



ARBORICULTURAL ASSESSMENT REPORT

Sydney Modern

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Prepared for
NSW Planning & Environment

Prepared by

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Executive Summary

This Arboricultural Assessment Report has been commissioned by NSW Planning & Environment to report on trees within the site of Sydney Modern. Sydney Modern is the proposed expansion of the existing Art Gallery of NSW as a new stand-alone building located on the adjacent Phillip Precinct of the Domain. The Scope of works has been defined as follows:

- Review the Arboricultural Impact Assessment Report prepared by Earthscape Horticultural Services, addendums 1 and 2 to the report, the proposed landscape plans, and other documentation (as relevant).
- Undertake an assessment and providing comments and recommendations in relation to:
 - o Whether any additional high significance trees in close proximity to the proposed development can be retained in-situ rather than removed or transplanted.
 - o Specifically the Trees to be assessed are 1363, 4578, 4579, 4580, 4581, 1226, 1227, 742, 1118, 1228, 2434, 2436, 2995 and 3002.
 - o whether Tree 1227 (Joseph Beuys tree) should be retained in-situ
 - o the risks associated with the proposed transplant of nine trees and methods to mitigate these risks
 - o Whether the proposed replacement tree planting scheme would provide an improved horticultural outcome on the site in the longer term. If appropriate, recommendations should be made to improve the overall horticultural outcome.

This report finds the subject trees to be in good health and condition. The subject trees are all found to have high landscape significance and high retention value.

The impact of the proposed development on the subject trees has been assessed in accordance with *AS4970-2009 Protection of Trees on Development Sites*. This Standard determines the Tree Protection Zones (TPZ) for each individual tree and defines a maximum of 10% encroachment to be a minor encroachment. Any encroachment over 10% requires the project arborist to give consideration as to the viability of the tree due to the proposed development. The impact of the built form and bulk earthworks has been separately calculated and combined to determine the overall encroachment within the TPZ of the subject trees.

The TPZ of Trees 742, 2436, 2995 and 3002 are totally encroached by the proposed bulk earthworks and are not viable to be retained due to the proposed development.

The TPZ of Trees 1227, 1228, 4578, 4579, 4580 and 4581 are totally encroached by the proposed built form and are not viable to be retained due to the proposed development.

The TPZ of Trees 1118 and 2434 are have an overall encroachment that is a major encroachment and significantly greater than the minor encroachment defined by *AS4970-2009*. This extent of encroachment is likely to impact the health and condition of these trees and these trees are not viable to be retained due to the proposed development.

Trees 2434, 2995 and 3002 are proposed to be removed.

Trees 742, 1227, 1228, 1363, 2436, 4578, 4579, 4580 and 4581 are proposed to be transplanted. The Transplanting methodology and specification provided in Section 12 of Earthscape Horticultural Services Arboricultural Impact Assessment Report – Art Gallery of NSW Expansion Project – Sydney Modern dated 3 November 2018 represents industry best practice and will provide suitable conditions for the successful transplantation of the subject trees however as these trees are large, established trees, there is a residual risk that these trees may not be successfully transplanted. In order to further mitigate this risk this report nominates a number of risk mitigation factors in section 8.3.

Trees 1118 and 1126 are proposed to be retained. Tree 1126 is not encroached by the proposed development and remains viable to be retained. The total area of the TPZ encroachment of Tree 1118 is 45%. This is significantly greater than the 10% minor encroachment as defined by AS4970-2009. This extent of encroachment is likely to impact on the health and condition of this tree and therefore the viability of this tree to be retained within the landscape in-situ. This tree is currently in good health and condition with a dense canopy, minimal deadwood and minimal epicormic growth however it was noted that there is a significant amount of apical dieback evenly spread over the entire canopy which is indicative of stress on this tree. This will further impact upon the viability of this tree to be retained in-situ.

In order to further investigate the total encroachment proposed for Tree 1118, we recommend further investigation of the root plate of this tree by means of root mapping. Root mapping may be carried out using Ground Penetrating Radar (GPR) or by non-destructive excavation using an Air Knife. Please note that vacuum trucks or high pressure water are not suitable. Further investigation to be made into the proposed shoring methods to accurately determine the extent of excavation required for shoring.

Contents

Executive Summary	2
Contents.....	4
1.0 Scope of Works	5
2.0 Site Analysis.....	5
2.1 Site.....	5
2.2 Topography.....	5
2.3 Identification.....	6
2.4 Soils	6
3.0 Existing Trees.....	7
4.0 Landscape Significance of Trees	19
4.1 Landscape Significance.....	19
4.2 Methodology of Determining Landscape Significance	19
4.3 Landscape Significance of Subject Trees	19
5.0 Subject Tree Retention Value	20
4.1 Tree Retention Value Methodology	20
5.2 Retention Value of Subject Trees.....	20
6.0 Impact of Development.....	21
6.1 Tree Protection Zone	21
6.2 Development Impact.....	22
7.0 Discussion and Recommendations	24
7.1 Tree Retention and Viability	24
7.2 Tree Retention Viability – Tree 1227	25
7.3 Tree Retention Viability – Tree 1118	25
8.0 Tree Transplanting.....	27
8.1 Methodology	27
8.2 Plant Species Suitability	27
8.3 Tree Transplant Risk Mitigation	27
9.0 Plant Replacement	29
9.1 Plant Replacement	29
9.2 Plant Replacement Species	29
10.0 References	29
11.0 Disclaimer	30
Appendix A - Tree Inspection Data.....	31
Appendix B Landscape Significance.....	32
Appendix C Tree Retention Values	33
Appendix D Tree Location Plans	34
Tree Impact Plans	34

1.0 Scope of Works

This Arboricultural Assessment Report has been commissioned by NSW Planning & Environment to report on trees within the site of the proposed works known as Sydney Modern within The Domain, Sydney. The Scope of works has been defined as follows:

- Review the Arboricultural Impact Assessment Report prepared by Earthscape Horticultural Services, addendums 1 and 2 to the report, the proposed landscape plans, and other documentation (as relevant). Development impact has been assessed based on the following drawings:
 - o Survey Drawings YSCO Geomatics Ref 0714/1J
 - o McGregor Coxall Landscape Drawing LD_DA_00 01 Rev M
 - o McGregor Coxall Landscape Drawing LD_DA_00 02 Rev Q
 - o McGregor Coxall Landscape Drawing LD_DA_10 01 Rev I
 - o McGregor Coxall Landscape Drawing LD_DA_10 02 Rev I
 - o McGregor Coxall Landscape Drawing LD_DA_10 03 Rev I
 - o McGregor Coxall Landscape Drawing LD_DA_30 04 Rev K
 - o SANAA Entry Level Plan DA_1001 Rev I
 - o ARUP Bulk Earthworks Plan DA_2005 Rev A
- Undertake an assessment and providing comments and recommendations in relation to:
 - o Whether any additional high significance trees in close proximity to the proposed development can be retained in-situ rather than removed or transplanted.
 - o Specifically the Trees to be assessed are 1363, 4578, 4579, 4580, 4581, 1226, 1227, 742, 1118, 1228, 2434, 2436, 2995 and 3002.
 - o Whether Tree 1227 (Joseph Beuys tree) should be retained in-situ
 - o the risks associated with the proposed transplant of nine trees and methods to mitigate these risks
 - o Whether the proposed replacement tree planting scheme would provide an improved horticultural outcome on the site in the longer term. If appropriate, recommendations should be made to improve the overall horticultural outcome.

On the 26th of June 2018, Glenn Bird of Birds Tree Consultancy attended site and inspected the subject trees from the ground. There was no aerial inspection carried out. A Visual Tree Assessment was undertaken in accordance with Visual Tree Assessment (VTA) guidelines (Mattheck and Breloer, 1994). Tree heights were measured using a Nikon Forestry 550 Heightmeter.

2.0 Site Analysis

2.1 Site

The subject site is the site of the proposed Sydney Modern Project within The Domain in Sydney. The site is proposed for redevelopment as defined by State significant development application (SSD 6471).

2.2 Topography

The area in the vicinity of Trees 1363, 4578, 4579, 4580, 4581, 1226, 1227 is relatively flat with trees 1363, 4578, 4579, 4580, 4581 in close proximity to pedestrian paving. The area in the vicinity of Trees 742, 1118, 1228, 2434, 2436, 2995 and 3002 slopes

moderately to steeply from the highest point on the Art Gallery Road frontage to the northeast of the trees to the lowest point on Lincoln Crescent east of the subject trees. There are sandstone outcrops in the vicinity of Trees 742, 1118, 1228, 2434, 2436, 2995 and 3002. Refer to survey drawings for greater definition of levels in this area.

2.3 Identification

Trees are as identified in the attached inspection forms in Appendix A and shown in Tree location Plans A01 and A02 in Appendix D. Tree numbering has been retained from Earthscape Horticultural Services Report numbering for continuity.

2.4 Soils

Soil material and horizons were not tested for this report.

3.0 Existing Trees

The following trees were inspected from the ground and the following items identified. Please refer also to the attached inspection data in Appendix A.

3.1 Tree 742 *Phoenix canariensis*

This mature tree is approximately 16m tall with a canopy spread of 6m. It has a single trunk with a diameter at breast height (DBH) of 710mm. This tree is in good health and condition with minimal deadwood and epicormic growth.

3.2 Tree 1118 *Ficus rubiginosa*

This mature tree is approximately 14.5m tall with a canopy spread of 18m. It has twin co-dominant trunks from 1.5m above the base with a DBH of 1130mm. This tree is in good health and condition with a dense canopy, moderate deadwood and epicormic growth. There is moderate apical dieback evenly distributed over the canopy. There is evidence of a bark inclusion within the primary junction on the eastern side of the trunk of this tree with evidence of decay within this junction.



Figure 1 – Tree 1118



Figure 2 - Bark inclusion in primary junction of Tree 1118

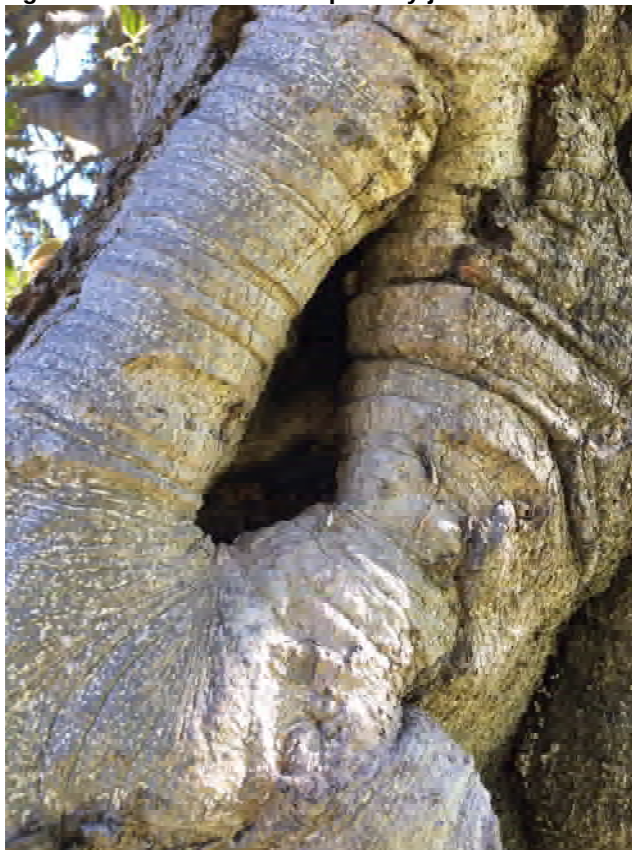


Figure 3 - Evidence of decay within junction of Tree 1118

3.3 Tree 1226 *Ficus macrophylla*

This mature tree is approximately 10.5m tall with a canopy spread of 18m. It has a single trunk with a DBH of 770mm. This tree is in good health and condition with minimal deadwood and epicormic growth.



Figure 4 - Tree 1126

3.4 Tree 1227 *Ficus macrophylla*

This mature tree is approximately 10.5m tall with a canopy spread of 13m. It has multiple (4) co-dominant trunks from the base with an aggregate DBH of 715mm. This tree is in good health and condition with minimal deadwood and epicormic growth. This tree has surface roots exposed extending approximately 6m.



Figure 5 - Tree 1227



Figure 6 - Surface roots of Tree 1227

3.5 Tree 1228 *Ficus macrophylla*

This mature tree is approximately 10.5m tall with a canopy spread of 14m. It has a single trunk with a DBH of 610mm. This tree is in good health and condition with minimal deadwood and epicormic growth.



3.6 Tree 1363 *Phoenix sylvestris*

This mature tree is approximately 13m tall with a canopy spread of 5m. It has a single trunk with a DBH of 520mm. This tree is in good health and condition.

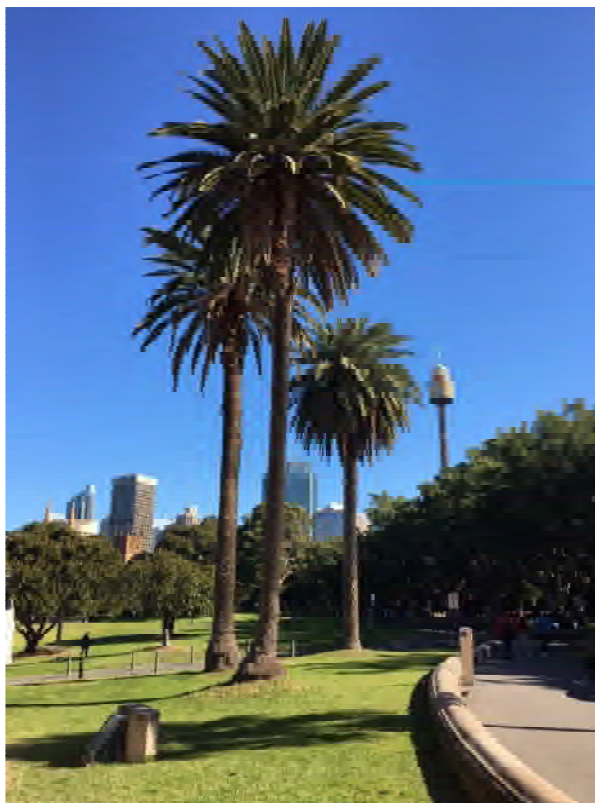


Figure 7 - Tree 1363 (right)

3.7 Tree 2434 *Banksia integrifolia*

This mature tree is approximately 10m tall with a canopy spread of 5m. It has a single trunk with a DBH of 240mm. This tree is in good health and condition with minimal deadwood and epicormic growth.



3.8 Tree 2436 *Chamaerops humilis*

This mature tree is approximately 3.6m tall with a canopy spread of 4m. It has multiple (8) co-dominant trunks from the base with an aggregate DBH of 420mm. This tree is in good health and condition with minimal deadwood and epicormic growth.



3.9 Tree 2995 *Eucalyptus tereticornis*

This mature tree is approximately 14m tall with a canopy spread of 12m. It has a single trunk with a DBH of 350mm. This tree is in good health and condition with minimal deadwood and epicormic growth.

3.10 Tree 3002

Eucalyptus tereticornis

This mature tree is approximately 13.5m tall with a canopy spread of 11m. It has a single trunk with a DBH of 440mm. This tree is in good health and condition with minimal deadwood and epicormic growth.



Figure 8 Tree 3002

3.11 Tree 4578 *Livistona australis*

This mature tree is approximately 6.5m tall with a canopy spread of 4m. It has a single trunk with a DBH of 290mm. This tree is in good health and condition.



3.12 Tree 4579 *Livistona australis*

This mature tree is approximately 6.5m tall with a canopy spread of 4m. It has a single trunk with a DBH of 300mm. This tree is in good health and condition however is showing some evidence of minor drought stress.



3.13 Tree 4580

Livistona australis

This mature tree is approximately 6m tall with a canopy spread of 4m. It has a single trunk with a DBH of 290mm. This tree is in good health and condition however is showing some evidence of minor drought stress.



3.14 Tree 4581 *Livistona australis*

This mature tree is approximately 6.5m tall with a canopy spread of 4m. It has a single trunk with a DBH of 280mm. This tree is in good health and condition however is showing some evidence of minor drought stress.



4.0 Landscape Significance of Trees

4.1 Landscape Significance

The significance of a tree within the landscape is a factor of the health and condition of the tree, vitality, the form of the tree, environmental, cultural, amenity and heritage value.

4.2 Methodology of Determining Landscape Significance

For the purpose of this report, the Significance of a Tree, Assessment Rating System (STARS) as developed by the Institute of Australian Consulting Arborists (IACA) has been implemented. Please refer to Appendix B for greater detail of this assessment system. This system defines Landscape Significance for individual trees as High, Medium or Low Significance.

Heritage value is an assessed factor within this Methodology. For the purposes of this report, Heritage Value is based on information within 5.3 Earthscape Horticultural Services Arboricultural Impact Assessment Report – Art Gallery of NSW Expansion Project – Sydney Modern dated 3 November 2017.

4.3 Landscape Significance of Subject Trees

Based on our assessment of the subject trees and implementation of the IACA Significance of a Tree, Assessment Rating System, the Landscape Significance of the Subject Trees was determined as shown in Table 1

Tree no.	Species	Landscape Significance
742	<i>Phoenix canariensis</i>	High
1118	<i>Ficus rubiginosa</i>	High
1226	<i>Ficus macrophylla</i>	High
1227	<i>Ficus macrophylla</i>	High
1228	<i>Ficus macrophylla</i>	High
1363	<i>Phoenix sylvestris</i>	High
2434	<i>Banksia integrifolia</i>	High
2436	<i>Chamaerops humilis</i>	High
2995	<i>Eucalyptus tereticornis</i>	High
3002	<i>Eucalyptus tereticornis</i>	High
4578	<i>Livistona australis</i>	High
4579	<i>Livistona australis</i>	High
4580	<i>Livistona australis</i>	High
4581	<i>Livistona australis</i>	High

Table 1 - Landscape Significance

5.0 Subject Tree Retention Value

4.1 Tree Retention Value Methodology

For the purpose of this report, the Tree Retention Values have been assessed by incorporating Landscape Significance Values as determined in 4.0 with the Useful Life Expectancy of the subject trees and assessing the retention values based on the Tree Retention Value Priority Matrix as developed by the Institute of Australian Consulting Arborists (IACA). Please refer to Appendix C for greater detail of this Tree Retention Value Priority Matrix. This matrix defines Landscape Significance for individual trees as High, Medium or Low Retention Value as well as Priority for Removal.

Useful Life Expectancy has been derived in part from planting date information within 5.3.3 of Earthscape Horticultural Services Arboricultural Impact Assessment Report – Art Gallery of NSW Expansion Project – Sydney Modern dated 3 November 2017.

5.2 Retention Value of Subject Trees

Based on our assessment of the subject trees and implementation of the IACA Tree Retention Value Priority Matrix, the Retention Values of the Subject Trees was determined as shown in Table 2

Tree no.	Species	Landscape Significance
742	<i>Phoenix canariensis</i>	High
1118	<i>Ficus rubiginosa</i>	High
1226	<i>Ficus macrophylla</i>	High
1227	<i>Ficus macrophylla</i>	High
1228	<i>Ficus macrophylla</i>	High
1363	<i>Phoenix sylvestris</i>	High
2434	<i>Banksia integrifolia</i>	High
2436	<i>Chamaerops humilis</i>	High
2995	<i>Eucalyptus tereticornis</i>	High
3002	<i>Eucalyptus tereticornis</i>	High
4578	<i>Livistona australis</i>	High
4579	<i>Livistona australis</i>	High
4580	<i>Livistona australis</i>	High
4581	<i>Livistona australis</i>	High

Table 2 – Tree Retention Value

6.0 Impact of Development

6.1 Tree Protection Zone

Tree Protection Zones (TPZs) have been defined for the subject trees in order to define the encroachment of the proposed development in accordance with AS4970-2009. The TPZs required have been taken as a circular area with a radius 12 x the diameter at breast height of the tree. This requirement is in line with Australian Standard AS 4970-2009 Protection of Trees on Development Sites. This standard defines a maximum of 10% encroachment to be minimal encroachment. Any encroachment over 10% requires the site arborist to give consideration as to the viability of the tree due to the proposed development.

In order to assess the development impact we have separately calculated the encroachment within the TPZ due to the proposed bulk earthworks and the built form.

Tree no.	Species	TPZ Radius (m)	Earthworks Encroachment (%)	Built Form Encroachment (%)	Total Encroachment (%)
742	<i>Phoenix canariensis</i>	3.5	100	N/A	100
1118	<i>Ficus rubiginosa</i>	13.56	25	20	45
1226	<i>Ficus macrophylla</i>	9.24	0	0	0
1227	<i>Ficus macrophylla</i>	8.58	0	100	100
1228	<i>Ficus macrophylla</i>	7.32	25	100	100
1363	<i>Phoenix sylvestris</i>	3	0		100
2434	<i>Banksia integrifolia</i>	2.88	0	50	50
2436	<i>Chamaerops humilis</i>	5.04	100	N/A	100
2995	<i>Eucalyptus tereticornis</i>	4.2	100	N/A	100
3002	<i>Eucalyptus tereticornis</i>	5.28	100	N/A	100
4578	<i>Livistona australis</i>	2.5	0	100	100
4579	<i>Livistona australis</i>	2.5	0	100	100
4580	<i>Livistona australis</i>	2.5	0	100	100
4581	<i>Livistona australis</i>	2.5	0	100	100

Table 3 - Tree Protection Zones and Encroachment

6.2 Development Impact

Tree 742 *Phoenix canariensis*

The Tree Protection Zone (TPZ) of this tree in accordance with AS 4970-2009 *Protection of Trees on Development Sites* will be totally encroached by the proposed development. This tree will not be viable to be retained under the proposed development.

Tree 1118 *Ficus rubiginosa*

The Tree Protection Zone (TPZ) of this tree in accordance with AS 4970-2009 *Protection of Trees on Development Sites* will be encroached by the bulk earthworks by 25% and by the proposed bicycle parking area by 20% resulting in a total encroachment of 45%. This encroachment is significantly greater than the minor encroachment as defined by AS 4970-2009. This encroachment has been calculated based on the extent of the excavation extending 1m beyond the back of the shoring shown on the earthworks drawings. The topography of the area in the vicinity of this tree slopes significantly from the existing pathway and the base of the tree. As a result of this slope the extent of the encroachment may increase beyond that shown on the site plans to meet the level between the proposed bicycle parking and existing levels. This level of encroachment will impact upon the viability of this tree to be retained under the proposed development.

Tree 1226 *Ficus macrophylla*

The Tree Protection Zone (TPZ) of this tree in accordance with AS 4970-2009 *Protection of Trees on Development Sites* will not be further encroached by the proposed development. This tree will be viable to be retained under the proposed development.

Tree 1227 *Ficus macrophylla*

The Tree Protection Zone (TPZ) of this tree in accordance with AS 4970-2009 *Protection of Trees on Development Sites* will be totally encroached by the proposed development. This tree will not be viable to be retained under the proposed development.

Tree 1228 *Ficus macrophylla*

The Tree Protection Zone (TPZ) of this tree in accordance with AS 4970-2009 *Protection of Trees on Development Sites* will be totally encroached by the proposed development. This tree will not be viable to be retained under the proposed development.

Tree 1363 *Phoenix sylvestris*

The Tree Protection Zone (TPZ) of this tree in accordance with AS 4970-2009 *Protection of Trees on Development Sites* will be totally encroached by the proposed development. This tree will not be viable to be retained under the proposed development.

- Tree 2434** ***Banksia integrifolia***
The Tree Protection Zone (TPZ) of this tree in accordance with AS 4970-2009 *Protection of Trees on Development Sites* will be encroached by the revised pathways by 50% which is significantly greater than the minor encroachment as defined by AS 4970-2009. In this case the extent of encroachment is likely to increase due to required level changes between the proposed new path and the existing levels. This tree will not be viable to be retained under the proposed development.
- Tree 2436** ***Chamaerops humilis***
The Tree Protection Zone (TPZ) of this tree in accordance with AS 4970-2009 *Protection of Trees on Development Sites* will be totally encroached by the proposed development. This tree will not be viable to be retained under the proposed development.
- Tree 2995** ***Eucalyptus tereticornis***
The Tree Protection Zone (TPZ) of this tree in accordance with AS 4970-2009 *Protection of Trees on Development Sites* will be totally encroached by the proposed development. This tree will not be viable to be retained under the proposed development.
- Tree 3002** ***Eucalyptus tereticornis***
The Tree Protection Zone (TPZ) of this tree in accordance with AS 4970-2009 *Protection of Trees on Development Sites* will be totally encroached by the proposed development. This tree will not be viable to be retained under the proposed development.
- Tree 4578** ***Livistona australis***
The Tree Protection Zone (TPZ) of this tree in accordance with AS 4970-2009 *Protection of Trees on Development Sites* will be totally encroached by the proposed development. This tree will not be viable to be retained under the proposed development.
- Tree 4579** ***Livistona australis***
The Tree Protection Zone (TPZ) of this tree in accordance with AS 4970-2009 *Protection of Trees on Development Sites* will be totally encroached by the proposed development. This tree will not be viable to be retained under the proposed development.
- Tree 4580** ***Livistona australis***
The Tree Protection Zone (TPZ) of this tree in accordance with AS 4970-2009 *Protection of Trees on Development Sites* will be totally encroached by the proposed development. This tree will not be viable to be retained under the proposed development.
- Tree 4581** ***Livistona australis***
The Tree Protection Zone (TPZ) of this tree in accordance with AS 4970-2009 *Protection of Trees on Development Sites* will be totally

encroached by the proposed development. This tree will not be viable to be retained under the proposed development.

7.0 Discussion and Recommendations

7.1 Tree Retention and Viability

The landscape significance and associated tree retention values of the subject trees were determined in 4.0 and 5.0. The retention value of all of the subject trees was found to be High Retention Value.

The viability of the subject trees to be retained within the proposed development was assessed in accordance with the requirements of AS4970-2009 *Protection of Trees on Development Sites*.

Tree retention values, retention viability and the current actions as defined by the current Landscape Plan LD_DA_30-04 are summarised below in Table 4.

Tree no.	Species	Retention Value	Retention Viability	Current Proposed Action
742	<i>Phoenix canariensis</i>	High	Not Viable to be retained due to Major TPZ encroachment.	Transplant
1118	<i>Ficus rubiginosa</i>	High	Not Viable to be retained due to Major TPZ encroachment.	Retained (See 7.3)
1226	<i>Ficus macrophylla</i>	High	Viable to be retained.	Retained
1227	<i>Ficus macrophylla</i>	High	Not Viable to be retained due to Major TPZ encroachment.	Transplant
1228	<i>Ficus macrophylla</i>	High	Not Viable to be retained due to Major TPZ encroachment.	Transplant
1363	<i>Phoenix sylvestris</i>	High	Not Viable to be retained due to Major TPZ encroachment.	Transplant
2434	<i>Banksia integrifolia</i>	High	Not Viable to be retained due to Major TPZ encroachment.	Remove
2436	<i>Chamaerops humilis</i>	High	Not Viable to be retained due to Major TPZ encroachment.	Transplant
2995	<i>Eucalyptus tereticornis</i>	High	Not Viable to be retained due to Major TPZ encroachment.	Remove

3002	<i>Eucalyptus tereticornis</i>	High	Not Viable to be retained due to Major TPZ encroachment.	Remove
4578	<i>Livistona australis</i>	High	Not Viable to be retained due to Major TPZ encroachment.	Transplant
4579	<i>Livistona australis</i>	High	Not Viable to be retained due to Major TPZ encroachment.	Transplant
4580	<i>Livistona australis</i>	High	Not Viable to be retained due to Major TPZ encroachment.	Transplant
4581	<i>Livistona australis</i>	High	Not Viable to be retained due to Major TPZ encroachment.	Transplant

Table 4 - Tree Retention Summary

7.2 Tree Retention Viability – Tree 1227

Tree 1227 which is also known as the Joseph Beuys tree, has been determined using the methodology outlined in 3.0 to have a high Landscape Significance. By extension, based on the Tree Retention Value Priority Matrix outlined in 4.0 this tree was defined as having a High Tree Retention Value. We note that this varies from the moderate retention value defined within Earthscape Horticultural Services Arboricultural Impact Assessment Report – Art Gallery of NSW Expansion Project – Sydney Modern dated 3rd November 2017. These values are subjective and qualitative and this variation is not contradictory but a result of differences in the methodology used. Specifically the Assessment Rating System (STARS) as developed by the Institute of Australian Consulting Arborists (IACA) methodology includes the parameter “*The tree supports social and cultural sentiments or spiritual associations, reflected by the broader population or community group or has commemorative values.*” As this tree has been named to commemorate the German artist Joseph Beuys, this parameter in conjunction with the good health and vigour of this tree and typical form and habit resulted in the high landscape significance and retention value.

The viability of this tree to be retained has been assessed in accordance with AS4970-2009 *Protection of Trees on Development Sites* based on development impact assessment of Architectural Plan DA_1001 Revision I. This assessment shows that the Tree Protection Zone (TPZ) of this tree will be totally encroached within the proposed new Entry Plaza. Additionally the canopy of this tree is likely to be impacted by the proposed structure over the Entry Plaza. As a result of this encroachment and canopy impact, this tree will not be viable to be retained in situ.

7.3 Tree Retention Viability – Tree 1118

Tree 1118 has been determined using the methodology outlined in 3.0 to have a high Landscape Significance. By extension, based on the Tree Retention Value Priority Matrix outlined in 4.0 this tree was defined as having a High Tree Retention Value.

The viability of this tree to be retained has been assessed in accordance with AS4970-2009 *Protection of Trees on Development Sites* based on development impact assessment of Architectural Plan DA_1001 Revision I and Bulk Earthworks Plan DA_2005 Revision A. The impact assessment of the proposed bulk earthworks

is based on the total area of excavation extending no more than 1m from the back of the shoring as show on this drawing. This assessment shows that the Tree Protection Zone (TPZ) of this tree will be encroached by the proposed bulk earthworks by 25% and by the proposed Bicycle Parking Area by an additional 20% bringing the total area of the TPZ encroachment to 45%. This is significantly greater than the 10% minor encroachment as defined by AS4970-2009. The extent of encroachment is likely to be increased as the level of the Bicycle Parking Area is significantly higher than the base of Tree 1118 and additional filling may be required to marry these levels.

There is a sprinkler and hydrant booster proposed to be installed in close proximity to the TPZ of this tree. Further investigation is required to the location of associated piping in relation to the TPZ of this tree.

This tree is proposed to be retained within the proposed development as shown on Landscape Plan LD_DA_30-04 however the extent of the encroachment within the TPZ of the proposed earthworks and bicycle parking area are likely to impact on the health and condition of this tree and therefore the viability of this tree to be retained within the landscape in-situ. This tree is currently in good health and condition with a dense canopy, minimal deadwood and minimal epicormic growth however it was noted that there is a significant amount of apical dieback evenly spread over the entire canopy which is indicative of stress on this tree. This will further impact upon the viability of this tree to be retained in-situ.

The Structural Root Zone (SRZ) of this tree, which is defined by AS4970-2009 *Protection of Trees on Development Sites* as the area of root development required for the structural stability of the tree, is approximately 3.8m and is not impacted by the proposed bulk excavation based on a 1m offset from shoring.

In order to further investigate the total encroachment proposed for this tree, we recommend further investigation of the root plate of this tree by means of root mapping. Root mapping may be carried out using Ground Penetrating Radar (GPR) or by non-destructive excavation using an Air Knife. Please note that vacuum trucks or high pressure water are not suitable. Further investigation to be made into the proposed shoring methods to accurately determine the extent of excavation required for shoring.

8.0 Tree Transplanting

8.1 Methodology

The Transplanting methodology and specification provided in Section 12 of Earthscape Horticultural Services Arboricultural Impact Assessment Report – Art Gallery of NSW Expansion Project – Sydney Modern dated 3 November 2018 represents industry best practice and will provide suitable conditions for the successful transplantation of the subject trees.

8.2 Plant Species Suitability

- *Phoenix sylvestris*
- *Phoenix canariensis*
- *Ficus macrophylla*
- *Ficus rubiginosa*
- *Chamaerops humilis*
- *Livistona australis*

These species are suitable for transplantation. We been involved with successful transplantation of these species with the exception of *Phoenix sylvestris* and *Chamaerops humilis* on projects such as:

- Annangrove Retail Centre (*P. canariensis*, *Livistona australis*)
- Beare Park Elizabeth Bay (*Livistona australis*)
- Resmed – Norwest Business Park (*Ficus rubiginosa*)

8.3 Tree Transplant Risk Mitigation

As stated in 8.1 the proposed methodology is extensive and will be suitable to provide the best opportunity for the successful transplantation of the nine proposed trees however as these trees are large, established trees, there is a residual risk that these trees may not be successfully transplanted. In order to further mitigate this risk we propose the following:

1. All transplant works to be carried out under the supervision and authority of the Project Arborist (AQF Level 5).
2. The tender selection process for the Transplant Contractor is to preferentially select Contractors with extensive proven experience in transplanting trees of similar size and species as well as methodology consistent with Earthscape Horticultural Services Transplant Specification within Arboricultural Impact Assessment Report – Art Gallery of NSW Expansion Project – Sydney Modern dated 3 November 2018. The Project Arborist is to be part of this process.
3. Site Management to allow large clear area preserved around both the donor and recipient sites in order to allow unrestricted access for earthworks. In particular this is critical for the *Ficus spp.* transplants in order to allow access for the installation of support beams under the root ball through directional boring.
4. Site management to allow access so that unrestricted transport access is possible between donor and recipient sites allowing trees to be

transported vertically with minimal handling and minimal loading and unloading.

5. Earthscape Horticultural Services Transplant Specification nominates that trees other than palms are to be lifted using a constructed lifting platform. In order to minimise risk, this lifting platform is to be constructed in-situ and is to be constructed of a steel structure with secure sides fixed to supporting steel beams beneath the root plate. This lifting platform is to be engineered such that it is self-supporting and the load is lifted from hooks or eyelets on the steel support structure and only vertical forces are applied to the base of the root plate.
6. Earthscape Horticultural Services Transplant Specification nominates that palms are to be lifted using soft slings wrapped around the root ball. This method is regularly used in palm transplants and is typically successful however there is some increased risk of tearing of the roots within the root ball as torsion forces are applied through the root ball as the tree is lifted as the slings compress against the root ball. Under these circumstances is a compressive force on the root ball as well as the vertical lifting force. Generally the soil within the root ball supports these compressive forces however if the root ball soil is sandy or has a low clay/silt component, the root ball is typically less stable and prone to fracture placing the roots at risk of tearing due to torsional forces. In order to remove or mitigate this risk we propose the following options:
 - 6.1.1 Construction of lifting platform to the same requirements as used for other trees and outlined above,
 - 6.1.2 Construction of lifting “ring” constructed of steel or other engineering such that the slings apply only vertical lifting force to the root ball and the steel ring absorbs the compressive force.
 - 6.1.3 Use of the widest possible slings in order to transfer the force over the widest area of the root ball possible.
7. Depending on seasonal conditions at the time of transplanting, the palms may benefit from an application of anti-transpirant such as Envy ©to the fronds. Use of Anti-transpirant to be at the discretion and direction of the Project Arborist.
8. Installation of a temporary and automatic irrigation system to the transplanted trees will reduce the risk of insufficient watering during establishment.
9. Tree protection measures to be installed to the donor sites prior to transplanting and the recipient sites post-transplant to be in accordance with Section 10 of Earthscapes Horticultural Services Arboricultural Impact Assessment Report – Art Gallery of NSW Expansion Project – Sydney Modern dated 3 November 2018.

9.0 Plant Replacement

9.1 Plant Replacement

Due to the size and maturity of the subject trees, replacement of the trees proposed to be transplanted will not be directly viable. Replacement trees will be significantly smaller and younger and not provide the immediate landscape value and amenity that the existing trees provide. Large replacement palms are likely to be ex-ground stock and therefore carry a risk of transplant failure. This risk would be greater than for the existing palms as there is additional transport required. Large mature *Chamaerops humilis* will be difficult to source.

9.2 Plant Replacement Species

The proposed tree replacement planting defined within the Landscape Plan utilizes a range of tree species that are representative of Sydney Sandstone Ridgetop Woodland. These tree species include *Eucalyptus pilularis*, *Eucalyptus piperita*, *Corymba gummifera* and *Angophora costata*. Replacement planting using Sydney Sandstone Woodland species provides the opportunity to re-establish tree species that were endemic to the area prior to settlement and clearing of the area within the Domain (Benson and Howell, 1990). The re-establishment of these locally endemic species provides a living and enduring link to the natural history and heritage of the site and also provides a connection to recently re-established headland planting at the northern headland at Barangaroo. These species are naturally suited to the local environment and microclimate and therefore provides an advantage in establishment. This proposed planting scheme will provide a positive outcome with regards to preserving and consolidating the landscape character, natural heritage and wildlife habitat of the area.

10.0 References

Mattheck, C. Breloer, K. 1993, The Body Language of Trees: A Handbook for Failure Analysis, 12th Impression 2010 The Stationery Office.

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IACA, 2010, Sustainable Retention Index Value (SRIV), Version 4, A visual method of objectively rating the viability of urban trees for development sites and management, based on general tree and landscape assessment criteria, Institute of Australian Consulting Arboriculturists, Australia. www.iaca.org.au

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11.0 Disclaimer

This Appraisal has been prepared for the exclusive use of the Client and Birds Tree Consultancy.

Birds Tree Consultancy accepts no responsibility for its use by other persons. The Client acknowledges that this Appraisal, and any opinions, advice or recommendations expressed or given in it, are based on the information supplied by the Client and on the data inspections, measurements and analysis carried out or obtained Birds Tree Consultancy and referred to in the Appraisal. The Client should rely on the Appraisal, and on its contents, only to that extent.

Every effort has been made in this report to include, assess and address all defects, structural weaknesses, instabilities and the like of the subject trees. All inspections were made from ground level using only visual means and no intrusive or destructive means of inspection were used. For many structural defects such as decay and inclusions, internal inspection is required by means of Resistograph or similar. No such investigation has been made in this case. Trees are living organisms and are subject to failure through a variety of causes not able to be identified by means of this inspection and report.

Appendix A - Tree Inspection Data

Birds Tree Consultancy

Consulting Arborist • Project Management • Horticultural Consultancy • Landscape Management

Inspection Data

26-Jun-18

Sydney Modern

Tree no.	Species	Height (m)	Spread(m)	DBH (mm)	TPZ Radius (m)	Maturity	Trunk (single, twin, multiple @)	Trunk lean	Form/Crown shape	Branching Habit	Crown Distribution	Stability	Branching Structure	Pruning History
742	Phoenix canariensis	16	6	710	3.5	Mature	Single	NIL	Normal	Normal	Balanced	Stable	Stable	No evidence
1118	Ficus rubiginosa	14.5	18	1130	13.56	Mature	Twin @ 1800	NIL	Normal	Normal	Balanced	Stable	Stable	Previously selectively pruned
1226	Ficus macrophylla	10.5	18	770	9.24	Mature	Single	NIL	Normal	Normal	Balanced	Stable	Stable	Previously selectively pruned
1227	Ficus macrophylla	10.5	13	715	8.58	Mature	Multiple 4 @ base	NIL	Normal	Normal	Balanced	Stable	Stable	Crown lifted
1228	Ficus macrophylla	10.5	14	610	7.32	Mature	Single	NIL	Normal	Normal	Balanced	Stable	Stable	Crown lifted
1363	Phoenix sylvestris	13	5	520	3	Mature	Single	NIL	Normal	Normal	Balanced	Stable	Stable	No evidence
2434	Banksia integrifolia	10	5	240	2.88	Mature	Single	NIL	Normal	Normal	Balanced	Stable	Stable	No evidence
2436	Chamaerops humilis	3.6	4	420	5.04	Mature	Multiple (8) @ base	NIL	Normal	Normal	Balanced	Stable	Stable	No evidence
2995	Eucalyptus tereticornis	14	12	350	4.2	Mature	Single	NIL	Normal	Normal	Balanced	Stable	Stable	No evidence
3002	Eucalyptus tereticornis	13.5	11	440	5.28	Mature	Single	NIL	Normal	Normal	Balanced	Stable	Stable	No evidence
4578	Livistona australis	6.5	4	290	2.5	Mature	Single	NIL	Normal	Normal	Balanced	Stable	Stable	No evidence
4579	Livistona australis	6.5	4	300	2.5	Mature	Single	NIL	Normal	Normal	Balanced	Stable	Stable	No evidence
4580	Livistona australis	6	4	290	2.5	Mature	Single	NIL	Normal	Normal	Balanced	Stable	Stable	No evidence
4581	Livistona australis	6.5	4	280	2.5	Mature	Single	NIL	Normal	Normal	Balanced	Stable	Stable	No evidence

Tree no.	Species	Defects	Damage	Overall Health & Vigour	Canopy Density	Foliage	Deadwood	Epicormic Growth	Pest Infestation	Disease	Life expectancy	Env. & Landscape significance	Retention Value	Notes/Comments
742	Phoenix canariensis	Nil	Nil	Good	Normal	Normal	<5%	<5%	No evidence	No evidence	15-40y	High	High	
1118	Ficus rubiginosa	Bark Inclusion	Nil	Good	Normal	Normal	0.1	0.15	No evidence	No evidence	15-40y	High	High	Moderate apical dieback evenly distributed over canopy. moderate epicormic growth. Bark inclusion evident in primary junction on eastern side. Evidence of decay within this junction.
1226	Ficus macrophylla	Nil	Nil	Good	Normal	Normal	<5%	<5%	No evidence	No evidence	>40y	High	High	
1227	Ficus macrophylla	Nil	Nil	Good	Normal	Normal	<5%	<5%	No evidence	No evidence	>40y	High	High	Surface roots visible extending beyond canopy dripline
1228	Ficus macrophylla	Nil	Nil	Good	Normal	Normal	<5%	<5%	No evidence	No evidence	>40y	High	High	
1363	Phoenix sylvestris	Nil	Nil	Good	Normal	Normal	<5%	<5%	No evidence	No evidence	15-40y	High	High	Surface roots visible. .In close proximity to existing stair structure.
2434	Banksia integrifolia	Nil	Nil	Good	Normal	Normal	<5%	<5%	No evidence	No evidence	15-40y	High	Moderate	
2436	Chamaerops humilis	Nil	Nil	Good	Normal	Normal	<5%	<5%	No evidence	No evidence	>40y	High	High	
2995	Eucalyptus tereticornis	Nil	Nil	Good	Normal	Normal	<5%	<5%	No evidence	No evidence	>40y	High	High	
3002	Eucalyptus tereticornis	Nil	Nil	Good	Normal	Normal	<5%	<5%	No evidence	No evidence	>40y	High	High	
4578	Livistona australis	Nil	Nil	Good	Normal	Normal	<5%	<5%	No evidence	No evidence	>40y	High	High	
4579	Livistona australis	Nil	Nil	Good	Normal	Normal	<5%	<5%	No evidence	No evidence	>40y	High	High	
4580	Livistona australis	Nil	Nil	Good	Normal	Normal	<5%	<5%	No evidence	No evidence	>40y	High	High	
4581	Livistona australis	Nil	Nil	Good	Normal	Normal	<5%	<5%	No evidence	No evidence	>40y	High	High	

Appendix B Landscape Significance

IACA Significance of a Tree, Assessment Rating System (STARS) © (IACA 2010)©

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 in June 2001.

The landscape significance of a tree is an essential criterion to establish 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. To assist this process all definitions for terms used in the *Tree Significance - Assessment Criteria* and *Tree Retention Value - Priority Matrix*, are taken from the IACA Dictionary for Managing Trees in Urban Environments 2009.

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 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 for individual trees only, however, can be applied to a monocultural stand in its entirety e.g. hedge.

Appendix C Tree Retention Values

		Significance				
		1. High	2. Medium	3. Low		
		Significance in Landscape	Significance in Landscape	Significance in Landscape	Environmental Pest / Noxious Weed Species	Hazardous / Irreversible Decline
Estimated Life Expectancy	1. Long >40 years					
	2. Medium 15-40 Years					
	3. Short <1-15 Years					
	Dead					

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.

INSTITUTE OF AUSTRALIAN
CONSULTING ARBORICULTURISTS

MANAGING URBAN TREES

REFERENCES

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Draper BD and Richards PA 2009, *Dictionary for Managing Trees in Urban Environments*, Institute of Australian Consulting Arboriculturists (IACA), CSIRO Publishing, Collingwood, Victoria, Australia.

Footprint Green Pty Ltd 2001, *Footprint Green Tree Significance & Retention Value Matrix*, Avalon, NSW Australia, www.footprintgreen.com.au

Appendix D Tree Location Plans

Tree Impact Plans



Legend



Tree proposed to be Retained and Protected



Tree Proposed to be Transplanted



Tree proposed to be Removed due to development



Tree Protection Zone (TPZ) in accordance with AS4970-2009

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Project: Sydney Modern
Client: NSW Planning & Environment
DWG: A01
Plan: Tree Location Plan 01
Date: 20 July 2018
Scale : 1:500 @ A3

