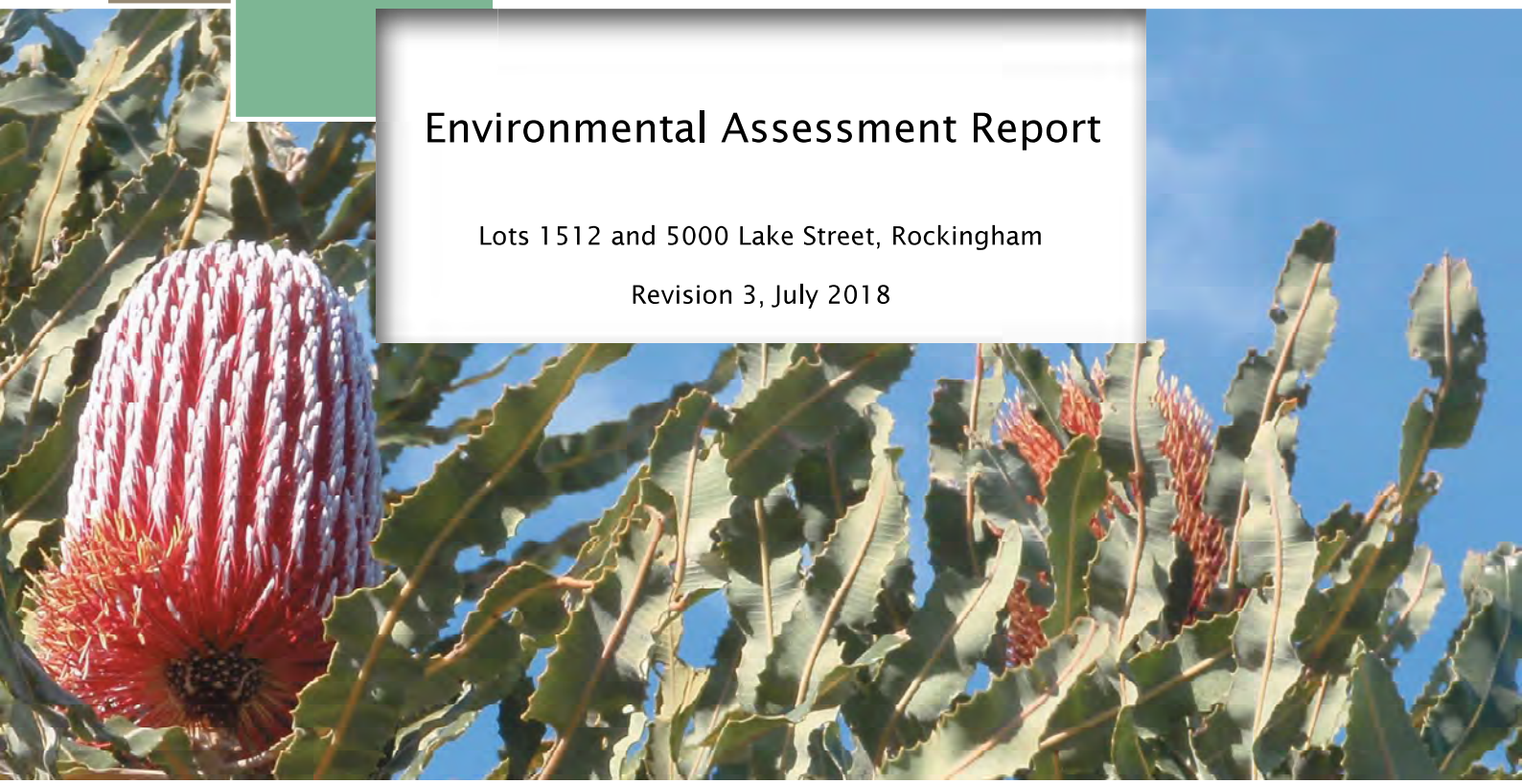
COTERRA ENVIRONMENT

Environmental Assessment Report

Lots 1512 and 5000 Lake Street, Rockingham

Revision 3, July 2018



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Environmental Assessment Report

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Revision 3, July 2018

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This report was prepared for:

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Notice

EXECUTIVE SUMMARY

Defence Housing Australia (DHA) is proposing to develop Lots 1512 and 5000 Lake Street, Rockingham for residential housing/apartment construction. The site is 3.75 ha in size and is located to the north east of Lake Richmond, in the suburb of Rockingham, approximately 50km south of the Perth CBD.

The site is currently zoned 'Urban' under the Metropolitan Region Scheme (MRS) and 'Development' under the City of Rockingham Town Planning Scheme No. 2 (TPS).

The site was previously utilised as a caravan park, with short and long-term tenants, and had been cleared. During this time, eucalypts, pine trees and palm trees were planted across the site. The eucalypts (mostly Tuarts – *Eucalyptus gomphocephala*) have been trimmed and maintained within the caravan park, removing any growth past approximately 3-5m in height.

As a result, of the historical land use, the site itself has minimal environmental value. The site is adjacent to the Rockingham Lakes Regional Park which includes Lake Richmond, a Conservation Category Wetland (CCW), and a community of thrombolites, which are critically endangered and classified as a Threatened Ecological Community (TEC) (DEC, 2010a).

Additionally, the bushland surrounding Lake Richmond contains 'sedgelands in holocene dune swales' which are also considered critically endangered and are identified as a TEC by the Department of Biodiversity, Conservation and Attractions (DBCA), as well as being protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

While the site has limited environmental value as a result of historical land uses, the site's proximity to sensitive and significant environmental areas will require management of potential indirect impacts.

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1.0 INTRODUCTION

1.1 Background

Defence Housing Australia (DHA) is proposing to develop Lots 1512 and 5000 Lake Street, Rockingham for residential housing and apartment construction. The site is 3.75 ha in size and is located to the north east of Lake Richmond, in the suburb of Rockingham, approximately 50km south of the Perth CBD (Figures 1 and 2).

The site is currently zoned 'Urban' under the Metropolitan Region Scheme (MRS) and in 2015 was rezoned to 'Development' under the City of Rockingham Town Planning Scheme No. 2 (TPS) Amendment 157.

1.2 Scope of Report

This Environmental Assessment Report (EAR) has been prepared to accompany the Local Structure Plan (LSP) for the redevelopment of the site. It also identifies key environmental characteristics of the site, demonstrates compliance with regulatory objectives by detailing proposed management measures to minimise, avoid or mitigate potential environmental impacts.

A Local Water Management Strategy (LWMS) and Bushfire Management Plan (BMP) have also been prepared for the site.

1.3 Previous Environmental Assessment

The redevelopment of the site was referred to the former Department of Sustainability, Environment, Water, Population and Communities (SEWPaC; now the Department of the Environment and Energy) for review and assessment under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in 2013. The project was referred to SEWPaC due to potential impacts to Matters of National Environmental Significance (MNES), identified as the Thrombolites and the Sedgelands in Holocene Dune Swales. Both these MNES are associated with Lake Richmond, and both are recognized as Threatened Ecological Communities. The assessment of the proposed project was 'Not a Controlled Action'. No advice or conditions were included in this approval. The decision notice is appended as Appendix A.

The TPS amendment was assessed by the Environmental Protection Authority (EPA) in 2015. The EPA's, assessment outcome was 'Scheme Not Assessed-Advice Given (No Appeals)' (Appendix B).

1.4 Stakeholder Consultation

Since the projects inception, consultation with the City of Rockingham and key stakeholders through community engagement workshops and meetings has been undertaken by the project team. This process has ensured that local issues/matters (i.e. transport, access, bushfire and environment) have been considered and accommodated within the key elements of the project design and implementation.

2.0 EXISTING ENVIRONMENT

2.1 Topography and Soils

The site has minimal topographical features and is relatively flat. The site elevation ranges from approximately 2 to 3 metres (m) Australian Height Datum (AHD) (Figure 3).

The Department of Minerals and Energy (2000) mapping provided in Figure 3 indicates that the site contains one single natural soil type of the Safety Bay Sand soil system consisting of Sand (S13): which is described as – Calcareous Sand – white, medium-grained, rounded quartz and shell debris, well sorted, of eolian origin.

This soil type is identified as being suitable for urbanisation and road construction (Dept. of Minerals and Energy, 2000).

A geotechnical investigation was undertaken by Galt Geotechnics in January 2013. The results of the investigation indicated that site soils generally consist of loose sand fill and medium to very dense sand to the maximum test depth of 9.1 m. These findings are consistent with regional soil mapping.

2.2 Acid Sulfate Soils

The Department of Water and Environmental Regulation (DWER) Acid Sulfate Soil (ASS) Risk Map indicates that the site has 'no known risk' of ASS occurring within 3m of natural soil surface (Figure 4) (DER, 2015a). A high-moderate risk area of ASS is mapped as occurring approximately 60m from the south west corner of the site over Lake Richmond.

2.3 Hydrology

2.3.1 Groundwater

2.3.1.1 Overview

The site is underlain by a series of unconfined, semi-confined and confined aquifers located at increasing depths beneath the site, from the shallow unconfined Superficial and Rockingham Sand aquifers, to the (semi-confined to confined) Leederville aquifer, and the deep (confined) Yarragadee aquifer (DoW, 2008).

Regional maximum groundwater contours mapped in the Perth Groundwater Map (DoW, 2016) and indicate that maximum groundwater levels occur at approximately 1 mAHD across the site.

Regional groundwater flow is generally in a westerly direction towards the coast however local groundwater flow is anticipated to be in a south westerly direction towards Lake Richmond.

Department of Water and Environmental Regulation's Water Information Network (WIN) provides groundwater information from monitoring bores located within the area. WIN Bore 61410009 (Figure 6) is located on the south eastern boundary of the

site and has monthly groundwater level recordings from December 1983 through to April 1986. This data includes two groundwater peak periods (considered September/October) and indicates that the maximum groundwater level at the site during this period was 1.32 mAHD.

2.3.1.2 Site Data

Four groundwater monitoring bores were installed at the site during the geotechnical investigation in January 2013 (Figure 5). Prior to the commencement of groundwater monitoring at the site the (then) Department of Water was consulted to confirm the groundwater monitoring requirements. It was agreed that monitoring of one groundwater peak period would be sufficient, based on the following:

- The infill nature of the proposed development, and the fact there is an existing development (Caravan Park) already located on the site.
- Monthly groundwater level monitoring would be undertaken between January and October 2013.
- Collected data would be compared to regional WIN data.

The maximum groundwater level recorded over the monitoring period ranged from 1.18 mAHD in the south-western corner of the site to 1.29 mAHD in the centre to east of the site. This equates to a separation of approximately 0.85 to 1.62 m from existing ground levels. Maximum groundwater contours based on the onsite monitoring data are included on Figure 5.

For further information refer to the sites LWMS.

2.3.2 Wetlands

There are no mapped wetlands within the site as identified in the DBCA geomorphic wetlands database (Figures 5 and 6).

Lake Richmond, located approximately 100m to the south west of the site is mapped as a Conservation Category Wetland (CCW) by the DBCA (DEC, 2012). CCW's are considered as the highest priority wetlands and are described as wetlands which support a high level of attributes and functions. The DBCA's objective for CCW's are to preserve and protect the existing conservation values of the wetlands through various mechanisms including:

- reservation in national parks, crown reserves and State owned land,
- protection under Environmental Protection Policies, and
- wetland covenanting by landowners.

Wetland buffers are required for CCW's, with the generic buffer widths recommended by the DBCA varying depending on factors such as existing condition of wetland and buffer area (i.e. management category of the wetland), values requiring protection, potentially threatening processes and type of adjacent land use. Recommended buffers range from 50 to 200m, with the DBCA generally applying a 50m buffer provided management and protection of the wetland values can be demonstrated. The EPA (2008) urges that all Conservation category wetlands and appropriate

buffers are fully protected. In relation to wetland buffers the EPA provides the following advice 'Wetlands that are to be protected require a minimum 50m buffer distance. A range of generic buffer distances is provided in Water and Rivers Commission Position Statement: Wetlands (WRC, 2001). Alternatively a site-specific buffer requirement may be determined.'

The south western corner of the site is approximately 100m to Lake Richmond and therefore does not intrude to the generic 50m buffer associated with the CCW (refer to Figure 5).

2.4 Lake Richmond and Thrombolites

Lake Richmond is located approximately 100m southwest of the site and is protected under the Rockingham Lakes Regional Park Management Plan (DEC, 2010a). Associated with the lake is the occurrence of thrombolites.

The site is vested to the City of Rockingham and designated for Conservation and Protection. The management emphasis of this zone is to protect and where possible enhance the conservation values (biota and heritage) as well as the landscape qualities of the park. Priority will be given to restoring and maintaining the natural state of conservation and protection areas. Visible evidence of management will be minimal.

The thrombolites are considered critically endangered by the DBCA, and are listed as protected threatened ecological communities under both the State *Wildlife Conservation Act 1950*, and the Federal EPBC Act.

DBCA coordinates the development and implementation of recovery strategies that aim to address the threats to communities such as the thrombolites, including those that occur outside the caravan park. An Interim Recovery Plan has been developed for the thrombolites at Lake Richmond.

2.5 Vegetation and Flora

2.5.1 General

The Local Biodiversity Program (LBP) Regional Framework for local biodiversity conservation priorities have identified Local Natural Areas (LNA) which are defined as all nature areas outside of Bush Forever, DBCA managed land and regional parks. (WALGA LBP, 2013). Based on LBP (2015) database there is currently no mapped remnant vegetation (or LNAs) within the site.

Plate 1: Native Vegetation Extent Mapping (LBP)

Historically (50 years) the site has been utilised as a caravan park, and the vegetation within the site consists of mostly exotic planted species. As a result there is no understorey, apart from planted non-native plants and grass, with the over-storey consisting of planted peppermint trees (*Agonis flexuosa*), Palm trees, and some planted native trees, mostly consisting of Tuart (*Eucalyptus gomphocephala*) species. The established trees have been maintained and pruned to prevent significant over-storey growth. The main trunks of the Tuarts appear to have been pruned at approximately 3 to 5m above the ground.

The vegetation associated with Lake Richmond is separated from the site by a wide servicing corridor associated with the main sewerage line to the Point Peron Waste Water Treatment Plant. The development will not impact on this area bushland, and management measures (outlined in Section 4.1 below) will prevent any in-direct impacts, or damage during construction.

2.5.2 Landscape Assessment and Arboricultural Impact Assessment

A landscape assessment was undertaken to determine which planted trees (native and exotic) were viable for retention and site relocation. A Landscape Concept Plan has been developed for the site, which includes the retention of many Peppermints and Tuarts along Fisher Street.

In August 2017, an Arboricultural Impact Assessment of the trees remaining at the site and within the adjacent road reserves was undertaken by The Arbor Centre. The findings of this assessment included:

- The majority of the trees assessed as part of the survey were eucalyptus species (62%) and Agonis species (18%).
- 71% of trees present were Western Australian species, 15% were Australian native species and 14% were introduced species.
- 89% of the trees were assessed to be in good to acceptable health.

- 67% of the trees has a good to acceptable canopy structure. Structural issues which were observed included rubbing/crossing stems, deadwood in the canopy, wounding to the trunk and/or basal area, previous branch failures, surface root injuries, narrow points of attachment and bark inclusions and canopy suppression.
- Lopping/height reduction pruning was noted to have been previously undertaken on a number of the assessed trees. These trees require varying levels of remedial and corrective pruning to improve structural form and manage canopy growth.
- Further arboricultural advice in recommended in relation to remediation works/strategies for a number of trees onsite.

The Arboricultural report contains specific detail on each tree surveyed and comment in relation to remedial works recommended. A copy of this report is provided in Appendix C.

2.5.3 Holocene Dune Swales – Threatened Ecological Communities

The Floristic Community Type (FCT) 19 – Sedgelands in Holocene Dune Swales, has been mapped adjacent to Lake Richmond within the Rockingham Lakes Regional Park.

The Sedgelands in Holocene Dune Swales are considered critically endangered by the DBCA, and are listed as protected threatened ecological communities under both the State *Wildlife Conservation Act 1950*, and the EPBC Act.

2.6 Fauna and Habitat

Fauna habitat within the site is limited, and fauna utilising the site are anticipated to consist primarily of transient bird species. There is no understorey or significant native vegetation that would provide suitable habitat for fauna species within the site.

Habitat is available outside the site, within the bushland located immediately west of the site, and associated with Lake Richmond. Therefore in-direct impacts to Lake Richmond, and the associated vegetation surrounding the lake will be managed as detailed further in Section 4.2 below.

2.7 Ecological Linkages

Regional ecological linkages for the Perth Metropolitan Region were identified and mapped by the Perth Biodiversity Project in 2003. Regional ecological linkages connect protected regionally significant natural areas by retaining the best condition local natural areas available between them that can act as stepping stones for flora and fauna (Del Marco et al., 2004) Local ecological linkages aim to link protected natural areas to other regionally significant natural areas and regional ecological linkages.

There is an ecological linkage which is located south of the site which transverses through the Rockingham Lakes Regional Park. The site is not included within the ecological linkage (LBP, 2015).

2.8 Cultural Heritage

A search of the Department of Aboriginal Affairs Heritage Sites database determined that there are no registered Aboriginal Sites or Other Heritage Sites currently recorded within or immediately adjacent to the subject area (DAA, 2015).

A search was also undertaken of the State Heritage database, administered by the State Heritage Office of Western Australia (2016). No areas of heritage significance have been recorded within the site (Heritage Council and City of Rockingham). However, there are several sites in the vicinity which include:

- Rockingham Beach Primary School (Heritage Place No. 3205)
- Palm Beach Precinct (Heritage Place No. 16809)
- Lake Richmond (including surrounding bushland) (State Register) (Heritage Place No. 18438)

All contractors working on the development will be made aware of their responsibilities under the *Aboriginal Heritage Act 1972* with regard to finding potential archaeological sites. In the event a site is discovered, all work in the area will cease and the Department of Aboriginal Affairs will be contacted.

2.9 Potential Contamination

A search of the (then) Department of Environmental Regulation contaminated sites database did not identify any contaminated sites within or nearby the site (DER, 2015).

2.10 Surrounding Land Use

Bush Forever site No. 358, inclusive of Lake Richmond is located adjacent to the southern boundary of the site. As noted above, Lake Richmond is mapped as a CCW by the DBCA, which contains a protected significant thrombolite community (Figure 6).

Remnant bushland is located to the immediate west of the site. The bushland is separated from the bushland surrounding Lake Richmond by a cleared service corridor running along the southern boundary of the site (Figures 2 and 6).

Urban development is located to the north and east of the site, with a school and school oval present immediately across Fisher Street to the east of the site.

2.11 Onsite Structures

Demolition of existing structure on site commenced in mid 2016 by a licenced contractor in accordance with the Demolition Permit issued by the City of Rockingham.

3.0 POTENTIAL IMPACTS AND MANAGEMENT

3.1 Vegetation and Flora

Existing vegetation predominantly consists mostly planted species (exotics, peppermint trees and tuarts) and grassed areas with no native understorey present. Remnant native vegetation is present in areas associated with Lake Richmond, and within the landholdings immediately adjacent to the western side of the site. Therefore the priority for vegetation management is to avoid potential in-direct impacts to these areas, particularly the Holocene Dune Swales located within the vegetation surrounding Lake Richmond.

Where possible mature tuarts and other landscape trees will be retained. The location of trees proposed for retention is provided in Appendix D.

3.1.1 Potential Impacts

It is not envisaged that any significant impacts to vegetation will occur due to development of the site, however it is recognised that without control or management within the development, there is potential for impacts to occur to vegetation offsite. As a result, the proposed management measures focus on ensuring the construction, design and post development project actions avoid potential impacts offsite, including damage to adjacent bushland, introduction of grass and weeds, and changes to surface and groundwater quantity and quality.

3.1.2 Management Measures

To ensure the future viability of adjacent areas of vegetation, in consideration of the potential impacts and proposed management outlined in the Rockingham Lakes Regional Park Management Plan and Interim Recovery Plan No. 314 – Sedgelands in Holocene Dune Swales (DEC, 2011), the following management strategies are proposed:

- The interface between the internal road and site boundary is a managed area and has been allocated for planting and tree retention (Appendix E). Due to the Bushfire Protection Zone specifications, native vegetation species selected and planting densities within this area will need to comply with bush fire requirements. The FESA (2011) Plant Guide within the Building Protection Zone guide will be consulted to ensure that appropriate species and planting densities are provided in this area.
- Selected established trees will be retained within the site and within the adjacent road reserves (see Appendix D). Guidance regarding tree management is provided in the Arboricultural Report (Appendix C).
- Controlled access from the development to the adjacent bushland (Rockingham Lakes Regional Park) will be management through providing defined access points and installing signage. A perimeter fence has been proposed along the southern and western boundary of the site, with two defined access points as follows:
    - Emergency Link for Fire Truck (south western corner)

- Gated access/connection point along the southern boundary of the site.

- The site area and adjacent bushland will be clearly demarcated with temporary fencing during construction so as to avoid any impacts to adjacent vegetation during this period.

- Local native species (where appropriate) will be incorporated in landscaping within the central communal gardens and street verges.

- An educational package will be provided to owners and tenants of the development to promote an understanding and appreciation of the significance and sensitivity of the nearby environments surrounding Lake Richmond. The educational package can be prepared by or include input from the local Naregebup Environment Centre.

- Dust and stormwater runoff will also be closely monitored and controlled during construction and development to limit any in-direct impacts to nearby sensitive environments.

- Stormwater discharge and groundwater management will be comprehensively addressed in a Local Water Management Strategy (LWMS), in consideration of the sensitivity of the adjacent environment (thrombolites) and in accordance with the DWER's and the EPA's expectations (further details below and in the LWMS).

3.2 Fauna and Habitat

As discussed in Section 2.6, fauna habitat within the site is limited, and fauna utilising the site are anticipated to consist primarily of transient bird species.

Given fauna habitat is generally dependant on the condition of the remnant bushland and vegetation, the in-direct impacts to nearby vegetation, including areas associated with Lake Richmond, and within the landholding immediately adjacent to the western side of the site. In this respect, management will be focussed on ensuring the vegetation adjacent to and nearby the site is not impacted.

3.2.1 Potential Impacts

Impacts to fauna habitat will likely be minimal within the development area, with no understorey and scattered, pruned over-storey trees the only vegetation existing within the site. As such, management will focus on ensuring any fauna habitats located offsite will not be impacted.

3.2.2 Management Measures

To ensure the future viability of adjacent areas of vegetation and therefore fauna habitat, the following management strategies, in addition to those proposed for vegetation and flora management above (Section 3.1.2), are proposed:

- The Lake Richmond Management Plan (Ecoscape, 2008) provides recommendations for cat control within 200m of the Lake Richmond reserve. Due to the development being in close proximity to adjacent reserve, the keeping of cats within the development will be discouraged.

- Future residents will be advised that dogs are to be kept on a leash throughout all areas of the Lake Richmond Reserve to minimise potential fauna impact. This will be included in the future resident education package.

3.3 Water Management

The site was used as a caravan park, with on-site effluent disposal and no surface water treatment. The re-development of the site includes connection to sewerage and will therefore improve the ground and surface water quality, and result in less nutrient infiltration to the groundwater catchment.

3.3.1 Potential Impacts

If uncontrolled, drainage from areas surrounding Lake Richmond has the potential to impact the water quality of the lake and therefore the health of the Lake Richmond thombolites community. The design and control of the drainage system onsite is described below, which greatly improves upon the historical conditions present onsite.

In addition to water quality impacts the thrombolites have been subject to historical and ongoing disturbance and threatening processes including:

- physical crushing by visitors;
- alterations to groundwater through-flow or an increase in runoff, creating a reduction or increase in lake water levels, changes to lake hydrology or salt water intrusion;
- alterations to surrounding vegetation;
- smothering by weeds or sediment; and
- dumping of rubbish.

3.3.2 Management Measures

3.3.2.1 Design Objectives

A LWMS has been developed for the site in accordance with the Better Urban Water Management (BUWM) guidelines (WAPC, 2008). The LWMS describes the drainage system design and summarises the urban water management strategies which are proposed for the site.

The water management design objectives for the site are presented in Table 1 and have been derived from relevant policies and guidance documents (refer to LWMS).

Table 1 Design Objectives

Element	Principle	Objective
Surface Water Management	Manage catchments to maintain or improve water resources.	Prevent stormwater discharge to Lake Richmond.
		Treat stormwater as close to source as possible.
Groundwater Management	Manage catchments to maintain or improve water resources.	Maintain or improve groundwater quality.
	Manage risks to human life and property.	Provide adequate separation distance to groundwater for built infrastructure.
Flood Risk Management	Manage risks to human life and property.	Protect people and the built environment from flooding and inundation on site.
Nutrient Management	Manage catchments to maintain or improve water resources.	Reduce nitrogen load generated on the site.
		Reduce phosphorous load generated on the site.
Water conservation strategy (potable and wastewater)	Manage catchments to maintain or improve water resources.	Maintain or reduce water usage.
	Ensure the efficient use of water resources	Achieve WA State Water Plan targets of household potable water consumption
		Minimise the external use of potable water.

The design of the drainage system will ensure that stormwater is adequately treated in accordance with best practice and DWER expectations and therefore will not detrimentally impact the water quality entering Lake Richmond. This includes:

- Runoff from the 'first flush' (15 mm) event from roads and uncovered carparks will be treated within bio-retention areas.
- Infiltration of stormwater from impervious surfaces (roads, carparks, roofs) in up to the 100 year ARI event within underground infiltration cells and/or soakwells in up to the 100 year ARI event. Stormwater will not be discharged off site or to Lake Richmond.

For further information on stormwater treatment and management, water quality management, water use strategy and monitoring and implementation, refer to the LWMS.

3.3.2.2 Groundwater Abstraction

Groundwater abstraction will be required, for construction activities (including dust suppression) and irrigation for landscaping. As there is no current registered groundwater bore within the site, an application for a 5C Licence to Take Water and a 26D Licence to Construct or Alter a Well has been submitted to the DWER. An allocation of 6,145.5 kL/annum has been requested based on an irrigation rate of 7,500 kL/ha/annum.

3.3.2.3 Thrombolite Physical Disturbance Prevention

The following management measures will be implemented to prevent any in-direct physical disturbance to the Thrombolites:

- Controlled access from the development into Lake Richmond will be encouraged, with signage and pedestrian access developed in consultation with the DPaW and the City of Rockingham.

- An educational package will be provided to owners and tenants of the development to promote an understanding and appreciation of the significance and sensitivity of the nearby environments surrounding Lake Richmond.

3.4 Acid Sulfate Soils

WAPC mapping indicates that the nearest mapped area of high-moderate risk of ASS is approximately 60m from the south western corner of the site associated with Lake Richmond (Figure 4).

Unless excavation works and/or dewatering is required in an area identified as having ASS present, then no further work needs to be undertaken (refer to WAPC ASS self assessment form).

3.5 Construction Impacts

Construction activities will be managed to minimise the impact to adjacent residents, retained vegetation and wetlands. Impacts can include:

- Nuisance dust generation during bulk earthworks.

- Silt and sediment run-off from uncontrolled run-off during site works.

- Inadvertent damage to trees and other vegetation earmarked for retention.

- Inappropriate disposal of waste building material and poor housekeeping on building sites leading to wind-blown litter.

All of these potential impacts are manageable through appropriate engineering design and appropriate site management practices. Specific management measures and procedures to avoid and/or mitigate these potential impacts will be incorporated within the site construction and contractors aware of specific requirements prior to site works commencing.

4.0 IMPLEMENTATION STRATEGY

The following table summarises the management measures outlined above, and allocates timing and responsibilities for these actions.

Table 2: Management Measures Implementation Strategy

Issue	Action	Timing	Responsibility
Pre-development			
Acid Sulfate Soils	Assess engineering plans in relation to excavation and dewatering requirements. If the WAPC self-assessment form triggers are met undertake an ASS investigation	Subdivision stage	Developer
Vegetation	Ensure that the detailed Landscape Design Plans include local native species which comply with BFP zone requirements.	Subdivision stage	Developer /landscape consultant
	Consult with the City of Rockingham whether there is a preferred local species list for revegetation.	Subdivision stage	Developer /landscape consultant
Water management	A LWMS has been submitted to the DWER for approval in accordance with the BUWM Guidelines (DoW, 2008).	LSP Stage	Developer
Access control	Ensure planning does not allow for un-controlled access to nearby and adjacent reserves.	LSP and subdivision stages	Developer
Construction Impacts	Confirm management requirements with the City of Rockingham to manage potential impacts during construction.	Subdivision stage, prior to construction commencing	Developer
During Development			
Adjacent vegetation	The site (cadastral) boundary along adjacent bushland will be clearly demarcated with temporary fencing.	During construction	Developer/ Contractor
Dust and runoff	Dust and runoff will be closely monitored and controlled during construction, in accordance with agreed management measures.	During construction	Developer/ Contractor
Tree Protection	Mature trees identified for retention are to be protected and managed in accordance with the recommendations contained within the Arboricultural Assessment (Arbor Centre, 2017).	During construction	Developer/ Contractor
Post-Development			
Landscaping	Ensure local native species are included (where possible) in any landscaping or street tree plantings.	Subdivision stage	Developer/ Landscaper
Fauna Protection	Due to the development being in close proximity to adjacent reserve, the keeping of cats within the development will be discouraged All dogs to remain on a leash throughout the Lake Richmond Reserve. Requirement to be included in future resident education package.	Subdivision stage	Developer
Educational Package	Prepare and provide an education package to residents/tenants, involving Naragebup Environment Centre	Subdivision/Sale of Lots stage	Developer

5.0 SUMMARY

While the site has limited environmental value as a result of historical land uses (i.e. caravan park), the site's proximity to sensitive and significant environmental areas will require management of potential indirect impacts.

The removal of the on-site effluent disposal system, the treatment and management of stormwater on-site and the implementation of the management measures will improve the quality of water infiltrating on site. Additional management measures proposed in relation to vegetation and fauna will assist to further avoid potential offsite impacts.

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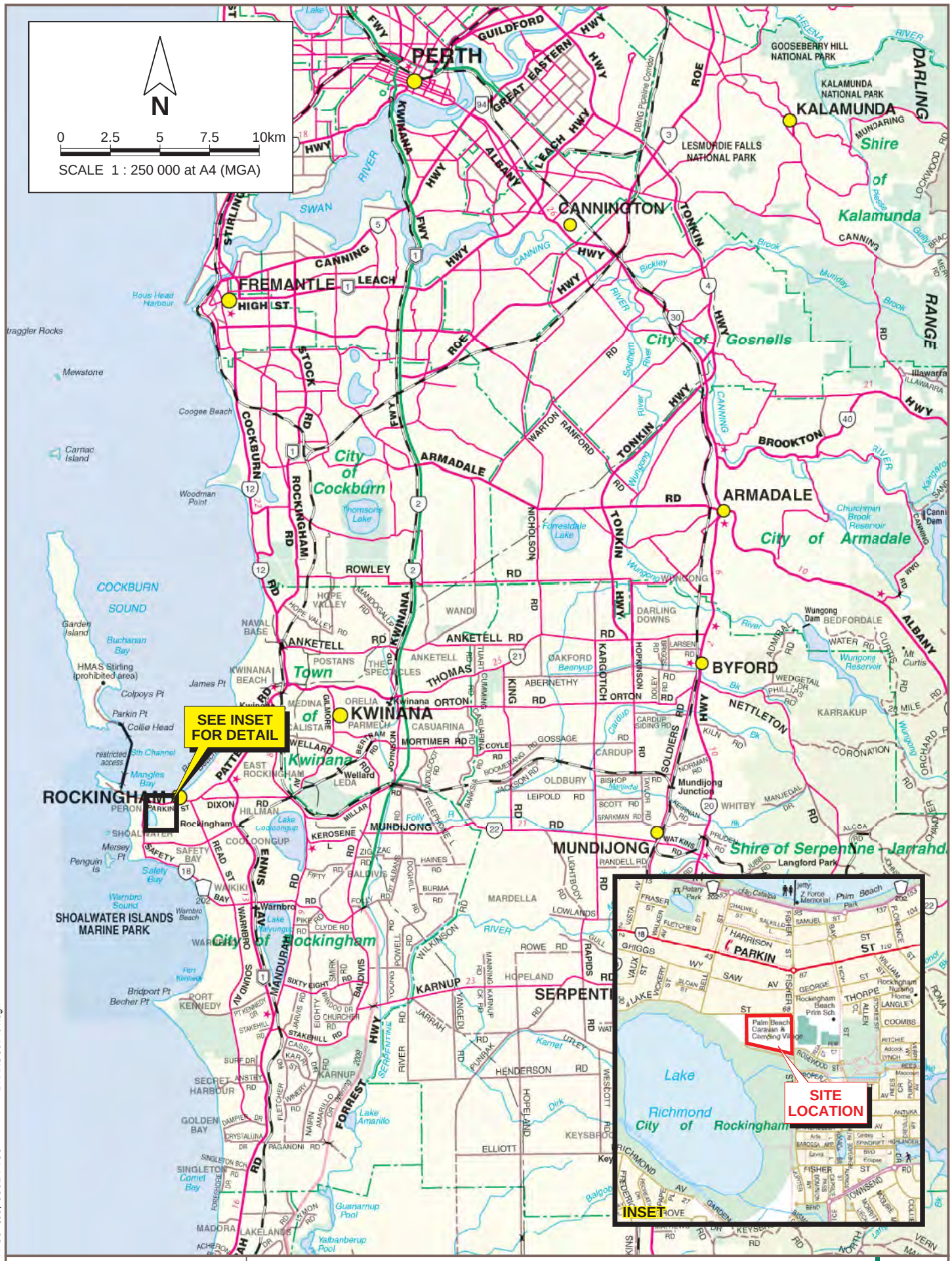
FIGURES



DHAROC01-f01.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

COTERRA ENVIRONMENT

Defence Housing Australia
ENVIRONMENTAL ASSESSMENT REPORT
FISHER STREET, ROCKINGHAM

Drawn: K.Cooper	Date: 19 Sep 2016
Job: DHAROC01	Revision: A

SITE LOCATION

Figure 1

CADASTRAL SOURCE: Landgate, September 2016.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown June 2016.

PINPOINT CARTOGRAPHICS (08) 9562 7136 DHAROC01f02.dgn

COTERRA ENVIRONMENT

Defence Housing Australia
ENVIRONMENTAL ASSESSMENT REPORT
FISHER STREET, ROCKINGHAM

Drawn: K. Cooper	Date: 19 Sep 2016
Job: DHAROC01	Revision: A

AERIAL PHOTOGRAPH

Figure 2

N

0 10 20 30 40 50m

SCALE 1 : 1 500 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary
- Topographic Contour

Environmental Geology

S13 CALCAREOUS SAND - white, medium-grained, rounded quartz and shell debris, well sorted, of eolian origin

LAKE STREET

FISHER STREET

S13

Lot 1512

Lot 5000

R 35176 1513

R 35176 1597

R 42518 1530

R 42518 1531

R 42518 1598

R 9458 1596

R 21181 321

R 21181 445

R 44041 1600

R 42518 1637

R 44041 4803

6 427 600mN

6 427 400mN

379 200mE

379 400mE

Lake Richmond

CADASTRAL SOURCE: Landgate, September 2016.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown June 2016.
CONTOURS SOURCE: DoW, Perth Groundwater Atlas, December 2012.
GEOLOGY SOURCE: Geological Survey of WA, 1:50,000 Environmental Geology Series.

PINPOINT CARTOGRAPHICS (08) 9562 7136 DHAROC01-f03.dgn

COTERRA ENVIRONMENT

Defence Housing Australia
ENVIRONMENTAL ASSESSMENT REPORT
FISHER STREET, ROCKINGHAM

Drawn: K. Cooper	Date: 19 Sep 2016
Job: DHAROC01	Revision: A

TOPOGRAPHY AND SOILS

Figure 3

N

0 10 20 30 40 50m

SCALE 1 : 1 500 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary

Acid Sulfate Soils Risk

- High to Moderate Risk

6 427 600mN

6 427 400mN

379 200mE

379 400mE

LAKE STREET

FISHER STREET

Lot 1512

Lot 5000

R 35176 1513

R 35176 1597

R 42518 1530

R 42518 1531

R 42518 1598

R 9458 1596

R 21181 321

R 21181 445

R 44041 1600

R 42518 1637

R 44041 4803

Lake Richmond

ASS SOURCE: DPI, February 2012.
CADASTRAL SOURCE: Landgate, September 2016.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown June 2016.

DHAROC01-f04.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

COTERRA ENVIRONMENT

Defence Housing Australia
ENVIRONMENTAL ASSESSMENT REPORT
FISHER STREET, ROCKINGHAM

Drawn: K. Cooper | Date: 19 Sep 2016

Job: DHAROC01 | Revision: A

ACID SULFATE SOILS

Figure 4

EPP LAKES SOURCE: EPA, 1992.
WETLANDS SOURCE: DEC, October 2012.
CADASTRAL SOURCE: Landgate, September 2016.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown June 2016.

PINPOINT CARTOGRAPHICS (08) 9562 7136 DHAROC01-f05.dgn

COTERRA ENVIRONMENT

Drawn: K. Cooper	Date: 19 Sep 2016
Job: DHAROC01	Revision: A

Defence Housing Australia
ENVIRONMENTAL ASSESSMENT REPORT
FISHER STREET, ROCKINGHAM

HYDROLOGY

Figure 5

N

0 50 100 150 200m

SCALE 1 : 5 000 at A3 (MGA)

379 000mE

379 500mE

6 427 500mN

6 427 000mN

Residential

LAKE STREET

FISHER STREET

Rockingham Beach Primary School

Residential

Residential

Lake Richmond

355

358

6166

6160

6161

6162

Legend

- Site Boundary
- Bush Forever Site

Geomorphic Wetlands

- Conservation Category
- *6166* Wetland UFI

WETLANDS SOURCE: DPaW, March 2016.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown June 2016.
BUSH FOREVER SOURCE: Department of Planning, April 2016.

PINPOINT CARTOGRAPHICS (08) 9562 7136 DHAROC01-f06.dgn

COTERRA ENVIRONMENT

Defence Housing Australia
ENVIRONMENTAL ASSESSMENT REPORT
FISHER STREET, ROCKINGHAM

Drawn: K. Cooper	Date: 19 Sep 2016
Job: DHAROC01	Revision: A

SURROUNDING LANDUSES

Figure 6

APPENDIX A – EPBC ACT DECISION NOTICE

Notification of

REFERRAL DECISION – not controlled action

Palm Beach Caravan Park Redevelopment, Rockingham, Western Australia (EPBC 2013/6853)

This decision is made under Section 75 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

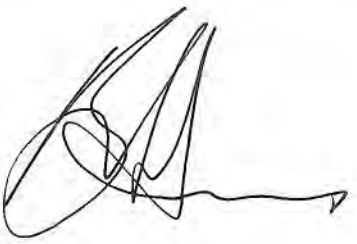
Proposed action

person named in the referral	Lyons Australia Pty Ltd ACN 137 106 668
proposed action	To redevelop Palm Beach Caravan Park on Lots 1512 and 5000, Lakes and Fisher Streets, Rockingham, Western Australia, for residential housing and apartment construction [See EPBC Act referral 2013/6853].

Referral decision: Not a controlled action

status of proposed action	The proposed action is not a controlled action.

Person authorised to make decision

Name and position	Barbara Jones Assistant Secretary North, West & Offshore Assessment Branch
signature	
date of decision	26 May 2013

APPENDIX B – EPA RESPONSE TO CITY OF ROCKINGHAM TPS AMENDMENT

Environmental Protection Authority

Weekly Record of Determinations for

S48A Referrals

Scheme Title:	City of Rockingham - Town Planning Scheme 2 - Amendment 157		**Determination:** Scheme Not Assessed: Advice Given (no appeals)
Location:	Lots 1512 and 5000 Lake Street Rockingham		
Ref ID:	CMS15195		
Date Received:	13-07-2015	**Date Sufficient Information Received:**	
Referror:			
Responsible Authority:	City of Rockingham		**Procedure:**
Contact:	Mr Craig Zanotti		
Telephone:	9528 0333		
Environmental Factors:	Hydrological Processes		**Chairman's Initials:**
Potential Significant Effects:	Potential hydrological impacts, from the development, to Lake Richmond.		
Management:	The EPA considers that the development will be managed by the CIty of Rockingham Town Planning Scheme No.2 scheme provisions and in accordance with the Rockingham Lakes Regional Park Management Plan 2010 (DEC) and Better Urban Water Management 2008 (WAPC).		**Date Signed:** 29.7.15

COTERRA
ENVIRONMENT

APPENDIX C – ARBORICULTURAL IMPACT ASSESSMENT (ARBOR CENTRE, 2017)

Stage 1:- Site Investigation and Preliminary Report

Palm Beach Development - Rockingham

Prepared for:

Peter Woodward
Landscape Architect
peter@woodwarddesign.com.au

Prepared by: Luke Lumbus & Charlie Firth
September 2017
luke@arborcentre.com.au

Reference Number - ACC 512

Arbor Centre PTY LTD
731 Welshpool Road East, Wattle Grove 6107
Phone:- (08) 9359 9300 ~ info@arborcentre.com.au ~ www.arborcentre.com.au

Contents

1. Purpose of the Report

The purpose of this report was to attend site at the corner of Lake and Fisher Streets, Rockingham to undertake a preliminary Arboricultural Survey and provide a level of Arboricultural Impact Assessment to inform the capacity and condition under which existing trees can be considered for removal and/or retention as part of the residential development proposed for the site.

Figure 1. Satellite Image showing the approximate Area of Assessment (outlined red). – Image Source – www.NearMap.com , Image date 7th June 2017

2. Background

2.1 Arbor Centre's Brief

At the request of Peter Woodward (Woodward Design) Arbor Centres brief was to attend site to obtain and provide the following information:

- Benchmark findings from Visual Tree Assessments (VTA) & general comments and observations relating to the subject trees within the identified Area (refer figure 1);
- Preliminary tree protection and preservation considerations for the subject trees;
- Conclusions and recommendations.

2.2 Arboricultural Inspection

On the 29th August 2017, Arbor Centre undertook an Arboricultural assessment of 104 trees within the specified area at the corner of Lake and Fisher Streets, Rockingham as requested and specified by the Peter Woodward (Woodward Design). The assessment was a visual inspection undertaken from ground level and did not incorporate any form of below ground or aerial inspection of the trees.

2.3 Limitations of This Report

The information contained within this report are stand-alone observations on the individual trees and general in nature; to provide an overview on the status of the tree population. Please note that additional site and circumstances assessments will be required to develop other forms of reporting that supports management of the trees (e.g. Tree Management Plan) or for the retention of specific trees that may be impacted any future developments (e.g. Tree Retention Plan or Tree Protection Works).

2.3.1 Tree Management

The information contained within this report is not intended to be used as an ongoing *Tree Management Plan* or as a final *Tree Protection Plan* for the proposed development project - further Arboricultural advice should be sought in developing these specifications and procedures.

3. Tree Assessment and Summary of Findings

A total of 104 trees were identified and inspected within the Palm Beach Development site. Each of the trees were identified and numbered (refer *Appendix A Tree Location Image*), and visually inspected from ground level to assess: species; height and canopy spread; trunk diameter; age & estimated life expectancy; current tree health and structure; and to provide observations/ comments and recommended works. - *refer Appendix B Table of Results for detail.*

3.1 Tree Population Diversity

Approximately x 95 (92%) of the trees assessed consisted of x 5 different Genera.

They are: -

- *Eucalyptus species* x 64 (62%)
- *Agonis species* x 19 (18%)
- *Callistemon species x* 4 *(4%)*
- *Metrosideros species* x 4 (4%)
- *Phoenix species* x 4 (4%)
- Other x 9 (9%)

The tree population within the area assessed varies in diversity from endemic West Australian species (71%) to Australian native species (15%) through to introduced species (14%).

Of the 104 trees assessed; 98% were classified as mature; 1% as semi mature; and; 1% were assessed as juvenile at the time of inspection.

3.2 Tree Health

Of the trees that were assessed, 89% (x 93) displayed good to acceptable health; 10% (x 10) displayed signs/ symptoms of poor to questionable health; x1 tree was confirmed dead (i.e. no active conductive tissue was present; indicating no possibility of recovery).

Several trees within the assessed area displayed canopy decline and/or reduced vigour at the time of inspection.

The signs/symptoms of declining health observed may be attributed - but not limited to: -

- Previous root loss/root zone impact (proximity trenching/excavations; demolition of previous structures; changes to grade (soil level); installation of hardstand over root zones; mechanical

damage/root scalping etc.); *Note: Evidence of soil level changes and root zone impacts was noted to various degrees throughout the area of assessment.*

- Previous deleterious pruning (refer below point 3.3.1 for detail);
- Mechanical damage to the trees conductive tissue (caused by vehicle impacts; bird damage etc.);
- Competition and canopy suppression (lack of available above and below ground growing space);
- Environmental influences (poor seasonal rainfall, possible storm damage);
- Natural senescence (old age);
- Potential pH (Acidity) and/or EC (Salinity) soil issues;
- The influence of pests and/or disease.

3.3 Tree Canopy Structure

Most of the trees that were assessed (67%) have developed a good to acceptable canopy structure; several structural issues were observed within the surveyed tree population including; rubbing/crossing stems, deadwood in the canopy; wounding to the trunk and/or basal area; previous branch failures, surface root injuries, narrow points of attachment and bark inclusions, canopy suppression etc... However; these issues are generally considered manageable within the scope of an ongoing, proactive tree management program.

3.3.1 Deleterious Pruning

Lopping/height reduction pruning* (indiscriminate/deleterious pruning that doesn't conform to Australian Standard AS 4373 '*Pruning of Amenity Trees'* 2007) was noted to have been previously undertaken on a number of the assessed trees. These trees will require varying levels of remedial and corrective pruning (Canopy reconstruction - undertaken as specified by the Arboriculturist), to address structural defects, improve structural form and manage canopy growth. Regular ongoing monitoring of their structural status will be required over the coming years to gauge tree responses and make further recommendations if required.

Certain tree species (to a limited extent) are more tolerant of this type of pruning than others and can redevelop acceptable points of attachment and canopy structure if remedial/reconstructive pruning is appropriately undertaken to the standard required.

**Note: - Lopping/Topping can have problematic repercussions as regrowth is often poorly attached and; the excessive end loading and extension of regrowth stems can increase their likelihood of failure if specialist remedial works are not appropriately undertaken.*

3.4 Retain, Seek Further Arboricultural Advice

It was noted that x 23 (22%) of the trees assessed displayed health and/or structural issues that will require a level of further Arboricultural Advice to develop and implement appropriate remediation works/strategies for the trees - refer Appendix B *Table of Results* for further detail.

They are trees: AC0017, AC0027, AC0031, AC0038, AC0045, AC0047, AC0048, AC0049, AC0050, AC0051, AC0052, AC0059, AC0063, AC0065, AC0074, AC0084, AC0085, AC0093, AC0096, AC0097, AC0099, AC0101 and AC0102.

3.5 Seek Further Arboricultural Advice (long term tree management)

A number of trees assessed (x13 (12%)) currently display problematic health and/or structural issues that require individual consideration - refer *Appendix B Table of Results* for further detail.

Further discussion with the Arboriculturist is required regarding tree numbers AC0003, AC0034, AC0036, AC0040, AC0042, AC0044, AC0053, AC0054, AC0091, AC0092, AC0094, AC0095 and AC0104, prior to making definitive recommendations regarding appropriate management strategies for these trees.

3.5 Consider for removal and replacement

Due to factors specific to each individual specimen that are considered to be beyond the scope of reasonable ongoing tree management practices, x 4 trees (4%) have been identified as consider for removal/replacement - refer *Appendix B Table of Results* for further detail.

Trees recommended for removal and replacement are: AC0024, AC0025, AC0043 and AC0100.

3.6 Protection of Trees During Further Site Works

Specialist Arboricultural input will be required for trees that are identified for retention, to incorporate site and tree specific retention and protection measures into the final design specifications of the proposed development (prior to tender) and; in determining tree sensitive works methodologies and construction specifications to be actioned prior to and during some project activities.

This will ensure that measures to minimize and/or effectively offset tree root and canopy impact on specimens identified for retention can be successfully designed into the project specifications and documentation and; implemented during construction – refer Point 4. Overview of Australian Standards AS 4970 & AS 4373 *Preliminary Tree Preservation Guidelines & Point 5 Preliminary Tree Retention Guidelines* for further detail.

4. Overview of Australian Standards AS 4970 & AS 4373

4.1 AS 4970 'Protection of Trees on Development Sites' 2009

To successfully incorporate trees into proposed development sites, careful consideration, planning and protection should be afforded to both above and below ground parts of the tree - leaves, branches, stems of the above ground parts and; below ground, absorbing roots and structural roots.

Damage to tree roots is often irreversible and a common cause of tree decline and/or death following the construction and development phase. The implementation of a Tree Protection Process will help lessen the impact that proposed development will have on the root zone (resulting from grade changes, excavations, soil compaction, mechanical damage etc...) and enable timely remedial action to help the tree to retain enough root mass for the continuation of natural growth and development.

The operations and activities associated with the construction and development process can have adverse effects on tree health and stability. Those activities that can potentially impact on the tree(s) will require remedial measures to be taken prior to, during and post development to ensure that all reasonable measures are taken to offset such damage.

Australian Standards have created AS 4970 *'Protection of Trees on Development Sites'* 2009 that addresses many of the issues that construction and development can have on trees and provides a guide only on how to avoid unnecessary damage and outlines a process that will protect tree welfare during the construction and development phase.

To calculate the minimum area required to be protected during construction, development or during any activities that may cause harm or injure the tree and its parts, the formula 12x the trunk Diameter at Breast Height* (DBH) is used. For Example - if trunk diameter of the tree in question is 500mm – 12 x 500mm = 6 meter TPZ which is measured in meters as a radius and taken from the centre of trunk.

Note: - *Accurate measurement of trunk diameter(s) in millimetres - Typically measured at 1.4 meters above ground level for single stemmed trees; at the narrowest point of trunk for co dominant specimens or; at ground level for (low) multi stemmed form. - TPZ to not be <2 meters or >15 meter in diameter.

Where encroachment (building, construction, excavation, landscaping or otherwise) into the Tree Protection Zone is required, Arboricultural input will be necessary to assess the extent of potential impact that may occur and if required, provide Arboricultural measures that can be taken to enable modification of the TPZ and allow root zone encroachment to occur.

Any tree preservation recommendations made for the subject trees need to recognise that the Australian Standards do not consider the individual tree characteristics and tolerances that the species possess or; the soil type and other environmental conditions or circumstances that are specific to the Palm Beach Development site.

It is important to recognise that the estimated TPZ's described in this report are simply an indication of a boundary around the tree beyond which disturbance is considered inconsequential and is unrestricted. However; the main purpose is to identify that any change or disturbance within the TPZ boundary will require Arboricultural input and approval. This includes activities such as (but not limited to:): soil level changes and excavations, demolition and/or removal of vegetation and/or infrastructure, installation of paths & below ground services (including irrigation) hard and soft landscaping and; activities that could impact on tree canopy i.e. cranage, vehicular/machinery movement etc.

Any tree retention and/or protection specifications/recommendations made should be specified by an (minimum) Australian Qualification Framework Level 5 Arborist (AQF 5 – *Diploma in Arboriculture*); in keeping with the Australian Standards AS 4970 '*Protection of Trees on Development Sites'* 2009 and be undertaken under the direction of the Arboriculturist.

4.2 AS 4373 'Pruning of Amenity Trees' 2007

AS 4373 '*Pruning of Amenity Trees'* 2007 has been developed to provide a guide on tree pruning procedures and practices to limit poor or deleterious type pruning being unnecessarily inflicted onto amenity trees.

The result of incorrect pruning of a tree is often irreversible, can negatively impact its health and structure and create unnecessary hazards within and surrounding the trees.

Correct tree pruning practices can reduce the likelihood of branch failures, limit pest and disease infestations, improve site safety and tree amenity, encourage sound structural development and extend tree longevity.

Any pruning works undertaken to the assessed trees should be specified by a (minimum) Australian Qualification Framework Level 5 Arborist (AQF 5 – *Diploma in Arboriculture*); comply with the Australian Standards AS 4373 '*Pruning of Amenity Trees'* 2007 and be undertaken by suitably trained and qualified Arborists with a minimum AQF Certificate 3 in Arboriculture under the supervision of the Arboriculturist.

References: AS 4373 2007, AS 4970 2009

5. Preliminary Tree Retention Guidelines

Root zone impacts (and associated root loss) can negatively affect tree health (and stability) many years after the event, it is essential for tree success that tree protection and remedial measures are factored into designs and construction specifications and appropriately implemented and; that specific remedial measures are actioned and supervised, to ensure the potential longevity of retained trees can be realised. Below is an outline of the matters that will need to be addressed as part of the Tree Retention Plan for the project. It is these matters that will need to be developed in collaboration with the Arboriculturist to the level of detail considered appropriate for inclusion in the tender specifications.

To minimize root loss and better manage long term tree health (and in-ground stability), Tree Protection and Retention measures should consider, (but not be limited to):

i. How to best implement tree specific Tree Protection Zones (TPZ's) and the staged erection of approved protective fencing and identification signage over the course of the works period (refer *Point 4 Overview of Australian Standards AS 4373 & AS 4970* for high level guidance to the tree retention process).

ii. Ways of assessing and/or diverting proposed below ground services that might otherwise travel through/encroach within the specified TPZ's of trees identified for retention and; identifying where new service alignments are best located to minimise impact on those trees (including methodologies associated with their installation).

iii. Identifying in advance where exploratory excavations and/or site assessments may need to be undertaken by the Arboriculturist to quantify potential root loss, limit unnecessary root damage/impact, and/or provide possible remedial measures necessary to offset potential root loss.

iv. Identifying "Hold Points" for individual trees that are being retained, such that Arboricultural approval and/or supervision for scheduled works proposed within TPZ's can be undertaken (usually determined in conjunction with the Architectural/Landscape design team).

v. Identifying where selective pruning of tree canopies (including crown lifting for vehicular or machinery access and/or remedial pruning) will help improve structural form and site safety and in ensuring approved Arboricultural practices are being exercised.

vi. In addressing the pruning of roots where works encroach into TPZ's and associated specifications or protocols.

vii. Determining the extent of supplementary watering potentially required by the trees – in keeping with the amount of potential root zone impacts & seasonal variation* that might apply
**Note: Timing of works around the retained tree(s) could have significant implications regarding irrigation volumes and frequencies and the associated level of maintenance required i.e. active growing periods within warmer months as opposed to slower growth periods in winter.*

viii. Identifying remedial measures for both canopy and root zone that would be the most effective and necessary pre-construction.

ix. The kind of surface protection options that could enable vehicle/machinery movement within TPZ's if required.

x. Verification of soil and water quality; soil nutritional status and associated testing.

xi. Measures/Procedures to ensure contractor awareness of the restricted activities within/adjacent specified TPZ's.

xii. Determining the level of Arboricultural inspections &/or supervision during the works period that ensures tree welfare is reasonably preserved.

xiii. The appointment of a Project Arboriculturist and/or an Operations Arboriculturist such that effective tree protection occurs consistently throughout the life of the project.

xiv. In potentially determining appropriate tree protection penalties for non-compliance (e.g. could be based on individual Amenity Tree Valuation ($) or damage to tree parts could be considered).

6. Conclusions

6.1 The trees surveyed for this report currently provide valuable environmental, habitat, aesthetic/ amenity and social benefits for the local area, the value of these services can be expected to increase over time as urbanisation of the local area continues.
It is reasonable to also consider the future shading & cooling benefits, as well as urban heat island effect mitigation provided by the mature trees on the site for residents that will come into effect once development of the Palm Beach Development in Rockingham occurs.

6.2 By adopting a proactive approach to project tree management which ensures that specialist Arboricultural input is incorporated into the development of final design specifications and; tree sensitive works methodologies are adopted during any remaining demolition works and throughout the construction processes and; appropriate Arboricultural remediation works occur in a timely manner.
It will be possible to ensure that those trees which are identified as worthwhile for retention into the proposed Palm Beach Development are afforded the Arboricultural inputs necessary to achieve their long-term viability and success in the landscape.

6.3 Achieving the successful preservation & protection of the assessed trees will require specific and timely Arboricultural input into the development of construction specifications and drawings.
Further consultation with the Arboriculturist will be required regarding: the type of construction works being proposed around the trees and their associated methodologies, the impact it may have on the trees (and the surrounding vegetation) and; how best to limit construction impact and utilise the suggested Tree Protection Zones (TPZ's) areas during and after the construction and development phase.

6.4 Consideration needs to be given to the specialised nature of the tree management and remedial works contained within this report which; if undertaken or specified incorrectly, may have a negative effect on tree health and/or structure. It is imperative that only arboricultural organisations with staff suitably qualified and experienced in tree management and/or tree preservation are engaged in monitoring, maintaining, and managing the trees into the future. Any further recommendations made should be specified by an (minimum) Australian Qualification Framework Level 5 Arborist (AQF 5 – *Diploma in Arboriculture*); in keeping with the Australian Standards AS 4970 '*Protection of Trees on Development Sites'* 2009 & AS 4373 'Pruning of Amenity Trees' 2007 and be approved prior to commencement by the Arboriculturist.

6.6 To achieve successful tree retention Planning, Design, Engineering, and Arboricultural input will need to coalesce so that health, vigour and long term retention of the trees is not compromised.

6.7 Trees are dynamic, ever changing organisms. Regular Arboricultural inspections should be undertaken in an ongoing capacity, by the Arboriculturist to assess, identify and report any change or tree related problems that may cause issues in and around the assessed trees within the Palm Beach Development site in Rockingham.

7. Recommendations

1. That the *Stage 2: Arboricultural Interpretation of Proposed Designs and Stage 3: Tree Protection and Preservation Specifications* be undertaken for those trees identified for retention, to facilitate continuity in the interpretation and application of Arboricultural standards of practice that will be required throughout the remainder of the project, in ensuring the successful retention of worthwhile trees into the proposed development.

2. Further Arboricultural input will be required to develop and implement appropriate remediation works for trees AC0017, AC0027, AC0031, AC0038, AC0045, AC0047, AC0048, AC0049, AC0050, AC0051, AC0052, AC0059, AC0063, AC0065, AC0074, AC0084, AC0085, AC0093, AC0096, AC0097, AC0099, AC0101 and AC0102.

3. Further Arboricultural input will be required prior to making a definitive conclusion on appropriate management strategies for trees - AC0003, AC0034, AC0036, AC0040, AC0042, AC0044, AC0053, AC0054, AC0091, AC0092, AC0094, AC0095 and AC0104.

4. That consideration be given to the removal and replacement of trees AC0024, AC0025, AC0043 and AC0100.

8. References

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Appendix A – Tree Locations

Appendix B – Table of Results (& Definitions)

Field Definitions

Tree Number - States the individual tree identification number.

Species Identification - States the genus, species and common name for each tree.

Tree Height - Measured in meters taken from ground level to the highest point of the trees canopy.

Canopy Spread - Measured in meters taken at the widest points of the trees canopy.

Diameter at Breast Height (DBH) - Accurate measurement of trunk diameter in millimetres. Measured at 1.4 meters above ground level for single stemmed trees; immediately below bifurcation in co-dominant stemmed trees or at ground level for multi stemmed trees.

Tree Health: - States the health of the tree at the time of assessment. (Good, Acceptable, Questionable, Poor, Dead). Refer *Health and Structure Definitions* below for further explanation.

Tree Structure: - States the structure of the tree at the time of assessment. (Good, Acceptable, Questionable, Poor) Refer *Health and Structure Definitions* below for further explanation.

Age Status: - States the estimated age at the time of assessment. (Juvenile, Semi Mature, Mature, Post Mature).

Useful Life Expectancy: - Provides estimation of the individual trees remaining Useful Life Expectancy (ULE) (<5 Years, 5 – 10 years, 10 – 40 years, or 40+).

Tree Protection Zone (TPZ) Radius: - Minimum root zone required to be protected during construction, development or during any activities that may encroach into the zone which may cause harm or injure the tree and its parts. Measured in meters, as a radius from centre of trunk. Calculated as: x12 DBH. TPZ is to not be <2 meters and; not >15 meters. As per Australian Standards AS *4970 "Protection of trees on development sites"* 2009.

Structural Root Zone (SRZ) Radius - Root zone required for tree stability only. Measured in meters, as a radius from centre of trunk. Calculated as: - (Diameter x 50) ^ 0.42 x 0.64. (For trees with a diameter less then 150mm the SRZ is 1.5 meter radius - Palms and Monocots are excluded from SRZ Formula). As per Australian Standards AS *4970 "Protection of trees on development sites"* 2009.

Recommended Works: Provides recommendations and further arboricultural management considerations for the assessed specimens re: replacement, retention, or seek further Arboricultural Advice.

Observations & Comments: - Provides general information relevant for the individual specimen.

Health & Structure Definitions

Tree Health	Definition
Good	Tree displays typical foliage size, colouration and density for a specimen of the species. Seasonal stem elongation and wound wood response also appears typical. A build-up of seasonal deadwood may be present.
Acceptable	Tree displays typical foliage size and colouration. Canopy mass may be slightly thin or have more than typical amount of deadwood present within canopy. Seasonal stem elongation and wound wood response may be inhibited. Tree may be displaying a response to recently changed environs.
Questionable	Tree displays less than typical foliage size, colouration and density for a specimen of the species. Large sections of deadwood may be evident in upper canopy. Seasonal stem elongation and wound wood response may be suppressed. Retention of the tree requires remedial works in order for the specimen to become "Acceptable".
Poor	Tree canopy indicates decline. Tree displays less than 30% live canopy mass and will be problematic to long term retention. Beginning of spiral of decline. Remedial works unlikely to improve tree health.
Dead	Tree has no living conductive tissue within its main stem.

Tree Structure	Definition
Good	Primary frame work has structure that is typical of the species at its stage of maturity. Secondary (and beyond) branch attachments are typical of the species. The tree may have inconsequential/minor imperfections.
Acceptable	Primary frame work has structure that is typical of the species at its stage of maturity, but which presents defects that may need to be monitored. Secondary (and beyond) branch attachment are typical of the species, but presents structural defects that may require remedial work within the scope of ongoing maintenance. Can include storm damaged and Lopped trees that have developed acceptable branch attachment (subject to species).
Questionable	Primary and secondary frame work has evidence of its structural integrity being compromised (i.e.: Storm damage, deleterious pruning, breaks, cracks, fractures, included bark, major decay, poor branch taper etc.). Retention of the tree requires remedial works in order for the specimen to become "Acceptable".
Poor	Tree displays significant structural defects that will be problematic to long term retention. i.e.: extensive stem cavities, split/broken unions. Remedial works unlikely to improve form.

Tree Number	Species	Common Name	Tree Height (M)	Canopy Spread (M)	Trunk Diameter (DBH) (M)	Tree Health	Tree Structure	Age	Useful Life Expectancy (ULE)	TPZ Radius (M)	SRZ Radius (M)	Recommended Works	Observations & Comments
AC0001	*Howea forsteriana*	Kentia Palm	5	6	0.180	Good	Good	Mature	10-40 Years	4.00		Retain; Develop tree retention specifications	Reasonable specimen
AC0002	*Metrosideros excelsa*	New Zealand Christmas Tree	5	4	0.300	Good	Acceptable	Mature	40+ Years	3.60	2.00	Retain; Develop tree retention specifications	Reasonable specimen; bifurcates at 300mm from ground level
AC0003	*Agonis flexuosa*	WA Peppermint	12	12	1.050	Good	Questionable	Mature	10-40 Years	12.60	3.38	Seek further arboricultural advice to discuss long term tree management considerations	Bifurcates at 2m from ground level; heartwood decay noted to east of main stem from ground level to 2m; northern stem over path has partly failed; lopped stems throughout canopy; previous branch failures noted throughout canopy; old, large specimen
AC0004	*Agonis flexuosa*	WA Peppermint	12	10	0.850	Good	Acceptable	Mature	40+ Years	10.20	3.09	Retain; Develop tree retention specifications	Tree on lean to northest; main stem and limbs bifurcate at 2m, 4m, 6m from ground level , swelling noted; minor lopped stems present throughout canopy; canopy suppression noted from adjacent palm and Agonis; minor surface root damage noted
AC0005	*Phoenix canariensis*	Canary Island Date Palm	10	8	0.450	Good	Good	Mature	40+ Years	5.00		Retain; Develop tree retention specifications	Reasonable specimen; basal suckers noted
AC0006	*Phoenix canariensis*	Canary Island Date Palm	7	8	0.450	Good	Good	Mature	40+ Years	5.00		Retain; Develop tree retention specifications	Reasonable specimen; basal suckers noted
AC0007	*Phoenix canariensis*	Canary Island Date Palm	7	7	0.450	Good	Good	Mature	40+ Years	5.00		Retain; Develop tree retention specifications	Reasonable specimen; basal suckers noted
AC0008	*Agonis flexuosa*	WA Peppermint	12	13	1.130	Acceptable	Good	Mature	40+ Years	13.56	3.48	Retain; Develop tree retention specifications	Reasonable specimen; rubbing crossing stems and deadwood present throughout canopy; canopy slightly sparse; canopy suppression noted
AC0009	*Livistona chinensis*	Chinese Fan Palm	11	4	0.390	Good	Acceptable	Mature	40+ Years	3.00		Retain; Develop tree retention specifications	Reasonable specimen; canopy suppression noted
AC0010	*Beaucarnea recurvata*	Ponytail Palm	4	4	0.200	Acceptable	Acceptable	Mature	5-10 Years	3.00		Retain; Develop tree retention specifications	Canopy slightly sparse; canopy starting to indicate decline; canopy suppression noted
AC0011	*Metrosideros excelsa*	New Zealand Christmas Tree	7	6	0.350	Acceptable	Good	Mature	40+ Years	4.20	2.13	Retain; Develop tree retention specifications	Good specimen; mechanical damage noted at base; surface roots and root damage noted
AC0012	*Metrosideros excelsa*	New Zealand Christmas Tree	6	8	0.550	Acceptable	Acceptable	Mature	40+ Years	6.60	2.57	Retain; Develop tree retention specifications	Reasonable specimen; main stem bifurcates at ground level; deadwood present throughout canopy; surface roots and root damage noted
AC0013	*Agonis flexuosa*	WA Peppermint	10	15	1.040	Good	Acceptable	Mature	40+ Years	12.48	3.36	Retain; Develop tree retention specifications	Good mature specimen; deadwood present throughout canopy; significant rubbing crossing stems noted throughout canopy
AC0014	*Callistemon viminalis*	Bottlebrush	7	9	0.460	Good	Good	Mature	10-40 Years	5.52	2.39	Retain; Develop tree retention specifications	Good specimen; canopy suppression noted
AC0015	*Agonis flexuosa*	WA Peppermint	9	11	0.760	Acceptable	Good	Mature	40+ Years	9.12	2.95	Retain; Develop tree retention specifications	Canopy slightly sparse; mechanical damage noted; deadwood present throughout canopy
AC0016	*Agonis flexuosa*	WA Peppermint	10	14	1.600	Acceptable	Acceptable	Mature	10-40 Years	15.00	4.03	Retain; Develop tree retention specifications	Multi stemmed form; mechanical damage noted; canopy slightly sparse
AC0017	*Jacaranda mimosifolia*	Jacaranda	9	7	0.400	Acceptable	Questionable	Mature	40+ Years	4.80	2.25	Retain; Seek further arboricultural advice regarding root damage remediation considerations; Develop tree retention specifications	Significant root damage noted; canopy suppression noted; previous branch failures noted throughout canopy
AC0018	*Melaleuca bracteata*	Black Tea-tree	5	5	0.200	Acceptable	Acceptable	Mature	5-10 Years	2.40	1.68	Retain; Develop tree retention specifications	Main stem bifurcates at 1m from ground level; canopy suppression noted; canopy slightly sparse
AC0019	*Metrosideros excelsa*	New Zealand Christmas Tree	5	6	0.420	Good	Good	Mature	40+ Years	5.04	2.30	Retain; Develop tree retention specifications	Good specimen; significant aerial root development noted throughout canopy
AC0020	*Bauhinia x blakeana*	Hong Kong Orchid	4	5	0.500	Acceptable	Acceptable	Mature	10-40 Years	6.00	2.47	Retain; Develop tree retention specifications	Multi stemmed form; rubbing crossing stems present throughout canopy
AC0021	*Agonis flexuosa*	WA Peppermint	8	9	0.900	Acceptable	Acceptable	Mature	10-40 Years	10.80	3.17	Retain; Develop tree retention specifications	Canopy slightly sparse; deadwood present throughout canopy
AC0022	*Phoenix canariensis*	Canary Island Date Palm	9	8	0.700	Good	Good	Mature	40+ Years	5.00		Retain; Develop tree retention specifications	Good specimen

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AC0023	*Callistemon viminalis*	Bottlebrush	6	5	0.300	Acceptable	Acceptable	Mature	10-40 Years	3.60	2.00	Retain; Develop tree retention specifications	Stand of 4 x *Callistemon viminalis* ; multi stemmed forms
AC0024	*Eucalyptus camaldulensis var. obtusa*	Northern River Red Gum	12	11	0.650	Questionable	Questionable	Mature	5-10 Years	7.80	2.76	Consider for removal and replacement due to problematic health/ structural issues	Canopy chlorotic and indicates decline;lopped stems and previous branch failures present throughout canopy; terminal decline noted; health and structure considered problematic for long term retention
AC0025	*Eucalyptus camaldulensis var.obtusa*	Northern River Red Gum	15	12	0.900	Acceptable	Questionable	Mature	5-10 Years	10.80	3.17	Consider for removal and replacement due to problematic health/ structural issues	Canopy chlorotic and indicates decline; lopped stems and previous branch failures noted throughout canopy; tree displays leggy form; structure considered problematic for long term retention
AC0026	*Agonis flexuosa*	WA Peppermint	13	10	1.010	Good	Acceptable	Mature	40+ Years	12.12	3.32	Retain; Develop tree retention specifications	Reasonable specimen; canopy slightly sparse; damage to surface roots noted
AC0027	*Agonis flexuosa*	WA Peppermint	12	12	1.180	Acceptable	Questionable	Mature	10-40 Years	14.16	3.55	Retain; Seek further arboricultural advice regarding remediation of questionable canopy structure; Develop tree retention specifications	Canopy previously revious lopped; basal wounding noted; damage to surface roots noted
AC0028	*Callistemon viminalis*	Bottlebrush	7	7	0.450	Good	Questionable	Mature	10-40 Years	5.40	2.37	Retain; Develop tree retention specifications	Multi stemmed form; canopy previously lopped; canopy suppression noted
AC0029	*Agonis flexuosa*	WA Peppermint	13	16	0.870	Acceptable	Acceptable	Mature	10-40 Years	10.44	3.12	Retain; Develop tree retention specifications	Main stem bifurcates at 1m from ground level; canopy slightly sparse; rubbing crossing stems present throughout canopy; canopy suppression noted; root damage noted
AC0030	*Agonis flexuosa*	WA Peppermint	13	15	0.880	Acceptable	Acceptable	Mature	10-40 Years	10.56	3.14	Retain; Develop tree retention specifications	Reasonable specimen; deadwood present throughout canopy throughout canopy;canopy suppression noted
AC0031	*Eucalyptus gomphocephala*	Tuart	14	8	0.520	Questionable	Acceptable	Mature	10-40 Years	6.24	2.51	Retain; Seek further arboricultural advice regarding remediation of canopy decline; Develop tree retention specifications	Main stem bifurcates at 1.8m from ground level; deadwood present throughout canopy; canopy indicates decline; terminal decline noted
AC0032	*Eucalyptus leucoxylon*	SA Blue Gum	11	9	0.260	Acceptable	Acceptable	Mature	10-40 Years	3.12	1.88	Retain; Develop tree retention specifications	Tree on lean; canopy suppression noted; canopy slightly sparse;
AC0033	*Eucalyptus gomphocephala*	Tuart	14	12	0.600	Acceptable	Good	Mature	40+ Years	7.20	2.67	Retain; Develop tree retention specifications	Reasonable specimen; canopy starting to indicate decline
AC0034	*Agonis flexuosa*	WA Peppermint	10	14	1.100	Questionable	Acceptable	Mature	10-40 Years	13.20	3.44	Seek further arboricultural advice to discuss long term tree management considerations	Main stem bifurcates at ground level; canopy sparse
AC0035	*Agonis flexuosa*	WA Peppermint	10	10	1.360	Good	Acceptable	Mature	40+ Years	15.00	3.77	Retain; Develop tree retention specifications	Main stem bifurcates at ground level; mechanical damage noted to northern stem
AC0036	*Agonis flexuosa*	WA Peppermint	11	12	0.720	Good	Questionable	Mature	40+ Years	8.64	2.88	Seek further arboricultural advice to discuss long term tree management considerations	Mani stem bifurcates at 800mm from ground level, bark inlusion present; fungal fruiting bodies present at ground level; mechanical damage noted
AC0037	*Agonis flexuosa*	WA Peppermint	15	16	1.300	Good	Good	Mature	40+ Years	15.00	3.69	Retain; Develop tree retention specifications	Good specimen
AC0038	*Eucalyptus camaldulensis var. obtusa*	Northern River Red Gum	12	13	0.610	Good	Questionable	Mature	10-40 Years	7.32	2.69	Retain; Seek further arboricultural advice regarding remediation of questionable canopy structure; Develop tree retention specifications	Questionable structural form; lopped stems and previous branch failures present throughout canopy;
AC0039	*Agonis flexuosa*	WA Peppermint	4	4	0.200	Good	Acceptable	Semi-Mature	40+ Years	2.40	1.68	Retain; Develop tree retention specifications	Reasonable specimen; bifurcates at ground level
AC0040	*Eucalyptus gomphocephala*	Tuart	15	16	1.600	Acceptable	Questionable	Mature	10-40 Years	15.00	4.03	Seek further arboricultural advice to discuss long term tree management considerations	Previously lopped at 1.8m from ground level; basal suckers present ;lopped stems and previous branch failures present throughout canopy
AC0041	*Agonis flexuosa*	WA Peppermint	10	12	0.980	Good	Good	Mature	40+ Years	11.76	3.28	Retain; Develop tree retention specifications	Rubbing crossing stems present throughout canopy ; canopy suppression noted
AC0042	*Eucalyptus camaldulensis var. obtusa*	Northern River Red Gum	12	11	0.630	Questionable	Acceptable	Mature	10-40 Years	7.56	2.73	Seek further arboricultural advice to discuss long term tree management considerations	Tree displays questionable health; Canopy indicates decline; significant rubbing crossing stems and bark included branch present unions throughout canopy;
AC0043	*Eucalyptus species*	Gum Tree	6	4	0.200	Dead	Questionable	Mature		2.40	1.68	Consider for removal and replacement due to problematic health/ structural issues	Dead Tree
AC0044	*Eucalyptus camaldulensis var. obtusa*	Northern River Red Gum	12	10	0.540	Questionable	Acceptable	Mature	10-40 Years	6.48	2.55	Seek further arboricultural advice to discuss long term tree management considerations	Tree Displays questionable health; Canopy indicates decline; rubbing crossing stems present throughout canopy; canopy suppression noted;

Tree Number	Species	Common Name	Tree Height (M)	Canopy Spread (M)	Trunk Diameter (DBH) (M)	Tree Health	Tree Structure	Age	Useful Life Expectancy (ULE)	TPZ Radius (M)	SRZ Radius (M)	Recommended Works	Observations & Comments
AC0045	*Eucalyptus gomphocephala*	Tuart	14	13	1.700	Good	Questionable	Mature	10-40 Years	15.00	4.14	Retain; Seek further arboricultural advice regarding remediation of questionable canopy structure; Develop tree retention specifications	Main stems previously lopped at 1m and 3m from ground level ; 7 main stems noted
AC0046	*Callistemon viminalis*	Bottlebrush	6	5	0.200	Acceptable	Acceptable	Mature	10-40 Years	2.40	1.68	Retain; Develop tree retention specifications	Previously lopped ; canopy slightly sparse
AC0047	*Eucalyptus gomphocephala*	Tuart	17	13	0.900	Acceptable	Questionable	Mature	10-40 Years	10.80	3.17	Retain; Seek further arboricultural advice regarding remediation of questionable canopy structure; Develop tree retention specifications	Previously lopped at 1.2m from ground level; tree displays leggy form
AC0048	*Eucalyptus gomphocephala*	Tuart	16	13	1.100	Acceptable	Questionable	Mature	10-40 Years	13.20	3.44	Retain; Seek further arboricultural advice regarding remediation of questionable canopy structure; Develop tree retention specifications	Previously lopped at 1.2m from ground level; tree displays leggy form
AC0049	*Eucalyptus gomphocephala*	Tuart	16	13	1.300	Acceptable	Questionable	Mature	10-40 Years	15.00	3.69	Retain; Seek further arboricultural advice regarding remediation of questionable canopy structure; Develop tree retention specifications	Previously lopped at 1.2m from ground level; tree displays leggy form
AC0050	*Eucalyptus gomphocephala*	Tuart	14	10	0.800	Acceptable	Questionable	Mature	10-40 Years	9.60	3.01	Retain; Seek further arboricultural advice regarding remediation of questionable canopy structure; Develop tree retention specifications	Previously lopped at 1.2m from ground level; tree displays leggy form
AC0051	*Agonis flexuosa*	WA Peppermint	5	10	0.500	Questionable	Acceptable	Mature	10-40 Years	6.00	2.47	Retain; Seek further arboricultural advice regarding remediation of canopy decline; Develop tree retention specifications	Main stem bifurcates at ground level; canopy sparse; canopy indicates decline
AC0052	*Eucalyptus gomphocephala*	Tuart	5	4	0.500	Good	Questionable	Mature	10-40 Years	6.00	2.47	Retain; Seek further arboricultural advice regarding remediation of questionable canopy structure; Develop tree retention specifications	Previously lopped at 1.2m from ground level; tree displays leggy form
AC0053	*Eucalyptus rudis*	Flooded Gum	14	11	0.700	Questionable	Acceptable	Mature	10-40 Years	8.40	2.85	Seek further arboricultural advice to discuss long term tree management considerations	Canopy sparse ; lopped stems and deadwood present throughout canopy; damage to surface roots noted
AC0054	*Eucalyptus gomphocephala*	Tuart	16	12	0.700	Acceptable	Questionable	Mature	10-40 Years	8.40	2.85	Seek further arboricultural advice to discuss long term tree management considerations	Canopy slightly sparse; tree displays leggy form; deadwood present throughout canopy; narrow points of attachment and included bark branch unions present throughout canopy; canopy suppression noted ;
AC0055	*Eucalyptus rudis*	Flooded Gum	16	15	0.730	Acceptable	Acceptable	Mature	40+ Years	8.76	2.90	Retain; Develop tree retention specifications	Deadwood present throughout canopy; canopy suppression noted; tree displays somewhat leggy form
AC0056	*Melia azedarach*	Cape Lilac	4	4	0.060	Good	Acceptable	Juvenile	40+ Years	2.00	1.50	Retain; Develop tree retention specifications	Tree displays leggy form; juvenile tree
AC0057	*Eucalyptus gomphocephala*	Tuart	15	13	0.600	Acceptable	Acceptable	Mature	40+ Years	7.20	2.67	Retain; Develop tree retention specifications	Tree displays leggy form; deadwood present throughout canopy
AC0058	*Agonis flexuosa*	WA Peppermint	10	15	0.800	Good	Good	Mature	40+ Years	9.60	3.01	Retain; Develop tree retention specifications	Good mature specimen
AC0059	*Eucalyptus gomphocephala*	Tuart	17	14	1.000	Acceptable	Questionable	Mature	10-40 Years	12.00	3.31	Retain; Seek further arboricultural advice regarding remediation of questionable canopy structure; Develop tree retention specifications	Reasonable specimen; previously lopped at 10m from ground level; main stem bifurcates at 2m from ground level
AC0060	*Eucalyptus gomphocephala*	Tuart	8	10	0.700	Acceptable	Good	Mature	40+ Years	8.40	2.85	Retain; Develop tree retention specifications	Reasonable specimen; deadwood present throughout canopy; canopy slightly sparse
AC0061	*Eucalyptus gomphocephala*	Tuart	12	8	0.700	Good	Acceptable	Mature	40+ Years	8.40	2.85	Retain; Develop tree retention specifications	Tree displays leggy, multi stemmed form
AC0062	*Washingtonia robusta*	Mexican Fan Palm	16	5	0.420	Good	Good	Mature	10-40 Years	5.04		Retain; Develop tree retention specifications	Good mature specimen
AC0063	*Eucalyptus gomphocephala*	Tuart	18	17	1.300	Good	Questionable	Mature	10-40 Years	15.00	3.69	Retain; Seek further arboricultural advice regarding remediation of questionable canopy structure; Develop tree retention specifications	Reasonable specimen; main stem bifurcates at 2m from ground level; previously lopped at 3m from ground level; deadwood present throughout canopy; canopy suppression noted

Tree Number	Species	Common Name	Tree Height (M)	Canopy Spread (M)	Trunk Diameter (DBH) (M)	Tree Health	Tree Structure	Age	Useful Life Expectancy (ULE)	TPZ Radius (M)	SRZ Radius (M)	Recommended Works	Observations & Comments
AC0064	*Eucalyptus gomphocephala*	Tuart	16	12	0.940	Good	Good	Mature	40+ Years	11.28	3.22	Retain; Develop tree retention specifications	Reasonable specimen; canopy suppression noted
AC0065	*Eucalyptus gomphocephala*	Tuart	14	14	1.110	Acceptable	Questionable	Mature	10-40 Years	13.32	3.46	Retain; Seek further arboricultural advice regarding remediation of questionable canopy structure; Develop tree retention specifications	Main stem bifurcates at 1.6m from ground level; canopy previous lopped; deadwood present throughout canopy
AC0066	*Eucalyptus gomphocephala*	Tuart	18	20	1.400	Good	Good	Mature	40+ Years	15.00	3.81	Retain; Develop tree retention specifications	Verge tree; reasonable specimen; wounding noted at root buttress; minor bird damage to branch conductive tissue noted
AC0067	*Eucalyptus gomphocephala*	Tuart	17	14	0.810	Acceptable	Acceptable	Mature	40+ Years	9.72	3.03	Retain; Develop tree retention specifications	Reasonable specimen; main stem bifurcates at 3m from ground level; deadwood present throughout canopy
AC0068	*Eucalyptus gomphocephala*	Tuart	17	14	0.630	Acceptable	Acceptable	Mature	40+ Years	7.56	2.73	Retain; Develop tree retention specifications	Damage to surface roots noted; deadwood present throughout canopy; canopy suppression noted
AC0069	*Eucalyptus gomphocephala*	Tuart	14	13	0.620	Acceptable	Acceptable	Mature	40+ Years	7.44	2.71	Retain; Develop tree retention specifications	Deadwood present throughout canopy; basal suckering noted; canopy suppression noted
AC0070	*Eucalyptus gomphocephala*	Tuart	17	17	1.110	Good	Acceptable	Mature	40+ Years	13.32	3.46	Retain; Develop tree retention specifications	Good specimen; deadwood present throughout canopy; mechanical damage noted
AC0071	*Eucalyptus gomphocephala*	Tuart	16	15	1.520	Good	Acceptable	Mature	40+ Years	15.00	3.95	Retain; Develop tree retention specifications	Good specimen; bifurcates at 100mm above ground level; deadwood present throughout canopy
AC0072	*Eucalyptus gomphocephala*	Tuart	19	18	0.990	Good	Good	Mature	40+ Years	11.88	3.30	Retain; Develop tree retention specifications	Good specimen; deadwood present throughout canopy
AC0073	*Eucalyptus gomphocephala*	Tuart	17	14	0.820	Good	Acceptable	Mature	40+ Years	9.84	3.04	Retain; Develop tree retention specifications	Reasonable specimen; canopy suppression noted; rubbing crossing stems noted; deadwood noted throughout canopy;
AC0074	*Eucalyptus gomphocephala*	Tuart	9	4	0.510	Good	Questionable	Mature	10-40 Years	6.12	2.49	Retain; Seek further arboricultural advice regarding remediation of questionable canopy structure; Develop tree retention specifications	Canopy previously lopped and/or affected by storm damage; deadwood and rubbing crossing stems present throughout canopy
AC0075	*Eucalyptus gomphocephala*	Tuart	16	14	0.660	Acceptable	Acceptable	Mature	40+ Years	7.92	2.78	Retain; Develop tree retention specifications	Canopy slightly sparse; bird damage to branch conductive tissue noted; basal suckering noted; canopy suppression noted
AC0076	*Eucalyptus gomphocephala*	Tuart	15	12	0.710	Acceptable	Acceptable	Mature	40+ Years	8.52	2.87	Retain; Develop tree retention specifications	Reasonable specimen; previous branch failures present throughout canopy
AC0077	*Eucalyptus gomphocephala*	Tuart	14	13	0.710	Acceptable	Acceptable	Mature	40+ Years	8.52	2.87	Retain; Develop tree retention specifications	Reasonable specimen; main stem bifurcates at 2m from ground level; canopy slightly sparse
AC0078	*Eucalyptus gomphocephala*	Tuart	13	12	0.720	Acceptable	Acceptable	Mature	40+ Years	8.64	2.88	Retain; Develop tree retention specifications	Main stem bifurcates at ground level; deadwood present throughout canopy; canopy slightly sparse
AC0079	*Eucalyptus gomphocephala*	Tuart	12	7	0.590	Acceptable	Acceptable	Mature	40+ Years	7.08	2.65	Retain; Develop tree retention specifications	Multi stemmed form; deadwood present throughout canopy; canopy suppression noted
AC0080	*Eucalyptus gomphocephala*	Tuart	17	10	0.910	Acceptable	Acceptable	Mature	40+ Years	10.92	3.18	Retain; Develop tree retention specifications	Canopy slightly sparse; deadwood present throughout canopy; canopy suppression noted
AC0081	*Eucalyptus gomphocephala*	Tuart	14	12	0.450	Acceptable	Acceptable	Mature	40+ Years	5.40	2.37	Retain; Develop tree retention specifications	Tree displays leggy,multi stemmed form; deadwood present throughout canopy; canopy slightly sparse
AC0082	*Eucalyptus gomphocephala*	Tuart	13	13	0.570	Acceptable	Acceptable	Mature	40+ Years	6.84	2.61	Retain; Develop tree retention specifications	Deadwood present throughout canopy; canopy suppression noted
AC0083	*Eucalyptus gomphocephala*	Tuart	20	19	1.100	Good	Good	Mature	40+ Years	13.20	3.44	Retain; Develop tree retention specifications	Good specimen; deadwood present throughout canopy; minor canopy suppression noted
AC0084	*Eucalyptus gomphocephala*	Tuart	12	8	0.450	Good	Questionable	Mature	10-40 Years	5.40	2.37	Retain; Seek further arboricultural advice regarding remediation of questionable canopy structure; Develop tree retention specifications	Canopy previously lopped ; tree displays leggy form; canopy suppression noted ; canopy slightly sparse
AC0085	*Eucalyptus rudis*	Flooded Gum	16	12	1.100	Acceptable	Questionable	Mature	10-40 Years	13.20	3.44	Retain; Seek further arboricultural advice regarding remediation of questionable canopy structure; Develop tree retention specifications	Canopy previously lopped ; tree displays leggy form; canopy sparse
AC0086	*Eucalyptus gomphocephala*	Tuart	16	14	0.850	Good	Acceptable	Mature	40+ Years	10.20	3.09	Retain; Develop tree retention specifications	Main stem bifurcates at 200 mm from ground level; deadwood present troughout canopy; canopy suppression noted
AC0087	*Eucalyptus gomphocephala*	Tuart	13	12	0.780	Good	Acceptable	Mature	40+ Years	9.36	2.98	Retain; Develop tree retention specifications	Main stem bifurcates at ground level; deadwood present throughout canopy; canopy suppression noted
AC0088	*Eucalyptus gomphocephala*	Tuart	17	13	0.590	Acceptable	Acceptable	Mature	40+ Years	7.08	2.65	Retain; Develop tree retention specifications	Reasonable specimen; deadwood present throughout canopy; canopy suppression noted

Tree Number	Species	Common Name	Tree Height (M)	Canopy Spread (M)	Trunk Diameter (DBH) (M)	Tree Health	Tree Structure	Age	Useful Life Expectancy (ULE)	TPZ Radius (M)	SRZ Radius (M)	Recommended Works	Observations & Comments
AC0089	*Eucalyptus gomphocephala*	Tuart	18	14	0.900	Acceptable	Acceptable	Mature	40+ Years	10.80	3.17	Retain; Develop tree retention specifications	Reasonable specimen; main stem bifurcates at 1.8m from ground level; deadwood present throughout canopy; canopy suppression
AC0090	*Eucalyptus gomphocephala*	Tuart	17	7	0.420	Acceptable	Acceptable	Mature	40+ Years	5.04	2.30	Retain; Develop tree retention specifications	Reasonable specimen; deadwood present throughout canopy; canopy suppression noted
AC0091	*Eucalyptus rudis*	Flooded Gum	15	12	0.800	Acceptable	Questionable	Mature	10-40 Years	9.60	3.01	Seek further arboricultural advice to discuss long term tree management considerations	Canopy previously previous lopped; tree displays multi stemmed form
AC0092	*Eucalyptus rudis*	Flooded Gum	12	7	0.420	Acceptable	Questionable	Mature	10-40 Years	5.04	2.30	Seek further arboricultural advice to discuss long term tree management considerations	Canopy previous lopped ; tree displays leggy, multi stemmed form
AC0093	*Eucalyptus gomphocephala*	Tuart	13	12	0.700	Acceptable	Questionable	Mature	10-40 Years	8.40	2.85	Retain; Seek further arboricultural advice regarding remediation of questionable canopy structure; Develop tree retention specifications	Canopy previously lopped; tree displays leggy,multi stemmed form; deadwood present throughout canopy; canopy slightly sparse
AC0094	*Eucalyptus gomphocephala*	Tuart	14	10	0.500	Acceptable	Questionable	Mature	40+ Years	6.00	2.47	Seek further arboricultural advice to discuss long term tree management considerations	Canopy previously previous lopped; Tree displays leggy form; bark inclusion at branch unions noted throughout canopy; deadwood present throughout canopy
AC0095	*Eucalyptus gomphocephala*	Tuart	17	17	0.950	Good	Questionable	Mature	10-40 Years	11.40	3.24	Seek further arboricultural advice to discuss long term tree management considerations	Previously lopped at 1.6m from ground level; previous stem failure noted; tree displays leggy form; rubbing crossing stems present throughout canopy
AC0096	*Eucalyptus gomphocephala*	Tuart	17	16	0.950	Acceptable	Questionable	Mature	10-40 Years	11.40	3.24	Retain; Seek further arboricultural advice regarding remediation of questionable canopy structure; Develop tree retention specifications	Previously lopped at 1m from ground level; tree displays leggy form
AC0097	*Eucalyptus gomphocephala*	Tuart	16	18	0.800	Good	Questionable	Mature	10-40 Years	9.60	3.01	Retain; Seek further arboricultural advice regarding remediation of questionable canopy structure; Develop tree retention specifications	Previously lopped at 1m from ground level; tree displays leggy form
AC0098	*Eucalyptus gomphocephala*	Tuart	12	7	0.360	Good	Acceptable	Mature	40+ Years	4.32	2.15	Retain; Develop tree retention specifications	Reasonable specimen; main stem bifurcates at 5m from ground level, bark inclusion noted at main union
AC0099	*Eucalyptus gomphocephala*	Tuart	12	5	0.340	Questionable	Questionable	Mature	10-40 Years	4.08	2.10	Retain; Seek further arboricultural advice regarding remediation of questionable canopy structure and canopy decline; Develop tree retention specifications	Canopy previoiusly lopped; significant deadwood present throughout canopy ; canopy starting to indicate decline
AC0100	*Casuarina Species*	She-oak	7	5	0.800	Questionable	Questionable	Mature	5-10 Years	9.60	3.01	Consider for removal and replacement due to problematic health/ structural issues	Multi stemmed form (6 main stems); canopy indicates decline; Health/structure considered problematic for long term retention
AC0101	*Eucalyptus leucoxylon*	SA Blue Gum	5	8	0.500	Questionable	Acceptable	Mature	5-10 Years	6.00	2.47	Retain; Seek further arboricultural advice regarding remediation of canopy decline; Develop tree retention specifications	Canopy indicates decline ; significant deadwood present throughout canopy
AC0102	*Eucalyptus leucoxylon*	SA Blue Gum	7	7	0.300	Acceptable	Questionable	Mature	10-40 Years	3.60	2.00	Retain; Seek further arboricultural advice regarding remediation of questionable canopy structure; Develop tree retention specifications	Previously lopped at 1m from ground level; tree displays leggy form
AC0103	*Eucalyptus gomphocephala*	Tuart	13	7	0.300	Acceptable	Acceptable	Mature	40+ Years	3.60	2.00	Retain; Develop tree retention specifications	Deadwood noted throughout canopy
AC0104	*Eucalyptus cornuta*	Yate	11	13	1.000	Good	Questionable	Mature	10-40 Years	12.00	3.31	Seek further arboricultural advice to discuss long term tree management considerations	Canopy previously lopped; tree displays leggy,multi stemmed form; deadwood present throughout canopy; decay noted at main trunk

If you have any queries or if I can be of further assistance, don't hesitate to contact me on:

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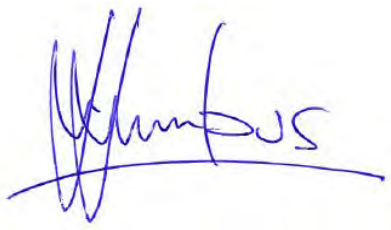
Email: - luke@arborcentre.com.au

Kind regards,



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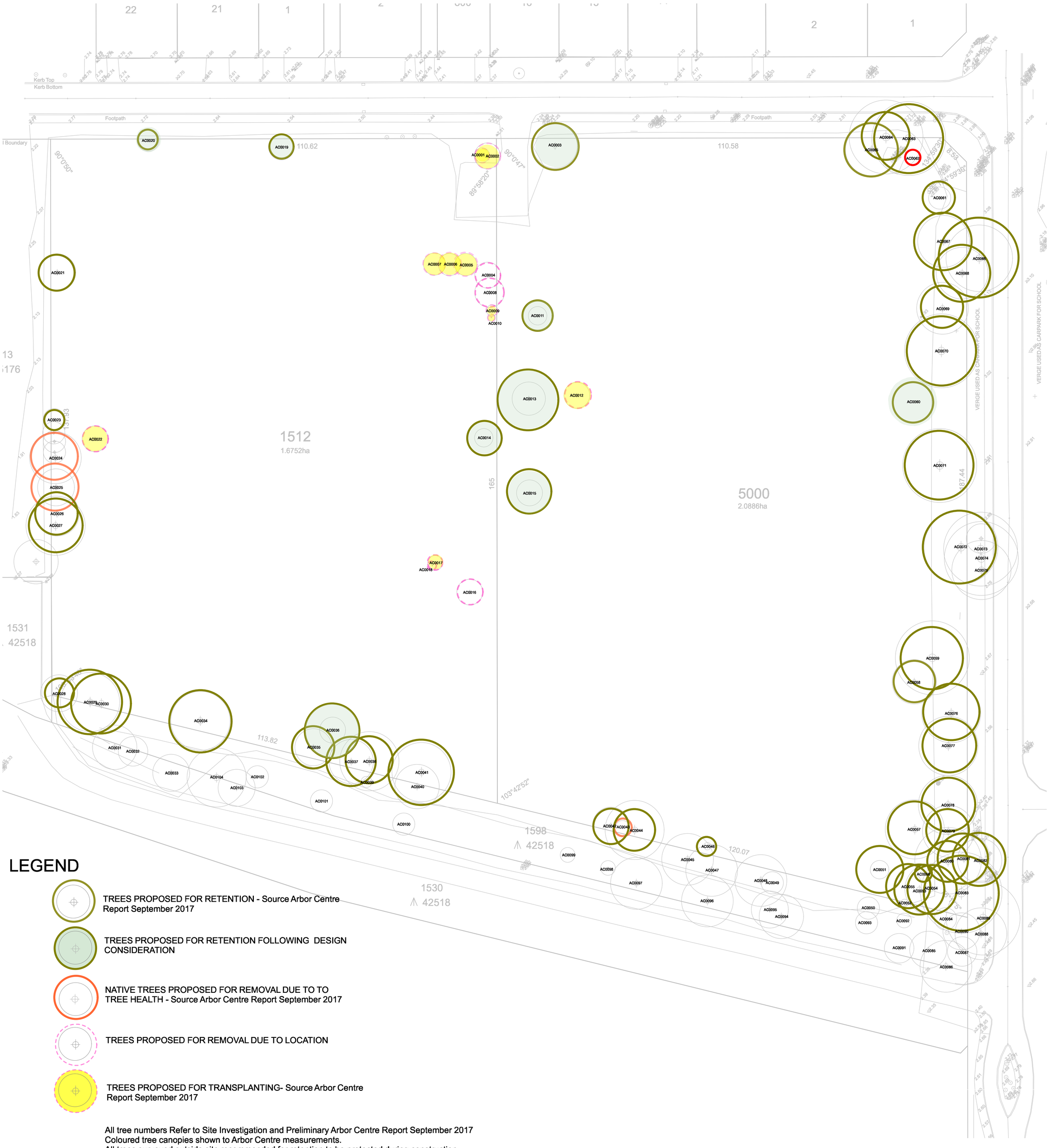
APPENDIX D – TREE RETENTION PLAN



LEGEND

TREES PROPOSED FOR RETENTION - Source Arbor Centre Report September 2017

TREES PROPOSED FOR RETENTION FOLLOWING DESIGN CONSIDERATION

NATIVE TREES PROPOSED FOR REMOVAL DUE TO TO TREE HEALTH - Source Arbor Centre Report September 2017

TREES PROPOSED FOR REMOVAL DUE TO LOCATION

TREES PROPOSED FOR TRANSPLANTING- Source Arbor Centre Report September 2017

All tree numbers Refer to Site Investigation and Preliminary Arbor Centre Report September 2017
Coloured tree canopies shown to Arbor Centre measurements.
All trees surveyed outside site recommended for retention to be protected during construction.

TABLE OF TREES PROPOSED FOR REMOVAL - Source Arbor Centre Report September 2017

Tree Number	Species	Common Name	Tree Height (M)	Canopy Spread (M)	Trunk Diameter (DBH) (M)	Tree Health	Tree Structure	Age	Useful Life Expectancy	TPZ Radius (M)	SRZ Radius (M)	Recommended Works	Observations & Comments
HEALTHY NATIVE TREES PROPOSED TO BE REMOVED													
AC0004	Agonis flexuosa	WA Peppermint	12	10	0.85	Good	Acceptable	Mature	40+ Years	10.2	3.09	Retain; Develop tree retention specifications	Tree on lean to northest; main stem and limbs bifurcate at 2m, 4m, 6m from ground level , swelling noted; minor lopped stems present throughout canopy; canopy suppression noted from adjacent palm and Agonis; minor surface root damage noted
AC0008	Agonis flexuosa	WA Peppermint	12	13	1.13	Acceptable	Good	Mature	40+ Years	13.56	3.48	Retain; Develop tree retention specifications	Reasonable specimen; rubbing crossing stems and deadwood present throughout canopy; canopy slightly sparse; canopy suppression noted
AC0016	Agonis flexuosa	WA Peppermint	10	14	1.6	Acceptable	Acceptable	Mature	10-40 Years	15	4.03	Retain; Develop tree retention specifications	Multi stemmed form; mechanical damage noted; canopy slightly sparse
AC0018	Melaleuca bracteata	Black Tea-tree	5	5	0.2	Acceptable	Acceptable	Mature	5-10 Years	2.4	1.68	Retain; Develop tree retention specifications	Main stem bifurcates at 1m from ground level; canopy suppression noted; canopy slightly sparse
AC0058	Agonis flexuosa	WA Peppermint	10	15	0.8	Good	Good	Mature	40+ Years	9.6	3.01	Retain; Develop tree retention specifications	Good mature specimen
AC0059	Eucalyptus gomphocephala	Tuart	17	14	1	Acceptable	Questionable	Mature	10-40 Years	12	3.31	Retain; Seek further arboricultural advice regarding remediation of questionable canopy structure; Develop tree retention specifications	Reasonable specimen; previously lopped at 10m from ground level; main stem bifurcates at 2m from ground level
AC0065	Eucalyptus gomphocephala	Tuart	14	14	1.11	Acceptable	Questionable	Mature	10-40 Years	13.32	3.46	Retain; Seek further arboricultural advice regarding remediation of questionable canopy structure; Develop tree retention specifications	Main stem bifurcates at 1.6m from ground level; canopy previous lopped; deadwood present throughout canopy
UNHEALTHY NATIVE TREES PROPOSED TO BE REMOVED													
AC0024	Eucalyptus camaldulensis var. obtusa	Northern River Red Gum	12	11	0.65	Questionable	Questionable	Mature	5-10 Years	7.8	2.76	Consider for removal and replacement due to problematic health/ structural issues	Canopy chlorotic and indicates decline;lopped stems and previous branch failures present throughout canopy; terminal decline noted; health and structure considered problematic for long term retention
AC0024	Eucalyptus camaldulensis var. obtusa	Northern River Red Gum	12	11	0.65	Questionable	Questionable	Mature	5-10 Years	7.8	2.76	Consider for removal and replacement due to problematic health/ structural issues	Canopy chlorotic and indicates decline;lopped stems and previous branch failures present throughout canopy; terminal decline noted; health and structure considered problematic for long term retention
AC0043	Eucalyptus species	Gum Tree	6	4	0.2	Dead	Questionable	Mature		2.4	1.68	Consider for removal and replacement due to problematic health/ structural issues	Dead Tree
AC0100	Casuarina Species	She-oak	7	5	0.8	Questionable	Questionable	Mature	5-10 Years	9.6	3.01	Consider for removal and replacement due to problematic health/ structural issues	Multi stemmed form (6 main stems); canopy indicates decline; Health/structure considered problematic for long term retention
HEALTHY EXOTIC TREES PROPOSED TO BE REMOVED- All capable of transplanting													
AC0001	Howea forsteriana	Kentia Palm	5	6	0.18	Good	Good	Mature	10-40 Years	4		Retain; Develop tree retention specifications	Reasonable specimen
AC0002	Metrosideros excelsa	New Zealand Christmas Tree	5	4	0.3	Good	Acceptable	Mature	40+ Years	3.6	2	Retain; Develop tree retention specifications	Reasonable specimen; bifurcates at 300mm from ground level
AC0005	Phoenix canariensis	Canary Island Date Palm	10	8	0.45	Good	Good	Mature	40+ Years	5		Retain; Develop tree retention specifications	Reasonable specimen; basal suckers noted
AC0006	Phoenix canariensis	Canary Island Date Palm	7	8	0.45	Good	Good	Mature	40+ Years	5		Retain; Develop tree retention specifications	Reasonable specimen; basal suckers noted
AC0007	Phoenix canariensis	Canary Island Date Palm	7	7	0.45	Good	Good	Mature	40+ Years	5		Retain; Develop tree retention specifications	Reasonable specimen; basal suckers noted
AC0009	Livistona chinensis	Chinese Fan Palm	11	4	0.39	Good	Acceptable	Mature	40+ Years	3		Retain; Develop tree retention specifications	Reasonable specimen; canopy suppression noted
AC0010	Beaucarnea recurvata	Ponytail Palm	4	4	0.2	Acceptable	Acceptable	Mature	5-10 Years	3		Retain; Develop tree retention specifications	Canopy slightly sparse; canopy starting to indicate decline; canopy suppression noted
AC0012	Metrosideros excelsa	New Zealand Christmas Tree	6	8	0.55	Acceptable	Acceptable	Mature	40+ Years	6.6	2.57	Retain; Develop tree retention specifications	Reasonable specimen; main stem bifurcates at ground level; deadwood present throughout canopy; surface roots and root damage noted
AC0017	Jacaranda mimosifolia	Jacaranda	9	7	0.4	Acceptable	Questionable	Mature	40+ Years	4.8	2.25	Retain; Seek further arboricultural advice regarding root damage remediation considerations; Develop tree retention specifications	Significant root damage noted; canopy suppression noted; previous branch failures noted throughout canopy
AC0022	Phoenix canariensis	Canary Island Date Palm	9	8	0.7	Good	Good	Mature	40+ Years	5		Retain; Develop tree retention specifications	Good specimen

N

C	3/10/18	Trees outside site boundary not highlighted additional trees proposed for retention
B	28/9/17	Updated Tree Removal/ Retention
A	23/9/17	For issue to Defence Housing Authority

ISSUE	DATE	REVISION

PROJECT: Palm Beach — PROJECT # WD1709

CLIENT: Defence Housing Authority — DATE # 13-09-17 — DWG # 1709-01

DWG: TREE SURVEY OVERLAY — SCALE @A1 1:500 — DRAWN PW — CHKD - — REVISION C

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APPENDIX E – LANDSCAPE CONCEPT PLAN

ISSUE	DATE	REVISION	
PROJECT	Palm Beach Redevelopment		PROJECT # 1709
CLIENT	DHA	DATE # Date	DWG # OL1
		SCALE @ A1 NTS	
DWG	Indicative Outline Landscape PLan	DRAWN PW	
		CHKD -	REVISION

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