

Soil Specification – Backfill soil for CityGreen Soil Cell Treepits

1.1 General description

The Contractor shall consult both the complete documentation and drawings for soil types, uses and locations. The soil type required shall consist of imported soil that fully complies with this specification.

1.2. Definition

Growing media is defined as an amended existing topsoil that contains organic matter; is capable of sustaining vigorous plant growth; complies generally with the typical uses of AS 4419 (2003); is free from unwanted matter such as:

- Stones, rock and pebbles greater than 10mm measured by longest dimension
- Hard clods or objects greater than 25mm dimension
- Roots with a section diameter exceeding 10mm or a length exceeding 100mm
- Sticks and rubbish
- Material toxic to plants
- Materials that may pose a danger to human health (e.g. glass, hard plastic)

1.3 Performance Specification

The proposed growing media shall be analysed for its chemical and physical properties to ascertain quality. The Contractor is responsible for the collection and analysis of a sufficient number of samples to accurately characterise the resource and if required, determine the amendments required to meet the performance specification indicated in Table 1.

Table 1 Acceptable chemical and physical properties for the growing media used to backfill the Soil Cell matrix after installation.

Property	Unit	Target Range
pH in H ₂ O ¹ (standard range)	-	5.8 to 7.0
pH in CaCl ₂ ¹ (standard range)	-	5.2 to 6.5
pH in H ₂ O ¹ (alkaline range*)	-	7.0 – 8.0
pH in CaCl ₂ ¹ (alkaline range*)	-	6.6 – 7.6
Electrical conductivity ²	dS/m	< 2.0
Sodium ³	% ECEC	<5
Potassium ³	% ECEC	5 to 15
Calcium ³	% ECEC	60 to 80
Magnesium ³	% ECEC	15 to 25
Ca:Mg	ratio	2 to 10

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Property	Unit	Target Range
Mg:K	ratio	1 to 8
Aluminium ⁴	% ECEC	< 2
Cation Exchange Capacity	meq/100g (cmol ⁺ /kg)	> 8 ¹
Phosphate – P sensitive plantings ³	mg/kg	< 15
Phosphate – General plantings ³	mg/kg	50 to 150
Ammonium + Nitrate ⁵	mg/kg	50 to 100
Sulphate ³	mg/kg	40 to 100
Boron ³	mg/kg	0.5 to 5
Copper ³	mg/kg	5 to 20
Iron ³	mg/kg	75 to 300
Manganese ³	mg/kg	25 to 100
Zinc ³	mg/kg	5 to 20
Organic Matter ⁶	% dry weight basis	3 to 6
Bulk Density	Kg/L	> 0.7
Hydraulic conductivity – see Table 2 below	mm/hr	Table 2
Toxicity index ⁷	mm	> 70
Nitrogen Draw-down Index ⁸	-	> 0.7
Hydrophobicity ⁹	seconds	> 40
Dispersibility ¹⁰	Class	1 - 2
<p>Methods: ¹ AS4419 (2003) Appendix D ² AS4419 (2003) Appendix D ³ Extractable nutrients by Mehlich 3 (1984) ⁴ Method 83.1 to 83.5 Black (1983) ⁵ AS4419 (2003) Appendix D and Bradley et al (1983) ⁶ Organic matter based on calculation from Total carbon by Dumas Combustion Furnace ⁷ AS4419 (2003) Appendix F ⁸ AS4419 (2003) Appendix E ⁹ NSW OEH http://www.environment.nsw.gov.au/resources/soils/testmethods/rep.pdf ¹⁰ AS4419 (2003) Appendix G</p> <p>*If the material meets the alkaline pH criteria, the species to be planted need to be alkaline tolerant</p>		

¹ The highest possible CEC is desirable but a CEC of 8 cmol⁺/kg is considered possible by most commercial producers using available materials within the maximum 6% w/w organic matter requirement.

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Organic matter must be properly composted as per the requirements of A.S. 4454.

Table 2. Target hydraulic conductivity and fines content for different planting situations

Planting situation	Target minimum Hydraulic Conductivity (mm/hr)	Target maximum silt + clay (%)
1. Well drained base with no additional capture of stormwater (incident rain only though porous paving or similar or just irrigation dependant). Aeration in surface 150mm of soil only	20	12
2. Some additional stormwater capture for irrigation purposes	50	10
3. Tree pits used for stormwater filtration or raingarden application. Additional aeration at depth via drains as well as within 150mm of soil surface.	>100	<6

1.4 Controlled Release Fertilisers

Available Nutrients. Small amounts (0.5 to 1 kg/m³ of filler soil) may be needed to achieve the readily available nutrient contents in the above specification tables.

Controlled Release Fertiliser. The application of long term (>9 month) controlled release fertilisers at 4 to 6 kg/m³ form part of the specification for Citygreen Stratacell applications. The recommended products are-

- Nutricote: Nutricote Standard Black 270 Day - 16 : 4.4 : 8.3 at 4 kg/m³
Nutricote Standard Brown 360 Day - 16 : 4.4 : 8.3 at 5 kg/m³
Nutricote Standard Fawn 700 Day - 16 : 4.4 : 8.3 at 6 kg/m³
- Osmocote Osmocote Exact Standard15-9-11+2MgO+TE. 8-9 month at 4 kg/m³
Osmocote Exact Standard15-9-11+2MgO+TE. 12-14 month at 5 kg/m³

Note: It is unacceptable for fertiliser(s) and other amendments (as recommended based on laboratory testing) to be applied after growing media placement to bring the chemistry of the material into specification. Growing media should meet the specification before it is installed.

Note on use of heavily textured soils. Soils texturing as having higher clay content than a sandy loam can be used provided additional aeration at 900mm centres coming within 300mm of the newly planted rootball are used.

2 Quality Assurance and Control (QA/QC)

A minimum of two (2) weeks before Works commence, obtain and submit written statements from suppliers of growing media, giving:

- Production capacity for material of the required type, quantity and quality
- Source of supply
- Lead times for delivery of materials to the site

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- A certificate of compliance stating that all material supplied complies with contract requirements and is suitable for the intended use (see section 2.1 below)
- Details of conditions associated with warranties
- Recommendations for use and maintenance

2.1 Testing

Before soil installation, the contractor or soil manufacturer is required to submit soil samples to a testing laboratory. Testing is to be carried out on stockpiled growing media that has been dedicated for use on the project, and to the criteria specified in Table 1. Samples must be submitted allowing sufficient time for testing (at least one month) and re-formulation in case of failure.

All testing as required by the specification shall be arranged and carried out by the Contractor and all test results records made available to the Superintendent. The cost of all such testing shall be borne by the Contractor.

Once compliant, a test certificate clearly stating compliance with the criteria in Table 1 must be presented. 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. The test certificate will be accompanied by a statement of compliance from a competent person (e.g. qualified agronomist horticulturist or soil scientist).

If material is non-compliant, Hold Point 1 is generated.

Hold Point 1: If the material demonstrates minor non-compliance, a clear statement must be obtained from a qualified independent agronomist or soil scientist waiving the compliance and certifying the sample is compliant with or without conditions.

Non-compliance with the target range criteria does not necessarily render a soil not fit-for-purpose but making this judgement requires an expert person to take responsibility for such deviation. Also, a conditional compliance certificate may be issued requiring that a certain fertiliser or further organic matter or some other amendment be added, with the aim of achieving compliance.

If suitable documentation is received and the Superintendent is satisfied, the media may be installed.

In the case of substantive non-compliance **HOLD Point 2** will occur.

Hold Point 2. In the event that quality control samples show substantial non-compliance from the approved performance requirements, 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 a qualified person to meet correct analysis, making adjustments to mixing ratios, additives and procedures to achieve compliance.

Growing media is not to be installed until a certificate of compliance is provided.

The nominated soil testing laboratory for this project is:

SESL Australia Pty Ltd
Laboratory: 16 Chilvers Road THORNLEIGH NSW 2120
Phone: 02 9980 6554
Fax: 02 9484 2427

2.2 Testing Frequency

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Testing frequency shall follow the rates contained in Table 3 or an approved Quality Management System as deemed appropriate by the Superintendent. The Contractor should refer to the testing frequencies indicated in Table 3. 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.

Growing media shall only be supplied for installation from certified stockpiles that have been tested (as a minimum) at the rate specified in Table 3 and shown to conform to the requirements indicated in relevant sections and table of this report.

Table 3 Testing frequency

Material type	Application	Minimum test frequency
Growing media	For backfilling StrataCell modules after installation	One (1) at approval then one per 100m ³ or part thereof

2.3 Stockpile Management

Once the growing media has been produced and all QC approvals have been met, the stockpiled material shall be protected against the effects of weather. If heavy rain is expected, stockpiles shall be covered where practical. To protect against wind erosion of soil or organic components, the stockpiles shall be kept moist on the surface of the stockpile.

Once the growing media is transported to the installation site, care shall be taken to ensure that the loading equipment and haul vehicles are properly sanitized such to contain no foreign soil, aggregate, asphalt, etc., that might contaminate the Growing media. When the stockpile material is being picked up for loading, care shall be exercised to assure that the bucket of the loading equipment is not picking up underlying material and that tyres or tracks are not ‘tilling’ other material into the mix.

Once a stockpile has been tested and certified, no further material is to be added to the stockpile.

2.4 Lateral Pipe installation

Perforated aeration pipes must be installed within the top layer of modules, as per tree pit design details. The pipe must be laid in a complete connected circuit, within 600mm (24”) of outer edge of matrix. Junctions and risers to be fitted at spacings of no more than 3.6 metres (12’). Riser pipes to be trimmed to 150mm (6”) above finished pavement level, and supported in vertical position by temporary staking. Open ends of pipe to be sealed with caps or weather-proof tape.

2.5 QA/QC

Design, manufacturing and placement of a high quality growing media requires a well designed and administered calibration and QC program. This program shall set the parameters to be included in the QC testing, the procedures for sampling, sampling intervals, handling the samples (chain of custody), the limits/tolerances or confidence intervals for accept/reject status within a sample, and the allowable variability of test parameters between samples.

The quality control system must have a paper trail that provides for traceability at any point down the track. Each batch of soil should be identified by date of manufacture, quantity, and a corresponding test result and should link into when the material was delivered and where the material was placed.

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Materials supplied from operations that have a third party endorsed Quality Assurance Program may be acceptable pending submission of the relevant documentation.

2.6 Unsuitable Material

Unsuitable material is that material brought to site by the Contractor that fails to comply with the performance specifications listed in Table 1. Unsuitable materials may ultimately be approved for use if sufficient documentation and supporting laboratory testing from a suitably qualified agronomist is submitted, stating that the proposed material is equivalent or superior to the material specified.

All costs associated with testing, reworking, removal or replacing any material that the Superintendent deems to be unsuitable for renovation because of non-compliance to the performance specification shall be borne by the Contractor.

2.7 Records

The Contractor shall keep and maintain all Quality System records as required by AS/NZS ISO 9001 and this Specification. They shall be systematically recorded, indexed and filed so as to be retrievable and accessible to the Superintendent or an appointed Quality Auditor on a job basis within one working day of requisition. 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.

Conformance records shall be stored and maintained such that they are readily retrievable and in facilities that provide a suitable environment to minimise deterioration or damage and to prevent loss.

The Contractor shall make the quality records available to the Superintendent at all reasonable times. If requested by the Superintendent, the Contractor shall provide copies of the records or test results at no cost to the Principal.

2.8 Non-conformance

All nonconforming Works detected by the Contractor's Quality System shall be reported to the Superintendent via a Non-conformance Report (NCR) within one working day of being detected. NCR's shall be submitted with all records that indicate a departure from the requirements of the specification. The NCR shall indicate the proposed corrective action.

If the corrective action of the non-conformance cannot be determined within one working day, the Contractor shall submit a partially completed NCR identifying the non-conformance.

The non-conforming product shall not be covered up unless a corrective action has been accepted/approved by the Superintendent and implemented by the Contractor.

A NCR will automatically create a **HOLD POINT** which shall apply until conformance has been achieved and the Superintendent has signed the Authorisation to Proceed.

2.8.1 Authorisation to Proceed

The Superintendent will issue a Corrective Action Request (CAR) when a non-conformance to the Contractors Quality System or Methods is detected. Unless specifically stated, this will not create a Hold Point.

2.8.2 Corrective Action Request (CAR)

Where the Superintendent's inspections, surveillance or audits detect product Non-conformance, he will issue a Notice of Non-conformance (NNC). This will immediately create a Hold Point and the Contractor is required to submit an NCR in accordance with this Clause

2.8.3 Notice of Non-conformance (NNC)

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In instances where there is a discrepancy between the test results obtained by the Superintendent and those provided by the Contractor, the results from the Superintendent shall prevail except where the Superintendent may determine a specific audit test procedure to resolve the discrepancy.

2.8.4 Inspection and Rectification

Authorised representatives of the Contractor and Superintendent as applicable shall sign off all actions.

The Contractor shall nominate a proposed corrective action for any non-conformance within five (5) working days or shall show cause to the Superintendent for any further delay. Under no circumstances will the deliberation on corrective action of a non-conformance justify an extension of time to the Contract period.

The Contractor shall advise the Superintendent in the NCR of the proposed corrective action of the particular non-conformance. This proposed corrective action will constitute corrective action for the Works or material referred to in the NCR and may comprise one of the following:

- a) propose additional Works to bring the Works or material up to the specified standard; or
- b) replace all or part of the Works or material to bring it up to the specified standard; or
- c) request utilisation of a Works or material for a reduced level of service if such a clause exists in the relevant Technical Specification; or
- d) for incidental defects, request that the Superintendent accept the Works or material without alteration as an exception with or without alteration to the respective unit rates.

Any proposed corrective action shall be subject to the approval of the Superintendent. Reworked/replaced Works or materials shall be verified to conform to the specified requirements.

2.8.5 Corrective Action

The Contractor will be required to indicate on the NCR corrective action appropriate to ensure that the Quality Plan is effective in avoiding recurrence of the non-conformance and continues to be effective.