Arboricultural Impact Assessment

Prepared For

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CPB Dragados Samsung Joint Venture (CDS-JV)
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Kingsgrove NSW 2208

Site Address
Marsh Street Wetlands
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[redacted]

Revision 4

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Contents

Introduction

1.1 Brief

This Arboricultural Impact Assessment (AIA) was prepared by [redacted] and was commissioned by [redacted] CPB Dragados Samsung Joint Venture (CDB-JV).

"The site" is described as the Marsh Street Wetlands. This is an area of Road and Maritime Service owned land located north-east of the West Botany Street / Eve Street intersection, Arncliffe, New South Wales. The subject site location is as below Figure 1.

The proposed works are 'Additional Environmental Requirements' as provided in the *Habitat Creation and Captive Breeding Plan – Green and Golden Bell Frog at Arncliffe* based under Section 2 of the Scope of Work and Technical Criteria (SWTC) Appendix D.1. The scope of work required for the construction of the wetlands includes:

- earthworks;
- water reticulation;
- fencing;
- buildings and structures.

This report gives recommendations for tree retention or removal, and provides guidelines for tree protection and maintenance.

Care has been taken to obtain all information from reliable sources. All data has been verified as far as possible; however, I can neither guarantee nor be responsible for the accuracy of information provided by others.

This report is not intended to be a comprehensive tree risk assessment; however, the report may make recommendations, where appropriate, for further assessment, treatment or testing of trees where potential structural problems have been identified, or where below ground investigation may be required.

This AIA is not intended as an assessment of any impacts on trees by any proposed future development of the site, other than the current discussed scope of work.

The purpose of this report is to assess the vigour and condition of the trees, and identify the potential impacts the proposed development may have on those trees to be retained in proximity to the works.

The author of this report holds an AQF Level 5 Diploma of Horticulture (Arboriculture) and has 23 years in the horticultural industry. 18 of these 23 years have been specifically within the field of arboriculture with roles varying from tree climber at, Council Tree Management Officer at several local Councils and working with independent consultants prior to start up of [redacted] The author is independent from the project.

This AIA has been commissioned to ensure compliance with the requirements set out by the Department of Planning and Environment (DPE) as per Condition B63 - Table 1 (below/next page).

Condition	Requirement	Addressed in:
B63	The SSI must be designed to retain as many trees as possible and provide a net increase in the number of replacement trees. The Proponent must commission an independent experienced and suitably qualified arborist, to prepare a comprehensive Tree Report(s) prior to removing any trees on the periphery and/or outside the construction footprint as identified in the figures in Section 6 of the document referred to in condition A2(b), including any tree(s) removed along Euston Road. The Tree Report may be prepared for the entire SSI or separate reports may be prepared for individual areas where trees are required to be removed. The report(s) must identify the impacts of the SSI on trees and vegetation within and adjacent to the construction footprint. The report(s) must include:	This Report – Individual area as per Figure 2. Refer also to Part 2.2.2 Specialist advice Design Report ref. M5N-AJV-TER-100-300-CI-01635
B63(a)	a visual tree assessment with inputs from the design, landscape architect, construction team;	VTA noted in Appendix E, staff inputs as per onsite discussions & Section 2.2.2 Design Report.
B63(b)	consideration of all options to amend the SSI where a tree has been identified for removal, including realignment, relocation of services, redesign of or relocation of ancillary components (such as substations, fencing etc.) and reduction of standard offsets to underground services.	See Figure 2, onsite discussion. Part 2.2.2 Specialist advice Design Report ref. M5N-AJV-TER-100-300-CI-01635, and Habitat Creation and Captive Breeding Plan- Green & Golden Bell Frog at Arncliffe.
B63(c)	Measures to avoid the removal of trees or minimise damage to existing trees and is to ensure the health and stability of those trees to be protected. This includes details of any proposed canopy or root pruning, excavation works, site controls on waste disposal, vehicular access, and storage of materials and protection of public utilities.	Section 2 Part 2.4-2.5 & Section 3 and 4.
	In the event that trees are to be removed, then replacement trees are to be planted within, or in close proximity to, the SSI boundary, including along Euston Road where feasible and reasonable The location of the trees must be determined in consultation with the relevant council(s). The replacement trees are to have a minimum pot size of 75 litres. A copy of the report(s) must be submitted to the Secretary for approval prior to the removal, damage and/or pruning of any trees, including those affected by site establishment works. All recommendations of the report must be implemented by the Proponent, unless otherwise agreed by the Secretary.	Landscape design for the site is specified in the HCCBP in accordance with the habitat requirements of the Green and Golden Bell Frog and therefore no further input from a landscape architect is required for this report.

Table 1 –Condition of Approval B63 Compliance Table

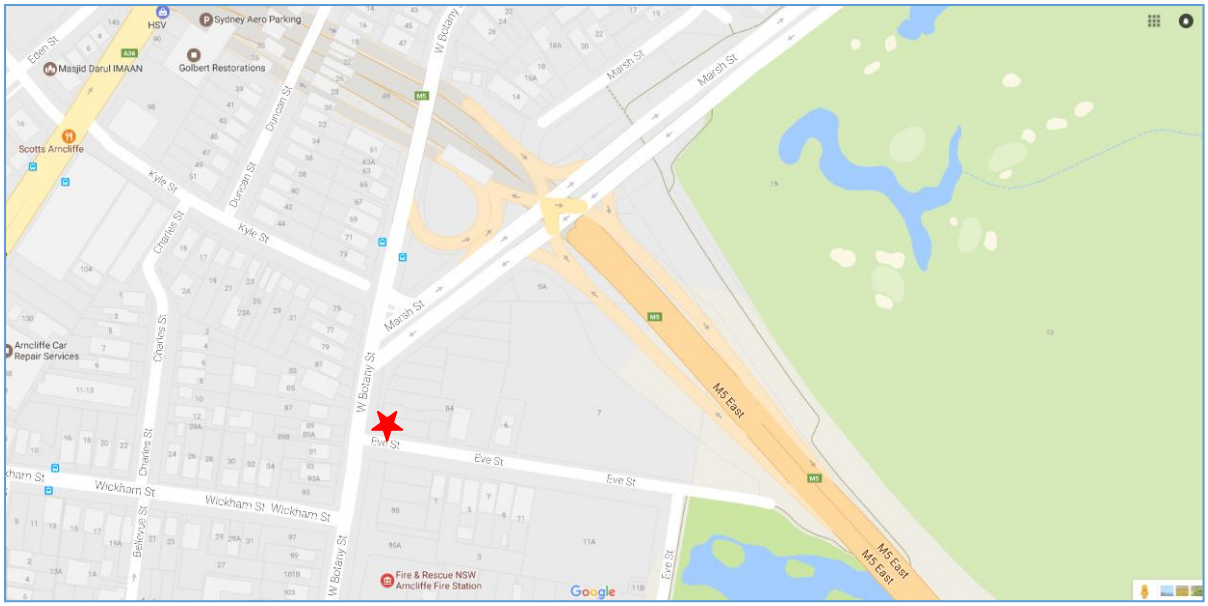

Figure 1 – Red star denotes site location, Aerial Map courtesy of Google Mapping 2017.

1.2 Methodology

In preparation for this report, ground-level, visual tree assessments (VTA), or limited VTA (e.g. where access was limited), were completed by the author of this report on 29th March 2017. Inspection details of these trees are provided in Appendix E —Schedule of Assessed Trees.

The tree heights were visually estimated, unless otherwise noted in Appendix E, the trunk Diameter at Breast Height were measured at 1.4 metres above ground level (DBH) using a diameter tape. Tree canopy spreads were stepped out with field observations written down, and photographs of the site and trees were taken using an iphone 6.

No aerial inspections, root mapping or woody tissue testing were undertaken as part of this tree assessment. Information contained in this report only reflects the condition of the trees at the time of inspection. Trees are dynamic, living things which can be subject to change without notice in certain circumstances.

An on-site meeting regarding the trees, design features and impacts was attended by the author of this report [redacted] and [redacted] (CDS-JV Construction Team, Project Engineer), [redacted] (CDS-JV Construction Team, Environment Manager, West) on 29th March 2017.

Plans and documents referenced for the preparation of this report include:

- AS4970-2009 Protection of trees on development sites, Standards Australia;
- Conditions B63 –(Table 1);
- Habitat Creation & Captive Breeding Plan - Green & Golden Bell Frog at Arncliffe, Project Number 15WOL-3386, prepared by [redacted] for Eco Logical Australia Pty Ltd, Version Number 2, dated 2 March 2016;
- Marsh St Wetlands, General Arrangement Plan, Drawing no. M5N-AJV-DWG-100-300-CI-0011, Issue: Substantial Detail Design, Sheet no. CI-0011, Rev.B, Dated 22/12/2016;
- Aurecon Jacobs New M5 Joint Venture; Design Report – Marsh Street Wetlands, Package; M5N-AJV-DPK-100-300-CI-1450; Document No; M5N-AJV-TER-100-300-CI-01635; Substantial Detailed Design; Revision D, dated 21 December 2016.

1.3 Tree Preservation and Management Guidelines

The proposed works form part of the approved WestConnex New M5 State Significant Infrastructure Project (SSI 6788). Clause 5.9 of the Rockdale Local Environment Plan 2011 (RLEP) therefore does not apply.

What constitutes a 'tree' as per planning approval is any tree that:

- is equal to or greater than three metres in height; or
- for a single trunk species, a trunk circumference of 300 millimetres at a height of one metre above ground level; or
- for a multi-trunk species, a trunk circumference exceeding 100 millimetres at a height of one metre above ground level.

However this excludes any species listed under the Noxious Weeds Act 1993.

Observations and Discussion

2.1 Summary of Assessed Trees

Twelve (12) trees/tree groups were assessed and included in this report. Details of these are included in the Schedule of Assessed Trees – Appendix E, the tree location plan is as below. Of these trees:

- six (6) are prescribed (i.e. considered a 'tree' under the planning approval) trees/tree groups – Trees 1, 2, 3, 5, 6, and Group 11; and
- six (6) are non-prescribed trees/tree groups (i.e. exempt from authority approval to remove or prune due to being noxious weed species), - Tree 4, 7 – 10 and Group 12

Of the six (6) prescribed trees/tree groups the following Retention Value (RV- see Appendix C) was ascribed to each:

- three (3) trees have High RVs – Trees 1, 2, and 5;
- three (3) trees/tree groups have Low RVs - Tree 3, 6 and Group 11.

The subject trees are shown as dot markings in Figure 2 below/next page.

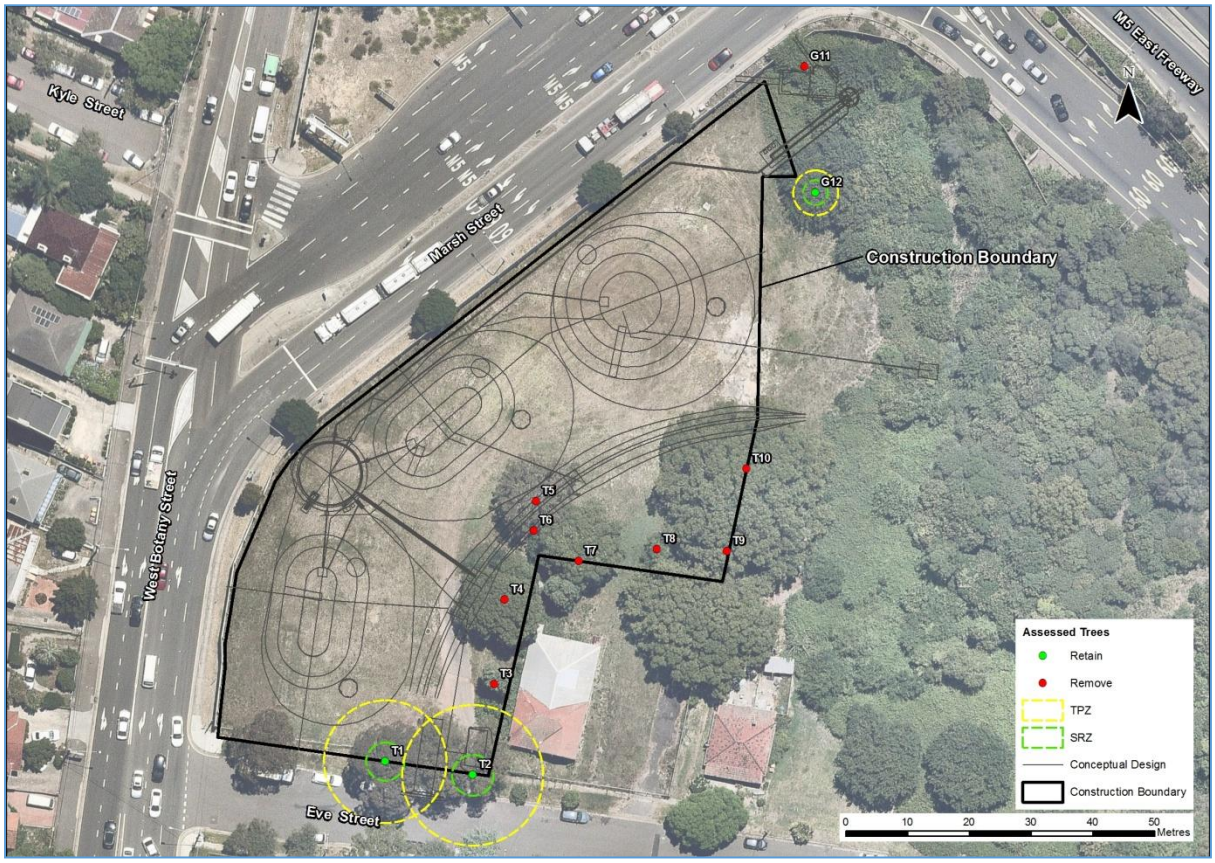

Figure 2 – Marked up Plan. Red dots indicate trees proposed for removal. Green dots indicate trees to be retained. Dotted are tree SRZ (yellow) and TPZ (green).

2.2 Threatened Species

Trees 1 and 2 *Eucalyptus nicholii* (Narrow Leaved Peppermint) are classed as Vulnerable under both the NSW Threatened Species Conservation Act 1995 and the Commonwealth Environment Protection and Biodiversity Conservation Act 1999.

However this classification is relevant to the trees growing in their native habitat of the New England Tablelands and not as planted street trees in the Sydney region.

2.3 Proposed Removal of Trees

Four (4) of the six (6) prescribed trees require removal to accommodate the proposed works.

Five (5) of the assessed trees (Tree 4, 7-10) were identified as *Cinnamomum camphor* (Camphor laurel). Although these trees are mature and healthy they are a declared noxious weed species and have been attributed a 'Low' Retention Value (RV – see Appendix C).

These five (5) trees require removal at the subject site due to comments provided by [redacted] (Project Herpetologist, [redacted] Consultants) regarding the identified toxicity produced in their leaves having an adverse affect on the establishment, and ongoing longevity, of the Green and Golden Bell Frog population. [redacted] also stated that overshadowing of the proposed ponds is another issue these trees pose (see Appendix G). Trees 7, 9 & 10 are in the location of the perimeter fencing required to keep the frog population in and intruders out.

Group 11 includes one (1) noxious weed species (*Sapium*/*Triadica sebiferum* Chinese Tallow) and three (3) *Morus* sp. Mulberry among other weedy shrubs and vines, all which appear to have self-sown along the stormwater easement. This group has been attributed a 'Low' Retention Value (RV – see Appendix C). Removal of this group is required due to the instalment of water piping, pump sump and for the previously discussed perimeter fence as per design features set out by CDS-JV Design Team ([redacted] CDS-JV Design Manager). These works will be within the SRZ and TPZ of these trees.

Tree 3 *Cupressus* sp. is a poor specimen that has previously lost 50% of the canopy when the co-dominant stem was removed (reasons unknown). The proposed perimeter fence is located within the SRZ of this specimen. The tree is of a condition not to warrant design changes.

Tree 5 *Corymbia citriodora* (Lemon Scented Gum) has been determined to have a 'High' Retention Value (RV- see Appendix C). The proposed drainage swale and Pond 2 are located within the trees notional SRZ. Additionally the tree will create overshadowing of ponds under the current design, specialist advice states low vegetation is favourable for frog habitat. Under the current proposal it is not possible to retain this tree.

Tree 6 *Photinia* x *fraseri* 'Robusta' (Chinese Hawthorn) has been attributed a 'Low' Retention Value (RV- see Appendix C) and is proposed for removal. This tree falls within the proposed drainage swale and requires removal under the current proposal.

Tree No.	Common Name	Reason	RV
3	Conifer	Fence location within trees SRZ, overshadowing issues for Frog pond as per Part 2.4.2 Habitat Creation and Captive Breeding Plan- Green & Golden Bell Frog at Arncliffe.	L
5	Lemon Scented Gum	Tree within footprint of proposed drainage swale, SRZ within proposed pond 2 footprint, overshadowing issues as per Part 2.4.2 & 2.4.3 Habitat Creation and Captive Breeding Plan- Green & Golden Bell Frog at Arncliffe.	H
6	Chinese Hawthorn	Tree within footprint of proposed drainage swale, overshadowing issues as per Part 2.4.2 & 2.4.3 Habitat Creation and Captive Breeding Plan- Green & Golden Bell Frog at Arncliffe.	L
G11	Mulberry x 3	Trees are within footprint and excavation zone of water supply piping, fence (Part 2.4.1 Habitat Creation and Captive Breeding Plan- Green & Golden Bell Frog at Arncliffe), proposed pump sump and boundary fence.	L

Table 2 - Prescribed trees proposed to be removed to facilitate works.

2.4 Proposed Tree Retention

The following trees/tree groups are proposed/recommended to be retained:

- Tree 1 - *Eucalyptus nicholii* (Narrow Leaved Peppermint);
- Tree 2 - *Eucalyptus nicholii* (Narrow Leaved Peppermint);
- Group 12 – *Celtis sinensis* (Hackberry).

2.5 Potential Impacts on Trees Proposed for Retention

Under the Australian Standard 4970-2009 Protection of trees on development sites ("AS4970"), encroachments of less than 10% of the Tree Protection Zone (TPZ) are considered to be minor. No specifications are provided in AS4970 for potential impacts of 10% or greater.
This 10% is taken as the threshold figure, beyond which arboricultural investigations (as set out in clause 3.3.4) need to be considered.

Encroachments within the Structural Root Zone (SRZ), and extent of encroachments into the TPZ's of protected trees to be retained are summarised in Table 3, below.

Tree No.	Tree Common name	Tree located on site	SRZ affected	TPZ area (m^2)	TPZ encroachment (approx. m^2)	TPZ encroachment (approx. %)
1	Narrow Leaved Peppermint	✕	✕	308	31.5	10
2	Narrow Leaved Peppermint	✕	✕	408	24.8	6.1
G12	Hackberry x 2	✓	✕	41	0	0

Table 3 – Estimated encroachments into the SRZ and TPZ of trees proposed for retention. Please note site-specific constraints will heavily influence the presence of roots in a particular location. The type of construction materials and methods used, and/or extent of change to soil/grade conditions during works may result in encroachment impacts lower or higher than estimated at the time of preparing this tree impact assessment.

Tree 1- *Eucalyptus nicholii* (Narrow Leaved Peppermint)

Under the current proposal site access will be within the TPZ of this street tree, a driveway is proposed and a new layback in the position of the existing gutter. The encroachment into the TPZ has been calculated as 10%. This is just on the threshold figure between minor and major encroachment under the Australian Standard 4970-2009 Protection of trees on development sites ("AS4970"). The encroachment will not require a reduction in ground level but a minor increase in ground level (as discussed on site). This should be acceptable and not detrimentally affect tree.

Pruning will be also required to allow vehicular access without risk of tree damage or the tearing of limbs.

A new perimeter fence is proposed, this fence location is just on the outer limit of the SRZ and well within the TPZ. This fence can be supported provided only replacement the wire itself is carried out and no excavation is completed. All branches are clear of the proposed fence height thus pruning will not be required.

Tree 2 - *Eucalyptus nicholii* (Narrow Leaved Peppermint)

This street tree is also proposed to have site access/driveway within the TPZ. The notional encroachment has been calculated as 6.1%, this is considered minor encroachment under the Australian Standard 4970-2009 Protection of trees on development sites ("AS4970"). Again the encroachment will not require a reduction in ground level but minor increase in ground level.

A new perimeter fence is also proposed, this fence location is just on the outer extent of the SRZ and well within the TPZ. Retention of the existing fence, replacement of just the wire itself/use of existing poles/piers should be carried out to reduce impact on this tree. No excavation can be supported for fence installation. Branches are clear of the proposed fence height.

Pruning is required allow vehicular access without risk of tree damage as branches are low over the proposed driveway area.

Group 12- *Celtis sinensis* (Hackberry) x 2

These trees will require pruning to allow the perimeter fence to be installed, branches are currently held very low to the ground. However the required pruning will not be of detriment to these noxious weed specimens.

Recommendations

3.1 Tree Removal

Four (4) of the six (6) prescribed trees/tree groups (Tree 3, 5, 6 & Group 11) are required to be removed to accommodate the proposed works considering the current design follow advice as per Ecological Report - Habitat Creation and Captive Breeding Plan (HCCBP) - Green & Golden Bell Frog at Arncliffe, Part 2.4.1-2.4.3.

Where trees to be removed are located on or outside the project boundary, approval will be sought from the relevant land owner. All removals should be carried out by minimally qualified AQF Level 2 Arborists in compliance with the NSW Workcover Code of Practice for the Amenity Tree Industry.

Replanting will be undertaken as specified in the HCCBP in accordance with the habitat requirements of the Green and Golden Bell Frog. Five (5) non-prescribed trees (Tree 4, 7-10) are also proposed for removal to accommodate works.

3.2 Minimising Impacts on Trees to be Retained

Tree 1- *Eucalyptus nicholii* (Narrow Leaved Peppermint)

- Any ground-level change within 9 m of the tree is to be directly supervised by an arboriculturist with a minimum AQF5 in arboriculture or Council.
- Crown-lift pruning to Australian Standard 4373-2007 *Pruning of Amenity Trees* will be required by a minimally qualified AQF Level 3 Arborist prior to works commencing. Given the pruning may be in excess of 10% of the total live canopy, this pruning shall be as advised by the project arboriculturist or Council.
- Tree protection fencing is to be placed at a radial distance 9m from tree stem (outside of the proposed works zone). Guidelines as per Tree Protection Measures Part 4.1 below, prior to and during works. Compensatory 10% TPZ fencing is to be extended to the north and west for the encroachment to the east/south in the TPZ.
- Stem protection is required given works are required with the TPZ, this shall be padding placed against the stem and battens strapped together over this padding (not fixed in any way into the tree stem). A minimum height of 2m is recommended.
- Retention of the existing kerb is required due to the location to the tree stem (outside of driveway zone).
- Refer to Sections 4.2 – 5.3 for additional recommendations that may require adoption during works.
- The project arboriculturist must advise on all aspects of tree protection prior to and during works. This may include the use of Track mat or wide timber sheeting placed on ground should vehicles be accessing the TPZ.
- No excavation is to be carried out within the TPZ. Existing pole/piers for the fence are to be utilised.
- Required fill within the TPZ is to be carried out as per Tree Protection Measures Part 4.3 below.

Tree 2 - ***Eucalyptus nicholii*** **(Narrow Leaved Peppermint)**

- Any ground-level change within 11 m of the tree is to be directly supervised by an arboriculturist with a minimum AQF5 in arboriculture or Council.
- Crown-lift pruning to Australian Standard 4373-2007 *Pruning of Amenity Trees* will be required by a minimally qualified AQF Level 3 Arborist prior to works commencing. Given the pruning may be in excess of 10% of the total live canopy, this pruning shall be as advised by the project arboriculturist or Council.
- Tree protection fencing is to be placed at a radial distance 11m from tree stem (outside of the proposed works zone). Guidelines as per Tree Protection Measures Part 4.1 below, prior to and during works. Compensatory 10% TPZ fencing is to be extended to the north and east for the encroachment to the west/south in the TPZ.
- Stem protection is required given works are required with the TPZ, this shall be padding placed against the stem and battens strapped together over this padding (not fixed in any way into the tree stem). A minimum height of 2m is recommended.
- Retention of the existing kerb is required due to the location to the tree stem (outside of driveway zone).
- Refer to Sections 4.2 – 5.3 for additional recommendations that may require adoption during works.
- The project arboriculturist must advise on all aspects of tree protection prior to and during works. This may include the use of Track mat or wide timber sheeting placed on ground should vehicles be accessing the TPZ.
- No excavation is to be carried out within the TPZ. Existing pole/piers for the fence are to be utilised.

Group 12 – ***Celtis sinensis*** **(Hackberry) x 2**

- Crown-lift pruning to Australian Standard 4373-2007 *Pruning of Amenity Trees* will be required by a minimally qualified AQF Level 3 Arborist prior to works commencing. Any pruning in excess of 15% of the total live canopy shall be as advised by the project arboriculturist or Council.
- Tree protection is to be placed as per Tree Protection Measures Part 4.1 below, prior to and during works.

Tree Protection Measures

4.1 Tree Protection Devices

The tree protection is to be in accordance with the following:

- Tree Protection Devices (TPD) may include mulching, tree guards and other devices other than fencing.
- The TPD must be in place prior to any site works commencing, including clearing, demolition or grading.
- The most appropriate fencing for tree protection is 1.8m chainlink with 50mm metal pole supports. During installation, care must be taken to avoid damage to significant roots. The practicality of providing this fencing on this site must be addressed by the arboriculturist.
- Locate large primary roots by careful removal of soil within the fencing area. Do not drive any posts or pickets into tree roots. Replace soil back over tree roots.

- Nothing should occur inside the tree protection fenced areas, so therefore all access is prohibited for personnel and machinery, storage of fuel, chemicals, cement and site sheds.
- Signage should explain exclusion from the area defined by TPD and carry a contact name for access or advice.
- The TPD cannot be removed, altered, or relocated without the project arborist's prior assessment and approval.

4.2 Stockpiling and Location of Site Sheds

- Any ground identified for proposed stockpiling that is within the TPZ of trees to be retained shall be covered with thick, coarse mulch, placement of wooden pallets over the mulch, covering of the pallets with a tarpaulin (or similar), and the placement of materials on top of this device to prevent loose or potentially contaminating materials from moving into the soil profile.

4.3 Fill Material

- Placement of fill material within the TPZ of trees to be retained should be avoided where possible. Where placement of fill cannot be avoided, the material should be a coarse, gap graded material such as 20 — 50mm crushed basalt or equivalent to provide some aeration to the root zone. Note that roadbase or crushed sandstone or other material containing a high percentage of fines is unacceptable for this purpose.
- The fill material should be consolidated with a non-vibrating roller to minimise compaction of the underlying soil.
- A permeable geotextile may be used beneath the sub-base to prevent migration of the stone into the sub-grade. No fill material should be placed in direct contact with the trunk.

4.4 Fencing and Walls within the SRZ and TPZ of Retained Trees.

- Where fencing and/or masonry walls are to be constructed along site boundaries, they must provide for the presence of any living woody tree roots greater than 50mm diameter.
- Hand digging must occur within the SRZ of trees to be retained.
- For masonry walls or fences it may be acceptable to replace continuous concrete strip footings with suspended in-fill panels (e.g. steel or timber pickets, lattice etc) fixed to pillars.

4.5 Pavements

- Where possible pavements should be avoided within the TPZ of trees to be retained.
- Proposed paved areas within the TPZ of trees to be retained are to be placed above grade to minimise excavations within the root zone, avoiding root severance and damage.

4.6 Landscaping within Tree Root Zones.

- The level of introduced planting media into any proposed landscaped areas within the TPZ is not to be greater than 75mm depth, and be of a coarse, sandy material to avoid development of soil layers that may impede water infiltration.
- Container size of proposed plants within the SRZ of trees should be determined prior to purchase of plants. This is to identify planting locations and container size of plants at the time of planting. Otherwise, any proposed landscaping within the SRZ must consist of tubestock only. This is required to ensure that damage to tree roots is avoided.

- Mattocks and similar digging instruments must not be used within the TPZ of the trees. Planting holes should be dug carefully by hand with a garden trowel, or similar small tool.
- Where possible, do not plant canopy trees beneath, or within 6 - 8m of, overhead power lines.

4.7 Hygiene Practices

- No washing or rinsing of tools or other equipment, preparation of any mortars, cement mixing, or brick cutting is to occur within 8m up slope of any palms/trees to be retained.

Post Construction Tree Care Measures

5.1 Mulching

The removal of mulch after construction to remove any contaminants and its replacement with a good quality mulch and addition of 10% organic matter will improve beneficial soil micro-organisms, retain moisture and improve aeration and water infiltration.

5.2 Irrigation

An arboriculturist should determine whether irrigation should be carried out during extended periods of drought.

5.3 Pest Management

Monitoring is required, as trees under stress are more prone to insect attack

5.4 Hazard Management

Monitoring, management and routine re-assessment of the trees by a qualified arboriculturist is required for adequate long-term safety of residents.

References

Credit to [redacted] of 'Urban Forestry Australia' for general report layout and several areas of text.

Aurecon Jacobs New M5 Joint Venture; Design Report – Marsh Street Wetlands, Package; M5N-AJV-DPK-100-300-CI-1450; Document No; M5N-AJV-TER-100-300-CI-01635; Substantial Detailed Design; Revision D, dated 21 December 2016.

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Report prepared by [redacted] – May, 2017

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ISA Tree Risk Assessment Qualification (TRAQ) 2016

6.1 Appendix A - Terms and Definitions

Age classes

Y Young refers to an established but juvenile tree.
SM Semi-mature refers to a tree at growth stages between immaturity and full size.
EM Early-mature refers to a tree close to full sized still actively growing.
M Mature refers to a full sized tree with some capacity for further growth.
LM Late-Mature refers to a full sized tree with little capacity for growth that is not yet about to enter decline.
OM Over-Mature refers to a full sized tree with little capacity for growth that is entering or has entered decline.

Co-dominant: refers to stems or branches equal in size and relative importance.

Condition/Structure: refers to the tree's form and growth habit, as modified by its environment (aspect, suppression by other trees, soils) and the state of the scaffold (i.e. trunk and major branches), including structural defects such as cavities, crooked trunks or weak trunk/branch junctions. These are not directly connected with health and it is possible for a tree to be healthy but in poor condition/structure.

Deadwood: refers to any whole limb that no longer contains living tissues (e.g. live leaves and/or bark). Some dead wood is common in a number of tree species.

Diameter at Breast Height (DBH): Refers to the tree trunk diameter at breast height (1.4 metres above ground level).

Epicormic growth: adventitious branches that are considered to be a weak attachment in the short term due to minimal wood formation. There are generally formed following storm-related branch breakage or poor pruning practices. Should sufficient holding wood form in the long-term this growth is less of an issue.

Hazard: refers to anything with the potential to harm health, life or property.

Health: Refers to the tree's vigour as exhibited by the crown density, leaf colour, presence of epicormic shoots, ability to withstand disease invasion, and the degree of dieback.

Inclusion stem/bark: the pattern of development at branch or stem junctions where bark is turned inward rather than pushed out. This fault is located at the point where the stems/branches meet. This is normally a genetic fault and potentially a weak point of attachment as the bark obstructs healthy tissue from joining together to strengthen the joint.

Secondary Stem: refers to stems or branches with one of unequal size and relative importance.

SRZ: refers to the Structural Root Zone of the tree, this is the area required for tree stability.

TPZ: refers to the Tree Protection Zone of the tree, this is the primary method of protecting trees, it is a combination of the root area and the canopy and the SRZ is located within it.

Visual Tree Assessment (VTA): a procedure of defect analysis developed by Mattheck and Breloer (1994) that uses the growth response and form of trees to detect defects.

6.2 Appendix B - ULE Guide

ULE categories (after Barrell 1996, Updated 01/04/01)

The five categories and their sub-groups are as follows:

1. Long ULE - tree appeared retainable at the time of assessment for over 40 years with an acceptable degree of risk, assuming reasonable maintenance:

    a) Structurally sound trees located in positions that can accommodate future growth
    b) Trees which could be made suitable for long term retention by remedial care
    c) Trees of special significance which would warrant extraordinary efforts to secure their long term retention

2. Medium ULE - tree appeared to be retainable at the time of assessment for 15 to 40 years with an acceptable degree of risk, assuming reasonable maintenance:

    a) Trees which may only live from 15 to 40 years
    b) Trees which may live for more than 40 years but would be removed for safety or nuisance reasons
    c) Trees which may live for more than 15 years but would be removed to prevent interference with more suitable individuals or to provide space for new planting
    d) Trees which could be made suitable for retention in the medium term by remedial care

3. Short ULE - tree appeared to be retainable at the time of assessment for 5 to 15 years with an acceptable degree of risk, assuming reasonable maintenance:

    a) Trees which may only live from 5 to 15 years
    b) Trees which may live for more than 15 years but would be removed for safety or nuisance reasons
    c) Trees which may live for more than 15 years but would be removed to prevent interference with more suitable individuals or to provide space for new planting
    d) Trees which require substantial remediation and are only suitable for retention in the short term.

4. Removal - trees which should be removed within the next 5 years:

    a) Dead, dying, suppressed or declining trees because of disease or inhospitable conditions
    b) dangerous trees through instability or recent loss of adjacent trees
    c) Dangerous trees because of structural defects including cavities, decay, included bark, wounds or poor form
    d) Damaged trees that are clearly not safe to retain
    e) Trees which may live for more than 5 years but would be removed to prevent interference with more suitable individuals or to provide space for new planting
    f) Trees which are damaging or may cause damage to existing structures within the next 5 years
    g) Trees that will become dangerous after removal of other trees for the reasons given in (a) to (f)
    h) Trees in categories (a) to (g) that have a high wildlife habitat value and, with appropriate treatment, could be retained subject to regular review

5. Small, young or regularly pruned - Trees that can be reliably moved or replaced:

    a) small trees less than 5m in height
    b) young trees less than 15 years old but over 5m in height
    c) formal hedges and trees intended for regular pruning to artificially control growth

6.3 Appendix C – STARS – Significance of a Tree Assessment Rating System (IACA 2010)©

The landscape significance of a tree is an essential criterion for establishing the importance that a particular tree may have on a site. However, rating the significance of a tree becomes subjective and difficult to ascertain in a consistent and repetitive fashion due to assessor bias. It is therefore necessary to have a rating system utilising structured qualitative criteria to assist in determining the retention value for a tree.
This rating system will assist in the planning processes for proposed works, above and below ground where trees are to be retained on or adjacent a development site. The system uses a scale of *High*, *Medium* and *Low* significance in the landscape. Once the landscape significance and *Useful Life Expectancy* of an individual tree has been defined, the retention value can be determined.

Tree Significance - Assessment Criteria

1. High Significance in landscape.

- The tree is in good condition and good vigour;
- The tree has a form typical for the species;
- The tree is a remnant or is a planted locally indigenous specimen and/or is rare or uncommon in the local area or of botanical interest or of substantial age;
- The tree is listed as a Heritage Item, Threatened Species or part of an Endangered ecological community or listed on Councils significant Tree Register;
- The tree is visually prominent and visible from a considerable distance when viewed from most directions within the landscape due to its size and scale and makes a positive contribution to the local amenity;
- The tree supports social and cultural sentiments or spiritual associations, reflected by the broader population or community group or has commemorative values;
- The tree's growth is unrestricted by above and below ground influences, supporting its ability to reach dimensions typical for the taxa *in situ* - tree is appropriate to the site conditions.

2. Medium Significance in landscape.

- The tree is in fair-good condition and good or low vigour;
- The tree has form typical or atypical of the species;
- The tree is a planted locally indigenous or a common species with its taxa commonly planted in the local area;
- The tree is visible from surrounding properties, although not visually prominent as partially obstructed by other vegetation or buildings when viewed from the street;
- The tree provides a fair contribution to the visual character and amenity of the local area;
- The tree's growth is moderately restricted by above or below ground influences, reducing its ability to reach dimensions typical for the taxa *in situ*.

3. Low Significance in landscape.

- The tree is in fair-poor condition and good or low vigour;
- The tree has form atypical of the species;
- The tree is not visible or is partly visible from surrounding properties as obstructed by other vegetation or buildings;
- The tree provides a minor contribution or has a negative impact on the visual character and amenity of the local area;
- The tree is a young specimen which may or may not have reached dimension to be protected by local Tree Preservation orders or similar protection mechanisms and can easily be replaced with a suitable specimen;
- The tree's growth is severely restricted by above or below ground influences, unlikely to reach dimensions typical for the taxa *in situ* - tree is inappropriate to the site conditions;
- The tree is listed as exempt under the provisions of the local Council Tree Preservation Order or similar protection mechanisms;
- The tree has a wound or defect that has potential to become structurally unsound.

Environmental Pest / Noxious Weed Species:

- The tree is an Environmental Pest Species due to its invasiveness or poisonous/ allergenic properties;
- The tree is a declared noxious weed by legislation.

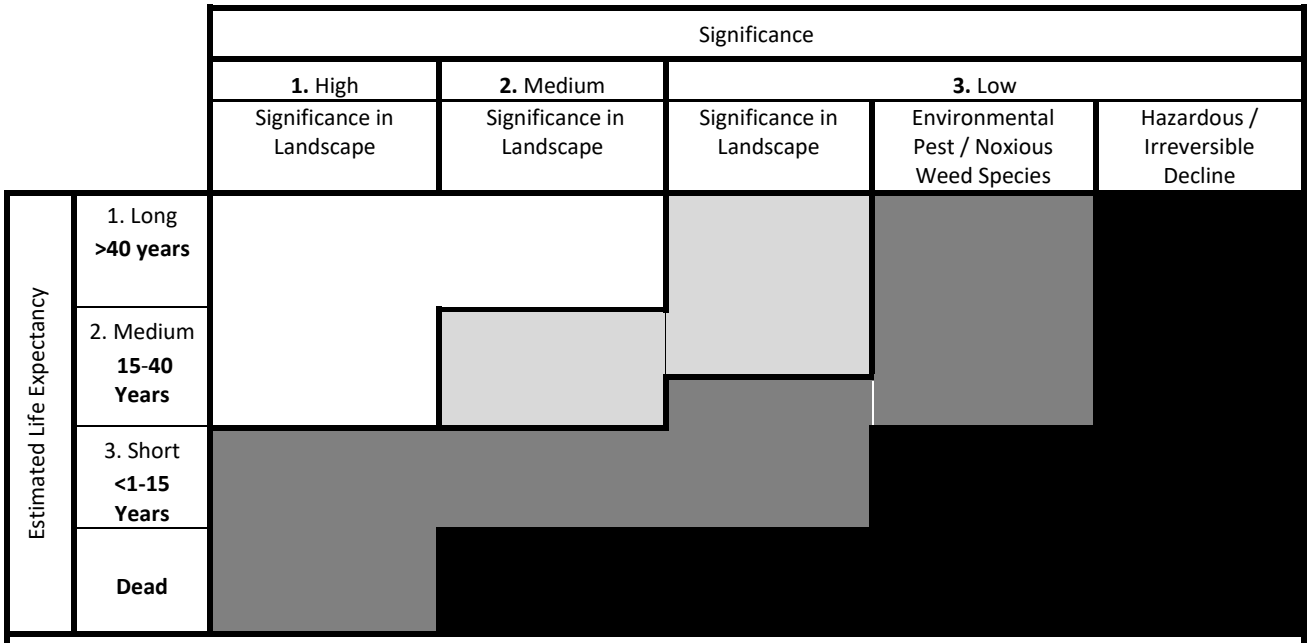
Hazardous/Irreversible Decline:

- The tree is structurally unsound and/or unstable and is considered potentially dangerous;
- The tree is dead, or is in irreversible decline, or has the potential to fail or collapse in full or part in the immediate to short term.

The tree is to have a minimum of three (3) criteria in a category to be classified in that group.

Note: The assessment criteria are designed for individual trees only, but can be applied to a monocultural stand in its entirety e.g. hedge.

In the development of this document IACA acknowledges the contribution and original concept of the Footprint Green Tree Significance & Retention Value Matrix, developed by Footprint Green Pty Ltd and Andrew Morton in June 2001.



Legend for Matrix Assessment

	Priority for Retention (High) -These trees are considered important for retention and should be retained and protected. Design modification or re-location of building/s should be considered to accommodate the setbacks as prescribed by the Australian Standard AS4970 *Protection of trees on development sites*. Tree sensitive construction measures must be implemented e.g. pier and beam etc if works are to proceed within the Tree Protection Zone.
	Consider for Retention (Medium) -These trees may be retained and protected. These are considered less critical; however their retention should remain priority with removal considered only if adversely affecting the proposed building/works and all other alternatives have been considered and exhausted.
	Consider for Removal (Low) -These trees are not considered important for retention, nor require special works or design modification to be implemented for their retention.
	Priority for Removal -These trees are considered hazardous, or in irreversible decline, or weeds and should be removed irrespective of development.

Table 1 - Tree Retention Value - Priority Matrix.

IACA, 2010, *IACA Significance of a Tree, Assessment Rating System (STARS)*, Institute of Australian Consulting Arboriculturists, Australia, www.iaca.org.au

6.4 Appendix D - Excerpt of Design Report – Marsh Street Wetlands – Part 2.2.2

(Reference document number- M5N-AJV-TER-100-300-CI-01635, Rev D, dated 21 December 2016)

2.2.2 Specialist advice

On 19 May 2016, a meeting was held with [redacted] to discuss the requirements for the Marsh Street Wetlands specifically related to the Green and Golden Bell Frogs. Representatives of Roads and Maritime [redacted] and CDSJV [redacted] also attended the meeting. The key outcomes from the meeting included:

- The key requirements of the Marsh Street Wetlands are defined in SWTC Appendix D.1. Additional requirements are provided in the Habitat Creation and Captive Breeding Plan.
- Any Camphor Laurels and Oleanders (or other potentially toxic plants) on site are to be removed.
- The landscaping around the ponds is to be grasses rather than trees. Planting is also required within the ponds to provide habitat.
- Some gabions or sandstone should be provided around the edges of the ponds and some scattered rock piles should be considered for around the site (boulder fields and over-winter habitat).
- A frog exclusion fence will be required around the site.
- A boardwalk is required to provide access to the ponds.
- The Eve Street access will require a tap for vehicle washdown.
- The control of water levels in the ponds will be a manual process – not automated.
- The shed will require:
  - Small fridge
  - Work bench / table
  - Sink and tap
  - 2 power points
  - Toilet.
- The use of treated groundwater (Arncliffe Treatment Plant) may need to be considered for the water supply to the ponds, however, the frogs cannot survive any concentrations of nitrogen, phosphorus or ammonia. An assessment will be required on the quality of the effluent to confirm if this will provide an acceptable water source (refer Section 3.1.2 for outcome).

6.5 Appendix E – Schedule of Assessed Trees

Marsh Street Wetlands.

Tree No.	*Genus* & *species* **Common Name**	Ht (m)	Sp (m)	DBH (mm)	Age	V	C	Comments	ULE	TSR	RV	SRZ (m)	TPZ (m)	TPZ (area)
1	*Eucalyptus nicholii* **Narrow Leaved Peppermint**	14	18	825	LM	G	F	Located on street. Introduced native species. High percentage of epicormic growth, prolific deadwood. Secondary stem @ 2.5m AGL. Low branches noted.	2D	H	H	3.1	9.9	308
2	*Eucalyptus nicholii* **Narrow Leaved Peppermint**	14	15	950	LM	G	F-G	Located on street. Introduced native species. Large diameter deadwood, large diameter failure over roadway, stub remains. High percentage of epicormic growth. Co-dominant @ 4m AGL.	2D	H	H	3.3	11.4	408
3	*Cupressus* sp. **Conifer**	9	5	@ 1.6m AGL 500	LM	F-P	P	Introduced exotic species. Co-dominate at 1.3m AGL, however lost co-dominant stem many years ago	3C	L	L	2.5	6.0	113
4	*Cinnamomum camphor* **Camphor laurel**	12	12	@ GL 1050	LM	G	F-G	Introduced exotic species, declared noxious weed NSW. Multi-stemmed @ base, squeezing stems.	2B	L	L	3.4	12.6	499
5	*Corymbia citriodora* **Lemon Scented Gum**	13	15	550	M	G-F	G	Introduced native specimen. Twiggy die-back, large V-shaped wound at base of stem to south-east, likely mechanical wounding.	1A	M	H	2.6	6.6	137
6	*Photinia x fraseri 'Robusta'* **Chinese Hawthorn**	4.5	10	@ GL 125	LM	G	F	Introduced exotic species. Deep inclusion into main co-dominant stems. Co-dominant @ 0.1m AGL.	5A	L	L	1.5	2	8
7	*Cinnamomum camphor* **Camphor laurel**	10	16	@GL 975	M	G	F	Introduced exotic species, declared noxious weed NSW. Multi-stemmed (4) specimen. Suspect cavity into stem, low branches.	2B	L	L	3.3	11.8	434
8	*Cinnamomum camphor* **Camphor laurel**	7	12	275	EM	G	G	Introduced exotic species, declared noxious weed NSW. Fence hard against stem, low sprawling branches.	2B	L	L	2.0	3.3	35

Tree No.	*Genus* & *species* **Common Name**	Ht (m)	Sp (m)	DBH (mm)	Age	V	C	Comments	ULE	TSR	RV	SRZ (m)	TPZ (m)	TPZ (area)
9	*Cinnamomum camphor* **Camphor laurel**	13	20	600 /400	LM	G	G-F	Introduced exotic species, declared noxious weed NSW. Multi-stemmed at approximately 3-4m AGL. Limited assessment due to location within fenced off area.	2B	L	L	2.9	8.8	241
10	*Cinnamomum camphor* **Camphor laurel**	15	35	600 /400 /1500	LM	G	G-F	Introduced exotic species, declared noxious weed NSW. Trifurcate from ground level. High percentage of deadwood.	2B	L	L	4.1	15.0	707
G11	*Sapium/Triadica sebiferum* **Chinese Tallow X 1** *Morus* sp. **Mulberry X 3**	5	8	*200	EM	G	G	Introduced exotic species, Chinese Tallow is a declared noxious weed NSW. Within large clump of weed vine and shrub species.	5B	L	L	1.7	2.4	18
G12	*Celtis sinensis* **Hackberry X 2**	8	16	300	EM	G	G	Introduced exotic species, declared noxious weed NSW. Located in dense vine/shrub growth, no access. Low, sprawling branches hitting ground.	2B	L	L	2.0	3.6	41

KEY

Tree to be retained.

Dead/noxious weed – not classed as 'a tree' under DPE conditions.

Tree proposed to be removed.

L — Low Retention Value-These trees are not considered important for retention.

M — Medium Retention Value-These trees may be retained & protected.

H — High Retention Value -These trees are considered important for retention and should be retained and protected.

* DBH/Height is visually estimated (usually adjoining trees or those that are hard to access).

AB – above *buttress roots*. AGL - above ground level.

** Determined by the largest number found (i.e. broadest branch spread or highest DBH) within a tree group to ensure ample tree protection zone.

H refers to the approximate height of a tree in metres, from base of stem to top of tree crown.

Sp refers to the approximate and average spread in metres of branches/canopy (the 'crown') of a tree.

DBH refers to the approximate diameter of tree stem at breast height i.e. 1.4 metres above ground (unless otherwise noted), and expressed in millimetres.

Age refer to Appendix A -Terms and Definitions for more detail.

V refers to the tree's vigour (health) Refer to Appendix A -Terms and Definitions for more detail.

C refers to the tree's structural condition. Refer to Appendix A -Terms and Definitions for more detail.

ULE refers to the estimated *Useful Life Expectancy* of a tree. Refer to Appendices A and B for details.

TSR The *Tree Significance Rating* considers the importance of the tree as a result of its prominence in the landscape and its amenity value, from the point of view of public benefit. Refer to Appendix C – Significance of a Tree Assessment Rating for more detail.

RV Refers to the retention value of a tree, based on the tree's ULE *and* Tree Significance. Refer to Appendix C – Significance of a Tree Assessment Rating for more detail.

SRZ Structural Root Zone (SRZ) refers to the critical area required to maintain stability of the tree. Refer to Appendix A -Terms and Definitions for more detail.

TPZ Tree Protection Zone (TPZ) refers to the *tree protection zones* for trees to be retained. Refer to Appendix A -Terms and Definitions for more detail.

6.6 Appendix F - Photographs

Photo 1 – Group 11, tree noted with red arrow is Chinese Tallow wood, noxious weed.

Photo 2 – T10. Large, mature Camphor laurel, species is a noxious weed.

Photo 3 – Tree 6; Shrub like Chinese Hawthorn.

Photo 4 – Tree 5; Lemon Scented Gum noted with red arrow.

Photo 5 – Wound at base of Tree 5.

Photo 6 – Tree 3; co-dominant stem that has been removed noted with red arrow.

Photo 7 – Street trees; Tree 2 – current gate access.

Photo 8 –The area between these two street trees is proposed to provide access into site.

6.7 Appendix G – Excerpt of HCCBP

Excerpt (Part 2.4.2) of Habitat Creation & Captive Breeding Plan (HCCBP) - Green & Golden Bell Frog at Arncliffe, Project Number 15WOL-3386, prepared by [redacted] for Eco Logical Australia Pty Ltd, Version Number 2, dated 2 March 2016

2.4.2 Removal of unwanted vegetation

The assessment of the site as part of the preferred infrastructure report identified there were some exotic and non-indigenous native trees present. The remainder of the site was exotic grassland. The trees would need to be removed for construction and also to minimise shading of the ponds. When ponds are shaded for long periods, frogs tend to not favour these areas. The vegetation removed should be disposed of appropriately. If there are some plants (non-toxic) that could be used to create over wintering habitat, they should be piled neatly for use later in the program.