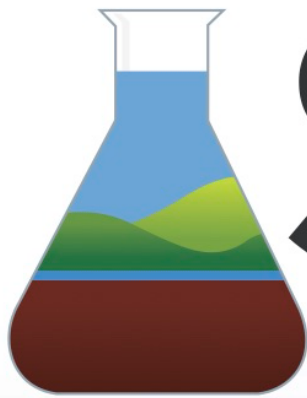




SES
AUSTRALIA
Environment & Soil Sciences

2 Mandala Pl, Castle Hill – Specification Design

Prepared for:

Deicorp Projects Showground Pty Ltd

April 2021

(Ref: J002662)

DOCUMENT RECORD

Client:	Deicorp Projects Showground Pty Ltd
Project:	2 Mandala Pl, Castle Hill – Soil Specification Design
Document Title:	J002662 - 2 Mandala Pl, Castle Hill – Soil Specification Design
Document Version:	Final 1.0
Our Reference:	J002662
File Name:	J002662 - 2 Mandala Pl Castle Hill - Soil specification Design 1.0.docx
Last Saved:	9 April 2021 07:44 am
Main Author:	Owen Guy
Qualifications:	Soil Scientist, BSc Agr (Hons 1), SSA
Technical Reviewer:	Simon Leake
Qualifications:	Principal Soil Scientist B Sc (Ag) Hons, ASSSI, CPSS
Final Reviewer	Simon Leake
Qualifications:	Principal Soil Scientist B Sc (Ag) Hons, ASSSI, CPSS

Revision	Reviewed By	Action	Issued To	Date	Release Approval
0.1	Owen Guy	Initial Draft	Internal	26/03/21	
0.2	Simon Leake	Draft Review	Internal	06/04/21	
0.3	Simon Leake	Draft Approval	Internal	7/04/21	
0.3	Owen Guy	Draft Amendment	Client	09/04/21	
1.0	Owen Guy	Final Amendment (Client Comment)	Client	18/05/21	

TABLE OF CONTENTS

DOCUMENT RECORD.....	I
TABLE OF CONTENTS.....	II
EXECUTIVE SUMMARY	IV
1 INTRODUCTION	1
2 SPECIFICATION 1: GROUND COVER, SHRUBS AND TREES (ON-SLAB A AND B HORIZON SOIL MIX)...	2
2.1 'FIT-FOR-PURPOSE' PERFORMANCE DESCRIPTION – SPECIFICATION 1 – A HORIZON	2
2.2 'FIT-FOR-PURPOSE' PERFORMANCE DESCRIPTION – SPECIFICATION 1 – B HORIZON.....	2
2.3 TECHNICAL PARAMETERS – SPECIFICATION 1 – A HORIZON	2
2.4 METHOD REFERENCES	4
2.5 EXAMPLE COMPONENTS	5
2.6 TECHNICAL PARAMETERS – SPECIFICATION 1 – B HORIZON	6
2.7 METHOD REFERENCES	7
2.8 EXAMPLE COMPONENTS	8
3 SPECIFICATION 2: GROUND COVER, SHRUBS AND TREES (ON-STRUCTURE A AND B HORIZON SOIL MIX - LIGHTWEIGHT).....	9
3.1 'FIT-FOR-PURPOSE' PERFORMANCE DESCRIPTION – SPECIFICATION 2 - A HORIZON	9
3.2 'FIT-FOR-PURPOSE' PERFORMANCE DESCRIPTION – SPECIFICATION 2 - B HORIZON	9
3.3 TECHNICAL PARAMETERS – SPECIFICATION 2 – A HORIZON	10
3.4 METHOD REFERENCES	12
3.5 EXAMPLE COMPONENTS	12
3.6 TECHNICAL PARAMETERS – SPECIFICATION 2 – B HORIZON	13
3.7 METHOD REFERENCES	15
3.8 EXAMPLE COMPONENTS	15
4 SPECIFICATION 3: ACTIVE TURF (ON-SLAB A AND B HORIZON SOIL MIX).....	17
4.1 'FIT-FOR-PURPOSE' PERFORMANCE DESCRIPTION – SPECIFICATION 3 - A HORIZON	17
4.2 TECHNICAL PARAMETERS – SPECIFICATION 3 – A HORIZON	18
4.3 METHOD REFERENCES	19
4.4 EXAMPLE COMPONENTS	19
4.5 'FIT-FOR-PURPOSE' PERFORMANCE DESCRIPTION – SPECIFICATION 3 - B HORIZON	20
4.6 TECHNICAL PARAMETERS – SPECIFICATION 3 – B HORIZON	20
4.7 METHOD REFERENCES	21
4.8 EXAMPLE COMPONENTS	21

5	QUALITY CONTROL AND HOLD POINTS	22
5.1	INITIAL COMPLIANCE CERTIFICATION	22
5.2	RECORD KEEPING.....	22
5.3	QUALITY CONTROL: COMPLIANCE DURING CONSTRUCTION	23
5.4	HOLD POINT TEMPLATE	25
6	CONCLUSION.....	26
7	LIMITATIONS.....	27

DOCUMENT TABLES IN TEXT

Table 1	Summary of landscape areas within 2 Mandala Pl, Castle Hill	1
Table 1	Specification 1 - Ground Cover, Shrubs and Trees A Horizon Physical Properties.....	3
Table 2	Specification 1 - Ground Cover, Shrubs and Trees A Horizon Chemical Properties	3
Table 3	Example Components for Specification 1 - Ground Cover, Shrubs and Trees A Horizon	5
Table 4	Specification 1 - Ground Cover, Shrubs and Trees B Horizon Physical Properties	6
Table 5	Specification 1 - Ground Cover, Shrubs and Trees B Horizon Chemical Properties.....	6
Table 6	Example Components for Specification 1 - Ground Cover, Shrubs and Trees A Horizon	8
Table 7	Specification 2 - Ground Cover, Shrubs and Trees (Lightweight) A Horizon Physical Properties.....	10
Table 8	Specification 2 - Ground Cover, Shrubs and Trees (Lightweight) A Horizon Chemical Properties	11
Table 9	Example Components for Specification 2 - Ground Cover, Shrubs and Trees (Lightweight) A Horizon..	12
Table 10	Specification 2 - Ground Cover, Shrubs and Trees (Lightweight) B Horizon Physical Properties.....	13
Table 8	Specification 2 - Ground Cover, Shrubs and Trees (Lightweight) A Horizon Chemical Properties	14
Table 12	Example Components for Specification 2 - Ground Cover, Shrubs and Trees (Lightweight) A Horizon	15
Table 13	Specification 3 - Active Turf (On Slab) - A Horizon Physical Properties	18
Table 14	Specification 3 - Active Turf (On Slab) - A Horizon Chemical Properties.....	18
Table 15	Example Components for Specification 2 - Active Turf (On Slab) - A Horizon.....	19
Table 13	Specification 3 - Active Turf (On Slab) - B Horizon Physical Properties.....	20
Table 13	Specification 3 - Active Turf (On Slab) - B Horizon Chemical Properties	20
Table 15	Example Components for Specification 2 - Active Turf (On Slab) - A Horizon.....	21
Table 19.	Outline of the required testing frequency to achieve compliance testing. Samples must be tested to the performance criteria indicated in the product specification.	23

APPENDICES

Appendix A - Species List

EXECUTIVE SUMMARY

SESL Australia (SESL) has been engaged by Deicorp Projects Showground Pty Ltd (the Client) to provide professional soil science advice and specifications for 2 Mandala Place, Castle Hill – Showground Station (the Project) for the design phase of the Project.

This report provides the soil specifications and advice for the Showground Station project. The soil specifications have been developed in accordance with the plant species palate, drainage, load requirements and Deicorp Projects Showground Pty Ltd landscape design diagrams.

SESL has presented a total of six (6) specifications for use within the project landscape areas as outlined by the client. These specifications are for inclusion within the client's final design documentation, the purpose of which is to provide guidance tenderers / contractors as to what quality parameters are required of soil media to ensure successful landscape establishment and longevity.

1 INTRODUCTION

SESL Australia (SESL) has been engaged by Deicorp Projects Showground Pty Ltd (the Client) to provide professional soil science advice and specifications for 2 Mandala Place, Castle Hill – Showground Station (the Project) for the design phase of the Project.

SESL’s objective is to provide soil specifications to ensure a suitable medium is imported, or at least partly constructed using recovered materials from site (if available), for successful plant growth. Where there is an opportunity to retain and reuse on-site resources, specifications within this report may be used to ensure materials are suitable. On-grade landscapes are most appropriate such as mass planting or passive amenity turf areas.

The client has provided a load limit of 27 kPa for this project, which has been taken into account as part of the bulk density requirement of the specifications provided.

Table 1 Summary of landscape areas within 2 Mandala Pl, Castle Hill

Landscape Area	Soil Mix Type	Vegetation Types
Specification 1	On-Slab A and B Horizon Soil Mix	Ground Cover, Shrubs and Trees
Specification 2	On-Structure A and B Horizon Soil Mix – Lightweight	Ground Cover, Shrubs and Trees
Specification 3	On-Slab A and B Horizon Soil Mix	Active Turf

For simplicity, SESL has applied the nomenclature used by the client. Where applicable, topsoil mixes are defined as “A horizons” and subsoil mixes as “B Horizons”.

SESL understands that species planted in these soils have been developed in consultation with landscape architects, stakeholders and environmental scientists. Vegetation types have been broadly defined in table 1. Full plant lists (current at the writing of this report) are available in appendix A – Plant Species List.

2 SPECIFICATION 1: GROUND COVER, SHRUBS AND TREES (ON-SLAB A AND B HORIZON SOIL MIX)

Specification 1 is expected to be applied to the Doran Plaza area of the project. The soil profile is expected to be installed to a depth of 1.5 to 2.0m and planted out with various native and exotic species. Stock sizes vary from tube stock to 200L.

A horizon shall be installed to a minimum depth of 300mm with B Horizon installed for the remainder of the required depth.

2.1 'FIT-FOR-PURPOSE' PERFORMANCE DESCRIPTION - SPECIFICATION 1 - A HORIZON

Topsoil is specified as the top 300mm of the soil profile and consists of a sandy loam to clay loam topsoil mix designed for mass planting of grasses, woody and herbaceous perennials that do not have very high nutrient target ranges and is not subject to compaction by pedestrian or other traffic. The heavier textured soils in this specification may require the use of engineered solutions (drainage techniques) where excessive wetness is anticipated. Planting methods may vary and include direct seeding, tube and potted specimens. For plant stock 50L or greater, U shaped ag piping must be installed below the rootball and communicate each end with the atmosphere to ensure sufficient oxygen is delivered to the subsoil.

2.2 'FIT-FOR-PURPOSE' PERFORMANCE DESCRIPTION - SPECIFICATION 1 - B HORIZON

Subsoil is to be installed in any situation where specification 1 is to be applied at a depth greater than 300mm. Subsoil is specified as a low organic matter material that is balanced chemically, non-saline, sodic or excessively acidic or calcium deficient and not dispersive. This specification is designed to provide improved rooting depth for larger plantings and reduce the likelihood of waterlogging. The subsoil may be made using site subsoil, fill material or imported materials. There is no requirement for fertiliser addition, however phosphorous levels should be monitored for P-sensitive species.

Note: Planting methods may vary and include direct seeding, tube and potted specimens. For plant stock 50L or greater, U shaped ag piping must be installed below the rootball to ensure sufficient oxygen is delivered to the subsoil.

2.3 TECHNICAL PARAMETERS - SPECIFICATION 1 - A HORIZON

Generally, the soil must be free of 'unwanted material' and must meet all the Target ranges of Table 2 and 3

Table 2 Specification 1 - Ground Cover, Shrubs and Trees A Horizon Physical Properties

Property	Units	Target range	
Texture, preferred range ¹	n/a	Sandy loam to clay loam	
Saturated Bulk Density ⁸	kg/m ³	≤ 1800	
Organic matter ²	% dwb	2-5	
Permeability (@ 16 drops by McIntyre Jakobsen) ³	mm/h	> 20	
Wettability ⁴	mm/h	> 5	
Dispersibility in water ⁷	Class	> 4	Emerson Aggregate Class
Large particles (naturally occurring) ⁴			
2-20 mm	% w/w	< 20	
> 20 mm	% w/w	< 10	
Visible contaminants > 2 mm (glass, plastic and metal) ⁵	%w/w	< 0.5	

Table 3 Specification 1 - Ground Cover, Shrubs and Trees A Horizon Chemical Properties

Property	Units	Target range
pH in water (1:5) standard range ⁶	pH units	5.4-6.8
pH in CaCl ₂ (1:5) standard range ⁶	pH units	5.2-6.5
Electrical conductivity (1:5) ⁶	dS/m	< 0.5
Phosphorus - P-sensitive plants. Acid soils method ⁶	mg/kg	< 30
Exchangeable sodium (Na) ⁶	% of ECEC	< 7%
Exchangeable potassium (K) ⁶	% of ECEC	3-10%
Exchangeable calcium (Ca) ⁶	% of ECEC	60-80
Exchangeable magnesium (Mg) ⁶	% of CEC	15-25
Exchangeable aluminium (Al) ⁶	% of CEC	< 5

Exchangeable Ca/Mg ratio ⁶	ratio	3-9
Available iron (Fe) ⁶	mg/kg	100-400
Available manganese (Mn) ⁶	mg/kg	25-100
Available zinc (Zn) ⁶	mg/kg	5-30
Available Copper (Cu) ⁶	mg/kg	1-15
Available boron (B) ⁶	mg/kg	0.5-5
Available N (ammonium-N + nitrate-N) ⁶	mg/kg	> 25

2.4 METHOD REFERENCES

1. Texture (SES Method)
2. Rayment and Lyons 6B2
3. McIntyre & Jakobsen-1998
4. AS4419
5. AS4454-2012 Appendix I
6. Rayment & Lyons (2011)
7. Emerson (1991)
8. AS3743

2.5 EXAMPLE COMPONENTS

The following table outlines suggested components that may likely meet the physical target ranges of this specification. This is **not** part of the product specification. It is an example for the edification of the soil supplier of what might meet the product specification.

Table 4 Example Components for Specification 1 - Ground Cover, Shrubs and Trees A Horizon

Example components (likely to meet the physical Target ranges of this specification)		
Sandy loam soil or site won topsoil	70-100% by volume	e.g. 8 parts washed sand/2 parts sandy loam/1 part AS4454 compost.
Composted soil conditioner conforming with Australian Standard AS 4454	0-30% by volume	
Base level Target ranges for fertilisers (to be verified by laboratory testing and per Soil Scientist's report)		
Lime and/or dolomite	2 kg/m ³ at mixing	
Low phosphorous native fertiliser	0.5 kg/100 m ² after placement	
Minor and trace elements	300 g/m ³ at mixing	

For the purposes of tendering the contractor must allow for the inclusion of the above soil amendments but the specific amendments required must be verified by laboratory testing and Soil Scientist recommendations

2.6 TECHNICAL PARAMETERS - SPECIFICATION 1 - B HORIZON

Generally, the soil must be free of 'unwanted material' and must meet all the Target ranges of Table 5 and 6.

Table 5 Specification 1 - Ground Cover, Shrubs and Trees B Horizon Physical Properties

Property	Units	Target range	
Texture, preferred range ¹	n/a	Sandy loam to clay loam	
Saturated Bulk Density ⁸	kg/m ³	≤ 1800	
Organic matter ²	% dwb	< 3	
Dispersibility in water ⁷	Class	> 4	Emerson Aggregate Class
Large particles (naturally occurring) ⁴			
2-10 mm	% w/w	< 20	
10-20 mm	% w/w	< 10	
> 20 mm	% w/w	< 10	
> 50 mm	% w/w	< 2	
Visible contaminants > 2 mm (glass, plastic and metal) ⁵	%w/w	< 0.5	
Wettability ⁴	mm/h	> 5	

Table 6 Specification 1 - Ground Cover, Shrubs and Trees B Horizon Chemical Properties

Property	Units	Target range
pH in water (1:5) standard range ⁶	pH units	5.4-6.8
pH in CaCl ₂ (1:5) standard range ⁶	pH units	5.2-6.5
Electrical conductivity (1:5) ⁶	dS/m	< 0.5
Chloride ⁶	mg/kg	< 200
Phosphorus - P-sensitive plants. Acid soils method ⁶	mg/kg	< 30
Exchangeable sodium (Na) ⁶	% of ECEC	< 7%

Exchangeable potassium (K) ⁶	% of ECEC	3-10%
Exchangeable calcium (Ca) ⁶	% of ECEC	60-80
Exchangeable magnesium (Mg) ⁶	% of ECEC	15-25
Exchangeable aluminium (Al) ⁶	% of ECEC	< 5
Exchangeable Ca/Mg ratio ⁶	Ratio	1.5-8

2.7 METHOD REFERENCES

1. Texture (SESL Method)
2. Rayment and Lyons 6B2
3. McIntyre & Jakobsen-1998
4. AS4419
5. AS4454-2012 Appendix I
6. Rayment & Lyons (2011)
7. Emerson (1991)
8. AS3743

2.8 EXAMPLE COMPONENTS

The following table outlines suggested components that may likely meet the physical target ranges of this specification. This is **not** part of the product specification. It is an example for the edification of the soil supplier of what might meet the product specification.

Table 7 Example Components for Specification 1 - Ground Cover, Shrubs and Trees A Horizon

Example components (likely to meet the physical Target ranges of this specification)	
Sandy or Sandy Loam Soil	20-40% by volume
Clay loam or Clay soil	30-60% by volume
Base level Target ranges for additives (to be verified by laboratory testing and per Soil Scientist's report)	
Lime and/or dolomite or Gypsum	2 kg/m ³ at mixing

For the purposes of tendering the contractor must allow for the inclusion of the above soil amendments but the specific amendments required must be verified by laboratory testing and Soil Scientist recommendations.

3 SPECIFICATION 2: GROUND COVER, SHRUBS AND TREES (ON-STRUCTURE A AND B HORIZON SOIL MIX - LIGHTWEIGHT)

Specification 2 is expected to be applied to the Communal Open Spaces on levels 2, 3, 8 and 16 of the project. The soil profile is expected to be installed to a minimum depth of 500mm and planted out with various native and exotic species. Stock sizes vary from tube stock to 100L. Additional engineering measures will be required for stabilisation of large stock during establishment.

A horizon shall be installed to a depth of 300mm with B Horizon installed for the remainder of the required depth.

3.1 'FIT-FOR-PURPOSE' PERFORMANCE DESCRIPTION - SPECIFICATION 2 - A HORIZON

A-Horizon Soil Mix specification describes the formulation of an open granular well-drained growing media with a saturated density of less than 1800 kg/m³ (1.8 kg/L) for use in on-structure applications, such as rooftop gardens with an expectation of longevity. The A horizon formulation is to be used in the surface 300 mm of all on-slab installations.

In order to maintain structure and porosity over extended periods, and to avoid slumping and volume loss over time, the formulation must employ low density mineral components such as ash, perlite, scoria, pumice and diatomaceous earth or artificial components such as urea formaldehyde and Styrofoam. Physically, the media has the properties of a potting media and is assessed using the methodology of AS 3743 Potting mixes.

It is worth noting, that due to the low-density nature of the specified media, larger plant stock, or top-heavy trees are unlikely to be stable within the media. Especially during establishment larger stock and top-heavy trees have potential to topple over as materials have a lower density to soil and do not become compact. SESL recommends that planting stock sizes be kept to tubestocks and shrubs to prevent this occurring. Alternatively assess the size of planting stock and ensure engineering measures are put in place to prevent toppling.

3.2 'FIT-FOR-PURPOSE' PERFORMANCE DESCRIPTION - SPECIFICATION 2 - B HORIZON

B Horizon should be used in profiles deeper than 300mm. A lower percentage of organic components (< 5 % w/w) is prescribed in the B horizon due to susceptibility to slumping over time. This configuration may also be applied within planter boxes and moveable beds if applicable.

In order to maintain structure and porosity over extended periods, and to avoid slumping and volume loss over time, the formulation must employ low density mineral components such as ash, perlite, scoria, pumice and diatomaceous earth or artificial components such as urea formaldehyde and Styrofoam. Physically, the media has the properties of a potting media and is assessed using the methodology of AS 3743 Potting mixes.

It is worth noting, that due to the low-density nature of the specified media, larger plant stock, or top-heavy trees are unlikely to be stable within the media. Especially during establishment larger stock and top-heavy trees have potential to topple over as materials have a lower density to soil and do not become compact. SESL recommends that planting stock sizes be kept to tubestocks and shrubs to prevent this occurring. Alternatively assess the size of planting stock and ensure engineering measures are put in place to prevent toppling.

3.3 TECHNICAL PARAMETERS - SPECIFICATION 2 - A HORIZON

Generally, the soil must be free of 'unwanted material' and must meet all the Target ranges of **AS 3743 Potting mixes** and the specified Target ranges of **Australian Standard AS 4419:2003 Landscape soils**. However, compliance with AS 3743 does not demonstrate compliance with this specification. Where the Target ranges of this specification and AS3743 conflict, properties specified here must take precedence. Target ranges have been presented within tables 8 and 9.

Table 8 Specification 2 - Ground Cover, Shrubs and Trees (Lightweight) A Horizon Physical Properties

Property	Units	Target range
Texture, preferred range ¹	n/a	Gravelly loamy sand to organic sandy loam
Air-filled porosity ²	%	≥ 10
Water-holding capacity ²	%	≥ 40
Saturated density ³	kg/m ³	< 1800
Permeability (@ 16 drops by McIntyre Jakobsen) ³	mm/h	> 100
Organic matter ⁴	% w/w	< 15
Wettability ⁵	min	≤ 5

Dispersibility in H ₂ O (AS4419) ⁵	Category	1 or 2
Large particles in the largest dimension ⁵		
< 2 mm	% w/w	30-70
2-10 mm	% w/w	10-20
10-20 mm	% w/w	5-10
20-50 mm	% w/w	< 5
> 50 mm	% w/w	0

Table 9 Specification 2 - Ground Cover, Shrubs and Trees (Lightweight) A Horizon Chemical Properties

Chemical properties	Units	A-Horizon Target range
pH in water (1:5) Standard range ²	pH units	5.4-6.8
Electrical Conductivity (1:1.5) ²	dS/m	< 2.2
Chloride ²	mg/L	≤ 200
Ammonium-N (NH ₄) ²	mg/L	≤ 100
Ammonium-N + nitrate-N (NH ₄ + NO ₃) ²	mg/L	≥ 50
Nitrogen draw-down index ²	-	≥ 0.7
Toxicity index ²	mm	≥ 70
Low phosphorus - P (P-sensitive plants)* ²	mg/L	< 3
Potassium (K) ²	mg/L	50-250
Sulphate (SO ₄) ²	mg/L	≥ 40
Calcium (Ca) ²	mg/L	≥ 80
Magnesium (Mg) ²	mg/L	≥ 15
Ca:Mg ratio ²	ratio	1.5-10
K:Mg ratio ²	ratio	1-7
Sodium (Na) ²	mg/L	≤ 130

Iron (Fe) ²	mg/L	≥ 35
Copper (Cu) ²	mg/L	0.4-15
Zinc (Zn) ²	mg/L	0.3-10
Manganese (Mn) ²	mg/L	1-15
Boron (B) ²	mg/L	0.02-0.65

3.4 METHOD REFERENCES

1. Texture (SESL Method)
2. AS3743
3. McIntyre & Jakobsen-1998
4. Rayment & Lyons 6G1-2011
5. AS4419

3.5 EXAMPLE COMPONENTS

The following table outlines suggested components that may likely meet the physical target ranges of this specification. This is **not** part of the product specification. It is an example for the edification of the soil supplier of what might meet the product specification.

Table 10 Example Components for Specification 2 - Ground Cover, Shrubs and Trees (Lightweight) A Horizon

Components	A-Horizon Components
Sandy loam soil or site won topsoil	20-40% by volume
Horticultural ash, perlite, or similar lightweight low-density mineral matter or mixtures of these	30-60% by volume
Composted soil conditioner conforming with AS4454	20-30% by volume
Composted 10mm pine bark	-
Base level Target ranges for fertilisers (to be verified by laboratory testing and per Soil Scientist's report)	
Lime and/or dolomite	2 kg/m ³ at mixing
Balanced compound Low Phosphorous Fertiliser	3.0 kg/100 m ² after placement

Minor and trace elements	300 g/m ³ at mixing
--------------------------	--------------------------------

For the purposes of tendering, the contractor must allow for the inclusion of the above soil amendments, but the specific amendments required must be verified by laboratory testing and Soil Scientist recommendations.

The suggested **fertilisers are expected to last 3-6 months** of sustained growth. A suitable fertiliser (e.g. controlled slow release) and organic matter maintenance program may be required after this period, depending on the design intent.

3.6 TECHNICAL PARAMETERS - SPECIFICATION 2 - B HORIZON

Generally, the soil must be free of 'unwanted material' and must meet all the Target ranges of **AS 3743 Potting mixes** and the specified Target ranges of **Australian Standard AS 4419:2003 Landscape soils**. However, compliance with AS 3743 does not demonstrate compliance with this specification. Where the Target ranges of this specification and AS3743 conflict, properties specified here must take precedence. Target ranges have been presented within tables 11 and 12 below.

Table 11 Specification 2 - Ground Cover, Shrubs and Trees (Lightweight) B Horizon Physical Properties

Property	Units	Target range
Texture, preferred range ¹	n/a	Gravelly loamy sand to organic sandy loam
Air-filled porosity ²	%	≥ 10
Water-holding capacity ²	%	≥ 40
Saturated density ³	kg/m ³	< 1800
Permeability (@ 16 drops by McIntyre Jakobsen) ³	mm/h	> 100 (Must be less than A horizon)
Organic matter ⁴	% w/w	< 5
Wettability ⁵	min	≤ 5

Dispersibility in H ₂ O (AS4419) ⁵	Category	1 or 2
Large particles in the largest dimension ⁵		
< 2 mm	% w/w	30-70
2-10 mm	% w/w	10-20
10-20 mm	% w/w	5-10
20-50 mm	% w/w	< 5
> 50 mm	% w/w	0

Table 12 Specification 2 - Ground Cover, Shrubs and Trees (Lightweight) A Horizon Chemical Properties

Chemical properties	Units	B-Horizon Target range
pH in water (1:5) Standard range ²	pH units	5.4-6.8
Electrical Conductivity (1:1.5) ²	dS/m	< 2.2
Chloride ²	mg/L	≤ 200
Ammonium-N (NH ₄) ²	mg/L	≤ 100
Ammonium-N + nitrate-N (NH ₄ + NO ₃) ²	mg/L	≥ 50
Nitrogen draw-down index ²	-	≥ 0.7
Toxicity index ²	mm	≥ 70
Low phosphorus - P (P-sensitive plants)* ²	mg/L	< 3
Potassium (K) ²	mg/L	50-250
Sulphate (SO ₄) ²	mg/L	≥ 40
Calcium (Ca) ²	mg/L	≥ 80
Magnesium (Mg) ²	mg/L	≥ 15
Ca:Mg ratio ²	ratio	1.5-10
K:Mg ratio ²	ratio	1-7
Sodium (Na) ²	mg/L	≤ 130

Iron (Fe) ²	mg/L	≥ 35
Copper (Cu) ²	mg/L	0.4-15
Zinc (Zn) ²	mg/L	0.3-10
Manganese (Mn) ²	mg/L	1-15
Boron (B) ²	mg/L	0.02-0.65

3.7 METHOD REFERENCES

1. Texture (SESL Method)
2. AS3743
3. McIntyre & Jakobsen-1998
4. Rayment & Lyons 6G1-2011
5. AS4419

3.8 EXAMPLE COMPONENTS

The following table outlines suggested components that may likely meet the physical target ranges of this specification. This is **not** part of the product specification. It is an example for the edification of the soil supplier of what might meet the product specification.

Table 13 Example Components for Specification 2 - Ground Cover, Shrubs and Trees (Lightweight) A Horizon

Components	A-Horizon Components
Sandy loam soil or site won topsoil	10-30% by volume
Horticultural ash, perlite, or similar lightweight low-density mineral matter or mixtures of these	30-50% by volume
Composted soil conditioner conforming with AS4454	< 20% by volume
Composted 10mm pine bark	-
Base level Target ranges for fertilisers (to be verified by laboratory testing and per Soil Scientist's report)	
Lime and/or dolomite	2 kg/m ³ at mixing
Balanced compound Low Phosphorous Fertiliser	3.0 kg/100 m ² after placement

Minor and trace elements	300 g/m ³ at mixing
--------------------------	--------------------------------

For the purposes of tendering, the contractor must allow for the inclusion of the above soil amendments, but the specific amendments required must be verified by laboratory testing and Soil Scientist recommendations.

The suggested **fertilisers are expected to last 3-6 months** of sustained growth. A suitable fertiliser (e.g. controlled slow release) and organic matter maintenance program may be required after this period, depending on the design intent.

4 SPECIFICATION 3: ACTIVE TURF (ON-SLAB A AND B HORIZON SOIL MIX)

Specification 3 is expected to be applied to the Doran Plaza area of the project. The soil profile is expected to be installed to a depth of 1.5m and seeded with a commercial lawn mix.

A horizon shall be installed to a depth of 150mm with B Horizon installed for the remainder of the required depth.

4.1 'FIT-FOR-PURPOSE' PERFORMANCE DESCRIPTION - SPECIFICATION 3 - A HORIZON

A-Horizon soil mix is a loamy sand to sandy loam 'turf underlay' topsoil mix for use on-structure to a depth of 200 mm above B Horizon Soil mix.

The specification is not suitable for active recreational areas and is not generally considered suitable for construction of playing fields, even with specific turf management practices to prevent compaction. There is some allowance for finer materials to improve water and nutrient holding capacity, however fines have been minimised to provide some resistance to compaction. Defined as 'active high traffic turf' these areas will withstand regular foot traffic, however, will require regular irrigation and fertiliser schedules.

The most important parameters are the hydraulic conductivity of which the particle size is a recipe to achieve the appropriate hydraulic conductivity. Organic matter, pH and electrical conductivity are also equally important chemical properties. Final products should meet the target ranges outlined in this specification.

Note: This specification has been designed under the assumption there is no specific load limits required for the 'on structure' component of this landscape area. Designed to provide moderate resistance to compaction in public and other amenity turf areas subject moderate levels of pedestrian traffic.

4.2 TECHNICAL PARAMETERS - SPECIFICATION 3 - A HORIZON

Generally, the soil must be free of 'unwanted material' and must meet all the target ranges of tables 14 and 15.

Table 14 Specification 3 - Active Turf (On Slab) - A Horizon Physical Properties

Property	Units	Target range	
2.0 mm (fine gravel) ¹	by mass	< 3	
1.0 mm (very coarse sand) ¹		< 10	
0.5 mm (coarse sand) ¹		10-30	30-50
0.25 mm (medium sand) ¹		20-40	
0.1 mm (fine sand) ¹		10-30	
0.05 (very fine sand) ¹		< 15 (max 20% combined vfs, Si +Cl)	
0.002 mm (silt) ¹		< 8 (Si + Clay combined 5-8)	
< 0.002 mm (clay) ¹		2-6	
Large particles ²		2-20 mm = < 2% > 20 mm = 0%	
Organic matter content ⁴	% w/w	2 to 5	
Saturated Bulk Density ⁷	kg/m ³	≤ 1800	
Permeability ³	mm/hour	> 50-200 (@ 16 drops by McIntyre Jakobsen)	
Wettability (AS 4419) ²	mm/hour	> 5	
Dispersibility in water ⁶	Class	> 4	Emerson Aggregate Class

Table 15 Specification 3 - Active Turf (On Slab) - A Horizon Chemical Properties

Property	Units	Target range
pH in water (1:5) ⁵	pH units	5.4-8.0
pH in CaCl ₂ (1:5) ⁵	pH units	5.2-7.5
Electrical conductivity (1:5) ⁵	dS/m	< 0.5
Exchangeable Na percentage ⁵	% of ECEC	< 7
Exchangeable Ca/Mg ratio ⁵	Ratio	3-9
Available phosphorus Mehlich 3 ⁵	mg/kg	50-150

Available phosphorus Olsen		20-50
Available nitrogen (nitrate N + ammonium N) ⁵	mg/kg	30-100

4.3 METHOD REFERENCES

1. AS1289 1632 - 2003
2. AS4419 (2018)
3. McIntyre & Jakobsen-1998
4. Rayment and Lyons 6B2
5. Rayment & Lyons (2011)
6. Emerson (1991)
7. AS3743

4.4 EXAMPLE COMPONENTS

The following table outlines suggested components that may likely meet the physical Target ranges of this specification. This is **not** part of the product specification. It is an example for the edification of the soil supplier of what might meet the product specification.

Table 16 Example Components for Specification 2 - Active Turf (On Slab) - A Horizon

Example components likely to meet the physical target ranges of this specification		
Medium-coarse grade washed sand	60-80% by volume	e.g. 5 parts washed sand / 4 parts site soil loam / 1 part AS4454 compost.
Sandy loam soil or site soil	10-30% by volume	
Composted soil conditioner conforming with AS4454	10% by volume	
Turf Starter Fertiliser (N:P:K 18:10:9)	Surface Applied at 20 g/m ² 1 week prior to turf installation	Note: Similar N:P:K turf starter fertiliser may be used.

For the purposes of tendering, the contractor must allow for the inclusion of the above soil amendments, but the specific amendments required must be verified by laboratory testing and Soil Scientist recommendations.

4.5 'FIT-FOR-PURPOSE' PERFORMANCE DESCRIPTION - SPECIFICATION 3 - B HORIZON

Specification 3 B horizon is specified as a low organic matter material that is balanced chemically, non-saline, sodic or excessively acidic or calcium deficient and not dispersive. This specification is designed to support turf growth and facilitate rapid drainage.

4.6 TECHNICAL PARAMETERS - SPECIFICATION 3 - B HORIZON

Generally, the soil must be free of 'unwanted material' and must meet all the target ranges of tables 17 and 18.

Table 17 Specification 3 - Active Turf (On Slab) - B Horizon Physical Properties

Property	Units	Target range
Texture, preferred range ¹	n/a	Sandy loam to clay loam
Saturated Bulk Density ⁷	kg/m ³	≤ 1800
Organic matter ²	% dwb	< 3
Dispersibility in water ⁷	Class	> 4 Emerson Aggregate Class
Permeability ³	mm/hour	> 50-100 (@ 16 drops by McIntyre Jakobsen) (Lower than A horizon)
Large particles (naturally occurring) ⁴		
2-10 mm	% w/w	< 20
10-20 mm	% w/w	< 10
> 20 mm	% w/w	< 10
> 50 mm	% w/w	< 2
Visible contaminants > 2 mm (glass, plastic and metal) ⁵	%w/w	< 0.5
Wettability ⁴	mm/h	> 5

Table 18 Specification 3 - Active Turf (On Slab) - B Horizon Chemical Properties

Property	Units	Target range
pH in water (1:5) ⁵	pH units	5.4-8.0

pH in CaCl ₂ (1:5) ⁵	pH units	5.2-7.5
Electrical conductivity (1:5) ⁵	dS/m	< 0.5
Exchangeable Na percentage ⁵	% of ECEC	< 7
Exchangeable Ca/Mg ratio ⁵	Ratio	3-9

4.7 METHOD REFERENCES

1. AS1289 1632 - 2003
2. AS4419 (2018)
3. McIntyre & Jakobsen-1998
4. Rayment and Lyons 6B2
5. Rayment & Lyons (2011)
6. Emerson (1991)
7. AS3743

4.8 EXAMPLE COMPONENTS

The following table outlines suggested components that may likely meet the physical target ranges of this specification. This is **not** part of the product specification. It is an example for the edification of the soil supplier of what might meet the product specification.

Table 19 Example Components for Specification 2 - Active Turf (On Slab) - A Horizon

Example components (likely to meet the physical Target ranges of this specification)	
Sandy or Sandy Loam Soil	30-50% by volume
Medium-coarse grade washed sand	50-70% by volume
Base level Target ranges for fertilisers (to be verified by laboratory testing and per Soil Scientist's report)	
Lime and/or dolomite or Gypsum	2 kg/m ³ at mixing

For the purposes of tendering the contractor must allow for the inclusion of the above soil amendments but the specific amendments required must be verified by laboratory testing and Soil Scientist recommendations.

5 QUALITY CONTROL AND HOLD POINTS

The contractor must use analytical testing to verify compliance with the Product Specification. This will be done in two parts: initial compliance certification and quality control, described below.

5.1 INITIAL COMPLIANCE CERTIFICATION

Before any soil installation, the contractor or soil manufacturer will submit samples of trial blends likely to meet the performance specifications (see suggested formulations) to a NATA-registered testing laboratory (SES Australia or equivalent). The trial blend must be based on available test information on components and, if necessary, employ a soil scientist for advice.

Submit trial samples to the NATA-registered testing laboratory (SES Australia or equivalent), allowing sufficient time for testing and re-formulation in the case of failure to satisfy the performance criteria. Once compliant, a test certificate clearly stating compliance with the applicable criteria must be presented to the site supervisor or quality officer.

Note that alternative test methodologies may be accepted and certified as compliant by an independent Certified Professional Soil Scientist (CPSS).

Non-compliance will automatically generate the first **Hold point 1**. No soil will be installed until initial compliance certification has been demonstrated.

Manufacturer's product representation: For imported soils from manufacturers, a 'product representation' document produced by the supplier may be accepted as a compliance certificate if:

- It is an off-the-shelf product line, not a custom mix;
- A representative test certificate is available and is acceptably recent (within 3 months);
- The testing covers all those criteria in the performance specification; and
- The manufacturer's quality assurance system is externally certified.

5.2 RECORD KEEPING

Growing media initial compliance certification records must be kept in an easily retrievable manner that provides for traceability of purchase and location on site. Each compliance certification for all the product specifications used on site must be identified by date, quantity to be supplied and a copy of the formulation used to reach compliance.

5.3 QUALITY CONTROL: COMPLIANCE DURING CONSTRUCTION

The contractor must submit samples of blended soils or imported soil mixes at regular intervals during construction for the purposes of demonstrating continued compliance as part of quality control.

5.3.1 Test submissions

For Hold Point 1, contractor or supplier is to submit representative samples of ~ 5 kg of each product specification, packed and labelled to indicate the source and the specification to be met. The samples must be taken in a representative manner.

For Hold Point 2 and 3, representative samples should be collected by a qualified soil scientist in accordance to *Section 9 Landscape: Standard Specification for Urban Infrastructure Works (TAMS 2002)*.

The contractor must refer to the testing frequencies indicated in Table 20. Variations to the frequencies in this table are permitted on the submission to the superintendent of an alternative testing program that clearly achieves the desired outcome of quality control. Materials supplied from operations that have a third-party-endorsed quality assurance program may be acceptable pending submission of the relevant documentation.

Table 20. Outline of the required testing frequency to achieve compliance testing. Samples must be tested to the performance criteria indicated in the product specification.

Specification	Material	Minimum test frequency
Specification 1	Ground Cover, Shrubs and Trees (On-Slab A and B Horizon Soil Mix)	1 per 1,000 m ³ .
Specification 2	Ground Cover, Shrubs and Trees (On-Structure A and B Horizon Soil Mix – Lightweight)	1 per 100 m ³ .
Specification 3	Active Turf (On-Slab A and B Horizon Soil Mix)	1 per 1,000 m ³ .

Note: Where the delivery is less than the stated QC testing frequency, the initial compliance certificate must be deemed to demonstrate compliance.

5.3.2 Analysis

All testing as required by the product specifications must be arranged by the contractor, and carried out by NATA-registered testing laboratory (SESL Australia or equivalent). All test results records will be made available to the superintendent or quality officer.

Hold point 1. The test certificate will be accompanied by a statement of compliance from a soil scientist.

Compliance certificates will be in the form of a report clearly stating the material is compliant, with an attachment showing the test result relied upon. In the case of minor non-compliance or substantial compliance, a clear statement must be obtained from a soil scientist waiving the compliance and certifying the sample is compliant or fit for purpose, with or without conditions.

5.3.3 Non-compliance

In the case of substantive non-compliance, **Hold Points 2 and Hold Point 3** will occur – one to correct soil already installed and another to ensure new deliveries are compliant. In the case of minor non-compliance or substantial compliance, a clear statement must be obtained from an independent CPSS report certifying the corrective procedure has resulted in compliance or fit for purpose including acceptance of any non-compliance with or without conditions and certifying the sample is fit for purpose. The superintendent will examine the submitted documentation prior to authorising the release of the Hold Point.

Hold point 2. The contractor will need to make corrective procedures to bring any soil that has been placed with substance compliance in accordance with the CPSS Soil Scientist advice.

Hold point 3. In the event that quality control samples show substantial non-compliance from the approved performance Target ranges, the supplier must demonstrate compliance of any future loads. This may require re-formulation or alteration to existing formulations and may require the advice of an independent CPSS to meet correct analysis, making adjustments to mixing ratios, additives and procedures to achieve compliance.

5.3.4 Record keeping

Growing media construction and QC compliance records must be kept in an easily retrievable manner that provides for traceability of purchase and location on site. Each batch of soil must be identified by date of manufacture, quantity and a corresponding test result and must link into when the material was delivered and where the material was placed.

5.4 HOLD POINT TEMPLATE

HOLD POINT 1	
Process Held:	Completion of <i>insert specification</i> initial compliance certification. .
Submission Details:	Initial soil analysis with sample provided by supplier or contractor demonstrated soil results compliance with the <i>insert specification</i> . Sample analysed must include subsoil improvement as recommended in specification. .
Release of Hold Point:	Submission of laboratory test certificates to superintendent together with suppliers, contractors or independent soil scientist report certifying compliance or fit for purpose including acceptance of any non-compliance with or without conditions. .
HOLD POINT 2	
Process Held:	Supply of <i>insert specification</i>
Submission Details:	At least (3) working days prior to supply for <i>insert specification</i> , the Contractor shall provide certificate(s) from a NATA-registered or approved non NATA-registered laboratory for physical and chemical analysis. Certificates are to be certified compliant or fit for purpose by a soil scientist, including acceptance of any non-compliance with or without conditions.
Release of Hold Point:	The superintendent will examine the submitted documentation prior to authorising the release of the Hold Point.
HOLD POINT 3	
Process Held:	Compliance failure of <i>insert specification</i> during ongoing compliance certification
Submission Details:	Corrective procedures specification from a Certified Professional Soil Scientist (CPSS) for soil corrective amendments likely to result in compliance with the <i>insert specification</i>
Release of Hold Point:	Submission of laboratory test certificates to superintendent together with an independent CPSS report certifying the corrective procedure has resulted in compliance or fit for purpose including acceptance of any non-compliance with or without conditions. The superintendent will examine the submitted documentation prior to authorising the release of the Hold Point.

6 CONCLUSION

SESL Australia is pleased to present these specifications Deicorp Projects Showground Pty Ltd for the 2 Mandala Place Castle Hill. A total of six (6) soil specifications along with professional soil science advice has been provided based on the information provided by the client and with the intent of outstanding and long-lasting landscapes.

Please feel free to contact us if you have any questions regarding this report.



Owen Guy
Soil Scientist
BScAgr (Hons.)



Simon Leake
Principal Soil Scientist
B Sc (Ag) Hons, ASSSI, CPSS

7 LIMITATIONS

This report only covers a limited desktop review, information provided by the client and from limited site assessment conducted by SESL Australia Pty Limited (SESL). SESL does not make any representation or warranty that the conclusions in this report will be applicable in the future as there may be changes in the condition of the materials covered in this assessment, applicable legislation or other factors that would affect the conclusions contained in this report.

This report is for the use of the named Client and any relevant authorities that rely on the information for development applications and approval processes. Any reliance on this report by third parties shall be at such parties' sole risk. This report shall only be presented in full and may not be used to support any other objective other than those set out in the report.

SESL's assessment has relied upon and presumed accurate information provided by the client and/or any third party (or absence thereof) in making the assumptions made in this report. Nothing in this report should be taken to imply that SESL has verified or audited any of the information supplied to us other than as expressly stated in this report. We have assumed this information to be both adequate and accurate for the purposes of this report.

Where findings, observations and conclusions are based solely upon information provided by the client and/or a third party and SESL do not accept, to the maximum extent permitted by law, any liability for any losses, claims, costs, expenses, damages (whether in statute, in contract or tort for negligence or otherwise) suffered or incurred by the client or any third party as a result of or in connection with SESL's reliance on any such the information to the extent that such information is false, misleading or incomplete and SESL gives no warranty or guarantee, express or implied as to such findings, observations and conclusions.

If further information becomes available, or additional assumptions need to be made, SESL reserves its right to amend any statements or opinions made in this report.

COPYRIGHT

The concepts, information and design ideas contained in this document are the property of SESL Australia Pty Ltd (ABN 70 106 810 708). Use or copying of this document in whole or in part without the written permission of SESL constitutes an infringement of copyright.

Appendix A

Species Lists

6.0 PLANTING SCHEDULE

LANDSCAPE SPECIFICS

The plant palette used for the site should reinforce all the themes as previously discussed. The environmental theme requires that the planting palette draw from the existing local vegetation communities.

In general;

Street trees should respond to the street hierarchy and Council’s street tree list.

The following list outlines the signature planting for the site and has been established with reference to:

Hills shire DCP 2012: Section C3- Landscape

APPENDIX A - RECOMMENDED SPECIES

Office of Environment and Heritage: River-flat Eucalpyt Forest on Coastal Floodplain - species list

OBJECTIVES:

To increase the number of indigenous species planted in Hills shire region

To eliminate the use of noxious weeds of potentially invasive species in developments

To use plants in such a way to foster energy efficient developmnt that relies on passive energy principles for heating and cooling

To reduce maintnance and water consumption through appropriate species selection

To create buffer zones and add to existing areas of remnant vegetation with locally indigeneous species including supplementary River-Flat Eucalpyt Forest on Coastal Floodplains planting.

The Landscape planting for the site will have a minimum of 75% of indigenous / water sensitive planting species.

OVERVIEW

The planting palette has been carefully selected in direct response to a variety of site specific conditions. Key planting zones of the landscape proposal include:

Streetscape:

This will include Corymbia maculata street trees with an understorey of lomandra and pennisetum species. The development will be set within a native bushland setting with tree species such as Angophora, Eucalyptus and Waterhousia’s. A developed understorey will provide visual relief from the scale of the building with shrubs and groundcovers including Acacia, Grevillea, Lomandra and Westringia species.

Northern and Southern Boundary Planting [River-flat on Coastal Flood Plains:

The northern and southern boundary planting will be comprised of a native palette inspired by the sites ecological setting. The planting scheme will create seperation from the adjoining site to the south and tie into the existing parkland to the north. Species will include Acmena, Eucalptus and Melaleuca.

Communal Open Space:

A shade tolerant planting scheme has been developed for the communal open space on podium level. The planting scheme also seeks to create privacy for adjoining units to the podium whilst achieving year round seasonal interest. Species include Elaeocarpus, Tristaniopsis, Clivia, Dicksonia and Philodendron. All planting on structure will be in accordance with the NSW Planning and Environment Apartment Design Guide: Section 4P Planting on Structures.

Rooftop Terrace:

A drought tolerant and wind resistant planting palette has been selected for the rooftop area. The planting palette will include a mix of native shrubs including Syzygium and grevillea species to create a series of outdoor rooms with feature plantings of Agave and Cordyline species. Shade trees will include Waterhousia and Magnolia species. All planting on structure will be in accordance with the NSW Planning and Environment Apartment Design Guide: Section 4P Planting on Structures.

PUBLIC DOMAIN PLANTING SCHEDULE

Botanic Name	Common Name	Na- tive/ Exotic	Size	Spacing
Trees				
Acmena smithii	Lilly Pilly	Native	200L	As shown
Angophora floribunda	Rough Barked Apple	Native	200L	As shown
Eucalyptus longifolia	Woollybutt	Native	200L	As shown
Eucalyptus tereticornis	Forest Red Gum	Native	200L	As shown
Ficus macrophylla	Moreton Bay Fig	Native	200L	As shown
Jacaranda mimosifolia	Blue Jacaranda	Exotic	200L	As shown
Livistona australis	Cabbage Tree Palm	Native	200L	As shown
Liquidambar styraciflua	Sweet Gum	Exotic	200L	As shown
Liriodendron tulipifera	Tulip Tree	Exotic	200L	As shown
Melaleuca decora	White Feather Honeymyrtle	Native	200L	As shown
Melaleuca linariifolia	Narrow-leaved Paperbark	Native	200L	As shown
Melaleuca styphelioides	Prickly-leaved Paperbark	Native	200L	As shown
Pyrus calleryana	Callery Pear	Exotic	200L	As shown
Tristaniopsis laurina	Water Gum	Native	200L	As shown
Shrubs, and Ground Covers				
Acacia floribunda	White Sally Wattle	Native	150mm	1/m2
Aiantum aethiopicum	Maiden Hair Fern	Native	150mm	2/m2
Backhousia myrtifolia	Grey Myrtle	Native	150mm	0.5/m2
Banksia spinulosa	Hair Pin Banksia	Native	200mm	0.5/m2
Casuarina glauca	Swamp She-oak	Native	150mm	3/m2
Dichondra repens	Kidney Weed	Native	150mm	4/m2
Grevillea 'Robyn Gordon'	Grevillea	Native	150mm	1/m2
Lomandra longifolia	Spiny Head Mat Rush	Native	150mm	3/m2
Pandorea pandorana	Wonga Vine	Native	150mm	3/m2
Themeda australis	Kangaroo Grass	Native	150mm	4/m2
Viola hederacea	Native Violet	Native	150mm	4/m2



6.1 PLANTING SCHEDULE

COMMUNAL OPEN SPACE PLANTING SCHEDULE

Botanic Name	Common Name	Native/ Exotic	Size	Spacing
Trees				
Elaeocarpus eumundi	Eumindi Quandong	Native	100L	As shown
Elaeocarpus reticulatus	Blue Berry Ash	Native	100L	As shown
Brachychiton acerifolius	Illawarra flame tree	Native	100L	As shown
Howea forsteriana	Kentia Palm	Native	100L	As shown
Hymenosporum flavum	Native frangipani	Native	100L	As shown
Livistona australis	Cabbage Tree Palm	Native	45L	As shown
Pyrus calleryana 'Capital'	Capital Ornamental Pear	Exotic	100L	As shown
Tristaniopsis laurina	Water Gum	Native	100L	As shown
Waterhousia floribunda	Weeping Lilli Pilli	Native	100L	As shown
Shrubs, Ground Covers and Climbers				
Acanthus mollis	Oyster Plant	Exotic	300mm	1/m2
Alcantarea imperialis	Bromeliad	Exotic	300mm	0.1/m2
Acmena smithii 'Allyn Magic'	Lilly Pilly	Native	200mm	0.5/m2
Asplenium australasicum	Bird's Nest Fern	Native	200mm	2/m2
Cordyline terminalis 'Rubra'	Cordyline 'Rubra'	Native	200mm	1/m2
Clivia miniata	Clivia	Exotic	200mm	3/m2
Cycas revoluta	Sago Palm	Exotic	200mm	1/m2
Dianella caerulea	Blue Flay-lily	Native	150mm	3/m2
Dicksonia antarctica	Soft Tree Fern	Native	200mm	0.5/m2
Hardenbergia violacea	False sarsaparilla	Native	200mm	2/m2
Liriope muscari	Lily Turf	Exotic	150mm	4/m2
Lomandra Longifolia	Mat Rush	Native	200mm	4/m2
Philodendron 'Xanadu	Philodendron Xanadu	Exotic	150mm	3/m2
Phormium tenax	New Zealand Flax	Exotic	200mm	2/m2
Monstera deliciosa	Swiss Cheese Plant	Exotic	150mm	1/m2
Murraya paniculata	Orange Jasmine	Exotic	150mm	1/m2
Rhapis excelsa	The Lady Palm	Exotic	150mm	1/m2
Strelitzia reginae	Bird of Paradise	Exotic	150mm	1/m2
Trachelospermum jasminoides	Star Jasmine	Exotic	150mm	4/m2
Viola hederacea	Native Violet	Native	150mm	5/m2
Viburnum odoratissimum	Sweet Viburnum	Exotic	200mm	1/m2
Zamia furfuracea	Cardboard Palm	Exotic	200mm	2/m2



ROOFTOP TERRACE PLANTING SCHEDULE

Botanic Name	Common Name	Na- tive/ Exotic	Size	Spacing
Trees				
Citrus x meyeri	Meyer lemon	Exotic	100L	As shown
Magnolia grandiflora 'Little Gem'	Magnolia 'Litte Gem'	Native	100L	As shown
Plumeria rubra acutifolia	Frangipani	Exotic	100L	As shown
Waterhousia floribunda	Weeping Lilli Pilli	Native	100L	As shown
Shrubs, Ground Covers and Climbers				
Agave attenuata	Fox Tail Agave	Exotic	150mm	1/m2
Anigozanthos hybrid 'Gold Velvet'	Kangaroo Paw 'Gold Velvet'	Native	150mm	3/m2
Banksia ericifolia	Heath-leaved Banksia	Native	300mm	0.5/m2
Carpobrotus Menziesii	Pigface	Native	200mm	4/m2
Cordyline terminalis 'Rubra'	Cordyline 'Rubra'	Native	200mm	1/m2
Grevillea rosmarinifolia	Crimson Villea	Native	300mm	2/m2
Ricinocarpos pinifolius	Wedding Bush	Native	150mm	1/m2
Syzygium australe 'Pinnacle'	Lilly Pilly	Native	300mm	1/m2

