Arboricultural Impact Assessment

Project Address: 1825 Pittwater Road Bayview.NSW.2104

Prepared for: Bayview Golf Club

Date: 21 April 2023

Prepared by:

Bellevue Tree Consultants

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Table of Contents

Page

1. Introduction

1.1. Engagement.

Bellevue Tree Consultants (BTC) was engaged by Bayview Golf Club the owners of the subject site identified as Lot 5/-/DP4114;1825 Pittwater Road, Bayview NSW. To provide an Arboricultural Impact Assessment (AIA) for a proposed development within the subject site. This AIA is to accompany a Development Application (DA) to Northern Beaches Council.

1.2. Aim

The aim of the report is to assess the health/vigour and structural condition of trees within the subject property, trees on neighbouring properties and street trees potentially impacted by the proposed development and make recommendations for tree protection, pruning, retention and/or removal.

1.3. Proposed development.

The renovation and replacement of 12 greens within the existing golf course.

1.4. Documents reviewed in the preparation of this report.

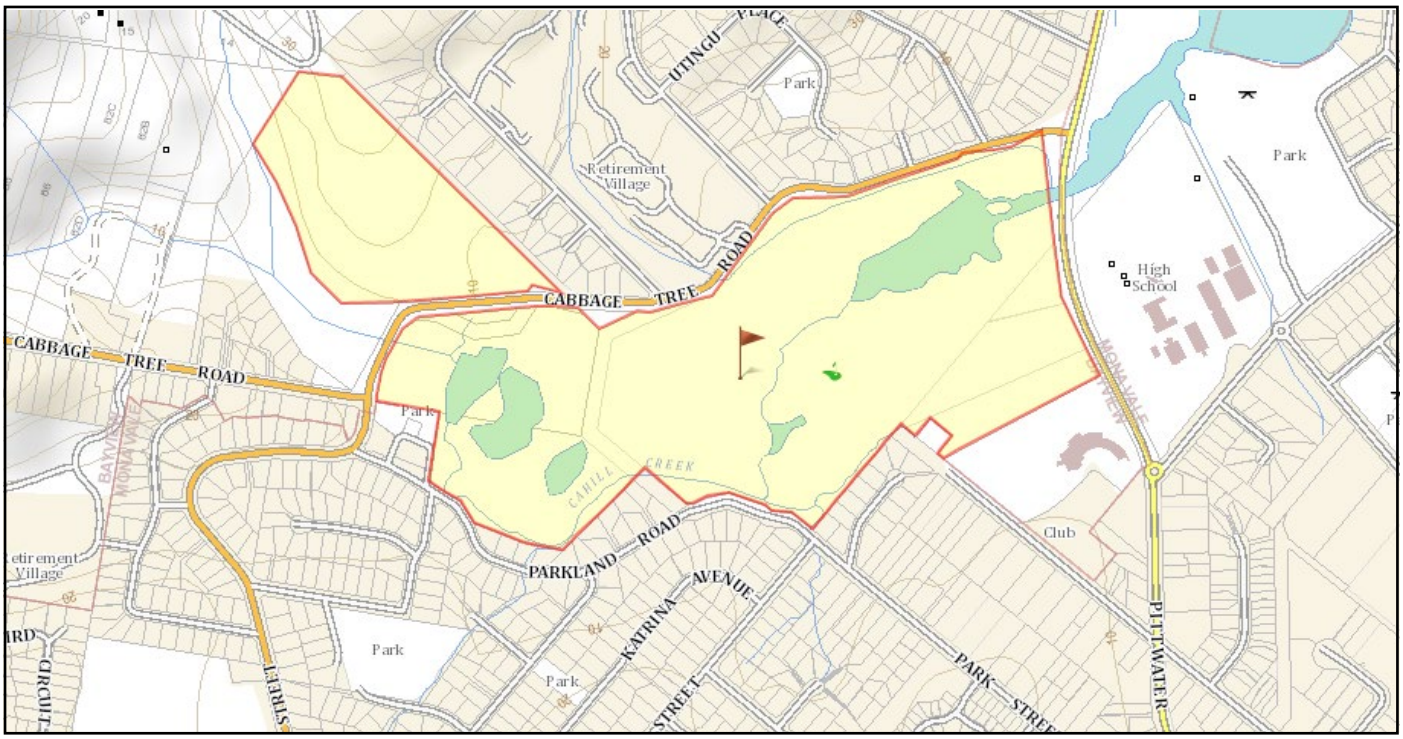
- Proposed Golf course design plans,12 holes prepared by Craig Parry Design dated 10 Jan-2022
- Pre-lodgement notes (PLM2022/0075. Northern Beaches Council dated 10 May 2022
- Northern beaches; Pittwater 21 Development Control Plan as amended 2021
- Australian Standard AS 4970-2009 'Protection of trees on Development sites'.
- Australian Standard AS 4373-2007 'Pruning of amenity trees'.

2. Methodology

- A site visit was performed on 22-03-2023, weather was clear and dry.
- Only trees within 15 m of the proposed development were assessed.
- Proposed green, bunker and associated elements were measured & outlined at ground level during site visit.
- A Tree Evaluation was completed using the Visual Tree Assessment (VTA) method as described in The Body Language of Trees (Mattheck. & Breloer 1999).
- Canopy radius and tree height were estimated. Diameter at Breast Height (DBH) at 1.4m from ground level and Diameter at Base (DAB) were measured by diameter tape measure (MillionX10). DBH was rounded up in 5mm increments. Multi-trunks DBH inserted into AS4970-2009 Calculator Council Arboriculture Victoria (CAV) to determine combined measurement in millimetres.
- All trees inspected are numbered and are provided in the Tree Schedule (refer Appendix A)
- A tree retention value has been calculated using. Tree Retention Matrix Modified by Morton.A. from Couston,M and Howden.M (2001) Tree Retention Values Table Footprint Green Pty Ltd, Sydney Australia.(Refer Appendix B)
- The Useful Life Expectancy (U.L.E.) was estimated using U.L.E. categories and sub groups *(Pre –planning Tree surveys; Barrell.J:1993).* Explanatory notes U.L.E. categories and terminology (Refer appendix D).
- A site location map showing the approximate position of the trees inspected has been included.
- Soil Landscapes of NSW *(e-spade)* was consulted, no soil samples or Ph tests were performed.
- No sonic tomograph, resistograph, or aerial inspections were performed,

3. Site Details

3.1. Figure 1. Site Location *(Source: Six maps)*



3.2 Site description.

1825 Pittwater Road is a privately owned 18-hole golf club located on the Northern Beaches bordered by Pittwater Road, Cabbage Tree Road and Parkland Road.

Table 1. Site information	
Local Government Area	Northern Beaches Council
Relevant Planning policies	Pittwater Local Environmental Plan 2014 Pittwater 21 Development Control Plan as amended 2021. State environmental planning policy (Coastal) 2018 SEPP (Biodiversity & Conservation) 2021
Land zoning	RE2 - Private recreation
Acid sulphate soils	Class 2,3 5
Soil Type.	Low lying sand plain; fine sandy loam -Field PH 7
Bush fire prone land	Vegetation buffer category 1
Biodiversity Offset Scheme (BOS) Threshold Mapping	Stand of trees South-West end fairway 2
Threatened species/Endangered ecological community LEP 2011	Swamp Oak Forest; Swamp Sclerophyll Forest remnants within course.
Heritage Item LEP 2014	3 Concrete elephant statues within course.

4. Subject trees

4.1. Of the estimated 975 trees on the course a total of 40 prescribed trees were assessed and were selected for their proximity to the proposed works (≤15m) or to demonstrate the proximity to existing construction elements and services. A tree being a palm or woody perennial plant with a single or multi stem greater than five (5) metres in height as outlined in Pittwater 21 Development Control Plan.

4.2. Of the 40 prescribed trees the species include.

- *Casuarina glauca* (Swamp She-oak)
- *Melaleuca quinquenervia* (Broad-Leaved Paperbark).
- *Eucalyptus robusta* (Swamp Mahogany)
- *Acacia spp* (Wattle)
- *Syncarpia glomulifera* (Turpentine)
- *Livistona australis* (Cabbage Tree Palm)
  - *Lagunaria patersonii* (Norfolk Island Hibiscus)
  - Tree species suitable for removal without consent. Exempt tree species list (Pittwater 21 DCP).

5. Impact Appraisal

5.1. The Tree Protection Zone (TPZ) is the area that protects the above and below ground parts of a tree. Structural Root Zone (SRZ) is the area required for tree stability. As described in the Australian Standard *Protection of trees on development sites* (AS4970), encroachments less than 10% are considered to be minor and acceptable. No specifications are provided within the AS4970 for encroachments greater than 10% and it is the consulting arborist that must investigate if the tree will remain stable and viable. The extent of potential impacts to the trees is summarised in Tables 2 and 3 and outlined in Appendix C.

Table 2. Trees proposed for removal

Impact	Removal		
	Hole No	Tree No	Retention Value
Trees wholly or partially within footprint of proposed development.	3	5	Mod
	5	6	High
Unacceptable level of impact, major encroachment into TPZ (>10%)	7	8,9,10	High
	8	12	Mod
Trees viability & stability compromised	10	21,22,23,24,25	Low
	11	27	Mod
	13	30,31,32,33,34,35,36,37,38,39 40	Mod

Table 3. Trees proposed for retention

Impact	Retention		
	Hole No	Tree No	Retention value
Works outside of TPZ or acceptable level of encroachment tolerable for the species. ❖ Trees > 15m from works. No impact. Surrounding trees can be retained and protected	1	1,2	High
	2	3	Mod
	3	4	High
	4	❖	-
	6	❖	-
	7	7	Mod
	8	11	Mod
	10	13,14,15,16,17,18,19,20	Mod
	11	26	Mod
	12	28,29	Mod

6. Conclusions and Recommendations

6.1. Holes 1, 2.
The proposed design is sufficiently set-back from the trees 1,2,3 that the encroachment from the works is considered a low level of impact (0-5%). Trees can be safely retained and protected (refer 6.10)

6.2. Holes 4, 6. Proposed design to relocate bunkers will not impact surrounding trees, all works are to be performed outside of the their TPZ. Trees are located ≥15m from proposed works. Trees can be safely retained and protected (refer 6.10)

6.3. Holes 3,5,7.
The proposed design requires bunkers to be placed within the TPZ & SRZ of trees 5,6,8,9,10. The associated earthworks and drainage trenching represents a high level of impact (>25%). This level of impact is not tolerable for the species. Trees 5,6,8,9,10 are therefore recommended for removal. Trees 4 & 7 are sufficiently set-back that the encroachment from the works is considered a low level of impact (<10%). Trees can be safely retained and protected (refer 6.10)

6.4. Hole 8.
The new bunkering and associated earthworks are sufficiently set-back from trees 11,12. However, tree 12 is in irreversible decline with a high probability of failure (Mattheck C & Breloer H 1999).Tree 12 is therefore recommended to be removed to allow neighbouring tree 11 to thrive.

6.5. Hole 10
The design for hole 10 requires the existing green to be removed and extensive ground works including demolition of existing cart path and garden beds requiring ground level changes (>300mm) with associated drainage and irrigation works impacting trees 21,24 & 25 representing a high level of impact (>25%). This level of impact is not tolerable for the species. Trees 21,24,25 are therefore recommended for removal.

Trees 13,15,16,17,18,19,20 are sufficiently set-back that the encroachment from the works is considered a low level of impact (<10%) Root mass lost can be compensated elsewhere. Trees can be safely retained and protected (refer 6.10)

Trees 22,23 will be partially impacted by the installation of new bunkers and associated earthworks with the placement of the new Tee box for hole 11. Trees are identified in the Exempt tree species list, Northern Beaches Council and are therefore recommended for removal.

6.6. Hole 11.

The proposed design requires that new bunkers be placed either side of the existing green.1 bunker (South) will impact trees 26 & 27. The excavation for the new bunker and associated earthworks represents a significant level of impact (>35%) on tree 27. This level of impact and resulting root mass loss is not tolerable for a tree currently exhibiting severe crown bias to the North. This level of encroachment will compromise trees stability. Tree 27 is therefore recommended for removal.

Tree 26 located 3m South of T27 will have a tolerable level of impact (<10%) and can be safely retained and protected (refer 6.10)

6.7. Hole 12.

The proposed design requires that a new green and bunker be placed within the existing 12th fairway. Trees 28,29 are sufficiently set-back that the encroachment from the works is considered a low level of impact (0-5%). Ensure that no soil level changes occur within 2m of tree 28. Trees can be safely retained and protected (refer 6.10)

6.8 Hole 13.

The proposed design requires the extension of the existing green and the placement of 2 new bunkers within the adjacent cluster of trees numbered 30 - 40 (11 trees). The extensive excavations and ground level changes for bunkers, drainage and irrigation works represents a significant level of impact (>35%) the volume of root mass lost is not tolerable for the species. Trees 30- 40 are therefore recommended for removal.

6.9. Tree removal.

Under the current design the proposed development will require the removal of 23 trees. Compensatory replacement trees are to be provided (refer 6.9.2 & 6.9.3)

6.9.1. Tree removal

- Tree removal shall be performed by a fully insured arborist with a minimum AQF level 3 qualification in arboriculture.
- All works performed must not damage any adjacent trees to be retained.
- The works must be undertaken in compliance with Safe Work Australia's – Guide to Managing Risks of Tree Trimming and Removal Work
- Stump grinding must not be performed within 3 metres of any retained tree.
- Any ropes used to lower branches shall not be placed over any part of trees to be retained without the appropriate trunk or branch protection.

6.9.2. The replacement trees shall:

- Be grown in accordance with the Australian Standard AS2303 Tree stock for landscape.
- Ensure there is adequate deep soil volume to support long term growth and development.

6.9.3. Suitable replacement trees include:

- *Casuarina glauca* (Swamp She-oak)
- *Melaleuca quinquenervia* (Broad-Leaved Paperbark).
- *Eucalyptus robusta* (Swamp Mahogany)
- *Elaeocarpus reticulatus* (Blueberry Ash).
- *Waterhousea floribunda* (Weeping Lilly Pilly).
- *Tristaniopsis laurina* (Water Gum)

6.10. Tree Protection.

All retained trees within area of the proposed works will require tree protection measures to be implemented prior to works commencing. Tree protection measures are designed to protect the above and below ground parts of a tree during construction including the movement & storage of materials and to be are to be supervised by the project arborist with a minimum AQF level 5 qualification in arboriculture refer to Section 7.1.1. Arboricultural Method Statement.
A detailed tree protection plan is to be implemented once details of construction methodology is finalised. Tree protection may include the installation of fencing to create a No-Go Zone within the TPZ of retained trees or trunk and ground protection as outlined in in Sections 7.2, 7.3. Tree location plans for each hole provides a guideline to placement of tree protection measures Refer Section 9.0.
For activities prohibited within the TPZ refer to Section 7.4. For excavations or installation of services within the TPZ refer to Sections 7.5, 7.6.

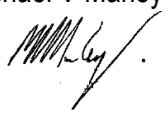
6.11. Pruning

6.11.1. Impact to the canopy of retained trees may arise from the movement and storage of construction machinery. Under no circumstances are branches or foliage to be damaged by construction machinery, where there is a conflict between tree canopy and construction machinery or any other elements, the project arborist shall provide advice and direction. All pruning is to be incompliance with AS-4373; Pruning of amenity trees and represent ≤10% of total canopy removed within a 12-month period.

6.11.2. No root pruning on any retained trees is to occur, unless under the supervision of the project arborist

Regards

Michael V Marley



Principle Arborist
Bellevue Tree Consultants
Dip Hort / Dip Arb
AQF level 5 (TAFE-2006-2911234)
Registered Quantified Tree Risk Assessment (QTRA) and Advanced registered licensee (QTRA4431).
Accredited member- Institute of Australian Consulting Arboriculturists (ACM0692019).

7. Arboricultural Method Statement

7.1 Prior to works commencing

7.1.1 A project arborist is to be engaged prior to any demolition or constructions works. The Project Arborist shall have a minimum AQF level 5 qualification in Arboriculture.

7.1.2 The Project Arborist, in consultation with the Project Supervisor, are to review and augment the site contractor induction to ensure all tree protection measures and all relevant guidelines within this statement are included.

7.1.3 Details of requirements relating to Project Arborists are set out in section 7.9 Key hold points.

7.1.4 Principal contractor to implement all tree protection measures in compliance with the tree protection plan and tree protection guidelines.

7.2 Tree protection guidelines

All tree protection measures must be maintained in good condition during the construction works and kept in place until the completion of works or as otherwise advised by the Project Arborist.

7.2 1 Each Tree Protection Zone shall:

- be enclosed by a 1.8m high fully supported chainmesh protective fencing.
- The fencing shall be secure and fastened to prevent movement.
- The fencing shall have a lockable opening for access.
- Roots greater than ≥40mm in diameter shall not be pruned, damaged, or destroyed during the installation or maintenance of the fencing.

7.2.2 The fencing shall not:

- be moved, altered or removed without the approval of the Project Arborist;
- have a minimum of two signs that include the words “Tree Protection Zone – Keep Out”. Each sign shall be a minimum size of 600mm x 500mm and state the name and contact details of the Project Arborist. Signs shall be attached facing outwards in prominent positions at 10 metre intervals or closer where the fence changes direction.
- The TPZ shall be kept free of weeds except where there is existing turf. The weeds shall be removed by hand; and unless the existing surface is turf, have mulch installed and maintained to a depth of 75mm. The mulch shall consist of mixed leaf and coarse woodchip in accordance with AS4454:2012 Composts, Soil Conditioners and Mulches.

7.3 Ground protection and trunk protection

7.3.1 Shall be installed when the Project Arborist determines protection fencing is not feasible, or the tree protection fencing is to be temporarily removed.

7.3.2 The stem and branches of retained trees shall be protected, as follows:

- install 65mm Drain coil Agg pipe around trunk at 1m intervals (refer Figure 6)
- install hardwood or treated pine timbers (100mm x 50mm) the same length as the stem or branch shall be positioned over the drain coil and next to each other around the stem or branch, secured together with galvanised wire or strapping. Boards shall not be nailed or screwed into the stem or branch.
- No part of the protection shall be secured to the tree.

7.3.3 The ground surface within the Tree Protection Zone shall be protected by placing geotextile fabric on the ground surface, covered with a layer of mulch to a depth of 75mm and then placing load bearing boarding (truck matts, steel plates or similar material) on top. The geotextile fabric and mulch shall be kept clear of tree stems by a least 50mm.

7.4 Activities prohibited within the Tree Protection Zone

- disposal of chemicals and liquids (including concrete and mortar slurry, solvents, paint, fuel or oil)
- stockpiling, storage or mixing of materials
- refuelling, parking, storing, washing and repairing tools, equipment, machinery and vehicles
- disposal of building materials and waste
- increasing or decreasing soil levels (cut and fill);
- soil cultivation, excavation or trenching;
- placing of offices or sheds;
- erection of scaffolding or hoardings; and/or
- any other act that may adversely affect the vitality or structural condition of the tree.

7.5 Excavation within the Tree Protection Zone

7.5.1 Shall be undertaken using non-destructive methods (e.g. an airspade, hydro-vac or by hand) to ensure no roots greater than ≥40mm in diameter are damaged, pruned or removed. All care shall be taken to preserve and avoid damaging roots; Where roots <40mm cannot be avoided, they are to be clean cut with sharp saw or secateurs. All exposed roots are to be covered immediately with mulch or dampened hessian or similar material.

7.5.2 Excavation shall not to occur within the Structural Root Zone

7.5.3 Any additional stormwater drainage, detention pits, rainwater tanks and/or absorption trenches must accommodate the TPZ's set out in Appendix A - Tree assessment schedule. All amended plans shall be reviewed, and the impact assessed by the Project Arborist.

7.6 Installation of underground services

7.6.1 The method for trenching within a TPZ shall either be by hand methods e.g. hand digging with a spade or trowel, hydro-vac or an air spade. Trenchless technology such as directional underground boring shall be considered where feasible.

The underground services shall be positioned below the network of protected roots without causing damage to roots ≥40mm in diameter.

7.6.2 Where feasible, all underground services shall be routed & installed beyond the identified TPZ's. Where it is impossible to divert services beyond the TPZ's, detailed plans showing the proposed routing shall be drawn in conjunction with advice from the Project Arborist.

7.6.3 Topsoil and subsoil excavated from the trench shall be deposited into separate piles and kept apart and covered until required for backfilling.

7.6.4 No roots ≥40mm in diameter are to be severed without prior agreement with the Project Arborist.

7.6.5 In cases of extreme heat or unless the trench is to be backfilled within the same day, all exposed roots > 40mm in diameter shall be wrapped with damp hessian to prevent drying out.

7.6.6 Where is it necessary to sever any woody roots, they shall be clean cut with secateurs or a pruning saw.

7.7 Demolition

7.7.1 To prevent root damage all demolition works within the TPZ are be performed with the use of hand tools and/or machinery with a long reach located outside the TPZ or supported by ground protection.

7.7.2 To ensure trees are not impacted by the movement of vehicles or machinery, a no-go zone area shall be established using protective fencing (refer A.G3 Tree Protection Plan). If protection fencing must be moved or is not practicable, then ground protection shall be installed and approved by the Project Arborist (refer section 7.3.3).

7.7.3 Impact to the canopy may arise from the operation (slewing) of cranes or similar construction machinery. Under no circumstances are branches or foliage to be damaged by construction machinery, where there is a conflict between tree canopy and construction machinery or other elements (e.g. scaffolding), the project arborist shall provide advice and direction.

7.8 Landscaping

7.8.1 Any new gardens and footpaths are to be installed on or slightly above existing levels.

7.8.2 No excavation within the TPZ or skimming within the SRZ shall occur.

7.8.3 For turfing, the existing ground levels shall be maintained within a minimum variation of depth or height of 50mm.

7.8.4 Excavation for new plant material shall be flexible in their location, if tree roots >40mm within the TPZ are encountered, the planting hole is to be moved to avoid roots.

7.8.5. Fencing posts shall be flexible in their location, if tree roots >40mm within the TPZ are encountered, the post hole is to be moved to avoid roots

7.8.6. Excavation for irrigation services (trenching) refer 7.5

7.8.7. Any additional retaining walls must accommodate the TPZ's set out in Appendix A - Tree assessment schedule. All amended plans shall be reviewed, and the impact assessed by the Project Arborist.

7.9 Key Hold Points (Table 4)

Hold point	Stage	Task	Responsibility	Certification
1	Prior to all work commencing.	Clearly mark trees approved for removal.	Principle contractor	Project arborist
2	Prior to demotion and site establishment	Implement all approved tree protection measures	Principle contractor	Project arborist
3	Construction	Supervision of excavations within the TPZ	Principle contractor	Project arborist
4	Monthly inspections or as required	Inspection of trees and tree protection and/or any works within the TPZ.	Principle contractor	Project arborist
5	Prior to issue of occupation certificate	Final inspection of trees	Principle contractor	Project arborist

8. Examples of tree protection.

Figure 4. Tree protective fencing and signage.

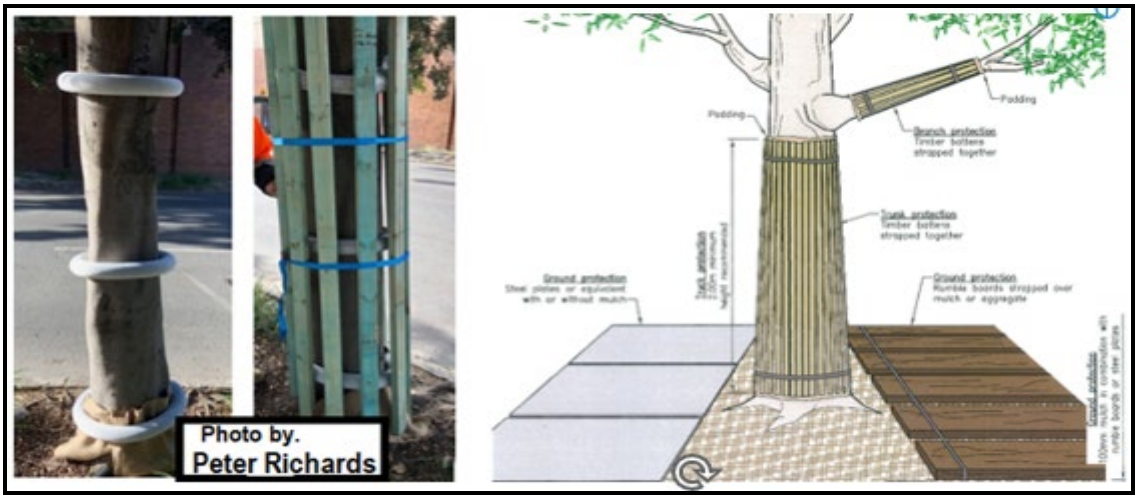


Figure 5. Trunk and branch protection.

Figure 6. Ground protection.

9.0.Tree location plan.

Hole 2

Retain & protect tree 3


Hole 3
Remove Tree 5. Protect tree 4
5
4
3rd
Legend
Tree No 22
Tree Removal
Tree Retention
Tree Protective Fencing

Hole 4

Trees >15m from works. Restrict movement & storage of materials from neighbouring trees

Hole 5

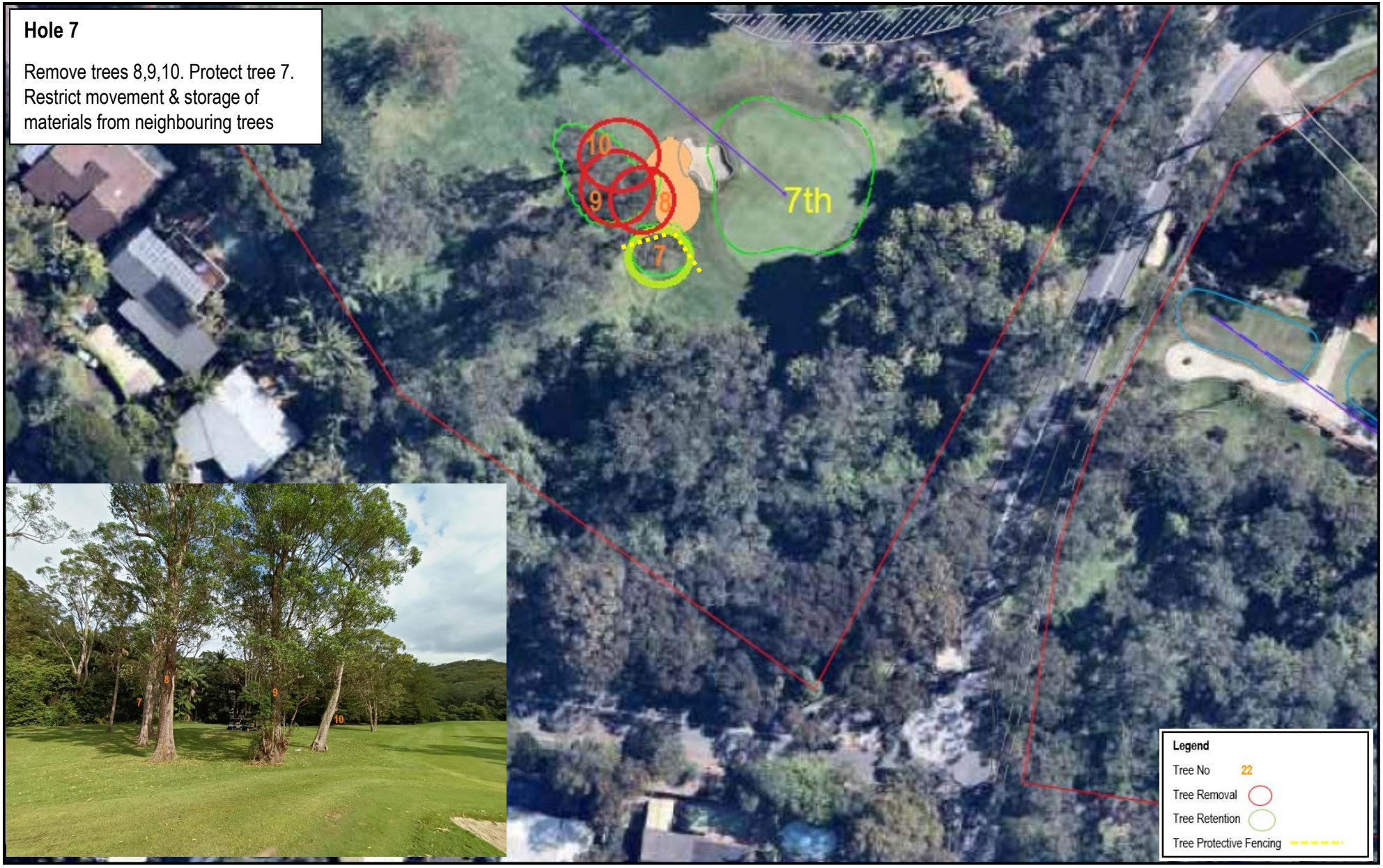
Remove Tree 6. Restrict movement & storage of materials from neighbouring trees

Hole 6.

Trees >15m from works. Restrict movement & storage of materials from neighbouring trees

Hole 7

Remove trees 8,9,10. Protect tree 7. Restrict movement & storage of materials from neighbouring trees

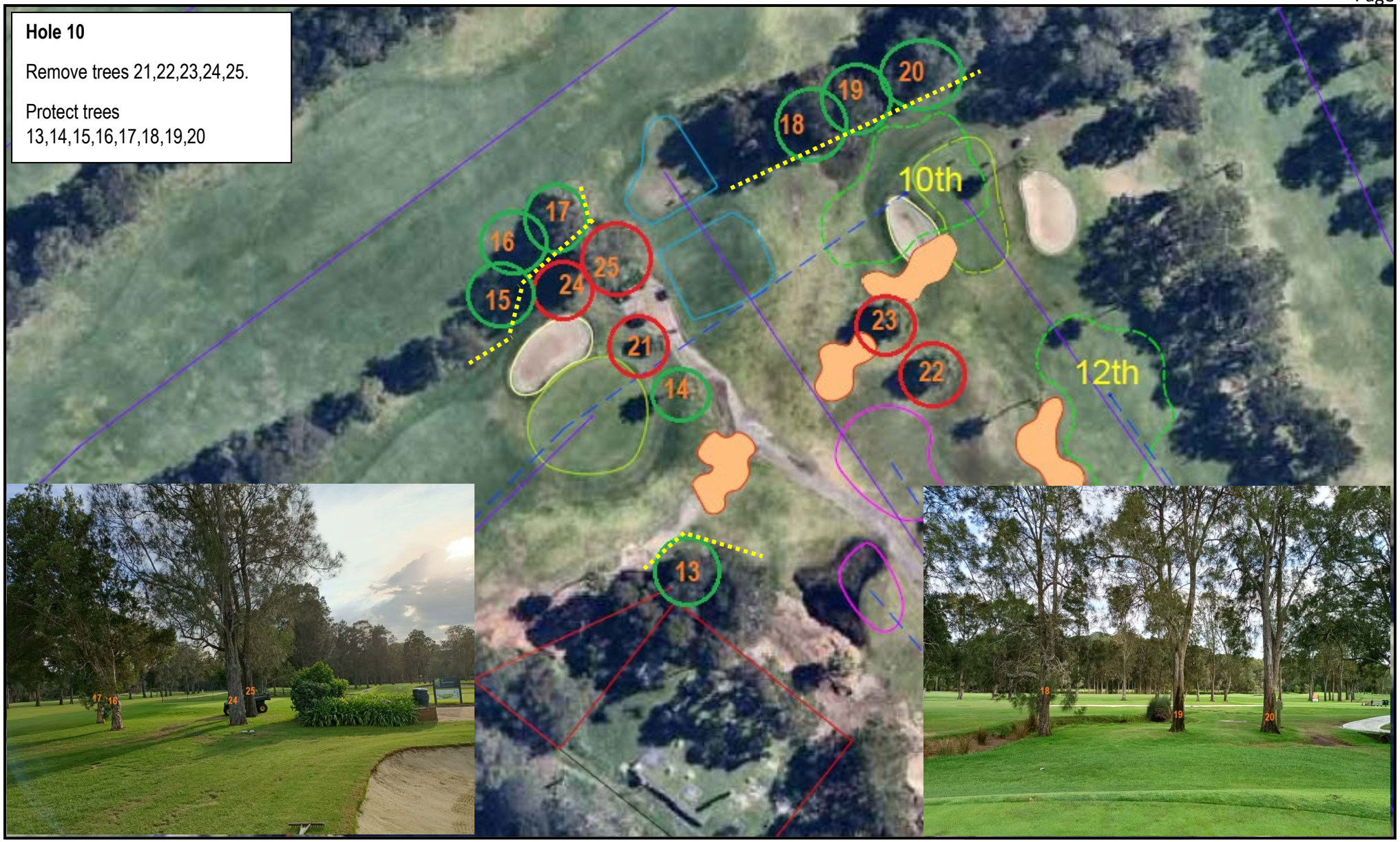



Hole 8
Remove Tree 12. Protect tree 11
12
11
8th
11
12
Legend
Tree No 22
Tree Removal
Tree Retention
Tree Protective Fencing

Hole 10

Remove trees 21,22,23,24,25.

Protect trees
13,14,15,16,17,18,19,20



Hole 11

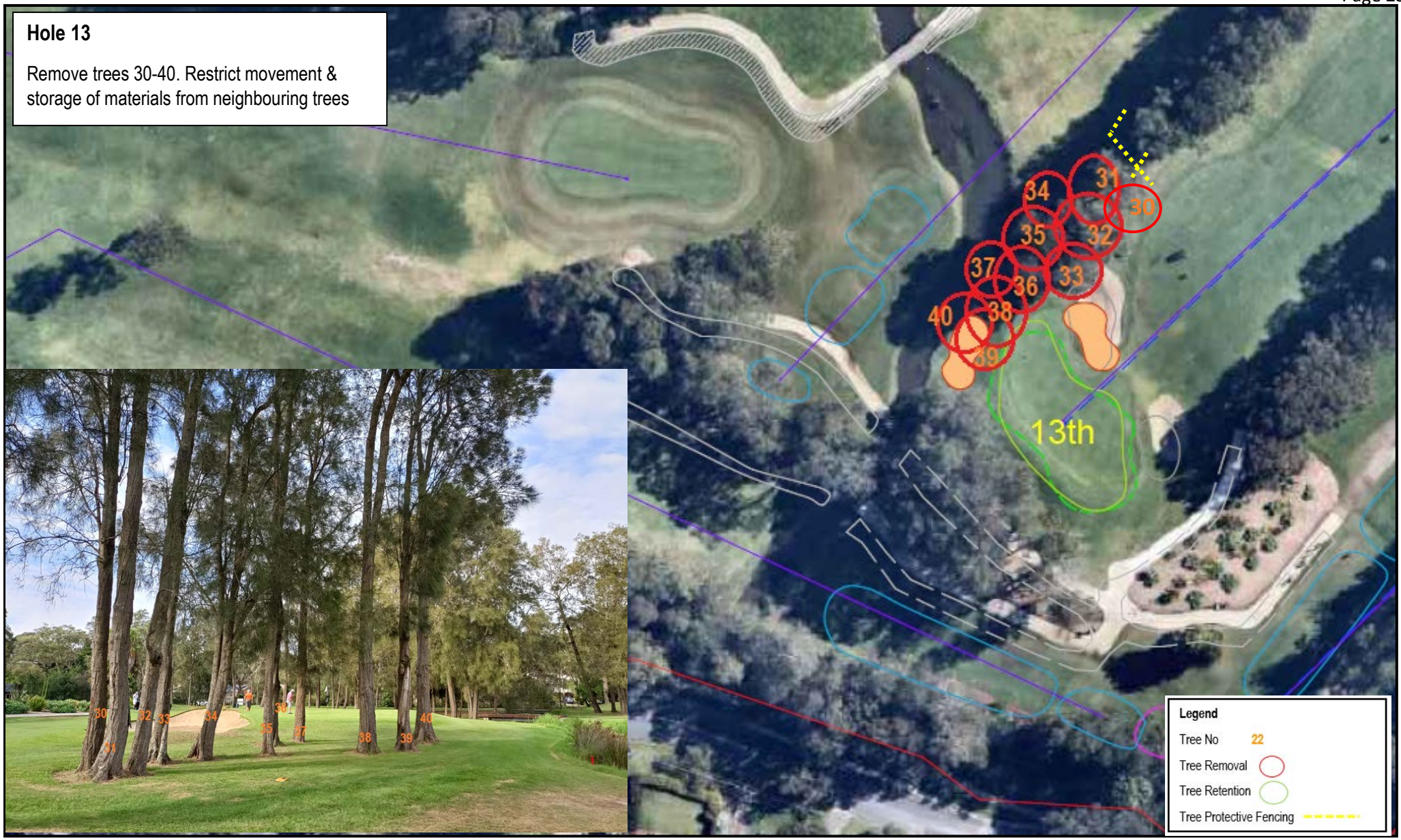
Remove tree 27. Protect tree 26

Hole 12

Protect trees 28 & 29 by restricting movement & storage of materials. No soil level changes within 2m of T28

Hole 13

Remove trees 30-40. Restrict movement & storage of materials from neighbouring trees



Appendix A. Tree assessment schedule

Tree No	Botanical & Common Name	Age	Height (m)	DBH & DAB (mm)	TPZ & SRZ (m)	Canopy Radius (m)	ULE	Condition	Vigour	Retention Value	Crown Class	Live crown Ratio (%)	Landscape significance	Comment
1	*Casuarina glauca* (Swamp She-oak)	M	18	440 510	5.28 2.5	3.0	15-40 2.d	Fair	Good	High	Co	80	3	Fork @ 2m Sound union, Low probability of failure (Slater 2016) Pruning stubs with good wound-wood development. Crown bias to North-East. Soil compaction within TPZ.
2	*Casuarina glauca* (Swamp She-oak)	M	15	350 400	4.2 2.2	2.5	15-40 2.d	Fair	Good	Mod	Co	80	4	Fork @ 1m Sound union, Low probability of failure (Slater 2016) Pruning stubs with good wound-wood development. Crown bias to North-East. Soil compaction within TPZ.
3	*Melaleuca quinquenervia* (Broad-Leaved Paperbark).	M	12	450 500	5.4 2.4	4.0	5-15 3.b	Fair	Fair	Mod	Dom	50	5	Sparse foliage. Fork @ 1.4m sound union, Low probability of failure (Slater 2016). Deadwood <10%
4	*Eucalyptus robusta* (Swamp Mahogany)	M	16	650 700	7.8 2.8	3.0	15-40 2.d	Good	Good	High	Dom	75	3	Fork @ 4m Sound union, Low probability of failure (Slater 2016) Pruning stubs with good wound-wood development.
5	*Eucalyptus robusta* (Swamp Mahogany)	M	16	620 680	7.4 2.8	3.0	15-40 2.d	Fair	Fair	Mod	Dom	70	4	Sparse foliage with deadwood & deadwood stubs. Mechanical damage at base
6	*Eucalyptus robusta* (Swamp Mahogany)	M	16	890 920	10.6 3.2	3.5	15-40 2.b	Fair	Fair	Mod	Dom	60	4	Fork @ 2.2m Sound union, Low probability of failure (Slater 2016). North leader with wound/cracks/splits.
7	*Eucalyptus robusta* (Swamp Mahogany)	M	15	350 400	4.2 2.2	3.0	15-40 2.b	Fair	Good	Low	Co	60	5	Fork @ 2m Sound union, Low probability of failure (Slater 2016) Pruning stubs with good wound-wood development.
8	*Eucalyptus robusta* (Swamp Mahogany)	M	16	775 850	9.3 3.0	3.0	15-40 2.b	Fair	Fair	Mod	Co	70	4	Wound to trunk @ 2m. Epicormic shoots.

Tree No	Botanical & Common Name	Age	Height (m)	DBH & DAB (mm)	TPZ & SRZ (m)	Canopy Radius (m)	ULE	Condition	Vigour	Retention Value	Crown Class	Live crown Ratio (%)	Landscape significance	Comment
9	*Eucalyptus robusta* (Swamp Mahogany)	M	16	800 980	9.6 3.2	3.0	15-40 2.d	Poor	Fair	Mod	Co	70	4	Mechanical damage to base. Medium volume epicormic shoots (Draper & Richards 2009). Sooty mould in mid-upper crown.
10	*Eucalyptus robusta* (Swamp Mahogany)	M	16	720 780	8.6 2.9	3.0	5-15 3.b	Poor	Fair	Mod	Co	60	4	Hollow @ base with decay. Sparse foliage. Deadwood <20% & deadwood stubs. Fair wound-wood development. Self-correcting trunk bias.
11	*Casuarina glauca* (Swamp She-oak)	M	10	300 350	3.6 2.1	2.0	40+ 1.a	Good	Good	Low	Co	80	6	Sound branching habit. No pest or disease. Obstructed by T12
12	*Acacia spp* (Wattle)	M	8	520 600	6.2 2.6	3.0	<5 4.c	Poor	Poor	Low	Co	40	7	Multi-trunked at base with cracks. Previous side trunk failure. In decline
13	*Casuarina glauca* (Swamp She-oak)	M	14	800 850	9.6 3.0	3.0	15-40 2.b	Fair	Good	Mod	Co	70	5	Fork @ Base cracked union, High probability of failure (Slater 2016) Pruning stubs with good wound-wood development.
14	*Livistona australis* (Cabbage Tree Palm)	M	16	150 200	2.5 1.5	1.5	40+ 1.a	Good	Good	Mod	Dom	20	4	Sound branching habit. No pest or disease.
15	*Melaleuca quinquenervia* (Broad-Leaved Paperbark).	M	12	300 350	3.6 2.1	2.5	15-40 2.b	Fair	Good	Low	Co	50	5	Fork @ 1m Sound union, Low probability of failure (Slater 2016) Pruning stubs with good wound-wood development.
16	*Melaleuca quinquenervia* (Broad-Leaved Paperbark).	M	12	250 300	3.0 2.0	3.0	15-40 2.b	Fair	Good	Mod	Co	50	5	Fork @ 1.4m Sound union, Low probability of failure (Slater 2016) Pruning stubs with good wound-wood development.
17	*Melaleuca quinquenervia* (Broad-Leaved Paperbark).	M	12	350 400	4.2 2.2	3.5	15-40 2.b	Fair	Good	Mod	Co	50	5	Fork @ 1m Sound union, Low probability of failure (Slater 2016) Pruning stubs with good wound-wood development.

Tree No	Botanical & Common Name	Age	Height (m)	DBH & DAB (mm)	TPZ & SRZ (m)	Canopy Radius (m)	ULE	Condition	Vigour	Retention Value	Crown Class	Live crown Ratio (%)	Landscape significance	Comment
18	*Casuarina glauca* (Swamp She-oak)	M	16	600 650	7.2 2.7	3.0	15-40 2.d	Fair	Fair	Mod	Co	80	4	Fork @ 2m Sound union, Low probability of failure (Slater 2016) Deadwood 15%
19	*Casuarina glauca* (Swamp She-oak)	M	16	550 600	6.6 2.6	3.0	15-40 2.d	Fair	Fair	Mod	Co	80	4	Fork @ 2.4m Sound union, Low probability of failure (Slater 2016). Mechanical damage @ base wound with decay. Minor deadwood<10%
20	*Casuarina glauca* (Swamp She-oak)	M	16	400 450	4.8 2.3	3.0	15-40 2.d	Fair	Fair	Mod	Co	80	4	Fork @ 1.8m Sound union, Low probability of failure (Slater 2016). Mechanical damage @ base wound with decay. Minor deadwood<10%
21	*Lagunaria patersonii* (Norfolk Island Hibiscus)	M	4	300 350	3.6 2.1	1.8	15-40 2.c	Fair	Good	Low	Dom	70	6	Poor pruning history. Previously looped
22	*Lagunaria patersonii* (Norfolk Island Hibiscus)	M	4	300 350	3.6 2.1	1.8	15-40 2.c	Fair	Good	Low	Dom	70	6	Poor pruning history. Previously looped
23	*Lagunaria patersonii* (Norfolk Island Hibiscus)	M	4	300 350	3.6 2.1	1.8	15-40 2.c	Fair	Good	Low	Dom	70	6	Poor pruning history. Previously looped
24	*Casuarina glauca* (Swamp She-oak)	M	14	480 520	5.7 2.5	2.5	15-40 2.d	Fair	Fair	Mod	Co	70	5	Fork @ 1.8m Sound union, Low probability of failure (Slater 2016). Mechanical damage @ base. Minor deadwood<10%
25	*Casuarina glauca* (Swamp She-oak)	M	14	620 660	7.4 2.7	3.0	15-40 2.d	Fair	Fair	Mod	Co	70	5	Fork @ 1.6m Sound union, Low probability of failure (Slater 2016). Mechanical damage @ base. Minor deadwood<10%
26	*Eucalyptus robusta* (Swamp Mahogany)	M	12	460 500	5.6 2.4	3.0	15-40 2.d	Fair	Fair	Mod	Co	60	5	Fork @ 1.8m Sound union, Low probability of failure (Slater 2016).Minor deadwood <10%

Tree No	Botanical & Common Name	Age	Height (m)	DBH & DAB (mm)	TPZ & SRZ (m)	Canopy Radius (m)	ULE	Condition	Vigour	Retention Value	Crown Class	Live crown Ratio (%)	Landscape significance	Comment
27	*Eucalyptus robusta* (Swamp Mahogany)	M	12	470 500	5.7 2.4	5.0	5-15 3.b	Poor	Fair	Mod	Co	50	5	Severe lean (>30º). Self-correcting trunk bias to North. Excessive end weight. Minor deadwood 10%.
28	*Livistona australis* (Cabbage Tree Palm)	M	18	150 200	2.5 1.5	1.5	40+ 1.a	Good	Good	Mod	Dom	20	4	Sound branching habit. No pest or disease.
29	*Livistona australis* (Cabbage Tree Palm)	M	18	150 200	2.5 1.5	1.5	40+ 1.a	Good	Good	Mod	Dom	20	4	Sound branching habit. No pest or disease.
30	*Casuarina glauca* (Swamp She-oak)	M	14	300 350	3.6 2.1	2.0	15-40 2.d	Fair	Fair	Mod	Co	70	5	Fork @ 2.4mSound union, Low probability of failure (Slater 2016Minor deadwood<10%
31	*Casuarina glauca* (Swamp She-oak)	M	14	350 370	4.2 2.3	2.2	15-40 2.d	Fair	Fair	Mod	Co	70	5	Self-correcting trunk bias. Mechanical damage @ base. Minor deadwood<10%
32	*Casuarina glauca* (Swamp She-oak)	M	14	280 310	3.4 2.2	2.0	15-40 2.d	Fair	Fair	Mod	Co	70	5	Slight lean-to West <15º. Minor deadwood
33	*Casuarina glauca* (Swamp She-oak)	M	9	300 350	3.6 2.1	2.2	15-40 2.d	Poor	Fair	Mod	Supp	70	5	Previous branch failure upper crown. Mechanical damage @ base.
34	*Casuarina glauca* (Swamp She-oak)	M	10	310 360	3.7 2.2	2.0	15-40 2.d	Poor	Fair	Mod	Supp	70	5	Hollow @ base with decay. Deadwood <20% & deadwood stubs. Torsion wind effect to trunk. Fork @ 1.6m sound
35	*Casuarina glauca* (Swamp She-oak)	M	14	200 250	2.4 1.8	2.0	15-40 2.d	Fair	Fair	Mod	Co	70	5	Fork @ 4m. Sound union, Low probability of failure (Slater 2016Minor deadwood<10%

Tree No	Botanical & Common Name	Age	Height (m)	DBH & DAB (mm)	TPZ & SRZ (m)	Canopy Radius (m)	ULE	Condition	Vigour	Retention Value	Crown Class	Live crown Ratio (%)	Landscape significance	Comment
36	*Casuarina glauca* (Swamp She-oak)	M	10	300 350	3.6 2.1	2.0	15-40 2.b	Fair	Fair	Mod	Co	70	5	Torsion wind effect to trunk with crack forming @ base. Wound @2.4m.
37	*Casuarina glauca* (Swamp She-oak)	M	14	300 350	3.6 2.1	2.0	15-40 2.b	Good	Fair	Mod	Co	70	5	Sound branching habit. No pest or disease.
38	*Casuarina glauca* (Swamp She-oak)	M	14	350 400	4.2 2.2	2.0	15-40 2.b	Fair	Fair	Mod	Co	70	5	Fork @ 4m Sound union, Low probability of failure (Slater 2016. Minor deadwood<10%. Crack forming @ base
39	*Casuarina glauca* (Swamp She-oak)	M	14	280 300	3.4 2.0	2.0	5-15 3.b	Poor	Fair	Low	Co	70	6	Large wound @ 0.5 -1.4m from branch failure, with epicormic shoots. Fair wound wood development
40	*Casuarina glauca* (Swamp She-oak)	M	14	370 420	4.4 2.3	2.2	15-40 2.b	Fair	Fair	Mod	Co	70	5	Fork @ 8m Sound union, Low probability of failure (Slater 2016. Minor deadwood<10%. Crack forming @ base.

Appendix B. Tree Retention Matrix

Estimated Life Expectancy	Landscape Significance Rating 1	2	3	4	5	6	7
Long - Greater than 40 Years	High Retention Value						
Medium- 15 to 40 Years			Moderate Value	Retention			
Short - 5 to 15 years				Low Ret. Value			
Transient - Less than 5 Years				Very Low Retention Value			
Dead or Potentially Hazardous							

Modified by Morton .A. from Couston,M and Howden.M (2001) Tree Retention Values Table Footprint Green Pty Ltd, Sydney Australia.

Appendix C. Explanation of terms

Height – Provided in Tree Schedule as metres

U.L.E. - Useful Life Expectancy.

D.B.H - Diameter at Breast Height (*measured at 1.4 meters from base*)

D.A.B - Diameter at base.

Age Class - J juvenile **SM** semi mature **M** mature **OM** over mature

Crown Class - D Dominant **CO** Co-dominant **I** Intermediate **S** Suppressed

Live Crown Ratio - Is the ratio of the foliage canopy to the total height of the tree.

Canopy Spread - N north **S south** **E** east **W** west

T.P.Z. Tree Protection Zone means an area above and below ground calculated in accordance with AS 4970-2009 Protection of trees on development sites. It is a radial distance from the stem set aside for the protection of a tree's roots and crown to provide for the viability and stability of the tree. The extent of potential impacts to the trees is summarised as:
0% of root zone impacted – no impact of significance
0 to 10% of TPZ impacted – low level of impact
10 to 15% of TPZ impacted – low to marginal level of impact
15 to 20% of TPZ impacted – marginal level of impact
20 to 25% of TPZ impacted – marginal to high level of impact
25 to 35% of TPZ impacted – high level of impact
>35% of TPZ impacted – significant level of impact *(Sourced from Guy Paroissien Landscape Matrix Pty Ltd)*

S.R.Z. Structural Root Zone is the area root zone area required to maintain a stable tree. The tree's woody roots and soil cohesion in this area are necessary to hold the tree upright. It is a radial distance from the stem calculated in accordance with AS 4970 -2009 Protection of trees on development sites. A greater area is required to maintain a trees vigour and longevity.

Vigour. The general appearance of the canopy/foliage of the tree at the time of inspection. Vigour can vary with the season and rainfall frequency. A tree can have 'Good' vigour but be hazardous due to 'Poor' condition. A tree in good vigour has the ability to sustain its life processes. Vigour is synonymous with health **G** Good **F** Fair **P** Poor

Wound wood Development - **G** Good **F** Fair **P** Poor

Structural Condition The general form and structure of the trunk/s and branching. Trunk lean, trunk/branch structural defects, canopy skewness or other hazards are considered. - **G** Good **F** Fair **P** Poor

Appendix D. U.L.E

Useful Life Expectancy (U.L.E) Categories and Subgroups (J Barrell 1996)

1. Long ULE > 40 Years

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 of 15 – 40 Years

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 of 5 – 15 Years

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. Remove tree within 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

5.Trees suitable for transplanting.

a) small trees less than 5m in height

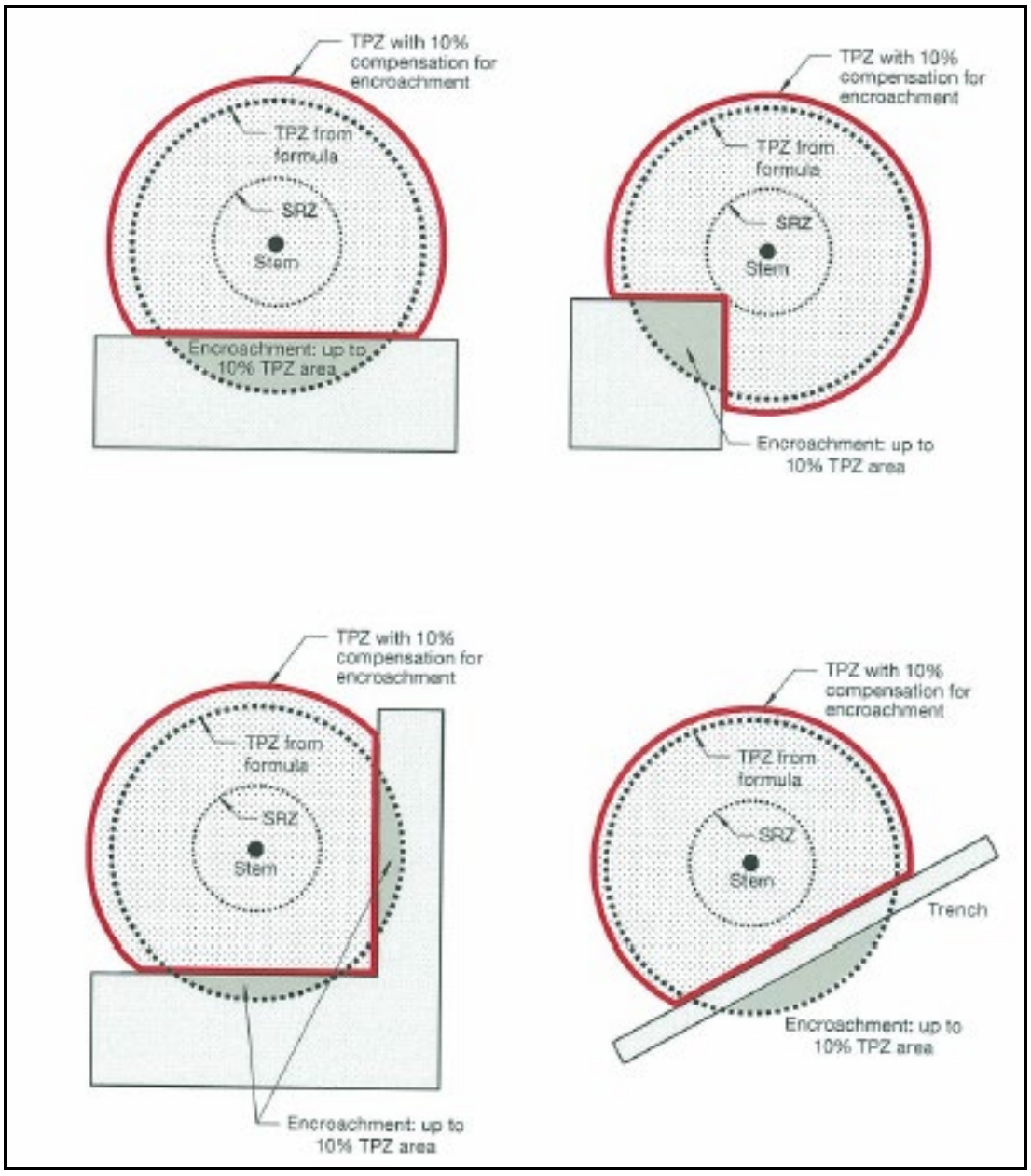
b) young trees less than 15 years old but over 5m in height

c) formal hedges and trees intended for regular pruning to control growth.

d) palms, monocots, cycads and tree ferns.

Appendix E. Examples of minor encroachment into the TPZ

Sourced from AS4970 Protection of trees on development sites-2009.



Appendix F. References

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- Appendix C. TPZ potential impacts. Sourced from Guy Paroissien Landscape Matrix Pty Ltd