CHAMBERS, LEVEL 1, CIVIC CENTRE, HARRY CHAN AVENUE, DARWIN**
**ON TUESDAY, 17 MARCH 2020 AT 5:30PM**

**PRESENT:** Lord Mayor Kon Vatskalis, Alderman Andrew Arthur, Alderman Paul Arnold, Alderman Jimmy Bouhoris, Alderman Justine Glover, Alderman Gary Haslett, Alderman Robin Knox, Alderman George Lambrinidis, Alderman Simon Niblock, Alderman Mick Palmer, Alderman Rebecca Want de Rowe, Alderman Emma Young

**OFFICERS:** Scott Waters (Chief Executive Officer), Joshua Sattler (General Manager Innovation Growth & Development Services), Polly Banks (General Manager Community & Regulatory Services), Vanessa Green (Acting General Manager Government Relations & External Affairs), Ron Grinsell (General Manager Engineering & City Services)

Chris Kelly (Executive Manager Corporate Services), Fiona van der Weide, (Governance and Legislation Advisor), Matt Grassmayr (Executive Manager Leisure and Regulatory Services) Bruce Cutler (Managing Director RedSplash Creative Solutions, City of Darwin Media Contractor)

**APOLOGY:** Alderman Peter Pangquee

**GUESTS:** NT News – Will Zwar

**WEBCASTING DISCLAIMER**

The City of Darwin is live webcasting the Open Section of Ordinary Council Meetings. Audio-visual recording equipment has been configured to avoid coverage of the public gallery area and the City of Darwin will use its best endeavours to ensure images in this area are not webcast. However the City of Darwin expressly provides no assurances to this effect and in the event your image is webcast, you will by remaining in the public gallery area be taken to have given the City of Darwin a non-exclusive licence to copy and broadcast your image worldwide for no reward.

## Order Of Business

## 1 ACKNOWLEDGEMENT OF COUNTRY

## 2 THE LORD'S PRAYER

## 3 MEETING DECLARED OPEN

**RESOLUTION ORD113/20**

Moved: Lord Mayor Kon Vatskalis
Seconded: Alderman George Lambrinidis

The Chair declared the meeting open at 5:30 pm.

**CARRIED 12/0**

The Chair welcomed Alderman Paul Arnold to his first meeting of Council.

## 4 APOLOGIES AND LEAVE OF ABSENCE

### 4.1 APOLOGIES

**RESOLUTION ORD114/20**

Moved: Alderman Emma Young
Seconded: Alderman Rebecca Want de Rowe

THAT the apology from Alderman Peter Pangquee, be received.

**CARRIED 12/0**

### 4.2 Leave of Absence Granted

Nil

### 4.3 Leave of Absence Requested

### 4.3 LEAVE OF ABSENCE REQUESTED

**RESOLUTION ORD115/20**

Moved: Alderman Emma Young
Seconded: Alderman Rebecca Want de Rowe

A. THAT a Leave of Absence be granted for Alderman Gary Haslett for the period 9 April 2020 to 14 April 2020.

B. THAT a Leave of Absence be granted for Alderman Robin Knox for the period 27 March 2020 to 14 April 2020.

**CARRIED 12/0**

## 5 ELECTRONIC MEETING ATTENDANCE

### 5.1 Electronic Meeting Attendance Granted

Nil

### 5.2 Electronic Meeting Attendance Requested

### 5.2 ELECTRONIC MEETING ATTENDANCE REQUESTED

**RESOLUTION ORD116/20**

Moved: Alderman Justine Glover
Seconded: Alderman Jimmy Bouhoris

THAT Council note that pursuant to Section 61 (4) of the Local Government Act and Decision No. 21\0009 – 15/04/12, the following members request Electronic Meeting Attendance:

C. Alderman Robin Knox to attend all Council Meetings and Briefing Sessions for the period 27 March 2020 to 14 April 2020.

D. Alderman Gary Haslett to attend all Council Meetings and Briefing Sessions for the period 9 April 2020 to 14 April 2020.

**CARRIED 12/0**

## 6 DECLARATION OF INTEREST OF MEMBERS AND STAFF

### 6.1 Declaration of Interest by Members

Nil

### 6.2 Declaration of Interest by Staff

Nil

## 7 CONFIRMATION OF PREVIOUS MINUTES

**RESOLUTION ORD117/20**

Moved: Alderman Emma Young
Seconded: Alderman Rebecca Want de Rowe

That the minutes of the Ordinary Council Meeting held on 25 February 2020 be confirmed.

**CARRIED 12/0**

## 8 MOVING OF CONFIDENTIAL ITEMS

Nil

## 9 MATTERS OF PUBLIC IMPORTANCE / LORD MAYORAL MINUTE

Nil

## 10 PUBLIC QUESTION TIME

Nil

## 11 PETITIONS

Nil

## 12 DEPUTATIONS AND BRIEFINGS

Nil

## 13 NOTICES OF MOTION

Nil

## 14 OFFICERS REPORTS

### 14.1 ANIMAL REGISTRATIONS

**SUMMARY**

The purpose of this report is to advise Council of the recommendations from the Top End Regional Organisation of Councils (TOPROC) Animal Management Reference Group (AMRG) regarding animal registrations.

**RESOLUTION ORD118/20**

Moved: Alderman Emma Young
Seconded: Alderman Rebecca Want de Rowe

1. THAT the report entitled Animal Registrations be received and noted.
2. THAT Council endorse the annual registration period for dogs and cats be amended from 1 July-30 June to 1 September-31 August.
3. THAT Council endorse the correspondence to the Office of Parliamentary Counsel at **Attachment 1** to report entitled Animal Registrations to request an amendment to Darwin City Council By-Laws, Part 1, Division 3, By-Law 15 (3) to change the annual registration period for animals.
4. THAT Council withdraw five-year and lifetime registration options for dogs and cats from 1 July 2020 for new animal registrations.
5. THAT Council endorse reciprocal registration administration for animals registered in TOPROC Councils from 1 September 2020.

**CARRIED 12/0**

## 14.2 UNIFORM COMPANION ANIMAL LEGISLATION IN THE NORTHERN TERRITOTY

**SUMMARY**

The purpose of this report is to provide Council with a draft response regarding the Discussion Paper for Uniform Companion Animal Legislation in the Northern Territory.

**RESOLUTION ORD119/20**

Moved: Alderman Rebecca Want de Rowe
Seconded: Alderman Emma Young

1. THAT the report entitled Uniform Companion Animal Legislation in the Northern Territory be received and noted.
2. THAT Council endorse the draft submission for the Uniform Companion Animal Legislation in the Northern Territory - Discussion Paper at **Attachment 2** to the report entitled Uniform Companion Animal Legislation in the Northern Territory.

**CARRIED 12/0**

## 14.3 SPORTS FIELD INFRASTRUCTURE

**SUMMARY**

The purpose of this report is to advise Council of an agreed list of priorities from Peak Sporting Bodies for infrastructure upgrades at Council ovals.

**RESOLUTION ORD120/20**

Moved: Alderman Robin Knox
Seconded: Alderman Jimmy Bouhoris

1. THAT the report titled Sports Field Infrastructure be received and noted.

   THAT Council acknowledge the Peak Sporting Bodies priorities for future infrastructure upgrades and oval lighting detailed in **Attachments 1 and 2** of the report titled Sports Field Infrastructure, for consideration regarding future sporting oval upgrades.

**CARRIED 12/0**

## 14.4 CAR PARK EXTENSIONS TO AN EXISTING CASINO - LOTS 5244 & 5772, 1 CASINO DRIVE & 73 GILRUTH AVENUE, THE GARDENS

### SUMMARY

The purpose of this report is to present to Council an application to redevelop a portion of Lot 5772 (73) Gilruth Avenue from landscaping into a hard stand (car parking), and remove landscaped centre islands in the road reserve to create an access to the new car park.

**RESOLUTION ORD121/20**

Moved: Alderman Jimmy Bouhoris
Seconded: Alderman Mick Palmer

1. THAT the report entitled Car park Extensions to an existing Casino - Lots 5244 & 5772, 1 Casino Drive & 73 Gilruth Avenue, The Gardens be received and noted.

**CARRIED 12/0**

2. That Council supports the removal of landscaping located within Lot 5772 (73) Gilruth Avenue, proposed for development as a car parking area, and that the leased area shall be handed back to Council in the same condition as provided, as a landscaped area. The applicant is to submit further details including, but not limited to: the design of landscaping areas, tree pits, irrigation, installation, and maintenance of the shade trees.

**Alderman Mick Palmer called for division.**

**For:** Alderman Paul Arnold, Alderman Mick Palmer, Alderman Jimmy Bouhoris, Alderman George Lambrinidis

**Against:** Alderman Simon Niblock, Alderman Andrew Arthur, Alderman Gary Haslett, Alderman Robin Knox, Alderman Justine Glover, Lord Mayor, Alderman Emma Young, Alderman Rebecca Want De Rowe

**LOST – 4/8**

**RESOLUTION ORD122/20**

Moved: Alderman Simon Niblock
Seconded: Alderman Robin Knox

2. That Council do not support the removal of landscaping located within Lot 5772 (73) Gilruth Avenue.

**CARRIED 8/4**

## 14.5 MINUTES BOMBING OF DARWIN AND MILITARY HISTORY ADVISORY COMMITTEE 5 FEBRUARY 2020 AND REVIEW OF TERMS OF REFERENCE

**SUMMARY**

The purpose of this report is to present the Minutes of the Bombing of Darwin and Military History Advisory Committee held on 5 February 2020 and seek Council's endorsement of the revised Terms of Reference for the Committee.

**RESOLUTION ORD123/20**

Moved: Alderman Mick Palmer
Seconded: Alderman Gary Haslett

1. THAT the report entitled Minutes Bombing of Darwin and Military History Advisory Committee 5 February 2020 and Review of Terms of Reference be received and noted.
2. THAT the minutes of the Bombing of Darwin and Military History Advisory Committee of 5 February 2020, at **Attachment 1**, be received and noted.
3. THAT Council endorse the change to the title of the Bombing of Darwin and Military History Advisory Committee to Bombing of Darwin and Military and Civilian History Advisory Committee.
4. THAT Council endorse the revised Terms of Reference of the Bombing of Darwin and Military and Civilian History Advisory Committee, at **Attachment 2**.

**CARRIED 12/0**

## 14.6 MINUTES YOUTH ADVISORY COMMITTEE MEETING 13 FEBRUARY 2020 - APPOINTMENT OF NEW MEMBERS

**SUMMARY**

The purpose of this report is to present the minutes of the Youth Advisory Committee February meeting held on 13 February 2020 and seek approval of three nominations to the Committee.

**RESOLUTION ORD124/20**

Moved: Alderman Emma Young
Seconded: Alderman Justine Glover

1. THAT the report entitled Minutes Youth Advisory Committee Meeting 13 February 2020 and Appointment of new members be received and noted.
2. THAT, pursuant to Section 54 of the Local Government Act Council appoint David Ninan, Tanisha Cubillo and Martin Feng to the Youth Advisory Committee from 13 February 2020 – 30 June 2022.

**CARRIED 12/0**

### 14.7 ADOPTION OF PROCUREMENT POLICY

**SUMMARY**

The purpose of this report is to seek approval for the draft Procurement Policy.

**RESOLUTION ORD125/20**

Moved: Alderman Emma Young
Seconded: Alderman Jimmy Bouhoris

1. THAT the report entitled Adoption of Procurement Policy be received and noted.
2. THAT Council repeal Policy No. 70 Purchasing Policy.
3. That Council adopt the draft Policy No. 70 Procurement Policy at Attachment 2 to this report.

**CARRIED 12/0**

### 14.8 ADOPTION OF COUNCIL'S PRIVACY POLICY

**SUMMARY**

The purpose of this report is to seek approval for council's reviewed Privacy Policy.

**RESOLUTION ORD126/20**

Moved: Alderman Emma Young
Seconded: Alderman Rebecca Want de Rowe

1. THAT the report entitled Adoption of Council's Privacy Policy be received and noted.
2. THAT Council rescind *Policy No 033 Privacy* (**Attachment 1**).
3. THAT Council rescind *Policy No 078 Privacy and Confidentiality* (**Attachment 2**).
4. THAT Council adopts *Policy No. 33 Privacy* (**Attachment 3)**

**CARRIED 12/0**

## 15 RECEIVE & NOTE REPORTS

### 15.1 DARWIN LIVING LAB UPDATE

**SUMMARY**

The purpose of this report is to update Council on the progress of the Darwin Living Lab initiative.

**RESOLUTION ORD127/20**

Moved: Alderman Emma Young
Seconded: Lord Mayor Kon Vatskalis

1. THAT the report entitled Darwin Living Lab Update be received and noted.

**CARRIED 12/0**

## 16 REPORTS OF REPRESENTATIVES

THAT the following Reports of Representatives be received and noted.

### 16.1 REPORTS OF REPRESENTATIVES

**RESOLUTION ORD128/20**

Moved: Alderman Gary Haslett
Seconded: Alderman George Lambrinidis

Alderman Robin Knox attended the access and inclusion committee meeting on Tuesday 10 March.

The Committee has conducted a survey on access to disability parking, to see where people may face issues. There were recommendations from this survey to make amendments to the disabled car park. The Committee is disappointed that Council will wait another year before making these amendments, and query why Council has given this feedback.

Alderman Robin Knox attended the NT Water Safety and Advisory Committee, and reported that they are continuing to do good work throughout the committee.

The Committee would like to re-raise the issue with regarding Box Jelly Fish / Stinger signs, noting that some signs are missing and others do not have enough information. As the LGANT representative on the Committee, Alderman Robin Knox has advised the Committee that City of Darwin message is that it is the Northern Territory Government's responsibility. The Chair will be speaking to Northern Territory Government to ask them to put up signs. Alderman Robin Knox hopes that Council and Northern Territory Government can work together, so someone puts up the signs as they are needed.

General Manager Community advised that this is Northern Territory Government responsibility and obligation, and if we start erecting signs this will devolve the responsibility from Northern Territory Government.

**CARRIED 12/0**

# 17 QUESTIONS BY MEMBERS

## 17.1 END OF TRIP FACILITIES AT THE STATE SQUARE UNDERGROUND CAR PARK

**RESOLUTION ORD129/20**

Moved: Alderman Simon Niblock
Seconded: Alderman Rebecca Want de Rowe

THAT the following Questions by Members be received and noted.

**Question:**

Alderman Robin Knox queried do public have access to end of trip facilities in the State Square Underground Car Park, and if not, when will these be available?

**Response:**

General Manager Innovation Growth and Development Services advised that Council is working with Northern Territory Government, to see what systems they will put in place. Once commissioned and tested, a report will be put to Council. Currently the time frames are unknown.

**CARRIED 12/0**

## 17.2 NORTHERN TERRITORY GOVERNMENT GRANT FUNDING - UPDATE

**RESOLUTION ORD130/20**

Moved: Alderman Simon Niblock
Seconded: Alderman Rebecca Want de Rowe

THAT the following Questions by Members be received and noted.

**Question:**

Alderman Simon Niblock queried about a letter to the Northern Territory Government in April 2019, regarding funding for projects, including traffic calming infrastructure, Lee Point Road Cycle Path and Velodrome redevelopment. What information have we heard from Northern Territory Government regarding this?

**Response:**

General Manager Engineering and City Services has not yet received information from Northern Territory Government. Chief Executive Officer responded that he spoke with Treasurer and Deputy Chief Minister about 3 weeks ago, there has been very little progress to date. The only project we are developing is the Velodrome, and the small projects which are underway. All other projects are being delivered by Northern Territory Government, and we are waiting for them to report. Senior staff have spoken to Director of Department of Infrastructure Planning and Logistics regarding this. The Department has been prompted by Council at the highest level.

**CARRIED 12/0**

## 17.3 CORONAVIRUS DISEASE (COVID-19) - COUNCIL RESPONSE

**RESOLUTION ORD131/20**

Moved: Alderman Simon Niblock
Seconded: Alderman Rebecca Want de Rowe

THAT the following Questions by Members be received and noted.

**Question:**

Alderman Jimmy Bouhoris asked what Council's response and communication plan is to the outbreak of Coronavirus disease (COVID-19) regarding City of Darwin facilities. Are we being proactive by letting the community know what we are doing?

**Response:**

The Lord Mayor noted that Council officers are taking additional cleaning and hygiene approaches to public and City of Darwin spaces.

The Chief Executive Officer noted that this a concerning situation for the entire community, and that Council plays an important role ensuring stability.

The Chief Executive Officer has had six updates to staff, and have also put into place the Communicable Diseases procedure.

There are additional cleaning protocols in place for the pools.

Taking a cautious approach to the Library, a meeting will be held on 18 March regarding the Library status.

Regarding public amenities officers have put up hygiene posters and are ensuring handwashing treatments are installed across the City.

The Strategic Directions Group are working on a daily basis to monitor the situation. Currently we are business as usual – this will change when appropriate. We are following Northern Territory Government and Federal Government. We will follow the emergency management line.

Council has met with Danila Dilba, Larakia Nation and the NT Police Commissioner regarding the vulnerable itinerant community and options to return home. People are choosing to go back home which is positive.

From update 7 we will start external communications. We will enhance what we are sharing, and also provide support to LGANT and the all Top End Councils.

Specific messaging from Council will be out soon, as the Federal and Northern Territory Government are putting put messaging, and we don't want to confuse this space.

**CARRIED 12/0**

## 17.4 SOLAR POWER AT SHOAL BAY WASTE MANAGEMENT FACILITY

**RESOLUTION ORD132/20**

Moved: Alderman Mick Palmer
Seconded: Alderman Jimmy Bouhoris

THAT the following Questions by Members be received and noted.

**Question:**

Alderman Simon Niblock asked if the grant for solar power at Shoal Bay Waste Management Facility has been received yet? Noting that the funding had been announced in by Lord Mayor and Minister on the 28 June 2019

**Response:**

General Manager Engineering and City Services advised this was approved October 2019, and a meeting will be held on 18 March 2020 to confirm timelines.

.**CARRIED 12/0**

# 18 GENERAL BUSINESS

## 18.1 DARWIN ECONOMY

**RESOLUTION ORD133/20**

Moved: Lord Mayor Kon Vatskalis
Seconded: Alderman Rebecca Want de Rowe

THAT due to the unprecedented situation occurring with the COVID-19 Pandemic, Council undertake the following fiscal steps to support the Darwin Economy;

1. Car Parking fees and charges for CBD on-street car parking are waived from 18 March 2020 for an initial period of 60 days
2. The charging of interest on outstanding rates balances is suspended from 18 March 2020 until 30 June 2020
3. As part of the 2020/21 FY budget deliberations that the current interest rate for outstanding rates balances is reviewed within these deliberations
4. Innovation Growth and Development Services, investigate and present to Council options for encouraging residents to shop and dine in the CBD/ Municipality wide

**CARRIED 11/1**

**Point of order**

Alderman Robin Knox: This should be a Lord Mayoral Minute, not in General Business.

Lord Mayor responded that due to timings, and under the meeting procedure it could not go under Lord Mayoral Minute, so it was most appropriate in General Business.

Alderman Simon Niblock: There has not been enough time for consideration, the budgets and costs are not provided. What will be the financial impact?

Lord Mayor responded that the urgency of the ever changing situation, so determined there was no call for Point of Order.

## 18.2 COMMENT TO DEVELOPMENT CONSENT AUTHORITY

**Summary**

This Resolution Is Further To Report 14.4, Report Car Park Extensions to the Existing Casino

**RESOLUTION ORD134/20**

Moved: Alderman Andrew Arthur
Seconded: Alderman Rebecca Want de Rowe

THAT Council's response to the Development Consent Authority for Development Application PA2020/0032, requests amended plans demonstrating additional landscaping for shade and amenity purposes on Lot 5244, in accordance with Clause 8.2 of the Northern Territory Planning Scheme.

**CARRIED 9/3**

## 18.3 FAREWELL TO SALLY VASEY

**RESOLUTION ORD135/20**

Moved: Lord Mayor Kon Vatskalis

Seconded: Alderman George Lambrinidis

THAT Sally Vasey, the Lord Mayors Executive Assistant has been an incredible asset to Council, and she will be missed when she departs on 27 March 2020. The City of Darwin thanks Sally for her 11 years of service and wishes her all the best.

**CARRIED 12/0**

## 19 DATE, TIME AND PLACE OF NEXT ORDINARY COUNCIL MEETING

**RESOLUTION ORD136/20**

Moved: Alderman Jimmy Bouhoris
Seconded: Alderman Emma Young

THAT the next Ordinary Meeting of Council be held on Tuesday, 31 March 2020, at 5:30 pm (Open Section followed by the Confidential Section), Council Chambers, Level 1, Civic Centre, Harry Chan Avenue, Darwin.

**CARRIED 12/0**

## 19 CLOSURE OF MEETING TO THE PUBLIC

THAT pursuant to Section 65 (2) of the Local Government Act and Regulation 8 of the Local Government (Administration) Regulations the meeting be closed to the public to consider the Confidential Items of the Agenda.

**RECOMMENDATIONS**

That Council considers the confidential report(s) listed below in a meeting closed to the public in accordance with Section 65(2) of the Local Government Act:

**26.1 YMCA Pool Management Mid-Contract Review**

This matter is considered to be confidential under Section 65(2) - 8(c) (i) of the Local Government Act, and the Council is satisfied that discussion of this matter in an open meeting would, on balance, be contrary to the public interest as it deals with information that would, if publicly disclosed, be likely to cause commercial prejudice to, or confer an unfair commercial advantage on any person.

**26.2 Operating Subsidy Requests 2020/2021**

This matter is considered to be confidential under Section 65(2) - 8(c) (iv) of the Local Government Act, and the Council is satisfied that discussion of this matter in an open meeting would, on balance, be contrary to the public interest as it deals with information that would, if publicly disclosed, be likely to prejudice the interests of council or some other person.

**26.3 Review of Confidential Decisions - June to December 2019**

This matter is considered to be confidential under Section 65(2) - 8(c) (iv) of the Local Government Act, and the Council is satisfied that discussion of this matter in an open meeting would, on balance, be contrary to the public interest as it deals with information that would, if publicly disclosed, be likely to prejudice the interests of council or some other person.

## 21 ADJOURNMENT OF MEETING AND MEDIA LIAISON

**RESOLUTION ORD137/20**

Moved: Alderman Andrew Arthur
Seconded: Alderman Gary Haslett

THAT the open meeting adjourned at 7:27pm.

**CARRIED 12/0**

## 22 RESUMPTION OF OPEN MEETING

**RESOLUTION ORD150/20**

Moved: Lord Mayor Kon Vatskalis
Seconded: Alderman Justine Glover

THAT the open meeting resumed at 10:50pm.

**CARRIED 12/0**

## 23 CLOSURE OF MEETING

**RESOLUTION ORD151/20**

Moved: Lord Mayor Kon Vatskalis
Seconded: Alderman Justine Glover

THAT the meeting closed at 10:50pm.

**CARRIED 12/0**

**The minutes of this meeting were confirmed at the Ordinary Council Meeting held on 31 March 2020.**

**.....**

**CHAIR**