2B-6 HASSALL ST, PARRAMATTA

Landscape Technical Specification

Issued For Tender

Client: **Charter Hall**
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LANDSCAPE TECHNICAL SPECIFICATIONS

1 GENERAL

This **Landscape Technical Specification** (S19003-TS-001) includes the following worksections:

2 WORKSECTION NOTES

- Substituted or additional texts to NATSPEC standards are shown in blue.
- Adjustments of format, spelling, or punctuation are not identified, unless likely to affect the sense.
- Deletions to NATSPEC standards and superseded text is deleted by removal entirely.
- Refer **Landscape Selections Schedule** (S19003-LS-001) for materials and finishes selections and specifications.
- The full scope and extent of revisions should be comprehended by comparison with previous editions.

0131 PRELIMINARIES

1 GENERAL

1.1 GENERAL

Interpretation

General: The words principal and contract administrator have the same meaning, respectively, as owner and architect, unless the context requires otherwise.

Cross reference: The clause **GENERAL**, **INTERPRETATION**, in *0171 General requirements*, also applies.

1.2 THE SITE

Secure areas

Entry permits: Make available, to persons entering designated secure areas, valid entry permits. Make sure these persons comply with conditions of entry.

Personnel: At least 10 working days before entry is required, submit the full name, address, and date and place of birth of persons required to enter designated secure areas.

- Purpose of submission: Review.

Occupied premises

General: For the parts of the site, documented in the **Occupied premises schedule**:

- Allow occupants to continue in secure possession and occupancy of the premises for the required period.
- Maintain safe access for occupants.
- Arrange work to minimise nuisance to occupants and for their safety.
- Protect occupants against weather, dust, dirt, water or other nuisance.

Proposals: Submit details of proposed methods.

- Purpose of submission: Information only.

Occupied premises schedule

Occupants	Occupied premises	Period of occupancy

Protection of persons and property

Temporary works: Provide and maintain required hoardings, barricades, guards, fencing, shoring, temporary roadways, footpaths, signs, lighting, watching and traffic management.

Accessways, services: Do not obstruct or damage roadways and footpaths, drains and watercourses and other existing services in use on or adjacent to the site. Determine the location of such services.

Property: Do not interfere with or damage trees and property which are to remain on or adjacent to the site, including adjoining property encroaching onto the site.

Rectification

Accessways and services: Rectify immediately any obstruction or damage to roadways and footpaths, drains and watercourses and other existing services in use on or adjacent to the site. Provide temporary services whilst repairs are carried out.

Property: Rectify immediately any interference or damage to trees and property which are to remain on or adjacent to the site, including adjoining property encroaching onto the site.

Existing services

Service to be continued: Repair, divert or relocate service, as documented.

Trenches: If the existing service crosses the line of a required trench or will lose support when the trench is excavated, provide permanent support for the existing service.

Redundant services: Remove redundant parts and make safe.

Interruption to services: Minimise the number and duration of interruptions.

Proposals: Submit proposals for action to be taken to existing services before starting this work.

- Purpose of submission: For review.

Adjoining property

Notice: At least 10 working days before commencing work, submit to owners and occupants of adjoining property written notice of intention to commence work and an outline description of the type and extent of work.

Revealed encroachments: If the works reveal unknown encroachments of adjoining property on to the site or of existing site structures on to adjoining property, immediately seek instructions.

Records: For each property described in the **Adjoining properties to be recorded schedule**:

- Inspect the property with the architect and owner and occupant of the property, before commencement of work.
- Make detailed records of conditions existing within the property, especially structural defects and other damage or defacement.
- Arrange for at least 2 copies of each record, including drawings, written descriptions, and photographs, endorsed by the owner and occupant of the property, or their representatives, as evidence of conditions existing before commencement of work.

Endorsed copies: Submit one endorsed copy of each record. Keep the other endorsed copy on site.

- Purpose of submission: Information only.

Adjoining properties to be recorded schedule

Title	Owner	Description

1.3 CONSTRUCTION PLANT

Access roads

Owner's existing roads: Use only designated roads.

Parking

Owner's existing parking areas: Use only designated parking areas.

Use of existing services

General: Existing services may be used as temporary services for the performance of the contract subject to conditions of use, as documented in the **Existing services schedule**.

Existing services schedule

Service	Conditions of use

Owner's site office

General: Provide a weathertight site office for the use of the owner or the owner's agents before major site operations are started and as follows:

- Pay charges for services.
- Maintain in good order and in clean condition, with secure access, for duration of the work.
- Obtain permission for removal.
- Remove on completion.

Protective clothing

Protective clothing: Make available protective clothing for the use of visitors, as follows:

- Safety helmets: To AS/NZS 1801, Type 1.
- Certification provider: Submit product certification from an organisation accredited by the Joint Accreditation System of Australia and New Zealand (JAS-ANZ).

Project signboards

General: Provide project-specific signboards and as follows:

- Locate where directed.
- Maintain in good condition for duration of the work.
- Obtain permission for removal.
- Remove on completion.

1.4 BUILDING THE WORKS

Survey marks

Definition: A survey peg, bench mark, reference mark, signal, alignment, level mark or any other mark used or intended to be used for the purpose of setting out, checking or measuring the work.

Care of survey marks: Preserve and maintain the principal's survey marks in their true positions.

Rectification: If survey marks are disturbed or obliterated, immediately rectify.

Safety

Accidents: Promptly notify the architect of the occurrence of the following:

- Accidents involving death or personal injury.
- Accidents involving loss of time.
- Incidents with accident potential such as equipment failure, slides and cave-ins.

Accident reports: Submit reports of accidents.

- Purpose of submission: Information only.

Contractor's representative

General: Must be accessible, and fluent in English and technical terminology.

Subcontracting

General: Submit a complete list of proposed subcontractors and suppliers.

Program of work

Construction program: Show the following:

- Sequence of work.
- Critical paths of activities related to the work.
- Allowance for holidays.
- Activity inter-relationships.
- External dependencies including provision of access, document approvals and work by others.
- Periods within which various stages or parts of the work are to be executed.

Time scale: Working days.

Updated program: Identify changes since the previous issue, and show the estimated percentage of completion for each item of work.

Program chart: Display in the contractor's site office an up-to-date bar chart and network diagram based on the construction program.

Order of work schedule

Portion of work	Order of work	Time of work

Site meetings

General: Hold and attend site meetings throughout the contract and arrange attendance of appropriate subcontractors, the architect, and appropriate consultants.

Minutes: Make a record of site meetings. Within 5 working days after each meeting, distribute a copy of the minutes to each party.

- Purpose of submission: Review.

Contacts: At the first site meeting, submit names and telephone numbers of responsible persons who may be contacted after hours during the course of the contract.

- Purpose of submission: Information only.

Progress photographs

General: Take colour progress photographs within 5 working days, before each site meeting. At each site meeting submit 2 sets of prints and the digital files. Identify the project, date, time, location and orientation.

- Purpose of submission: Information only.

Items supplied by owner

General: Materials and other items supplied free of charge to the contractor for installation in the execution of the works. Unload and take delivery, inspect for defects and take care of the items. If defects are found, advise. Return unused items to the owner.

Items supplied by owner schedule

Location	Item	Quantity	Date

Persons other than contractor

Facilities: Refer to person other than contractor documentation.

Contractor/person other than contractor interfaces: Refer to person other than contractor documentation.

1.5 COMPLETION OF THE WORKS

Final cleaning

General: Before the date for practical completion, clean throughout, including interior and exterior surfaces exposed to view. Vacuum carpeted and soft surfaces. Clean debris from the site, roofs, gutters, downpipes and drainage systems. Remove waste and surplus materials.

Samples: Remove non-incorporated samples, prototypes and sample panels.

Reinstatement

General: Before the date for practical completion, clean and repair damage caused by installation or use of temporary work and restore existing facilities used during construction to original condition.

Adjoining property

Evaluation: At practical completion, for each property described in the **Adjoining properties to be recorded schedule**, inspect the property with the architect and owner and occupant of the property, recording any damage that has occurred since the pre-commencement inspection.

Pest eradication

General: Employ suitably qualified pest exterminators. At practical completion, verify that completed works are free of pest types documented in the **Pest eradication treatments schedule**.

Pest eradication treatment schedule

Pest type to be treated	Eradication method

Removal of plant

General: Within 10 working days after practical completion, remove temporary works and construction plant no longer required. Remove the balance before the end of the defects liability period.

1.6 PAYMENT FOR THE WORKS

Import costs
Definition: Import costs include costs attributable to exchange rates, customs and import duty of imported content of items purchased for incorporation in the works.

Adjustment: If there are changes in rates applying to import costs of items documented in the **Import cost adjustment schedule**, add or deduct the amount of the difference to or from the contract sum, as applicable.

Import cost adjustment schedule

Item	Country of origin	Import cost

Anticipated progress claims schedule
General: At commencement of the works, submit a schedule of anticipated progress claims for the contract period. Submit a revised schedule with each progress claim.

- Purpose of submission: Information only.

Progress claims
Break-down: With each progress claim, submit a statement of amounts claimed in respect of each worksection or trade heading designated in the specification.

- Purpose of submission: Review.

Method of measurement
General: In conformance with the principles of the Australian Standard Method of Measurement of Building Works (ASMM6).

1.7 MISCELLANEOUS

Contractor and owner to observe confidentiality
Publicity: Do not issue information concerning the project for publication in the media without prior written approval of the owner. Refer to the owner, enquiries from the media concerning the project.

Compliance with the law
Requirements of authorities: The owner, before entering into the contract, has given the notices, paid the fees, and obtained the permits, approvals and other authorisations, as documented in the **Prior applications and approvals schedule**.

Prior applications and approvals schedule

Prior notices given and applications made	Fees paid	Permits, approvals and authorisations received

Authority conditions schedule

Authority	Document	Condition

0171 GENERAL REQUIREMENTS

1 GENERAL

1.1 DESIGN

- **Design development**

General: The works include development of the design beyond that documented, as required.

Design by contractor: If the contractor provides design, use only appropriately qualified persons and conform to all statutory requirements.

Conflict with the documents: If it is believed that a conflict exists between statutory requirements and the documents, notify the contract administrator immediately and provide a recommendation to resolve the conflict.

1.2 PRECEDENCE

- **General**

Order of precedence:

- **The requirements of the Landscape Selections Schedule override conflicting requirements of this worksection.**
- **The requirements of other worksections of the specification override conflicting requirements of this worksection.**
- **The requirements of the worksections override conflicting requirements of their referenced documents, excluding the Landscape Selections Schedule. The requirements of the referenced documents are minimum requirements.**

1.3 REFERENCED DOCUMENTS

- **Contractual relationships**

General: Responsibilities and duties of the principal, contractor and contract administrator are not altered by requirements in the documents referenced in this specification.

- **Current editions**

General: Use referenced documents which are the editions, with amendments, current 3 months before the closing date for tenders, except where other editions or amendments are required by statutory authorities.

1.4 INTERPRETATION

- **Documentation conventions**

Imperative mood and streamlined language: The words shall or shall be are implied where a colon is used following a keyword or within a sentence or sentence fragment.

Subject of sentences and phrases: Specification requirements are to be performed by the contractor, unless stated otherwise.

- **Abbreviations**

General: For the purposes of this specification the following abbreviations apply:

- **AS: Australian Standard.**
- **BCA: National Construction Code Series Volume One: Building Code of Australia Class 2 to 9 Buildings and Volume Two: Building Code of Australia Class 1 and Class 10 Buildings.**
- **GRP: Glass Reinforced Plastic.**
- **IP: Ingress protection.**
- **NATA: National Association of Testing Authorities.**
- **NCC: National Construction Code.**
- **NZS: New Zealand Standard.**
- **PCA: National Construction Code Series Volume 3: Plumbing Code of Australia.**
- **PVC: Polyvinyl Chloride.**
- **PVC-U: Unplasticised Polyvinyl Chloride. Also known as UPVC.**
- **SDS: Safety data sheets.**

- **VOC: Volatile Organic Compound.**
- **WHS: Work Health and Safety.**
- **Definitions**

General: For the purposes of this specification, the following definitions apply:

- **Access for maintenance: Includes access for maintenance, inspection, measurement, operation, adjustment, repair, replacement and other maintenance related tasks.**
- **Accessible, readily: Readily accessible, easily accessible, easy access and similar terms mean capable of being reached quickly and without climbing over or removing obstructions, mounting upon a chair, or using a movable ladder, and in any case not more than 2.0 m above the ground, floor or platform.**
- **Attendance: Attendance, provide attendance and similar expressions mean give assistance for examination and testing.**
- **Contract administrator: Has the same meaning as architect or superintendent and is the person appointed by the owner or principal under the contract.**
- **Contractor: Has the same meaning as builder and is the person or organisation bound to carry out and complete the work under the contract.**
- **Default: Specified value, product or installation method which is to be provided unless otherwise documented.**
- **Design life: The period of time for which it is assumed, in the design, that an asset will be able to perform its intended purpose with only anticipated maintenance but no major repair or replacement being necessary.**
- **Documented: Documented, as documented and similar terms mean contained in the contract documents.**
- **Economic life: The period of time from the acquisition of an asset to the time when the asset, while still physically capable of fulfilling its function and with only anticipated maintenance, ceases to be the lowest cost alternative for satisfying that function.**
- **Electricity distributor: Any person or organisation that provides electricity from an electricity distribution system to one or more electrical installations. Includes distributor, supply authority, network operator, local network service provider, electricity retailer or electricity entity, as may be appropriate in the relevant jurisdiction.**
- **Fire hazard properties: To BCA A2.4.**
- **Geotechnical site investigation: The process of evaluating the geotechnical characteristics of the site in the context of existing or proposed construction.**
- **Give notice: Give notice, submit, advise, inform and similar expressions mean give notice (submit, advise, inform) in writing to the contract administrator.**
- **High level interface: Systems transfer information in a digital format using an open system interface.**
- **Hot-dip galvanized: Zinc coated to AS/NZS 4680 after fabrication with coating thickness and mass to AS/NZS 4680 Table 1.**
- **Ingress protection: IP, IP code, IP rating and similar expression have the same meaning as IP Code in AS 60529.**
- **Joints:**
  - Construction joint: A joint with continuous reinforcement provided to suit construction sequence.
  - Contraction joint: An opening control joint with a bond breaking coating separating the joint surfaces to allow independent and controlled contraction of different parts or components, induced by shrinkage, temperature changes or other causes. It may include unbound dowels to assist vertical deflection control.
  - Control joint: An unreinforced joint between or within discrete elements of construction which allows for relative movement of the elements.
  - Expansion joint: A closing control joint with the joint surfaces separated by a compressible filler to allow axial movement due to thermal expansion or contraction with changes in temperature or creep. It may include unbound dowels to assist vertical deflection control.
  - Sealant joint: A joint filled with a flexible synthetic compound which adheres to surfaces within the joint to prevent the passage of dust, moisture and gases.

  - Structural control joint: A control joint (contraction, expansion and isolation) in structural elements when used with applied material and finishes.
  - Substrate joint: A joint in the substrate which includes construction joints and joints between different materials.
  - Weakened plane joint: A contraction joint created by forming a groove, extending at least one quarter the depth of the section, either by using a grooving tool, by sawing, or by inserting a premoulded strip.
- **Local (government) authority: A body established for the purposes of local government by or under a law applying in a state or territory.**
- **Low level interface: Systems transfer information via terminals and voltage free contacts.**
- **Manufacturer's recommendations: Recommendations, instructions, requirements, specifications (and similar expressions) provided in written or other form by the manufacturer and/or supplier relating to the suitability, use, installation, storage and/or handling of a product.**
- **Metallic-coated: Steel coated with zinc or aluminium-zinc alloy as follows:**
  - Metallic-coated steel sheet: To AS 1397. Metal thicknesses specified are based metal thicknesses.
  - Ferrous open sections zinc coated an in-line process: To AS/NZS 4791.
  - Ferrous hollow sections zinc coated by a continuous or specialised process: To AS/NZS 4792.
- **Network utility operator: The entity undertaking the piped distribution of drinking water or natural gas for supply or is the operator of a sewerage system or external stormwater drainage system.**
- **Obtain: Obtain, seek and similar expressions mean obtain (seek) in writing from the contract administrator.**
- **Pipe: Includes pipe and tube.**
- **Practical completion or defects free completion: The requirements for these stages of completion are defined in the relevant building contract for the project.**
- **Principal: Principal has the same meaning as owner, client and proprietor and is the party to whom the contractor is legally bound to construct the works.**
- **Professional engineer: As defined by the BCA.**
- **Proprietary: Identifiable by naming the manufacturer, supplier, installer, trade name, brand name, catalogue or reference number.**
- **Prototype: A full size mock-up of components, systems or elements to demonstrate or test construction methods, junctions and finishes, and to define the level of quality.**
- **Provide: Provide and similar expressions mean supply and install and include development of the design beyond that documented.**
- **Record drawings: Record drawings has the same meaning as as-installed drawings, as-built drawings and work-as-executed drawings.**
- **Referenced documents: Standards and other documents whose requirements are included in this specification by reference.**
- **Registered Testing Authority:**
  - An organisation registered by the National Association of Testing Authorities (NATA) to test in the relevant field; or
  - An organisation outside of Australia registered by an authority recognised by NATA through a mutual recognition agreement; or
  - An organisation recognised as being a Registered Testing Authority under legislation at the time the test was undertaken.
- **Required: Required by the contract documents, the local council or statutory authorities.**
- **If required: A conditional specification term for work which may be shown in the documents or is a legislative requirement.**
- **Sample: A physical example that illustrates workmanship, materials or equipment, and establishes standards by which the work will be judged. It includes samples, prototypes and sample panels.**

- **Statutory authority: A public sector entity created by legislation, that is, a specific law of the Commonwealth, State or Territory.**
- **Supply: Supply, furnish and similar expressions mean supply only.**
- **Tests – completion: Tests carried out on completed installations or systems and fully resolved before the date for practical completion, to demonstrate that the installation or system, including components, controls and equipment, operates correctly, safely and efficiently, and meets performance and other requirements. The superintendent may direct that completion tests be carried out after the date for practical completion.**
- **Tests – pre-completion: Tests carried out before completion tests, including:**
  - . Production: Tests carried out on a purchased item, before delivery to the site.
  - . Progressive: Tests carried out during installation to demonstrate performance in conformance with this specification.
  - . Site: Tests carried out on site.
  - . Type: Tests carried out on an item identical with a production item, before delivery to the site.
- **Tolerance: The permitted difference between the upper limit and the lower limit of dimension, value or quantity.**
- **Verification: Provision of evidence or proof that a performance requirement has been met or a default exists.**

1.5 CONTRACT DOCUMENTS

- **Services diagrammatic layouts**

General: Layouts of service lines, plant and equipment shown on the drawings are diagrammatic only, except where figured dimensions are provided or calculable.

Before commencing work:

- **Obtain measurements and other necessary information.**
- **Coordinate the design and installation in conjunction with all trades.**

- **Levels**

General: Spot levels take precedence over contour lines and ground profile lines.

1.6 SUBMISSIONS

- **Requirement**

General: Submit the following, as documented:

- **Authority approvals: Notes of meetings with authorities whose requirements apply to the work and evidence that notices, fees and permits have been sought and paid, that authority connections are complete and that statutory approvals by the authorities whose requirements apply to the work have been received.**
- **Building penetrations: Details of the methods to maintain the required structural, fire and other properties to** EXECUTION, BUILDING PENETRATIONS**.**
- **Certification: Certification of conformance to documented requirements, including certification that the plant and equipment submitted meets all requirements of the contract documents and that each installation is operating correctly.**
- **Design documentation: Design data and certification of proposed work, if required and as documented.**
- **Electronic facility and asset management information: For the whole of the work to** EXECUTION, ELECTRONIC FACILITY AND ASSET MANAGEMENT INFORMATION**.**
- **Execution details: Execution programs, schedules and details of proposed methods and equipment. For building services include the following:**
  - . Embedded services: Proposed method for embedding services in concrete walls or floors or chasing into concrete or masonry walls.
  - . Fixing of services: Typical details of locations, types and methods of fixing services to the building structure.
  - . Inaccessible services: If services will be enclosed and not accessible after completion, submit proposals for location of service runs and fittings.

- **Marking and labelling: Samples and schedules of proposed marking and labels to** EXECUTION**,** MARKING AND LABELLING.
- **Operation and maintenance manuals: For the whole of the work to** EXECUTION**,** OPERATION AND MAINTENANCE MANUALS**.**
- **Products: Products and materials data, including manufacturer's technical specifications and drawing, evidence of conformance to product certification schemes, performance and rating tables and installation and maintenance recommendations.**
- **Prototypes: Prototypes of components, systems or elements.**
- **Records: As-built documents, photographs, system diagrams, schedules and logbooks to** EXECUTION**,** RECORD DRAWINGS**.**
- **Samples: Refer Landscape Selections Schedule.**
- **Shop drawings: Refer Landscape Selections Schedule.**
- **Substitutions: To PRODUCTS**, GENERAL, Substitutions**.**
- **Tests:**
  - Inspection and testing plan consistent with the construction program including details of test stages and procedures.
  - Certificates for type tests.
  - Fire hazard properties: Evidence of conformance of proposed proprietary products to documented requirements for fire hazard properties.
  - Test reports for testing performed under the contract to **EXECUTION**, **TESTS**.
- **Warranties: To** EXECUTION**,** WARRANTIES**.**

Contractor review: Before submissions, review each submission item and check for coordination with other work of the contract and conformance to contract documents.

- **Submission times**

Default timing: Make submissions at least 5 working days before ordering products or starting installation of the respective portion of the works.

Submission response times: Allow in the construction program for at least the following times:

- Shop drawings: Refer Landscape Selections Schedule
- Samples and prototypes: Refer Landscape Selections Schedule
- Manufacturers' or suppliers' recommendations: 4 days
- Product data: 4 days
- Product/design substitution or modification: 4 days

Proposed products schedules: If major products are not specified as proprietary items, submit a schedule of those proposed for use within 3 weeks of site possession.

- **Identification**

Requirement: Identify the project, contractor, subcontractor or supplier, manufacturer, applicable product, model number and options, as appropriate and include relevant contract document references. Include service connection requirements and product certification.

Non-conformance: Identify proposals that do not conform with project requirements, and characteristics which may be detrimental to successful performance of the completed work.

- **Errors**

Requirement: If a submission contains errors, make a new or amended submission as appropriate, indicating changes made since the previous submission.

1.7 INSPECTION

- **Notice**

Concealment: If notice of inspection is required for parts of the works that are to be concealed, advise when the inspection can be made before concealment.

Tests: Give notice of the time and place of documented tests.

Minimum notice: As documented in the **INSPECTION, Site Inspections**.

- **Light levels**

Requirements: To AS/NZS 1680.2.4.

- **Attendance**

General: Provide attendance for documented inspections and tests.

- **Site Inspections**

The Sub Contractor is to notify the head contractor where applicable in order to arrange inspection of the works at the stages described below. Sub-Contractor will ensure that site visits by Landscape Architect are coordinated such that multiple items can be inspected concurrently, where possible.

A minimum of 3 days' notice is to be provided. Items for Landscape Architect inspection are noted below.

The Sub Contractor is not to proceed to the next stage of construction until obtaining approval for the works. Program inspection's activities accordingly to ensure approval times do not affect the works programme. Where completion schedules vary or overlap, inspections may be negotiated. Approval of samples to be carried out on site, with all samples to be retained on site.

Inspection	Release Authority
Inspection: Sample and Prototypes Inspections	
Inspection of all materials and surfaces samples units samples	Superintendent and Project Landscape Architect
Prototype of all bespoke furniture and fixture sample units bespoke	Superintendent and Project Landscape Architect
Prototype of all precast concrete elements	Superintendent and Project Landscape Architect
Prototype of all Landscape Signage and Wayfinding items.	Superintendent and Project Landscape Architect
Completion of excavations, set out to tree planting areas at ground level	Superintendent and Project Landscape Architect
Substrate installation complete (prior to planting media infill)	Superintendent and Project Landscape Architect
Completion of layout and set out of landscape edges and walls.	Superintendent and Project Landscape Architect
Inspection of all softscape samples	Superintendent and Project Landscape Architect
Completion of topsoil installation. Topsoil and testing results	Superintendent and Project Landscape Architect
Inspection of all plant stock from supplier for quality assurance	Superintendent and Project Landscape Architect
Substrate installation complete	Superintendent and Project Landscape Architect
Soil installation complete	Superintendent and Project Landscape Architect
Mulch installation complete	Superintendent and Project Landscape Architect
Practical Completion	Superintendent and Project Landscape Architect
Final Completion	Superintendent and Project Landscape Architect

2 PRODUCTS

2.1 GENERAL

- **Manufacturers' or suppliers' recommendations**

General: Provide and select, if no selection is given, transport, deliver, store, handle, protect, finish, adjust and prepare for use the manufactured items in conformance with the recommendations of the manufacturer or supplier.

Proprietary items/systems/assemblies: Assemble, install or fix to substrate in conformance with the recommendations of the manufacturer or supplier.

Project modifications: Advise of activities that supplement, or are contrary to the recommendations of the manufacturers or supplier.

- **Sealed containers**

General: If materials or products are supplied by the manufacturer in closed or sealed containers or packages, bring the materials or products to point of use in the original containers or packages.

- **Prohibited materials**

General: Do not provide the following:

- **Materials, exceeding the limits of those listed, in the Safe Work Australia Hazardous Substances Information System (HSIS).**
- **Materials that use chlorofluorocarbon (CFC) or hydro chlorofluorocarbon (HCFC) in the manufacturing process.**

- **Substitutions**

Identified proprietary items: Identification of a proprietary item does not necessarily imply exclusive preference for the identified item, but indicates the necessary properties of the item.

Alternatives: If alternatives to the documented products, methods or systems are proposed, submit sufficient information to permit evaluation of the proposed alternatives, including the following:

- **Evidence that the performance is equal to or greater than that specified.**
- **Evidence of conformity to a cited standard.**
- **Samples.**
- **Essential technical information, in English.**
- **Reasons for the proposed substitutions.**

Availability: If the documented products or systems are unavailable within the time constraints of the construction program, submit evidence.

Criteria: If the substitution is for any reason other than unavailability, submit evidence that the substitution:

- **Is of net enhanced value to the principal.**
- **Is consistent with the contract documents and is as effective as the identified item, detail or method.**

2.2 MATERIALS AND COMPONENTS

- **Consistency**

General: For each material or product use the same manufacturer or source and provide consistent type, size, quality and appearance.

- **Corrosion resistance**

General: Conform to the following atmospheric corrosivity category as defined in AS 4312 and the AS/NZS 2312 series.

- **Galvanizing**

Severe conditions: Galvanize mild steel components (including fasteners) to AS/NZS 1214 or AS/NZS 4680 as appropriate, if:

- **Exposed to weather.**
- **Embedded in masonry.**
- **Exposed to or in air spaces behind the external leaf of masonry walls.**
- **In contact with chemically treated timber, other than copper chrome arsenate (CCA).**

3 EXECUTION

3.1 SAMPLES

- **General**

Incorporation of samples: Only incorporate samples in the works which have been endorsed for inclusion. Do not incorporate other samples. Refer Landscape Selections Schedule.

Retention of samples: Keep endorsed samples in good condition on site, until the date of practical completion.

Unincorporated samples: Remove on completion.

- **Samples**

Submit representative samples of each material as set out in Landscape Selections Schedule for approval by the Superintendent, Landscape Architect and where necessary the Architect:

Proposed products schedules: If major products are not specified as proprietary items, submit a schedule of those proposed for use with the tender submission.

- **Authorities**

Authorities' approvals: Submit documents showing approval by the authorities whose requirements apply to the work.

Correspondence: Submit copies of correspondence and notes of meetings with authorities whose requirements apply to the work.

- **Identification**

General: Identify the project, contractor, subcontractor or supplier, manufacturer, applicable product, model number and options, as appropriate and include pertinent contract document references. Include service connection requirements and product certification. Identify proposals for non-compliance with project requirements, and characteristics which may be detrimental to successful performance of the completed work.

- **Materials and components**

Product certification: If products must conform to product certification schemes, submit evidence of conformance.

Product data: For proprietary equipment, submit the manufacturer's product data as follows:

- **Technical specifications and drawings.**
- **Type-test reports.**
- **Performance and rating tables.**
- **Recommendations for installation and maintenance.**
- **Additional product data for services equipment:**
  - . Model name, designation and number.
  - . Country of origin and manufacture.
  - . Capacity of all system elements.
  - . Size, including required clearances for installation.
  - . Materials used in the construction.

3.2 DESIGN

- **General**

Design by contractor: If the contractor provides design, use only appropriately qualified persons and comply with all statutory requirements.

Conflict with the documents: If it is believed that a conflict exists between statutory requirements and the documents notify the Superintendent immediately and provide a recommendation to resolve the conflict.

3.3 SHOP DRAWINGS

- **General**

Documentation: Include dimensioned drawings showing details of the fabrication and installation of structural elements, building components, services and equipment, including relationship to building structure and other services, cable type and size, and marking details.

Diagrammatic layouts: Coordinate work shown diagrammatically in the contract documents, and prepare dimensioned set-out drawings.

Record drawings: Amend all documented shop drawings to include changes made during the progress of the work and up to the end of the defects liability period.

Services coordination: Coordinate with other building and service elements. Show adjusted positions on the shop drawings.

Space requirements: Check space and access for maintenance requirements of equipment and services indicated diagrammatically in the contract documents.

Submission medium: .pdf (.dwg upon request)

Building work drawings for building services: On dimensioned drawings show all:

- **Access doors and panels.**
- **Conduits to be cast in slabs.**
- **Holding down bolts and other anchorage and/or fixings required complete with loads to be imposed on the structure during installation and operation.**
- **Openings, penetrations and block-outs.**
- **Sleeves.**
- **Plinths, kerbs and bases.**
- **Required external openings.**

- **Submissions**

Submit the Shop Drawings as per Landscape Selections Schedule.

Submit to: Superintendent.

Default timing: Make submissions at least 5 working days before ordering products for, or starting installation of, the respective portion of the works.

3.4 OFF-SITE DISPOSAL

- **Removal of material**

General: Dispose of building waste material off site to the requirements of the relevant authorities.

3.5 FIXING

- **General**

Suitability: If equipment is not suitable for fixing to non-structural building elements, fix directly to structure and trim around penetrations in non-structural elements.

- **Fasteners**

General: Use proprietary fasteners capable of transmitting the loads imposed, and sufficient for the rigidity of the assembly.

3.6 SERVICES CONNECTIONS

- **Connections**

General: Connect to network distributor services or service points. Excavate to locate and expose connection points. Reinstate the surfaces and facilities that have been disturbed.

- **Network distributors' requirements**

General: If the network distributor elects to perform or supply part of the works, make the necessary arrangements. Install equipment supplied, but not installed, by the authorities.

3.7 SERVICES INSTALLATION

- **General**

Fixing: If non-structural building elements are not suitable for fixing services to, fix directly to structure and trim around holes or penetrations in non-structural elements.

Installation: Install equipment and services plumb, fix securely and organise reticulated services neatly. Allow for movement in both structure and services.

Concealment: Unless otherwise documented, conceal all cables, ducts, trays and pipes except where installed in plant spaces, ceiling spaces and riser cupboards. If possible, do not locate on external walls.

Lifting: Provide heavy items of equipment with permanent fixtures for lifting as recommended by the manufacturer.

Suspended ground floors: Keep all parts of services under suspended ground floors at least 150 mm clear of the ground surface. Make sure services do not impede access.

Arrangement: Arrange services so that services running together are parallel with each other and with adjacent building elements.

- **Dissimilar metals**

General: Join dissimilar metals with fittings of electrolytically compatible material.

- **Temporary capping**

Pipe ends: During construction protect open ends of pipe with metal or plastic covers or caps.

- **Piping**

General: Install piping in straight lines at uniform grades without sags. Arrange to prevent air locks. Provide sufficient unions, flanges and isolating valves to allow removal of piping and fittings for maintenance or replacement of plant.

Spacing: Provide at least 25 mm clear between pipes and between pipes and building elements, additional to insulation.

Changes of direction: Provide long radius elbows or bends and sets where practicable, and swept branch connections. Provide elbows or short radius bends where pipes are led up or along walls and then through to fixtures. Do not provide mitred fittings.

Vibration: Arrange and support piping so that it remains free from vibration whilst permitting necessary movements. Minimise the number of joints.

Embedded pipes: Do not embed pipes that operate under pressure in concrete or surfacing material.

Valve groupings: If possible, locate valves in groups.

Pressure testing precautions: Isolate items not rated for the test pressure. Restrain pipes and equipment to prevent movement during pressure testing.

- **Differential movement**

General: If the geotechnical site investigation report predicts differential movements between buildings and the ground in which pipes or conduits are buried, provide control joints in the pipes or conduits, as follows:

- **Arrangement: Arrange pipes and conduits to minimise the number of control joints.**
- **Magnitude: Accommodate the predicted movements.**

3.8 BUILDING PENETRATIONS

- **Penetrations**

Requirement: Maintain the required structural, fire and other properties when penetrating or fixing to the following:

- **Structural building elements including external walls, fire walls, fire doors and access panels, other tested and rated assemblies or elements, floor slabs and beams.**
- **Membrane elements including damp-proof courses, waterproofing membranes and roof coverings. If penetrating membranes, provide a waterproof seal between the membrane and the penetrating component.**

- **Sealing**

Fire-resisting building elements: Seal penetrations with a system conforming to AS 4072.1.

Non fire-resisting building elements: Seal penetrations around conduits and sleeves. Seal around cables within sleeves. If the building element is acoustically rated, maintain the rating.

- **Sleeves**

General: If piping or conduit penetrates building elements, provide metal or PVC-U sleeves formed from pipe sections as follows:

- **Movement: Arrange to permit normal pipe or conduit movement.**
- **Diameter (for non fire-resisting building elements): Sufficient to provide an annular space around the pipe or pipe insulation of at least 12 mm.**

- **Prime paint ferrous surfaces.**
- **Terminations:**
  . If cover plates are fitted: Flush with the finished building surface.
  . In fire-resisting and acoustic rated building elements: 50 mm beyond finished building surface.
  . In floors draining to floor wastes: 50 mm above finished floor.
  . Elsewhere: 5 mm beyond finished building surface.
  . Termite management: To AS 3660.1.
- **Thickness:**
  . Metal: 1 mm or greater.
  . PVC-U: 3 mm or greater.

Sleeves for cables: For penetrations of cables not enclosed in conduit through ground floor slabs, beams and external walls provide sleeves formed from PVC-U pipe sections.

3.9 CONCRETE PLINTHS

- **Construction**

General: Provide concrete plinths as documented and under all equipment located on concrete floor slabs as follows:

- **Height: 75 mm or greater, as documented.**
- **Concrete: Grade N20.**
- **Finish: Steel float flush with the surround.**
- **Reinforcement: Single layer of F62 fabric.**
- **Surround: Provide galvanized steel surround at least 75 mm high and 1.6 mm thick. Fix to the floor with masonry anchors. Fill with concrete.**

3.10 WARRANTIES

- **General**

Requirement: If a warranty is documented, name the principal as warrantee. Register with manufacturers as necessary. Retain copies delivered with components and equipment.

Warranty period: Start warranty periods at acceptance of installation.

Approval of installer: If installation is not by manufacturer, and product warranty is conditional on the manufacturer's approval of the installer, submit the manufacturer's written approval of the installing firm.

3.11 RECORD DRAWINGS

- **General**

Requirement: Show the following:

- **Installed locations of building elements, services, plant and equipment.**
- **Off-the-grid dimensions and depth if applicable.**
- **Any provisions for the future.**

- **Recording, format and submission**

Progress recording: Keep one set of drawings on site at all times, expressly for the purpose of marking changes made during the progress of the works.

Drawing layout: Use the same borders and title block as the contract drawings.

Quantity and format: Conform to **SUBMISSIONS.**

Endorsement: Sign and date all record drawings.

Accuracy: If errors in, or omissions from, the record drawings are found, amend the drawings and re-issue in the quantity and format documented for **SUBMISSIONS.**

Date for submission: Not later than 2 weeks after the date for practical completion.

- **Services record drawings**

General: To **General** and **Recording, format and submission** and the following:

- **Contents: As for the respective shop drawings.**

- **Extensions and/or changes to existing: If a drawing shows extensions and/or alterations to existing installations, include sufficient of the existing installation to make the drawing comprehensible without reference to drawings of the original installation.**
- **Detention: If on-site detention tanks or pondage are provided, include the volume required on the drawing and the permitted flow rate to the connected system.**
- **Domestic cold water or fire mains: Show the pressure available at the initial connection point and the pressure available at the most disadvantaged location on each major section of the works.**
- **Stormwater: If storm water pipes are shown, include the pipe size and pipe grade together with the maximum acceptable flow and the actual design flow.**

Diagrams: Provide diagrammatic drawings of each system including the following:

- **Controls.**
- **Piping including all valves and valve identification tags.**
- **Principal items of equipment.**
- **Single line wiring diagrams.**
- **Acoustic and thermal insulation.**
- **Access provisions and space allowances.**
- **Fixings.**
- **Fixtures.**
- **Switchgear and control gear assembly circuit schedules including electrical service characteristics, controls and communications.**
- **Charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.**

Subsurface services: Record information on underground or submerged services to the documented quality level, conforming to AS 5488.

3.12 OPERATION AND MAINTENANCE MANUALS

- **General**

Authors and compilers: Personnel experienced in the maintenance and operation of equipment and systems installed, and with editorial ability.

Referenced documents: If referenced documents or technical worksections require that manuals be submitted, include corresponding material in the operation and maintenance manuals.

Subdivision: By installation or system, depending on project size.

- **Contents**

Requirement: Include the following:

- **Table of contents: For each volume. Title to match cover.**
- **Directory: Names, addresses, email addresses and telephone and facsimile numbers of principal consultant, subconsultants, contractor, subcontractors and names of responsible parties.**
- **Record drawings: Complete set of record drawings, full size.**
- **Drawings and technical data: As necessary for the efficient operation and maintenance of the installation. Include:**
  - Switchgear and controlgear assembly circuit schedules including electrical service characteristics, controls and communications.
  - Charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- **Installation description: General description of the installation.**
- **Systems descriptions and performance: Technical description of the systems installed and mode of operation, presented in a clear and concise format readily understandable by the principal's staff. Identify function, normal operating characteristics, and limiting conditions.**
- **Systems performance: Technical description of the mode of operation of the systems installed.**
- **Baseline data: To AS 1851 and AS/NZS 1668.1.**

- **Documentation to AS 1851 including the schedule of essential functionality and performance requirements.**
- **Digital photographic records to** Underground services**.**
- **Equipment descriptions:**
  - Name, address, email address and telephone and facsimile numbers of the manufacturer and supplier of items of equipment installed, together with catalogue list numbers.
  - Schedules (system by system) of equipment, stating locations, duties, performance figures and dates of manufacture. Provide a unique code number cross-referenced to the record and diagrammatic drawings and schedules, including spare parts schedule, for each item of equipment installed. Equipment schedules in tabular form including the equipment designation used on the drawings, manufacturer's name and contact details, equipment name plate data, function of item, associated system and capacity data.
  - Manufacturers' technical literature for equipment installed, assembled specifically for the project, excluding irrelevant matter. Mark each product data sheet to clearly identify specific products and component parts used in the installation, and data applicable to the installation.
  - Supplements to product data to illustrate relations of component parts. Include typed text as necessary.
- **Certificates:**
  - Certificates from authorities.
  - Copies of manufacturers' warranties.
  - Product certification.
  - Test certificates for each service installation and all equipment.
  - Test reports
  - Test, balancing and commissioning reports.
  - Control system testing and commissioning results.
- **7 day record of all trends at commissioning.**
- **Operation procedures:**
  - Manufacturers' technical literature as appropriate.
  - Safe starting up, running-in, operating and shutting down procedures for systems installed. Include logical step-by-step sequence of instructions for each procedure.
  - Control sequences and flow diagrams for systems installed.
  - Legend for colour-codes services.
  - Schedules of fixed and variable equipment settings established during commissioning and maintenance.
  - Procedures for seasonal changeovers.
  - If the installation includes cooling towers, a water efficiency management plan.
- **Maintenance procedures:**
  - Detailed recommendations for periodic maintenance and procedures, including schedule of maintenance work including frequency and manufacturers' recommended tests.
  - Manufacturer's technical literature as appropriate. Register with manufacturer as necessary. Retain copies delivered with equipment.
  - Safe trouble-shooting, disassembly, repair and reassembly, cleaning, alignment and adjustment, balancing and checking procedures. Provide logical step-by-step sequence of instructions for each procedure.
  - Schedule of spares recommended to be held on site, being those items subject to wear or deterioration and which may involve the principal in extended deliveries when replacements are required. Include complete nomenclature and model numbers, and local sources of supply.
  - Schedule of normal consumable items, local sources of supply ,and expected replacement intervals up to a running time of 40 000 hours. Include lubrication schedules for equipment.
  - Schedules for recording recommissioning data so that changes in the system over time can be identified.
  - Instructions for use of tools and testing equipment.

. Emergency procedures, including telephone numbers for emergency services, and procedures for fault finding.
. Safety data sheets (SDS).
. Instructions and schedules conforming to AS 1851, AS/NZS 3666.2, AS/NZS 3666.3 and AS/NZS 3666.4.

- **Maintenance records:**
  . Prototype service records conforming to AS 1851 prepared to include project specific details.
  . Prototype periodic maintenance records and report to AS/NZS 3666.2, AS/NZS 3666.3 and AS/NZS 3666.4 as appropriate, prepared to include project specific details.
  . For hard copies: In binders which match the manuals, loose leaf log book pages designed for recording completion activities including operational and maintenance procedures, materials used, test results, comments for future maintenance actions and notes covering the condition of the installation. Include completed log book pages recording the operational and maintenance activities performed up to the time of practical completion.
  . Number of pages: The greater of 100 pages or enough pages for the maintenance period and a further 12 months.
- **Emergency information: For each type of emergency, including fire, flood, gas leak, water leak, power failure, water failure, system or sub system failure, chemical release or spill, include the following:**
  . Emergency instructions.
  . Emergency procedures including:
    * Instructions for stopping or isolating.
    * Shutdown procedures and sequences.
    * Instructions for actions outside the property.
    * Special operating instructions relevant to the emergency.
    * Contact details relevant to the emergency.

- **Emergency information manual**

Form of emergency information: Provide one of the following:

- **An index and coloured tabs identifying emergency information for each type of emergency within the Operation and maintenance manual.**
- **A separate Emergency manual containing copies of emergency information from the main Operation and maintenance manual.**

- **Format – electronic copies**

Scope: Provide the same material as documented for hardcopy in electronic format.

Quantity and format: Conform to **SUBMISSIONS , Electronic submissions**.

Printing: Except for drawings required in the **RECORD DRAWINGS** clause provide material that can be legibly printed on A4 size paper.

- **Format – hard copy**

General: A4 size loose leaf, in commercial quality, 4 ring binders with hard covers, each indexed, divided and titled. Include the following features:

- **Cover: Identify each binder with typed or printed title *OPERATION AND MAINTENANCE MANUAL*, to spine. Identify title of project, volume number, volume subject matter, and date of issue.**
- **Dividers: Durable divider for each separate element, with typed description of system and major equipment components. Clearly print short titles under laminated plastic tabs.**
- **Drawings: Fold drawings to A4 size with title visible, insert in plastic sleeves (one per drawing) and accommodate them in the binders.**
- **Pagination: Number pages.**
- **Ring size: 50 mm maximum, with compressor bars.**
- **Text: Manufacturers' printed data, including associated diagrams, or typewritten, single-sided on bond paper, in clear concise English.**

Number of copies: 3.

- **Date for submission**

Draft submission: The earlier of the following:

- **4 weeks before the date for practical completion.**
- **Commencement of training on services equipment.**

Final submission: Within 2 weeks after practical completion.

3.13 TOOLS AND SPARE PARTS

- **Spare parts**

General: Provide spare parts listed in the appropriate worksections.

Replacement: Replace spare parts used during the maintenance period.

- **Tools and spare parts schedule**

Submission timing: At least 8 weeks before the date for practical completion.

Requirement: Prepare a schedule of tools, portable instruments and spare parts necessary for maintenance of the installation. For each item state the recommended quantity and the manufacturer's current price. Include the following in the prices:

- **Checking receipt, marking and numbering in conformance with the spare parts schedule.**
- **Packaging and delivery to site.**
- **Painting, greasing and packing to prevent deterioration during storage.**
- **Referencing equipment schedules in the operation and maintenance manuals.**
- **Suitable means of identifying, storing and securing the tools and instruments. Include instructions for use.**

Replacement: Replace spare parts used during the maintenance period.

3.14 TESTING

- **Attendance**

General: Provide attendance on tests.

- **Testing authorities**

General: Except for site tests, have tests carried out by a Registered testing authority.

Test instruments: Use instruments calibrated by a Registered testing authority.

- **Test reports**

General: Indicate observations and results of tests and conformance or non-conformance with requirements.

- **Notice**

Inspection: Give sufficient notice for inspection to be made of the commissioning and completion testing of the installation.

- **Controls**

General: Calibrate, set and adjust control instruments, control systems and safety controls.

- **Circuit protection**

General: Confirm that circuit protective devices are sized and adjusted to protect installed circuits.

- **Completion tests**

General: Test the works under the contract to demonstrate conformance with the documented performance requirements of the installation.

Functional checks: Carry out functional and operational checks on energised equipment and circuits and make final adjustments for the correct operation of safety devices and control functions.

Type test reports: Required, as evidence of conformance of proprietary equipment.

Sound pressure level measurements: Conform to the following:

- **Correction for background noise: To AS/NZS 2107 Table B1.**
- **External: To AS 1055.1.**
- **Internal: To AS/NZS 2107.**
- **Measurement positions: If a test position is designated only by reference to a room or space, do not take measurements less than 1 m from the floor, ground or walls.**

- **Sound pressure level analysis: Measure the sound pressure level and the background sound pressure level over the full range of octave band centre frequencies from 31.5 Hz to 8 kHz at the designated positions.**
- **Sound pressure levels: Measure the A-weighted sound pressure levels and the A-weighted background sound pressure levels at the designated positions.**

- **Certification**

General: On satisfactory completion of the installation and before the date of practical completion, certify that each installation is operating correctly.

3.15 TRAINING

- **General**

Duration: Instruction to be available for the whole of the commissioning and running-in periods.

Format: Conduct training at agreed times, at system or equipment location. Also provide seminar instruction to cover all major components.

Operation and maintenance manuals: Use items and procedures listed in the final draft operation and maintenance manuals as the basis for instruction. Review contents in detail with the principal's staff.

Certification: Provide written certification of attendance and participation in training for each attendee. Provide register of certificates issued.

- **Demonstrators**

General: Use only qualified manufacturer's representatives who are knowledgeable about the installations.

- **Maintenance**

General: Explain and demonstrate to the principal's staff the purpose, function and maintenance of the installations.

- **Operation**

General: Explain and demonstrate to the principal's staff the purpose, function and operation of the installations.

- **Seasonal operation**

General: For equipment requiring seasonal operation, demonstrate during the appropriate season and within 6 months.

3.16 CLEANING

- **Final cleaning**

General: Before the date for practical completion, clean throughout, including all exterior and interior surfaces except those totally and permanently concealed from view.

Labels: Remove all labels not required for maintenance.

3.17 PERIODIC MAINTENANCE OF SERVICES

- **General**

Requirement: During the maintenance period, carry out periodic inspections and maintenance work as recommended by manufacturers of supplied equipment, and promptly rectify faults.

Emergencies: Attend emergency calls promptly.

Annual maintenance: Carry out recommended annual maintenance procedures before the end of the maintenance period.

Maintenance period: The greater of the defects liability period and the period documented in the **Maintenance requirements schedule**.

- **Maintenance program**

General: Submit details of maintenance procedures and program, relating to installed plant and equipment, 6 weeks before the date for practical completion. Indicate dates of service visits. State contact telephone numbers of service operators and describe arrangements for emergency calls.

- **Maintenance records**

General: Record in binders provided with the Operation and maintenance manuals.

Referenced documents: If referenced documents or technical worksections require that log books or records be submitted, include this material in the maintenance records.

Certificates: Include test and approval certificates.

Service visits: Record comments on the functioning of the systems, work carried out, items requiring corrective action, adjustments made and name of service operator. On completion of the visit, obtain the signature of the principal's designated representative on the record of the work undertaken.

- **Site control**

General: Report to the principal's designated representative on arriving at and before leaving the site.

3.18 POST-CONSTRUCTION MANDATORY INSPECTIONS AND MAINTENANCE

- **General**

Requirement: For the duration of the defects liability period, provide inspections and maintenance of safety measures required by the following:

- **AS 1851.**
- **Other statutory requirements applicable to the work.**

Records: Provide mandatory records.

Certification: Certify that mandatory inspections and maintenance have been carried out and that the respective items conform to statutory requirements.

Annual inspection: Perform an annual inspection and maintenance immediately before the end of the defects liability period.

0172 ENVIRONMENTAL MANAGEMENT

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide environmental management, as documented.

Management and control plans for contractor submission
Implementation: To approved management plans documented in **SUBMISSIONS**, **Control plans**.

Management and control measures
Implementation: To the management and control measures documented in **EXECUTION**.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:

- *0171 General requirements*.

1.3 INTERPRETATION

Abbreviations
General: For the purposes of this worksection the following abbreviations apply:

- EIA: Environmental impact assessment.
- EMP: Environmental management plan.

Definitions
General: For the purposes of this worksection the following definitions apply:

- Authorities: Any authority or agency covering statutory requirements relating to the project, including clearances for work in that particular area.
- Clearances: A formal certificate, approval or condition issued by an authority to allow work to be carried out in a particular area.
- Contamination of land: The presence of a substance in, on or under the land which is designated hazardous material and/or is at a concentration above that which is normally found in that locality, such that there presents a risk of harm to human health or to the environment.
- Environment: The physical factors of the surroundings of human beings including the land, waters, atmosphere, climate, sound, odours, tastes, the biological factors of animals and plants and the social factor of aesthetics.
- Environmental audits: A review of environment management practices, in particular the evaluation of a site for environmental liability.
- Environmental impact assessment: A method for predicting environmental impacts of a proposed development including minimising identified impacts.
- Environmental management plan (EMP): A project or site specific plan describing the management of the environmental issues and considerations for the activity being undertaken. This applies to the design, construction and operation of the buildings, external works and infrastructure.
- Organic waste: Includes all food wastes, vegetative wastes from land clearing and pruning operations, biosolids produced from the treatment of liquid wastes, garden wastes and forestry waste (bark and saw dust) and paper and cardboard products.
- Pollution incident: An incident or set of circumstances during or as a consequence of which there is, or is likely to be, a leak, spill or other escape of a substance as a result of which pollution has occurred, is occurring or is likely to occur.
- Weed: An invasive plant that degrades natural areas, reduces the sustainability or affects the health of people and animals.

1.4 SUBMISSIONS

Control plans
Requirement: Submit the following:

- Environmental management plan.
- Soil erosion and sediment control plan.
- Waste management plan.
- Ground contamination control plan.
- Weed management plan.

1.5 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- Discovery of non-conforming items, e.g. contamination.
- Completed removal or rectification of non-conforming items.
- Discovery of unexpected finds.

2 EXECUTION

2.1 ENVIRONMENTAL MANAGEMENT PLAN

Control plan

EMP: Submit a plan with the following details:

- Project description, including site location, construction activities, and project schedule.
- EMP context, describing how the EMP fits into the overall project planning process.
- EMP objective and environmental policy.
- Assignment of responsibility for environmental controls, including hierarchy of management.
- Conditions of approvals, licences and permits to meet statutory requirements.
- Reporting requirements.
- Environmental training plan and procedures. Include in the plan, a program to familiarise staff with the EMP and/or management controls, environmentally sensitive areas and responsibilities.
- Environmental auditing program and corrective action procedures.
- Emergency response procedures including response time.
- Risk assessment.
- Control plans: Conform to **SUBMISSIONS**, **Control plans**.
- Details of potential environmental impacts and operational control measures for implementation including:
  - . Heritage.
  - . Preservation of visual values.
  - . Protection of endangered species.
  - . Preservation of habitat.
- Details of environmental protection for each activity.
- Locations of environmental controls and environmentally sensitive areas.
- Communication procedures.
- Other items necessary to protect the surrounding environment.

Activities staging: Address the phases of activity, as appropriate:

- Before construction and site establishment.
- During construction.
- After construction, including rehabilitation activities and site and landscaping maintenance such as erosion and sedimentation controls.

Preliminary EMP: Submit with the tender documentation.

Completed EMP: Submit before work commences on site.

2.2 PROCEDURAL AND PERSONNEL

Community liaison

General: Notify residents of construction activities which will affect access to, or disrupt the use of, their properties.

Notice: Minimum 5 working days, unless the work is of an urgent nature with safety implications.

Notification content:

- The nature of the work.
- The reason for it being undertaken.
- The expected duration.
- Changes to traffic arrangements and property access.
- The 24-hour contact number of the representative responsible.

Internal monitoring

Documentation: Provide descriptions of the following:

- Environmental monitoring: Procedures for implementation and recording.
- For all control measures to be implemented: Non-conformance control and corrective action procedures.

Records: Maintain records of results of environmental monitoring, including the effectiveness of any remedial action taken.

Internal monitoring personnel: Provide staff names and contact details.

Machinery and equipment: Provide details of proposed plant.

Review timing: Undertake reviews of the EMP or control measures at the following stages:

- When there is a change in the project, e.g. scope.
- Following significant environmental accidents.
- When improved performance is required to reduce specific environmental impact.
- At completion of environmental audits.
- At the end of the project.

Emergency response

Emergency response personnel: Provide staff names and contact details.

Complaints

Reporting: Within 1 working day of receiving a complaint about any environmental issue, including pollution, submit a written report detailing the complaint and remedial action taken.

Register: Keep a register of all environmental complaints and action taken.

Reporting

Requirement: Compile the environmental management reports to record the progress of the following:

- Performance against statutory requirements.
- Performance against the EMP, environmental objective and policy, ecologically sustainable development outcomes and targets.
- Summary of monitoring, inspection and audits.
- Summary of reports required to meet the statutory requirements.
- Summary of environmental emergencies, incidents, non-conformance and complaints.
- Summary of corrective actions where required.

Unexpected finds

Requirement: If encountered, give notice and close off affected site area with barrier tapes and warning signs to prevent access. Unexpected finds include asbestos and other hazardous or volatile contaminants, archaeological finds and items of heritage value.

2.3 SOIL EROSION AND SEDIMENT CONTROL

Control plan

Plan: Submit a soil erosion and sediment control plan with the following details:

- Staging of operations and sequence of works.
- Diversion of upstream water around the site.

- Provision of temporary drains and catch drains.
- Application of diversion, dispersal and/or retention measures to concentrate flows to control and dissipate stormwater through the site without damage.
- Spreader banks or other structures to disperse concentrated runoff.
- Temporary grassing or other treatments such as contour ploughing or bunding to disturbed areas and long-term stockpiles.
- Restoration of disturbed areas in progress with the works.
- Use of mulch materials to protect disturbed or exposed areas where suitable.

Areas: Include all site areas and access and haulage tracks, borrow pits, stockpile and storage areas and compound areas.

Control measures

- Stockpile protection: Provide the following at the end of each working day:
  - Sandbags: Placed on downslope of stockpile to prevent movement.
  - Waterproof cover: Placed over stockpile material.
  - Sandbags, filter bags or fibre sausages: Locate to divert upslope flow of stormwater into grassed areas of the site and away from the stockpiled material.

Maintenance of controls: Check control measures, minimum daily and following storms, and make sure they are in good working order. Replace barriers if they are torn, damaged or no longer anchored.

Areas: Include all site areas and access and haulage tracks, borrow pits, stockpile and storage areas and compound areas.

Sediment filters – general

Inspection: Inspect for displacement, undercutting, over-topping and soil build-up, after each rain event. Effect repairs immediately.

Removal: When the upslope areas have been permanently stabilised.

Filters at toe of a slope: Place filter 1500 to 2000 mm away from slope, to provide access for maintenance and to allow coarse sediment to drop out of suspension before reaching sediment filter.

Sediment filters - straw bales

Straw bale filters: Provide temporary structures made of straw bales (cereal straw) laid end to end across direction of stormwater flow in order to filter sediment.

Binding: Wire-bound or with string-tied bindings wrapped around the bale sides.

Installation:

- Trench: 100 mm deep trench, the width of a bale and the length of the proposed sediment filter.
- Placement: Lengthwise in the trench with ends tightly abutting and corners lapped.
- Fixing: Drive two 50 x 50 mm wooden stakes or metal star pickets through each bale. Make sure bales are packed closely and staked securely. Tightly wedge gaps with loose straw.

Backfilling: Compacted excavated soil to ground level on downhill side of barrier, and 100 mm above ground level on the uphill side of the bales.

Sediment filters – silt fence

Silt fence: Provide geotextile temporary barrier, supported on wire or mesh fencing for filtering sediment from stormwater flow conforming to the following:

- That will retain soil on site.
- Have openings large enough to permit drainage and prevent clogging.

Contours: Locate fence line and posts along contours curving upstream at the sides to direct flow toward middle of the fence.

Installation:

- Trench: 100 mm wide x 200 mm deep along line of posts and upslope from barrier.
- Posts: 1200 mm long pre-drilled steel star picket posts at 3000 mm centres, driven 600 mm and fitted with plastic safety caps.
- Wire mesh: ≥ 14 gauge x ≤ 150 mm mesh spacing. Fasten wire mesh to upslope side of posts with 25 mm long heavy-duty wire staples and tie wire. Extend wire mesh 150 mm into trench.
- Filter: Geotextile to suit local soil conditions, cut from a continuous roll to minimise joints.

- Fixing: Wire ties to the uphill side of fence posts, extended 200 mm into the trench. Do not staple onto trees.
- Joints: 150 mm overlap at a support post, with both ends fastened to the post.

Fence height: 600 mm average.

Backfilling: Backfill trench over toe of geotextile and compact soil.

Sediment filters – straw bale and geotextile filters

Filters: Provide sediment filter comprising straw bales and geotextile conforming to the following:

- That will retain soil on site.
- Have openings large enough to permit drainage and prevent clogging.

Binding: Wire-bound or with string-tied bindings wrapped around the bale sides.

Bale installation:

- Trench: 100 mm deep trench the width of a bale and the length of the proposed sediment filter.
- Placing: Lengthwise in the trench with ends tightly abutting and corners lapped.
- Fixing: Drive two 50 x 50 mm wooden stakes or metal star pickets through each bale. Make sure bales are packed closely and staked securely. Tightly wedge gaps with loose straw.

Geotextile installation:

- Geotextile selection: To suit local soil conditions cut from a continuous roll to minimise joints.
- Fixing: Staple geotextile to top of straw bale and extend down the uphill face of the bale into the trench. Stretch the geotextile and peg securely into the subgrade.
- Joints: 150 mm overlap at a support post, with both ends fastened to the post.

Backfilling: Compacted excavated soil to ground level on downhill side of barrier, and 100 mm above ground level on the uphill side of the bales against and over toe of the fabric.

2.4 WASTE MANAGEMENT

Control plan

Plan: Submit a waste management plan and identify major waste streams that will be generated during the contract including:

- Organic waste.
- Construction waste, including:
  - . Spoil.
  - . Demolition waste.
  - . Asphalt or bitumen.
  - . Concrete
  - . Metal.
  - . Paint materials and empty containers.
  - . Office waste.
  - . Kitchen waste.
  - . Sewage effluent.
- For each waste stream indicate:
  - . How and where the waste will be re-used, recycled, stockpiled or disposed of.
- How the waste will be transported between the site and point of re-use, recycling, stockpiling, treating or disposal and who will be responsible.

Waste stream: Submit details of location, labelling and protection of separate skips for the identified waste stream.

Control measures

Requirement: Establish major waste streams that will be generated during the contract including:

- Organic waste.
- Construction waste, including:
  - . Spoil.
  - . Demolition waste.
  - . Asphalt or bitumen.

. Concrete
. Metal.
. Paint materials and empty containers.
. Office waste.
. Kitchen waste.
. Sewage effluent.
. Hazardous materials.

Identification: Submit details of location, labelling and protection of separate skips for the identified waste stream.

Disposal of materials

Spoil: Remove cleared and grubbed material from the site and dispose of legally.

Burial: Bury concrete and other inorganic fragments as follows:

- Location: Beyond built or paved areas.
- Depth: More than 600 mm from finished ground level to the top of the object.
- Compaction: Eliminate voids.

Mulch

Seed free aerial vegetative matter: Using a chipper, reduce to pieces not larger than 75 x 50 x 15 mm and stockpile for re-use as mulch.

Material not permitted: Leaf matter and tree loppings from privet, camphor laurel, coral tree, poplar, willow and noxious weeds.

Mulching cleared vegetation: Submit details of provisions.

2.5 GROUND CONTAMINATION

Control plan

Requirement: Submit a ground contamination control plan if land is suspected of being contaminated or the presence of acid sulphate soil is found.

Plan: Prepared in conformance with the Environmental Protection Authority (EPA) and planning guidelines for each state with the following details:

- Preliminary investigation.
- Detailed investigation.
- Site Remedial Action Plan (RAP).
- Site auditing and reporting procedures.
- Record maintenance procedures, e.g. record of remediation work, certificates issued and restrictions placed on the site.

Control measures

Stockpile sites: Locate on previously cleared areas.

2.6 WEED MANAGEMENT

Control plan

Plan: Submit a weed management plan with the following details:

- Identify weeds and infestation zones within the work site and the investigation period.
- Method and date of cleaning vehicles and machinery.
- Cleaning bay location and treatment date.
- Contaminated fill stockpile, treatment type and treatment date.

Weed management personnel

Requirement: Submit details of the following:

- Subcontractors who will treat weed infestations.
- Chemical handlers, qualifications, date, and spray type.

2.7 SITE CONTROL AND PROTECTION MEASURES

Air quality control

Requirement: Protect adjoining owners, residents and the public against dust, dirt, water nuisance and injury. Use dust screens and watering to reduce dust nuisance.

Dewatering

Requirement: Keep earthworks free of water. Provide and maintain slopes, crowns and drains for excavations and embankments, to make sure there is free drainage. Construct, including placing of fill, masonry, concrete and services, on ground where free water has been removed. Prevent water flow over freshly laid work.

Water disposal: Dispose off-site.

Dust control

Lighting of fires

Prohibition: Do not light fires.

Noise control and vibration

Standard: To the recommendations of AS 2436.

Noise levels: Avoid excessive noise and long periods of elevated noise that is reasonably anticipated to annoy or adversely effect the adjacent community.

Noise suppression: Minimise noise nuisance with measures including the following:

- Enclose noisy equipment.
- Provide noise attenuation screens.
- Maintain plant in good working order.
- Fit effective residential class silencers to all engine exhausts.
- Fit engine covers to all plant.

Limits on ground vibration: Make sure ground vibration levels transmitted from operating items of plant in the vicinity of buildings do not exceed levels that are close to the lower level of human perception inside the premises or cause structural damage to the buildings and other structures.

Monitoring: Provide the following:

- Baseline condition measurements before commencement of the works.
- Progressive monitoring during the works to confirm conformance with approval conditions.

Vegetation and fauna

Wildlife to be protected: All native species.

Trees to be removed: Inspect to establish if nesting native fauna are present. If present, give notice.

Pruning: To AS 4373.

Water quality

Wash out: Prevent wash out from entering waterways or stormwater drains.

Cross connection: Make sure there are no cross connections between stormwater and the public sewerage system.

Vehicular and equipment contamination precautions

Covers: Use tarpaulins to prevent the dropping of materials on public roads.

Washing: Wash the underside of all vehicles leaving the site as follows:

- Mud: Do not carry onto other areas, including adjacent paved streets.
- Noxious plants: If those designated by the local authority are present on the site, make sure seeds are not carried onto other areas, including adjacent paved streets.

Wheel wash/shaker bay

Surface: Crushed concrete or rock of between 100 mm and 200 mm approximate diameter.

Services: High pressure hose water supply.

Location: Locate the shaker bay and provide berms to drain to grassed areas of the site and allow infiltration to the subsurface.

2.8 OTHER ENVIRONMENTAL CONTROLS

Cultural heritage

Training: Make sure all personnel working on the site have received training on their responsibilities regarding cultural heritage and are made aware of any sites/areas, which must be avoided. Mark-up such sites/areas on a site map and make available to all relevant personnel during the works.

Notice: Give notice if any item encountered is suspected to be an artefact of heritage value, relic or material which is Aboriginal or belonging to early settlement.

Action: Stop construction work that might affect the item and protect the item from damage or disturbance.

Habitat provision

Material: Felled trees and excavated rocks.

0181 ADHESIVES, SEALANTS AND FASTENERS

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide adhesives, sealants and fasteners, as documented.

Performance

Requirements: Conform to the following:

- Fitness for purpose: Capable of transmitting imposed loads, sufficient to maintain the rigidity of the assembly, or integrity of the joint.
- Finished surface: That will not cause discolouration.
- Compatibility: Compatible with the products to which they are applied.
- Sealant replacement: Capable of safe removal without compromising the application of the replacement sealant for future refurbishment.
- Movement: If an adhered or sealed joint is subject to movement, select a system certified to accommodate the projected movement under the conditions of service.
- Fasteners: Suitable for the particular use, capable of transmitting imposed loads and maintaining the rigidity of the assembly.

1.2 PRECEDENCE

General

Order of precedence:

- The requirements of other worksections of the specification override conflicting requirements of this worksection.
- The requirements of worksections override conflicting requirements of their referenced documents. The requirements of the referenced documents are minimum requirements.

1.3 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.4 SUBMISSIONS

Products and materials

Sealants: Submit technical data sheets.

Samples

Visible joint sealants: Submit colour samples.

Tests

Compatibility testing: Submit adhesion and compatibility testing data demonstrating that adhesive, sealant or fastener is compatible with materials to be fixed and is suitable for the project conditions.

Warranties

Manufacturer’s warranty: Submit the manufacturer’s published product warranties.

1.5 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of prepared joints and penetrations for each sealant application included in the **Installed sealant tests schedule**.

2 PRODUCTS

2.1 ADHESIVES

Standards

Gypsum plaster adhesive: To AS 2753.

High strength adhesive tape

General description: A foam of cross linked polyethylene or closed cell acrylic coated both sides with a high performance acrylic adhesive system, encased in release liners of paper or polyester.

Product classification: Select tape to suit substrate as follows:

- Firm high strength foam tapes: For high energy surfaces including most bare metals such as stainless steel and aluminium.
- Conformable high strength foam: For the following:
  - . Medium energy surfaces including many plastics and paints, and bare metals.
  - . Lower energy surfaces including many plastics, most paints and powder coatings, and bare metals.

Thickness: Select the tape to make sure a mismatch between surfaces does not exceed half the tape thickness under the applied lamination pressure.

2.2 SEALANTS

Standards

General: To ISO 11600.

External masonry joints

General: Provide sealant and bond breaking materials which are non-staining to masonry. Do not use bituminous materials with absorbent masonry units.

Bond breaking backing:

- Bond breaking materials: Non-adhesive to sealant, or faced with a non-adhering material.
- Foamed materials: Closed-cell or impregnated, not water-absorbing.

Fire-resisting control joints

General: Provide sealant materials that maintain the nominated fire-resistance level (FRL).

- Fire-stopping: To AS 4072.1.

Lightweight building element joints

Joints subject to rapid changes of movement: Provide sealants that accommodate the movement of the contact materials.

Floor control joints

General: Provide trafficable sealants.

Bond breaking backing:

- Bond breaking materials: Non-adhesive to sealant, or faced with a non-adhering material.
- Foamed materials: Closed-cell or impregnated, not water-absorbing.

2.3 FASTENERS

General

Masonry anchors: Proprietary expansion or bonded type anchors conforming to **SELECTIONS, ANCHORS**.

Plain washers: To AS 1237.1.

- Provide washers to the heads and nuts of bolts, and the nuts of coach bolts.

Plugs: Proprietary purpose-made plastic.

Stainless steel fasteners: To ASTM A240/A240M.

Steel nails: To AS 2334.

- Length: At least 2.5 times the thickness of the member being secured, and at least 4 times the thickness if the member is plywood or building board less than 10 mm thick.

Unified hexagon bolts, screws and nuts: To AS/NZS 2465.

Fasteners in CCA treated timber: Epoxy coated or stainless steel.

Bolts

Coach bolts: To AS/NZS 1390.

Hexagon bolts Grades A and B: To AS 1110.1.

Hexagon bolts Grade C: To AS 1111.1.

Corrosion resistance

Atmospheric corrosivity category: To *0171 General requirements*.

Steel products: Conform to the **Corrosion resistance table** or provide proprietary products with metallic and/or organic coatings of equivalent corrosion-resistance.

Corrosion resistance table

Atmospheric corrosivity category to AS 4312	**Threaded fasteners and anchors**		**Powder actuated fasteners**
	Material	**Minimum local metallic coating thickness (µm)**	**Material**
C1 and C2	Electroplated zinc or Hot-dip galvanized	30	Stainless steel 316
C3	Hot-dip galvanized	50	Stainless steel 316
C4 and T	Stainless steel 316	-	Stainless steel 316

Finishes

Electroplating:

- Metric thread: To AS 1897.
- Imperial thread: To AS 4397.

Galvanizing:

- Threaded fasteners: To AS/NZS 1214.
- Other fasteners: To AS/NZS 4680.

Mild steel fasteners: Galvanize if:

- Embedded in masonry.
- In external timbers.
- In contact with chemically treated timber other than CCA treated timber.

Epoxy coated: CCA treated timber.

Nuts

Hexagon chamfered thin nuts Grades A and B: To AS 1112.4.

Hexagon nuts Grade C: To AS 1112.3.

Hexagon nuts Style 1 Grades A and B: To AS 1112.1.

Hexagon nuts Style 2 Grades A and B: To AS 1112.2.

Screws

Coach screws: To AS/NZS 1393.

Hexagon screws Grades A and B: To AS 1110.2.

Hexagon screws Grade C: To AS 1111.2.

Hexagon socket screws: To AS 1420.

Self-drilling screws: To AS 3566.1.

Self-tapping screws:

- Crossed recessed countersunk (flat – common head style): To AS/NZS 4407.
- Crossed recessed pan: To AS/NZS 4406.
- Crossed recessed raised countersunk (oval): To AS/NZS 4408.
- Hexagon: To AS/NZS 4402.
- Hexagon flange: To AS/NZS 4410.
- Hexagon washer: To AS/NZS 4409.
- Slotted countersunk (flat – common head style): To AS/NZS 4404.

- Slotted pan: To AS/NZS 4403.
- Slotted raised countersunk (oval – common head style): To AS/NZS 4405.

Blind rivets

Description: Expanding end type with snap mandrel.

Type: Closed end for external application, open end for internal application.

End material:

- Aluminium base alloy for metallic-coated or prepainted steel.
- Stainless steel for stainless steel sheet.
- Copper for copper sheet.

Size:

- For sheet metal to sheet metal: 3 mm.
- For sheet metal to supports, brackets and rolled steel angles: 4.8 mm.

3 EXECUTION

3.1 ADHESIVES

General

Requirement: Install to the manufacturer’s recommendations.

Preparation

Substrates: Conform to the following:

- Remove any deposit or finish which may impair adhesion.
- If framed or discontinuous, provide support members in full lengths without splicing.
- If solid or continuous, remove excessive projections.
- If previously painted, remove cracked or flaking paint and lightly sand the surface.

Contact adhesive

Precautions: Do not use contact adhesive if:

- A substrate is polystyrene foam.
- A PVC substrate may allow plasticiser migration.
- The adhesive solvent can discolour the finished surface.
- Dispersal of the adhesive solvent is impaired.

Two-way method: Immediately after application, press firmly to transfer adhesive and then pull both surfaces apart. Allow to tack off and then reposition and press firmly together. Tap areas in contact with a hammer and padded block.

One-way method: Immediately after application, bring substrates together and maintain maximum surface contact for 24 hours by clamps, nails or screws as appropriate. If highly stressed, employ permanent mechanical fasteners.

High strength adhesive tape

Preparation:

- Non-porous surfaces: Clean with surface cleaning solvents such as isopropyl alcohol/water, wash down and allow to dry.
- Porous surfaces: Prime the surface with a contact adhesive compatible with the tape adhesive system.

Application to copper, brass, plasticised vinyl and hydrophilic surfaces such as glass and ceramics in a high humidity environment: Conform to manufacturer's recommendations.

Applied lamination pressure: Make sure the tape experiences 100 kPa.

Application temperature: Generally above 10°C and to the manufacturer's recommendations.

Completion: Do not apply loads to the assembly for 72 hours at 21°C.

3.2 JOINT SEALING

General

Requirement: Install to the manufacturer’s recommendations.

Joint preparation

Cleaning: Cut flush joint surface protrusions and rectify if required. Mechanically clean joint surfaces free of any deposit or finish which may impair adhesion of the sealant. Immediately before sealant application, remove loose particles from the joint, using oil-free compressed air.

Bond breaking: Install bond breaking backing material.

Taping: Protect the surface on each side of the joint using 50 mm wide masking tape or equivalent means. On completion of sealant application, remove the tape and remove any stains or marks from adjacent surfaces.

Primer: Apply the recommended primer to the surfaces in contact with sealant materials.

Sealant joint proportions

General weatherproofing joints (width:depth):

- 1:1 for joint widths less than 12 mm.
- 2:1 for joint widths greater than 12 mm.

Sealant application

General: Apply the sealant to dry joint surfaces using a pneumatic applicator gun. Make sure the sealant completely fills the joint to the required depth, provides good contact with the full depth of the sides of the joint and traps no air in the joint. Do not apply the sealant outside the recommended working time for the material or the primer.

Weather conditions

Two pack polyurethanes: Do not apply the sealant if ambient conditions are outside the following:

- Temperature: Less than 5°C or greater than 40°C.
- Humidity: To the manufacturer's recommendations.

Joint finish

General: Force the sealant into the joint and finish with a smooth, slightly concave surface using a tool designed for the purpose.

Excess sealant: Remove from adjoining surfaces using cleaning material nominated by the sealant manufacturer.

Protection

General: Protect the joint from inclement weather during the setting or curing period of the material.

Rectification

General: Cut out and remove damaged portion of joint sealant and reinstall so repaired area is indistinguishable from undamaged portion.

3.3 TESTING

Installed sealant tests

Sampling: For each sealant test, take 3 samples of installed and cured sealant, each at least 50 mm long, from completed joints.

Reinstatement: Repair-as-new the joints from which the samples were taken.

Installed sealant tests schedule

Item to be tested	Property to be tested	Applicable standard

3.4 FASTENERS

General

Requirement: Install to the manufacturer's recommendations.

Fastening to wood and steel

Timber substrates: To AS 1720.1 Section 4.

Self-drilling screws: To AS 3566.1 for timber and steel substrates.

Masonry anchors

Installation: To the manufacturer's recommendations.

4 SELECTIONS

4.1 ADHESIVES

Application schedule

Application	Product	Relevant worksections
Adhesive fixed timber strip flooring and parquetry systems		*0655 Timber flooring*
Colourback glass faced wall panels or splashbacks		*0551 Joinery*, *0641 Applied wall finishes*
Drywall lining/wall panels		*0511 Lining*, *0522 Partitions – framed and lined*
Engineered panel floors		*0654 Engineered panel flooring*
Joinery doors		*0453 Doors and access panels*
Mirrors		*0467 Glass components*
Stainless steel faced wall panels or splashbacks		*0551 Joinery*, *0553 Stainless steel benching*
Timber joinery fitments		*0551 Joinery*
Trim, mouldings, skirtings and architraves		*0511 Lining*

4.2 ANCHORS

Bonded anchor schedule

Property	A	B	C
Adhesive			
Anchor rod: Diameter (mm)			
Anchor rod: Length (mm)			
Anchor rod: Finish/coating			
Anchor rod: Strength grade			
Anchor rod: Depth of embedment (mm)			
Anchor rod: Part number			
Drill hole: Diameter (mm)			
Drill hole: Depth (mm)			
Tightening torque (Nm)			

Expansion anchor schedule

Property	A	B	C
Anchor name			
Part number			
Size			
Finish/coating			
Drill hole: Diameter (mm)			
Drill hole: Depth (mm)			

Property	A	B	C
Socket size (mm)			
Tightening torque (Nm)			

4.3 SEALING, POINTING AND BEDDING

Application schedule

Application	Product	Relevant worksections
Metal flashings and rainwater goods		*0421 Roofing – combined*, *0423 Roofing – profiled sheet metal*, *0424 Roofing – seamed sheet metal*, *0425 Roofing – shingles and shakes*, *0426 Roofing – slate*, *0427 Roofing – tiles*
Metal flashings and sealing non-porous substrates		*0431 Cladding – combined*, *0432 Curtain walls*, *0434 Cladding – flat sheets and panels*, *0435 Cladding – planks and weatherboards*, *0436 Cladding – profiled and seamed sheet metal*
Window and external doors		*0432 Curtain walls*, *0451 Windows and glazed doors*, *0453 Doors and access panels*, *0463 Glass blockwork*
Mechanical services		*0724 Air handling plant – combined*, *0725 Air handling plant – built-up*, *0726 Air handling plant – minor*, *0727 Air handling plant – packaged*, *0732 Air filters*, *0741 Ductwork*, *0702 Mechanical design and install*, *0752 Mechanical piping insulation*, *0762 Cool rooms*
Hydraulic services		*0811 Sanitary fixtures*, *0812 Tapware*, *0813 Water heaters*, *0815 Boiling, chilled and filtered water dispensers*

Adhesives, sealants and fasteners combined function schedule

Application	Product	Relevant worksections
Cool rooms fixing and sealing		*0762 Cool rooms*
Fixing and sealing acoustic ceiling tiles		*0531 Suspended ceilings – combined*
Control joints, tile adhesives and wet area sealants		*0631 Ceramic tiling*, *0632 Stone and terrazzo tiling*
Timber floor control joints, adhesives and fixings		*0655 Timber flooring*, *0654 Engineered panel flooring*
Wet area sealants and lightweight detail items		*0525 Cubicle systems*, *0551 Joinery*, *0811 Sanitary fixtures*

4.4 SEALING STRUCTURALLY DESIGNED CONTROL JOINTS

Application schedule

Application	Sealant type	Bond breaking	Sealant colour	Relevant worksection
Masonry control joints				*0322 Tilt-up concrete*, *0331 Brick and block construction*, *0332 Stone masonry*
Trafficable masonry control joints				*0274 Concrete pavement*, *0275 Paving – mortar and adhesive bed*

4.5 FIRE-RESISTING SEALANTS

Application schedule

Application	Sealant type	Bond breaking	Sealant colour	Fire-resistance level to AS 1530.4 (FRL)	Relevant worksection
Masonry control joints					*0322 Tilt-up concrete*, *0331 Brick and block construction*, *0332 Stone masonry*.
Pointing and stopping (including acoustic applications)					*0182 Fire-stopping*, *0346 Structural fire protection systems*, *0472 Acoustic insulation*.
Sealing of structural steel fire protection systems					*0346 Structural fire protection systems*.

0183 METALS AND PREFINISHES

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirements: Provide metal and prefinishes, as documented.

Performance

Requirement: Provide metals in sections of strength and stiffness suited to their required function, finish and method of fabrication.

1.2 PRECEDENCE

General

Order of precedence:

- The requirements of other worksections of the specification override conflicting requirements of this worksection.
- The requirements of worksections override conflicting requirements of their referenced documents. The requirements of the referenced documents are minimum requirements.

1.3 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.4 SUBMISSIONS

Samples

General: Submit samples of the following:

- Stainless steel: One sample of every documented surface finish.
- Anodising: One sample of every colour and finishing option.

2 PRODUCTS

2.1 METALS

Aluminium and aluminium alloys

Drawn pipe: To AS/NZS 1867.

Drawn rod, bar and strip: To AS/NZS 1865.

Extrusions: To AS/NZS 1866.

Plate and sheets: To AS/NZS 1734.

Coated steel

Electrogalvanized (zinc) coating on ferrous hollow and open sections: To AS 4750.

Metallic-coated: Steel coated with zinc or aluminium-zinc alloy as follows:

- Ferrous open sections by an in-line process: To AS/NZS 4791.
- Ferrous hollow sections by a continuous or specialised process: To AS/NZS 4792.
- Metallic-coated steel sheet: To AS 1397. Metal thicknesses specified are base metal thicknesses.

Steel wire: To AS/NZS 4534.

Copper and copper alloys

Casting: To AS 1565.

Plate, sheet and strip: To AS 1566.

Rods, bars and sections: To AS/NZS 1567.

Composition and designations: To AS 2738.

Stainless steel

Bars: To ASTM A276/A276M.

Plate, sheet and strip: To ASTM A240/A240M.

Welded pipe (plumbing applications): To AS 1769.

Welded pipe (round, square, rectangular): To ASTM A554.

Steel

Sheet: To AS/NZS 1595.

Structural bars and sections: To AS/NZS 3679.1.

Structural hollow sections: To AS/NZS 1163.

Steel for prefinishes

Cold rolled bar: To AS 1443 - Bright.

Cold rolled sheet: To AS/NZS 1595.

- Designation: CA2S-E.

Electric resistance welded tube: To AS 1450.

3 EXECUTION

3.1 GENERAL

Metal separation

Incompatible sheet metals: Prevent direct contact between incompatible metals. Provide separation by one of the following:

- Apply an anti-corrosion low moisture transmission coating such as alkyd zinc phosphate primer or aluminium pigmented bituminous paint to contact surfaces.
- Insert a concealed, non-metallic separation layer such as polyethylene film, adhesive tape, neoprene, nylon or bituminous felt.

Incompatible fixings: Do not use.

Incompatible service pipes: Install lagging or grommets. Do not use absorbent, fibrous or paper products.

Brazing

General: Make sure brazed joints have sufficient lap to provide a mechanically sound joint.

Butt joints: Do not use butt jointing for joints subject to load. If butt joints are used, do not rely on the filler metal fillet only.

Filler metal: To AS/NZS 1167.1.

Finishing

Visible joints: Finish visible joints made by welding, brazing or soldering using methods appropriate to the class of work (including grinding or buffing) before further treatment such as painting, galvanizing or electroplating. Make sure self-finished metals are without surface colour variations after jointing.

Preparation

General: Before applying decorative or protective prefinishes to metal components, complete welding, cutting, drilling and other fabrication, and prepare the surface using a suitable method.

Standard: To AS 1627 series.

Priming steel surfaces: If site painting is documented to otherwise uncoated mild steel or similar surfaces, prime as follows:

- After fabrication and before delivery to the works.
- After installation, repair damaged priming and complete the coverage to unprimed surfaces.

Welding

Aluminium: To AS 1665.

Stainless steel: To AS/NZS 1554.6.

Steel: To AS/NZS 1554.1.

3.2 STAINLESS STEEL FINISHES

General

Requirement: Provide a surface finish to match the approved sample.

Pre-assembly

Mechanically polished and brushed finishes: Apply grit faced belts or fibre brushes that achieve uni-directional finishes with buffing.

Bead blasted finish: Provide a uniform non-directional low reflective surface by bead blasting. Do not use sand, iron or carbon steel shot. Blast both sides of austenitic stainless steel to equalise induced stress.

Post-assembly pre-treatment

Heat discolouration: Remove by pickling.

Welds: Grind excess material, brush, and polish to match the pre-assembly finish.

Post-assembly finish

Electropolish finish for external installations: Provide an electro-chemical process to stainless steel type 316.

Brushed electropolish finish: Conform to the following:

- Pre-assembly finish: No. 4 brushed finish.
- Post-assembly finish: Provide an electro-chemical processed finish to achieve a No. 7 to No. 8 brushed finish.

Mirror electropolish finish:

- Pre-assembly finish: Mill finish 2B or mirror polished finish.
- Post-assembly finish: Provide an electro-chemical processed finish to achieve a No. 8 mirror like finish.

Completion

Cleaning: Clean and rinse to an acid free condition and allow to dry. Do not use carbon steel abrasives or materials containing chloride.

Protection: Secure packaging or strippable plastic sheet.

3.3 NON-FERROUS FINISHING

Mechanical finishes

Bright finished copper alloy surfaces: For indoor applications, apply a clear lacquer protective coating.

3.4 ELECTROPLATING

Electroplated coatings

Chromium on metals: To AS 1192.

- Service condition number: At least 2.

Nickel on metals: To AS 1192.

- Service condition number: At least 2.

Zinc on iron or steel: To AS 1789.

3.5 ANODISING

General

Standard: To AS 1231.

Thickness grade: To AS 1231 Table H1.

Sample

General: Provide a finish to match the sample in terms of colour and finishing options.

3.6 METAL SPRAYING

Metal spray

Standard: To ISO 2063.2.

Minimum thicknesses:

- Indoor applications: 125 µm.
- Outdoor applications: 175 µm.

Process: Electric arc.

Seal coat: Cover the metal spray finish with two coats of vinyl seal to a total dry film thickness of 80 µm.

3.7 PREPAINTING

Air-drying enamel
Application: Spray or brush.

Finish: Full gloss.

General use:

- Primer: Two-pack epoxy primer to AS/NZS 3750.13.
- Top coats: 2 coats to AS 3730.6.

Oil resistant use:

- Primer: Two-pack epoxy primer to AS/NZS 3750.13.
- Top coats: 2 coats to AS/NZS 3750.22.

Equipment paint system
Description: Brush or spray application using paint as follows:

- Full gloss enamel finish coats, oil and petrol resistant: To AS/NZS 3750.22, two coats.
- Prime coat to metal surfaces generally: To AS/NZS 3750.19 or AS/NZS 3750.20.
- Prime coat to zinc-coated steel: To AS 3730.15 or AS/NZS 3750.16.
- Undercoat: To AS/NZS 3750.21.

Prepainted metal products
Standard: To AS/NZS 2728.

Product type as noted in AS/NZS 2728: Not lower than the type appropriate to the atmospheric corrosivity category.

Stoving enamel
Application: Spray or dip.

Two-pack liquid coating
Application: Spray.

Finish: Full gloss.

Primer: Two pack epoxy primer to AS/NZS 3750.13.

Topcoat:

- Internal use: Proprietary polyurethane or epoxy acrylic system.
- External use: Proprietary polyurethane system.

3.8 COMPLETION

Damage
Damaged prefinishes: Remove and replace items, including damage caused by unauthorised site cutting or drilling.

Repair
Metallic-coated sheet: If repair is required to metallic-coated sheet or electrogalvanizing on inline galvanized steel products, clean the affected area and apply a two-pack organic primer to AS/NZS 3750.9.

0195P DTAC TACTILE INDICATORS AND STAIR EDGINGS

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide DTAC tactile indicators and edging, as documented.

1.2 COMPANY CONTACTS

DTAC technical contacts
Website: www.dtac.com.au/contact

1.3 CROSS REFERENCES

General
Requirement: Conform to the following:
- *0171 General requirements*.

1.4 STANDARDS

General
Tactile indicators: To AS/NZS 1428.4.1.
Stair edging: To AS 1428.1.

Slip resistance
Classification: To AS 4586.

1.5 MANUFACTURER'S DOCUMENTS

Technical manuals
Technical data sheets and laying guides: www.dtac.com.au/resources
DTAC Stair & Tread Edging: www.dtac.com.au/product/edging
DTAC Warning Tactile: www.dtac.com.au/product/warning-tactile
DTAC Directional Tactile: www.dtac.com.au/product/directional
DTAC Integrated Tactile: www.dtac.com.au/product/integrated
DTAC Edge Protector: www.dtac.com.au/product/edge-protector

1.6 SUBMISSIONS

Products and materials
Type tests: Submit results, as follows:
- Slip resistance of tactile indicators and edgings.
- Luminance contrast testing: Submit evidence of conformance to AS/NZS 1428.4.1 Appendix E and AS 1428.1 Appendix B.

Prototypes
General: Provide a prototype of the DTAC product installed in the finished substrate.
Location and extent: Basement driveway ramp

Warranties
Tactile indicators, edge protectors and stair edging: Submit DTAC product and installation warranties.

1.7 INSPECTION

Notice
Inspection: Give notice so that inspection may be made of the completed substrate ready for tactile indicators and edging installation.

2 PRODUCTS

2.1 GENERAL

Product substitution

Other products: Conform to PRODUCTS, **GENERAL**, **Substitutions** in *0171 General requirements*.

2.2 DTAC TACTILE INDICATORS, EDGE PROTECTORS AND STAIR EDGING

Warning tactile products

Classic: Tactile indicators with a concentric circle design machined or injection moulded on the horizontal face and a smooth outer edge.

Terraced: Tactile indicators with a concentric circle design machined or injection moulded on the horizontal face and a terraced slip-resistant outer edge.

Classic Colourmax: Tactile indicators with a concentric circle design machined on the type 316 stainless steel horizontal face with a smooth injection moulded UV stabilised thermoplastic urethane (TPU) outer edge.

Handrail button: Machined domed type 316 stainless steel button.

Ecotac™ Classic: Tactile indicators with a cupped underside, a concentric circle design machined on the type 316 stainless steel horizontal face and a smooth outer edge.

Ecotac™ Terraced: Tactile indicators with a cupped underside, a concentric circle design machined on the type 316 stainless steel horizontal face and a terraced slip-resistant outer edge.

Ultimat™ Tactile Classic: UV stabilised thermoplastic urethane (TPU) injection moulded tactile with Classic tactile indicators on the horizontal face.

Directional tactile products

Ecotac™ Classic: Tactile indicator type 316 stainless steel with a cupped underside, a grooved design machined on the horizontal face and a smooth outer edge.

Ecotac™ Terraced: Tactile indicator type 316 stainless steel with a cupped underside, a grooved design machined on the horizontal face and a terraced slip-resistant outer edge.

Classic: UV stabilised thermoplastic urethane (TPU) injection moulded tactile with an undulating groove design on the horizontal face and a smooth outer edge.

Integrated tactile products

Classic: Type 316 stainless steel plate with Classic tactile indicators integrated on the horizontal face.

Classic Black Top: Type 316 stainless steel plate with Classic Black tactile indicators integrated on the horizontal face.

Edge protector

Round button: 35 mm diameter urban edge protector.

Bevelled button: 35 mm diameter urban edge protector.

Thin bar: 5 mm thick type 316 stainless steel bar.

Thick bar: 10 mm thick type 316 stainless steel bar.

Stair edging products

Corduroy edging: Extruded aluminium sections with a continuous corduroy pattern.

Pinstripe edging: Extruded smooth, blunt edged aluminium sections with an intermittent high and low profile.

Pleat edging: Extruded smooth, aluminium sections with an intermittent continuous corduroy pattern.

Stitch edging: Extruded aluminium sections with a continuous stitch pattern.

Suede edging: Extruded anodised aluminium sections with a continuous band of silicon carbide.

Urban edging: Continuous band of silicon carbide inserted into anodised aluminium extrusions.

Urban edging - Mill finished aluminium: Intermittent striations of silicon carbide inserted into aluminium extrusions.

Rugged™ edging: Continuous band of fibre glass reinforced plastic extrusion.

3 EXECUTION

3.1 GENERAL

Substrate preparation and installation of DTAC products

Requirement: To DTAC's recommendations and fitting instructions.

Location: As documented.

Classic, Terraced and Classic Colourmax:

- Stone, masonry, timber or vinyl substrates: Drill and pressure fit.
- Carpet or carpet tile substrates: Drill and screw.

Handrail button: Drill and glue to substrate.

Ultimat™ Tactile: Direct stick to substrate with DTAC anchor adhesive.

Button and bar urban edge protector:

- Stone, masonry, timber or vinyl substrates: Drill and glue.
- Vitrified porcelain, ceramics, glass or metal substrates: Diamond core drill and glue.

Fixing stair edging

Corduroy, Pinstripe, Pleat, Stitch, Suede:

- Stone, masonry, timber or vinyl substrates: Adhesive fix.
- Vitrified porcelain, ceramics, glass or metal substrates: Adhesive fix.
- Carpet or carpet tile substrates: Screw-fix or adhesive fix.

Urban and Rugged™: Screw-fix with optional adhesive.

3.2 TESTING

Completion tests

Slip resistance of completed installation: To AS 4663.

Luminance contrast testing of completed installation: Submit evidence of conformance to AS/NZS 1428.4.1 Appendix E and AS 1428.1 Appendix B.

3.3 COMPLETION

Warranties

Conditions: Installation by DTAC or DTAC approved by installer.

Warranty period: 2 years.

4 SELECTIONS

4.1 DTAC PRODUCTS

Tactile indicator and edge protector schedule

Property	TI1	TI2	TI3
Type			
Product code			
Design			
Material/Colour			
Slip-resistance classification			
Substrate			

Stair edging schedule

Property	SE1	SE2	SE3
Product code			
Application			

Property	SE1	SE2	SE3
Design			
Colour			
Slip-resistance classification			
Substrate			

0221 SITE PREPARATION

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide site preparation, as documented.

Incidental works
Generally: Undertake the following:

- Reinstatement: Reinstate undeveloped ground surfaces to the condition existing at the commencement of the contract.
- Minor trimming: As required to complete the works, as documented.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:

- *0171 General requirements*.

1.3 INTERPRETATION

Definitions
General: For the purposes of this worksection the following definitions apply:

- Authorities: Any authority or agency covering statutory requirements relating to the project, including clearances for work in that particular area.
- Clearances: A formal certificate, approval or condition issued by an authority to allow work to be carried out in a particular area.
- Network utility operator: The entity undertaking the piped distribution of drinking water or natural gas for supply or is the operator of a sewerage system or external stormwater drainage system.

1.4 SUBMISSIONS

Execution details
Requirement: Submit details of methods and equipment proposed for the following:

- Clearing and grubbing.
- Tree removal and transplanting.

1.5 INSPECTION

Notice
Inspection: Give notice so that inspection may be made of the following:

- Enclosures around trees to be retained.
- Trees to be removed.

2 EXECUTION

2.1 COMMUNITY LIAISON

Notification
General: Notify residents about construction activities which will affect access to, or disrupt the use of, their properties.

Notice: Minimum 5 working days, unless the work is of an urgent nature with safety implications.

Notification content:

- The nature of the work.
- The reason for it being undertaken.
- The expected duration.
- Changes to traffic arrangements and property access.

- The 24-hour contact number of the representative responsible.

2.2 EXISTING SERVICES

General

Requirement: Before commencing earthworks, locate and mark existing underground services in the areas which will be affected by the earthworks operations including clearing, excavating and trenching.

Utility services: Contact DIAL BEFORE YOU DIG to identify location of underground utility services pipes and cables.

Excavation: Do not machine excavate within 1 m of existing underground services.

Existing service lines: If required, divert services detected during excavation to new routes, clear of the building, and reconnect to the Network Utility Operator's requirements.

2.3 SITE CLEARING

Extent

Requirement: Clear only areas to be occupied by works such as structures, paving, excavation, regrading and landscaping or other areas designated to be cleared.

Contractor's site areas: If not included within the areas documented above, clear generally only to the extent necessary for the performance of the works.

Clearing and grubbing

Clearing: Remove everything on or above the site surface, including rubbish, scrap, grass, vegetable matter and organic debris, scrub, trees, timber, stumps, boulders and rubble.

Grubbing: Grub out stumps and roots over 75 mm diameter to a minimum depth of 500 mm below subgrade under buildings, embankments or paving, or 300 mm below finished surface in unpaved areas. Backfill holes remaining after grubbing with sand material to prevent ponding of water. Compact the material to the relative density of the existing adjacent ground material.

Redundant/decommissioned works: Remove works, including slabs, foundations, pavings, drains and access chambers covers found on the surface.

Batters

Temporary protection: Where change in level between crest and toe is more than 1.5 m, protect from erosion with geofabric, a hessian and tar or heavy duty black polythene sheet waterproof cover. Seal joints and securely fix down at crest and toe.

Surplus material

Topsoil and excavated material: Continually remove unwanted stripped soil and other material from the site as the work proceeds, including any material dropped on footpaths or roadways.

2.4 STORMWATER AND SEDIMENT CONTROL

General

Erosion and sediment control measures: To *0172 Environmental management*.

Waterways and drains

Waterways: Temporarily divert, as necessary, ditches, field drains and other waterways affected by excavation and reinstate on completion.

Stormwater drains: Divert drains detected during excavation to new routes, clear of the building, and reconnect to the Network Utility Operator's requirements.

2.5 EXISTING WORKS TO BE RETAINED

Marking

Requirement: Mark out works with 1 m high 50 x 50 mm timber stakes with yellow plastic tapes attached to prevent accidental damage.

2.6 TREES TO BE REMOVED

Designation

Marking: Mark trees and shrubs to be removed 1000 mm above ground level.

2.7 TREE PROTECTION

General

Warning signs: Display in a prominent position at each entrance to the site, warning that trees and plantings are to be protected during the contract. Remove on completion.

Lettering: Road sign type sans serif letters, 100 mm high to AS 4970 Appendix C.

Protection measures: Provide before commencement of earthworks.

Trees to be retained

Extent: All trees NOT marked for removal.

Tree protection

Tree protection zone (TPZ): To AS 4970 Section 3.

Tree protective measures: To AS 4970 Section 4.

Monitoring and certification: To AS 4970 Section 5.

Work near trees

Harmful materials: Conform to the following:

- Keep the area within the dripline free of sheds and paths, construction material and debris.
- Do not place bulk materials and harmful materials under or near trees.
- Do not place spoil from excavations against tree trunks.
- Prevent wind-blown materials such as cement from harming trees and plants.

Damage: Prevent damage to tree bark. Do not attach stays, guys and the like to trees.

Work under trees: Do not remove topsoil from, or add topsoil to, the area within the dripline of the trees.

Excavation: If excavation is required near trees to be retained, give notice. Minimise period of excavation under tree canopies.

Hand methods: Use hand methods to locate, expose and cleanly remove the roots on the line of excavation. If it is necessary to excavate within the drip line, use hand methods so that root systems are intact and undamaged.

Roots: Do not cut tree roots exceeding 50 mm diameter. Where it is necessary to cut tree roots, use cutting methods that do not excessively disturb the remaining root system. Immediately after cutting, water the tree and apply a liquid rooting hormone to stimulate the growth of new roots.

Backfilling: Backfill excavations around tree roots. Place the backfill in layers of 300 mm maximum depth and compacted to a dry density similar to that of the original or surrounding soil. Do not backfill around tree trunks to a height greater than 200 mm above the original ground surface. Immediately after backfilling, thoroughly water the root zone surrounding the tree.

Backfill material:

- Mix proportions (topsoil:well-rotted composts) by volume: 3:1.
- Neutral pH value.
- Free from weed growth and harmful materials.

Compacted ground: Do not compact the ground or use skid-steel vehicles under the tree dripline. If compaction occurs, give notice.

Compaction protection: Protect areas adjacent the tree dripline. Submit proposals for an elevated platform to suit the proposed earthworks machinery.

Watering: Water trees as necessary, including where roots are exposed at ambient temperature more than 35°C.

Mulching: Spread 100 mm thick organic mulch to the whole of the area covered by the drip line of all protected trees.

2.8 TEMPORARY LANDSCAPE FENCING

Fence dimensions

Height: 1200 mm.

Maximum post spacing: 5000 mm.

Components sizes

Corner and gate posts: Hardwood or preservative-treated softwood, 250 mm diameter.

Intermediate posts: Star picket.

Gate: Provide a suitable hinged gate with a gate latch.

Wire: Top, intermediate and bottom rows of 3.2 mm plain galvanized steel wire. Thread the top wire through pieces of plastic tube and through corner posts.

Removal

Completion: Remove the fence at the end of the planting establishment period.

2.9 TRANSPLANTING

General

Notice: Give notice before:

- Watering
- Fertilising
- Root cutting

Conditions: Select a time for transplanting appropriate to the season, time of actual operation, rootball diameter and depth, lifting methods and weather conditions.

Preparation

Watering: Establish a temporary trickle irrigation system, or manually water the intended trees for a period of two weeks before ball excavation work.

Fertilising: Apply one application of liquid fertiliser mix to the foliage and root as appropriate to the species. Apply sufficient liquid fertiliser mix to allow the spray to drip from foliage and soak into the rootball. Do not spray the fertiliser mix on excessively hot, dry or windy days.

Rootball

General: Minimise the cutting of roots. Use only sharp tools, water blasting or water cutting.

Initial cut: Conform to the following:

- Manually or using chain trenching machine. Replace trees where rootballs have been excavated by backhoe or an excavator.
- Cut 250 mm beyond the required finished rootball dimensions of each side to allow damaged roots to be trimmed back to final dimensions and sealed.

Hand trimming: To 100 mm less than the required finished rootball dimension. Cut back all roots greater than 25 mm diameter.

Rootball cutting: Conform to the following:

- Symmetrical about the trunk and in proportion to the overall size of the tree except where the limitations of individual tree planter openings require specific tailoring of the rootball dimension.
- Cut the rootball to a size which maximise the rootball for each specimen.

Trench: Backfill and lightly compact with clean sand, free of any foreign matter, pathogens or any substances which may be deleterious to future root growth. Apply root inducing formulation to the manufacturer's recommended concentration, to effectively saturate the backfill in the trench.

Maintenance of on-site plant material

Watering: Maintain a trickle irrigation system around each tree, located within the trenched rootball perimeter. Program the system to supply water at an optimum rate to encourage healthy growth and avoid desecration through excessive transpiration following the pruning of the roots. Monitor the system continuously until the tree is lifted and removed to its final destination.

Fertilising: Submit a program for regular fertiliser application continued over this period.

Responsibility: Take all necessary precautions to safeguard the health and well-being of all on site plant material before the lifting and transplanting into their location.

Above ground

Pruning: If pruning of branches is required to balance root loss, obtain prior approval. Prune only as directed and as documented in **TREE MAINTENANCE.**

Lifting: Thoroughly irrigate to the full depth of the rootball two days before transplanting of each specimen. Do not fracture the ball of soil around the root system. Maintain ball in firm condition during transplanting by wrapping in hessian or other appropriate open weave material, securely tied.

Storage: Transport transplanted trees to a designated nursery site. Store and maintain until ready for planting.

Planting: Avoid disturbing the rootball during moving and planting. After placement, remove the rootball wrapping and ties by cutting.

Watering: At completion of transplanting, water the rootball thoroughly and continue to water until established.

Transplanting schedule

Species	Method	Pruning

2.10 SITE NURSERY

Temporary works

Perimeter: Provide a bund wall of compacted fill as follows:

- Height: 400 mm.
- Batter grade (horizontal:vertical): 2:1.

2.11 TREE MAINTENANCE

General

Notice: Give notice before commencing tree maintenance.

Pruning: To AS 4373 using a fully qualified and experienced arborist. Carry out all required works in a safe manner.

Execution

Repair: Undertake tree surgery and rectify any damage to existing trees to be retained.

Operations: Remove dead and decayed wood or limbs that have been broken. Make all cuts at branch collars. If trees show signs of deterioration after the work is completed, carry out a program of soil amelioration such as soil aeration, irrigation or incorporation of organic material. Continue this program until the end of the plant establishment period.

Root pruning: Do not excessively disturb the remaining root system. Cut off damaged roots cleanly inside the exposed or damaged area. Cover exposed root area with soil immediately after pruning, do not leave roots exposed.

Wetting and new root stimulation: Form a water collecting basin and apply a rooting hormone and wetting agent to the rootball.

Precautions: Avoid damage to trees being treated and to nearby trees and surroundings. Do not use trees as anchors for winching operations or bracing. Provide bracing as necessary before cutting to prevent uncontrolled breakages and damage to surroundings.

Failure: If repair work is impracticable, or is attempted and is rejected, remove the tree and root system and make good.

Tree maintenance schedule

Tree species	Description of work

2.12 COMPLETION

Temporary works

Remove at completion

Clean up

Progressive cleaning: Keep the work included in the contract clean and tidy as it proceeds and regularly remove from the site waste and surplus material arising from execution of the work, including any work performed during the defects liability period or the plant establishment period.

Removal of plant: Within 10 working days of the date of practical completion, remove temporary works, construction plant, buildings, workshops and equipment which does not form part of the works, except what is required for work during the defects liability period or the plant establishment period. Remove these on completion.

Waste disposal: To *0172 Environmental management*.

Vermin management

Requirement: Employ an approved firm of pest exterminators and provide a certificate from the firm stating that the completed works is free of vermin.

0224 STORMWATER – SITE

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide stormwater drainage, as documented.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:
- *0171 General requirements*.
- *0222 Earthwork*.
- *0814 Hydraulic pumps* for pumped discharge.

1.3 STANDARDS

Stormwater drainage
Standard: To AS/NZS 3500.3.

1.4 INTERPRETATION

Definitions
General: For the purposes of this worksection the following definition applies:
- Pipe surround: Includes pipe overlay, pipe side support, side zone and haunch zone.

1.5 SUBMISSIONS

Products and materials
Documentation: Produce documentary evidence that the pipes conform to the requirements of this worksection.

Samples
General: Submit samples of the following:
- Each type of imported pipe bedding material.
- Each type of filter material.

Tests
Results: Submit results from pre-completion leak testing.
Certification: Submit certificate stating that network is leak free upon completion.

1.6 INSPECTION

Notice
Inspection: Give notice so that inspection may be made at the following stages:
- Excavated surfaces prior to placing bedding material.
- Concealed or underground services prior to being covered.
- Pipe joints before covering.
- Placing of cast in situ concrete.
- Upon completion.

2 PRODUCTS

2.1 MATERIALS

Concrete and mortar
Concrete: To AS 3500.3 clause 2.9 and the following:
- Grade: N15.
- Cement: To AS 3972.

. Type: GP, GL or GB.

Steel reinforcement:

- Bars and machine welded mesh: To AS/NZS 4671.

Joints

Solvent cement and priming fluid: To AS/NZS 3879.

Type of pipes and fittings

Fibre reinforced cement (FRC): To AS 4139 and the following:

- ≤ 450 mm diameter: Rubber ring joints to AS 4139.
- > 450 mm diameter: With a purpose machined internal spigot and socket system within the pipe wall.

Glass-reinforced polyester (GRP): To AS 3571.1.

Cast iron access chamber covers and frames: To AS 1830 or AS 1831, as appropriate.

Polyvinyl chloride (PVC): To AS/NZS 1254, AS/NZS 1260 or AS 1273, as appropriate.

Polyethylene (PE): To AS/NZS 4129, AS/NZS 4130, ISO 8770 or AS/NZS 2033, as appropriate.

Precast concrete: To AS/NZS 4058.

Rubber ring joints/elastomeric seals: To AS 1646.

Plastic pipe for subsoil drainage: To AS 2439.1.

Vitrified clay or ceramic: To AS 1741.

Bedding material

Bed and haunch zones: Provide granular material graded to the AS 1141 series.

Bedding material grading table

Sieve size (mm)	**Weight passing %**	
	Bed and haunch	**Side zones**
75.0	-	100
19.0	100	-
9.5	-	50 - 100
2.36	50 - 100	30 - 100
0.60	20 - 90	15 - 50
0.30	10 - 60	-
0.15	0 - 25	-
0.075	0 - 10	0 - 25

Filter material

General: Filter materials consisting of natural clean washed sands and gravels and screened crushed rock conforming to AS/NZS 3500.3 clause 2.13.1.

2.2 GEOTEXTILES

General

Requirement: Polymeric fabric formed from plastic yarn composed of at least 85% by weight propylene, ethylene amide or vinylidene chloride and containing stabilisers or inhibitors which provide resistance to deterioration due to ultraviolet light.

Subsoil drainage

Filter: Conform to AS/NZS 3500.3 clause 2.13.2.

2.3 PREFABRICATED PITS

General

Requirement: Precast or prefabricated pits conforming to AS/NZS 3500.3 clauses 2.12.8 and 7.5.

Metal access covers and grates

Standard: To AS 3996.

Cover finish and load classification: Provide access cover and grate with the documented finish, slip resistance and load class.

2.4 STORMWATER DRAINAGE PUMPS

General

Standard: To AS/NZS 3500.3 Section 8.

Requirement: Conform to **Pumped discharge system** in *0814 Hydraulic pumps*.

3 EXECUTION

3.1 PIPING

General

Laying: Lay lengths separately with the barrel bearing evenly on the prepared bedding.

Sockets: Lay with sockets pointing upstream.

Cleaning: Clean pipe interior of dirt, debris, mortar and other foreign matter.

Protection: Provide temporary caps over the ends of incomplete sections to prevent the entry of foreign matter.

3.2 TOLERANCES

Pipeline tolerances table

	Permissible angular deviation from the documented alignment	**Permissible displacement from the documented positions**
Horizontal	1:300	15 mm
Vertical	1:500	5 mm
Note: These tolerances are conditional on falls to outlets being maintained and no part of a pipeline having less than the documented gradient.		

3.3 STORMWATER DRAINS

Location

General: Provide stormwater drains to connect surface drains, subsoil drains and drainage pits to the outlet point or point of connection. Make sure that location of piping will not interfere with other services and building elements not yet installed or built. Subject to the preceding and documented layouts, follow the most direct route with the least number of changes in direction.

Laying

General: Lay in straight lines between changes in direction or grade with socket end placed upstream. If other pipes are adjacent, set each pipe true to line and complete each joint before laying the next pipe. If work is not continuous, cap open ends to prevent entry of foreign matter.

Identification

General: Lay a detectable strip or plastic tape in the trench after pipe laying, testing and initial backfilling.

Pipe underlay (bedding)

General: Bed piping on a continuous underlay of bedding material, minimum 75 mm, maximum 150 mm thick after compaction. Grade the underlay evenly to the gradient of the pipeline.

Chases: If necessary, form chases to prevent projections such as sockets and flanges from bearing on the trench bottom or underlay.

Pipe surrounds

General: Place the material in the pipe surround in layers, maximum 200 mm loose thickness, and compact without damaging or displacing the piping.

Trench backfill

General: Backfill the remainder of the trench to the underside of the subgrade with fill material in conformance with *0222 Earthwork*.

Lifting holes

General: Seal lifting holes in all pipes with plastic preformed plugs or 3:1 (sand:cement) mortar, before the commencement of backfilling.

Anchor blocks

General: If necessary, to restrain lateral and axial movement of the stormwater pipes, provide anchor blocks at junctions and changes of grade or direction conforming to AS/NZS 3500.3 clause 7.9.

Encasement

General: As documented.

Location: Encase the pipeline in concrete at least 150 mm above and below the pipe, and 150 mm each side or the width of the trench, whichever is the greater.

3.4 SUBSOIL DRAINS

General

Requirement: Provide subsoil drains to intercept groundwater seepage and prevent water build-up behind walls and under pavements. Connect subsoil drains to surface drains or to the stormwater drainage system as applicable.

Piping: As documented.

Trench width: ≥ 450 mm.

Trench floor: Grade the trench floor evenly to the gradient of the pipeline. If the trench floor is rock, correct any irregularities with compacted bedding material.

Pipe depth: Provide the following minimum clear depths, measured to the crown of the pipe, where the pipe passes below the following elements:

- 100 mm below subgrade level of the pavement, kerb or channel.
- 100 mm below the average gradient of the bottom of footings.
- 450 mm below the finished surface of unpaved ground.

Jointing

General: At junctions of subsoil pipes, provide tees, couplings or adaptors to AS 2439.1.

Pipe underlay (bedding)

General: Bed piping on a continuous underlay of bedding material, minimum 75 mm, maximum 150 mm thick after compaction. Grade the underlay evenly to the gradient of the pipeline.

Chases: If necessary, form chases to prevent projections such as sockets and flanges from bearing on the trench bottom or underlay.

Pipe surrounds

General: Place the material in the pipe surround in layers, maximum 200 mm loose thickness, and compact without damaging or displacing the piping.

Depth of overlay:

- To the underside of the bases of overlying structures such as pavements and channels.
- To within 150 mm of the finished surface of unpaved or landscaped areas.

Geotextiles

Marking: To AS 3705.

Laying: Place geotextile as documented.

Protection: Provide heavy duty protective covering. Store clear of the ground and out of direct sunlight. During installation do not expose the filter fabric to sunlight for more than 14 days.

Filter socks

General: Provide permeable polyester socks, capable of retaining particles 0.25 mm and greater. Securely fit or join the sock at each joint.

3.5 PITS

Installation

General: Prepare foundation, install pit and connect pipes, to manufacturer’s recommendations.

Location: At junctions, changes of gradient and changes of direction of stormwater drains, as documented.

Finish to in situ exposed surfaces

General: Provide a smooth, seamless finish, using steel trowelled render or concrete cast in steel forms.

Corners: Cove or splay internal corners.

Metal access covers and grates

Cover levels: Top of cover or grate, including frame:

- In paved areas: Flush with the paving surface.
- In landscaped areas: 25 mm above finished surface.
- Gratings taking surface water runoff: Locate to receive runoff without ponding.

3.6 TESTING

Pre-completion tests

General: Before backfilling or concealing, carry out the following tests:

- Site stormwater drains and main internal drains: Air or water pressure test to AS/NZS 3500.3 Section 9.

Leaks: If leaks are found, rectify and re-test.

3.7 COMPLETION

Cleaning

General: Clean and flush the whole installation.

4 SELECTIONS

4.1 STORMWATER

Stormwater pipeline schedule

Properties	A	B	C
Pipe material and nominal size			
Class			
Jointing			
Pipe support			
Concrete encasement			

Pipe bedding schedule

Properties	A	B	C
Bedding application			
Bedding zone			
Bedding type			
Material and grading			
Required density			

Subsoil pipeline schedule

Properties	A	B	C
Trench depth (mm)			
Pipe size (nominal)			
Pipe type			
Pipe class			

Pit schedule

Properties	**A**	**B**	**C**
Type			
Size (mm)			
Cover type			
Cover finish			
Slip resistance			
Load class			

0241 LANDSCAPE – WALLING AND EDGING

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide landscape walling and edging, as documented.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:
- *0171 General requirements*.

1.3 SUBMISSIONS

Samples
Refer Landscape Selections Schedule.

1.4 INSPECTION

Notice
Inspection: Give notice so inspection may be made of the following:
- Set out before starting construction.
- Geotextiles and subsurface drainage in place before backfilling.

2 PRODUCTS

2.1 CONCRETE

General
Standard: To AS 1379.
Exposure classification: To AS 3600 Table 4.3.
Grade, if there are cast-in metal items: To AS 3600 Table 4.4.

2.2 GEOTEXTILES

General
Type: Polymeric fabric formed from a plastic yarn composed of at least 85% by weight of propylene, ethylene, amide or vinylidene chloride and containing stabilisers or inhibitors to make the filaments resistant to deterioration due to ultraviolet light.
Identification and marking: To AS 3705.

3 EXECUTION

3.1 GENERAL

Set-out
General: Set out the position of walls and edging and mark the position of furniture.
Clearing
Extent: Except for trees or shrubs to be retained, clear vegetation within 1 m of the landscape walls. Grub out stumps and roots of removed trees or shrubs and trim the grass to ground level, but do not remove the topsoil.
Excavation
Extent: Excavate for foundations and footings.

Geotextiles
Storage and handling: Store clear of the ground and out of direct sunlight. During installation do not expose the filter fabric to sunlight for more than 14 days.

0251 LANDSCAPE – SOILS

1 GENERAL

1.1 RESPONSIBILITIES

- General

Soil Types: Provide landscape soils that are 'fit for purpose' and meet the performance requirements specified herein.

- Performance

Identification of fit for purpose: Testing certificates.

1.2 CROSS REFERENCES

- General

Requirement: Conform to the following:

- ***0171 General requirements*.**
- ***0222 Earthwork*.**
- ***0224 Stormwater – site*.**

1.3 STANDARDS

- Soils

Site and imported topsoil: To AS 4419.

Potting mixes: To AS 3743.

Composts, soil conditioners and mulches: To AS 4454.

1.4 INTERPRETATION

- Definitions

General: For the purposes of this worksection the following definitions apply:

- **Bad ground: Ground unsuitable for the work, including fill liable to subsidence, ground containing cavities, faults or fissures, ground contaminated by harmful substances and ground which is, or becomes, soft, wet or unstable.**
- **Imported topsoil: Similar to naturally occurring local topsoil, suitable for the establishment and ongoing viability of the selected vegetation, free of weed propagules and of contaminants, and classified by texture to AS 4419 Appendix 1, as follows:**
  - . Fine: Clay loam, fine sandy loam, sandy clay loam, silty loam, loam.
  - . Medium: Sandy loam, fine sandy loam.
  - . Coarse: Sand, loamy sand.
- **Low density soil: Soil for use on an artificial base material, e.g. roof top garden or large landscape containers. Such soils will usually be blends of mineral and organic compounds, and will typically have:**
  - . Bulk density: 0.3 to 0.6 Kg/L.
  - . Organic matter: 10% to 40% by mass.
- **Natural soil: A soil that has been dug from the landscape and is presented for use with no more than minor amendment. This soil could be topsoil, subsoil or a mixture of them and have a bulk density greater than 0.6 Kg/L.**
- **Organic soil: A general purpose soil (normally an amended natural soil or soil blend) that has:**
  - . Bulk density: > 0.6 Kg/L.
  - . Organic matter: 15% to 25% by mass. Naturally occurring organic soil can be 95% organic by mass.
- **Site rock: Rocks selected for salvage.**

- **Site topsoil: Soil excavated from the site which contains organic matter, supports plant life, conforms to the technical specification and is free from:**
  - . Stones more than 25 mm diameter.
  - . Clay lumps more than 75 mm diameter.
  - . Weeds and tree roots.
  - . Sticks and rubbish.
  - . Material toxic to plants.
- **Soil blend: A general purpose soil derived from the blending of two or more of sand, natural soil material or organic materials, and with a bulk density and organic matter content to meet site specific requirements.**
- **Top dressing: A sandy soil which is suitable for surface application to lawn.**

Commented [JF1]: •A specification for SP02.2 (Existing Topsoil) is missing to assess the performance of the topsoil (with coarse sand mixed, see below) when submitting samples for analysis. Use Leake & Haege (2014) Specification D1: Mass Planting Soil as a template for desired physical and chemical properties and ranges. Ensure the 15 % by weight coarse sand has been added prior to submitting soil for analysis and amelioration recommendations (as per **6.5 TOPSOIL**).

Commented [JF2]: Enforce via a technical specification

1.5 SITE INVESTIGATION

- Notice

Requirement: If the following are encountered, give notice immediately and obtain instructions before carrying out any further work in the affected area:

- **Bad ground.**
- **Discrepancies.**
- **Rock.**
- **Springs, seepages.**
- **Topsoil > 100 mm deep.**

1.6 SUBMISSIONS

- Execution

Program: Submit a work program in the form of a bar chart, for the landscape works.

- Materials

Supplier's data: Submit supplier's data including the following:

- **Material source of supply for topsoil, filling, stone and filter fabrics.**

Compost: Submit a certificate of proof of compost pH value.

- Suppliers

Statements: Submit statements from suppliers of soils and other materials, giving the following, where applicable:

- **Particulars of the supplier's experience in the required type of work.**
- **Production capacity for material of the required type, sizes and quantity.**
- **Lead times for delivery of material to the site.**

1.7 INSPECTION

- Notice

Inspection: Give notice so that inspection may be made of the following:

- **Setting out completed.**
- **Subgrades cultivated or prepared for placing topsoil.**
- **Topsoil spread before planting.**
- **Grassing bed prepared before turfing, seeding, or temporary grassing.**

1.8 QUALITY ASSURANCE AND CONTROL

- General

The contractor must use analytical testing to verify compliance with the product specification. Testing shall be carried out by a NATA-accredited laboratory such as SESL Australia. Testing shall be done in two parts: Initial compliance certification and Quality control, as described below.

- Initial compliance certification

Before any soil installation, the contractor or soil manufacturer will submit samples of trial blends likely to meet the performance specifications to SESL Australia or equivalent NATA-accredited laboratory. See Example components for the soil supplier below for suggested formulations to start this process.

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 testing laboratory, allowing sufficient time for testing and re-formulation in the case of failure to satisfy the performance criteria. Once compliant, a test certificate signed by a Certified Professional Soil Scientist (CPSS) 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 Soil Scientist.

HOLD POINT 1

Non-compliance will automatically generate HOLD POINT 1. No soil will be installed until initial compliance certification has been demonstrated.

Manufacturer's product representation: For imported soils from manufactures, 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**
- **The manufacturer's quality assurance system is externally certified**

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.

Quality control: compliance during construction

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

- Soil tests

General: To AS 4419, Table 1.

Sampling: As recommended in AS 4419 Appendix A.

Laboratory: SESL Australia or other NATA registered laboratory.

Imported topsoil tests: Type tests to AS 4419 Appendix B to I (topsoil), or AS 3743 Appendix D to G (potting mixes), as applicable.

Site topsoil tests: To AS 4419 Appendix C to I.

Test submissions

Submit representative samples of ~ 5 kg of each product specification, packed and labelled to indicate the source and the specification to be met. Ten litres of material is required for compost testing. The samples must be taken in a representative manner.

The contractor must undertake testing frequencies at 1 per 500m^3. Variations to this testing frequency 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.

Testing

All testing as required by the product specifications must be arranged by the contractor, and carried out by the Principal's nominated soil testing laboratory. All test results records will be made available to the superintendent, for review and approval by the project Landscape Architect.

Non-compliance

In the case of substantive non-compliance, Hold Points 2 and 3 will be invoked – HP2 to correct soil already installed and HP3 to ensure new deliveries are compliant. In the case of a minor non-compliance or substantial compliance, a clear statement must be obtained from a qualified independent Soil Scientist waiving the compliance and certifying the sample is fit for purpose.

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 by a CPSS requiring that a certain fertiliser or further organic matter or some other amendment be added, with the aim of achieving compliance.

Where a drainage layer is coarser than around 5mm, a transition layer may be needed between it and the filtration soil media to prevent soil migrating into the drainage gravel layer. Generally this will be an intermediate very coarse sand or fine gravel. Do not use geotextile fabrics over the drainage layer to prevent soil migration.

HOLD POINT 2

The contractor will need to make corrective procedures to bring any soil that has been placed within substantial compliance in accordance with any Soil Scientist's advice.

HOLD POINT 3

In the event that quality control samples show substantial non-compliance from the approval 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 CPSS to meet correct analysis, and make adjustments to mixing ratios, additives and procedures to achieve compliance.

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.

2 PRODUCTS

2.1 TOPSOIL

- Source

General: All soils to be imported shall be manufactured specialist planting media.

- General

Deliveries: Documentation to AS 4419, clause 8.

Additives: If using additives to raise topsoil to the required standard, ensure compliance with the relevant test criteria of AS 4419.

Nitrogen drawdown: If the NDI_{150} value is less than 0.5 to AS 4419 Appendix E, a source of soluble nitrogen should be added to or specified for those soils.

Nutrient levels: Provide soil nutrients as outlined in the **Physical and Chemical Properties** tables for each specified soil type.

Bushland restoration nutrient levels: Provide topsoil with nutrient levels related to the soils of the local natural bushland.

3 EXECUTION

3.1 PREPARATION

- Vegetative spoil

Spoil suitable for mulch or spreading for bushland restoration: Spread freshly harvested native plant biomass, free of weed propagules.

Unsuitable material: Remove vegetative spoil from site. Do not burn.

- Embankment stabilisation

General: Where necessary to prevent erosion or soil movement, stabilise embankments.

Method: Either matting overlay or hydromulching.

Matting generally: Biodegradable fibre reinforced with lightweight polymer mesh. Provide lightweight material for seeding, medium or heavy weight material for planting.

Matting in high erosion zones: Flexible carbon black UV stabilised interwoven nylon mesh.

Matting installation: Sow before matting is installed, where sowing is required. Plant after matting is installed, where planting is required. Peg the matting into 300 x 300 mm anchor trenches at top and bottom, backfill the trenches with soil and compact.

Matting pegs: U-shape galvanized steel, at 1000 x 1000 mm intervals generally, 250 mm at overlaps.

3.2 ROCK WORK

- Existing rock

General: Protect existing rock, rock shelves and rock outcrops from mechanical damage, surface defacement and other works.

Rock surfaces: Report damage or defacement occurring to any rock faces during the course of the Works.

Replacement: If restoration is not feasible repair the rock face with replaced rocks imported or taken from site.

- Planted treatment to rock faces

Treatment: Bonded fibre matrix product including the following:

- **Fertiliser starter hydraulically applied as one blended slurry.**
- **Seed mix.**
- **Insecticide.**

Application: Spray, by a certified soil guard applicator, on to the rockface to encourage vegetation growth in crevices and hollows.

- New rock work

Erosion control: Bury rock two thirds by volume or as appropriate for effective erosion control, with weathered faces exposed. Protect the weathered faces from damage.

Site rock: Stockpile for future placement and accessibility for lifting. Dispose of other rock off site.

Imported rock: Provide rock which has been selected before delivery.

Placing rocks: Place while ground formation work is being carried out, as shown in the Landscape Drawings.

3.3 EARTH MOUNDS

- Construction

Placing: Place clean fill in layers approximately 150 mm thick compacted to 85% of the dry density ratio of the surrounding soil as determined by AS 1289.5.4.1. Minimise slumping and further compacting.

Edges: Construct changes in grade over a minimum width of 500 mm to smooth, gradual and rounded profiles with no distinct joint.

Existing trees: Maintain the natural ground level under the canopy.

Pipes, culverts and associated structures: Construct mounding to avoid unbalanced loading.

3.4 SUBSTRATE

- Podium levels
- Screed

General: Provide a high strength mortar screed to podium levels where garden beds and tree planting is to be installed.

Screed depths:

- **Maximum unreinforced : 50 mm**
- **Minimum thickness 25mm**

- Drainage layer

Excavated: Install drainage cell to top of screed such that drain points freely discharge to the storm water recovery system (into rainwater tank).

Install drainage cell to all sides of void formers as detailed.

Where void former is used, drainage cell must be applied above and below the void former, as well as vertically beside the void former to ensure unimpeded storm water movement. Void former and drainage cell, should be cut to fit the space, so the gap from the planter box wall is no greater than 15mm.

- Geofabric

Lay geofabric loosely over drainage cell and ensure that a minimum 100mm of overlay exists

- Planter media installation

Planter media should be delivered in bulka bags or small 20kg bags dependant on site access restrictions.

- Consolidation

General: Compact lightly and uniformly in 50 mm layers. Avoid differential subsidence and excess compaction and produce a finished topsoil surface which has the following characteristics:

- **Finished to design levels.**
- **Smooth and free from stones or lumps of soil.**
- **Graded to drain freely, without ponding, to catchment points.**
- **Graded evenly into adjoining ground surfaces.**
- **Ready for planting.**

3.5 SUBSOIL

- General

Excavated: Excavate to bring the subsoil to at least 300 mm below finished design levels. Shape the subsoil to fall to subsoil drains where applicable. Break up the subsoil to a further depth of 100 mm.

Unexcavated: Remove weeds, roots, builder's rubbish and other debris. Bring the planting bed to 75 mm below finished design levels.

- Cultivation

Cultivation depths (mm):

- Grassed areas (instant turf): 100mm
- Planting areas: 300mm

Services and roots: Do not disturb services or tree roots and if necessary cultivate these areas by hand.

Cultivation: Thoroughly mix in materials required to be incorporated into the subsoil. Cultivate manually within 300 mm of paths or structures. Remove stones exceeding 25 mm, clods of earth exceeding 50 mm, and weeds, rubbish or other deleterious material brought to the surface during cultivation. Trim the surface to design levels after cultivation.

- Additives

Subsoils shall be tested prior to any cultivation to determine subsoil conditions and formulate appropriate recommendations for their amelioration.

3.6 TOPSOIL

- General

Following installation of all garden bed and turf areas, soil compaction to be tested and in the event it is excessively high, to be remediated to the satisfaction of the Landscape Architect prior to planting or grassing. Testing to be done with a penetrometer to test soil compaction to a depth of 500mm. If resistance as measured by the penetrometer is greater than 300psi or 2,000kPa, decompaction of material must be undertaken.

- Site topsoil preparation

Screeding: By a power hydraulic screen capable of handling 100 tonne per hour, with sieves grading from 20 mm to 15 mm.

Contamination: If diesel oil, cement or other phytotoxic material has been spilt on the site topsoil, excavate the contaminated soil and dispose of it off the site.

Additives program: 8 weeks before stolonizing or turfing.

- Placing topsoil

Site topsoil: Do not incorporate site topsoil into the works until soil testing certification has been approved. Remove unauthorised material from the site.

General: Spread the topsoil on the prepared subsoil and grade evenly, making the necessary allowances to permit the following:

- **Required finished levels and contours may be achieved after light compaction.**
- **Grassed areas may be finished flush with adjacent hard surfaces such as kerbs, paths and mowing strips.**

Spreading: On steep batters, if using a chain drag, ensure there is no danger of batter disturbance.

Finishing: Feather edges into adjoining undisturbed ground.

- Consolidation

General: Compact lightly and uniformly in 150 mm layers. Avoid differential subsidence and excess compaction and produce a finished topsoil surface which has the following characteristics:

- **Finished to design levels.**
- **Smooth and free from stones or lumps of soil.**
- **Graded to drain freely, without ponding, to catchment points.**
- **Graded evenly into adjoining ground surfaces.**
- **Ready for planting.**

3.7 STRUCTURAL SOIL

Transport and handling: Structural support soil is a uniformly blended mixture of aggregate and filler soil that is prone to segregation during handling at the source and during transport. Particular care must be taken to ensure that all structural support soil is thoroughly homogenised before placement and compaction. To assist this, and to prevent segregation, ensure that the soil mixture remains moist and covered at all times during mixing, transport, storage, and placement.

Placement: Structural soil is to be placed in 150mm layers and compacted to a minimum of 95% of maximum dry density at optimum moisture content, in accordance with ASTM D 698 Standard Proctor Method. Compact the subgrade with a minimum of three passes of a suitable vibrating machine or apply other compaction forces as needed to achieve the required subgrade compaction rate.

Watering and aeriation pipes: Water and aeriation pipes are to be installed with structural soil to provide air and water to soil below pavements – refer to tree planting details for location and fixing of pipes.

Installation: Ensure structural soil is covered to retain moisture level and protect filler soil from damage immediately after installation. Do not install structural soil if it is raining as the filler soil can be washed away, or washed to the bottom of the tree pit. If structural soil has become segregated during transport, or filler soil is washed away during installation, seek advice from Landscape Architect and soil scientist to rectify the damaged soils.

4 SELECTIONS

4.1 SOIL TYPE 4 | IMPORTED TOP SOIL – MASS PLANTING ON SLAB 'A' HORIZON

Reference: 'Specification E1 On-Slab Soil Media 'A' Horizon' in Soils for Landscape Development (Leake S & Haege E, 2014)

Part A. 'Fit-for-purpose' performance description

This specification describes the formulation of an open granular well-drained growing media with a saturated density of less than 2400 kg/m3 (2.4 kg/L) for use in on-slab applications, including green roofs with an expectation of longevity. It is a topsoil formulation to be used in the surface 300 mm of all on-slab installations including planter boxes, containers and garden beds.

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.

Phosphorous-sensitive plants: Phosphorus-tolerant plants have been chosen for this soil type. Phosphorus levels must be within the standard range of the chemical properties.

Part B. Product specification (technical parameters)

Generally, the soil must be free of 'unwanted material' and must meet all the requirements of AS 3743 Potting mixes and the specified requirements of AS 4419. However, compliance with AS 3743 does not demonstrate compliance with this specification. Where the requirements of this specification and AS 3743 conflict, properties specified here must take precedence.

Use AS 3743 unless otherwise stated.

- ***Soil Type 4 – Physical Properties***

Property	Unit	Sufficiency range
Texture, preferred range	n/a	Gravelly loamy sand to organic sandy loam
Air-filled porosity	%	≥ 10

Property	Unit	Sufficiency range
Water-holding capacity	%	≥ 40
Permeability (@ 16 drops by McIntyre Jakobsen)	mm/h	> 100
Organic matter	% w/w	< 15
Wettability	min	≤ 5
Dispersibility in water	Category	1 or 2 (AS 4419) category
Large particles in the largest dimension		
< 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

- ***Soil Type 4 – Chemical properties***

Property	Unit	Sufficiency range
pH in water (1:5) standard range	pH units	5.4–6.8
Electrical conductivity (1:1.5)	dS/m	< 2.2
Chloride	mg/L	≤ 200
Ammonium-N (NH_4)	mg/L	≤ 100
Ammonium-N + nitrate-N (NH_4 + NO_3)	mg/L	≥ 50
Nitrogen draw-down index	-	≥ 0.7
Toxicity index	mm	≥ 70
Phosphorus – P-tolerant plants (P)	mg/L	8–40
Low phosphorus – P-sensitive plants (P)	mg/L	< 3
Potassium (K)	mg/L	50–250
Sulphate (SO_4)	mg/L	≥ 40
Calcium (Ca)	mg/L	≥ 80
Magnesium (Mg)	mg/L	≥ 15
Ca:Mg ratio	Ratio	1.5–10
K:Mg ratio	Ratio	1–7
Sodium (Na)	mg/L	≥ 130
Iron (Fe)	mg/L	≥ 35
Copper (Cu)	mg/L	0.4–15
Zinc (Zn)	mg/L	0.3–10
Manganese (Mn)	mg/L	1–15
Boron (B)	mg/L	0.02–0.65

Part C. Example components for the soil supplier

The following table outlines suggested components that may likely meet the physical requirements 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.

- ***Example components (likely to meet the physical requirements of this specification)***

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 AS 4454	20–30% by volume

- ***Base level requirements for fertilisers (to be verified by laboratory testing and per agronomist's report)***

Lime and / or dolomite	2 kg/m3 at mixing
Balanced compound NPK turf starter 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 agronomist's 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.

4.2 SOIL TYPE 5 | IMPORTED TOP SOIL – MASS PLANTING ON SLAB 'B' HORIZON

Reference: 'Specification E2 On-Slab Soil Media 'B' Horizon' in Soils for Landscape Development (Leake S & Haege E, 2014)

Part A. 'Fit-for-purpose' performance description

The specification describes the formulation of an open granular well-drained growing media with an all-up saturated density of less than 2400 kg/m3 (2.4 kg/L) for use in on-slab applications with an expectation of longevity to be used as a subsoil below 300 mm of all on-slab installations, including planter boxes, containers and garden beds.

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.

Phosphorous-sensitive plants: Phosphorus-tolerant plants have been chosen for this soil type. Phosphorus levels must be within the standard range of the chemical properties.

Part B. Product specification (technical parameters)

Generally, the soil must be free of 'unwanted material' and must meet all the requirements of AS 3743 and the specified requirements of AS 4419. However, compliance with AS 3743 does not demonstrate compliance with this specification. Where the requirements of this specification and AS 3743 conflict, properties specified here must take precedence.

- ***Soil Type 5 – Physical Properties***

Property	**Unit**	**Sufficiency range**
Texture, preferred range	n/a	Gravelly loamy sand to organic sandy loam
Air-filled porosity	%	≥ 10
Water-holding capacity	%	≥ 40
Permeability (@ 16 drops by McIntyre Jakobsen)	mm/h	> 100
Organic matter	% w/w	< 5
Wettability	min	≤ 5
Dispersibility in water	Category	1 or 2 (AS 4419) category
Large particles in the largest dimension		
< 2 mm	% w/w	30–70
2–10 mm	% w/w	10–20

Property	Unit	Sufficiency range
10–20 mm	% w/w	5–10
20–50 mm	% w/w	< 5
> 50 mm	% w/w	0

- ***Soil Type 5 – Chemical properties***

Property	Unit	Sufficiency range
pH in water (1:5) standard range	pH units	5.4–6.8
Electrical conductivity (1:1.5)	dS/m	< 2.2
Chloride	mg/L	≤ 200
Ammonium-N (NH_4)	mg/L	≤ 100
Ammonium-N + nitrate-N (NH_4 + NO_3)	mg/L	≥ 50
Nitrogen draw-down index	-	≥ 0.7
Toxicity index	mm	≥ 70
Phosphorus – P-tolerant plants (P)	mg/L	8–40
Low phosphorus – P-sensitive plants (P)	mg/L	< 3
Potassium (K)	mg/L	50–250
Sulphate (SO_4)	mg/L	≥ 40
Calcium (Ca)	mg/L	≥ 80
Magnesium (Mg)	mg/L	≥ 15
Ca:Mg ratio	Ratio	1.5–10
K:Mg ratio	Ratio	1–7
Sodium (Na)	mg/L	≥ 130
Iron (Fe)	mg/L	≥ 35
Copper (Cu)	mg/L	0.4–15
Zinc (Zn)	mg/L	0.3–10
Manganese (Mn)	mg/L	1–15
Boron (B)	mg/L	0.02–0.65

Part C. Example components for the soil supplier

The following table outlines suggested components that may likely meet the physical requirements 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.

- ***Example components (likely to meet the physical requirements of this specification)***

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 10mm pine bark	20–40% by volume
Composted soil conditioner conforming with AS 4454	<20% by volume

- ***Base level requirements for fertilisers (to be verified by laboratory testing and per agronomist's report)***

Lime and / or dolomite	2 kg/m3 at mixing
Balanced compound NPK turf starter fertiliser	3.0 kg/100m^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 agronomist's 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.

4.3 SOIL TYPE 6 | IMPORTED TOP SOIL – STRUCTURAL SUPPORT SOIL

Reference: 'Specification F1 Structural Support Soils' in Soils for Landscape Development (Leake S & Haege E, 2014)

Part A. 'Fit-for-purpose' performance description

The specification describes the formulation of a structural support soil (SSS) for tree planting in urbanised environments. SSS are designed to form a basement for engineered structures such as roads, pavements and kerbing, while also providing rooting volume for tree roots. Due to the high void space, they will permit root growth through the medium and also help distribute root pressures over a wider section of pavement, reducing or delaying pavement heaving by roots. The size of the aggregates or stone fraction determines how large the roots can grow before heaving occurs.

SSS is a two-part system comprised of a stone lattice for strength and structural support (load bearing) and filler soil to service the horticultural needs. The stone lattice provides structural stability through stone-to-stone contact, while also providing interconnected voids for root penetration, air and water movement. The system is engineered to maintain a high degree of porosity after installation and compaction. The intention is to 'suspend' the horticultural soil component of the blend between stones, which come together during compaction, producing a load-bearing, compacted stone lattice with uncompacted soil in the voids.

The ratio of filler soil to aggregate is the major consideration for achieving the engineering and horticultural objective. Thus the 'aggregate', 'filler soil' and blending ratio of the two need to be specified and carefully validated. Generally, it will be an amount of filler soil equal to half the void space of the compacted aggregate. Assuming the aggregate has a void space of 40%, it will be 10 parts aggregate by volume to 2 parts filler soil.

Important note:

The total volume of SSS is determined by the volume of aggregate as adding filler soil does not increase the overall volume. Tree soil volume estimations must factor this into calculations for recommending soil volume.

Transport and placement of SSS

SSS must be a uniformly blended mixture of aggregate and filler soil and are prone to segregation during handling at the source and during transport. Particular care must be taken to ensure that all structural soil is thoroughly homogenised before placement and compaction. To assist this, and to prevent segregation, ensure that the mixture remains moist at all times during mixing, transport, storage and placement.

Part B. Product specification (technical parameters): filler soil

The criteria provided in Tables 6.23 and 6.24 must be applied to the filler soil component of the SSS blend. In addition to the performance specification listed below, the filler soil component must be a clay loam or similar texture and be of uniform composition without admixture of subsoil must be free of 'unwanted material'. It must be free of stone and gravel greater than 8 mm and be free from toxic substances harmful to plant growth.

- ***Soil Type 6 – Physical Properties***

Property	Unit	Sufficiency range
Texture, preferred range	n/a	Loam to clay loam
Organic matter	% dwb	3–8
Wettability	mm/h	> 5
Gravel > 4 mm	% w/w	< 2
Dispersibility in water	Category	1 or 2 (AS 4419) category

The following assessment criteria apply to the nominal 63 mm aggregate to be used in the SSS blend. The aggregate must be a free-draining granular material capable of sustaining the anticipated load

bearing requirements of the pavement and must be free of 'unwanted material'. As a guide, an aggregate that conforms to the requirements of AS 2758.7 (1996) for Class L 60 mm railway ballast is likely to possess the desired properties.

Part C. Example components for the soil supplier

The following table outlines suggested components that may likely meet the physical requirements 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.

- ***Example components (likely to meet the physical requirements of this specification)***

Nominal 63 mm hard rock aggregate (usually basalt, diorite or granite)	1 m^3
Filler soil (preferably loam to clay loam)	200 L

- ***Soil Type 6 – Chemical properties***

Property	Unit	Sufficiency range
pH in water (1:5) standard range	pH units	5.4–6.8
pH in CaCl2 (1:5) standard range	pH units	5.2–6.5
Electrical conductivity (1:5)	dS/m	< 0.5
Phosphorus (P)	mg/kg	30–100
Exchangeable sodium (Na)	% of ECEC	< 7
Exchangeable potassium (K)	% of ECEC	3–10
Exchangeable calcium (Ca)	% of ECEC	60–80
Exchangeable magnesium (Mg)	% of CEC	15–25
Exchangeable aluminium (Al)	% of CEC	< 5
Exchangeable Ca:Mg ratio	Ratio	3–9
Available iron (Fe)	mg/kg	100–400
Available manganese (Mn)	mg/kg	25–100
Available zinc (Zn)	mg/kg	5–30
Available copper (Cu)	mg/kg	1–15
Available boron (B)	mg/kg	0.5–5
Available N (N as nitrate)	mg/kg	> 20

0253 LANDSCAPE – PLANTING

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide landscape planting, as documented.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:
- *0171 General requirements*.

1.3 SUBMISSIONS

Certification
Plant species: Submit the supplier's certification as evidence that plants are true to the required species and type and free from diseases, pests and weeds at time of delivery.

Compost: Submit a certification as evidence of compost pH value.

Execution details
Program: Submit a work program in the form of a bar chart, for the landscape works.

Maintenance program: Submit a proposed planting maintenance program.

Planting machine: If a planting machine is to be used as an alternative to hand planting, submit proposal.

Spraying: Submit proposal.

Plants – open rooted stock: If open rooted stock is to be used, submit proposal.

Material site storage: Submit proposal.

Operations and maintenance manuals
General: Submit recommendations for maintenance of plants.

Products and materials
Supplier's data: Submit supplier's data including the following:
- Material source of supply.

Samples
General: Submit representative samples of each material, packed to prevent contamination and labelled to indicate source and content.

Bulk materials: Submit a 5 kg sample of each type specified, with required test results, at least 5 working days before bulk deliveries.

1.4 INSPECTION

Notice
Inspection: Give notice so that inspection may be made of the following:
- Before transplanting small trees and shrubs.
- Plant holes excavated and prepared for planting.
- Plant material set out before planting.
- Planting, staking and tying completed.
- Completion of planting establishment work.

2 PRODUCTS

2.1 SOIL CONDITIONING COMPOST

Compost
Type: Mature soil conditioning compost free from harmful chemicals, grass and weed growth.

Application rate: Apply at an application rate that accounts for the immediate fertilizer equivalence of the compost as part of the overall fertilizer management schedule.

Particle size as a soil conditioner, pH, physical and chemical contaminants: To AS 4454 Table 3.1(A).

Mature compost: To AS 4454 Appendix N Table N3.2.

Soil conditioning properties

Wettability: ≤ 2 to AS 3743 Table 2.1 as tested to Appendix C.

Total water holding capacity: ≥ 40 to AS 3743 Table 2.1 tested to Appendix B.

Nitrogen draw down index: ≥ 0.7 to AS 3743 Table 2.1 tested to Appendix E.

Chlorine content: < 1000 mg/kg to Rayment and Lyons 2010 test method.

Compost fertiliser equivalence properties values

Requirement: Establish the following values for each type of soil conditioning compost to Rayment and Lyons 2011 test methods:

- Nitrogen content (kg/ton):
  - . Total N.
  - . Nitrate.
- Phosphorus content (kg/ton):
  - . Total P.
  - . Colwell P.
- Plant available Potassium (kg/ton).

2.2 FERTILISER

General

Type: Proprietary fertilisers, delivered to the site in sealed bags marked to show manufacturer or supplier, weight, fertiliser type, N:P:K ratio, recommended uses and application rates.

Application rate: Vary the application rate to allow for the plant available immediate fertilizer equivalence value of the soil conditioning compost.

2.3 MULCH

General

Type: Free of deleterious and extraneous matter including soil, weeds and sticks. Do not include fine mulch.

Properties:

- Particle size, physical and chemical contaminants: To AS 4454 Table 3.1(A).
- pH, electrical conductivity, ammonium, chlorine and other nutrients: To AS 3743 Table 2.1 for regular mix.
- Organic mulches: Free of stones.

Organic mulch types

Brush chippings and leaf litter: Vegetative material processed through a chipper to pieces not larger than 75 x 50 x 15 mm as follows:

- Material permitted: Leaf matter and tree loppings from *Eucalyptus, Tristania and Pinus species*.
- Material not permitted: Leaf matter and tree loppings from privet, camphor laurel, coral tree, poplar, willow, and declared (noxious) weeds.

Pine bark: From mature trees, graded in size from 50 x 50 x 25 mm to 25 x 15 x 15 mm, free from wood slivers.

Pine flake: Pinus species sapwood slivers in size range 250 x 25 mm to 30 x 3 mm, including fragments of pine bark.

Straw: Cereal straw, wood fibre, or other suitable vegetative material (but not meadow hay) free from weeds and seeds, applied in conjunction with a bitumen emulsion or polymer binder.

Inorganic mulch types

Washed river pebble: Uniform size or graded material in the size range 6 to 10 mm.

Decomposed granite gravel: Uniform size or graded material in the size range 5 to 20 mm, of uniform colour and low plasticity.

Crushed quartz: Uniform size or graded material in the size range 5 to 20 mm, of uniform colour.

Marble chip gravel: Uniform size or graded material in the size range 5 to 20 mm, of uniform colour.

Slate: Plum slate slivers in the size range 5 to 25 mm.

Shale: Uniform size or graded material, no particles smaller than 0.1 mm diameter.

Scoria: Uniform size or graded material.

Binders

General: Materials suitable for cold spray application to stabilise mulched or seeded surfaces on banks or high erosion areas.

3 EXECUTION

3.1 PREPARATION

Weed eradication

Herbicide: Eradicate weeds using environmentally acceptable methods, such as a non-residual glyphosate herbicide in any of its registered formulae, at the recommended maximum application rate.

Manual-weeding: Regularly remove weed growth by hand throughout grassed, planted and mulched areas. Remove weed growth from an area 750 mm diameter around the base of the trees in grassed areas. Continue weeding throughout the course of the works and during the planting establishment period.

Vegetative spoil

Disposal: Remove vegetative spoil from site. Do not burn.

3.2 PLANTING

General

Plant location and spacing: If necessary to vary plant locations and spacings to avoid service lines, or to cover the area uniformly, or for other reasons, give notice.

Planting conditions

Weather: Do not plant in unsuitable weather conditions, including extreme heat, cold, wind or rain. In other than sandy soils, suspend excavation when the soil is wet, or during frost periods.

Watering

Timing: Thoroughly water the plants before planting, immediately after planting, and as required to maintain growth rates free of stress.

Preparation

Individual plantings in grassed areas: Prepare for planting as follows:

- Excavate a hole twice the diameter of the root ball and at least 100 mm deeper than the root ball.
- Break up the base of the hole to a further depth of 100 mm.
- Loosen compacted sides of the hole to prevent confinement of root growth.

Ripline planting: Prepare for planting as follows:

- Rip the row and excavate a plant hole for each plant large enough to accept the root ball plus 0.1 m³ of backfilling with topsoil.
- Clear weeds and other vegetative material within 300 mm radius of the plants.
- If planting holes are excavated by mechanical means, increase the hole size by 100 mm and loosen compacted sides to prevent confinement of root growth.

Placing

General: Place plants as follows:

- Remove the plant from the container with minimum disturbance to the root ball. Make sure that the root ball is moist.
- If required, root prune to make sure all circling roots have been either severed or aligned radially into the surrounding soil.
- Place the plant in its final position, in the centre of the hole and plumb, and with the topsoil level of the plant, level with the finished surface of the surrounding soil.

Fertilising

Pellets: In planting beds and individual plantings, place fertiliser pellets around the plants at the time of planting.

Backfilling
General: Backfill with topsoil mixture. Lightly tamp and water to eliminate air pockets. Make sure that topsoil is not placed over the top of the root ball, so the plant stem remains the same height above ground as it was in the container. Avoid mixing mulch with topsoil.

Watering basins for plants in grassed areas
Location: To each individual plant not located in irrigated grassed areas or naturally moist areas.

Water basin method: Construct around the base of each individual plant, consisting of a raised ring of soil capable of holding at least 10 L.

Plant surrounds schedule – Information as required

3.3 MULCHING

Placing mulch
General: Place mulch to the required depth and clear of plant stems so that after settling it conforms to the following:

- Smooth and evenly graded between design surface levels.
- Flush with the surrounding finished levels.
- Sloped towards the base of plant stems in plantation bed.
- For gravel mulches: Not closer to the stem than 50 mm.

Extent: Provide mulch to 750 mm diameter to surrounds of plants planted in riplines and grassed areas.

Depths:

- Organic mulch: 75 mm.
- Gravel mulch: 50 mm.

Installation:

- In ripline and grassed areas: Place mulch to 750 mm diameter around plants.
- In mass planted areas: Place after the preparation of the planting bed but before planting and other work.
- In smaller areas (e.g. planter boxes): Place after the preparation of the planting bed, planting and other work.

Mulching schedule– Information as required

3.4 TREATMENT

General
Insect attack or disease: If evidence of insect attack or disease of plant material is discovered, immediately give notice.

Physical removal
General: Remove insect infestation and diseased plant material by hand if appropriate.

Pesticide
Product: Spray with insecticide, fungicide or both, as required.

3.5 STAKES AND TIES

Stakes
Material: Hardwood, straight, free from knots or twists, pointed at one end.

Installation: Drive stakes into the ground at least one third of their length, avoiding damage to the root system.

Stake sizes and quantities:

- For plants ≥ 2.5 m high: Three 50 x 50 x 2400 mm stakes per plant.
- For plants 1 to 2.5 m high: Two 50 x 50 x 1800 mm stakes per plant.
- For plants < 1 m high: One 38 x 38 x 1200 mm stake per plant.

Ties

General: Provide ties fixed securely to the stakes, one tie at half the height of the main stem, others as necessary to stabilise the plant. Attach ties loosely so as not to restrict plant growth.

Tie types:

- For plants ≥ 2.5 m high: Two strands of 2.5 mm galvanized wire neatly twisted together, passed through reinforced rubber or plastic hose, and installed around stake and stem in a figure eight pattern.
- For plants < 2.5 m high: 50 mm hessian webbing stapled to the stake.

Marker stakes

Material: Timber offcuts 25 x 25 x 1200 mm. Dip the top 200 mm in white paint.

Installation: Drive firmly into the ground at least 300 mm from the plant. Do not tie to the plant.

Location of marker stakes:

- Trees in grass: Mark each tree.
- Ripline planting areas: Mark each ripline at every fifth plant along the line.

Trunk protection

Collar guards: 200 mm length of 100 mm diameter agricultural pipe split lengthways.

3.6 COMPLETION

Cleaning

Stakes and ties: Remove those no longer required at the end of the planting establishment period.

Temporary fences: Remove temporary protective fences at the end of the planting establishment period.

0254 IRRIGATION

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide automatically controlled, fixed irrigation systems, as documented.
Performance
Requirements:

- Achieve the documented flow rates over the irrigated area.
- Meet statutory requirements for backflow prevention.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:

- *0171 General requirements*.

1.3 STANDARDS

Water supply
General: To AS/NZS 3500.1.

1.4 INTERPRETATION

Abbreviations
General: For the purposes of this worksection the following abbreviations apply:

- LDPE: Low-density polyethylene.

Definitions
General: For the purposes of this worksection the following definitions apply:

- Backflow prevention device: A device, required by law, on an irrigation system that prevents water from re-entering the potable water lines once it flows into the irrigation pipes.
- Emitter: A device used to control the rate at which water is applied to a specific area.

1.5 SUBMISSIONS

Shop drawings
General: Submit drawings and schedules showing the layout and details of the system, including the following:

- Micro-irrigation stake layout.
- Irrigation controller cabinets.

1.6 INSPECTION

Notice
Inspection: Give notice so that inspection may be made in accordance with 0171 GENERAL REQUIREMENTS, INSPECTIONS, Site Inspections.

2 PERFORMANCE SPECIFICATION

2.1 AIMS

Pump, filtration and all infrastructure requiring servicing and maintenance is easily accessible.

Tank lids and pit lids ideally located in hard stand (paths/pavement).

Rain switch device or mains top up/balance tank are ok – as long as water tracking can be achieved and operational pressure is maintained.

Need to be able to track both potable and non potable water usage – best method is to install pulse type flow meter on the irrigation output line (which is a general requirement for cloudmaster) and in alternate supply sites also use a pulse type flow meter on the town water top up. These meters are to

be wired into the cloudmaster. Meters should be easily accessible to allow for manual meter reading in the event of controller failure.

Systems should include rain sensor and/or soil moisture sensors to optimise system efficiency.

2.2 TREATMENT

UV filter should be installed per manufactures spec – braced and secured in a water proof enclosure (most water harvesting sites require a pump station so put all infrastructure together).

All primary and secondary filtration to be serviceable and sufficient to ensure water quality is suitable for use and ensure public health is maintained. Note that UV filtration may not be effective if water is cloudy or turbid when entering UV chamber.

2.3 CABLING, WIRING, AND PIPE WORK

The system design will be dependent upon the requirements of the site, manufacturer and designer recommendations, and available technology and resources. The following is the hierarchy of system types.

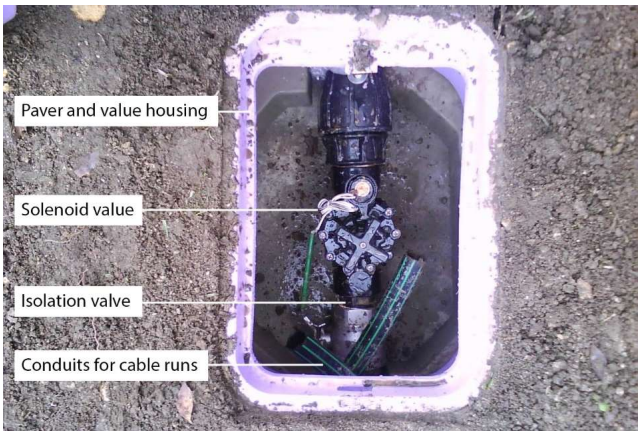
- Decoder system (Large sites only)
- multi strand cabling
- Hydraulic system

All can be operated by Cloudmaster controllers. Decoder systems allow for ease of future system expansion and repairs so are preferred in large systems. Multi strand systems are sufficient in small scale systems. Hydraulic systems have been problematic in the past and are not desirable.

Other key items for consideration are:

- All cabling should be installed in conduits with connections at valve boxes only.
- All connections must be water tight.
- If Decoder system is used please ensure the designer calculates the cable runs and voltage draw down. This is particularly important when using cloudmaster decoders.
- If cable runs are long or the system is constructed in large parklands, cable isolation points are desirable.
- Mainlines should have warning tape installed with it. Tape should be at 200mm above the pipe and contain a tracer line for locating purposes.

Image 1 – Preferred valve box layout



2.4 DEPTH OF PIPE WORK

Some issues have been encountered previously with pipe work not being installed at sufficient depth. The pipes are hard to detect and if not at a sufficient depth can be damaged during maintenance works (image below). Mainlines should be installed at a minimum depth of 450mm. Lateral lines

should be at a minimum of 300mm – with articulated riser assemblies used to attach and raise sprinklers.

Image 2 – Mainline installed too shallow and damaged by mower

Image 3 – Mainlines to be installed at minimum 450mm below surface

2.5 MAINS CONNECTIONS

All water meters and back flow prevention devised must the registered with Sydney water on installation. The installer will require the lot number of the parkland to complete this. Key requirements for mains connections are:

- Ensure appropriate backflow/duel use controls are installed. Mains top up should be placed to achieve relevant air gap as specified by Sydney water.
- Backflow prevention or RPZ units must be installed to Sydney water requirements. These units are tested annually as part of ongoing maintenance so it is critical that units comply with regulations at construction or development.

- QCV (Quick Coupler Valves) should be incorporated in the initial design and installation works. This allows for water supply in event of failure.
- If alternate water supply is utilised, signage should be installed to notify the public.

Image 4 – Sample signage – Hornsby Council

Cloudmaster controller and system initiation

- GSM modem and SIM card (Paul Rowley) and set up operations for back to base
- Initialise controller and PC communication
- Upload aerial image of site (bitmap)
- Cloudmaster detail

2.6 TESTING AND COMMISSIONING

To include but not limited to:

- System flushing to remove all residue
- Test pump units and operate at duty flow rates. Shut off heads to confirm their integrity. Reset after testing
- Test mainlines at 1.5 times pressure rating of the pipe for 30 min. Take readings at 0min, 10min, 20min, 30min. Test will be successful if the 3rd and 4th reading are less than 2% difference, and the 4th is not lower than 7% lower than the original test pressure.
- After testing adjust solenoid control valves, heads, and controllers for operation.
- Test all electrics and rectify any issues.
- All water harvesting components are to be fully operational at hand over to parks services. Trunk valves, feeder lines, storage tanks etc will have been tested and be fully operational.
- Commissioning must incorporate initiation of any storm water harvesting agreements, water disposal/trade waste agreements or initial system testing requirements to ensure that the system is successfully validated as legally required and to minimise public risk.
- As the end user of the system and being responsible for future testing we need to ensure that the system at hand over has been fully operated and thoroughly tested (trunk lines open, storm water supply and treatment units etc fully tested and operated on recycled supply). The Contractor shall be responsible for full commissioning of the system to prove the scheme is operating as designed. Commissioning will involve the testing of all pumps, pressure pipe, storages, alarms, treatment systems and any other aspect of the scheme as designed including the testing of RPZ valves and solenoid valves on the potable water back up. The objective is to define the routine conditions of the scheme for the long term and to confirm that the equipment and systems operate as intended.
- The Contractor shall leave each system in full operation condition. Its proper function shall then be demonstrated to Council maintenance staff to the satisfaction of the Superintendent who will then accept handover.
- Water quality testing of the recycled stormwater shall be undertaken over a minimum period of 4 weeks where the recycled water quality shall meet the compliance values set. All testing shall be at the cost of the Contractor until 4 successive weeks of compliance has been met. The testing parameters and frequency is will be at weekly intervals (minimum) and by a NATA accredited

laboratory. A validation report outlining the results from the water quality testing and the compliance shall be submitted to the Superintendent for approval.

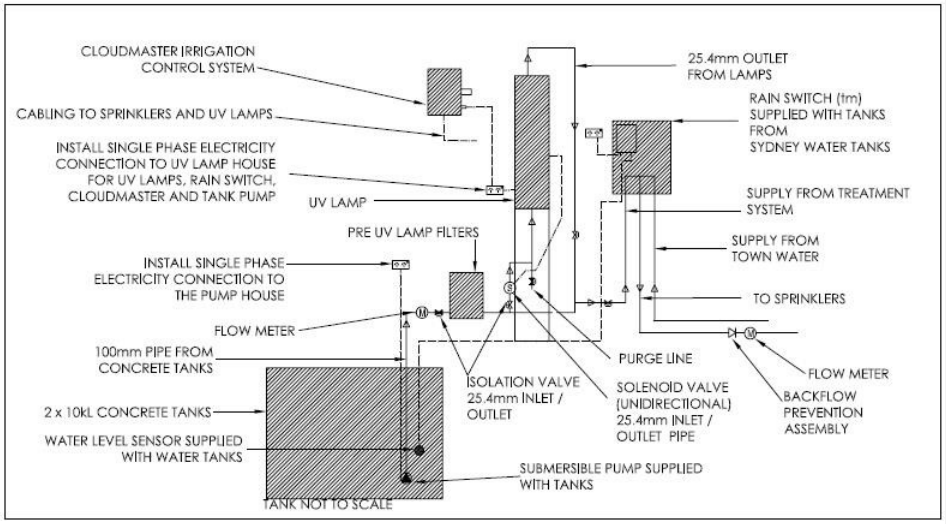
- Defect period should include follow up servicing of irrigation components as required.

2.7 HAND OVER

Site hand over will occur at successful completion of testing and commissioning period. This will include the following:

- Site meeting and induction/training of parks maintenance staff
- Spare parts – 2 x full circle sprinklers, 1 x solenoid valve
- Provision of servicing manuals and maintenance manuals for the system and all components.
- As constructed drawings
- electronic copies – 1 x DWG (CAD) file and 1 x PDF
- 2 x hard copies in A3 or bigger
- Diagram of pump station and system component (example below)

Image 5 – Diagram of pump station and system component



0255 LANDSCAPE – PLANT PROCUREMENT

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide plants as documented.

Performance

Maintenance: Encourage and maintain healthy growth for the duration of the contract.

Program: Provide a suitable irrigation, pruning, fertiliser and monitoring program for all plant materials held by the supplier. Take any other precautions required to safeguard the health and well-being of all plant materials before and including their delivery to site.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.

1.3 STANDARD

General

Tree stock supply: Conform to the recommendations of AS 2303.

1.4 INTERPRETATION

Definitions

General: For the purposes of this worksection the definitions given in AS 2303 and the following below apply:

- Destructive inspection (of trees): The washing away of all soil from a rootball to allow inspection of rootball development.
- Investigative inspection: Any method of root inspection that involves the washing away of all or portions of the soil from the rootball to expose a section or all the roots.
- Known history: Supplier documentation, demonstrating and enabling verification that the product was grown by essentially the same processes and under essentially the same system of control.
- Large tree: A tree grown in a container not less than 20 L or ex-ground with a minimum rootball diameter of 400 mm.
- Partial inspection (of trees): A method of exposing a section of a root system to enable inspection of root development by washing the soil away in a wedge-shaped section from the stem to the extremity of the rootball. This soil can be gently replaced so the tree is not damaged.
- Shrub: A woody perennial plant smaller than a tree, usually having permanent stems branching from or near the ground.
- Small trees: Tree or shrub grown in a container less than 20 L (other than tubes or plant cells) or ex-ground trees of size index less than 35.

1.5 SUBMISSIONS

Forward order contracts

Reports: Complete regular reports using the pro forma **TREE INSPECTION FORM** provided in **SELECTIONS**. Include checks against specification requirements.

- Photographs: Provide current colour copies with date verification.
- Inspection: Complete and return the attached pro-forma **TREE INSPECTION FORM** before despatch of every batch, and at the following frequencies:
  - . Inspections: At 3 monthly intervals.
- Reports: At time of inspections.

Photographic examples

Requirement: Submit photographic examples as follows:

- All palm species.
- 100, 200, 400 L plant species.
- Specimen plant species.

Program: Within fourteen (14) days of the date of contract.

Clarity: Sufficient to be able to ascertain the species, size and quality of a single specimen of the subject plant.

Identification: Provide photographs as follows:

- In colour.
- With a clearly identifiable scale reference located in the same plane as the plant stem or trunk.
- Labelled with plant species name.

Plant provenance

Locality: Provide written certification that all plant material has been grown from locally sourced stock. If this is not achievable give notice.

Species: Provide written certification that all plant material is true to the required species and type.

Progress reports

Content: A detailed resume of the quantities, growth, general health and geographic location of the complete inventory of plant material for the works.

Purpose: To evaluate progress payments under the general conditions of contract.

Program: At 3 monthly intervals.

Test results

General: Complete and return the **TREE INSPECTION FORM** for each batch inspected.

Rejection: Non-conformity may lead to rejection of the entire batch.

Corrective action: Conform to corrective action procedures for each order as instructed.

Substitution: If non-conforming trees are proposed, submit a proposal in writing.

Authentication: Submit a copy of the written approval of substitution with any non-conforming trees.

1.6 INSPECTION

Notice – off-site

Inspection: Give notice so that inspection may be made of the following:

- Immediately prior to the acceptance of tender to establish conformance of the representative samples of all stock scheduled. Conform to **PRODUCTS**, **BALANCE**.
- After eight weeks of the growing on period.
- At 80% completion of stocking of plant material.
- At completion of stocking of plant material, deemed to be as close as practical to 100% in terms of species and numbers.
- At the date of commencement of delivery.
- At a time to be determined to assess potting on procedures, if necessary.

2 PRODUCTS

2.1 PLANTS – GENERAL ASSESSMENT CRITERIA

General

Requirement: Supply trees to AS 2303 and with the following properties:

- Stress: Free from stress resulting from inadequate watering, excessive shade or excessive sunlight experienced at any time during their development.
- Site environment: Grown and hardened off to suit anticipated site conditions at the time of delivery.
- Native species with a history of attack by native pests: Restrict plant supply to those with evidence of previous attack to less than 15% of the foliage and make sure of the absence of actively feeding insects.

Labelling

General: To AS 2303 clause 2.2.1.

Label type: To withstand transit without erasure or misplacement.

2.2 ABOVE-GROUND ASSESSMENT CRITERIA - TREES

General

Requirement: Supply trees to AS 2303 clause 2.2 and with the following properties:

- Clean stem height: < 40% of total tree height.
- Trunk position: Variation in distance from the centre of the trunk to the extremity of the rootball:
  . < 10%.
- Tree stock in containers less than 45 L: Self-supporting at dispatch.
- Pest and diseases: No evidence of active pests and diseases.
- Indication of north: Trees in containers greater than 100 L or of Size Index greater than 140:
  . Label the northerly aspect during growth in the nursery and maintain during transit.

2.3 BELOW-GROUND ASSESSMENT CRITERIA - TREES

General

Requirement: Supply trees to AS 2303 clause 2.3 and with the following properties:

- Rootball occupancy: Soil retention:
  . On shaking or handling the unsupported rootball, at least 90% of the soil volume is to remain intact.
- Rootball diameter:
  . Containers less than or equal to 45 L and ex-ground stock: ≥ to rootball depth.
  . Bare-rooted tree stock with size index less than or equal to 57: ≥ 10 x calliper
- Pest, diseases and weeds: No evidence of active pests, diseases and weeds.

2.4 BELOW-GROUND QUALITIES – SHRUBS

Root system

Requirement: Supply plant material with a root system as follows:

- Well-proportioned in relation to the size of the plant material.
- Conducive to successful transplantation.
- Free of any indication of having been restricted or damaged.

Root inspection: If inspection is by the removal of soil test such as destructive inspection, sample as follows:

- For > 100 samples: Inspect 1%.
- For < 100 samples: Inspect 1 sample.

Sample plants: Replace plants used in inspection.

Rejection: Do not provide root bound stock.

2.5 BALANCE - ASSESSMENT CRITERIA

Small trees and shrubs

Containers (except tubes or plant cells) or rootballs: To remain flat on the ground when the stern, held at 80% of height above ground, is deflected 30°C from the vertical, side to side.

Exempt: Species that naturally produce hard inflexible wood in the early stages of their development.

Small container-grown trees and shrubs table

Container size or minimum rootball diameter	**Height range above soil (m)**	
	Thin-stemmed species	**Thick-stemmed species**
Tubes or plant cells	1.5 to 2.5 x the height of the container	
150 mm (1.8 L)	0.4 – 0.6	0.3 – 0.5
170 mm (2.6 L)	0.5 – 0.7	0.4 – 0.6
200 mm pot (4 L)	0.7 – 0.9	0.6 – 0.8
200 mm bag (5 L)	0.8 – 1.0	0.7 – 0.9
250 mm (8 L)	1.0 – 1.2	0.8 – 1.0

Container size or minimum rootball diameter	Height range above soil (m)	
	Thin-stemmed species	Thick-stemmed species
300 mm (15 L)	1.2 – 1.5	1.0 – 1.2

Large trees
Size Index range for trees grown in containers ≥ 20 L: To AS 2303 Appendix E Table E1.

Minimum rootball diameter for ex-ground trees: To AS 2303 Appendix E Table E2.

2.6 SPECIMEN PLANTS

Properties
Source: From locations where these plant materials are growing in natural ground conditions.

Non-containerised nursery stock: Required.

Presentation: Provide maximum initial impact at the time of project opening.

Properties: As documented in the **Specimen plants schedule**.

Preparation: Undertake the preliminary preparation of all specimen plants and the programming of all necessary preparation works to assure readiness of specimen plants for transplanting to site when required.

Indication of north
Trees in containers greater than 100 L or of Size Index greater than 140: Label the northerly aspect during growth in the nursery and maintain during transit.

2.7 INTERNAL PLANTS

Properties
Presentation: Provide maximum initial impact at the time of project opening. Consideration providing alternative species that may mimic or offer similar foliage display to those nominated.

Properties: As documented in the **Internal plants schedule**.

Growing medium: Anticipate and match the soil type and drainage conditions of the works.

3 EXECUTION

3.1 SUPPLY PROGRAM

Delivery
Guideline dates for delivery: As documented in the **Supply program schedule**.

Plant material per stage: As documented in the SELECTIONS, **SUPPLY schedule(s)**.

Supply program schedule

Stage	Date

3.2 ACCLIMATISATION

Internal plants
Requirement: To cause physiological changes within the plant that will enable it to withstand the transition to the project site without loss of foliage or variance from a healthy and attractive state for five years or more.

Method: Provide internal plants nursery grown in their final nursery containers for six months or longer, under a lighting regime of shading from natural light appropriate to the plant variety. During the final four months simulate conditions in the shadehouse to match the climate anticipated on the project site.

3.3 TRANSPLANTING

General

Requirement: As documented in the **Transplanting schedule**.

Notice: Give notice before:

- Watering
- Fertilising
- Root cutting

Conditions: Select a time for transplanting having regard to the appropriate season, time of actual operation, rootball diameter and depth, lifting methods and weather conditions.

Preparation

Watering: Establish a temporary trickle irrigation system, or manually water the intended trees for a period of two weeks before ball excavation work.

Fertilising: Apply one application of liquid fertiliser mix to the foliage and root as appropriate to the species. Apply sufficient liquid fertiliser mix to allow the spray to drip from foliage and soak into the rootball. Do not spray the fertiliser mix on excessively hot, dry or windy days.

Rootball

General: Minimise the cutting of roots. Use only sharp tools, water blasting or water cutting.

Initial cut:

- Manually or by chain trenching machine. Trees whose rootballs have been excavated by backhoe or excavator will be rejected.
- Located 250 mm beyond the required finished rootball dimensions of each side to allow any damaged roots to be trimmed back to final dimensions and sealed.

Hand trimming:

- To 100 mm less than the required finished rootball dimension. Cut back and seal with an approved horticultural sealer on and all roots greater than 25 mm diameter.

Outcome: Cut rootball to be:

- Symmetrical about the trunk and in proportion to the overall size of the tree except where the limitations of individual tree planter openings requires specific tailoring of the rootball dimension.
- Cut to a size designed to maximise the rootball in the best interests of each specimen. Rootball size not less than 10 x calliper.

Trench: Backfill and lightly compact with clean sand, free of any foreign matter, pathogens or any substances likely to be deleterious to future root growth. Apply sufficient root inducing formulation, at the manufacturer's recommended concentration, to effectively saturate the backfill in the trench.

Maintenance of on-site plant material

Watering: Maintain a trickle irrigation system around each tree, located within the trenched rootball perimeter. Program the system to supply water at an optimum rate to encourage healthy growth and avoid desecration through excessive transpiration following the pruning of the roots. Monitor the system continuously until the tree is lifted and removed to its final destination.

Fertilising: Submit a program for regular fertiliser applications continued over this period.

Responsibility: Take any other precautions required to safeguard the health and well being of all on-site plant material before the lifting and transplanting of all such stock into their finished location.

Above ground

Pruning: If selected pruning of branches appears necessary to balance root loss obtain prior approval.

Pruning requirements: In conformance with AS 4373. Works to be carried out by a fully qualified and experienced arborist. Carry out all required works in a safe and progressive manner.

Lifting: Thoroughly irrigate to the full depth of the rootball two days before transplanting of each specimen. Do not fracture the ball of soil around the root system. Maintain ball in firm condition during transplanting by wrapping in hessian or other appropriate open weave material, securely tied.

Storage: Transport transplanted trees to a designated nursery site. Store and maintain until ready for planting.

Planting: Avoid disturbance to the rootball during moving and planting. After placement, remove the rootball wrapping and ties by cutting.

Watering: At the completion of transplanting, water the rootball thoroughly and continue to water until established. Use 10% rootball volume, per application, as a guide to watering volume.

3.4 PRE-COMPLETION TESTS

Production tests

Sampling: Select sample trees, of known history, at evenly distributed intervals within each batch.

Above ground tree inspection:

- Frequency: Inspect trees at dispatch.
- Sampling strategy: To AS 2303 Appendix A Table A1.
- Inspector: Supplier.

Investigative tree inspection:

- Frequency: Inspect trees before dispatch.
- Inspector: Qualified person authorised by the contract administrator.
- Destructive inspection: Use for trees with rootballs/containers not more than 200 mm.
- Allowance: Allow for sample trees in addition to quantity ordered.
- Partial inspection: Use for trees with rootballs/containers more than 200 mm.

Investigative tree inspection sampling table

Number of trees per batch	Number of trees to sample
0 – 20	1
21 – 50	2
51 – 100	4
101 – 500	4 for the first 100 + 2% of balance of order
501 – 2000	12 for first 500 + 1% of balance of order
2001+	27 for the first 2000 + 0.5% of balance of order

3.5 CONTINGENCY PLANT MATERIAL

Replacement

Provision: Anticipate replacement of failures on site.

Amount: 15% above any normal allowances made in the nursery trade for anticipated losses in the course of propagation and the growing on of plant materials.

Delivery: Supply to the site upon 7 days' notice to the supplier.

Holding: Until the contingency plant material is delivered to site or until the expiry of twelve months from the date of completion of the works, whichever is the earlier. The supplier is not entitled to holding costs for contingency plant material.

Surplus plant material: To remain the property of the supplier.

3.6 WARRANTIES

True-to-species

Parties: Supplier(s) to the principal.

Form: All the plants supplied under these works are true-to-species and type, and free of disease, fungal infection and/or any other impediment to their future growth and that they have been fully acclimatised for the conditions of the site.

Submission of warranty: At the time of each delivery.

Maintenance

Parties: Supplier(s) to the principal.

Form: Maintain all plant materials sourced and secured by the supplier throughout the procurement and pre-transplanting maintenance period. Cover the cost of purchase, labour, equipment, transport and materials to replace any losses, with plant materials of equivalent sizes and quality during the warranty period. Ensure that it is physically possible for any or all of the on-site plant material to be successfully prepared and transplanted.

Warranty period:

- Commencement: The date of contract.

- Completion: To cease in respect of any particular plant material upon issue of a delivery notice issued by the contractor upon delivery to site.
- Earliest delivery date: One week after the date of contract.

4 SELECTIONS

Refer to Landscape Planting Plans and Plant Schedules

0256 LANDSCAPE – ESTABLISHMENT

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide plant establishment, as documented.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:
- *0171 General requirements*.

1.3 INTERPRETATION

Definitions
General: For the purpose of this worksection the following definitions apply:
- Plant establishment period: The period between the date of practical completion and the end of the defects liability period.

1.4 SUBMISSIONS

Certification
Replacement plants species: Submit the supplier's certification as evidence that all plants are true to the required species and type and free from diseases, pests and weeds at time of delivery.

Execution details
General: Give two days notice of the following operations:
- Application of herbicide.
- Application of fertiliser.
- Watering.
- Each site maintenance visit.

Reporting: Submit monthly reports by the last Friday of each month.

Monitoring program
General: Submit a monitoring program developed by a specialist monitoring consultant and incorporating the following:
- Photographic record including:
  - . Colour photographs.
  - . Documented monitoring locations and photograph angles.
- Reporting periods including photographic records at the following:
  - . Before commencement of the works.
  - . Date of practical completion.
  - . Three monthly intervals during the plant establishment period.
  - . End of defects liability period.
  - . Date of final completion.
  - . Benchmark definition based on remnant communities.
  - . Replicated measurements over time and comparative analysis with regard to the benchmark.

Specialist consultant: Submit the name, contact details and qualifications including research papers and scientific publication details of the specialist monitoring consultant.

Records
Logbook: Record the following on a weekly basis:
- Description, time and method of application of toxic material.
- Maintenance work details.

- Inclement weather to verify inability to carry out work within the specified time frame.

Availability: Upon request.

1.5 INSPECTION

Notice

Inspection: Give notice so that inspection may be made at the following intervals:

- Date of practical completion.
- Three monthly intervals during the plant establishment period.
- End of defects liability period.

2 EXECUTION

2.1 GENERAL

Special instructions

Requirement: If directed, attend to identified areas and procedures as a priority. Obtain approval for additional costs before starting the works.

Reporting

Monthly report: Provide regular written reports each month on the following:

- General status of works.
- Soil test results as required for the fertilising programs.
- Plant replacement requirements.

Incident reports: Report immediately verbally and confirm in writing any disturbance or incident affecting or likely to affect the day to day scheduling of works.

Disruption of works by others

Requirement: Make arrangements to work around the disturbance caused by other contractors.

Rubbish removal

Rubbish: Remove loose rubbish such as bottles, papers, and cigarette butts from the site. Execute this work regularly so that all areas are free from rubbish when observed at fortnightly intervals.

Leaf litter: Remove from all path and lawn areas.

2.2 PLANTING WORKS

Planting

Requirement: Make sure the general appearance and presentation of the landscape and the quality of plant material at date of practical completion is maintained for the planting establishment period.

Existing plant material: Maintain existing planting and grass within the landscape contract area as documented for the matching classifications of new grassland or planting.

Plant replacement: Replace failed, dead and/or damaged plants at maximum 3 weekly intervals as necessary throughout the plant establishment period.

Pruning

Prune: To AS 4373 and as documented in the **Pruning schedule**.

Fertilising

Soil tests: Take samples from both planting beds and lawn areas and conduct tests.

Fertilising program: Base the program on soil testing results.

Application: Apply either an all purpose fertiliser or a 12 month slow release fertiliser, in two rows and cultivated into soil to a depth of 100 mm.

Program: September and March according to seasonal growth requirement.

N:P:K ratio: Balanced 10:4:6.

Rate: To the manufacturer's recommendation.

Sensitive native species: Apply appropriate dosage.

Insect and disease control

Period for treatment: Until the problem has been eliminated.

Chemical spray: Apply outside of normal working hours.

Stakes and ties

Generally: If plants are not-self supporting or if stakes are damaged, stake or restake the plants as follows:

- Drive three hardwood stakes placed diagonally with the first stake on the opposite side to the prevailing winds.
- Do not single stake large plants.

Removal: If plants are robust with well developed systems and no longer require support, remove stakes and ties.

2.3 WEEDING

General

Requirement: Remove unwanted broadleaf plants and grasses considered invasive to the locality.

Program:

- Lawns: Quarterly, and as required to maintain the general lawn condition.
- Trees and shrubs: As required for planted, paved and mulched areas to be weed free when observed at fortnightly intervals.

Vigorous ground covers: Keep 200 mm clear from the base of any shrub or tree. Remove as follows:

- Small areas: By hand.
- Large areas: Proprietary herbicides.

Herbicide application: Apply as follows:

- To the manufacturer's instructions and Safety Data Sheets(SDS).
- When the weather is humid with moderate temperatures and maximum sunlight.
- When the ground has recommended soil moisture.
- Avoid windy days or if rain is likely to follow within 12 hours.

2.4 MULCHED SURFACES

General

Inspection: Fortnightly to determine mulch requirements.

Requirement: Maintain minimum depth as follows:

- 75 mm for organic mulch.
- 50 mm for gravel mulch.

Remulching: Maintain the original ground levels around the base of plants.

2.5 WATERING

Establishment

Water quality:

- pH between 5.5 and 7.5.
- Total soluble salts less than 1000 mg/litre.
- No substances toxic to plant growth.

Watering program: Minimum three complete waterings, soaking to a depth of 150 mm at fortnightly intervals for the first 6 weeks of plant establishment irrespective of natural rainfall. Confirm soaked depth and record in the log book.

Water restrictions: Coordinate the water supply and conform to legislation and restrictions applying at the time.

Irrigation

Hand watering: Manually water all lawn and planting areas until the proposed irrigation system is fully operational, soaking to a depth of 150 mm for lawn and 300 mm for planting. Avoid frequent dampening of the surface. Allow the surface of the soil to partially dry out between waterings.

Irrigation system program: Adjust to suit the following:

- The precipitation requirements of the individual zones/stations with regard to types of plants.
- The infiltration rate of the soil/medium and associated physical factors, seasons, evaporation, exposure, topography and local authority restrictions.
- Adjustment or shut down during and after periods of prolonged heavy rains.

Equipment maintenance:

- Check all components for proper operation.
- Repair or replace damaged components with parts from the same manufacturer.
- Flush any dirt or foreign matter from the system and clear all blockages.

Hand watering

Requirement: Manually water all lawn and planting areas, soaking to a depth of 150 mm for lawn and 300 mm for planting. Avoid frequent dampening of the surface. Allow the surface of the soil to partially dry out between waterings.

2.6 PAVING AND STRUCTURES

Furniture, signage and barriers

Maintenance guidelines:

- Furniture and pots: Keep in a good condition and move as required to carry out maintenance works.

Directional and building signs: Keep in a good condition and maintain visibility.

Boundary and car park barriers: Keep in a good condition and maintain visibility.

Drains

Maintenance: Inspect and clean all drainage structures and pit covers and maintain in working order.

Frequency: As required, so that all overflow drains are clear when observed at fortnightly intervals.

2.7 COMPLIANCE

Criteria

Generally: Plant establishment shall be deemed complete, subject to the following:

- Repairs to plant material are complete.
- Ground surfaces are covered with the documented treatment to the documented depths.
- Pests, disease, or nutrient deficiencies or toxicities are not evident.
- Organic and gravel mulched surfaces are in a weed free and tidy condition and to the documented depth.
- Vegetation is established and well formed.
- Vegetation cover to cell, seeded and/or hydromulched areas is established
- Plants have healthy root systems that have penetrated into the surrounding, undisturbed ground and are not able to be lifted out of the planting holes.
- Vegetation is not restricting essential sight lines and signage.
- Only frangible species are growing within road side clear zones.
- Specified vegetation setbacks from services and road furniture are evident.
- All hard landscape works are installed and operating as documented.
- Litter collection and removal is complete.
- Mulch is removed from drainage and access areas.
- All non-conformance reports and defects notifications are complete.

Plant establishment compliance table

Plant material	**Acceptable failure per area**	**Acceptable concentration of failure**
Tube stock	< 10%	< 15% in any given location
140 mm	< 5%	< 15% in any given location
300 mm or larger	Nil	Nil
Turf	< 5%	Nil
Cells	< 5%	< 15% in any given location
Direct seeded native species and cover crop – including hydromulch, drilled and broadcasted areas	Not less than 3 documented species per 1 m^2 grid (determined on a testing frequency of 20 grid areas per 500 m^2)	Nil grids with < three (3) documented plant species

Plant material	Acceptable failure per area	Acceptable concentration of failure
Direct seeded grass species and cover crop	< 15% (determined by a 1 m^2 grid on a testing frequency of 1 grid area per 500 m^2)	< 10%
Cover crop	< 5%	Nil

3 SELECTIONS

Refer to Landscape selection schedules.

0259 LANDSCAPE – MAINTENANCE

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide landscape maintenance of the contract area during the maintenance period.

Performance

Extent of maintenance:

- Weeding of lawn, garden bed areas, and pavement.
- Supply and spreading of fertiliser to lawn, garden bed areas and pots.
- Supply and installation of mulch to existing garden bed areas and pots.
- Pruning, trimming and tree surgery.
- Insect and disease control of lawn, shrubs and trees.
- Mowing and edge trimming to all lawn areas including collection and removal of clippings.
- Replacement of dead or failed plants.
- Maintenance of irrigation systems.
- Removal of rubbish and debris in garden areas.
- Keeping of a log book.
- Monthly reports.

Maintenance procedures: To the SELECTIONS **Maintenance schedule**.

1.2 THE SITE

Record drawings

Site restrictions

Site limitations: Comply with the following restrictions on the use of the site:

Entry permits: Make available, to persons entering designated secure areas, valid entry permits. Make sure these persons comply with conditions of entry.

List: At least 10 working days before entry is required, submit the full name, address, and date and place of birth of persons required to enter designated secure areas.

- Purpose of submission: Review.

Protection of persons and property

Temporary works: Provide and maintain required guards, fencing, footpaths, signs and lighting.

Accessways, services: Do not obstruct or damage footpaths, drains and watercourses or other existing services in use on or adjacent to the site.

Property: Do not interfere with or damage property which is to remain on or adjacent to the site, including adjoining property encroaching onto the site, and trees.

Rectification

Accessways, services: Rectify immediately any obstruction or damage to footpaths, drains and watercourses or other existing services in use on or adjacent to the site. Provide temporary services whilst repairs are carried out.

Property: Rectify immediately any interference or damage to property which is to remain on or adjacent to the site, including adjoining property encroaching onto the site, and trees.

1.3 GENERAL CONDITIONS

Contract

Form of contract: as required by Charter Hall and Western Sydney University.

Payment

Payment period: as required by Charter Hall and Western Sydney University.

Bond: Equal to one month's maintenance.

Expenditure of the bond: By the principal upon unsatisfactory maintenance, to employ others to carry out such work.

Contractor and staff

Representative: Nominate a senior partner/personal experienced in maintenance nursery practices and horticulture, to be responsible for taking and carrying out instruction, and reporting to the principal.

Special instructions

Priority: If instructed by the principal attend to certain areas and procedures as a priority. Obtain approval for additional costs prior to commencement of works.

Reporting

Monthly report: Submit regular reports by the last Friday of each month, to the SELECTIONS **Monthly reports schedule** and as follows:

- General status of the works.
- Soil test results included as required for the fertilising programs.
- Any plant replacement requirements.

Incident reports: Report immediately verbally and confirmed in writing any disturbance or incidence affecting or likely to affect the scheduling of the works.

Notice

Inspection: Provide two days' notice of the following operations:

- Application of herbicide.
- Application of fertiliser.
- Each site maintenance visit.
- Work affecting public access or amenity on the Thursday of the week before the work is planned.

Log book

Records: Log the following on a weekly basis:

- Description, time and method of application of toxic material.
- Maintenance work details.
- Inclement weather to verify inability to carry out work within the specified time frame.

Availability: Upon request.

Replacement plants

Species: Provide written certification that all plant material is true-to-species and type, and free of disease and fungal infection.

Disruption of works by others

Other contractors: Make arrangements to work around the disturbance.

2 EXECUTION

2.1 GENERAL

Weeding

Requirement: Remove unwanted broadleaf plants and grasses considered invasive to the locality.

Program:

- Lawns: Quarterly.
- Trees and shrubs: As required for planted, paved and mulched areas to be weed free when observed at fortnightly intervals.

Vigorous ground covers: Keep 200 mm clear from the base of any shrub or tree. Remove as follows:

- Small areas: By hand.
- Large areas: Proprietary herbicides.

Herbicide application: Apply as follows:

- To the manufacturer’s recommendations and the material data and safety data sheets.
- When the weather is humid with moderate temperatures and maximum sunlight.
- When the ground has adequate soil moisture.
- Avoid windy days or if rain is likely to follow within 12 hours.

Insect and disease control

Requirement: Control any insects or diseases affecting the lawn and garden bed areas as follows:

- Identify the problem.
- Execute the correct treatment until the problem has been eliminated.
- Apply hazardous material out of normal working hours.
- Protect staff and public.

2.2 GRASS

Mowing and trimming

Litter: Remove litter and fallen branches before mowing.

Height: Consistent with the growth habit of the grass variety and maintained at 25 mm to 40 mm throughout the year.

Program: Weekly during the mowing season, November to March, and at fortnightly intervals during April to October. Do not mow during wet conditions.

Raking: Once every month before mowing during the mowing season, rake the grass with a flexible rake. On alternate mowings, adopt a north-south and east-west pattern.

Edges: At the same time as mowing, trim lawn edges to plant beds, pathways, base of trees and other obstacles. Do not damage trees or shrubs.

Non-selective herbicide: Make sure application does not exceed the area limits of normal manual trimming. Repair any damage from overuse or over spray.

Fertilising

N:P:K (Nitrogen:Phosphorus:Potassium) ratio: Balanced 10:4:6.

Rate: To the manufacturer's recommendation.

Program:

- Regular application: Each September and April.
- Additional application: Each November and February at reduced rates.

Soil pH adjustment: Apply additional fertilisers and soil conditioners as indicated from soil testing or from the physical soil structure. Maintain a pH range of 5.5 to 6.5.

pH testing program: Two year schedule commencing in the first year of the contract.

Application: Spread as follows:

- Dry: Crush lumps and broadcast dry material by hand or mechanically when the lawn is dry.
- Spray: Acceptable.
- Prevent fertiliser from leaching to adjoining planted beds, particularly those with sensitive native trees and shrubs.

Topdressing

Topdressing material for established lawns: Weed free imported sandy topsoil to a depth of 5 mm.

Topdressing material for remediation of depressions or irregularities: Apply coarse or medium texture soil, to AS 4419, suitable for application to turf or grass seeded areas.

Renovation

Established lawns of sandy soil profile: Renovate by dethatching or verticutting.

2.3 TREES AND SHRUBS

Pruning and trimming

General: Prune to reflect the natural growth, flowering and regrowth habit of the individual species.

Program generally: Spring and Summer and on a spot basis as required.

Shrubs: Prune after flowering.

Hedge trimming: Schedule trimming at times that maintains the character and design of hedges. Allow up to three times per season.

Tip pruning:

- Purpose: To encourage development of new shoots during the active growing season.
- Method: Removal of the top 25 mm or growing tip of each branch.
- Restriction: Do not remove buds before the flowering season in those plants that have terminal flowers.

Radical pruning:

- Purpose: To maintain a hedge or formal shape or when a particular problem, growth habit, damage, or disease requires branch removal.

Tree pruning:

- Eliminate diseased or damaged growth, avoid inter-branch contact and thin out crowns in a natural manner.
- Maintain sight lines to signs and lights.
- Maintain visibility for personal security.

Tree branch removal:

- To AS 4373.
- Give notice and engage a suitably qualified arborist.

Fertilising

Fertilising program: Base the program on soil testing results.

Soil testing: Undertake soil tests as follows:

- At the commencement of the contract.
- Take samples from a cross section of planting beds.

Soil pH adjustment: Apply additional fertilisers and soil conditioners as indicated from soil testing or from the physical soil structure. Maintain a pH range of 5.5 to 6.5.

Shrubs:

- N:P:K ratio: Balanced 10:4:6.
- Rate: To the manufacturer's recommendation and cultivate two rows into the soil 100 mm deep.
- Regular application: Each September and March.
- Sensitive native species: Apply appropriate dosage.

Trees:

- Application: Apply pill to the root zone at a distance from the trunk equal to the spread of the foliage. Make holes 400 mm deep to take the pill, equally spaced around the plant and backfill with sand.

Micro nutrients: Apply 1 kg of urea in 20 litres of water per 100 m^2, through a hose proportioner every four weeks during Summer.

Stakes and ties

Generally: If plants are not self-supporting or if stakes are damaged, stake or re-stake the plants as follows:

- Drive three hardwood stakes placed diagonally with the first stake on the opposite side to the prevailing winds.
- Do not single stake large plants.

Removal: If plants are robust with well developed systems and no longer require support, remove stakes and ties.

Plant replacements

General: Replace all evergreen plants that have died or lost 50% of their normal foliage cover. Provide replacement plants as follows:

- Of the same species and variety and of the closest commercially available size.
- With a balanced root system in relation to the size of the plant and conducive to successful transpiration. Inspect the root conditions of plants by knocking plants from their containers.
- Without signs of having been stressed at any stage during their development due to inadequate watering, excessive shade/sunlight, suffered physical damage or have restricted habit due to growth in nursery rows.
- Grown in final containers for not less than twelve (12) weeks.

2.4 WATERING

Lawn and planted areas

Generally: Maintain a vigorous healthy appearance.

Application rates: Soak to a depth of 150 mm for lawn and 300 mm for planting. Avoid frequent dampening of the surface. Allow the surface of the soil to partially dry out between waterings. Confirm soaked depth and record in the log book.

Timing: Water at times of day to minimise water evaporation loss. Do not water during the hottest period of Summer days.

Water restrictions: Coordinate the water supply and conform to legislation and restrictions applying at the time.

Hand watering

General: Manually water all lawn and planting areas in the absence of an irrigation system or until the proposed irrigation system is fully operational.

Irrigation

Irrigation system program: Adjust to suit the following:

- The precipitation requirements of the individual zones/stations with regard to types of plants.
- The infiltration rate of the soil/medium and associated physical factors, of seasons, evaporation, exposure, topography, local authority restrictions.
- Adjustment or shut down during and after periods of prolonged heavy rains.
- Water supply and watering regime of legislation and restrictions applying at the time.

Equipment maintenance: Confirm the following:

- Check all components for proper operation.
- Obtain approval to repair or replace damaged component with equivalent parts.
- Flush any dirt or foreign matter from the system and clear all blockages.

System maintenance: Conform to the **Irrigation system maintenance schedule**.

Programming

Automated systems: Program to coincide with optimum periods of water pressure and water absorption.

Public access: Do not inconvenience persons occupying the site by water spray or block normal pedestrian or traffic flow.

2.5 MULCHING

General

Clean up: Remove all mulching materials off lawn or paved areas and maintain a clean and tidy appearance when viewed on a weekly basis.

Requirement: Maintain a minimum depth as follows:

- 75 mm for organic mulch.
- 50 mm for gravel mulch.

Top up: Areas of excessive wear.

2.6 INCIDENTAL WORKS

Supplementary works

General: Execute the following:

- Removal of waste from maintenance work.
- Removal of leaf litter fortnightly during leaf fall.
- Wash paving on completion of herbicide application.

Furniture, signage and barriers

Scope: All fixed and movable features noted in the record drawings.

Furniture and pots:

- Move and relocate as required for maintenance of the area.
- Repair or replace items damaged by the maintenance contract staff.

Signage: Maintain sight line visibility.

Drains

General: Inspect and clean all drainage structures and pit covers and make sure they are in proper working order.

Frequency: As required so that all overflow drains are cleared when observed at fortnightly intervals.

3 SELECTIONS

3.1 SCHEDULE OF RATES

Schedule of rates schedule

Item	Unit	Quantity	Rate	Total
Preliminaries/establishment (one off cost)	item			
Mowing and edge trimming	item			
Watering	item			
Irrigation repair	item			
Manual watering	item			
Fertiliser: Lawn	m^2			
Fertiliser: Garden/pot	m^2			
Fertiliser: Trees	no			
Weeding	item			
Insect and disease control	item			
Pruning and trimming	item			
Plant replacement: In lawn areas: 150 mm	no			
Plant replacement: In lawn areas: 5 litre	no			
Plant replacement: In lawn areas: 15 litre	no			
Plant replacement: In lawn areas: 25 litre	no			
Plant replacement: In lawn areas: 35 litre	no			
Plant replacement: In lawn areas: 75 litre	no			
Plant replacement: In lawn areas: 100 litre	no			
Plant replacement: In lawn areas: 200 litre	no			
Plant replacement: In garden areas: 150 mm	no			
Plant replacement: In garden areas: 5 litre	no			
Plant replacement: In garden areas: 15 litre	no			
Plant replacement: In garden areas: 25 litre	no			
Plant replacement: In garden areas: 35 litre	no			
Plant replacement: In garden areas: 75 litre	no			
Plant replacement: In garden areas: 100 litre	no			
Plant replacement: In garden areas: 200 litre	no			

Item	Unit	Quantity	Rate	Total
Staking and tying	item			
Mulching: Pine bark graded	m^3			
Mulching: Pine flake	m^3			
Mulching: Crushed gravel	m^3			
Lawn renovation	item			
Topdressing	m^3			
Incidentals (including protective clothing)	item			

Labour rates schedule

Item	Ordinary time $ per hour	Overtime $ per hour
Additional labour charge: Labourer	$	$
Additional labour charge: Tradesman	$	$

3.2 MAINTENANCE REPORT

Monthly reports schedule

Item	Action
Plant material	Replace failed plants
	Additional planting
	Treat for disease or insect attack
	Tree surgery
	Fertilising generally
	Fertilising for specific nutrient deficiencies
	Thin out planting
	Pruning/trimming
Turf	Returfing
	Seeding
	Treat for disease
	Topdressing
	Weeding
	Mowing/trimming
Soil	Erosion/bank stabilisation
	Additional soil
	Soil conditioner
	Weeding
Mulch	Top up mulch
Rubbish removal	Generally remove bottles, paper, cigarette butts etc.
	Remove leaf, litter from path and paved areas
Irrigation	Replace parts

Item	Action
	Repair
	Clean out
	Adjust
	Clean out subsurface drains
Paving and pathways	Repair dips, hollows, irregularities
	Remove stains and graffiti
	Replace sections of uplift
	Clear main pathway drains of debris
	Weeding
Infant playground	Make sure that all play structures are secure and in working order
Fencing	Repair fencing
Furniture and hard fixtures	Bench/seat
	Bollard
	Lighting
	Barriers

3.3 MAINTENANCE PROCEDURE

Maintenance schedule

WEEK	SPRING (Sept, Oct, Nov)	SUMMER (Dec, Jan, Feb)	AUTUMN (Mar, Apr, May)	WINTER (Jun, Jul, Aug)
1	Mow and trim lawns	Mow lawns; weed	Mow lawns	Weed
2	Weed; trim and adjust trees and shrubs	Weed; mow lawns, trim and adjust trees and shrubs	Weed; mow lawns, trim and adjust trees and shrubs	Mow and trim lawns Trim and adjust trees and shrubs
3	Mow and fertilise lawns; treat plant material for insects and disease	Mow lawns; weed; treat plant material for insects and disease	Mow and trim lawn	Weed
4	Weed; topdress, condition lawns and oversow bare patches; issue maintenance report	Weed; mow and trim lawns; issue maintenance report	Weed; mow lawns; issue maintenance report	Mow lawns; issue maintenance report
5	Fertilise all trees and shrubs in garden beds; mow and trim lawns	Mow lawns; weed	Mow lawns	Mow lawns
6	Weed; inspect mulch for deficiencies in cover; check and adjust irrigation	Mow lawns; check and adjust irrigation	Weed; inspect mulch for deficiencies in cover; check and adjust irrigation	Mow and trim lawns; treat for insects and disease; check and adjust irrigation
7	Reinstate mulch as required; treat plant material for insects	Mow lawns; weed	Reinstate mulch as required; mow, trim and fertilise lawns	Weed

WEEK	SPRING (Sept, Oct, Nov)	SUMMER (Dec, Jan, Feb)	AUTUMN (Mar, Apr, May)	WINTER (Jun, Jul, Aug)
	and disease; mow lawns			
8	Weed; inspect condition of paving and furniture; issue maintenance report	Mow and trim lawns; inspect condition of paving & furniture; issue maintenance report	Weed; inspect condition of paving and furniture; issue maintenance report	Mow lawns; Inspect condition of paving and furniture; issue maintenance report
9	Mow and trim lawns	Mow lawns; treat plant material for insects and disease	Mow lawns	Weed
10	Weed; mow lawns	Mow and topdress lawns	Weed; treat plant material for insects and disease	Mow and trim lawns
11	Mow and fertilise lawns; trim and adjust trees and shrubs	Mow lawns; trim and adjust lawns; weed	Mow and trim lawns; trim and adjust trees and shrubs	Prune back trees and shrubs after flowering
12	Weed; mow lawns; treat plant material for insects and disease	Mow, trim & fertilise lawns	Weed	Mow lawns; treat plant material for insects and disease
13	Check and adjust irrigation; mow lawns; issue maintenance report	Check and adjust irrigation; mow lawns; weed; issue maintenance report	Check and adjust irrigation; mow lawns; weed; issue maintenance report	Check and adjust irrigation; weed; issue maintenance report

3.4 IRRIGATION

Irrigation system maintenance schedule

Item	Frequency
Filters – mainline	Monthly
Electrical source output (auto system)	Monthly
Controller (automatic systems)	Monthly
Operation – progression - Station to Station.	Weekly
Proper activation of valves	Monthly
Proper timing of stations	6 monthly
Proper time and day readings	Weekly
Exterior appearance	6 monthly
Valve operation	6 monthly
Open, close completely (weeping)	Weekly
Sprinkler operation	Weekly
Rotaries – clogged nozzles	2 monthly
Plant obstructed pattern	2 monthly
Arc coverage	2 monthly
Radius adjustment	2 monthly
Pop-up action	2 monthly
Riser seal leaks	2 monthly
Set to grade	2 monthly
Coverage pressure	2 monthly

Rotational speed	2 monthly
Clogged screens	2 monthly
Head damage	2 monthly
Piping	2 monthly
Leaks – broken or cracked pipe	As Needed
Bad solvent welds, bad threaded	As Needed
Connection	As Needed
Clogged pipe	As Needed

0261 LANDSCAPE – FURNITURE AND FIXTURES

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide landscape furniture and fixtures, as documented.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:

- *0171 General requirements*.
- *0262 External sports and playground surfacing*.

1.3 SUBMISSIONS

Operation and maintenance manual
Requirement: Submit the manufacturer's published use, care and maintenance requirements for each item.

Products and materials
Requirement: Submit the manufacturer’s standard drawings and details showing methods of construction, assembly and installation; with dimensions and tolerances.

Type test: Submit results as follows:

- Playground equipment: To AS 4685 series.

Shop drawings
Custom-built furniture and fixtures: Submit shop drawings to a scale that best describes the details, showing methods of construction, assembly and installation, with dimensions and tolerances.

Subcontractors
General: Submit names and contact details of proposed suppliers and installers.

Warranties
Requirement: Submit the manufacturer's published product warranties.

1.4 INSPECTION

Notice
Inspection: Give notice so that inspection may be made of the following:

- Custom-built furniture and fixtures fabricated and ready to be delivered to the site.
- Furniture items delivered to site before installation.
- Site locations or substrates prepared to receive furniture or fixtures before installation.
- Set-out of furniture and fixtures.
- Completed installation.

2 PRODUCTS

2.1 GENERAL

Storage and handling
General: Deliver, unload and store products and accessories in sealed manufacturer's packaging.

Preservative treatment
CCA treated timber: If proposed, provide details.

Labelling
Playground equipment: To AS 4685 series.

3 EXECUTION

3.1 INSTALLATION

Erection
Line and level: Erect posts or poles vertically. Erect furniture items level. Where installed on slopes, provide a level area around benches and seats.

3.2 COMPLETION

Cleaning
General: On completion, remove protective coatings, clean all surfaces and remove all labels not required for maintenance, or by AS 4685 series.

4 SELECTIONS

4.1 FURNITURE

Refer to Landscape Selections Schedule

4.2 PLANTING FITTINGS

Refer to Landscape Selections Schedule

4.3 FIXTURES

Refer to Landscape Selections Schedule

4.4 CUSTOM-BUILT FURNITURE AND FIXTURES

Refer to Landscape Selections Schedule

0271 PAVEMENT BASE AND SUBBASE

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide base and subbase courses as documented.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:

- *0171 General requirements*.
- *0222 Earthwork*.

1.3 INTERPRETATION

Definitions
General: For the purposes of this worksection, the following definitions apply:

- Base: One or more layers of material, forming the uppermost structural element of a pavement and on which the surfacing may be placed.
- Subbase: Material laid on the subgrade below the base either for the purpose of making up additional pavement thickness required, to prevent intrusion of the subgrade into the base, or to provide a working platform.

1.4 SUBMISSIONS

Execution details
General: Submit details of the proposed work methods and equipment for each pathway and roadworks operation, including the following:

- Staging of the work, access and traffic control methods.
- Disposal of surface water, control of erosion, contamination and sedimentation of the site, surrounding areas and drainage systems.

Compaction: If a layer is proposed to exceed 200 mm in thickness, submit evidence that the proposed compaction equipment can achieve the required density throughout the layer.

Products and materials
Source of material: Submit the supplier name, material type (crushed rock, natural gravel, recycled concrete aggregate) and source quarry or recycling site.

Conformance: Submit type test results for each material listed in the **Base material properties and test methods table** and **Subbase material properties and test methods table** from an Accredited testing laboratory as evidence of material conformance.

1.5 INSPECTION

Notice
Inspection: Give notice so that inspection may be made of the following:

- Prepared subgrade.
- Proof rolling of subbase before spreading of base.
- Proof rolling of base before sealing.

2 PRODUCTS

2.1 BASE AND SUBBASE MATERIAL

Granular material
Requirement: Provide unbound granular materials, including blends of two or more different materials, which when compacted develop structural stability and are uniform in grading and physical characteristics.

Crushed rock

Requirement: Provide crushed rock as follows:

- Base: 20 mm nominal.
- Subbase: 40 mm nominal.

Recycled materials

Requirement: Provide recycled materials as follows:

- Base and subbase: Conform to the **Limits on use of recycled and manufactured materials as constituent materials table** and the **Undesirable material properties table**.

Natural gravel

Requirement: Provide unbound natural gravel materials as follows:

- Base: 20 mm nominal.
- Subbase: 40 mm nominal.

Subbase material properties and test methods table

Property and test method	**Differentiating criteria**	**Material requirements**	
		Crushed rock	**Natural gravel**
Particle size distribution or grading (% passing through sieve) to AS 1289.3.6.1	**Sieve size (mm)**	—	—
	53.0 mm	100	100
	37.5	90 - 100	95 - 100
	26.5	74 - 96	80 - 97
	19.0	62 - 86	—
	13.2	—	—
	9.5	42 - 66	48 - 85
	4.75	28 - 50	35 - 73
	2.36	20 - 39	25 - 58
	0.425	8 - 21	10 - 33
	0.075	3 - 11	3 - 21
Liquid limit (w_L) to AS 1289.3.1.1	—	max 25%	max 25%
Plasticity index (I_P) to AS 1289.3.3.1	—	max 12%	max 12%
Linear shrinkage (*LS*) to AS 1289.3.4.1	**Rainfall**	—	—
	Areas with annual rainfall > 500 mm	max 4.5%	max 4.5%
	Areas with annual rainfall < 500 mm	max 6.0%	max 6.0%
Maximum dry compressive strength on fraction passing 19 mm sieve (only applies if plasticity index is less than 1) to AS 1141.52	—	min 1.0 MPa	min 1.0 MPa
Particle shape by proportional calliper - % misshapen (2:1) to AS 1141.14	—	max 35%	—
Aggregate wet strength* to AS 1141.22	—	min 50 kN	—
Wet/dry strength variation* (dry - wet)/dry to AS 1141.22	—	max 40%	—
Los Angeles value to AS 1141.23	—	max 40%	—

Property and test method	Differentiating criteria	Material requirements	
		Crushed rock	Natural gravel
4 day soaked CBR (98% modified compaction) to AS 1289.6.1.1	—	min 30%	min 30%
*Use the fraction with the highest wet/dry strength variation as the value for determining conformance. Test the fraction 19.0 to 9.5 mm. For blended materials, also test the fraction 9.5 to 4.75 mm. Test any other fraction where there is risk of failing.			

Limits on use of recycled and manufactured materials as constituent materials table

Recycled material	Unbound or modified base and subbase	Bound base and subbase
Iron and steel slag	100%	100%
Crushed concrete	100%	100%
Brick	20%	10%
RAP	40%	40%
Fly ash	10%	10%
Furnace bottom ash	10%	10%
Crushed glass fines	10%	10%

Undesirable material properties table

Property and test method	Differentiating criteria	Material requirements		
		Crushed rock	Recycled material	Natural gravel
Undesirable constituent materials (% retained on a 4.75 mm sieve) to RMS T276	**Material type**	—	—	—
	Type I - Metal, glass, stone, ceramics and slag	—	max 2.0 %	—
	Type II - Plaster, clay lumps and other friable material	—	max 0.5%	—
	Type III - Rubber, plastic, paper, cloth, paint, wood and other vegetable matter	—	max 0.1%	—

Base material properties and test methods table

Property and test method	Differentiating criteria	Material requirements		
		Crushed rock	Recycled material	Natural gravel
Particle size distribution or grading (% passing through sieve) AS 1289.3.6.1	**Sieve size (mm)**	—	—	—
	26.5	100	100	100
	19.0	95 - 100	95 - 100	93 - 100
	13.2	77 - 93	78 - 92	—
	9.5	63 - 83	63 - 83	71 - 87
	4.75	44 - 64	44 - 64	47 - 70
	2.36	29 - 49	30 - 48	35 - 56
	0.425	13 - 23	13 - 21	14 - 32
	0.075	5 - 11	5 - 9	6 - 20
Liquid limit (w_L) to AS 1289.3.1.1	—	max 25%	max 30%	max 25%
Plasticity index (I_P) to AS 1289.3.3.1	**Rainfall**	—	—	—
	All areas	—	—	—

Property and test method	**Differentiating criteria**	**Material requirements**		
		Crushed rock	**Recycled material**	**Natural gravel**
	Areas with annual rainfall > 500 mm	max 6%	max 6%	max 6%
	Areas with annual rainfall < 500 mm	max 10%	max 10%	max 10%
Linear shrinkage (*LS*) to AS 1289.3.4.1	**Rainfall**	—	—	—
	All areas	—	—	—
	Areas with annual rainfall > 500 mm	max 2.0%	max 2.0%	max 2.0%
	Areas with annual rainfall < 500 mm	max 4.0%	max 4.0%	max 4.0%
For materials with plasticity index less than 1: Maximum dry compressive strength to AS 1141.52	—	min 1.7 MPa	min 1.7 MPa	min 1.7 MPa
Particle shape by proportional caliper (% misshapen for 2:1 caliper ratio) to AS 1141.14	—	max 35%	max 35%	—
Aggregate wet strength* to AS 1141.22	—	min 80 kN	min 80 kN	—
Wet/dry strength variation* to AS 1141.22	—	max 35%	max 35%	—
Los Angeles value (% loss or abrasion) to AS 1141.23	—	max 35%	max 40%	—
CBR (98% modified compaction) to AS 1289.6.1.1	—	min 80%	min 80%	min 80%
Unconfined compressive strength to AS 5101.4	—	max 1.0 MPa	max 1.0 MPa	—
NOTES: *Use the fraction with the highest wet/dry strength variation as the value for determining conformance. Test the fraction 19.0 to 9.5 mm. For blended materials, also test the fraction 9.5 to 4.75 mm. Test any other fraction where there is risk of failing.				

Tests

Material property testing: Conform to the **Base material properties and test methods table** and the **Subbase material properties and test methods table**.

Frequency of material property tests: Not less than the following:

- Particle size distribution: 1 per 1000 t (or part of).
- Liquid limit: 1 per 1000 t (or part of).
- Plasticity index: 1 per 1000 t (or part of).
- Linear shrinkage: 1 per 1000 t (or part of).
- Foreign materials content: 1 per 1000 t (or part of).
- Maximum dry compressive strength: 1 per 5000 t (or part of).
- Particle shape: 1 per 1000 t (or part of).
- Los Angeles value: 1 per 1000 t (or part of).
- Aggregate wet strength: 1 per 5000 t (or part of).
- Wet/dry strength variation: 1 per 5000 t (or part of).

3 EXECUTION

3.1 SUBGRADE PREPARATION

General

Requirement: Prepare the subgrade in conformance with *0222 Earthwork*.

3.2 PLACING BASE AND SUBBASE

General

Weak surfaces: Do not place material on a surface that is weakened by moisture and is unable to support, without damage, the construction plant required to perform the works.

Spreading: Spread material in uniform layers without segregation.

Moisture content: Maintain wet mixed materials at the required moisture content before and during spreading. Add water to dry mixed materials through fine sprays to the entire surface of the layer after spreading, to bring the material to the required moisture content.

Compacted layer thickness: 200 mm maximum and 100 mm minimum. Provide layers of equal thickness in multilayer courses.

Joints

General: Plan spreading and delivery to minimise the number of joints. Offset joints in successive layers by a minimum of 300 mm.

Start of shift: Remix last 2 m of previous days' work for continuity of compaction.

Final trimming

General: Trim and grade the base course to produce a tight even surface with no loose stones or slurry of fines.

3.3 TOLERANCES

Surface level

General: Provide a finished surface level which is free draining and evenly graded between level points.

Subbase: + 10 mm, - 25 mm.

Base: + 10 mm, - 5 mm.

Base abutting gutters: ± 5 mm from the level of the lip of the gutter, minus the design thickness of the wearing course.

Surface deviation

Base: ≤ 5 mm from a 3 m straightedge laid on the surface.

3.4 BASE AND SUBBASE COMPACTION

General

Construction operation: Compact each layer of fill to the required depth and density, as a systematic construction operation.

Unstable areas: If unstable areas develop during rolling or are identified by proof rolling, open up, dry back and recompact, to the requirements of this worksection. If dry back is not possible, remove for the full depth of layer, dispose of and replace with fresh material.

Minimum relative compaction table

Item description	Minimum dry density ratio (modified compaction) to AS 1289.5.2.1
Subbase	95%
Base	98%

Compaction requirements

General: Apply uniform compactive effort over the whole area to be compacted, until the required density is achieved or until failure is acknowledged. If failure is acknowledged, conform to **Rectification**.

Equipment: Use rollers appropriate to the materials and compaction requirements documented.

Moisture content

General: During spreading and compaction, maintain material moisture content within the range of -2% to +1% from the optimum moisture content (modified compaction).

Spraying: Use water spraying equipment to distribute water uniformly, in controlled quantities, over uniform lane widths.

Dry back: Allow materials to dry to 60 to 80% of the optimum moisture content before applying the seal or wearing course.

Rectification

General: If a section of the pavement material fails to meet the required density or moisture content after compaction, remove the non-conforming material, dispose of off-site or rectify for re-use, replace with fresh material, and re-compact.

Level corrections

General: Rectify incorrect levels as follows:

- High areas: If the area can be rectified by further trimming to produce a uniform, hard surface by cutting without filling, trim so that the rectified area conforms to **TOLERANCES**.
- Low areas and high areas not rectifiable by further trimming: Remove layers to a minimum depth of 75 mm, lightly tyne and replace with new material and re-compact.

3.5 TESTING

Site tests

Compaction control tests: To AS 1289.5.4.1 and AS 1289.5.4.2.

Frequency of compaction control tests: Not less than the following (whichever requires the most tests):

- 1 test per layer per 100 lineal metres for two-lane roads.
- 1 test per layer per 2000 m^2 for carparks.
- 3 tests per layer.
- 3 tests per visit.

0275 PAVING – MORTAR AND ADHESIVE BED

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide paving, as documented.

Performance
Requirements:
- Consistent in colour and finish.
- Firmly bonded to substrates for the expected life of the installation.
- Resistant to expected impacts in use.
- Set out with joints accurately aligned in both directions.
- To direct all water flowing from supply points to drainage outlets without leakage to the substrate or adjacent areas.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:
- *0171 General requirements*.

1.3 STANDARDS

Slip resistance
Classification: To AS 4586.

1.4 INTERPRETATION

Definitions
General: For the purposes of this worksection the following definitions apply.
- Absolute level tolerance: Maximum deviation from design levels.
- Adhesives - cementitious (C): Adhesive in which the binders are hydraulic, e.g. General purpose cement, with aggregates and organic additives.
- Bedding: Mixtures of materials which are applied to substrates in a plastic state and which dry, cure and adhere tiles to substrates:
  . Adhesive bedding: Paving/tiling adhered by adhesives.
  . Mortar bedding: Paving/tiling adhered in a cementitious mortar bed.
- Lippage: Height deviation between adjacent units.
- Pavers: Units made from clay, stone, precast concrete, ceramic, terrazzo and/or other inorganic raw materials, generally over 20 mm thick, used as coverings for horizontal surfaces. Larger pavers are often referred to as flags.
- Relative level tolerance: Maximum deviation from a 3 m straightedge laid on the surface.
- Substrate: The surface to which a material or product is applied.

1.5 TOLERANCES

Completed paving
Lippage:
- Unpolished pavers: Less than 2 mm.
- Polished pavers 300 x 300 mm or less: 1 mm, with 5% not exceeding 1.5 mm.
- Polished pavers over 300 x 300 mm: 1.5 mm, with 5% not exceeding 2 mm.

Paving surface level tolerances table

Item	Level tolerance	
	Absolute	**Relative**
Vehicular pavements	± 5 mm	5 mm
Pedestrian pavements	± 10 mm	10 mm

1.6 SUBMISSIONS

Execution details

Grouting: Submit proposals for grouting methods and materials.

Margins: If it appears that minor variations in joint widths or overall dimensions will avoid cut pavers, submit a proposal.

Operation and maintenance manuals

General: Submit a manual describing care and maintenance of the paving, including procedures for maintaining the slip-resistance grading stating the expected life of the slip-resistance grade.

Products and materials

Product conformity: Submit current assessments of conformity as follows:

- Marking and classification of adhesive to AS ISO 13007.1.

Type tests: Submit results, as follows:

- Slip resistance of pavers.
- Accelerated wear test of pavers.
- Stone paver properties.

Samples

General: Submit labelled samples of pavers, grout and sealants, illustrating the range of variation in colour and finish.

Sample panel: Prepare a sample panel of each type of finish as follows:

- Size: ≥ 2 m^2.
- Include samples of junction details and trim.
- Preserve each panel until related work is complete.

Sample panel location: Hassall street footpath and plaza

Tests

Site tests: Submit results, as follows:

- Slip resistance of completed installation.
- Stone paver properties tests.
- Salt efflorescence of paver prototype testing.

1.7 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- Substrate immediately before paving.
- Trial set-outs before execution.
- Control joints before sealing and grouting.

2 PRODUCTS

2.1 ADHESIVES

General

Standard: To AS ISO 13007.1.

Type

General: Provide adhesives compatible with the materials and surfaces to be adhered.

Prohibited uses: Do not provide the following combinations:

- Organic PVC-based adhesives and organic natural rubber latex adhesives in damp or wet conditions.
- PVA (polyvinyl acetate) based adhesives in wet areas or externally.

2.2 MORTAR

Materials

Cement: To AS 3972.

- Type: GP.
- Iron salt content:
  - . White cement: ≤ 1%.
  - . Off-white cement: ≤ 2.5%.

Lime: To AS 1672.1.

Sand: Fine aggregate with a low clay content selected for grading, sharp and free from efflorescing salts.

Water: Clean and free from any deleterious matter.

Measurement of volume: Measure binders and sand by volume using buckets or boxes. Do not allow sand to bulk by absorption of water.

Bedding mortar

Mix proportion (cement:sand): Select from the range 1:3 to 1:4 to obtain satisfactory adhesion. Provide minimum water.

Mixing: To AS 3958.1 clause 2.15.

Gauging: Site gauged by volume.

2.3 GROUT

Type

Portland cement based grout: Mix with fine sand. Provide minimum water to achieve workability.

- Mix proportion (cement:sand): 1:3.

Pigments

Pigments for coloured grout: Provide colourfast pigments compatible with the grout material. For cement-based grouts, provide inorganic mineral pigments or lime-proof synthetic metallic oxides compatible with cement.

Water

General: Clean and free from any deleterious matter.

2.4 PAVERS

Concrete and clay pavers

Standard: To AS/NZS 4455.2.

Application to AS/NZS 4455.2 Table 2.8

Properties: To AS/NZS 4455.2 Table 2.8.

Salt attack resistance grade to AS/NZS 4455.2 Table 2.7

Stone pavers

Description: Provide sound stone pavers of uniform quality. Reject stone pavers with any of the following defects liable to affect strength and durability:

- Vents.
- Cracks.
- Fissures.
- Seams.
- Porous inclusions.
- Foreign material.
- Loose surface material.
- Discolouration.

Matching: Select for optimum matching of colour and pattern.

Split flagging thickness: Minimum 50 mm, maximum 75 mm.

Face size: Use smaller sizes for pathways and larger sizes for open areas and maintain traditional stone flagging appearance.

Stone setts

Description: Igneous stone, cubed, cobble-style setts.

2.5 OTHER MATERIALS

Tactile ground surface indicators

Standard: To AS/NZS 1428.4.1.

Control joint types

General: As documented.

Divider strip: A proprietary expansion joint consisting of a neoprene filler sandwiched between plates with lugs or ribs for mechanical keying. Set flush with the finished surface.

Proprietary slide plate divider strip: An arrangement of interlocking metal plates grouted into pockets formed in the concrete joint edges.

Sealant: Two-pack self-levelling flexible mould resistant, one-part silicone or polyurethane sealant applied over a backing rod. Finish flush with the paver surface.

- Floors: Trafficable, shore hardness more than 35.

Backing rod: Compressible closed cell polyethylene foam with a bond-breaking surface.

3 EXECUTION

3.1 PREPARATION

Trial set-out

General: Prepare a trial paving set-out to each area as follows to:

- Maximise the size of equal margins of cut pavers.
- Locate control joints.
- Note minor variations in joint widths to eliminate cut pavers at margins.

Ambient temperature

General: If the ambient temperature is less than 5°C or more than 35°C, do not lay pavers.

Substrates

General: Make sure substrates are as follows:

- Clean and free of any deposit or finish which may impair adhesion or location of pavers.
- Projections are hacked off and voids and hollows are filled with a cement:sand mix not stronger than the substrate nor weaker than the bedding.

Drying and shrinkage: Before paving, allow at least the following times to elapse (for curing and initial shrinkage) for these substrates:

- Concrete slabs: 28 days.
- Toppings on slabs: A further 21 days.

Absorbent substrates: If suction is excessive, control it by dampening but avoid over-wetting and do not apply mortar bedding to substrates showing surface moisture.

Dense concrete: If not sufficiently rough to provide a mechanical key, roughen by scabbling or the like to remove 3 mm of the surface and expose the aggregate then apply a bonding treatment.

Fixtures

General: Before paving make sure that fixtures interrupting the surface are accurately positioned in their designed or optimum locations relative to the paving layout.

3.2 PAVING GENERALLY

Variations

General: If necessary, distribute variations in hue, colour, or pattern uniformly, by mixing pavers or paving batches before laying.

Paving joints

Joint widths: Set out pavers to give uniform joint widths of 6 to 12 mm.

Margins

General: Provide whole or purpose-made pavers at margins where practicable, otherwise set out to give equal margins of cut pavers. If margins less than half paver width are unavoidable, locate the cut pavers where they are least conspicuous.

Protection

Traffic: Keep pedestrian and vehicular traffic off paving until the bedding has set and attained its working strength.

Cleaning: Keep the work clean as it proceeds and protect finished work from damage.

3.3 MORTAR BEDDING

Preparation of pavers

Suction: Soak porous pavers in water for half an hour and then drain until the surface water has disappeared.

Bedding

General: Use bedding methods and materials which are appropriate to the paver, the substrate, the conditions of service, and which leave the paver firmly and solidly bedded in the bedding material and adhered to the substrate. Form falls integral with the substrate.

Mortar beds

Substrate preparation: Either lightly dust the screeded bed surface with dry cement and trowel level until the cement is damp, or spread a thin slurry of neat cement, on to the paver back. Do not provide mortar after initial set has occurred.

Nominal thickness: 30mm

Sandstone flagging

Mortar bed thickness: Minimum 50 mm to maximum 60 mm.

Laying pattern: Random, with smaller stones filling the gaps to produce roughly uniform joint widths. Lay flags and fill joints in one operation.

Stone setts dry bed

Description: Lay and tamp setts on to a dry sand and cement mix, compact and moisten as follows:

- Mortar bed mix proportion (cement:sand): 1:3 screeded to the level required to allow setts to be firmly tamped.
- Select the top side of the sett for surface uniformity and tap into the mix to the pre-compaction position.
- Compact with a hand ram or mechanical compactor.
- Water spray the surface and allow the bedding to harden.
- Grout joints.

3.4 ADHESIVE BEDDING

Preparation of pavers

Adhesive bedding: Fix pavers dry.

Bedding

General: Use bedding methods and materials which are appropriate to the paver, the substrate, the conditions of service, and which leave the paver firmly and solidly bedded in the bedding material and adhered to the substrate. Form falls integral with the substrate.

Thick adhesive beds

General: Provide on substrates with deviations up to 6 mm when tested with a 2 m straight edge, and with pavers having deep keys or frogs.

Nominal thickness: 6 mm.

Adhesive bedding application

General: Apply adhesive by notched trowel to substrates and direct to pavers if required, to provide evenly distributed coverage of more than 90% after laying.

Pattern of distribution of adhesive: Conform to AS 3958.1. Verify by examining one paver in ten as work proceeds.

Grouting: Allow the adhesive to cure for the period recommended by the manufacturer before grouting.

3.5 MOVEMENT JOINTS

General

Requirement: Provide control joints as follows:

- Location:
  - . Over structural control joints.
  - . At internal corners.
  - . Close to external corners in large paved areas.
  - . Around the perimeter at abutments.
  - . At junctions between different substrates.
  - . To divide large paved areas into bays, maximum 5 m wide, maximum area 16 m^2.
  - . At abutments with the building structural frame and over supporting walls or beams where flexing of the substrate is anticipated.
- Depth of joint: Right through to the substrate.
- Sealant width: 6 to 25 mm.
- Depth of elastomeric sealant: One half the joint width, or 6 mm, whichever is the greater.

3.6 GROUTED JOINTS

Grouting

General: Commence grouting as soon as practicable after bedding has set and hardened sufficiently. Clean out joints as necessary before grouting.

Face grouting: Fill the joints solid and tool flush. Clean off surplus grout and wash down as the grouting proceeds.

3.7 TESTING

Site tests

Prototype testing of cementitious tiles for salt efflorescence

Completion tests

Slip resistance of completed installation: To AS 4663.

3.8 COMPLETION

Spares

General: Supply spare matching pavers of each type for future replacement purposes. Store the spare materials on site.

Quantity: At least 1% of the quantity installed.

Cleaning

Completion: Clean progressively and leave pavements clean on completion.

4 SELECTIONS

Refer to Landscape Selections Schedule

0311 CONCRETE FORMWORK

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide formwork, as documented.

1.2 DESIGN

General

Formwork: The design of formwork, other than permanent composite form systems, is the contractor's responsibility. Allow for dimensional changes, deflections and cambers resulting from the following:

- Imposed actions.
- Concrete shrinkage and creep.
- Temperature changes.
- The application of prestressing forces (if any).

1.3 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.
- *0315 Concrete finishes*.

1.4 STANDARDS

General

Formwork design and construction: To AS 3610.1.

Plywood formwork: To AS 6669.

Composite steel-concrete construction, including profiled steel sheeting and shear connectors: To AS/NZS 2327.

Reinforced concrete construction: To AS 3600.

1.5 INTERPRETATION

Definitions

General: For the purposes of this worksection the definitions and terms given in AS 3610.1 apply.

1.6 TOLERANCES

Formwork

Plumb of elements > 8 m high: 1:1000.

Plumb of elements ≤ 8 m high: To AS 3610.1.

Position: Construct formwork so that finished concrete conforms to AS 3600 clauses 3.3 and 17.5 and as documented in the **Formwork dimensional deviation schedule**.

1.7 SUBMISSIONS

Certification

Formwork design certification: For other than permanent composite form systems, submit certification by a professional engineer experienced in formwork design verifying conformance of the design.

Formwork execution certification: Submit certification by a professional engineer experienced in formwork design and construction, verifying conformance of the completed formwork, including the suitability of the formwork for the documented surface finish class.

Design documentation

Formwork calculations: Submit calculations by a professional engineer experienced in formwork design to show that allowable concrete stresses will not be exceeded and formwork capability will be maintained if the following is proposed:

- Formwork procedures or loadings that differ from those documented.

- Props above a floor that do not coincide with the props below.
- Undocumented formwork shoring or stripping procedures.
- Loadings from stacked materials.

Execution details

Moveable formwork: Provide the following details on the formwork drawings:

- Table form and climbing formwork: Proposed method and sequence of moving the formwork to provide concrete of the documented quality and surface finish.
- Continuously climbing formwork (Slipform): The average rate of movement.

Reshoring: Submit details of any proposed reshoring.

Products and materials

Void formers: Submit test results as evidence of conformance to requirements of PRODUCTS, **MATERIALS**, **Void formers**.

Shop drawings

Formwork: Submit shop drawings including details of proposed forms, falsework, form liners, bolt positions, release agents and, where applicable, re-use of formwork.

1.8 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- Completed formwork before placing concrete.
- Used forms, after cleaning and before re-use.

2 PRODUCTS

2.1 MATERIALS

General

Form face, linings and release agents: Compatible with documented concrete surface finish and any proposed applied finishes to concrete.

Trapped forms: Free of timber or chlorides and not to impair the structural performance of the concrete members.

Void formers

Requirement: Material capable of maintaining rigidity and shape until the concrete has set, capable of withstanding construction loads and non-collapsible on absorption of moisture.

Laboratory testing: Use void formers tested under laboratory conditions for conformance with the following:

- Deflection during placing and compaction of the concrete does not exceed beam or slab span/1000.
- Additional deflection between initial set and 7 days does not exceed span/400.
- Collapse and loss of load carrying capacity occurs not more than 48 hours after flooding with water, creating a void at least 60% of the original depth of the void former.

Test method: Place formers on damp sand and load with a mass of wet concrete at least equal to the mass of the beams or slabs to be supported.

Profiled steel sheeting composite forms

Material: Hot-dipped zinc-coated sheet steel to AS 1397.

Minimum steel grade: G550.

Accessories: Use materials and corrosion protection compatible with the profiled steel sheeting.

Plywood forms

Material: To AS 6669.

Grade: Use appropriate grade for the documented design dimensions, loading and surface quality.

Joints: Seal the joints consistent with the documented surface finish class.

Tolerances: To AS 3610.1 Section 3.

3 EXECUTION

3.1 PREPARATION

Substrates
Cleaning: Before placing concrete remove free water, dust, debris and stains from the form face and the formed space.

3.2 CONSTRUCTION

General
Requirement: Conform to *0315 Concrete finishes*.

Bolt holes
Formwork tie bolts left in the concrete: Position more than 50 mm from the finished surface.

Corners
Work above ground: Bevel with a chamfer at re-entrant angles, and a fillet at corners.

Face of bevel: 25 mm.

Embedments
Fixing: Fix embedments through formwork to prevent movement, or loss of slurry or concrete, during concrete placement.

Openings
Requirement: In vertical forms provide openings or removable panels for inspection and cleaning, at the base of columns, walls and deep beams.

Access: For thin walls and columns, provide access panels for placing concrete.

Release agents
Application: Before placing reinforcement, apply a release agent to form face and linings.

Climbing formwork
Provision for inspection: Provide access below the movable formwork, from which surface treatment and inspection may be carried out.

Profiled steel sheeting composite formwork
Fixing: If sheeting cannot be fixed to structural steel supports with puddle welds, or with welded shear studs, provide details of proposed fixings.

Steel linings
Rust: Clean off any rust and apply rust inhibiting agent prior to re-use.

Visually important surfaces
Surface finish classes 1, 2 or 3: Set out the formwork to give a regular arrangement of panels, joints, bolt holes, and similar visible elements in the formed surface.

Void formers
Protection: Keep void formers dry until use, install on a firm level surface and place reinforcement and concrete with minimum delay.

3.3 COMPLETION

Formwork removal
Extent: Remove formwork, other than permanent forms and trapped forms, including formwork in concealed locations.

Timing: Do not disturb formwork until concrete has reached sufficient hardness to withstand formwork movements and removal without damage.

Stripping:

- General: To AS 3600 where it is more stringent than AS 3610.1.
- Vertical formwork: To AS 3610.1 Appendix C Table C2.
- Multi-storey work: Remove formwork without disturbing props supporting succeeding floors.
- Post-tensioned concrete: Remove formwork supporting post-tensioned concrete members to AS 3600 clause 17.6.2.7.

Removable bolts: Remove tie bolts without damaging the concrete.

Bolt hole filling: Provide material with durability and colour matching the concrete.

Recessed filling: Fill or plug the hole to 6 mm below the finished surface.

Curing: If formwork is stripped before the minimum curing period for the concrete has elapsed, continue curing the exposed faces as soon as the stripping is completed.

4 SELECTIONS

Refer to Landscape Selections Schedule

0314 CONCRETE IN SITU

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide concrete in situ, as documented.

Performance

Requirements:

- Conforming to the design details and performance criteria.
- Satisfying the quality and inspection requirements.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0171 General requirements*.
- *0311 Concrete formwork*.
- *0312 Concrete reinforcement*.
- *0315 Concrete finishes*.

1.3 STANDARDS

General

Reinforced concrete construction: To AS 3600.

Specification and supply of concrete: AS 1379.

Concrete structures for retaining liquids: To AS 3735.

Design, installation and testing of post-installed and cast-in fastenings: To AS 5216.

1.4 INTERPRETATION

Definitions

General: For the purposes of this worksection the following definitions apply:

- Ambient temperature: The air temperature at the time of mixing and placing of concrete.
- Average ambient temperature: Average value of the daily maximum and minimum ambient temperatures over the defined period at a site.
- Batch: A quantity of concrete containing a fixed amount of ingredients and produced in a discrete operation.
- Concrete class – normal: Concrete that is specified primarily by a standard compressive strength grade up to 50 MPa and otherwise in conformance with AS 1379 clause 1.5.3.
- Concrete class – special: Concrete that is specified to have certain properties or characteristics different from, or additional to, those of normal-class concrete and otherwise in conformance with AS 1379 clause 1.5.4.
- Early age strength: A mean compressive strength at 7 days exceeding the values shown in AS 1379 Table 1.2.
- Green concrete: Concrete which has recently set but has not achieved any design strength.
- Production assessment: An assessment procedure for concrete defined by strength grade, carried out by the supplier and based on the statistical assessment of standard compressive strength tests on concrete, specified by compressive strength and produced by a specific supplying plant.
- Project assessment: An assessment procedure for concrete defined by strength grade, specified at the customer's option, which provides additional test data for the statistical assessment of concrete supplied to a specific project.
- Sample: A physical example that illustrates workmanship, materials or equipment, and establishes standards by which the work will be judged. It includes samples, prototypes and sample panels.
- Specimen: A portion of a sample which is submitted for testing.

- Weather – cold: Ambient shade temperature less than 10°C.
- Weather – hot: Ambient shade temperature greater than 30°C.

1.5 SUBMISSIONS

Execution details

Loading: Submit details of proposed construction systems, loads and procedures, including propping and re-shoring.

Concrete: Submit proposals for mixing, placing, finishing and curing concrete including the following:

- Changes to the concrete mix.
- Curing and protection methods.
- Curing period for low-pressure steam curing.
- Cutting or displacing reinforcement, or cutting or coring hardened concrete.
- Handling, placing, compaction and finishing methods and equipment, including pumping.
- Placing under water.
- Sequence and times for concrete placement, and construction joint locations and relocations. Include any proposed sequential placement of slab segments.
- Site storage, mixing and transport methods and equipment, if applicable.
- Temperature control methods.
- Sawn joints: Submit details of proposed methods, timing and sequence of sawing joints.

Pre-mixed supply delivery dockets: For each batch, submit a docket listing the information required by AS 1379, and the following:

- For special-class performance concrete: Documented performance and type of cement binder.
- For special-class prescription concrete: Details of mix, additives, and type of cement binder.
- Method of placement and climate conditions during pour.
- Name of concrete delivery supervisor.
- Project assessment carried out each day.
- The concrete element or part of the works for which the concrete was ordered, and where it was placed.
- The total amount of water added at the plant and the maximum amount permitted to be added at the site.

Products and materials

Product conformity: Submit evidence of conformity, as appropriate, as follows:

- Certification by a JAS-ANZ accredited third party.
- Report by an accredited testing laboratory describing tests and giving results which demonstrate that the product conforms.

Concrete mixes: Submit details, for each grade and type of concrete including any proposed use of special-purpose cement types.

Curing compounds: Submit details of any proposed curing compounds, including the following:

- Certified test results for water retention to AS 3799 Appendix B for liquid membrane-forming compounds.
- Evidence of compatibility with concrete, and with applied finishes including toppings and render, if any, including methods of obtaining the required adhesion.
- For visually important surfaces, evidence that an acceptable final surface colour will be obtained.

Admixtures: Submit details of any proposed admixtures, including the following:

- Brand name.
- Place of manufacture.
- Basic chemical composition.

Samples

Coloured concrete: Submit sample blocks of coloured concrete produced using the proposed mix and casting method before casting final concrete, as follows:

- Number: 4.
- Size (nominal): 300 x 300 x 50 mm.

Shop drawings

Cores, fixings and embedded items: Submit the proposed locations, clearances and cover and show any proposed repositioning of reinforcement.

Subcontractors

Pre-mixed supply: Submit names and contact details of proposed pre-mixed concrete suppliers and alternative source of supply in the event of breakdown of pre-mixed or site mixed supply.

Tests

Requirement: Submit test results, as follows:

- Concrete compressive strength test results to AS 1012.9.
- Other concrete properties: Test results as documented in the **Tests schedule**.

1.6 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- Base or subgrade before covering.
- Membrane or film underlay installed on the base or subgrade.
- Completed formwork and reinforcement, tendons, cores, fixings and embedded items fixed in place before placing concrete.
- Concealed surfaces or elements before covering.
- Commencement of concrete placing.

2 PRODUCTS

2.1 CONCRETE

General

Stockpile: If uniform, consistent colour is documented, stockpile sand, cement and aggregates.

Properties

Concrete mix and supply: Conform to the following:

- Normal-class: To AS 1379 clause 1.5.3.
  - . Properties: As documented in the **Concrete properties schedule - performance**.
- Special-class: To AS 1379 clause 1.5.4.
  - . Performance properties: As documented in the **Concrete properties schedule - performance**.
  - . Prescription properties: As documented in the **Concrete properties schedule - prescription**.

Aggregates

Standard: To AS 2758.1.

Cement

Standard: To AS 3972.

Age: Less than 6 months old.

Storage: Store cement bags under cover and above ground.

Supplementary cementitious materials:

- Fly ash: To AS/NZS 3582.1.
- Slag: To AS 3582.2.
- Amorphous silica: To AS/NZS 3582.3.

Water

Standard: To AS 1379 clause 2.4.

Requirement: Clean, free from oil, acid, alkali, organic or vegetable matter and including not more than 500 mg/l of chloride ions.

Coloured concrete

Standard: To AS 3610.1.

Chemical admixtures

Standard: To AS 1478.1, used to manufacturer's recommendations.

2.2 MISCELLANEOUS

Polymeric film underlay
Vapour barriers and damp-proofing membranes: To AS 2870 clause 5.3.3.

Curing compounds
Liquid membrane-forming compounds: To AS 3799.

3 EXECUTION

3.1 POLYMERIC FILM UNDERLAY

Location
Requirement: Under slabs on ground, including integral ground beams and footings, provide a vapour barrier or, in areas prone to rising damp or salt attack, a damp-proofing membrane.

Base preparation
Requirement: Conform to base type, as follows:

- Concrete working base: Remove projections above the plane surface, and any loose material.
- Graded prepared subgrade: Blind with sand to create a smooth surface free from hard projections. Lightly wet the sand just before laying the underlay.

Installation
Standard: To AS 2870 clause 5.3.3.

Requirement: Lay underlay over the base, as follows:

- Lap joints at least 200 mm and seal the laps and penetrations with waterproof adhesive tape.
- Face the laps away from the direction of concrete pour.
- Continue up vertical faces past the damp-proof course where applicable, and tape fix at the top.
- Patch or seal punctures or tears before placing concrete.
- Cut back as required after concrete has gained strength and formwork has been removed.

3.2 CONCRETE SUPPLY

Elapsed delivery time
General: Make sure that the elapsed time between the wetting of the mix and the discharge of the mix at the site is in conformance with the **Elapsed delivery time table**. Do not discharge at ambient temperature below 10°C or above 30°C unless approved heating or cooling measures are taken to deliver concrete within the range 5°C to 35°C.

Elapsed delivery time table

Concrete temperature at time of discharge (°C)	Maximum elapsed time (minutes)
5 – 24	120
24 – 27	90
27 – 30	60
30 – 35	45

Pre-mixed supply
Addition of water: To AS 1379 clause 4.2.3.

Transport method: Select to prevent segregation, loss of material and contamination of the environment, and not to adversely affect placing or compaction.

Site mixed supply
Emergencies: If mixing by hand, provide details.

Plant: Mix concrete in plant located on the construction site.

3.3 TESTING

General
Test authority: Concrete supplier or an Accredited Testing Laboratory.

Reports and records of test results: To the relevant parts of the AS 1012 series. Keep results on site.

Assessment process of test results
Standard: To AS 1379.

Method of assessment: Project assessment.

Sampling

Method of sampling: AS 1012.1.

Sampling locations: To AS 1012.1 and the following:

- Slump tests: On site, at the point of discharge from the agitator.
- Compressive strength tests: Spread the site sampling evenly throughout the pour.

Frequency of sampling: To AS 1379 Sections 5 and 6 and the following:

- Slump tests: Take at least one sample from each batch.
- Compressive strength tests: To the **Project assessment strength grade sampling table.**

Project assessment strength grade sampling table

Number of batches for each type and grade of concrete per day	Minimum number of samples: Columns and load bearing wall elements/batch	Minimum number of samples: Other elements/day
1	1	1
2-5	1	2
6-10	1	3
11-20	1	4
each additional 10	1	1 additional

Making and curing of specimens

General: To AS 1012.8.1 and AS 1012.8.2.

Specimens for compressive strength tests: Make and cure at least two specimens from the sample of each grade.

Specimen size:

- Aggregate size ≤ 20 mm: Nominally 200 x 100 mm diameter.
- Aggregate size > 20 mm: Nominally 300 x 150 mm diameter.

Test methods

General: To the relevant parts of the AS 1012 series.

Acceptance criteria:

- General: As documented in the **Concrete properties schedule – performance**.
- Early age compressive strength: As documented in the **Control tests schedule**.

Drying shrinkage at 56 days: To AS 1012.8.4 and AS 1012.13.

Other concrete properties tests: As documented in the **Tests schedule**.

Liquid retaining structures

Testing for liquid tightness: To AS 3735.

3.4 CORES, FIXINGS AND EMBEDDED ITEMS

General

Requirement: Install fasteners to manufacturer's recommendations and the assumptions of AS 5216 Appendix D.

Adjoining elements

Fixings: Provide fixings for adjoining elements. If required, provide temporary support to the adjoining elements during concreting, to prevent movement.

Protection

General: Grease threads. Protect embedded items against damage.

Compatibility: Provide inserts, fixings and embedded items that are compatible with each other, with the reinforcement and with the documented concrete mix and surface finish.

Corrosion: In external or exposed locations, galvanize anchor bolts and embedded fixings.

Structural integrity

Position: Fix cores and embedded items to prevent movement during concrete placement. In locating cores, fixings and embedded items, displace but do not cut reinforcement, and maintain documented cover to reinforcement.

Isolation: Isolate embedded items to prevent water tracking to concrete that provides minimum cover to reinforcement.

Tolerances

General: Maximum deviation from correct positions:

- Anchor bolt groups for structural steel: To AS/NZS 5131.
- Cores and embedded items generally: 10 mm.
- Other fixing bolts: 3 mm.

3.5 CONCRETE WORKING BASE

Finish

Membrane support: Wood float finish or equivalent.

Installation

General: Lay over the base or subgrade and screed to the required level.

Surface flatness tolerance

Maximum deviation: 6 mm from a 3 m straightedge.

3.6 PLACING AND COMPACTION

Placing

Horizontal transport: Use suitable conveyors, clean chutes, troughs, hoppers or pipes.

Methods: Avoid segregation and loss of concrete, and minimise plastic settlement. Maintain a nominally vertical and plastic concrete edge during placement.

Horizontal elements: Place concrete in layers not more than 300 mm thick. Compact the following layer into previous layer before previous layer has taken initial set.

Compaction

Methods: Use immersion and screed vibrators accompanied by hand methods as appropriate to remove entrapped air and to fully compact the mix.

Vibrators: Do not allow vibrators to contact set concrete, reinforcement or items including pipes and conduits embedded in concrete. Do not use vibrators to move concrete along the formwork. Avoid causing segregation by over-vibration.

Placing records

Log book: Keep on site and make available for inspection a log book recording each placement of concrete, including the following:

- Date.
- Specified grade and source of concrete.
- Slump measurements.
- The portion of work.
- Volume placed.

Rain

Protection: During placement and before setting, protect the surface from damage.

Time between adjacent placements

Minimum time delay: As documented in the **Minimum time delay schedule.**

Vertical elements

Placement: Limit the free fall of concrete to maximum of 2000 mm.

Placing in cold weather

Cement: Do not use high alumina cement.

Temperature limits: Maintain the following:

- Freshly mixed concrete: ≥ 5°C.
- Forms and reinforcement before and during placing: ≥ 5°C.
- Water: Maximum 60°C when placed in the mixer.

High early strength cement: If deteriorating weather conditions are predicted, use high early strength cement.

Temperature control: Heat the concrete materials, other than cement, to the minimum temperature necessary so that the temperature of the placed concrete is ≥ 5°C.

Admixtures: Do not use calcium chloride, salts, chemicals or other material in the mix to lower the freezing point of the concrete.

Frozen materials: Do not allow frozen materials or materials containing ice to enter the mixer, and keep free of frost and ice any forms, materials, and equipment coming in contact with the concrete.

Freezing: Prevent concrete from freezing.

Placing in hot weather

Handling: Prevent premature stiffening of the fresh mix and reduce water absorption and evaporation losses.

Temperature limits: Maintain the following:

- Normal concrete in footings, beams, columns, walls and slabs: ≤ 35°C.
- For concrete strength grade less than 40 MPa with section thickness ≥ 1 m in all dimensions: ≤ 27°C.
- For concrete strength grade 40 MPa or greater with section thickness ≥ 600 mm in all dimensions: ≤ 27°C.
- Forms and reinforcement before and during placing: ≤ 35°C.

Evaporation control barriers: Erect barriers to protect freshly placed concrete from drying winds.

Temperature control: Select one or more of the following methods of maintaining the temperature of the placed concrete at 35°C or less:

- Cool the concrete using liquid nitrogen injection before placing.
- Cover horizontal transport containers.
- Spray the coarse aggregate using cold water before mixing.
- Use chilled mixing water.

Placing under water

General: Do not place under water unless conditions prevent dewatering.

Minimum cement content for the mix: Increase by 25%.

3.7 JOINTS

Construction joints

Location: Do not relocate or eliminate construction joints, or form undocumented construction joints. If emergency construction joints are made necessary by unforeseen interruptions to the concrete pour, submit a report on the action taken.

Finish: Butt join the surfaces of adjoining pours. In visually important surfaces make the joint straight and true, and free from blemishes impermissible for its surface finish class.

Preparation: Roughen and clean the hardened concrete joint surface. Remove loose or soft material, free water, foreign matter and laitance. Dampen the surface just before placing the fresh concrete and coat with a neat cement slurry.

Expansion joints

Joint filling: Fill with jointing materials as documented. Finish visible jointing material neatly, flush with adjoining surfaces.

Preparation: Before filling, dry and clean the joint surfaces, and prime.

Watertightness: Apply the jointing material so that joints subject to ingress of water are made watertight.

Jointing materials: Provide jointing materials compatible with each other, and non-staining to concrete in visible locations.

Bond breaking: Provide back-up materials for sealants, including backing rods, which do not adhere to the sealant.

Foamed materials (in compressible fillers): Closed-cell or impregnated, not water absorbing.

Slip joints

Requirement: If concrete slabs are supported on masonry, provide proprietary slip joints.

3.8 CURING

General

Requirements: Taking into account the average ambient temperature at site over the relevant period affecting the curing, adopt procedures to make sure of the following:

- Curing: Cure continuously from completion of finishing, when the concrete has set sufficiently not to be damaged by the curing process, until the minimum total cumulative number of days or fractions of days, during which the air temperature in contact with the concrete is above 10°C, conforms to the following, unless accelerated curing is adopted:
  - . Fully enclosed internal surfaces/Early age strength concrete: 3 days.
  - . Other concrete surfaces: 7 days.
- End of curing period: Prevent rapid drying out at the end of the curing period.
- Protection: Maintain at a reasonably constant temperature with minimum moisture loss, during the curing period.

Curing compounds

Liquid membrane-forming compounds: Provide a uniform continuous flexible coating without visible breaks or pinholes, which remains unbroken for at least the required curing period after application.

Substrates: Do not use wax-based or chlorinated rubber-based curing compounds on surfaces forming substrates to applied finishes, concrete toppings and cement-based render.

Self-levelling toppings: If used also as curing compounds, conform to AS 3799.

Visually important surfaces: Apply curing compounds to produce uniform colour on adjacent surfaces.

Cold weather curing

Temperature: Maintain concrete surface temperatures above 5°C for the duration of the curing period.

Hot weather curing

Requirement: If the concrete temperature exceeds 25°C, or the ambient shade temperature exceeds 30°C, protect from drying winds and sun by using an evaporative retarder until curing is commenced.

Water curing

Method: Select a method of ponding or continuously sprinkling to prevent damage to the concrete surface during the required curing period.

3.9 COMPLETION

Protection

General: Protect the concrete from damage due to construction loads, physical and thermal shocks, and excessive vibrations, particularly during the curing period.

Surface protection: Protect finished concrete surfaces and applied finishes from damage.

4 SELECTIONS

4.1 SCHEDULES

Refer to Landscape Selections Schedule

0315 CONCRETE FINISHES

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide finishes to formed and unformed concrete surfaces, as documented.

Performance
Requirement: Compatible with documented applied finishes.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:

- *0171 General requirements*.

1.3 STANDARDS

General
Formed surfaces: To AS 3610.1.

Slip resistance
Classification: To AS 4586.

1.4 INTERPRETATION

Definitions
General: For the purposes of this worksection the following definition applies:

- Green concrete: Concrete which has recently set but has not achieved any design strength.

1.5 TOLERANCES

Formed surfaces
Finish quality: To AS 3610.1 Table 3.3.3.1.

Unformed surfaces
Flatness: To the **Flatness tolerance class table,** using a straightedge placed anywhere on the surface in any direction, for the documented class of finish.

Flatness tolerance class table

Class	Measurement	Maximum deviation (mm)
A	2 m straightedge	4
B	3 m straightedge	6
C	600 mm straightedge	6

1.6 SUBMISSIONS

Execution details
Surface repairs: If surface repairs are required, submit proposed methods.

Prototypes
Test panels: Provide test panels to AS 3610.1 clause 3.7 and as documented in the **Test panels schedule**.

Manufacture: Cast the panels using the form, concrete, compaction equipment, form release agents, curing and formwork removal methods which are to be used in the final work.

Storage: Once accepted, maintain the panels on site undamaged and protected from the weather, as reference prototypes for evaluation of completed work.

Surface treatment: Do not proceed with the related work until the acceptable range of surface treatments has been determined.

Tests
Site tests: Submit test results, as follows:

- Slip resistance test of completed installations.

1.7 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- Completed formwork before placing concrete.
- Evaluation of the off-form finishes.
- Evaluation of surface finish.

2 PRODUCTS

2.1 MATERIALS

Surface modifiers

Hardeners, sealants and protectors: If documented, proprietary products conforming to the manufacturer's recommendations.

Slip resistance treatment: If documented, proprietary products conforming to the manufacturer's recommendations.

3 EXECUTION

3.1 SURFACE MODIFIERS

General

Application: Apply to clean surfaces, to the manufacturer's recommendations.

3.2 FORMED SURFACES

General

Surface finish: As documented in the **Surface finish class schedule** and the **Formed surface finishes schedule.**

Damage: Do not damage concrete works through premature removal of formwork.

Curing

Requirement: If formwork is stripped before the minimum curing period for the concrete has elapsed, continue curing the exposed faces as soon as the stripping is completed.

Evaluation of formed surfaces

General: If evaluation of formed surface is required, complete the evaluation before surface treatment.

Finishing methods

Requirement: If soffits of horizontal concrete elements or faces of vertical concrete elements are to have a finish other than an off-form finish, provide finishes as documented.

Form removal: If vertical face formwork needs to be removed for finishing methods, while the concrete is green, make sure the concrete has sufficiently set to prevent slump.

Blasted finishes:

- Abrasive: Blast the cured surface using hard, sharp graded abrasive particles until the coarse aggregate is in uniform relief.
- Light abrasive: Blast the cured surface using hard, sharp graded abrasive particles to provide a uniform matt finish without exposing the coarse aggregate.

Bush hammered finish: Remove the minimum matrix using bush hammering to expose the coarse aggregate, recessing the matrix no deeper than half the aggregate size, to give a uniform texture.

Exposed aggregate finish: While the concrete is green, wet the surface and scrub with stiff fibre or wire brushes, flushing continuously with clean water, until the aggregate is uniformly exposed. Do not use acid etching. Rinse the surface with water.

Floated finishes:

- Sand floated finish: While the concrete is green, wet the surface and rub using a wood float. Rub fine sand into the surface until a uniform colour and texture are produced.

- Grout floated finish: While the concrete is green, dampen the surface and spread a slurry, using hessian pads or sponge rubber floats. Remove surplus slurry and work until a uniform colour and texture are produced.

Smooth rubbed finish: While the concrete is green, wet the surface and rub using a carborundum or similar abrasive brick until a uniform colour and texture are produced.

3.3 UNFORMED SURFACES

General

Surface finish: As documented in the **Unformed surface finishes schedule**.

Finished levels: Strike off, screed and level slab surfaces to finished levels and to the flatness tolerance class documented.

Finishing methods – primary finish

Machine float finish:

- After levelling, consolidate the surface using a machine float.
- Cut and fill and refloat immediately to a uniform, smooth, granular texture.
- Hand float in locations inaccessible to the machine float.

Steel trowel finish: After machine floating, finish as follows:

- Use power or hand steel trowels to produce a smooth surface relatively free from defects.
- When the surface has hardened sufficiently, re-trowel to produce the final consolidated finish free of trowel marks and uniform in texture and appearance.

Burnished finish: Continue steel trowelling until the concrete surface attains a polished or glossy finish, uniform in texture and appearance, and free of trowel marks and defects.

Wood float finish: After machine floating, use wood or plastic hand floats to produce the final consolidated finish free of float marks and uniform in texture and appearance.

Broom finish: After machine floating and steel trowelling use a broom or hessian belt drawn across the surface to produce a coarse even-textured transverse-scored surface.

Scored or scratch finish: After screeding, use a stiff brush or rake drawn across the surface before final set, to produce a coarse scored texture.

Sponge finish: After machine floating and steel trowelling, use a damp sponge to wipe the surface to produce an even textured sand finish.

Exposed aggregate finish: After floating and when concrete has stiffened, wet the surface and scrub with stiff fibre or wire brushes, flushing continuously with clean water, until the aggregate is uniformly exposed. Rinse the surface with water.

Finishing methods – supplementary finish

Abrasive blast: After steel trowelling, abrasive blast the cured surface to provide texture or to form patterns without exposing the coarse aggregate, using hard, sharp graded abrasive particles.

Coloured applied finish: After machine floating, apply a proprietary liquid or dry shake material to the manufacturer's recommendations and trowel to achieve the required appearance.

Stamped and coloured faux paved or cobblestone finish: Provide a proprietary finishing system.

Polished finish: After steel trowelling, grind the cured surface of the concrete.

3.4 TESTING

Completion tests

Slip resistance of completed installation: To AS 4663.

4 SELECTIONS

Refer to Landscape Selections Schedule

0321 PRECAST CONCRETE

1 GENERAL

1.1 RESPONSIBILITIES

General
Responsibility: Provide precast concrete elements, as documented.

Performance
Requirement: Conform to the following:
- Fabricated in conformance with the shop drawings.
- Designed and certified by a professional engineer.
- Designed to conform to the documented performance requirements.
- Designed for handling, transport and erection.
- Undamaged by handling and installation.
- Certified by a professional engineer after erection.

Design
Structural design: To AS 3600 and BCA B1.1.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:
- *0171 General requirements*.
- *0313 Concrete post-tensioned*.

1.3 STANDARDS

General
Precast elements: Conform to the recommendations of NP PCH (Precast concrete handbook).

Materials, components and equipment for manufacture: To AS 3850.1.

Planning, design, construction, casting, transportation, erection and installation: To AS 3850.2.

Precast flooring systems: To AS 3600.

Design, installation and testing of post-installed and cast-in fastenings: To AS 5216.

1.4 INTERPRETATION

Definitions
General: For the purposes of this worksection the definitions given in AS 3850.1 clause 1.4 and the following apply:
- Precast concrete: Concrete building elements, cast in moulds and cured away from the final structural position, and then transported, lifted and fixed into position.

1.5 TOLERANCES

General
Position of reinforcement and tendons: To AS 3600 clause 17.5.3.

Manufacturing, installation, fixings and embedded items tolerance for precast elements: To AS 3610.1 Table 3.3.6.2 and AS 3850.2 clause 2.11.

1.6 SUBMISSIONS

Certification
Design: Provide independent certification by a professional engineer of conformance of the design to project criteria.

Design documentation
Calculations: Submit structural performance calculations.

Execution details
Panel casting: Submit panel casting checklist.

Manufacturer's details: Submit name, contact details and credentials of proposed manufacturer of precast elements.

Safe work method statement: Prepare a safe work method statement specific to the project for the precast erection and submit on request.

Erection documentation: Submit lifting device locations and specification including marking plans and shop drawings.

Early lifting: If it is proposed to lift the precast elements by their designated lifting points before 28 day strength has been achieved, submit evidence to demonstrate that the element has adequate strength to carry its own weight without damage or residual cracking or deflection on removal of the lifting device.

Lifting and handling equipment: Submit details of proposed equipment along with qualifications and training of the operating personnel in the form of a qualification register.

Products and materials

Protective coating details: Submit proposals for protective coatings to exposed metallic components to AS 2312.1 or AS/NZS 2312.2 with regard to site-specific corrosivity zoning.

Colour: Provide details of method of achieving the selected colour including details of the type and colour of the cement, sand and aggregates as well as colouring oxide pigments or stain.

Proprietary inserts: Submit proprietary documentation for any lifting, bracing or fixing inserts. Include make, type and working load limit.

Non-proprietary inserts: Submit certificate from a professional engineer certifying the working load limit.

Concrete mix: Submit concrete mix details including the proportions and source of the constituents, admixtures, release agents and curing compounds.

Prototypes

Requirement: Provide prototypes as documented in the **Prototypes schedule**.

Manufacture: Cast the prototype elements using the formwork, concrete, compaction equipment, form release agents, curing and formwork removal methods which are to be used in the final work.

Prototype storage: Maintain prototypes on site, undamaged and protected from discolouration for comparison with manufactured precast elements.

Prototype use: Use prototypes in the works if they conform with the structural drawings.

Samples

Surface finish: Submit samples for texture and colour.

Sample size: 500mm x500mm

Shop drawings

Precast concrete drawings: Submit shop drawings of architectural and structural precast concrete elements showing the proposed details for their design, manufacture, assembly, transport and installation, including the following:

- Project title and manufacturer's name.
- Marking plans and elevations referenced to the building grids and floors to locate each precast element.
- Shape or profile drawings (submit these before fabrication of moulds and tooling).
- Concrete mix and type of cement if special-class concrete.
- Locations, sizes, details, materials, ductility and stress grades of tendons and reinforcement.
- Locations, sizes, details, materials, corrosion protection and grades of cast-in ferrules, locating plates and angles, cut outs and openings, bolts, anchors and lifting devices.
- Cast-in services.
- Site fitments.
- Details of all joints caulking, baffles and waterproofing.
- Surface finish class and surface treatment, if applicable.
- Curing and protection methods.
- Weight of precast elements.
- Calculated maximum loading on lifting and bracing inserts and attachments.

- Equipment and methods for handling, transport and installation, including lifting inserts and pick-up points.
- Evidence of load capacity of lifting and bracing inserts and attachments in the form of test reports or calculations.
- Specification of plugs for sealing recesses for cast-in fixings.

Tests

Lifting inserts and attachments for precast elements: Submit test results.

Structural performance: Submit test results of prior testing for static load tests.

1.7 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- Formwork dimensions and stability.
- Panel edge details and penetrations.
- Connection materials and inserts in place.
- Reinforcement and/or prestressing tendons in place.
- Concreting.
- First precast element of each type at the earliest possible time before and immediately after stripping.
- Stripping and storage.
- Site erection including fixings and any in in situ topping.
- Installed temporary bracing.
- Final structure before removal of temporary bracing.

2 PRODUCTS

2.1 MATERIALS

General

Standard: To AS 3850.1.

Stockpile: If uniform, consistent colour is documented, stockpile sand, cement and aggregates.

Aggregates

Standard: To AS 2758.1.

Cement

Standard: To AS 3972.

Age: Less than 6 months old.

Storage: Store cement bags under cover and above ground.

Type: Do not use high alumina cement.

Water

Standard: To AS 1379 clause 2.4.

Requirement: Clean, free from oil, acid, alkali, organic or vegetable matter and including not more than 500 mg/l of chloride ions.

Other

Chemical admixtures: To AS 1478.1, used to manufacturer's recommendations.

Pigments: As follows:

- Chemically inert.
- Alkaline resistant.
- Insoluble.
- Light-fast.

Reinforcement

Standard: To AS/NZS 4671.

Surface condition: Free of loose mill scale, rust, oil, grease, mud or other material which would reduce the bond between the reinforcement and concrete.

Structural welding: To AS/NZS 1554.3.

Corrosion: Protect from corrosion in conformance with AS 3600 clause 17.2.1.2.

Prestressing tendons

Standard: To AS/NZS 4672.1.

Type: 7 wire, stress relieved, high tensile steel and strand.

Prestressing hardware: To AS 3600.

Welding tendons: Do not weld prestressing tendons.

Post-tensioning bars/tendons

Requirements: To *0313 Concrete post-tensioned*.

2.2 PRECAST CONCRETE

General

Concrete: To AS 3600 and AS 1379.

Testing: To the AS 1012 series.

Durability

Concrete cover: To AS 3600 clause 4.10.

Strength

Flexural strength required at lifting to AS 3850.2:

Finishes

Refer to Landscape Material Selection Schedule.

2.3 GROUTS AND MORTARS

General

Grout duct size: Large enough to provide erection tolerance and clearance for grout flow.

Post-tensioning grout: Conform to the *0313 Concrete post-tensioned* worksection.

2.4 CAST-IN ITEMS

Fixings and embedded items

Compatibility: Provide inserts, fixings and embedded items that are compatible with each other, with the reinforcement and with the documented concrete finish.

Corrosion: In external or exposed locations, galvanize anchor bolts and embedded fixings.

2.5 MISCELLANEOUS

Bearing pads

Selections and testing: To AS 5100.4.

Flashings

Standard: To AS/NZS 2904.

Sealants

Compression-seals: Polyethylene or polyurethane foam strip.

3 EXECUTION

3.1 PRECAST ELEMENTS

Marking

Precast element identification: Include the following:

- Plank thickness (mm).
- Number of strands.
- Strand diameter (mm).
- Concrete cover (mm).
- Remain legible until after the element has been fixed in place.
- Not visible in the completed structure.
- Date of casting.
- Orientation of the element.

- On precast elements other than those manufactured as a standard product, indicate their location within the structure, in conformance with the marking plan.
- Weight of the element.

Attachments for structural or architectural fixings

Ferrules: Provide ferrules anchored behind the reinforcing as documented.

Dowel bars: Provide dowel bars loose, cast in or screwed into a ferrule or coupler and projecting from the precast element. Alternatively, where dowels are cast into and project from in situ concrete, provide a mating sleeve with grout tube.

Grout tube: Provide grout tubes as documented, made from thin wall galvanized duct or similar cast into either in situ concrete or the precast element into which a dowel bar will be grouted.

Cast in plates and bolts: Provide purpose made steel brackets with bars, bolts or studs welded to them.

Restraint brackets: Provide all restraint brackets for the precast elements as documented or as required.

Starter bars: Provide all starter bars as documented or as required.

Welding of connections: To AS/NZS 1554.1.

Requirement: Cast in all lifting, bracing and fixing inserts.

External walls: Wall panels and connections to BCA C1.11.

Curing

Curing compounds: To AS 3799.

Release agent: Provide a release agent that is compatible with the curing compound.

Rejection

Assessment: Set aside for inspection any element having damage such as cracking, deformation or spalling, or exhibiting lack of adequate concrete cover. Repair or recast, as instructed.

Lifting points

Standard: To AS 3850.2.

General: Provide proprietary lifting devices with published load data designed specifically for lifting concrete elements. Use face and edge lifters as required.

Cast in inserts: Provide hot-dipped galvanized finish with a minimum coating mass of 600 g/m^2 to all cast-in lifting and bracing devices.

Bracing inserts or strongbacks: Provide bracing inserts or strongbacks designed by a professional engineer.

Proprietary systems: Use in conformance with manufacturer’s specifications and recommendations.

Lifting loops: Do not use deformed bars or stressing tendons as lifting loops.

Sealing: Recess lifting attachments such as bracing ferrules, or other types of cast-in fixings, and provide plugs for sealing.

Location: Do not place lifting attachments, holes and other temporary fixings for handling purposes on faces visible upon completion.

Marking: Clearly mark all lifting points and the positions for temporary bearing for storage and transport.

Welding: Do not site weld lifting, bracing or fixing inserts.

Requirement: Only lift or support members at specified points.

Lifting devices: Do not use the fixing devices for lifting or hoisting unless they have been designed to do so and confirmed by a professional engineer.

Precautions: Use handling methods which do not overstress, warp or damage the elements.

Completion: Remove, seal and rectify temporary attachments after erection.

Storage

Support points: Support elements at designated support points during storage.

Prevent damage: Store precast elements and protect to prevent warping, twisting, crushing, cracking, staining, discolouration and other damage until they are installed in their final location.

3.2 INSTALLATION

Lifting and handling

Requirement: Conform to the ASCC National code and AS 3850.2.

Site conditions: Make sure the wind and temperature conditions allow handling and fixing, and are consistent with the structural capability and geometry of the element.

Site Cranes: To AS 2550.1.

Temporary bracing and propping: To AS 3850.2 Section 5.

Fixing

Fixing: Fix the precast elements securely and accurately in their final position.

Ancillaries: Provide components and materials, including fasteners, braces, shims, jointing strips, sealant, flashings, grout and mortar, bearing pads or strips, ties and dowels, clips and fixings necessary for the installation of the elements.

Flooring systems

Shear keys: Grout with mix proportion (cement:sand) 3:1.

Preparation: Immediately before in situ topping, wet surface of plank without pooling.

Topping: Properties as follows:

- Grade: Minimum N32 to AS 1379.

Surfaces bonded to in situ concrete

Requirement: Fully scabble and roughen all surfaces required to bond with in situ concrete to achieve a shear plane surface coefficient in conformance with AS 3600 Table 8.4.3.

3.3 COMPLETION

Compliance

Tolerances: Check element compliance with AS 3610.1 Section 3.

Rejection: Reject any precast elements not conforming to the documented tolerances.

4 SELECTIONS

Refer to Landscape Selections Schedule

0342 LIGHT STEEL FRAMING

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide light steel floor, wall, roof and truss framing, as documented.

Performance
Requirements:

- Suitable for having flooring, linings, cladding and roofing fixed to it.
- In conformance with the documented performance criteria.
- Independently designed and documented.
- Independently certified by a professional engineer for the design and the erected framing.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:

- *0171 General requirements*.

1.3 STANDARDS

General
Design, materials and protection: To AS/NZS 4600.

Residential and Low-rise steel framing: To NASH-1 (National Association of Steel Housing) and NASH-2.

1.4 INTERPRETATION

Definitions
General: For the purposes of this worksection the definitions given in the NASH-1 and NASH-2 Standards apply.

1.5 TOLERANCES

General
Manufacturing, assembly and installation tolerances: To NASH-1 Appendix D and NASH-2 Appendix A.

1.6 SUBMISSIONS

Design documentation
General: Where the structural drawings define performance criteria, submit independent design, documentation and certification from a professional engineer including certification for the erected work.

Reactions: Submit the location and magnitude of reactions that are to be accommodated by the support structure.

Floor and wall frame member sizes: Submit a schedule of proposed member sizes, certified as meeting stated project, and AS/NZS 4600 requirements for span, spacings and loadings.

Shop drawings
General: Submit shop drawings, to a scale that best describes the detail, certified by a professional engineer stating that the design has been carried out to AS/NZS 4600 or NASH-1 and NASH-2, requirements for the documented configurations and loadings.

Prefabricated roof trusses: Include the following:

- Plan: Truss layout.
- Elevations: Arrangement of members, allowing for the accommodation of in-roof services, and the size and section type of each member.
- Method of assembly and connection details.
- Holding down and bracing: Details demonstrating capability to resist lateral and uplift forces.

Prefabricated wall frames: Include the following:

- Plan: Wall layout.
- Elevation: Arrangement of members, and size and section type of each member.
- Method of assembly, connection, holding down and bracing.

Drawing format: 2D and 3D CAD drawings.

1.7 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- Steel framing erected on site before lining or cladding.

2 PRODUCTS

2.1 GENERAL

Storage and handling

Requirement: Transport all components to site and store if required in a manner so as not to damage or distort the components.

2.2 COMPONENTS

Cold-formed steel framing

General: Cold-form sections from steel, metallic-coated to AS 1397.

Corrosion protection: To BCA 3.4.2.2.

Framing members

Cold-formed steel framing for proprietary systems: To NASH-1 and NASH-2.

Fascias and barge boards

3 EXECUTION

3.1 GENERAL

Fabrication

Length: Cut members accurately to length so that they fit firmly against abutting members.

Service holes: Form holes by drilling or punching.

Bushes: Provide plastic bushes or grommets to site cut holes.

Swarf: Immediately remove swarf and other debris from cold-formed steel framing.

Fastening

Type: Select from the following:

- Bolting.
- Self-drilling, self-tapping screws.
- Blind rivets.
- Proprietary clinching system.
- Structural adhesives.
- Welding. On-site welded connections are not permitted.

Welding

Burning: Avoid procedures that result in greater than localised burning of the sheets or framing members.

Prefabricated frames

General: Protect frames from damage or distortion during erection.

Metal separation

General: Install lagging to separate non-ferrous service pipes and accessories from the framing.

Unseasoned or CCA treated timber

General: Do not fix in contact with framing without fully painting the timber and/or the steel.

Earthing

Permanent earthing: Required.

Temporary earthing: Provide temporary earthing during erection until the permanent earthing is installed.

Protection

General: Restore coatings which have been damaged by welding or other causes. Thoroughly clean affected areas back to base metal and coat with a zinc rich organic primer.

Grommets: Provide grommets to isolate piping and wiring from cold-formed steel framing.

3.2 FLOOR FRAMING

General

Protection: If floor framing is for ground floor construction, make sure that it is protected from moisture.

Construction loads: If construction loading exceeds design loading, provide additional support so as to avoid overstressing of members.

Floor framing member schedule

Member type	Section	Design spacing (mm)	Design span (mm)

3.3 WALL FRAMING

Wall studs

General: Provide studs in single lengths without splices. Place a stud under each structural load point from the roof or ceiling (except at openings). Provide multiple studs at points of concentrated load.

Maximum stud spacing: 600 mm.

Heads to openings

Requirement: Provide lintels appropriate to load and span.

Additional support

General: Provide additional support in the form of noggings, trimmers and studs for support and fixing of lining, cladding, hardware, accessories, fixtures and fittings.

Vermin barriers

Brick veneer barrier: Close nail 10 mm steel wire mesh to the underside of the bottom plate of external stud walls, extending across the cavity for building into brickwork.

Damp-proof course

Requirement: Provide damp-proof courses under the bottom plate of stud walls built off slabs or masonry dwarf walls, as documented or as follows if not documented otherwise:

- External walls (not masonry veneer): Turn up a minimum of 75 mm on the inside and tack to studs. Project 10 mm beyond the external slab edge or dwarf wall and turn down at 45°.
- Walls of bathrooms, shower rooms and laundries: Turn up a minimum of 150 mm on the wet side and tack to studs.

Installation: Lay in long lengths. Lap full width at angles and intersections and at least 150 mm at joints.

Junctions: Preserve continuity of damp-proofing at junctions of damp-proof courses, sarking and waterproof membranes.

Flashings

Location: Provide flashings to external openings sufficient to prevent the entry of moisture. Form trays at the ends of sill flashings.

Masonry veneer construction: Extend across cavities and build into brickwork.

3.4 ROOF FRAMING

Beam framing

General: Construct framing for flat or pitched roofs where the ceiling follows the roof line, consisting of rafters or purlins supporting both ceiling and roof covering.

Additional support
General: Provide additional frame members at fibre cement or plasterboard sheeting or lining joint locations.

Battens
Requirement: Supply and fix battens suitable for span, spacing and proposed roofing material.

Anti-ponding boards
Standard: To AS 4200.2.

3.5 TRUSSES

Fabrication
Assembly: Factory assemble trusses.

Supports for in roof services
General: If walkways, mechanical plant or other services are to be supported within the roof space, provide support.

Water tank and heater: Where a water tank or heater is located in the roof space, provide a support platform to AS/NZS 3500.4 clause 5.5.1.

Marking
General: Permanently mark each truss to show:

- Project identification.
- Manufacturer.
- Tag or number.
- Location.
- Support points.

Installation
Support: Support and fix trusses on the bottom chord only, at the two nominated support points, unless designed for additional support.

Vertical movement: Over internal walls provide at least 10 mm vertical clearance and use wall bracing methods which allow for vertical movements.

3.6 ROOF TRIM

Fascia, valley and barge boards
Requirement: Fix fascia, valley gutter boards and barge boards in conformance with the manufacturer's requirements.

3.7 COMPLETION

Cleaning
General: On completion of framing remove debris from any gaps between members and make sure void between bottom chord of roof trusses and top of any non-supporting internal wall is clear.

0383 SHEET FLOORING AND DECKING

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide sheet flooring and decking, as documented.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:
- *0171 General requirements*.

1.3 STANDARD

General
Flooring and decking: To AS 1684.2, AS 1684.3 or AS 1684.4, as appropriate.

1.4 INTERPRETATION

Definitions
General: For the purposes of this worksection the following definitions apply:
- Butt joints (flooring): Floor units cross cut square with plain ends for joining over supports.
- Decking: Intermittently-supported external flooring with drainage gaps between boards.
- Flooring - fitted: Flooring fitted between the walls of each room i.e. not platform floors.
- Flooring - intermittently-supported: Flooring which is supported by, and spans across joists or battens.
- Platform flooring: Flooring laid over the whole of the joisted floor structure prior to the erection of external and internal wall frames.
- Subfloor: The structure that supports the flooring.

1.5 TOLERANCES

Sheet flooring
Maximum deviation from a 3 m straightedge laid in any direction on the floor surface: 3 mm.

1.6 SUBMISSIONS

Certification
Certificate: Submit a supplier's certificate (which may be included on an invoice or delivery docket) verifying conformance to grading, species and board size and noting the moisture content.

Inspection: If neither branding nor certification is adopted, submit a report by an independent inspecting authority verifying conformance.[complete/delete]

Samples
General: Submit samples of each timber or synthetic decking type illustrating the range of variation in colour and figure.

Subcontractors
General: Submit names and contact details of proposed suppliers and installers.

1.7 INSPECTION

Notice
Inspection: Give notice so that inspection may be made of the following:
- Subfloor before laying sheet flooring, fibre cement flooring or decking.

2 PRODUCTS

2.1 GENERAL

Storage

Timber decking: Deliver to site and store on dry ground on level bearers 150 mm high, block stacked, banded and protected against the weather.

Plywood and particleboard sheet flooring: Deliver to site and store on dry ground on level bearers 150 mm high, stacked on flat and protected against the weather.

2.2 DECKING

New timber decking

Standard:

- Treated softwood to AS 4785.1 Section 4.
  - . Grade to AS 4785.2: To the **Timber decking schedule**.
- Hardwood to AS 2796.1 Section 4.
  - . Grade to AS 2796.2: To the **Timber decking schedule**.

Durability:

- Natural durability classification to AS 5604: Class 2 minimum.
- Preservative treatment to AS 1604.1 Table D1: H3 minimum.
- Identification: Brand preservative treated decking timber to AS 1604.1.

Arrises: Chamfered or round.

3 EXECUTION

3.1 PREPARATION

Subfloors

General: Make sure support members are in full lengths without splicing.

Flatness: Less than 3 mm deviation of the substrate under a 3 m straightedge laid in any direction with no abrupt variations greater than 1 mm over 250 mm.

Timber decking on steel joists

General: Screw fix seasoned battens to the steel joists so that their top surfaces are aligned.

- Batten size: Minimum 35 mm thick.
- Spacing of fasteners: Less than 600 mm.

3.2 FIXING DECKING

Timber decking

Standard: To AS 1684.2, AS 1684.3 or AS 1684.4 as appropriate.

Installation: Lay in long lengths with the ends of each board firmly butted to the next and firmly in contact with the joists. Stagger the end joints and locate them centrally over joists.

Gap between edges of seasoned boards: Minimum 4 mm.

Minimum number of spans across supports: 3.

Nailing:

- General: Make sure the boards are in contact with the joists at the time of nailing, particularly where boards are machine nailed. If nails are to be less than 10 mm from ends of boards, pre-drill nail holes 0 to 1 mm undersize.
- Top nailing: Double nail at each bearing with hot dip galvanized or stainless steel nails driven flush. Offset nails at intermediate fixings or skew nail 10° in opposite directions.

Sealing: Apply 1 coat of water repellent preservative and 1 coat of finish coat to top surface of joists and all surfaces of boards before fixing.

4 SELECTIONS

Refer to Landscape Selection Schedules