Government of **Western Australia**
Department of **Communities**

Department of Communities

Landscape Specification

NATSPEC

December 2024

This reference specification has been developed by NATSPEC in conjunction with the Western Australia Department of Communities. The requirements in this specification are generic and are to be read in conjunction with the Department of Communities Landscape Brief and Guide, and project specific documents from the Design consultant, including drawings, schedules and appendices. It does not cover the requirements for every project situation.

The Design consultants' documents take precedence over this reference specification. Check the consultants' documents for any variations to the requirements of this specification.

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0171 GENERAL REQUIREMENTS

1 GENERAL

1.1 PRECEDENCE

General

Order of precedence: If there is conflict or inconsistency between the worksections of this specification, the requirements of worksections take the following order of precedence:

- All worksections other than those listed below.
- *018 Common requirements* worksections.
- *0171 General requirements*.

1.2 CROSS REFERENCES

General

Other documentation: If required, conform to the Department of Communities Construction Specification for BCA Class 1a and 10 buildings, and Construction Specification for BCA Class 2 and 3 buildings, including the following:

- Preliminaries: *0131 Preliminaries*.
- Hardscaping:
  - . *0271 Pavement base and subbase*.
  - . *0274 Concrete pavement.*
  - . *0276 Paving - sand bed*.
  - . *0277 Pavement ancillaries*.
- Waterproofing: *0411 Waterproofing - external and tanking*.
- Painting: *0671 Painting*.

Cross referencing styles

General: Within the text, titles are cross referenced using the following styles:

- Worksection titles are indicated by *Italicised* text.
- Subsection titles are indicated by CAPITAL text.
- Clause titles are indicated by **BOLD CAPITAL** text.
- Subclause titles are indicated by **Bold Sentence case** text.

1.3 REFERENCED DOCUMENTS

General

Precedence: The requirements of worksections override conflicting requirements of their referenced documents. The requirements of the referenced documents are minimum requirements.

Contractual relationships: Responsibilities and duties of the principal and contractor are not altered by requirements in the documents referenced in this specification.

Current editions: All referenced documents are the editions, with amendments, current on 1st September 2024.

Exception to current editions: If statutory requirements reference other editions or standards, conform to those other editions or standards. If the NCC (2022) references editions other than the current edition, the same editions cited in the NCC (2022) are referenced in each worksection.

Maintenance and repair works: If statutory requirements applicable to the maintenance or repair works reference other editions or standards, conform to those other editions or standards.

European standards: Any national European Standard (e.g. IS EN or DIN EN) may be used in place of the equivalent referenced European Standard (EN).

1.4 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.

Drawings and manuals for existing services

Warranty: No warranty is given as to the completeness or accuracy of drawings and/or manuals of existing services.

1.5 INTERPRETATION

Abbreviations

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

- 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.
- PCA: National Construction Code Series Volume 3: Plumbing Code of Australia.
- PVC: Polyvinyl Chloride.
- PVC-U: Unplasticised Polyvinyl Chloride. Also known as UPVC.
- 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 the use of a tool, without hazard, climbing over or removing obstructions, using a movable ladder,

and in any case not more than 2.0 m above the ground, floor or platform.

- Accredited Testing Laboratory:
  - . An organisation accredited by the National Association of Testing Authorities (NATA) to undertake the relevant tests; or
  - . An organisation outside Australia accredited to undertake the relevant tests by an authority recognised by NATA through a mutual recognition agreement; or
  - . An organisation recognised as being an Accredited Testing Laboratory under legislation at the time the test was undertaken.
  - . An organisation accredited for compliance with AS ISO/IEC 17025 (2018) to undertake the relevant tests.
- Appropriately qualified person: To NCC (2022) Schedule 1.
- Attendance: Attendance, provide attendance and similar expressions mean give assistance for examination and testing.
- Default: Specified value, product or installation method that is to be provided unless otherwise documented.
- Documented: Documented, as documented and similar terms mean contained in the contract documents.
- Errors and omissions: For the design prepared by the contractor, errors and omissions have the same meaning as defects.
- 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 principal.
- Hardscape: The inanimate and permanent landscaping elements, including all built elements related to external areas around the building envelope. Components include:
  - . Hard surfacing: Pathways, paving, decking.
  - . Built forms: Irrigation, water features, outdoor furniture, shade structure, fencing, walls, stones, rocks, signage, lighting and subsoil drainage.
- Hot-dip galvanized: Zinc coated to AS/NZS 4680 (2006) after fabrication with coating thickness and mass to AS/NZS 4680 (2006) Table 1.
- Ingress protection: IP, IP code, IP rating and similar expression have the same meaning as IP Code in AS 60529 (2004).
- 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 that 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 that 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 authority (local council): A body established for the purposes of local government by or under a law applying in a state or territory.
- 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 (2021). Metal thicknesses specified are base metal thicknesses.
  - . Ferrous open sections zinc coated by an in-line process: To AS/NZS 4791 (2006).
  - . Ferrous hollow sections zinc coated by a continuous or specialised process: To AS/NZS 4792 (2006).
- Network Utility Operator: To NCC (2022) Schedule 1. A person who undertakes the piped distribution of drinking water or non-drinking water for supply; or is the operator of a sewerage system or a stormwater drainage system.
- Northern areas: Sites located north of 27° latitude.
- Obtain: Obtain, seek and similar expressions mean obtain (seek) in writing from the principal.
- Pipe: Includes pipe and tube.
- Plant establishment period: The period between the date of practical completion and the end of the defects liability period.
- Practical completion or defects free completion: The requirements for these stages of completion are defined in the relevant building contract for the project.

- Proprietary: Identifiable by naming the manufacturer, supplier, installer, trade name, brand name, catalogue or reference number.
- 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.
- Required: Required by the contract documents, the local or statutory authorities.
  . If required: A conditional specification term for work that 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 and sample panels.
- Softscape: The animate and horticultural landscaping elements, including plants (lawns, flowers, shrubs, trees), soils, planting beds, mulch, seeding and other more transitory elements that continue to change.
- 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 - integrated system: Tests conducted on the project as a complete, integrated system to verify successful integration, interaction, and operation of all interrelated systems to the project requirements.
- Tests - production: Tests carried out on an item, before delivery to the site.
- Tests - site: Tests carried out on site.
- Tests - type: Tests carried out on an item identical with a production item, including with respect to materials, material suppliers, manufacturing processes, dimensions and marking.
- Tolerance: The permitted difference between the upper limit and the lower limit of dimension, value or quantity.
- Utility service provider: Includes Electricity distributor, Network Utility Operator, Gas Network Operator and organisations providing other reticulated utilities including data and telecommunications services.
- Verge: The area bounded by the back of the kerb (or edge of the road if no kerb exists) and the property boundary.
- Verge treatment: Any soft or hardscaping installed within the verge area, including street trees.
- Verification: Provision of evidence or proof that a performance requirement has been met or a default exists.

2 SUBMISSIONS AND INSPECTIONS

2.1 SUBMISSIONS

General

Requirement: Make submissions, as documented.

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

Submission times

Default timing: Submit information or other material for information, comment or approval at least 5 working days before ordering products or starting installation of the respective portion of the works.

Proposed products schedules: Submit a schedule of proposed products that have not been specified as proprietary items within 3 weeks of starting work on site.

Identification

Requirement: Identify the project, contractor, subcontractor or supplier, manufacturer, applicable product, model number and options, as appropriate and include relevant contract document references. If the submission covers more than one item, identify the item in the contract documents the submitted items relate to.

Non-conformance: Identify proposals that do not conform with project requirements, and characteristics that 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.

Submission format

Electronic copies: Provide at minimum files in pdf, dxf and dwg format.

Hard copies: Provide drawings in the same size, format and scale to those approved for construction.

Project requirements

General: Submit the following:

- Authority approvals: Notes of meetings with regulatory authorities and utility service providers whose requirements apply to the work and evidence that notices, fees and permits have been sought and paid, that utility service provider connections are complete and that statutory approvals by the authorities whose requirements apply to the work have been received.
- Certification: Certificates of conformance to documented and statutory requirements.
- Execution details: Execution programs, schedules and details of proposed methods and equipment.
- Marking and labelling: Samples and schedules of proposed marking and labels to **MARKING AND LABELLING**.
- Operation and maintenance manuals: For the whole of the work to **OPERATION AND MAINTENANCE MANUALS**.

- Products and materials: Products and materials data, including manufacturer's technical specifications and drawings, product data sheets, type tests results, evidence of conformity to documented requirements, product certification, performance and rating tables, service connection requirements and installation and maintenance recommendations.
- Records: As-built documents, photographs, system diagrams, schedules and logbooks to **RECORD DRAWINGS**.
- Safe Work Method Statement: For high risk construction works.
- Samples: Representative of proposed products and materials and including proposals to incorporate samples into the works, if any to **Non-approved** alternatives

Removal: If an alternative material, product or method has been installed/used without the principal's approval and replacement is required, cover all the costs associated with the removal, replacement and rectification of damage resulting from the substitution.

- SAMPLES.
- Shop drawings: To **SHOP DRAWINGS**.
- Substitutions: To **SUBSTITUTIONS**.
- Tests: Test reports for testing performed under the contract.
- Warranties: To **WARRANTIES**.

2.2 INSPECTION

Notice

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

Notification times

Minimum notice: As documented.

Light levels

Lighting levels for inspection: To AS/NZS 1680.2.4 (2017).

Attendance

General: Provide attendance for documented inspections and tests.

3 PERFORMANCE

3.1 BUSHFIRE-PRONE AREAS

General

Conformance: In areas designated as bushfire-prone, conform to statutory and local authority requirements.

Bushfire Attack Level (BAL): To AS 3959 (2018) and as documented.

3.2 CORROSION RESISTANCE

Atmospheric corrosivity category

General: Atmospheric corrosivity category as defined in AS 4312 (2019) for the site, the AS/NZS 2312 series, and as documented.

Galvanizing

Requirement: Galvanize mild steel components (including fasteners) to AS/NZS 1214 (2016) or AS/NZS 4680 (2006) 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).

3.1 WATER EFFICIENCY

General

Design: Incorporate Water Corporation's waterwise practices and products.

4 PRODUCTS AND MATERIALS

4.1 GENERAL

Consistency

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

Low VOC emitting paints

Paint types: To the recommendations of AS/NZS 2311 (2017) Table 4.2.

Prohibited materials

General: Do not provide the following:

- Materials exceeding the limits of those listed in the Safe Work Australia *Hazardous Chemical Information System* (HCIS) Workplace exposure standards.
- Blowing agents:
  - Materials that use chlorofluorocarbon (CFC) or hydrochlorofluorocarbon (HCFC) in the manufacturing process.
  - A blowing agent with a global warming potential (GWP) not less than 700.

4.2 PROPRIETARY ITEMS

Manufacturer's or supplier's recommendations

General: Provide manufactured items to the manufacturer's or supplier's recommendations.

Proprietary items/systems/assemblies: Assemble, install or fix to substrate to the manufacturer's or supplier's recommendations.

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

Identification of proprietary items

Sealed containers: If items are supplied by the manufacturer in closed or sealed containers or packages, bring them to point of use in the original containers or packages.

Other items: Marked to show the following, as applicable:

- Manufacturer's identification.
- Brand name.
- Product type.
- Quantity.

- Reference code and batch number.
- Date of manufacture.

4.3 SUBSTITUTIONS

General

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:

- Product, method or system identification.
- Product data sheets.
- Manufacturer's contact details.
- Detailed comparison between the properties of the documented product and proposed substitution.
- Details of manufacturer and/or installer warranty.
- Statement of NCC compliance, if applicable.
- Evidence of conformity to a cited standard or code of practice.
- Evidence that the performance is at least equal to that specified.
- Samples.
- Essential technical information, in English.
- Comparison between the products in relation to assembly method, finishes, installation methods and any protection/packaging.
- Reasons for the proposed substitutions.
- Statement of the extent of revisions to the contract documents.
- Statement of the extent of revisions to the construction program.
- Statement of cost implications including costs outside the contract.
- Statement of consequent alterations to other parts of the works.
- Statement of consequent maintenance conditions of warranty.

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.

Non-approved alternatives

Removal: If an alternative material, product or method has been installed/used without the principal's approval and replacement is required, cover all the costs associated with the removal, replacement and rectification of damage resulting from the substitution.

4.4 SAMPLES

General

Incorporation of samples: Only incorporate samples that have been endorsed for inclusion in the works. Do not incorporate other samples.

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

Unincorporated samples: Remove on completion.

4.5 SHOP DRAWINGS

General

Standard: To AS 1100.101 (1992), AS 1100.201 (1992), AS 1100.301 (2008), AS 1100.401 (1984) and AS/NZS 1100.501 (2002) as applicable.

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

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

Access for maintenance: Show space and provisions for access for maintenance.

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.

5 BUILDING SERVICES

5.1 GENERAL

Subcontractor qualifications

Requirement: Conform to the following:

- Hydraulic services: Licensed with the Plumbers Licensing Board.
- Electrical services: Licensed with the Department of Mines, Industry Regulation and Safety – Building and Energy.

5.2 SERVICES CONNECTIONS

Connections

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

Utility service provider requirements

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

5.3 SERVICES INSTALLATION

General

Installation: Install equipment and services as follows:

- Plumb and securely fixed.
- Allow for movement in both structure and services.

- Arrange services running together, parallel to each other and adjacent building elements.

Concealment: Conceal all cables, ducts, trays and pipes except where documented to be exposed. If alternative routes are available, do not locate on external walls.

Dissimilar metals

Jointing: 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.

Changes of direction: Provide as follows:

- If practicable, long radius elbows or bends and sets, and swept branch connections.
- Do not provide mitred fittings.

Vibration: Arrange and support piping to prevent vibration whilst permitting necessary movement. 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.

5.4 ACCESS FOR MAINTENANCE

General

Requirement: Provide access for maintenance of all items requiring inspection, measurement, operation, adjustment, repair, replacement and other maintenance-related tasks.

Standards: Conform to the relevant requirements of AS 1657 (2018), AS 1892.1 (2018) and AS 2865 (2009).

Work Health and Safety: Conform to the requirements of the applicable Work Health and Safety regulations.

Protection from injury: Protect personnel from injury caused by contact with objects including those that are sharp, hot or protrude at low level.

Trip hazards: Do not run small services including drains and conduits across floors where they may be a trip hazard.

Manufacturer's standard equipment: If necessary, modify manufacturer’s standard equipment to provide the plant access documented.

Clearances

Minimum clearances for access: Conform to the following:

- Vertical clearance: Not less than 2100 mm, vertically above horizontal floors, ground and platforms.
- Horizontal clearance: Preferably not less than 750 mm clear, but in no case less than 600 mm between equipment or between equipment and building features including walls.
- If tools are required to operate, adjust or remove equipment, provide sufficient space so the tools can be used in their normal manner and without requiring the user to employ undue or awkward force.
- Hinged or removable components: To the manufacturer's recommendations.
- Within plant items: Conform to the preceding requirements, and not less than the clearances recommended in BS 8313 (1997).

Facilities for equipment removal and replacement

Requirement: Provide facilities to permit removal from the building and replacement of plant and equipment, including space large enough to accommodate it and any required lifting and/or transportation equipment. Arrange plant so large and/or heavy items can be moved with the minimum changes of direction.

Removal of components: Allow sufficient space for removal and replacement of equipment components including air filters, tubes of shell and tube heat exchangers, removable heat exchanger bundles, coils and fan shafts. Provide access panels or doors large enough to permit the safe removal and replacement of components within air handling units.

Facilities for access

Equipment behind hinged doors: Provide doors opening at least 150°.

Equipment behind removable panels: Provide panels with quick release fasteners or captive metal thread screws.

Removable panels: Provide handles to permit easy and safe removal and replacement.

Piping

Requirement: Conform to the following:

- Provide access and clearance at fittings that require maintenance, inspection or servicing, including control valves and joints intended to permit pipe removal.
- Arrange piping so it does not interfere with the removal or servicing of associated equipment or valves or block access or ventilation openings.
- Preferably run piping, conduits, cable trays and ducts at high level and drop vertically to equipment.

Electrical equipment and controls

Electrical equipment: Provide clearances and access space to AS/NZS 3000 (2018).

Switchboards and electrical control equipment: Locate near the main entrance to plant space and with switchboards visible from the plant being operated.

Control panels: Locate near and visible from the plant being controlled.

5.5 FINISHES TO BUILDING SERVICES

General

Requirement: If exposed to view (including in plant rooms), paint building services and equipment.

Exceptions: Do not paint chromium or nickel plating, anodised aluminium, GRP, stainless steel, non-metallic flexible materials and normally lubricated machined surfaces. Surfaces with finishes applied off-site need not be re-painted on-site provided the corrosion resistance of the finish is not less than that of the respective finish documented.

Standard: Conform to the recommendations of AS/NZS 2311 (2017) Sections 3, 6 and 7 or AS 2312.1 (2014) Sections 6, 7 and 8, as applicable.

Inaccessible surfaces: If surfaces are inaccessible after installation, complete finish before installation.

Painting systems

New unpainted exterior surfaces: To AS/NZS 2311 (2017) Table 5.2.

Paint application

Coats: Apply the first coat immediately after substrate preparation and before contamination of the substrate can occur. Make sure each coat of paint or clear finish is uniform in colour, gloss, thickness and texture and free of runs, sags, blisters or other discontinuities.

Combinations: Do not combine paints from different manufacturers in a paint system.

Protection: Remove fixtures before starting to paint and refix in position undamaged when painting is complete.

Underground metal piping

Requirement: Provide corrosion protection for the following:

- Underground ferrous piping.
- Underground non-ferrous metal piping in chemically aggressive soils and environments.

Corrosion protection: Select from the following:

- Cathodic protection: Sacrificial anodes or impressed current. Incorporate a facility for periodic testing. Conform to the recommendations of AS 2832.1 (2015).
- Continuous wrapping using proprietary petroleum taping material.
- Impermeable flexible plastic coating.
- Sealed polyethylene sleeve.

Aggressive soils: If metallic piping or components are installed in chemically aggressive soil, provide additional protection as follows:

- Material: Continuous polyethylene sleeve to ASTM D1248 (2016) with a minimum thickness of 0.25 mm.
- Installation: Wrap or sleeve pipes and components. Tape joints between sections of polyethylene and between polyethylene and piping.

Repairs to finishes

Requirement: Repair damaged finishes to restore their corrosion protection, appearance and service life.

Painting of pipe threads: After pipe installation and before other finishes or insulation are applied, paint exposed threads in metallic-coated steel pipe with zinc rich paint.

5.6 MARKING AND LABELLING

General

Requirement: Mark and label services and equipment for identification purposes as follows:

- Locations exposed to weather: Provide durable materials.
- Pipes, conduits and ducts: To AS 1345 (1995) throughout its length, including in concealed spaces.

Consistency: Label and mark equipment using a consistent scheme across all services elements of the project.

Electrical accessories

Circuit identification: Label isolating switches and outlets to identify circuit origin.

Operable devices

Requirement: Mark to identify the following:

- Controls.
- Indicators, gauges, meters.
- Isolating switches.

Valves and pumps

General: Label to associate pumps with their starters and valves. Screw fix labels to body or attach label to valve handwheels with a key ring.

Underground services

Survey: Accurately record the routes of underground cables and pipes before backfilling. Include on the record drawings.

Records: Provide digital photographic records of underground cable and pipe routes before backfilling. Include in operation and maintenance manual.

Location marking: Accurately mark the location of underground cables and pipes with route markers consisting of a marker plate set flush in a concrete base, engraved to show the direction of the line and the name of the service.

Markers: Place markers at ground level at each joint, route junction, change of direction, termination and building entry point and in straight runs at intervals of not more than 100 m.

Marker bases: 200 mm diameter x 200 mm deep, minimum concrete.

Direction marking: Show the direction of the cable and pipe run by means of direction arrows on the marker plate. Indicate distance to the next marker.

Plates: Brass, aluminium or stainless steel with black filled engraved lettering, minimum size 75 x 75 x 1 mm thick.

Plate fixing: Waterproof adhesive and 4 brass or stainless steel countersunk screws.

Marker height: Set the marker plate flush with paved surfaces, and 25 mm above other surfaces.

Marker tape: Where electric bricks or covers are not provided over underground wiring, provide a 150 mm wide yellow or orange marker tape bearing the words WARNING – electric cable buried below, laid in the trench 150 mm below ground level.

Plastic pipe: Provide a detectable marker tape with trace wire to identify the route of buried piping. Terminate with 1000 mm coil in a readily accessible location. Tag to match the record drawings.

Labels and notices

Materials: Select from the following:

- Cast metal.
- Proprietary pre-printed self-adhesive flexible plastic labels with machine printed black lettering.
- Stainless steel or brass minimum 1 mm thick with black filled engraved lettering.

Emergency functions: To AS 1319 (1994).

Colours: Generally to AS 1345 (1995) as appropriate, otherwise black lettering on white background except as follows:

- Danger, warning labels: White lettering on red background.
- Main switch and caution labels: Red lettering on white background.

Edges: If labels exceed 1.5 mm thickness, radius or bevel the edges.

Labelling text and marking: To correspond to terminology and identifying number of the respective item as documented on the record drawings and documents and in operating and maintenance manuals.

Lettering heights:

- Danger, warning and caution notices: Minimum 10 mm for main heading, minimum 5 mm for remainder.
- Equipment labels within cabinets: Minimum 5 mm.
- Equipment nameplates: Minimum 40 mm.
- Identifying labels on outside of cabinets: Minimum 5 mm.
- Isolating switches: Minimum 5 mm.
- Valves:
  - . Not less than DN 65: Minimum 25 mm.
  - . Less than DN 65: Minimum 10 mm.
- Self-adhesive flexible plastic labels:
  - . Labels less than 2000 mm above floor: 5 mm.
  - . Labels minimum 2000 mm above floor: 10 mm.
  - . Other locations: Minimum 5 mm.

Label locations: Locate labels so they are easily seen and are either attached to, below or next to the item being marked.

Fixing: Fix labels securely using screws, rivets, proprietary self-adhesive labels or double-sided adhesive tape and as follows:

- If labels are mounted in extruded aluminium sections, use rivets or countersunk screws to fix the extrusions.
- Use aluminium or monel rivets for aluminium labels.

6 COMPLETION

6.1 CLEANING

Final cleaning

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

Labels: Remove all visible labels not required for maintenance.

Removal of material

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

6.2 WARRANTIES

General

Requirement: Name the principal as warrantee. Register with manufacturers as necessary. Retain copies delivered with components and equipment.

Approval of applicator or installer: If the warranty is conditional on the manufacturer’s approval of the applicator or installer, submit the manufacturer’s written approval of the installing company, and authorised personnel, with evidence of qualifications and experience in the specific use of the product, material or system.

Principal's responsibilities: Submit details of responsibilities of the principal required to keep warranties in force.

Warranty types

Manufacturer’s warranty: Warranty to cover manufacturing defects and defects with products and materials delivered to site.

Manufacturer and applicator’s/installer’s interlocking warranty: Interlocking warranty to cover manufacturing defects and defects with products and materials delivered to site, including their application or installation.

Supplier's warranty: Warranty to defects in materials delivered to site.

7 TESTING

7.1 TESTING - GENERALLY

Inspection and testing plan

Requirement: Provide inspection and testing plan consistent with the construction program including details of test stages and procedures.

Notice

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

Inspection: Give sufficient notice for inspection to be made of the commissioning, testing and verification tests on completion of commissioning.

Attendance

General: Provide attendance at tests.

Suppliers: If necessary to carry out documented tests, arrange equipment suppliers to assist.

Testing authorities

Requirement: Have tests carried out by an Accredited Testing Laboratory, accredited for the documented test method, except for site tests or test methods that do not have an accredited testing laboratory.

Test equipment

Accuracy: Use testing equipment designed to test and/or measure system performance within the documented tolerances.

Calibration: Use only instruments that have current calibration certificates issued by an Accredited Testing Laboratory. Tag or label instruments with calibration date and calibration authority name. Provide copies of certification if requested.

Maximum period since last calibration: As recommended by the manufacturer but less than 12 months, except as documented.

Recalibration: If dropped or damaged, recalibrate instruments.

Testing equipment: Provide test equipment and tools to perform documented tests as follows:

- Special testing equipment: If documented, provide special equipment, tools and instruments required for testing or calibration.
- Other testing equipment: Provide standard testing equipment.

Testing procedures

Verification: Verify test procedures by:

- Manual testing.
- Monitoring performance and analysing results using the control system trend logs.
- A combination of the above methods.

Sampling: Sampling may be used subject to the following:

- Use a sampling strategy only for multiple identical pieces of non-life-safety or otherwise non-critical equipment.
- If at any point, more than one identical item has failed, stop testing, determine the cause, rectify and document changes made to remaining units, before continuing with functional testing of the remaining units.

Type tests

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

Test outcome

Requirement: Test as documented and achieve the following:

- Pass the documented Pass/Fail test, and/or
- Values that meet documented requirements, and/or
- Verification of manufacturer's claimed performance.

Failure of multiple items

Requirement: If 10% or 3, whichever is greater, of identical pieces (size does not constitute a difference) of equipment fail to perform as documented for any reason, treat all identical units as having failed. Submit notice of failure and conform to the following:

- Within one week of notification, examine all other identical units and record the results. Submit a report of the findings within two weeks of the original failure notice.
- Within two weeks of the original failure notification, submit a signed and dated explanation of the problem, including the cause of failure, the proposed solution, full equipment details and any other information. Do not exceed the documented requirements of the original installation with the proposed solution.

Rectification of failure under test

Requirement: If an item fails a documented test, rectify the cause of failure and repeat the test.

Submissions: If submission of test results is documented, submit results of both successful and unsuccessful tests.

Test reports

Requirement: Include the following:

- Documented performance criteria including, if documented, tolerances.
- Observations and results of tests and conformance or non-conformance with documented requirements.

Test validity period

Requirement: As documented or, if no validity period is documented, no older than 5 years.

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.

Certification

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

Integrated system tests

Requirement: Conduct integrated system tests as documented.

Tests: Provide the following:

- Test the integrated operation of the systems listed in each mode documented.
- Restoration of the systems to their pre-test condition on completion of the tests above.

Failure: If any of the systems fails to perform as documented, including return to normal operation, rectify the cause and repeat the integrated system test.

Deferred and seasonal tests

Deferred tests: If documented testing cannot be completed at the scheduled or documented time, the principal may direct that they be deferred to a later time but as soon as possible after the scheduled or documented time.

Seasonal tests: If documented tests are dependent on specific weather conditions, they may be deferred to a time when weather conditions are close to the documented test conditions. Complete seasonal testing as soon as possible but no later

than one month before the end of the defects liability period.

Functional tests

Function: Carry out functional and operational tests on each energised equipment item and circuit.

8 PROJECT RECORDS

8.1 RECORD DRAWINGS

General

Requirement: Prepare record drawings showing the following:

- Softscape and hardscape components.
- 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

Requirement: Record changes made during the progress of the works on a set of drawings kept on site for that specific purpose.

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 **RECORD DRAWINGS**, **General** and **Recording, format and submission** and the following:

- Extensions and/or changes to existing: If a drawing shows extensions and/or alterations to existing installations, include sufficient detail of the existing installation to make the drawing comprehensible without reference to drawings of the original installation.
- Irrigation system: Include reticulation plans, and details and location of mainline piping and control valves.
- 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.
- Access provisions and space allowances.
- Fasteners.
- Fixtures.
- 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 5488.1 (2022).

8.2 OPERATION AND MAINTENANCE MANUALS

General

Standard: To SA TS 5342 (2021).

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 worksections require submissions of manuals, include corresponding material in the operation and maintenance manuals.

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

Revisions: Amend the operation and maintenance manuals to include changes made to the installation during construction and maintenance including changes to commissioning records.

Contents of manual

Table of contents: Include a table of contents in each volume. Title to match cover.

Table of amendments: Include a table of amendments.

Directory: Include names, addresses, email addresses and telephone and facsimile numbers of principal consultant, subconsultants, contractor, subcontractors and names of responsible parties.

Record drawings: Include complete set of record drawings, full size.

Drawings and technical data: Include as necessary for the efficient operation and maintenance of the installation.

Installation description: Include a general description of the installation.

Systems descriptions and performance: Include a technical description of the systems installed including the basis of design, the interrelation with other systems and the building and mode of operation, presented in a clear and concise format readily understandable by the principal's staff. Identify function, normal operating characteristics, safety features and limiting conditions.

Equipment: Include schedules with the following details for installed equipment:

- Item code for use on record and diagrammatic drawings, and spare parts schedule.
- Equipment name plate data including serial number, if any.
- Name and contact details of the manufacturer and supplier.
- Catalogue list number(s).
- Location.
- Function.
- Performance figures and capacity data.

- Date of manufacture.
- Manufacturer's product data sheets including only relevant matter for the project. Mark each product data sheet to clearly identify specific products and component parts used in the installation, and data applicable to the installation.
- Additional information and commentary to illustrate relations of component parts.

Certificates:

- Certificates from authorities.
- Product certification.
- Test certificates for each service installation and all equipment.
- Warranties.

Operation procedures: Include for systems installed:

- Manufacturer's technical literature as appropriate.
- Safe starting up, running-in, operating and shutting down procedures. Include logical step-by-step instructions for each procedure.
- Control sequences and flow diagrams.
- Legend for colour-codes services.
- Schedules of fixed and variable equipment settings established during commissioning and maintenance.
- A list of special safety devices and their set points.
- Procedures for seasonal changeovers.
- Warnings to operators.
- Procedures for identifying and rectifying common faults.
- Recommendations for efficient plant operation.

Format – electronic copies

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

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

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

Format – hard copies

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.

Date for submission

Draft submission: 4 weeks before the date for practical completion.

Final submission: On the date of practical completion to the resident.

9 MAINTENANCE

9.1 STATUTORY INSPECTIONS AND MAINTENANCE

General

Duration: From the time systems and equipment are put into service to the end of the maintenance period.

Requirement: Provide inspections and maintenance of safety measures required by the following 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 maintenance period.

Site control

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

0181 ADHESIVES, SEALANTS AND FASTENERS

1 GENERAL

1.1 RESPONSIBILITIES

Performance

Requirements: Conform to the following:

- Fitness for purpose: Suitable for particular use, 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.

1.2 SUBMISSIONS

Products and materials

Adhesives and sealants: Submit product data sheets.

Type tests: 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.

2 PRODUCTS

2.1 ADHESIVES

Standards

Gypsum plaster adhesive: To AS 2753 (2018).

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, paints and unfinished metals.
  - . Lower energy surfaces including many plastics, most paints and powder coatings, and unfinished 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 (2002).

External masonry joints

General: Provide sealant and bond breaking materials that 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.

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.

Plain washers: To AS 1237.1 (2002).

- 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 A276/A276M (2024).

Steel nails: To AS 2334 (1980).

- 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 (1999).

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

Bolts

Coach bolts: To AS/NZS 1390 (1997).

Hexagon bolts Grades A and B: To AS 1110.1 (2015).

Hexagon bolts Grade C: To AS 1111.1 (2015).

Nuts

Hexagon chamfered thin nuts Grades A and B: To AS 1112.4 (2015).

Hexagon nuts Grade C: To AS 1112.3 (2015).

Hexagon nuts Style 1 Grades A and B: To AS 1112.1 (2015).

Hexagon nuts Style 2 Grades A and B: To AS 1112.2 (2015).

Screws

Coach screws: To AS/NZS 1393 (1996).

Hexagon screws Grades A and B: To AS 1110.2 (2015).

Hexagon screws Grade C: To AS 1111.2 (2015).

Hexagon socket screws: To AS 1420 (2008).

Self-drilling screws: To AS 3566.1 (2002).

Self-tapping screws:

- Cross-recessed countersunk (flat – common head style): To AS/NZS 4407 (2015).
- Cross-recessed pan: To AS/NZS 4406 (2015).
- Cross-recessed raised countersunk (oval): To AS/NZS 4408 (2015).
- Hexagon: To AS/NZS 4402 (2015).
- Hexagon flange: To AS/NZS 4410 (2015).
- Hexagon washer: To AS/NZS 4409 (2015).
- Slotted countersunk (flat – common head style): To AS/NZS 4404 (2015).
- Slotted pan: To AS/NZS 4403 (2015).
- Slotted raised countersunk (oval – common head style): To AS/NZS 4405 (2015).

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:

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

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 (2019)	**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 Type 316
C3	Hot-dip galvanized	45	Stainless steel Type 316
C4	Stainless steel Type 316	-	Stainless steel Type 316
Note: For categories C5, CX and T to the AS/NZS 2312 series, seek specialist advice.			

Finishes

Electroplating:

- Metric thread: To AS 1897 (2016).
- Imperial thread: To AS 4397 (2007).

Galvanizing:

- Threaded fasteners: To AS/NZS 1214 (2016).
- Other fasteners: To AS/NZS 4680 (2006).

Mild steel fasteners: Galvanize if:

- Embedded in masonry.
- In external timbers.
- Exposed to or in air spaces behind the external leaf of masonry walls.
- In contact with chemically treated timber other than CCA treated timber.

Epoxy coated: CCA treated timber.

3 EXECUTION

3.1 ADHESIVES

General

Requirement: Install to the manufacturer's recommendations.

Preparation

Substrates: Conform to the following:

- Remove any deposit or finish that 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 that 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 FASTENERS

General

Requirement: Install to the manufacturer’s recommendations.

Fastening to wood and steel

Timber substrates: To AS 1720.1 (2010) Section 4.

Self-drilling screws: To AS 3566.1 (2002) for timber and steel substrates.

Masonry anchors

Installation: To the manufacturer’s recommendations.

0183 METALS AND PREFINISHES

1 GENERAL

1.1 RESPONSIBILITIES

Performance

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

2 PRODUCTS

2.1 METALS

Metallic-coated steel

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

Electrogalvanized (zinc) coating on ferrous hollow and open sections: To AS 4750 (2003).

- Ferrous open sections by an in-line process: To AS/NZS 4791 (2006).
- Ferrous hollow sections by a continuous or specialised process: To AS/NZS 4792 (2006).
- Steel sheet and strip: To AS 1397 (2021).
- Steel wire: To AS/NZS 4534 (2006).

Stainless steel

Bars: To ASTM A276/A276M (2024).

Plate, sheet and strip: To ASTM A240/A240M (2024).

Welded pipe (plumbing applications): To AS 1769 (1975).

Welded pipe (round, square, rectangular): To ASTM A554 (2021).

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-conductive 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

Lap-joints: Make sure brazed lap-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 ISO 17672 (2023).

Welding

Aluminium: To AS/NZS 1665 (2004).

Stainless steel: To AS/NZS 1554.6 (2012).

Steel: To AS/NZS 1554.1 (2014).

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 the 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.

3.2 STAINLESS STEEL FINISHES

General

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

Pre-assembly

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 to ASTM A380/A380M (2017).

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

Post-assembly finish

Electropolish finish: Provide an electro-chemical process to stainless steel Type 316.

Brushed electropolish finish: Conform to the following:

- Pre-assembly finish: No. 4 polished.
- Post-assembly finish: Provide an electro-chemical process to achieve a surface roughness R_a, no greater than 0.50 µm.

Mirror finish: Conform to the following:

- Pre-assembly finish: 2B cold-rolled finish.
- Post-assembly finish: Apply a polishing and buffing process to achieve a No. 8 mirror 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 ELECTROPLATED FINISHES

Electroplated coatings
Chromium on metals: To AS 1192 (2004).

- Service condition number: At least 2.

Nickel on metals: To AS 1192 (2004).

- Service condition number: At least 2.

Zinc on iron or steel: To AS/NZS 1789 (2023).

3.4 ANODISED FINISHES

General
Standard: To AS 1231 (2000).

Thickness grade: To the recommendations of AS 1231 (2000) Appendix H.

3.5 POWDER COATED FINISHES

General
Coating thickness: To the manufacturer's recommendations for protection in the documented atmospheric corrosivity category.

Standards
Application to aluminium and aluminium alloy substrates for architectural applications: To AS 3715 (2002) and AAMA 2603 (2022), AAMA 2604 (2022) and AAMA 2605 (2022) as appropriate.

Application to metal substrates other than aluminium for architectural applications: To AS 4506 (2024).

Substrate pre-treatment and application
Powder coating to aluminium: To AS 3715 (2002) Appendix G.

Powder coating to metals, other than aluminium: To AS 4506 (2024) Appendix I.

Thermoset powder coating system
Standards: To AS 3715 (2002) and AAMA 2604 (2022).

Thermoset fluoropolymer powder coating system
Standards: To AS 3715 (2002) and AAMA 2605 (2022).

3.6 HOT-DIP GALVANIZING

Standards
Coating: To AS/NZS 4680 (2006).

Durability: To AS/NZS 2312.2 (2014).

Metal finishing
Steel preparation methods: To AS 1627 series.

Coating mass/thickness minimum: To AS/NZS 4680 (2006).

Surface preparation
Surface contaminants and coatings generally: Chemical clean, then acid pickle.

Chemical cleaning: To AS 1627.1 (2003).

Acid pickling: To AS 1627.5 (2003).

- Inhibitor: Required.

Abrasive blast cleaning: To AS 1627.4 (2005) clause 4.2 and clause B2.4.

- Grade: Sa 2½ to AS 1627.9 (2002).

Coating process
General: To AS/NZS 4680 (2006) Section 6.

Post treatment
General: Passivate.

Drilling after completion of hot-dip galvanizing
Repair: Prime drill hole surfaces to AS/NZS 4680 (2006) clause 8 before the surfaces begin to corrode.

Surface finish
Standard: To AS/NZS 4680 (2006) clause 7.

Coating quality: Continuous and as smooth and evenly distributed as possible. Free of blisters, roughness, sharp points, flux residues and any defects that may affect the end use of the article.

Coating repair
Rejection: If uncoated surfaces or areas damaged by handling at the galvanizing plant exceed the limits specified for repair in AS/NZS 4680 (2006) Section 8, reject the galvanizing.

Extent and methods: To AS/NZS 4680 (2006) Section 8.

Preparation of galvanized surfaces for paint finishes
Coarse preparation: Remove spikes, and make sure edges are free from lumps and runs.

Light sweep blasting before painting: Required.

Site coating reinstatement
Rejection: If any item has damaged areas exceeding the limits specified for repair in AS/NZS 4680 (2006) clause 8.1, reject the item.

Method: To AS/NZS 4680 (2006) Section 8.

3.7 PREPAINTED FINISHES

Air-drying enamel
Application: Spray or brush.

Finish: Full gloss.

General use:

- Primer: Two-pack epoxy primer to AS/NZS 3750.13 (1997).
- Topcoats: 2 coats to AS 3730.6 (2006).

Oil resistant use:

- Primer: Two-pack epoxy primer to AS/NZS 3750.13 (1997).
- Topcoats: 2 coats to AS/NZS 3750.22 (2008).

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 (2008), two coats.
- Prime coat to metal surfaces generally: To AS/NZS 3750.19 (2008) or AS/NZS 3750.20 (2008).
- Prime coat to zinc-coated steel: To AS 3730.15 (2006) or AS/NZS 3750.16 (1998).
- Undercoat: To AS/NZS 3750.21 (2008).

Prepainted metal products
Standard: To AS/NZS 2728 (2013).

Product type: To AS/NZS 2728 (2013): Not lower than the type appropriate to the documented 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 (1997).

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
Anodising: Use sprayers or pens for minor scratches and mitre cuts as required.

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 (2009).

Cleaning
General: On completion, clean all surfaces. Do not use abrasive cleaners.

0184 TERMITE MANAGEMENT

1 GENERAL

1.1 RESPONSIBILITIES

Performance
Requirement: Building protection from termite attack.

1.2 STANDARD

General
Termite management systems: To AS 3660.1 (2014).

1.3 SUBMISSIONS

Certification
Installation: On completion, submit certificate to AS 3660.1 (2014) clause A3.

Tests
Site tests: Submit results, as follows:

- Chemical termite management systems: To **TESTING**, **Site tests**.

1.4 INSPECTION

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

- Completed earthworks or substrate preparation before system application or installation.
- Completed termite management system before concealing.
- Termite management system at the end of the defects liability period.

2 PRODUCTS

2.1 PHYSICAL SYSTEMS

Termite sheeting
General: To AS 3660.1 (2014) Section 5.

Granular materials
Standard: To AS 3660.1 (2014) Section 6.

2.2 CHEMICAL SYSTEMS

General
Standard: To AS 3660.1 (2014) Section 7.

System assessment: To AS 3660.3 (2014) Section 5.

2.3 CHEMICALLY IMPREGNATED PHYSICAL SYSTEMS

Impregnated polymer sheeting
Material: Flexible composite blanket, geotextile, fibre sheeting or membrane incorporating a termiticide.

Testing: To AS 3660.3 (2014) clause 5.5.

Impregnated accessories
Material/product: Extrusions, collars, foams and sealants incorporating a termiticide.

Testing: To AS 3660.3 (2014) clause 5.8.

3 EXECUTION

3.1 GENERAL

Concrete slabs
Standard: To AS 3660.1 (2014) Section 4.

3.2 PHYSICAL SYSTEMS

Termite sheeting
General: To AS 3660.1 (2014) Section 5.

Granular materials
Standard: To AS 3660.1 (2014) Section 6.

3.3 CHEMICAL SYSTEMS

General
Standard: To AS 3660.1 (2014) Section 7.

Soil treatments
Restrictions on areas of application: To AS 3660.1 (2014) clause 7.3.

Soil and environmental condition: Do not treat soil that is water saturated or when it is raining.

Application method
Application: To AS 3660.1 (2014) clause 7.5.

Application timing: To AS 3660.1 (2014) clause 7.6.

Protection: Protect treated area as follows:

- If a treated area is not scheduled to be covered with a vapour barrier on the same day, protect treated area with a waterproof covering such as polyethylene sheeting. Provide protection until the slab is installed.
- Prevent soil disturbance and keep off treated area until the soil is completely dry.

Reapplication: Reapply soil treatment to areas disturbed by subsequent excavation, grading, landscaping and other construction activities following the application.

Chemically impregnated physical systems
Installation: In conformance with the manufacturer's recommendations.

3.4 TESTING

Site tests
Chemical systems: To AS 3660.1 (2014) Appendix E.

3.5 COMPLETION

Termite management system notice
Signage: Permanently fix a durable notice in a prominent location to BCA (2022) B1D4(i)(ii) or BCA (2022) H1D3(3), as applicable.

Cleaning
Requirement: Clean progressively and remove from the site waste building materials that could attract termites.

3.6 MAINTENANCE

Inspection
Requirement: At the end of the defects liability period, inspect the termite management system to AS 3660.2 (2017) clause 3.3.2.2. Prepare a report on the efficacy and status to AS 3660.2 (2017) clause 3.4.

0185 TIMBER PRODUCTS, FINISHES AND TREATMENT

1 GENERAL

1.1 RESPONSIBILITIES

Performance

Requirements:

- Appropriate for durability.
- Appropriate surface finish.
- Appropriate certification for the finishing applications.

1.2 STANDARDS

General

Sawn and milled products:

- Hardwood: To AS 2796.1 (1999).
- Softwood: To AS 4785.1 (2002).

Reconstituted wood based panels:

- Particleboard: To AS 1859.1 (2017).
- Particleboard flooring: To AS/NZS 1860.1 (2017).
- Dry process fibreboard: To AS/NZS 1859.2 (2017).
- Decorative overlaid wood panels: To AS/NZS 1859.3 (2017).
- Wet process fibreboard: To AS/NZS 1859.4 (2018).

Plywood:

- Structural: To AS/NZS 2269.0 (2012).
- Exterior: To AS/NZS 2271 (2004).
- Marine: To AS/NZS 2272 (2006).

Timber grading methods:

- Stress graded: To the AS/NZS 1748 series.
- Visually graded F-grade: To AS 2082 (2007) or AS 2858 (2023).

1.3 SUBMISSIONS

Products and materials

Chain of custody of forest products: Submit the following as evidence of conformity to **CERTIFICATION**, **Timber source certification**:

- Third party certification of supplier's chain of custody management system.
- Formal claim of chain of custody by supplier.

Preservative treatment of timber: Submit a certificate from an independent testing authority to AS/NZS 1604.1 (2021) clause 1.5.3.6. Include details of treatment and a copy of the charge sheet.

Tests: Submit moisture content test results.

2 PRODUCTS

2.1 GENERAL

Storage and handling

General: Deliver timber products to site in unbroken wrapping or containers and store so that the moisture content is not adversely affected.

2.2 CERTIFICATION

Timber source certification

Requirement: Use timber products originating from sustainably managed forests to the recommendations of the Forest Products Commission's *Wood Encouragement Policy for Western Australia*.

Certification: Forest management and chain of custody to any of the following:

- Responsible Wood (Australian Forestry Standard (AFS)).
- FSC (Forestry Stewardship Council).

Engineered timber product certification and identification

Certification: To EWPAA Product Certification Scheme for the following:

- Cross laminated timber.
- Plywood.
- Preservative treated timber and engineered wood products.
- Solid structural timber.
- Wet process fibreboard, dry process fibreboard and particleboard.
- Wood-plastic composite products.

Branding: Brand timber products under the authority of a certification scheme applicable to the product. Locate the brand on faces or edges that will be concealed in the works.

2.3 FIRE-RESISTANCE

General

Structural timber: To AS/NZS 1720.4 (2019) or alternative conforming to NCC (2022) A5G3.

Bushfire-prone areas

Standard: To AS 3959 (2018).

2.4 DURABILITY

General

Requirement: Provide timbers with natural durability appropriate to the conditions of use, or preservative-treated timber of equivalent durability.

Natural durability class: To AS 5604 (2022).

Naturally termite-resistant timbers: To AS 3660.1 (2014) Appendix C.

Timber quality: Free of core wood (material within 50 mm of the tree's centre) and free of splits, checks, loose knots and cavities. Free of sapwood (lighter coloured wood found on the outer layer of the tree).

Lyctid susceptible timbers: To AS 5604 (2022). Do not provide untreated timbers containing lyctid susceptible sapwood.

Untreated sapwood: Do not use in applications requiring treated timber or natural durability.

Preservative treatment

Wood-based products: To AS/NZS 1604.1 (2021) or preservative-treated products conforming to NCC (2022) A5G3.

Verification requirements: To AS/NZS 1604.2 (2021).

Test methods: To AS/NZS 1604.3 (2021).

Moisture content

Moisture content:

- Seasoned timber < 15% moisture content.
- Unseasoned timber ≥ 15% moisture content.

Test: Methods as follows:

- Timber: To AS/NZS 1080.1 (2012).
- Plywood: To AS/NZS 2098.1 (2006).
- Reconstituted wood-based products: To AS/NZS 4266.1 (2017).

Protection: Protect timber and timber products stored on site from moisture and weather. For milled, prefinished, prefabricated and similar elements that are to be protected in the final structure, provide temporary weather protection until the permanent covering is in place.

2.5 FINISHING

Production finish

Hardwood: To AS 2796.1 (1999) Table B1.

Plywood: To AS/NZS 2269.0 (2012), AS/NZS 2270 (2006), AS/NZS 2271 (2004) and AS/NZS 2272 (2006).

Softwood: To AS 4785.1 (2002) Table B1.

Surface coating

Painting and staining: To *0671 Painting*.

Application: To the manufacturer's specification.

2.6 RECYCLED TIMBER

General

Grit blasted or re-machined: Remove all nails and screws.

Classification: Visually graded.

3 EXECUTION

3.1 JOINTS

General

Joints and connections: Use hot-dipped galvanized or stainless steel fasteners, composite bolts, nails or nailed metal connectors.

Timber-to-timber interfaces: To the manufacturer's recommendations and the following:

- Provide a seal coating of preservative treatment.
- Make sure the inside of bolt holes and the end grains of the timber are coated.

Water retention: Avoid details that may trap water including housing or birdsmouth joints.

Fasteners: To prevent chemical treatments reacting with fasteners, install to manufacturer's recommendations.

3.2 SHRINKAGE RESTRAINT

General

Requirement: If possible, use seasoned timber, particularly where timber elements are integrated with steel and/or concrete.

Moisture content: Maintain a timber moisture content near the anticipated in-service equilibrium moisture content.

Fasteners: Where possible, align fasteners along member axis.

Connections: Use connections that allow for movement without adversely affecting the performance of the connection.

Unseasoned timber: Provide as follows:

- Drill bolt holes 2 mm or 10% larger than the bolt diameter.
- Use species with similar shrinkage values to reduce movement and shrinkage.
- Provide adequate clearance between unseasoned timber framing, and interfacing structures and materials to allow for movement.

3.3 FINISHING

Ploughing

General: Back plough boards liable to warp (e.g. if exposed externally on one face). Make the width, depth and distribution of ploughs appropriate to the dimensions of the board and degree of exposure.

Painting

Edges: Chamfer edges of work to receive paint or similar coatings.

Priming: For woodwork to be painted, prime hidden surfaces before assembly.

0221 SITE PREPARATION

1 GENERAL

1.1 SUBMISSIONS

Certification

Vermin: Submit pest exterminator's certification as evidence that the completed site works are free from vermin.

Execution details

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

- Clearing and grubbing.
- Tree removal.
- Protecting the ground within and adjacent to tree driplines from compaction by proposed earthworks machinery.

1.2 INSPECTION

Notice

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

- Enclosures around trees requiring protection.
- Trees requiring removal.

2 EXECUTION

2.1 COMMUNITY LIAISON

Notification

General: Notify residents about construction activities that 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:

- Description of the work.
- The reason for the work.
- 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 starting earthworks, locate and mark existing underground services in the areas affected by the earthworks operations including clearing, excavating and trenching.

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

Construction plant: Conform to the utility service provider requirements for the operation of construction plant within the zone of influence of existing services. Maintain the required cover and do not exceed the allowable load limit.

Excavation: Do not machine excavate within 1000 mm of existing services.

Existing service lines: If required, divert services detected during excavation, clear of the building, and reconnect to the utility service provider requirements.

2.3 SITE CLEARING

Extent

Requirement: Clear only areas occupied by works such as structures, paving, excavation, regrading and landscaping or other areas documented for clearing.

Contractor’s site areas: If not included within the areas documented above, clear 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, timber, stumps, boulders and rubble.

Soil: Turn up soil to a minimum depth of 700 mm.

Grubbing: Grub out stumps and roots over 75 mm diameter to a minimum depth as follows:

- Below subgrade under buildings, embankments or paving: 500 mm.
- Below finished surface in unpaved areas: 300 mm.

Backfilling: Fill 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 no longer required, including slabs, foundations, paving, drains, and access chambers and covers within the works zone.

Batters

Temporary protection: If the change in level between crest and toe is more than 1500 mm, protect from erosion with geofabric, hessian and tar or heavy duty black polyethylene sheet cover. Securely fix down at crest and toe.

Surplus material

Topsoil and excavated material: 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

Erosion control

General: Plan and carry out the work to avoid erosion, contamination, and sedimentation of the site, surrounding areas, and drainage systems.

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 fill, masonry, concrete and services, on ground from where free water has been removed. Prevent water flow over freshly laid work.

Water quality

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

Cross connection: Prevent cross connections between stormwater and the public sewerage system.

Backflow prevention: To AS/NZS 3500.1 (2021) and the requirements of the Network Utility Operator.

Waterways and drains

Waterways: If required, temporarily divert ditches, field drains and other waterways affected by excavation and reinstate on completion.

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

2.5 EXISTING WORKS TO REMAIN

Marking

Requirement: Identify existing works to remain with 1000 mm high, 50 x 50 mm timber stakes connected by yellow plastic tape to prevent accidental damage.

2.6 TREE REMOVAL

Designation

Marking: Identify trees and shrubs for removal by tagging 1000 mm above ground level.

Tags: Select from the following:

- 100 x 50 mm zincanneal tags, painted yellow and lettered to conform to the tree number on the drawings. Secure tags to trees using loose galvanized steel wire bands.
- Surveyor's ribbon.
- Road marking paint.

2.7 TREE PROTECTION

General

Warning signs: Display warnings that trees and plantings require protection during the contract in a prominent position at each entrance to the site. Remove on completion.

Lettering: Road sign type sans serif letters, 100 mm high to AS 4970 (2009) Appendix C.

Protection measures: Provide before starting the earthworks.

Trees to remain

Extent: Trees not marked for removal.

Tree protection

Tree protection zone (TPZ): To AS 4970 (2009) Section 3.

Tree protection measures: To AS 4970 (2009) Section 4.

Monitoring and certification: To AS 4970 (2009) Section 5.

Work near trees

Materials placement: Conform to the following:

- Keep the area within the dripline of trees free of sheds and paths, construction material and debris.
- Do not place bulk materials and harmful materials within the dripline of 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 similar material 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, give notice. Minimise period and extent of excavation within the dripline.

Hand methods: If excavation is required within the dripline, use hand methods so that root systems remain intact and undamaged.

Roots: Do not cut tree roots exceeding 50 mm diameter. If required 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 compact to a dry density similar to that of the 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 by volume (topsoil: well-rotted composts): 3:1.
- Neutral pH value.
- Free from weed growth and harmful materials.

Compaction protection: Protect ground adjacent to the tree dripline.

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

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

Mulching: Spread 100 mm thick organic mulch conforming to AS 4454 (2012), to the whole of the area within the dripline of all existing trees to remain.

2.8 TEMPORARY LANDSCAPE FENCING

Fence dimensions

Height: 1200 mm.

Maximum post spacing: 5000 mm.

Component 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 plant establishment period.

2.9 COMPLETION

Site restoration
Requirement: Reinstate undeveloped ground surfaces to the condition existing at the commencement of the contract.

Clean up
Progressive cleaning: Keep the works clean and tidy, and regularly remove waste and surplus material arising from execution of the work from the site.

Waste disposal: As documented and as follows:

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

Vermin management
Requirement: Employ a suitably qualified pest exterminator to remove vermin found during site preparation.

0222 EARTHWORK

1 GENERAL

1.1 STANDARDS

General
Earthworks: Conform to the recommendations of those parts of AS 3798 (2007) that are referenced in this worksection.

Description and classification of soils: To AS 1726 (2017).

1.2 INTERPRETATION

Definitions
General: For the purposes of this worksection, the definitions given in AS 3798 (2007) and the following apply:

- Bad ground: Ground unsuitable for the works, including fill liable to subsidence, ground containing cavities, faults or fissures, ground contaminated by harmful substances and ground that is, or becomes, soft, wet or unstable.
- Rock: Monolithic material with volume greater than 0.3 m^3 that cannot be removed until broken up by rippers or percussion tools.
- Site topsoil: Natural soil, excavated from the site, that contains organic matter, supports plant life, conforms generally to the fine-to-medium texture classification to AS 4419 (2018) and is free from the following:
  . Stones more than 25 mm diameter.
  . Clay lumps more than 50 mm diameter.
  . Weeds and tree roots.
  . Sticks and rubbish.
  . Material toxic to plants.
- Subgrade: The trimmed or prepared earth material on which the pavement, footing or slab is constructed. Generally taken to relate to the upper line of the earth material.
- Zone of influence: A foundation zone bounded by planes extending downward and outward from the bottom edge of a footing, slab or pavement and defining the extent of foundation material having influence on the stability or support of the footings, slab or pavement.

1.3 TOLERANCES

General
Finish: Finish the surface to the required level, grade and shape within the following tolerances:

- Under building slabs and load bearing elements: +0, -25 mm.
- Pavement subgrades: +0, -40 mm.
- Batters: No steeper than the slope shown on the drawings. Make sure flatter slopes do not impact on boundaries or required clearances to buildings, pavements or landscaping.
- Other ground surfaces: ±50 mm, provided the area remains free draining and matches adjacent

construction if required. Provide smoothness as normally produced by a scraper blade.

1.4 SUBMISSIONS

Execution details

Site records: Submit the following to AS 3798 (2007) clause 3.4 and Appendix B:

- Geotechnical site visit record.
- Earthworks summary report or daily geotechnical reports.

Products and materials

Pesticides and herbicides: Submit manufacturer's product data before application.

Binders and wetting agents: Submit manufacturer's product data before use.

Imported fill: Submit certification from a geotechnical inspection and testing authority (GITA) or test results of the imported fill as evidence of conformity with the contract, including the source.

Tests

Requirement: Submit test results of the following:

- Compaction control.

1.5 INSPECTION

Notice

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

- Items to be measured as listed in **RECORDS OF MEASUREMENT**.
- Excavation completed to contract levels or founding material.
- Filling and compaction completed to contract levels.

2 PRODUCTS

2.1 GENERAL

Unsuitable materials

Requirement: Do not use fill or imported topsoil containing the following:

- Clay material.
- Refuse or materials toxic to humans, animals or plants.
- Stumps, roots or stones more than 50 mm.

Topsoil

Requirement: Topsoil conforming to the following:

- With an organic content not less than 3% by mass.
- With a pH between 5.5 and 7.5.
- With a soluble salt extent not more than 0.06% by mass.

2.2 FILL MATERIALS

General

Suitable material: To AS 3798 (2007) clause 4.4 including inorganic, non-perishable material suitably graded and capable of compaction to the documented density.

Unsuitable materials: Do not use fill defined as unsuitable by AS 3798 (2007) clause 4.3.

Sulfur content: Do not provide material with sulfur content exceeding 0.5% within 500 mm of concrete and cement bound elements (for example masonry) unless the elements are protected by impermeable membranes or equivalent means.

Re-use of excavated material: Only re-use suitable material.

Stockpiles

General: Segregate earth and rock material and stockpile for re-use in backfilling operations.

Location: Do not stockpile excavated material against tree trunks, buildings or fences. Do not obstruct the free flow of water along drainage channels.

2.3 BORROW OR IMPORTED FILL

General

Requirement: Use only when suitable material obtained from site excavations are insufficient for completing the documented earthworks.

- Suitable material: To AS 3798 (2007) clause 4.4.

Borrow pits:

- Locate more than 3000 mm from any fence line, boundary, edge of excavation or embankment.
- Strip and stockpile topsoil.
- Provide erosion protection during winning operations of material and make sure drainage is maintained.

2.4 GEOTEXTILE

General

Material: UV stabilised, permeable, polymeric, woven or non-woven textile material used in contact with soil/rock material.

Identification and marking: To AS 3705 (2012).

3 EXECUTION

3.1 GEOTECHNICAL

As found site conditions

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

- Bad ground.
- Discrepancy in expected conditions.
- Rock.
- Springs, seepages.
- Topsoil more than 100 mm deep.

Inspection and testing

Level of inspection and testing: Level 2 sampling and testing to AS 3798 (2007) clause 8.3 by a geotechnical testing authority (GTA).

Frequency of testing: To AS 3798 (2007) Table 8.1.

3.2 RECORDS OF MEASUREMENT

Excavation and backfilling

Agreed quantities: If a schedule of rates applies, provisional quantities are documented, or there are variations to the contract levels or dimensions of excavations, do not backfill or place permanent

works in the excavation until the following have been agreed and recorded:

- Depths of excavations in relation to the datum.
- Final plan dimensions of excavations.
- Quantities of excavations in rock.

Method of measurement: By a registered surveyor.

Rock

Level and class: If rock is measured for payment purposes, either as extra over excavation of material other than rock or for adjustment of provisional measurements, do not remove the rock until the commencing levels and classes of rock have been determined.

3.3 REMOVAL OF TOPSOIL

General

Extent: Areas of cut or fill and areas to be occupied by structures, pavements and embankments.

Maximum depth: 200 mm.

Disposal: Remove topsoil unsuitable for re-use from the site to AS 3798 (2007) clause 6.1.8.

Topsoil stockpiles

General: Stockpile site topsoil intended for re-use.

Stockpile maximum height: 1.5 m.

Identification: Mark and label stockpiles of different soil types.

Vegetation: Do not burn off or remove plant growth that occurs during storage.

Protection: Conform to the following:

- Provide drainage and erosion protection.
- Do not allow traffic on stockpiles.
- If a stockpile is to remain for more than four weeks, sow with temporary grass.
- Protect the topsoil stockpiles from contamination by other excavated material, weeds and building debris.

3.4 EXCAVATION

Extent

Site surface: Excavate the site to the levels and profiles required for the documented structures, pavements, filling and landscaping. Make allowance for compaction, settlement or heaving.

Footings, pits, wells and shafts: Excavate to the required sizes and depths. Confirm the foundation conditions meet the design bearing capacity.

Bearing surfaces

Requirement: Provide even plane bearing surfaces for loadbearing elements including footings. Step to accommodate level changes, as documented. If supporting masonry, make the steps appropriate to the courses.

Rock

General: Do not use explosives.

Existing footings

Requirement: If excavation is required within the zone of influence of an existing footing, provide supports to the footing sufficient to prevent damage arising from the works. Use methods including temporary shoring or underpinning.

Existing services

Location: Before starting earthworks, locate and mark existing underground services in the areas that will be affected by the earthworks operations including clearing, excavating and trenching.

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

Excavation: Do not excavate by machine within 1000 mm of existing services.

Proof rolling

Extent: Proof roll excavations for pavements, filling and non-spanning slabs on ground to determine the presence of bad ground.

Proof rolling method and equipment: To AS 3798 (2007) clause 5.5.

Requirement: If excessive settlement, rebound or heaving is encountered, provide test pits or trenching to determine the extent of bad ground.

Subgrade replacement: Excavate the full extent and depth of bad ground. Remove and replace with selected fill. Place and compact to **PLACING FILL** to achieve the required capacity and levels.

Disposal of excess excavated material

General: If not required or unsuitable for fill, remove from site.

Standard: To AS 3798 (2007) clause 6.1.8.

3.5 REINSTATEMENT

Deterioration of bearing surfaces

Requirement: If the bearing surface deteriorates, excavate to a sound surface before placing the loadbearing element.

Subgrades affected by moisture

Requirement: If, due to high moisture content, the subgrade cannot support construction equipment or the overlying pavement cannot be compacted, perform one or more of the following:

- Allow the subgrade to dry until it provides support for equipment and allows compaction.
- Scarify the subgrade to a depth of 150 mm, work as necessary to accelerate drying, and recompact when the moisture content is satisfactory.
- Excavate the wet material and move to spoil stockpile, and backfill excavated areas.

Over excavation

Requirement: If excavation exceeds the required depths, reinstate to the correct depths, levels and bearing capacity.

Zone of influence: Within the zone of influence of footings, beams, or other structural elements, use concrete of strength equal to the structural element, minimum 15 MPa. Make sure that remedial concrete does not create differential bearing conditions.

Below slabs or pavements: Rectify the over excavation as follows:

- Generally: Provide selected fill compacted to the documented density.
- Less than 100 mm: Do not backfill. Increase the thickness of the layer above.

Subsoil drains: Backfill over excavation of subsoil drains using coarse filter material conforming to AS/NZS 3500.3 (2021) clause 2.13.1.

3.6 SUPPORTING EXCAVATIONS

Removal of supports
General: Remove temporary supports progressively as backfilling proceeds.

Voids
General: If voids occur outside sheeting or sheet piling, fill and compact voids to a dry density similar to that of the surrounding material.

3.7 ADJACENT STRUCTURES

Temporary supports
General: If required, provide supports to adjacent structures, sufficient to prevent damage arising from the works.

Lateral supports: Provide lateral support with shoring.

Vertical supports: If required, provide vertical support with piling or underpinning or both.

Permanent supports
General: If permanent supports for adjacent structures are required and are not documented, give notice and obtain instructions.

Encroachments
General: If encroachments from adjacent structures are encountered and are not documented, give notice and obtain instructions.

3.8 ROCK BOLTING

General
Requirement: For temporary or permanent support of rock faces, provide proprietary high strength steel bars or cables anchored into holes drilled in the rock and tensioned against plates bearing on the rock face. Schedule the installation to conform to systematic bolting or calculated relief, as documented.

Standard: To AS 4678 (2002).

Protection
General: Protect permanent rock bolts by grouting the drilled hole with cement grout after tensioning the rock bolt. Protect the bearing plate and the exposed portion of rock bolt and anchorage with a protective coating or by embedment in concrete.

3.9 GEOTEXTILE

General
Preparation: Trim the ground to a smooth surface free from cavities and projecting rocks.

Installation: Lay the fabric flat, not stretched tight, and secure with anchor pins. Overlap joints 300 mm minimum.

3.10 PREPARATION FOR FILLING

Preparation
Stripping: Prepare the ground surface before placing fill (including topsoil fill), ground slabs or load bearing elements to AS 3798 (2007) clause 6.1.5. Remove loose material, debris, organic matter and material that inhibits or prevents satisfactory placement of fill layers.

Foundation preparation: To AS 3798 (2007) clause 6.1.7.

Compaction: Compact the ground exposed after stripping or excavation, to a minimum depth of 150 mm, to the minimum relative compaction in AS 3798 (2007) Table 5.1.

Ground treatment or improvement methods:

- Scarify method: Loosen exposed excavation by scarifying to a minimum of 150 mm, moisture-condition and compact to AS 3798 (2007) Section 5.
- Impact roller and impact compaction: Use an approved method.

Slope preparation: If fill is placed on a surface steeper than 4:1 (horizontal:vertical), bench the surface to form a key for the fill. As each layer of fill is placed, cut the existing ground surface progressively to form a series of horizontal steps more than 1 m in width and more than 100 mm deep. Recompact the excavated material as part of the filling. Shape to provide free drainage.

Under earth mounds
General: Cultivate the ground to a depth of 200 mm before mound formation.

Under slabs, paving and embankments
General: If required, loosen the ground to a depth of more than 200 mm and adjust the moisture content before compaction to a density consistent with subsequent filling.

Rock ledges
General: Remove overhanging rock ledges.

Embankments
Requirement: Grade embankments to an even slope.

Maximum gradient: 1:4.

3.11 PLACING FILL

General
Extent: Place fill to the documented dimensions, levels, grades, and cross-sections so that the surface is always self-draining.

Layers: Place fill in near-horizontal layers of uniform thickness no greater than 150 mm after compaction, deposited systematically across the fill area.

Edges: At junctions of fill and existing surfaces, do not feather the edges.

Mix: Place fill in a uniform mixture.

Previous fill: Before placing subsequent fill layers, make sure that previously accepted layers still conform to requirements, including moisture content.

Protection: Protect the works from damage due to compaction operations. If required, limit the size of compaction equipment or compact by hand.

Protective covering to membranes: Do not disturb or damage during backfilling.

Placing at structures
Fill adjacent structures and trenches: To AS 3798 (2007) clause 6.2.6.

Requirement: Place and compact fill in layers simultaneously on both sides of structures, culverts and pipelines to avoid differential loading. Commence compacting each layer at the structure and proceed away from structure.

Over the top of structures: Carefully place first layers of fill.

Retaining walls: Do not place fill against concrete retaining walls until the concrete has been in place for 28 days unless the structure is supported by struts.

Compaction

General: Compact the subgrade and each layer of fill to the required depth and density, as a systematic construction operation. Shape surface to provide drainage and prevent ponding.

Maximum rock and lump size in layer after compaction: To AS 3798 (2007) clause 6.2.2.

Fill batter faces: Either compact separately, or overfill and cut back. Form roughened surfaces to the faces.

Minimum relative compaction: To AS 3798 (2007) Table 5.1.

3.12 PLACING TOPSOIL

Stockpiled topsoil

Cultivation: Rip subgrade to a depth of 100 mm or to the depth of rippable subgrade if less. Cultivate around services and tree roots by hand. Trim to allow for the required topsoil depth.

Herbicide: Apply before placing topsoil. Use environmentally acceptable methods conforming to the *Health (Pesticides) Regulations 2011 (WA)*, such as a non-residual glyphosate herbicide, at the recommended maximum rate. Leave herbicide undisturbed for a minimum of 2 weeks unless cleared by the principal.

Binders and wetting agents: Apply to manufacturer's recommendations.

Placing: Spread and grade evenly to provide an average compacted thickness of 50 mm and a minimum compacted thickness of 30 mm at any location.

Compaction: Lightly compact topsoil so that the finished surface is smooth, free from lumps of soil, at the required level, ready for cultivation and planting.

Edges: Finish topsoil flush with abutting kerbs, mowing strips and paved surfaces. Feather edges into adjoining undisturbed ground.

Finish level: Conform to the following:

- 30 mm below paths, kerbs or slabs.
- Minimum one brick course below the damp-proof course of buildings.
- Levelled with bitumen or concrete driveways.
- Free of undulations, irregularities and wheel ruts.

Disposal of excess topsoil

On-site: Dispose of surplus topsoil remaining on site by spreading evenly over the areas already placed.

3.13 FILL MOISTURE CONTROL

General

Moisture content: Determine in conformance with AS 1289.5.1.1 (2017) or AS 1289.5.2.1 (2017), as appropriate. Adjust the moisture content of fill to ±2% optimum moisture content during compaction as required to achieve the documented density.

3.14 TESTING

Site tests

Compaction control tests: To AS 1289.5.4.1 (2007) or AS 1289.5.7.1 (2006).

Test frequency: To AS 3798 (2007) Table 8.1.

3.15 COMPLETION

Grading

External areas: Grade to give falls away from buildings, minimum 1:100.

Subfloor areas: Grade the ground surface under suspended floors to drain ground or surface water away from buildings without ponding.

Site restoration

Requirement: If variation of existing ground surfaces is not required as part of the works, restore surfaces to the condition existing at the commencement of the contract.

0241 LANDSCAPE – WALLING AND EDGING

1 GENERAL

1.1 RESPONSIBILITIES

Performance
Requirement:

- Complete for their function.
- Conforming to the details and locations documented.
- Firmly fixed in position.
- Does not form a safety hazard.

1.2 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 TIMBER

Durability
Natural durability class to AS 5604 (2022): Class 1.

Hazard class: To AS/NZS 1604.1 (2021).

Preservative treatment
Timber type: Provide only timbers with preservative treatment appropriate to the hazard class.

Cut surfaces: Provide supplementary preservative treatment to all cut and damaged surfaces.

CCA or LOSP treated timber: If proposed, provide details.

Hardwood
General: To AS 2796.1 (1999) Section 2.

Softwood
General: To AS 4785.1 (2002) Section 2.

2.2 STEEL

Steel posts
Hot-rolled steel bars and sections: To AS/NZS 3679.1 (2016).

Coating: Hot-dip galvanized to AS/NZS 4680 (2006).

2.3 CONCRETE

General
Standard: To AS 1379 (2007).

Exposure classification: To AS 3600 (2018) Table 4.3.

Grade, if there are cast-in metal items: To AS 3600 (2018) Table 4.4.

2.4 DRY STONE WALLS

Walling stone
Natural stone: Stone of uniform quality, sound and free from defects liable to affect its strength, appearance or durability.

Field stone: Local weathered uncut random sized natural stones.

Quarried stone: Cut or uncut random or regular size stone.

2.5 STONE PITCHING

General
Stones: Clean, hard and durable laterite.

- Size: No less than 150 mm or more than 300 mm.

Mortar mix proportion (cement:lime (hydrated or putty):sand): 1:0.1:3.

Bedding layer: Gravel, 30 mm thick.

2.6 SLEEPER WALLS

Sleepers
Concrete: Proprietary system of concrete sleepers and concrete or galvanized steel posts.

2.7 REINFORCED EARTH WALLS

General
Type: Proprietary system of galvanized steel strips, steel mesh strips or polymeric mesh reinforcement placed in layers with compacted selected fill and connected to precast concrete facing panels to form vertical retaining walls. Provide the necessary accessories including levelling pad, bearing pads, and joint fillers or covers to keep the selected fill material out of the panel joints.

2.8 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 (2012).

2.9 EDGING

Sawn timber
Hardwood: To AS 2796.1 (1999) Section 2.

Concrete
Standard: To AS 1379 (2007).

Grade: Minimum N20.

Steel
Finish: Hot-dip galvanized.

Thickness: Minimum 4 mm.

Aluminium
Thickness: Minimum 4 mm.

Brick
Requirement: Provide masonry units.

2.10 STONE BOULDERS

General
Dimension: Not less than 400 mm.

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.

Backfilling
Requirement: Make sure geotextiles and subsurface drainage have been installed before backfilling.

3.2 DRY STONE WALLS

Construction
Generally: Select the stones for their locations and lay in the wall with minimum stonecutting as follows:

- Each stone is stable, non-rocking and firmly interlocked with adjacent stones without mortar.
- The wall face shows reasonably regular, flat and vertical stone faces.
- Vertical joints or perpends between stones are spanned by the next stone above.
- Stones are laid generally as through stones whenever possible.
- At least 50% of footings, 30% of wall stones and all coping stones are laid as through stones.

Footings: Select the largest, flattest and most regular stones for footings and set them one third of their depth into the ground.

Copings: Select stones of reasonably uniform size and finish the top of the wall to a level line.

Retaining walls
Construction: If dry stone walls act as retaining walls, construct the stonework to be free draining through the wall. Secure the top course of the wall with cement mortar bedding. Backfill progressively, with a layer at least 300 mm thick of porous material, such as coarse aggregate or crushed rock in the size range 20 to 40 mm.

Minimum thickness: 300 mm.

Wall face batter: Batter back the wall face 50 to 70 mm for every 300 mm in height.

Rip-rap retaining walls
Construction: Construct as dry stone retaining walls with large random sized boulders recovered from excavations, to form gravity walls retaining, and supported by, embankments. Place boulders with large face down and stepped back from boulders below.

3.3 STONE PITCHING

General
Laying: Lay stones as follows:

- Lay stone in close fitting pattern rammed into position.
- Fill spaces between the stones with mortar to form an even, sealed surface.
- Keep exposed rock surface free from mortar.

Maximum spacing between stones: 10 mm.

3.4 SLEEPER WALLS

Construction
Concrete sleeper wall: To manufacturer's recommendations.

Backing: Backfill to ground level with compacted fine crushed rock or gravels.

3.5 REINFORCED EARTH WALLS

Construction
Requirement: Construct walls to the manufacturer's written recommendations.

3.6 EDGING

Sawn timber
Installation: Set edgings flush with adjoining surfaces. Drive galvanized steel stakes into the ground at 500 mm centres on the planting side of the edging. Fix edging to the stakes with galvanized nails, two per fixing.

Curving: Space the pegs to hold edging to a uniform curve. Reduce edging thickness to 15 mm if required for bending.

Concrete
Edging strip: Place in a shallow trench between timber forms. Wood float finish flush with the adjacent finished level. Provide control joints, filled with resilient bituminous material, at 3 m maximum centres.

Concrete kerb: Fixed form, extrusion or slip forms.

Steel
Installation: Drive galvanized steel stakes into the ground at 500 mm centres on the planting side of the edging. Butt weld edging to stakes and grind smooth.

Aluminium
Installation: Drive galvanized steel stakes into the ground at 500 mm centres on the planting side of the edging. Butt weld edging to stakes and grind smooth.

Brick
Setting: On a 1:1:6 (cement:lime:sand) mortar haunch.

Laying: Lay edging bricks to the documented bond or coursing pattern.

Joints: 3 mm struck flush.

Alignment: Even and free from dips, humps and bends.

Cleaning: Wash off mortar progressively.

0242 LANDSCAPE – FENCES AND BARRIERS

1 GENERAL

1.1 RESPONSIBILITIES

Performance
Requirements:
- Complete for their function.
- Conforming to the detail and location drawings.
- Firmly fixed in position.

1.2 INSPECTION

Notice
Inspection: Give notice so that inspection may be made of the following:
- Boundary survey location.
- Set-out before construction.
- Completion of installation.

2 PRODUCTS

2.1 TIMBER

Durability
Natural durability class: To AS 5604 (2005).

Hazard class: To AS/NZS 1604.1 (2021).

Posts and rails
Hardwood: To AS 2082 (2007).

Softwood: To AS 2858 (2023).

Pickets and palings
Hardwood: To AS 2796.1 (1999) Section 8.
- Grade to AS 2796.2 (2006): Select.

Softwood: To AS 4785.1 (2002) Section 7.

Seasoned cypress pine: To AS 1810 (1995) Section 5.

Preservative treatment
Timber type: Provide only timbers with preservative treatment to the documented hazard class.

Cut surfaces: Provide supplementary preservative treatment to all cut and damaged surfaces.

CCA treated timber: If proposed to be used, provide details.

2.2 STEEL

Steel tubes
Posts, rails, stays and pickets: To AS/NZS 1163 (2016).
- Grade: C350L0.

Post and rail finish: Hot-dip galvanized.

Fencing wire
Chain link, cable wire, tie wire and barbed wire: To AS 2423 (2002).

2.3 CONCRETE

General
Standard: To AS 1379 (2007), Grade N20.

Exposure classification: To AS 3600 (2018) Table 4.3.

2.4 COMPONENTS

Steel panel fencing
Steel framing: Zinc-coated or aluminium/zinc alloy coated steel to AS 1397 (2021).

Steel sheeting: Prepainted to AS/NZS 2728 (2013).

Timber fencing
General: Conform to the timber members as documented.

Gates
General: As documented.

3 EXECUTION

3.1 CONSTRUCTION GENERALLY

Set-out
General: Set out the fence line and mark the positions of posts, gates and bracing panels.

Property boundaries: Confirm by survey.

Clearing
Fence line: Except for trees or shrubs to be retained, clear vegetation within 1 m of the fence alignment. Grub out the stumps and roots of removed trees and shrubs, and trim the grass to ground level. Do not remove the topsoil.

Excavation
Posts: Excavate post holes so that they have vertical sides and a firm base. Spread surplus material on the principal's side of the fence.

Earth footings
Base: Place 100 mm of gravel in the footing base under posts.

Compaction: Backfill with earth around posts, compacting firmly by hand or machine in 150 mm deep layers.

Concrete footings
In ground: Place mass concrete around posts to protect posts from waterlogged conditions and finish the top with a 25 mm fall from the post to the footing edge.

On slabs: Provide welded and drilled post base flanges for fixing with masonry anchors to the concrete.

Erection
Line and level: Erect posts vertically. Set heights to follow the contours of natural ground.

3.2 GATES

General
Construction: Construct gates as follows:
- Ledges and braces: Match fence rails.
- Pickets or palings: Match fencing.

Pedestrian entry gates
General: Provide the following:
- Lockable gates with 180 degree opening range.
- Hinges with smooth operation and adjustment for future sagging.

Separate courtyard entry gates
Hardware: Provide the following:

- Drop bolt and ferrule to each leaf of double gates.
- Latch to one leaf of double gates.
- Provision for locking by padlock.
- Hinges with smooth operation and adjustment for future sagging.

Hand access: If required, provide hand holes to give access from outside to reach locking provision.

3.3 TIMBER FENCING

Installation
General: Mortice posts, taper splice rails and nail twice in mortices. Set pickets and palings clear of the ground.

Picket fence: Nail twice to each rail.

Plain paling fence: Provide 2 rails for fences up to 1800 mm high and locate 200 mm from the tops and bottoms of the palings. Close butt palings and nail twice to each rail.

Lap and cap paling fence: Provide 2 rails for fences up to 1800 mm high and locate 200 mm from the bottoms of the palings and abutting the tops of palings. Close butt larger palings and nail twice to each rail. Fix smaller palings over joints and nail twice to each rail. Nail capping to the top rail.

Timber gates
Ledges and braces: Match fence rails.

3.4 STEEL FENCING

Steel picket fencing
Footing type: Concrete.

Steel picket fencing installation
General: Fit tightly fitting caps to steel posts. Attach panels to posts with fixing clips and galvanized M8 x 75 mm hexagon head bolts before concreting footing.

Steel panel fencing
Protection: Make sure bottom rails are at least 50 mm clear of the ground.

3.5 CHAIN LINK FABRIC FENCING

Security fencing and gates
Standard: To AS 1725.1 (2010).

3.6 WELDED MESH FENCING

Welded mesh fencing
Footing type: Concrete.

Installation
General: Fit tightly fittings caps to steel posts. Attach panels to posts with fixing clips and galvanized M8 x 75 mm hexagon head bolts before concreting footing.

0251 LANDSCAPE – SOILS

1 GENERAL

1.1 STANDARDS

Soils
Site and imported topsoil: To AS 4419 (2018).

1.2 INTERPRETATION

Definitions
General: For the purposes of this worksection, the definitions given in AS 4419 (2018) and the following apply:

- Bad ground: Ground unsuitable for the works, including fill liable to subsidence, ground containing cavities, faults or fissures, ground contaminated by harmful substances and ground that is, or becomes, soft, wet or unstable.
- Imported topsoil: Similar to local natural soil, 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 (2018) Appendix K Table K1, as follows:
  - . Fine: Clay loam, fine sandy clay loam, sandy clay loam, silty loam, loam.
  - . Medium: Sandy loam, fine sandy loam.
  - . Coarse: Sand, loamy sand.
- Site rock: Rocks selected for salvage.
- Site topsoil: Natural soil, excavated from the site, that contains organic matter, supports plant life, conforms generally to the fine-to-medium texture classification to AS 4419 (2018) and is free from the following:
  - . Stones more than 25 mm diameter.
  - . Clay lumps more than 50 mm diameter.
  - . Weeds and tree roots.
  - . Sticks and rubbish.
  - . Material toxic to plants.
- Soil blend: A landscape 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 soil that is suitable for surface application to turf and lawns.
- Topsoil: Includes landscape soil, low density soils and soils for turf and lawns.

1.3 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 less than 100 mm deep.

1.4 SUBMISSIONS

Certification

Compost: Submit 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.

Products and materials

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

- Material source of supply.

Type tests: Submit test results for the following:

- Imported topsoil: To PRODUCTS, **TESTING**.

Samples

Requirement: Submit samples to PRODUCTS, **GENERAL**, **Samples**.

Subcontractors

General: Submit names and contact details of proposed suppliers and evidence of the following, if appropriate:

- Experience in the required type of work.
- Production capacity for material of the required type, sizes and quantity.
- Lead times for delivery of materials to the site.

Tests

Site tests: Submit test results for the following:

- Site topsoil: To EXECUTION, **TESTING**.

1.5 INSPECTION

Notice

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

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

2 PRODUCTS

2.1 GENERAL

Samples

Requirement: Provide representative samples of each material, packed to prevent contamination and labelled to indicate source and content.

Bulk materials: At least 5 working days before bulk deliveries, provide a 1 kg sample of each type documented.

2.2 TOPSOIL

General

Properties: Conform to the following:

- Decompacted.
- Aerated.
- Free draining.
- Free of contamination from construction waste.

Deliveries: Documentation to AS 4419 (2018) clauses 6 and 7.

Additives: If using additives to ameliorate topsoil conform to the relevant criteria of AS 4419 (2018).

Compost: Well-rotted vegetative material or animal manure, free from harmful chemicals, grass and weed growth to AS 4454 (2012) and to the organic content by mass, as documented.

Source

General: If the topsoil of documented quality cannot be provided from material recovered from site, provide imported topsoil.

Mix proportion (loam:sand): 1:1.

Site topsoil

Requirement: Site topsoil, as documented.

Soil blend: If required, stripped natural soil with sand and/or organic matter and recommended ameliorants.

Imported topsoil

Requirement: Imported topsoil to AS 4419 (2018) Tables 1, 2 and 3, and as documented.

Imported topsoil particle size table (% passing by mass)

Sieve size (mm)	Soil textures		
	Fine	Medium	Coarse
2.36	100	100	100
1.18	90 – 100	90 – 100	90 – 100
0.60	75 – 100	75 – 100	70 – 90
0.30	57 – 90	55 – 85	30 – 46
0.15	45 – 70	38 – 55	10 – 22
0.075	35 – 55	25 – 35	5 – 10
0.002		2 – 15	2 – 8

Imported topsoil nutrient level table

Nutrient	Unit	Sufficiency range
Nitrate-N (NO_3)	mg/kg	> 25
Phosphate-P (PO_4) – P tolerant	mg/kg	43 - 63
Phosphate-P (PO_4) – P sensitive	mg/kg	< 28
Phosphate-P (PO_4) – P very sensitive	mg/kg	< 6
Potassium (K)	mg/kg	178 - 388
Sulfate-S (SO_4)	mg/kg	39 - 68
Calcium (Ca)	mg/kg	1200 - 2400
Magnesium (Mg)	mg/kg	134 - 289
Iron (Fe)	mg/kg	279 - 552
Manganese (Mn)	mg/kg	18 - 44
Zinc (Zn)	mg/kg	2.6 - 5.1
Copper (Cu)	mg/kg	4.5 - 6.3
Boron (B)	mg/kg	1.4 - 2.7
Method References pH in H_2O (1:5), pH in $CaCl_2$ (1:5) and Electrical Conductivity (EC) by Rayment & Higginson (1992) method 4A2, 4B2, 3A1. Soluble Nitrate-N by APHA 4500. Soluble Chloride by Rayment and Lyons 2011 modified method 5A2. Extractable P by Mehlich 3 – ICP.		

Nutrient	Unit	Sufficiency range
Exchangeable cations – Ca, Mg, K, Na by Mehlich 3 – ICP. Extractable S by Mehlich 3 – ICP. Extractable trace elements (Fe, Mn, Zn, Cu, B) by Mehlich 3 - ICP.		

2.3 STRUCTURAL SUPPORT SOIL

General

Requirement: To AS 4419 (2018) Tables 4 and 5, and as documented.

2.4 TESTING

Topsoil tests

Sampling: To the recommendations of AS 4419 (2018) Appendix A.

Method: Test as follows:

- Landscape soils: To AS 4419 (2018) Table 1.
- Low density soils: To AS 4419 (2018) Table 2.
- Soils for turf and lawns: To AS 4419 (2018) Table 3.
- Structural support soils: To AS 4419 (2018) Table 4.

Test report

Requirement: Prepare a test report including the following:

- General:
  - . Suitability of the soil for documented use.
  - . Suitability for establishment and ongoing viability of the documented site vegetation.
  - . Prescence of any weed propagules or contaminants.
- Site topsoil:
  - . Contaminant removal.
  - . Weed eradication: Species and eradication method.
  - . Soil amelioration: If required, the source of ameliorant materials, rates and methods of incorporation and recommendations for use in bushland restoration areas, planting on grade and grass mixes.
- Imported topsoil:
  - . Similarity to naturally occurring local soil.
  - . Soil amelioration: If required, the source of ameliorant materials, rates and methods of incorporation.

3 EXECUTION

3.1 PREPARATION

Vegetative spoil

Spoil suitable 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

Requirement: If necessary to prevent erosion or soil movement, stabilise embankments with matting.

Matting overlay material: Biodegradable fibre reinforced with lightweight polymer mesh, coir.

- High erosion zones: Flexible carbon black UV stabilised interwoven nylon mesh.

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

Matting overlay installation:

- If seeding is required, sow before installing lightweight matting.
- If planting is required, plant after installing medium or heavy weight matting.
- Peg the matting into 300 x 300 mm anchor trenches at top and bottom, backfill the trenches with soil and compact.

3.2 ROCK WORK

New rock work

Erosion control: 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 that has been selected before delivery.

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 tested to AS 1289.5.4.1 (2007). 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.

Drainage: Construct mounds to allow free drainage of surface water and to eliminate ponding.

3.4 SUBSOIL

Ripping

General: Rip parallel to the final contours. Do not rip if the subsoil is wet or plastic. Do not rip within the dripline of trees and shrubs to be retained.

Subsoil: Rip the subsoil to the following typical depths:

- Compacted subsoil: 300 mm.
- Heavily compacted clay subsoil: 450 mm.

Planting beds

Excavated: Excavate to reduce the subsoil level to at least 300 mm below finished design levels. Shape the subsoil to fall to subsoil drains, if required. Break up the subsoil to a further depth of 100 mm.

Unexcavated: Remove weeds, roots, rubbish and other debris. Reduce the planting bed level to 75 mm below finished design levels.

Cultivation

Requirement: As documented.

Minimum depth: 100 mm.

Services and roots: Do not disturb services or tree roots. If required, cultivate these areas by hand.

Cultivation: 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

General: Apply additives after ripping or cultivation and incorporate into the upper 100 mm layer of the subsoil as documented.

Gypsum: Incorporate at the rate of 0.25 kg/m^2.

Herbicides

General: Before spreading topsoil apply a herbicide treatment.

3.5 TOPSOIL

Site topsoil preparation

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

Additives: During the screening process add the following:

- 15% by weight coarse sand minimum particle size 0.2 mm.
- Ameliorants materials to the recommendations of the test report.
- Additives program: 8 weeks before stolonising or turfing.

Waste: Remove from site all clay lumps, balled compacted particles greater than 20 mm, stones and rubbish foreign to the normal composition of soil.

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

Placing topsoil

Topsoil: Do not incorporate topsoil into the works until soil testing results have been approved. Remove unauthorised material from the site.

Spreading: Spread the topsoil on the prepared subsoil and grade evenly, making allowances, if appropriate, for the following:

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

Steep batters: If using a chain drag for spreading, make sure 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 that 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.

Topsoil depths

General: Spread topsoil to the following typical depths:

- Excavated planting areas:
  - . Organic mulch: 225 mm.
- Irrigated grassed areas generally: 150 mm.
- Irrigated grassed areas, heavy use (e.g. playing fields, playgrounds and public parks): 200 mm.
- Non-irrigated grass areas: 100 mm.
- Earth mounds:
  - . Mass planted surfaces: 300 mm.
  - . Grassed surfaces: 100 mm.
- Top dressing: 10 mm.

Surplus topsoil

General: Spread surplus topsoil on designated areas on-site or dispose off-site.

3.6 STRUCTURAL SUPPORT SOIL

Preparation

Existing soil: Remove.

Subsoil: Break up the surface and shape to drains. Remove rock.

Construction

Spreading: Maintain a self-draining surface.

Compaction: To **PLACING FILL**, **Compaction** in *0222 Earthwork*.

Protection: Limit the size of compaction equipment or compact by hand to prevent damage.

Moisture content: Adjust the moisture content at the time of works to 12.5% of the optimum moisture content to AS 1289.5.4.1 (2007).

Contaminated structural soil: If contamination occurs after placing, excavate and dispose off-site.

Surplus structural soil: Remove.

0252 LANDSCAPE – NATURAL GRASS SURFACES

1 GENERAL

1.1 SUBMISSIONS

Certification
Turf: Submit the supplier's certification as evidence that turf is free from diseases, pests and weeds at the time of delivery.

Execution details
Program: Submit a work program for the natural grass surfaces landscape works.

Maintenance program: Submit a proposed maintenance program.

Material storage on site: Submit proposal.

Products and materials
Supplier's data: Submit supplier's data including the following:

- Material source of supply.
- Evidence of experience in supply of the required material.
- Production capacity for material of the required type and quantity.
- Lead times for delivery of material to the site.

Samples
Requirement: Submit samples to PRODUCTS, **GENERAL**, **Samples**.

1.2 INSPECTION

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

- Clearing completed.
- Setting out completed.
- Grassing bed prepared before turfing.
- Grassing or turfing completed.

2 PRODUCTS

2.1 GENERAL

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

2.2 GRASS

Turf
Supplier: A specialist grower of cultivated turf.

Quality: Provide turf of even thickness, free from weeds, pests, disease and other foreign matter.

Turf properties: Provide turf with the following properties:

- Consisting of 25 mm deep, dense, well-rooted, vigorous grass growth in 25 mm deep topsoil.
- Drought tolerant.

Turf dimension:

- Roll width: Minimum 300 mm, in sound unbroken condition.
- Length: Minimum 1.5 m.

Stolons
Description: Well-established fibrous runners 50 to 100 mm in length, with minimum green leaf material.

Supplier: A specialist grower of cultivated turf.

2.3 FERTILISER

General
Description: Proprietary fertilisers, delivered to the site in the manufacturer's labelled and unopened bags or containers.

Labelling
General: To the applicable statutory requirements, including manufacturer or supplier, weight, fertiliser type, N:P:K ratio, recommended uses and application rates.

Label type: To withstand transit without erasure or misplacement.

2.4 ACCESSORIES

Grass reinforcement
Description: Lightweight interlocking plastic cellular paving system suitable for pedestrian and occasional vehicular traffic including emergency vehicles.

3 EXECUTION

3.1 PREPARATION

Existing grass removal
Herbicide: Spray existing grass with a non-residual glyphosate herbicide in any registered formulae, at the recommended maximum rate.

Manual removal: Remove existing grass layer a minimum 2 weeks after application of herbicide.

Weed eradication
Herbicide: Conform to the following:

- Method: Eradicate weeds using environmentally acceptable methods conforming to the *Health (Pesticides) Regulations 2011 (WA)*, such as a non-residual glyphosate herbicide, at the recommended maximum application rate.
- Timing: With sufficient timing before establishment of turf and as recommended by the plant supplier.

Manual weeding: Remove weed growth throughout grassed areas.

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

Soil preparation
Subsoil: To EXECUTION, **SUBSOIL** in *0251 Landscape – soils*.

Site topsoil or imported topsoil: To EXECUTION, **TOPSOIL** in *0251 Landscape – soils*.

Levelling: Remove any debris. Level and shape the dry soil surface. Allow maximum 30 mm set-down to hard surfaces for turf and stolons.

Fertiliser

Soil improvement: Spread the fertiliser evenly over the cultivated bed a maximum 48 hours before placing grass as follows:

- Turfing and stolonising: Mix the fertiliser thoroughly into the topsoil before placing the turf or stolons.

3.2 TURFING

Preparation for turfing

Requirement: Prepare planting area for turfing as follows:

- Remove any rubbish, rubble, stones and roots.
- Rotary hoe: To a minimum depth of 150 mm. Provide runners with minimum 50 mm soil cover.
- Soil improver: Apply to manufacturer's recommendations.
- Wetting agent: Apply to manufacturer's recommendations.
- Watering: Keep moist to 100 mm deep before planting.
- Light rolling: Lightly roll to form an even, levelled surface without wheel ruts.
- Level: If turfing areas are adjacent to paving, make sure soil level is 50 mm below the top of paving.

Supply

Elapsed time: Deliver the turf and lay within 24 hours of cutting. Prevent turf from drying out between cutting and laying. If not laid within 24 hours of cutting, roll turf out on a flat surface with the grass up and water as required to maintain a healthy condition.

Fertilising

Requirement: Mix the fertiliser thoroughly into the topsoil before placing the turf with a slow release fertiliser applied to the manufacturer’s recommendations.

Application

Requirement: Do not install turf on slopes steeper than 1:3.

Method: Lay the turf as follows:

- Stretcher bond pattern with the joints staggered and close butted.
- Parallel with the long sides of level areas and with contours on slopes.
- Finish flush, after tamping or rolling, with adjacent finished surfaces of ground, paving edging areas.

Laying: Close butt the end joints and space the turf strips 300 mm apart. Lay top dressing between the turf strips. Finish with an even surface.

Tamping or rolling: Lightly tamp or use a turf roller to provide to an even surface immediately after laying.

Stabilising on steep slopes: Peg the turf to prevent downslope movement. Remove the pegs when the turf is established.

Watering

General: Water immediately after laying until the topsoil is moistened to its full depth. Maintain moisture to this depth.

Initial establishment

General: Maintain turfed areas until there is a dense continuous sward of healthy grass over the whole turfed area, evenly green and of a consistent height.

Failed turf: Lift failed turf and replace with new turf.

Levels: If levels have deviated from the design levels after placing and watering, lift turf and regrade topsoil to achieve design levels.

Top dressing: Mow the established turf and remove cuttings. Lightly top dress to a depth of 10 mm. Rub the dressing into the joints and correct any unevenness in the turf surface.

3.3 STOLONISING

Preparation

General: Moisten topsoil to full depth.

Supply

Elapsed time: Deliver stolons to the site within 24 hours of harvesting and plant within 36 hours of arrival on site. Prevent stolons from drying out between harvesting and planting.

Application

General: As documented.

Method: Using a disk sprigger or row planter, mechanically sprig the stolons into the prepared soil to a minimum depth of half the stolon length, at maximum 150 mm centres in both transverse directions over the whole of the planting area, and extending 1 m into adjacent grassed areas.

Stimulant: Three days after planting, spray with hormone root growth stimulant.

Erosion areas, slopes and swales: Immediately after planting, spray with binder at the rate of 250 L/ha.

Watering

General: Water thoroughly on completion of planting. Keep the topsoil moist to full depth.

Initial establishment

General: Replant areas that fail to grow.

3.4 TEMPORARY GRASSING

Preparation

General: If a prepared area becomes compacted before sowing begins, rework the ground surface before sowing.

Application

General: As documented.

Method: Evenly distribute the seed using purpose made sowing machinery. Lightly rake the surface to cover the seed.

Cover crop density: Sufficient to hold the soil and prevent erosion.

Minimum coverage: No bare areas greater than 50 mm in diameter to 90% of the documented area, and no bare areas greater than 200 mm to 100% of the area.

Reseeding: Reseed areas where the seed fails to germinate within three weeks of the date of original sowing and within 3 months if required densities have not been met. Continue to reseed at minimum monthly intervals with an additional soil preparation as required, until required densities are met.

Watering

General: Immediately after sowing, water to a depth of 100 mm. Continue watering until germination and establishment.

After establishment: Water as required to maintain seed material in a healthy condition.

Establishment

General: Maintain temporary grassing areas until no longer required.

Weeding: Remove weeds that emerge in newly established areas.

Reseeding: Reseed over the course of the contract to maintain required densities.

3.5 GRASS REINFORCING

Installation

General: Install to the manufacturer's recommendations and as documented.

Preparation: Excavate to required levels and compact subgrade.

Base course: Place and compact either of the following:

- Non-calcareous, free-draining washed sand, comprising 80% 0.1 to 1.0 mm grading.
- 1.0 to 5.0 mm gravel aggregate.

Base course depth:

- Pedestrian walkways: 100 mm.
- Passenger vehicles: 150 mm.
- Heavy vehicles: 250 mm.

Growing media: 80:20 (sand:organic sandy soil) mix.

Grass reinforcement: Place on base course and interlock. Spread growing media over grass reinforcement to heights as follows:

- Turfed areas: 5 mm.

Protection: Prevent traffic until the root system is established and anchored to the base course.

3.6 COMPLETION

Existing grass

General: If existing grass is within the landscape contract area, maintain it as for the corresponding species of new grass.

Grassed areas

Maintenance: Start grass maintenance works at the completion of sowing and turfing. Maintain healthy weed-free growth.

Records

Logbook: Keep on site and make available for inspection a logbook, recording the following:

- 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.

0253 LANDSCAPE – PLANTING

1 GENERAL

1.1 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 the time of delivery.

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

Execution details

Alternative materials for ground cover: If proposed, submit proposal.

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 storage on site: Submit proposal.

Products and materials

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

- Material source of supply.

Samples

Requirement: Submit samples to PRODUCTS, **GENERAL**, **Samples**.

1.2 INSPECTION

Notice

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

- 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 GENERAL

Samples

Requirement: Provide representative samples of each material, packed to prevent contamination and labelled to indicate source and content.

Bulk materials: At least 5 working days before bulk deliveries, provide a 1 kg sample of each type documented with required test results.

2.2 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 fertiliser equivalence of the compost as part of the overall fertiliser management schedule.

Particle size as a soil conditioner, pH, physical and chemical contaminants: To AS 4454 (2012) Table 3.1(A).

Mature compost: To AS 4454 (2012) Appendix N Table N3.2.

Soil conditioning properties

Chlorine content: Less than 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 2010 test methods:

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

2.3 FERTILISER

General

Description: Proprietary fertilisers, delivered to the site in the manufacturer's labelled and unopened bags or containers, as documented.

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

Labelling

General: To the applicable statutory requirements, including manufacturer or supplier, weight, fertiliser type, N:P:K ratio, recommended uses and application rates.

2.4 MULCH

General

Type: Composted or pasteurised mulch to AS 4454 (2012). Free of deleterious and extraneous matter including soil, weeds, plastic, metal, paint, rubber and sticks. Do not include fine mulch.

Particle size: ≤ 20 mm.

Physical and chemical contaminants: To AS 4454 (2012) Table 3.1(A).

Organic mulch types

General: Free of stones.

Brush chippings and leaf litter: Vegetative material processed through a chipper 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, free from wood slivers.

Pine flake: Pinus species sapwood slivers, 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 surfaces on banks or high erosion areas.

3 EXECUTION

3.1 PREPARATION

Weed eradication

Herbicide: Eradicate weeds using environmentally acceptable methods conforming to the *Health (Pesticides) Regulations 2011 (WA)*, such as a non-residual glyphosate herbicide in any 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 of 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.

Fertiliser

Requirement: Fertilise all new planting areas with an organic fertiliser and pelleted fowl manure.

Shrub planting areas

Requirement: Prepare planting areas as follows:

- Remove weeds, rubbish, rubble and other foreign materials.
- Rake the area clean and level, to the following levels:
  . 100 mm below grassed area.
  . 50 mm below mowing edges.
  . Minimum one brick course below the damp-proof course of buildings.
  . Levelled with bitumen or concrete driveways.

3.2 PLANTING

General

Requirement: Provide plants to *0255 Landscape – plant procurement* and as documented.

Plant location and spacing: Conform to the Water Corporation's requirements. 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 if the soil is wet or during frost periods.

Watering

Timing: Thoroughly water the plants at the following stages:

- Before planting.
- Immediately after planting.
- In the days leading up to the date of practical completion.
- As required to maintain growth rates free of stress.

Preparation

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

  . Shrubs and groundcover: Provide a hole with 75 to 100 mm clearance around the rootball.
  . Trees: Provide a hole twice the diameter of the rootball.
- 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 rootball 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 rootball. Make sure that the rootball 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 rootball 100 to 200 mm below the finished surface of the surrounding soil.

Fertilising

Requirement: Apply fertiliser for each plant 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 rootball, 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.

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

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.
- 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.

Stabilisation:

- Leaf litter, pine flake and pine bark: Provide stabilisation on slopes greater than 1:3.
- River pebbles and gravels: Do not use on slopes greater than 1:6.

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.

3.4 TREATMENT

General

Pest attack or disease: If evidence of pest attack or disease of plant material is discovered, immediately give notice.

Physical removal

General: Remove pest 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. Position on the prevailing wind side of each plant.

Stake sizes and quantities:

- 13 L trees: Two 35 x 35 x 1500 mm stakes per tree.
- 45 L trees: Three 50 x 50 x 1800 mm stakes per tree.

Ties

General: Provide durable non-abrasive plastic 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.

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.

Protectors

Individual plantings in grassed areas: Fit with plastic stem protectors.

Trunk protection: Fit with collar guards made of 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.

Operation and maintenance manuals

Requirement: Prepare a manual that includes recommendations for maintenance of plants.

0254 IRRIGATION

1 GENERAL

1.1 RESPONSIBILITIES

Performance

Requirements:

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

1.2 STANDARDS

Water supply

General: To AS/NZS 3500.1 (2021).

Backflow prevention and water efficiency: To PCA (2022).

1.3 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:

- Emitter: A device used to control the rate at which water is applied to a specific area.

1.4 SUBMISSIONS

Execution details

Irrigation plan: Before installation, submit an irrigation plan in pdf format.

Programmable tap timer: If a programmable tap timer is to be used as an alternative to irrigation controllers in small garden areas, submit proposal.

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.

Tests

Site tests: Submit results to EXECUTION, **TESTING**.

1.5 INSPECTION

Notice

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

- Excavated surfaces ready for installation.
- Concealed or underground services ready for backfilling.

2 PRODUCTS

2.1 AUTOMATIC CONTROL VALVES

General

Type: 24 V solenoid actuated hydraulic valves with flow control and a maximum operating pressure rating of at least 1 MPa and able to be serviced without removal from the line.

Size: Same as the line in which they are installed or smaller, providing that the water flow restriction does not affect the sprinkler operation.

Materials:

- ≤ DN 50: Dezincification resistant copper alloy body and bonnet, screwed ends. Stainless steel bonnet holding down bolts and internal metal parts.
- ≥ DN 65: Cast iron body and bonnet, flanged ends. Stainless steel bonnet holding down bolts and internal metal parts.

Isolating valve: Provide a ball or gate valve of the same size immediately upstream of each automatic control valve.

Housing: House both valves in the same valve box large enough to permit easy operation and servicing of the valves.

2.2 FIXED SPRINKLER SYSTEMS

General

Restrictions: Do not use microsprays.

Heads

Performance: Heads conforming to the following:

- Maintain a preset arc of throw.
- Adjustable for radius during watering operations.
- Vandal-resistant.
- Protected from damage in normal operation.

Pop-up type heads:

- Type: Designed to rise at least 50 mm out of the housing under supply pressure and return to flush position on removal of pressure.
- Components: Provide wiper seals, stainless steel return springs and removable internal filters.
- Playing fields: Covers designed and constructed to prevent injury.

Sprinkler heads:

- Type: Gear driven and spray sprinklers with matched precipitation rates for the various areas of throw.
- Flow rate: Adjustable down to zero.

Impact sprinkler heads: Bronze bodies in high impact plastic cases with drainage holes.

Drippers

Requirement: Conform to the following:

- Type: Pressure compensating type with the capacity to apply the required water volume to the shrubs/trees.
- Able to be installed directly online, buried or laid on the surface.
- With provisions for fitting the flexible riser tube to the online dripper and placed at the base of the shrubs/trees.

Valves

Check valves: If a rotating head is more than 300 mm below the highest head on the same automatic valve, fit an internal or external anti-drain check valve to prevent low head drainage.

Pressure regulating valves: Provide pressure regulating valves at off-take points as follows:

- Adjustable between 100 and 700 kPa.
- Complete with 800 µm filter sized to suit the flow and installed immediately upstream from the pressure regulating valve.
- Installed with isolating valves upstream from the filter and downstream from the pressure regulating valve.
- Mount the assembly in a readily accessible position in a valve box, access pit or adjacent building.

Soil moisture sensors

Type: Fixed ceramic moisture sensors.

Connection: Fit to the irrigation controller via moisture control units.

Irrigation controllers

Type: Automatic controllers that are easily programmed and include the following:

- Manual cycle and individual control valve operation.
- Manual on/off operation of irrigation without loss of program.
- ≥ 4 on/off cycles per day.
- Day omit.
- 240 V input and 24 V output capable of operating 2 control valves simultaneously.
- Not less than 24 hour battery program backup.
- Power surge protection.
- Mounted in a lockable cabinet of minimum IP54 to AS 60529 (2004) in external locations.
- Electrical connection: If connected to wall outlets, provide 3 core 10 A, 240 V flexible cord and plug. Provide an isolating switch at the controller.

Programming: Able to change watering times, start times or days.

2.3 MICRO-IRRIGATION SYSTEMS

Tubing

Type: Polyethylene micro-irrigation pipe.

Fittings

Type: Barbed fittings rated for the pressure class of the pipe, fastened with ratchet type clamps.

Valve boxes

Requirement: Provide the following in each valve box:

- Automatic control valve.
- Isolating valve.
- Filter: 200 µm.
- Pressure-reducing valve with 170 kPa outlet pressure.

2.4 DRIP IRRIGATION SYSTEMS

Integrated drip line systems
Type: Tubing with integral drippers inserted into the tube during manufacture.

Discrete drip emitter systems
Tubing: Polyethylene micro-irrigation pipe.

Drippers: Turbulent flow types, easily dismantled for cleaning.

Emitters
Type: If the difference in elevation between the control box and all emitters is:

- < 1500 mm: Pressure compensated or non-pressure compensated type.
- ≥ 1500 mm: Pressure compensated type only.

Fittings
Type: Barbed fittings rated for the pressure class of the pipe, fastened with ratchet type clamps.

Valve boxes
Requirement: Provide the following in each valve box:

- Automatic control valve.
- Isolating valve.
- Filter: 100 µm.
- Pressure-reducing valve with 170 kPa outlet pressure.

2.5 SUBSURFACE DRIP IRRIGATION SYSTEMS

Tubing
Collector and distributor mains: LDPE or PVC pipe.

Dripline: LDPE pipe.

Components
System requirements:

- Reduced pressure zone (RPZ) backflow prevention device.
- Electric or manual valve.
- Filter: 120 mesh screen or disc.
- Auto pressure regulator: 150 to 200 kPa.
- Air vacuum breaker.
- Automatic line flushing valve.
- Chemical injection system.

Fittings
Type: Barbed fittings rated for the pressure class of the pipe, fastened with ratchet type clamps.

Root-intrusion prevention
Requirement: To prevent root intrusion, provide one of the following:

- Herbicide impregnated emitters or filters.
- Root-intrusion chemical injection system.

Valve boxes
Requirement: Provide valve boxes for system components.

Low density polyethylene pipes: Minimum 19 mm when used with drippers.

2.6 PIPING

General
Materials: To AS/NZS 3500.1 (2021) clauses 2.4 and 2.5 and as documented.

Underground piping and PVC-U fittings
PVC-U pipes: To AS/NZS 1477 (2017).

PVC-U pipe system installation: To AS/NZS 2032 (2006).

Mainline piping: Minimum Class 12 PVC-U.

Lateral piping: Minimum Class 9 PVC-U.

PVC-U fittings: Minimum Class 18 PVC-U. Allow for changes in pipework direction using fittings. Do not install pipes with excessive bending.

Low density polyethylene pipes: Minimum 19 mm when used with drippers.

2.7 VALVE BOXES

General
Construction: UV-resistant high impact plastic with high impact snap lock plastic cover and adequately sized for clear access to components inside the box.

3 EXECUTION

3.1 GENERAL

Authority requirements
General: To the Water Corporation and local water restriction requirements.

Integrated Water Supply Scheme (IWSS): Connect the irrigation system to the existing water supply.

Performance
Performance and efficiency of the system: Conduct a flow and pressure test and rectify system if inadequate.

Reticulation
Extent: To all landscaped areas including common areas.

Type: Provide as follows:

- Lawn areas: Rotator sprinklers.
- Individual plants: Drippers.

Reticulation sleeves: Provide as follows:

- 100 mm PVC-U sleeve 300 mm below driveways. Provide sleeve at the junction of driveway and carport floor.
- Provide a 90° elbow to each end, 300 mm out from the ground.
- Fit sleeves in one straight length under the driveway to allow draw wires to be easily drawn through the sleeve.

Solenoid conduit: Provide 15 mm diameter PVC conduit with draw wire from the garden reticulation cabinet, adjacent paths, hardstands and driveways to the nearest garden bed.

Reticulation cabinet
Requirement: Provide lockable aluminium reticulation cabinet next to the meter box. Conform to the following:

- Make sure solenoid wires can be routed from reticulation cabinet to the mains water supply

water meter without being obstructed by concrete, paving or walls.

- Supply conduit and draw wire to the reticulation cabinet.
- Install a 10 amp 250 volt socket outlet in the cabinet. Position socket outlet at the bottom right hand corner of cabinet and connect to common services power circuit.
  . Provide label to socket outlet: SUPPLIED BY COMMON SERVICES POWER CIRCUIT.

Connection to services

Connection to main water supply: By a licensed plumber and as follows:

- Connection location: Supply from a separate cut within 2 m of the master mains water meter.
- Connection component: 25 mm tested gate valve fitted with an approved backflow prevention device.

Connection to main electrical supply: By a licensed electrician.

Metering: Provide meters to the utility service provider's requirements and as follows:

- Group dwelling sites with 2 dwellings: One meter for each dwelling. Provide reticulation to common areas from adjacent dwellings.
- Group and multiple dwelling sites with 3 dwellings or more: One meter for each dwelling. Provide common meter for common areas.

Backflow prevention

Requirement: To PCA (2022) and Network Utility Operator requirements.

3.2 SERVICE TRENCHING

General

Requirement: Excavate for underground services in conformance with the following:

- To required lines and levels, with uniform grades.
- Straight between access chambers, inspection points and junctions.
- With stable sides.
- Tree protection: To AS 4970 (2009).

Trench widths

General: Keep trench widths to the minimum, consistent with the laying and bedding of the relevant service and construction of access chambers and pits.

Trench depths

General: As required by the relevant service and its bedding method, and as follows:

- Minimum cover for mainline and PVC pipes in garden beds:
  . Front area of dwelling: 300 mm.
  . Rear area of dwelling: 200 mm.

Obstructions

General: Clear trenches of sharp projections. Cut back roots encountered in trenches to at least 600 mm clear of services. Remove other obstructions including stumps and boulders that may interfere with services or bedding.

Pipes and conduits

Pipes and conduits across pavement or paths: If installation across roadways, driveways or paths is required, install under the pavement/path 90° to the road/path alignment using dry trenchless methods. Do not cut sealed surface without the principal's approval.

Subsidence: If subsidence occurs, repair and reinstate pavement or paths.

3.3 AUTOMATIC CONTROL VALVES

Installation

Location: Install in a valve box to **VALVE BOXES**.

Regional areas: Provide flow control valves to each station.

Valve protection: Do not use sand to cover the valves and wire junctions.

Wiring

Requirement: Provide low voltage solenoid wiring as follows:

- Solenoid wiring: Minimum 1 mm multi-strand cable.
  . Common wire: Black.
- Wiring and piping: Lay wiring in trenches under and attached to piping with insulation tape at maximum 3 m spacing.
- Wiring in areas with no piping: Install in conduits.
- Wiring run: Install in continuous unbroken lengths from the controller to the solenoid valves, with 1.5 m of spare cable coiled at the valve.

Wiring protection: Use multi-core wire protected with PVC sheaths. Protect with electrical conduits or strap beneath PVC piping.

3.4 FIXED SPRINKLER SYSTEMS

Sprinkler application and location

Type: Use sprinkler types as follows:

- Grassed areas (large and small): Gear driven sprinklers.
- Turfed areas: Pop-up sprinklers with minimum rise of 150 mm.
- Garden beds:
  . Generally: Pop-up sprinklers. Provide 150 mm minimum clearance for rigid risers.
  . Adjacent to lawn areas, driveways and paths: Pop-up sprinklers with minimum rise of 150 mm. Do not use rigid risers.
  . Adjacent to driveways and paths, and less than 500 mm wide: Pop-up strip sprays.
- Trees: Bubblers or high flow drippers.

Sprinkler location restrictions: Conform to the following:

- Sprinklers along buildings: Position minimum 60 mm from the building.
- Sprinklers in verge areas: Do not install along kerbs facing back into the development site.

Prevention of overspray: Position sprinklers so that:

- Those in verge areas do not overspray onto roads.
- There is no overspraying onto buildings.

- Those in garden beds do not overspray onto driveways.

Sprinkler spacing: As recommended by the manufacturer for the pressure and water volume.

Control wiring

General: Connect the automatic control valves and soil moisture sensors to the controller as follows:

- Cable type: Double insulated.
- Cable runs: Underground in PVC conduit to AS/NZS 3000 (2018) and laid alongside piping if possible.
- Connectors: Waterproof.
- Jointing: Loop cables and join only at valves, sensors and controllers.
- Movement provision: Provide expansion loops at changes of direction and at joints.

Quick coupling valves

General: Provide DN 20 double lugged bronze quick coupling valves with neoprene seats mounted on DN 20 copper risers offset at least 150 mm from the supply pipe. Install in valve boxes.

Heads

Impact sprinkler heads: Provide granular fill for at least 75 mm around the base of the case.

Risers: Mount as follows:

- Above ground heads: Mount on fixed risers.
- Galvanized steel risers: Set in 300 x 300 x 200 mm deep concrete blocks.
- In-ground heads: Mount on reticulated risers.

Piping

Requirement: Provide piping for mainline up to the solenoid valves and the lawn areas.

Mainline and submains: Install 600 mm below the finished surface and lay marker tape along the top of the line.

Lateral piping for roof and planting areas: Install below the topsoil profile and anchor at 1500 mm maximum centres with U-shaped stakes.

Jointing: Join piping and associated fittings using solvent welded pressure type glue.

Irrigation controllers

Requirement: Provide irrigation controllers as follows:

- Individual dwellings: One controller for each dwelling.
- Common areas: One controller.

Location: Locate irrigation controllers and single socket outlet in a readily accessible location.

Power supply: For group or multiple dwelling sites, connect to the common power source.

Number of stations in the controller: ≥ number of stations in the reticulation systems.

Number of controllers: Do not use more than one controller without the approval of the principal.

Controller type/product: Do not install without approval from the principal.

Sprinkler head protection

Requirement: Provide concrete surrounds for the following:

- Sprinklers along kerbs abutting roads, driveways or parking areas: Minimum 300 mm diameter, 90 mm thick.
- Sprinklers in lawn/grassed area: Minimum 200 mm diameter, 80 mm thick.

North West and Goldfields region

Requirement: Provide plastic surrounds to all sprinklers.

3.5 MICRO-IRRIGATION SYSTEMS

Installation

General: Connect micro-tube laterals with proprietary push in or screw in fittings.

Drippers: Connect directly into piping or provide appropriately sized micro-tubes.

Microsprays: Mount microsprays 300 mm above ground on stakes and connect to the piping with appropriately sized micro-tubes.

Piping: Lay polyethylene micro-irrigation pipe on finished ground surface under planting bed mulch and anchor at 1500 mm maximum intervals with U-shaped stakes.

Air release valves: Provide at the highest point in each section to drain the system when flow stops.

3.6 DRIP IRRIGATION SYSTEMS

Installation

Requirement: Conform to the Water Corporation's recommendations for waterwise garden irrigation.

Discrete drippers: Connect directly into piping or provide appropriately sized micro-tubes.

Piping: Lay polyethylene micro-irrigation pipe on finished ground surface under planting bed mulch and anchor at 1500 mm maximum intervals with U-shaped stakes.

Air release valves: Provide at the highest point in each section to drain the system when flow stops.

3.7 SUBSURFACE DRIP IRRIGATION SYSTEMS

Installation

Piping: Install at least 150 mm below ground.

Automatic line flushing valve:

- Location: At the furthest point from the valve on the collector main.
- Discharge point: Locate in same plane as the pipe leading to it, so water can easily be flushed out.
- Gravel bed: Install a 0.3 m^3 minimum volume gravel bed in valve box. Maintain 50 mm clearance between gravel bed and the lowest discharge point of the valve.

Filter: Install in horizontal plane (or to prevent material entering mainline on cleaning) with 100 mm clearance from soil level.

3.8 UNDERGROUND PIPING AND PVC-U FITTINGS

Installation

PVC-U pipe system: To AS/NZS 2032 (2006).

PVC-U fittings: Allow for changes in pipework direction using fittings. Do not install pipes with excessive bending.

3.9 VALVE BOXES

Installation
Requirement: Install with top of box flush with the surface.

Clearance: Allow 100 mm minimum clearance from filters and 50 mm minimum clearance from valves.

Base: Concrete plinth or crushed rock.

3.10 TESTING

Site tests
Requirement: Test the flow and pressure from the metered supply. If flow and pressure are inadequate, rectify system.

3.11 COMPLETION

General
Requirement: On completion of the irrigation system, carry out the following:

- Flush system thoroughly. Check heads, sprays and drippers and clean if blocked.
- Clean strainers.
- Adjust for even distribution with no dry areas.

Irrigation controllers: Program the controls in conformance with the Water Corporation and the local water restriction requirements, including seasonal variation requirements.

Operation and maintenance manuals
Requirement: Prepare a manual that includes the manufacturer's recommendations for operation, care and maintenance of the irrigation system, including irrigation controllers.

0255 LANDSCAPE – PLANT PROCUREMENT

1 GENERAL

1.1 RESPONSIBILITIES

Performance
Plants: Grown to a standard that allows rapid establishment and growth to maturity.

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 precautions to safeguard the health and well-being of all plant materials before and including their delivery to the project site.

1.2 STANDARD

General
Tree stock supply: Conform to the recommendations of AS 2303 (2018).

1.3 INTERPRETATION

Definitions
General: For the purposes of this worksection, the definitions given in AS 2303 (2018) 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.
- Locally sourced: Stock procured from district sources that is best suited to climatic, soil and environmental conditions in the immediate area of site.
- Partial inspection (of trees): A method of exposing a section of a root system to allow 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.

1.4 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 the time of delivery.

Source location: Submit the supplier's certification as evidence that plants have been grown from

locally sourced stock. If this is not achievable, give notice.

Photographic records

Requirement: Submit photographic records as follows:

- Rates:
  - . More than 100 plants: Submit 1%.
  - . Less than 100 plants: Submit 1 sample.
- Plant species:
  - . All palm species.
  - . 100, 200, 400 L plant species.

Identification: Submit 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.
- Clarity: Sufficient to be able to ascertain the species, size and quality of the subject plant.

Program: Submit within fourteen days of the date of contract.

Products and materials

Requirement: If non-conforming plants are proposed, submit a proposal.

Authentication: Submit a copy of the written approval of substitution with any non-conforming trees.

Progress reports

Content: Submit 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.

Tests

Requirement: Submit test results to EXECUTION, **TESTING**.

1.5 INSPECTION

Notice

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

- Representative samples of all stock scheduled to establish conformity immediately before the acceptance of tender.
- Plant material after eight weeks of the growing on period.
- Plant material at 80% completion of stocking of species and numbers.
- Plant material at, as close as practicable, 100% completion of stocking of species and numbers.
- Plant material at the date of commencement of delivery.
- Plant material to assess potting on procedures, if necessary.

2 PRODUCTS

2.1 ASSESSMENT CRITERIA - GENERAL

General

Requirement: Supply plants 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 and prevent dieback.
- Pests and disease: Free from attack by pests or disease, and resistant to polyphagous shot-hole borer (PSHB).
- 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 actively feeding insects are absent.
- Waterwise: If possible, use plants identified as waterwise by Water Corporation for the particular region. (See www.watercorporation.com.au/Waterwise/Waterwise-plants).
- Root system: Not root bound.

Supply and delivery: Supply plants from a nursery with Nursery Industry Accreditation Scheme Australia (NIASA) accreditation and deliver to site with a label displaying the botanical name.

Prohibited species: Do not supply species listed on the Western Australian Organism (WAOL) database declared as ‘Pest, Prohibited (s12)’ or ‘Pest (s22)’ under the *Biosecurity and Agriculture Management Act 2007 (WA)*.

Labelling

General: To the recommendations of the *National Plant Labelling Guidelines (2023)*.

Label type: To withstand transit without erasure or misplacement.

Label frequency: One for each plant.

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.

2.2 ABOVE-GROUND ASSESSMENT CRITERIA

Trees

Requirement: Supply trees to AS 2303 (2018) clause 4.2 and with the following properties:

- Minimum size: 45 L bag.
- Clean stem height: Less than 40% of total tree height.
- Trunk position: Less than 10% variation in distance from centre of the trunk to the extremity of the rootball.

2.3 BELOW-GROUND ASSESSMENT CRITERIA

Trees

Requirement: Supply trees to AS 2303 (2018) clause 4.3 and with the following properties:

- Rootball occupancy:
  - . Soil retention: On shaking or handling the unsupported rootball, at least 90% of the soil volume remains intact.
- Rootball diameter:
  - . Containers less than or equal to 45 L and ex-ground stock: Not less than rootball depth.
  - . Bare-rooted tree stock with size index less than or equal to 57: Not less than 10 x calliper.

Shrubs

Requirement: Supply plant material with a root system as follows:

- Well-proportioned in relation to the size of the plant material.
- Free of any indication of having been restricted or damaged.

Root inspection: If investigative inspection is required, sample as follows:

- More than 100 samples: Inspect 1%.
- Less than 100 samples: Inspect 1 sample.

Sample plants: Replace plants used in investigative inspection.

2.4 ASSESSMENT CRITERIA - BALANCE

Shrubs

Containers (except tubes or plant cells) or rootballs: To remain flat on the ground when the stem, held at 80% of height above ground, is deflected 30º from the vertical, side to side.

Exempt: Species that naturally produce hard inflexible wood in the early stages of their development.

Small container-grown 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
300 mm (15 L)	1.2 – 1.5	1.0 – 1.2

Trees

Size index range for trees grown in containers 18 L to 100 L and 100 L to 3000 L: To AS 2303 (2018) Appendix D Table D.1.

Minimum rootball diameter for ex-ground trees: To AS 2303 (2018) Appendix D Table D.2.

3 EXECUTION

3.1 TESTING

General

Requirement: To AS 2303 (2018).

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 (2018) Appendix A Table A1.
- Inspector: Supplier.

Investigative tree inspection:

- Frequency: Inspect trees before dispatch.
- Inspector: Qualified person authorised by the principal.
- 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.

Non-conformance

Corrective action: Conform to corrective action procedures, as documented.

Rejection: If corrective actions are unsatisfactory, reject the entire batch.

Substitutions: Do not use non-conforming trees unless approved.

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

3.2 COMPLETION

Warranties

True-to-species: Provide at the time of each delivery as follows:

- 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 have been fully acclimatised for the conditions of the site.

Maintenance:

- Parties: Supplier(s) to the principal.
- Form: Maintain all plant materials sourced and secured by the supplier throughout the procurement period.

- 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.

0256 LANDSCAPE – ESTABLISHMENT

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide landscape establishment to common areas and common water metered areas.

1.2 SUBMISSIONS

Certification

Replacement plants 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 the time of delivery.

Execution details

General: Give at least 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

Requirement: To **COMPLETION**, **Records**.

Tests

Requirement: Submit soil property test results to **PLANTING WORKS**, **Fertilising** for the following:

- Landscape soils.
- Low density soils.

- Soils for turf and lawns.

1.3 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 the 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. Provide replacement plants of similar size and quality, and of identical species and variety to the plants being replaced.

Plant pruning

Pruning: To AS 4373 (2007) and as documented.

Fertilising

Soil tests: Take samples from both planting beds and lawn areas and conduct tests, as follows:

- Landscape soils: To AS 4419 (2018) Table 1.
- Low density soils: To AS 4419 (2018) Table 2.
- Soils for turf and lawns: To AS 4419 (2018) Table 3.

Fertilising program: Base the program on soil testing results.

Application of fertiliser: Apply 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.

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 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.

2.3 GRASS SURFACES

Mowing and trimming

Preparation: Remove litter and fallen branches before mowing.

Grass height: Consistent with the growth habit of the grass variety and maintained at 25 to 40 mm throughout the year. Do not remove more than one-third of the grass height at any one time.

Program: Weekly during the mowing season, November to March, and at fortnightly intervals from April to October. Do not mow during wet conditions. Carry out last mowing not more than 7 days before end of plant establishment period.

Raking: Once every month before mowing from November to March, rake the grass with a flexible rake. On alternate mowings, adopt a north-south and east-west pattern.

Edge trimming: At the same time as mowing, trim lawn edges to plant beds, pathways, base of trees and other obstacles. Do not damage trees and shrubs.

Top dressing

Top dressing for established lawns: Weed-free imported sandy topsoil to a depth of 5 mm.

- Program: The spring following initial establishment.

Top dressing for remediation of depressions or irregularities: Apply coarse or medium texture soil to AS 4419 (2018), suitable for application to turf areas.

Fertilising

Application of fertiliser: Apply a slow release lawn fertiliser at the completion of the first and last mowings of the plant establishment period and at other times as required to maintain healthy grass cover.

2.4 WEEDING

General

Requirement: Remove unwanted broad-leaf 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 to the manufacturer's recommendations.

2.5 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.

Weed and grass growth in mulch areas: Control with a herbicide, approved by the principal, to the manufacturer's recommendations. Prevent herbicide contacting the new plants.

2.6 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 3 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.

Hand watering

Requirement: Manually water all lawn and planting areas in absence of an irrigation system or until the proposed irrigation system is fully operational. Avoid frequent dampening of the surface. Allow the surface of the soil to partially dry out between waterings.

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, seasons, evaporation, exposure, topography and local authority restrictions.
- Adjustment or shut down during and after periods of prolonged heavy rain.
- Water supply and watering regime of legislation and restrictions applying at the time.

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.

2.7 CONTROL MEASURES

Weed mats

Generally: Maintain mats in a weed-free condition and reinstate missing or damaged mats to the documented standard, until completion of the plant establishment period.

Feral animal control

Generally: Implement feral animal control until the completion of the plant establishment period.

Feral animal guards: Maintain feral animal guards in a working upright and taut order with three stakes. Replace missing or damaged guards with materials as documented.

Removal: At the completion of the plant establishment period.

2.8 ROAD VERGES AND FIRE REDUCTION ZONES

Native grass

Generally: Allow native grasses planted within 2 m of road verges or 5 m of property boundaries to grow in a form consistent with the growth habit of the species.

Mowing

Native grasses: Maintain as follows:

- Do not damage regeneration areas, including tree saplings.
- Mow at a minimum of twice a year and at least once at the end of October, before bushfire season, as a fire reduction measure.
- Maintenance mowing: Use a single pass of a mower along medians and verges with maximum width of 1.7 m for a slasher and 1.2 m for a slope mower.
- Fire hazard reduction mowing: Use a double pass of a mower along medians and verges with maximum width of 3.4 m for a slasher and a single 1.2 m pass by a slope mower.

Other types of grass verges: Mow to maintain a maximum 250 mm height.

Pruning

General: Cut back tree and shrub growth to road verges, to on/off ramps, and around emergency telephones and signs as required to achieve clear sight distances when viewed from a minimum of 100 m along roadway. Cut back tree and shrub growth within fire reduction zones to minimise risk to adjoining properties.

Pruning: As documented.

2.9 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. Remove all organic debris.

Frequency: As required, so that all overflow drains are clear when observed at fortnightly intervals.

2.10 COMPLIANCE

Criteria

Generally: Plant establishment is 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 weed-free, established and well formed.
- 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 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
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

2.11 COMPLETION

Records

Logbook: Keep on site and make available for inspection a logbook, recording 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.

0257 LANDSCAPE – VERGES AND STREET TREES

1 GENERAL

1.1 STANDARDS

General

Storage and handling of pesticides: To AS 2507 (1998).

Tree stock: To AS 2303 (2018).

1.2 INTERPRETATION

Definitions

General: For the purposes of this worksection the definitions given in AS 2303 (2018) and the following apply:

- Ameliorant material: Additives used to make or improve soil.
- Imported topsoil: Similar to local natural soil, 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 (2018) Appendix K Table K1, as follows:
  - . Fine: Clay loam, fine sandy clay loam, sandy clay loam, silty loam, loam.
  - . Medium: Sandy loam, fine sandy loam.
  - . Coarse: Sand, loamy sand.
- Top dressing: A soil that is suitable for surface application to turf and lawns.
- Topsoil: Includes landscape soil, low density soils and soils for turf and lawns.

1.3 SUBMISSIONS

Execution details

Soil amelioration recommendations: If required, the source of ameliorant material, rates and methods of incorporation.

Plant material: Submit details of proposed fertiliser to be used.

Soil conditioning: If other than gypsum is proposed, submit details.

Products and materials

Imported topsoil: Submit evidence verifying the following:

- Suitability of each soil type for its documented use.
- Similarity to naturally occurring local soil.
- Suitability for establishment and on-going viability of the site vegetation.
- Absence of any weed propagules or contaminants.

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 the time of delivery.

Source location: Submit the supplier's certification as evidence that plants have been grown from locally sourced stock. If this is not achievable, give notice.

Trees: Submit evidence of conformity to AS 2303 (2018).

Samples

Requirement: Submit samples to PRODUCTS , **GENERAL**, **Samples**.

1.4 INSPECTIONS

Notice

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

- Plants on arrival at site.
- Landscape planting: Set out of plants, soil conditioner and fertiliser.

2 PRODUCTS

2.1 GENERAL

Samples

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

Bulk materials: Provide a 5 kg sample of each type documented with required test results.

Transportation

Requirement: Transport plants to the site without physical damage or drying out.

2.2 TOPSOIL

General

Requirement: To *0251 Landscape – soils*.

2.3 FERTILISER AND MULCHES

General

Requirement: To *0252 Landscape – natural grass surfaces*.

2.4 PLANT MATERIAL

Turf

Requirement: To *0252 Landscape – natural grass surfaces* and as follows:

- Species: Use a species approved by the local authority for verge treatments.

Plant supply

Requirement: Supply plants to *0255 Landscape plant procurement* and conforming to the following:

- Species: Use a species approved by the local authority for verge treatments.
- Maximum height: 750 mm.
- Not hazardous (poisonous or an irritant).
- Does not obstruct pedestrians.

2.5 OTHER MATERIALS

Inorganic ground cover

Stone/rock mulch treatments: Conform to the following particle size distribution:

- River washed rounded stone: $D_{50} < 40$ mm.
- Crushed rock: $D_{50} < 40$ mm.
- Crusher dust: $D_{50} < 10$ mm.

Stone aggregates, loose pea gravel or crushed brick: If proposed, obtain approval from the local authority.

Gravel treatments: Do not install if not allowed by the local authority. If allowed, install as follows:

- Depth: 100 mm.
- Edging: Make sure edging depth is sufficient to prevent loose gravel spreading onto roads, footpaths or neighbouring properties.

3 EXECUTION

3.1 GENERAL

Transport and storage

Requirement: Inspect all plants at the time of delivery and reject non-conforming plants.

Preparation

Existing services: Before landscaping the verge, locate existing and position new services in the verge, including contact BEFORE YOU DIG AUSTRALIA to identify locations of underground utility services pipes and cables.

Herbicide treatment: Spray herbicide as follows:

- Type: Glyphosphate.
- Rate: 9 litres/200 litres water/ha.
- Program: Maintain sprayed areas undisturbed for 2 weeks.

Pesticide treatment: In the following form, as documented:

- Liquid:
  - . Application rate: 5 litres/hydromulch/ha.
  - . Powder: 10 kg/ha.

Herbicides and pesticides: To the Australian Pesticides and Veterinary Medicines Authority (APVMA) register.

Soil conditioning: Provide as follows:

- Gypsum application rate: 400 g/m².
- Application: Conform to the following:
  - . Spread evenly over the subsoil by a mechanical spreader and topsoil on the same day.
  - . Thoroughly mix into the topsoil whilst the topsoil is being removed from stockpiles.
  - . Apply conditioners other than gypsum to the supplier's recommendations.

Fertiliser treatment: Provide as follows:

- Application rate: 1000 kg/ha.

Watering

General: Conform to the following:

- Potable or sourced from areas without toxins, pollutants or any substance which may adversely affect plant growth.
- Initial watering: To a uniform moisture condition without run-off.
- After turfing: Re-water to a uniform moisture condition without run-off.
- After sowing: If required, re-water to a uniform moisture condition without causing rills in the surface, daily for 15 days.
- Excessive surface channelling through erosion: If watered areas result in excessive surface channelling, rehabilitate by re-preparing and re-sowing the affected area.

3.2 PREPARATION

Dimension and level

Level and grade: Do not alter from existing levels.

Setback: Set verge 1.5 m from the road frontage, including for verges without footpaths.

Surface preparation

Cultivation: Before applying topsoil, tine to a depth of 200 mm to produce a loose surface and remove all large stones, rubbish and other materials that may delay germination.

Cultivation depth: 50 mm for a roughened surface with soil lumps not exceeding 50 mm.

Topsoil

Application: Apply uniformly to an average compacted thickness of 50 mm with a minimum compacted thickness of 30 mm at any location.

Pesticide application

Timing: Immediately before sowing.

Pesticide type: Powder form.

Grassing

Turfing:

- Laying: On the prepared topsoiled surface and perpendicular to the direction of water flow.
- Joints: Butt runs of turf hard against each other and top dress with topsoil.
- Slopes 5:1 to 3:1: Peg turf and remove pegs when established.
- Top dressing:
  - . Timing: 4 to 6 weeks after laying turf.
  - . Requirement: Correct any undulations or unevenness in the established turf.

Maximum slope for areas to be maintained by a ride-on mower with a 2 m wide deck: 4:1.

3.3 LANDSCAPE PLANTING

Conditions

General: Do not carry out landscape planting when temperature is below 10°C or above 35°C.

Preparation

Weed management: Conform to the following:

- Herbicide spray: Conform to EXECUTION, **GENERAL** and the following:
  - . Program: Maintain sprayed areas undisturbed for 2 weeks.
  - . Spray drift: Make sure there is no contact with planted material.
- Weed management by synthetic weed blocking fabric:
  - . Extent: 800 mm surrounding each proposed planting.

Fertilising (N:P:K): Conform to the following:

- Ratio: 63:18:28.
- Application rate: 5 kg/m².

Mass planting in mulched bed

Surface preparation: Rip the surface at 500 mm centres to a depth of 300 mm and break up the top 200 mm of the planting bed by cultivation to a maximum size of 50 mm.

Mulch: Spread 75 mm thick.

Individual planting

Preparation: Loosen a planting area 600 mm diameter to a depth of 400 mm.

Mulch: Spread 75 mm thick to 600 mm radius around the plant.

Planting

Method: Remove the localised mulch. If required, root prune to make sure all circling roots have been either severed or aligned radially into the surrounding soil. Place the plant, backfill the planting hole with topsoil and compact lightly so as to minimise subsidence without compacting the backfill. Avoid mixing mulch with topsoil.

Stakes and ties: Advanced and super advanced stock:

- Drive stakes 300 mm deep and 200 mm clear of the plant.
- Ties: 50 mm wide hessian webbing strips, attached loosely.

Watering: 10 litres of water per hole before the mulch is respread over the disturbed area.

Mulching: Replace, and leave the plant stem clear.

Care of landscape planting

Watering: Water all plants, from the time of planting, every second day for the first twelve weeks at the following rates, per plant:

- Tube stock: 5 L.
- Advanced trees: 10 L.
- Super advanced (25 L): 30 L.
- Semi-mature (75 to 100 L): 50 L.

Replacement: Replace missing plants, dead plants and unhealthy plants with plants of similar size and quality and of identical species and variety to the plant being replaced.

Weed and grass growth in mulched areas: Control with herbicide, in conformance with the manufacturer's recommendations at monthly intervals during the construction period and contract maintenance period. Replace plants damaged by herbicide application.

3.4 STREET TREES

Unpaved areas

Excavation:

- Containers < 75 litre: Twice the diameter of the rootball.
- Containers ≥ 75 litre: Three times the diameter of the rootball.
- Depth: Rootball plus 100 mm. Loosen the compacted sides, and the bottom a further 100 mm.

Soil conditioning: If clay is present, add 1 kg of agricultural gypsum soil conditioning.

Accessories and drainage: Fit trunk collar guard, root barrier and subsoil drainage measures before backfilling.

Backfill: Topsoil.

Mulch: 75 mm thick and 50 mm clear of plant stem.

Initial watering: 50 litres per tree applied in stages during backfilling.

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

Paved areas

Excavation:

- Containers < 75 litre: Twice the diameter of the rootball.
- Containers ≥ 75 litre: Three times the diameter of the rootball.
- Depth: Rootball plus 100 mm. Loosen the compacted sides, and the bottom a further 100 mm.

Accessories and drainage: Fit trunk collar guard, root barrier and subsoil drainage measures before backfilling.

Mulch: 10 mm screenings 75 mm thick.

Initial watering: 50 litres per tree applied gradually.

Structural soil table

Type	Description	Fertiliser	Depth	Location
Structural soil 20 mm	75% 20 mm crushed river gravel 25% filler soil of 1 part screeded dolomite to 1 part screeded sandy loam	Trace element mix: 300 g/m^3 Potassium nitrate: 500 g/m^3 Ammonium nitrate: 500 g/m^3 Superphosphate: 500 g/m^3 Ion sulfate: 1.5 kg/m^3 8/9 month Controlled release: 2 kg/m^3 Gypsum: 500 g/m^3 Magnesium sulfate: 400 g/m^3 Magrilime: 600 g/m^3	100 mm	If pavements are installed around existing trees, replace 20 mm roadbase when the total soil depth available is 100 mm or less.
Structural soil 40 mm	80% 40 mm basalt aggregate 20% filler soil of 1 part screeded dolomite to 1 part screeded sandy loam	Trace element mix: 300 g/m^3 Potassium nitrate: 500 g/m^3 Ammonium nitrate: 500 g/m^3 Superphosphate: 500 g/m^3 Ion sulfate: 1.5 kg/m^3	Varies	Tree plantings in pavements, courtyards, carparks and kerbsides.

Type	Description	Fertiliser	Depth	Location
		8/9 month Controlled Release: 2 kg/m^3 Gypsum: 500 g/m^3 Magnesium sulfate: 400 g/m^3 Magrilime: 600 g/m^3		

Porous bonded gravel

Backfill: Allow for base aggregate and gravel.

Filter fabric: Lay over growing medium and pre-cut to size.

Base aggregate: 5 to 7 mm crushed blue metal, laid 70 mm deep and hand consolidated.

Porous paving: Mix and place to the manufacturer's recommendations.

3.5 LOCATION OF PLANTING

General

Requirement: Do not obstruct access to services or sightlines to signage. Do not obstruct pedestrian or vehicular traffic.

Street trees

Ground clearance:

- Clearance height at maturity: 2.4 m.
- Clearance height at time of planting: 1.5 m.

Setbacks: Locate trees to achieve mature canopy clearances from the following:

- Electricity or telecommunications poles or pillars: > 4 m.
- Streetlights: > 7.5 m.
- High voltage transmission lines: > 4 m radius.
- Stormwater drainage pits: > 2 m.
- Kerbs measured to the back of the kerb: 750 mm to 1000 mm.
- Driveways: > 3 m.
- Intersections measured from the face of the kerb of the adjoining street: > 10 m.
- Existing trees: The combined mature canopy width.

3.6 IRRIGATION

Installation

Requirement: Conform to *0254 Irrigation* and as follows:

- Location: Make sure the sprinkler system is installed in a readily accessible location.
- Water source: Supply from a point beyond the water meter and inside the site boundary, passing through a backflow prevention device.
- Reticulation pipes: Provide piping installed at minimum 300 mm below the surface ground level and pop-up sprinkler system with conduits installed under footpaths.

REFERENCED DOCUMENTS

The following documents are incorporated into this specification by reference:

AS/NZS 1080		Timber - Methods of test
AS/NZS 1080.1	2012	Moisture content
AS 1100		Technical drawing
AS 1100.101	1992	General principles
AS 1100.201	1992	Mechanical engineering drawing
AS 1100.301	2008	Architectural drawing
AS 1100.401	1984	Engineering survey and engineering survey design drawing
AS/NZS 1100.501	2002	Structural engineering drawing
AS 1110		ISO metric hexagon bolts and screws - Product grades A and B
AS 1110.1	2015	Bolts
AS 1110.2	2015	Screws
AS 1111		ISO metric hexagon bolts and screws - Product grade C
AS 1111.1	2015	Bolts
AS 1111.2	2015	Screws
AS 1112		ISO metric hexagon nuts
AS 1112.1	2015	Style 1 - Product grades A and B
AS 1112.2	2015	Style 2 - Product grades A and B
AS 1112.3	2015	Product grade C
AS 1112.4	2015	Chamfered thin nuts - Product grades A and B
AS/NZS 1163	2016	Cold-formed structural steel hollow sections
AS/NZS 1170		Structural design actions
AS/NZS 1170.2	2021	Wind actions
AS 1192	2004	Electroplated coatings - Nickel and chromium
AS/NZS 1214	2016	Hot-dip galvanized coatings on threaded fasteners (ISO metric coarse thread series) (ISO 10684:2004, MOD)
AS 1231	2000	Aluminium and aluminium alloys - Anodic oxidation coatings
AS 1237		Plain washers for metric bolts, screws and nuts for general purposes
AS 1237.1	2002	General plan
AS 1289		Methods of testing soils for engineering purposes
AS 1289.5.1.1	2017	Soil compaction and density tests - Determination of the dry density/moisture content relation of a soil using standard compactive effort
AS 1289.5.2.1	2017	Soil compaction and density tests - Determination of the dry density/moisture content relation of a soil using modified compactive effort
AS 1289.5.4.1	2007	Soil compaction and density tests - Compaction control test - Dry density ratio, moisture variation and moisture ratio
AS 1289.5.7.1	2006	Soil compaction and density tests - Compaction control test - Hilf density ratio and Hilf moisture variation (rapid method)
AS 1319	1994	Safety signs for the occupational environment
AS 1345	1995	Identification of the contents of pipes, conduits and ducts
AS 1379	2007	Specification and supply of concrete
AS/NZS 1390	1997	Cup head bolts with ISO metric coarse pitch threads
AS/NZS 1393	1996	Coach screws - Metric series with ISO hexagon heads
AS 1397	2021	Continuous hot-dip metallic coated steel sheet and strip - Coatings of zinc and zinc alloyed with aluminium and magnesium
AS 1420	2008	ISO metric hexagon socket head cap screws
AS/NZS 1477	2017	PVC pipes and fittings for pressure applications
AS/NZS 1554		Structural steel welding
AS/NZS 1554.1	2014	Welding of steel structures
AS/NZS 1554.6	2012	Welding stainless steels for structural purposes
AS/NZS 1604		Preservative-treated wood-based products
AS/NZS 1604.1	2021	Products and treatment
AS/NZS 1604.2	2021	Verification requirements
AS/NZS 1604.3	2021	Test methods
AS 1627		Metal finishing - Preparation and pretreatment of surfaces
AS 1627.1	2003	Removal of oil, grease and related contamination
AS 1627.4	2005	Abrasive blast cleaning of steel
AS 1627.5	2003	Pickling
AS 1627.9	2002	Pictorial surface preparation standards for painting steel surfaces
AS 1657	2018	Fixed platforms, walkways, stairways and ladders - Design, construction and installation
AS/NZS 1665	2004	Welding of aluminium structures
AS/NZS 1680		Interior and workplace lighting
AS/NZS 1680.2.4	2017	Industrial tasks and processes
AS 1720		Timber structures
AS 1720.1	2010	Design methods
AS/NZS 1720.4	2019	Fire resistance of timber elements
AS 1725		Chain link fabric fencing
AS 1725.1	2010	Security fences and gates - General requirements
AS 1726	2017	Geotechnical site investigations
AS/NZS 1748		Timber - Solid - Stress-graded for structural purposes
AS 1769	1975	Welded stainless steel tubes for plumbing applications

AS/NZS 1789	2023	Metallic and other inorganic coatings - Electroplated coatings of zinc with supplementary treatments on iron or steel (ISO 2081:2018, MOD)
AS 1810	1995	Timber - Seasoned cypress pine - Milled products
AS/NZS 1859		Reconstituted wood-based panels - Specifications
AS 1859.1	2017	Particleboard
AS/NZS 1859.2	2017	Dry process fibreboard
AS/NZS 1859.3	2017	Decorative overlaid wood panels
AS/NZS 1859.4	2018	Wet process fibreboard
AS 1860		Particleboard flooring
AS/NZS 1860.1	2017	Specifications
AS 1892		Portable ladders
AS 1892.1	2018	Performance and geometric requirements
AS 1897	2016	Fasteners - Electroplated coatings
AS/NZS 2032	2006	Installation of PVC pipe systems
AS 2082	2007	Timber - Hardwood - Visually stress-graded for structural purposes
AS/NZS 2098		Methods of test for veneer and plywood
AS/NZS 2098.1	2006	Moisture content of veneer and plywood
AS/NZS 2269		Plywood - Structural
AS/NZS 2269.0	2012	Specifications
AS/NZS 2270	2006	Plywood and blockboard for interior use
AS/NZS 2271	2004	Plywood and blockboard for exterior use
AS/NZS 2272	2006	Plywood - Marine
AS 2303	2018	Tree stock for landscape use
AS/NZS 2311	2017	Guide to the painting of buildings
AS/NZS 2312		Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings
AS 2312.1	2014	Paint coatings
AS/NZS 2312.2	2014	Hot dip galvanizing
AS 2334	1980	Steel nails - Metric series
AS 2423	2002	Coated steel wire fencing products for terrestrial, aquatic and general use
AS/NZS 2465	1999	Unified hexagon bolts, screws and nuts (UNC and UNF threads)
AS 2507	1998	The storage and handling of agricultural and veterinary chemicals
AS/NZS 2728	2013	Prefinished/prepainted sheet metal products for interior/exterior building applications - Performance requirements
AS 2753	2018	Adhesives - for bonding gypsum plaster linings to wood and metal framing members
AS 2796		Timber - Hardwood - Sawn and milled products
AS 2796.1	1999	Product specification
AS 2796.2	2006	Grade description
AS 2832		Cathodic protection of metals
AS 2832.1	2015	Pipes and cables
AS 2858	2023	Timber - Softwood - Visually stress-graded for structural purposes
AS 2865	2009	Confined spaces
AS/NZS 3000	2018	Electrical installations (known as the Australian/New Zealand Wiring Rules)
AS/NZS 3500		Plumbing and drainage
AS/NZS 3500.1	2021	Water services
AS/NZS 3500.3	2021	Stormwater drainage
AS 3566		Self-drilling screws for the building and construction industries
AS 3566.1	2002	General requirements and mechanical properties
AS 3600	2018	Concrete structures
AS 3660		Termite management
AS 3660.1	2014	New building work
AS 3660.2	2017	In and around existing buildings and structures
AS 3660.3	2014	Assessment criteria for termite management systems
AS/NZS 3679		Structural steel
AS/NZS 3679.1	2016	Hot-rolled bars and sections
AS 3705	2012	Geotextiles - Identification, marking, and general data
AS 3715	2002	Metal finishing - Thermoset powder coating for architectural applications of aluminium and aluminium alloys
AS 3730		Guide to the properties of paints for buildings
AS 3730.6	2006	Solvent-borne - Interior/exterior - Full gloss enamel
AS 3730.15	2006	Primer - Latex - For metallic zinc surfaces
AS/NZS 3750		Paints for steel structures
AS/NZS 3750.9	2009	Organic zinc-rich primer
AS/NZS 3750.13	1997	Epoxy primer (two pack)
AS/NZS 3750.16	1998	Waterborne primer and paint for galvanized, zinc/aluminium alloy-coated and zinc-primed steel
AS/NZS 3750.19	2008	Metal primer - General purpose
AS/NZS 3750.20	2008	Anticorrosive metal primer - Solvent-borne - Lead and chromate free
AS/NZS 3750.21	2008	Undercoat - Solvent-borne
AS/NZS 3750.22	2008	Full gloss enamel - Solvent-borne
AS 3798	2007	Guidelines on earthworks for commercial and residential developments
AS 3959	2018	Construction of buildings in bushfire-prone areas
AS/NZS 4266		Reconstituted wood-based panels - Methods of test
AS/NZS 4266.1	2017	Base panels
AS 4312	2019	Atmospheric corrosivity zones in Australia
AS 4373	2007	Pruning of amenity trees

AS 4397	2007	Electroplated coatings of zinc on steel fasteners with imperial threads
AS/NZS 4402	2015	Hexagon head tapping screws
AS/NZS 4403	2015	Slotted pan head tapping screws
AS/NZS 4404	2015	Slotted countersunk (flat) head tapping screws (common head style)
AS/NZS 4405	2015	Slotted raised countersunk (oval) head tapping screws (common head style)
AS/NZS 4406	2015	Cross-recessed pan head tapping screws
AS/NZS 4407	2015	Cross-recessed countersunk (flat) head tapping screws (common head style)
AS/NZS 4408	2015	Cross-recessed raised countersunk (oval) head tapping screws
AS/NZS 4409	2015	Hexagon washer head tapping screws
AS/NZS 4410	2015	Hexagon flange head tapping screws
AS 4419	2018	Soils for landscaping and garden use
AS 4454	2012	Composts, soil conditioners and mulches
AS 4506	2024	Metal finishing - Thermoset powder coatings
AS/NZS 4534	2006	Zinc and zinc/aluminium-alloy coatings on steel wire
AS 4678	2002	Earth-retaining structures
AS/NZS 4680	2006	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
AS 4750	2003	Electrogalvanized (zinc) coatings on ferrous hollow and open sections
AS 4785		Timber - Softwood - Sawn and milled products
AS 4785.1	2002	Product specification
AS/NZS 4791	2006	Hot-dip galvanized (zinc) coatings on ferrous open sections, applied by an in-line process
AS/NZS 4792	2006	Hot-dip galvanized (zinc) coatings on ferrous hollow sections, applied by a continuous or a specialized process
AS 4970	2009	Protection of trees on development sites
AS 5488		Classification of subsurface utility information (SUI)
AS 5488.1	2022	Subsurface utility information
AS 5604	2022	Timber - Natural durability ratings
AS ISO/IEC 17025	2018	General requirements for the competence of testing and calibration laboratories
AS/NZS ISO 17672	2023	Brazing - Filler metals
AS 60529	2004	Degrees of protection provided by enclosures (IP Code)
SA TS 5342	2021	Technical specification for building commissioning
BCA B1D4	2022	Structure - Structural provisions - Determination of structural resistance of materials and forms of construction
BCA H1D3	2022	Class 1 and 10 buildings - Structure - Site preparation
NCC	2022	National Construction Code
NCC A5G3	2022	Governing requirements - Documentation of design and construction - Evidence of suitability - Volumes One and Two (BCA)
NCC Schedule 1	2022	Schedule 1 Definitions
PCA	2022	National Construction Code Series Volume 3 - Plumbing Code of Australia
SWA HCIS		Hazardous chemical information system
WA Gov S.R. Pesticides		2011 Health (Pesticides) Regulations 2011
WA Gov Act No. 023	2007	Biosecurity and Agriculture Management Act 2007
BS 8313	1997	Code of practice for accommodation of building services in ducts
AAMA 2603	2022	Voluntary specification, performance requirements and test procedures for pigmented organic coatings on aluminum extrusions and panels (with coil coating appendix)
AAMA 2604	2022	Voluntary specification, performance requirements and test procedures for high performance organic coatings on aluminum extrusions and panels (with coil coating appendix)
AAMA 2605	2022	Voluntary specification, performance requirements and test procedures for superior performing organic coatings on aluminum extrusions and panels (with coil coating appendix)
ASTM A240/A240M	2024	Standard specification for chromium and chromium-nickel stainless steel plate, sheet and strip for pressure vessels and for general applications
ASTM A276/A276M	2024	Standard specification for stainless steel bars and shapes
ASTM A380/A380M	2017	Standard practice for cleaning, descaling, and passivation of stainless steel parts, equipment, and systems
ASTM A554	2021	Standard specification for welded stainless steel mechanical tubing
ASTM D1248	2016	Standard specification for polyethylene plastics extrusion materials for wire and cable
ISO 11600	2002	Building construction - Jointing products - Classification and requirements for sealants

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Department of **Communities**

Landscape specification

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