

Landscape Specification

prepared for:
FRASERS PROPERTY
project:

IVANHOE VILLAGE GREEN & COMMUNITY CENTRE C2

R	Description:	B	C	Date
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0.0 GENERAL**0.1 PROJECT INFORMATION****0.1.1. GENERAL****OUTLINE DESCRIPTION OF THE WORKS**

The project includes landscape works for Village Green, centrally located within the Midtown Masterplan (C2), between Main Street and Neighbourhood Street. The site is surrounded by retail spaces along the Green Link to the east and community amenities such as the Community Centre, public swimming pool, and Gym to the west. The design vision is to create an engaging and vibrant public space featuring diverse landscapes, active frontages, play areas, and open green fields.

GENERAL

All endeavours have been made to ensure conflicts do not occur within the Contract Documentation Packages from the various Consultants. If however, the Contractor does find conflicting information, not identified in the Precedence Table below, they are to immediately seek clarification from the Principal and cease that part of the works until clarification is provided.

PRECEDENCE

The table below outlines the consultant responsible for documenting and specifying a range of elements noted on the LANDSCAPE ARCHITECTS drawings. Where conflicting information is provided in the Contract Documentation, the Consultant checked below shall take precedence.

PRECEDENCE TABLE				
Element	Responsibility			
	LANDSCAPE ARCHITECT	STRUCTURAL	CIVIL	STORMWATER
Subgrade			X	
Subgrade to swales				X
Base			X	
Fill			X	
Footings		X		
Slabs		X		
Concrete Mixes	X	X		
Finishes to visible elements	X			

All finishes to be approved by Landscape Architect prior to start of works.

0.2 ENVIRONMENTAL PERFORMANCE

0.2.1. GENERAL

ESD OBJECTIVES

Selection of all materials under this contract will be based on minimising whole-of-life ecological impacts. Provide materials that conform to the following environmental criteria.

Sustainable extraction

Provide materials that utilise sustainable and low energy extraction techniques for constituent raw materials. Use suppliers that remediate/rehabilitate extraction sites.

Low embodied energy

Provide materials that minimise embodied energy in their manufacturing, fabrication, delivery, recycling and processing.

Recycled materials content

Provide materials that comprise the highest amount of recycled content that meet relevant regulations.

Pollutant emissions during manufacture and life

Provide materials and systems that minimise and avoid pollutant emissions during manufacture and lifecycle.

Maintenance and durability

Provide materials that minimise maintenance and have maximum durability for their respective purpose.

Recyclability

Provide materials that can be recycled or upcycled.

Prohibited materials

Do not provide the following materials:

- Asbestos
- DDT
- PVC
- Non-certified sustainable extraction Timbers [excluding recycled timber]
- CCA treated timber
- Mulch sourced from land-clearing practices
- Item: List items, procedures and materials identified in other work sections as attracting Green Stars under the rating system of the Green Building Council of Australia.
- Documentation: Nominate verification requirements.

0.2.2. GREEN STAR REQUIREMENTS

GENERAL

The project must comply with GREEN STAR objectives set for the site.

Refer to GREEN STAR D&AB SPECIFICATION\ by INTEGRAL consultant for further credit compliance information and requirements. Credits directly related to Landscape, but not limit;

Credit 18 – Water & irrigation

Credit 25 - Heat island Effect

Credit 30C - Community benefits

ENVIRONMENTAL MANAGEMENT

Each subcontractor must ensure that they will adhere to the Environmental Management Plan prepared by the Contractor. In addition each subcontractor must ensure that they will adhere to the applicable ISO14001 requirements.

WASTE MANAGEMENT

Each subcontractor must ensure that they will adhere to the Waste Management Plan prepared by the Head Contractor. Each subcontractor must ensure that they will monitor and report on all waste generated during the construction phase. Each subcontractor must ensure that they

adhere to the target, that at least 80% (by mass) of all waste generated during construction is either recycled or re-used (i.e. diverted from going to landfill)

LEARNING RESOURCES

Educational signage to be included into landscape as per design.

LANDSCAPE IRRIGATION

Landscaping and associated systems must be designed in such a way that either drip irrigation with moisture sensor override is installed; or no potable water is used for irrigation. In the case of xeriscape gardens, irrigation must be removed, after the establishment period. Irrigation consultant must be engaged for the next stage.

CONCRETE

The content of Portland cement in all concrete used in the project is to be reduced by replacing it with supplementary cementitious materials:

The Portland cement content is to be reduced by 40%, measured by mass across all concrete used in the project compared to the reference case.

Mineral additions include flyash, ground granulated blast furnace slag or limestone and are defined in AS 3972-2010 General purpose and blended cements.

No industrial waste products are to come from industrial facilities co-fired with hazardous waste.

This credit addresses all concrete, including non-structural uses such as paving, footpaths, kerbs, channels and gutters.

STEEL

At least 95% of all structural and reinforcing steel used in the building's structure is to be sourced from a responsible steel maker. This is defined as having valid ISO 14001

Environmental Management Systems in place and being a member of the World Steel Association's (WSA) Climate Action Programme (CAP). Certificates confirming ISO accreditation and CAP membership must be obtained from the steel making facilities.

At least 95% of all reinforcing bar and mesh must have a strength grade of at least 500MPa, and at least 60% of all reinforcing bar and mesh must be produced using energy-reducing processes (Polymer Injection Technology) in its manufacture (measured by average mass by steel maker annually).

The Contractor is required to obtain approval from The Superintendent before substituting any specified products. Any substitute steel product must be fully compliant with the credit criteria. All calculations are to be based on mass. Refer to the steel weight calculator available at www.steelselect.com for conversion factors.

PVC

The adverse environmental and health impacts of PVC are to be reduced by ensuring that 90% (by cost) of all PVC products installed in the applications listed below adhere to the Green Building Council of Australia's Best Practice Guidelines for PVC in the built environment (available www.gbca.org.au).

90% of all PVC products used in the following applications must be independently verified as being compliant with the Guidelines: Pipes, conduit and associated fittings, Wire and cable insulation, and

Flooring (vinyl flooring or carpet containing a PVC backing) and resilient wall covering products that contain PVC. There are no requirements for other PVC applications, or products that are re-used.

The Contractor is required to obtain approval from the Superintendent or Cundall before substituting any specified products. Any substitute PVC product must be fully compliant with the credit criteria.

Independent verification that the product complies with the guidelines must be provided in one of the following ways: Copy of an ISO 14001 certified EMS that includes the requirements of the Best Practice Guidelines; or

An independently audited manufacturer's declaration of compliance to the Best Practice Guidelines; or Product third party certification of compliance to the guidelines (ISO type 5 certificate or eco label).

Each of the above documents must be independently verified in accordance with the GBCA's 'Verification Guidance Document'.

0.3 QUALITY REQUIREMENTS

0.3.1. GENERAL

STANDARDS AND AUTHORITY REQUIREMENTS

The contractor shall at all times observe recognised good practice and carry out all works in accordance with applicable standards, laws, ordinances and regulations required by authorities having jurisdiction over such work. Provide all inspections and permits required by Federal, State and Local Governments and Authorities in furnishing, transporting and installing materials. All materials and components used in the works shall meet all relevant standards.

INTERPRETATION

Definitions

For the purposes of this worksection the definitions given in AS/NZS ISO 9000 and the following apply:

- Quality package: A designated part of the works, which may include the whole works, for which an individual quality system is required.
- Superintendent: Agent of the principal i.e. of the purchaser or customer.
- Contractor: The supplier of a product to the principal, for the defined quality package, and the supplier's subcontractors and suppliers in turn.
- Product: That which is supplied by the contractor, which may be either of the following:
- Tangible (e.g. a built item).
- Intangible (including services such as design and delivery of tangible product).
- Servicing: 'After sales' service, repairs, maintenance.

0.3.2. QUALITY SYSTEM REQUIREMENTS

As a minimum the Australian Standards apply to all landscape works. It is the responsibility of the contractor to ensure all standards are applicable.

Quality system schedule

Quality package	Activities included	Standard	Options
The whole of the works	All	AS/NZS ISO 9001	See below

0.3.3. SUPPLEMENTARY REQUIREMENTS

QUALITY PLAN

Standard: Comply with the recommendations of AS/NZS ISO 10005. Include inspection and test plans.

Quality manual: Conform to the recommendations of AS ISO 10013.

Audit plan: Conform to the recommendations of AS/NZS ISO 19011 clause 6.4.

Quality package: Submit a quality plan for each quality package, at least 10 working days before work on that package commences. Keep on site a copy of each approved quality plan.

0.3.4. HOLD POINTS/ SHOP DRAWINGS/ PROTOTYPES/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTION

HOLD POINTS

Hold Points shall apply to the Contractor as required for the various elements of works listed below. Notification: 3 working days of Hold [H] Points required.

HOLD POINTS SCHEDULE	
Description	Comment
Refer relevant worksections	

SHOP DRAWINGS

Shop drawings shall be supplied by the Contractor as required below for approval. No work covered by the shop drawings should be commenced prior to review and formal written acceptance of the drawings by the LANDSCAPE ARCHITECT.

SHOP DRAWINGS SCHEDULE	
Description	Comment
Refer relevant worksections	

PROTOTYPES/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS

Prototypes/ Samples/ Tests/ Submissions/ Inspections shall be produced for the following works or materials: Other items may also be required as outlined in this specification.

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
Vibration levels	Measure vibration levels of the peak particle velocity to relevant standards	Test	
Existing services	Proposal for action to be taken in respect to existing services	Submission	
Commencement of work	Written notice of intention to commence work to owners and occupants of adjoining properties	Submission	Submit at least 10 working days before commencing work
Accident reports	Reports of accidents	Submission	Submit if required
Subcontracting	Complete list of proposed subcontractors and suppliers	Submission	
Site meetings	Written copy of site meeting minutes to each party	Submission	Within 5 working days
After hours contacts	Names and telephone numbers of responsible persons who may be contacted after hours during the course of the contract	Submission	Submit at first site meeting
Progress photographs	Daily colour progress photographs of the works	Submission	Submit digital files at each site meeting
Anticipated progress claims	Schedule of anticipated progress claims which will be made throughout the contract	Submission	Submit at commencement of the works
Progress claims	Statement of amounts claimed in respect of each work section or trade heading designated in the specification	Submission	Submit with each progress claim
Quality plan	Quality plan for each quality package	Submission	Submit at least 10 working days before work on that package
Green Star	List items, procedures and materials identified in other work sections as attracting Green Stars under the rating system of the Green Building Council of Australia	Submission	

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
Verification	Nominate verification requirements	Submission	
Environmental audit program	Monthly audits of all management and control plans	Submission	Keep on site and make available for inspection if requested
Environmental management plan (EMP)	Environmental management plan including details required outlined in this specification	Submission	Submit preliminary EMP with the tender documentation and completed EMP before work commences on site
Soil erosion and sediment control plan	Soil erosion and sediment control plan including details required outlined in this specification	Submission	Submit within 2 weeks of award of contract
Waste management plan	Waste management plan including details required outlined in this specification	Submission	Submit within 2 weeks of award of contract
Ground contamination plan	Ground contamination plan including details required outlined in this specification	Submission	Submit within 2 weeks of award of contract
Maintenance management plan	Maintenance management plan including details required outlined in this specification	Submission	Submit within 2 weeks of award of contract
Environmental monitoring	Documented procedures describing how environmental monitoring is to be planned, implemented and recorded and maintain records of the results including any remedial action taken Names and contact details of internal monitoring personnel Details of proposed machinery and equipment plant	Submission	
Emergency response	Names and contact details of emergency response personnel	Submission	
Community liaison	Details of new or changed construction activities which will affect access to residents properties	Submission	Notify 5 working days prior
Complaints	Written report outlining any environmental complaint received and keep a register of all environmental complaints and action taken	Submission	Within 1 working day of receiving complaint
Noise control measures	Details of noise control measures	Submission	
Cultural heritage	Give notice if any item is encountered which is suspected to be an artifact of heritage value or relic of Aboriginal or early settlement origin	Submission	Submit if required

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
Environmental safeguards schedule	Complete the table contained in the specification and progressively update for issue	Submission	Complete within 2 weeks of contract execution and issue updates on a monthly basis
Proposed products	Schedule of proposed products	Submission	Submit within 3 weeks of site possession
Authorities approvals	Documents showing approval by the authorities whose requirements apply to the work	Submission	
Inspection and testing plan	Inspection and testing plan consistent with the construction program including particulars of test stages and procedures	Submission	
Product certification	Evidence of conformance	Submission	Submit if products required to conform to product certification schemes
Product data	Manufacturer's product data for proprietary equipment	Submission	
Substitution	Sufficient information to permit evaluation of proposed alternatives to documented products, methods or systems	Submission	Submit if required
Warranties	Manufacturer's written approval of the installing firm	Submission	Submit if installation is not by manufacturer
Record drawings	Record drawings showing 'as installed' locations of building elements, plant and equipment	Submission	Submit within 2 weeks after practical completion
Operation and maintenance manuals for installations	Operation and maintenance manuals for installations containing certificates, directories, drawings, descriptions, procedures, records	Submission	Submit a draft copy then 3 final copies within 2 weeks after practical completion
Inspections	Enclosures to trees to be retained Trees to be removed, numbered and tagged	Inspection	Give notice so that inspection may be made
Paint Coatings			
Painting and coating colour	Provide up to 10no. samples of the selected paint coating applied to the documented material for each different coating system	Sample	400x400mm sample panel of documented material

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
Tests	Abrasive blast cleaning; Power tool cleaning; Hand tool cleaning; Surface profile; Chloride level testing; Wet film thickness; Dry film thickness; Slip resistance classification of new pedestrian surface materials.	Test	Testing to relevant Standards.
ITPs	Details for each proposed coating system Name and experience record of the quality supervisor nominated to oversee the implementation of the ITPs	Submission	
Removal of deleterious materials	Details on suitability of marking paints and removal of materials deleterious to coating processes	Submission	
Repair of coating damage	Proposal for repairing the coating Proposal for reinstatement of the visible final coating	Submission	Submit proposal if the protective coating is damaged
Warranties	Warranties for the period to the first schedule maintenance	Submission	
Inspections	Items after fabrication prior to commencing surface cleaning and preparation Surfaces after preparation prior to application of first coating Coating stages (after application of primer or seal coats and each subsequent coat)	Inspection	Give notice so that inspection may be made
Hot Dip Galvanized Coatings			
Tests	Coating mass test, Magnetic method; Coating thickness tests; Sampling plan.	Test	Testing to relevant Standards.
Holes and lifting lugs	Details on size and location of holes and lifting lugs proposed to facilitate handling, filling, venting and draining during galvanizing	Submission	
Inspections	Coating integrity at the galvanizing plant	Inspection	
Stone			
Prototypes	Prototype of the full size of the unit, fixed in position and including joint finishes	Prototype	Provide at least 2 prototypes
Stone samples	Samples of each type and grade of stone unit and cast stone	Sample	Submit at least 3no. of each type
Associated materials and products	Samples of sand, and each type of structure fixing	Sample	Submit 2kg sample of sand and 2no. of each type of fixing

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
Tests	Refer Natural Stone Tests Schedule Refer Cast Stone Tests Schedule Refer Mortar Tests Schedule	Test	
Structural fixings tests	Sample structural fixings of each type to determine whether the fixings conform to requirements	Test	
Subcontractors	Name and contact details of proposed specialist stoneworker	Submission	
Supplier's data	Statements from the stone supplier including experience, production capacity, quality procedures, physical properties and lead times	Submission	
Maintenance manual	Maintenance manual setting out a program for regular maintenance cycles including cleaning, inspection, repair	Submission	Submit on completion
Inspections	Proposed stone source (quarry, storage yard) Proposed mason's yard Materials stored at the yard or on site The prepared stone sample range Stone in worked condition at the mason's yard Stone laid out before fixing Setting out before commencement of construction Filter fabric and subsurface drainage in place before backfilling Items to be built-in located in their correct positions including damp-proof course, flashings, bolts, cramps, brackets, structural fixings and rainwater goods Commencement of cast stone production Completed stone work	Inspection	Give notice so that inspection may be made
Adhesives, Sealants and Fasteners			
Sealants	Colour samples of visible joint sealants	Sample	
Installed Sealant Test	Samples of installed and cured sealant from completed joints	Test	For each sealant test take 3no. samples, submit results
Sealants documents	Technical data sheets	Submission	
Inspections	Joints and penetrations prepared for the application of sealants	Inspection	Give notice so that inspection may be made

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
Maintenance			
Trial samples	Small trial samples for correcting any nutrient deficiencies or herbicide and pesticide applications for approval of site-wide application	Sample	
Soil tests	Six (6) interpreted tests throughout maintenance period	Test	
Irrigation water	Two (2) interpreted tests throughout the maintenance period	Test	
Inspections	Completion of maintenance visit	Inspection	Give notice so that inspection may be made

0.4 GENERAL MATERIAL REQUIREMENTS

0.4.1. GENERAL

STANDARDS AND AUTHORITY REQUIREMENTS

The contractor shall at all times observe recognised good practice and carry out all works in accordance with applicable standards, laws, ordinances and regulations required by authorities having jurisdiction over such work. Provide all inspections and permits required by Federal, State and Local Governments and Authorities in furnishing, transporting and installing materials.

0.4.2. CONCRETE INTERPRETATIONS

Definitions

For the purposes of this worksection the definitions given below apply.

- Concrete class:
 - Normal: Concrete which is specified primarily by a standard compressive strength grade.
 - Special: Concrete which is specified to have certain properties or characteristics different from, or additional to, those of normal-class concrete.
- Early age: A mean compressive strength at 7 days exceeding the values shown in AS 1379.
- Green concrete: Concrete which has set but not appreciably hardened.
- Precast units: Concrete elements manufactured in other than their final position including elements manufactured on site.
- Ambient temperature: The air temperature at the time of mixing and placing of concrete, and the predicted or likely air temperature at any time during the 48 hours following a concrete pour.
- Weather:
 - Cold: Ambient shade temperature < 10°C.
 - Hot: Ambient shade temperature > 32°C.

TOLERANCES

Surface quality

Formed surfaces: Confirm conformance with the surface finish requirements of current version of AS 3610.

Flatness

Unformed surfaces: Confirm conformance with the Flatness tolerance classes table for the class of finish nominated using a straight edge placed anywhere on the surface in any direction.

Flatness tolerance class table

Class	Measurement	Maximum deviation (mm)
A	3 m straight edge	3
B	3 m straight edge	6
C	600 mm straight edge	6

SHRINKAGE SENSITIVE STRUCTURES

Concrete performance

Drying shrinkage (maximum including tolerances): 650 mm for concrete up to and including strength grade 32; 700 mm for higher strength grades.

— Duration of air drying: 56 days

SAMPLES AND PROTOTYPES

Precast elements

Conformance: Supply sample panels to current version of AS 3610 and in conformance with the Hold Points/ Shop Drawings/ Prototypes/ Samples/ Tests/ Submissions/ Inspection Table in the relevant worksection.

Manufacture: Cast the panels using the formwork, concrete, compaction equipment, form release agents, curing and formwork removal methods which are to be used in the final work.

Storage: Once accepted, maintain the panels on site undamaged and protected from the weather, as reference prototypes for future evaluation of completed work.

IN-SITU CONCRETE

Products

The CIVIL ENG. specification shall override this section where inconsistencies occur.

Execution*Elapsed delivery time*

General: Ensure that the elapsed time between the wetting of the mix and the discharge of the mix at the site is in conformance with the Elapsed delivery time table. Do not discharge at ambient temperature below 10°C or above 30°C.

Elapsed delivery time table

Concrete temperature at time of discharge (°C)	Maximum elapsed time (hours)
10 – 24	2.00
24 – 27	1.50
27 – 30	1.00
30 – 32	0.75

Placing in cold weather

- Do not use high alumina cement.
- If severe weather conditions are predicted, use high early strength cement.
- Temperature control: Heat the concrete materials, other than cement, to the minimum temperature necessary to ensure that the temperature of the placed concrete is within the limits specified.
- Admixtures: Do not use calcium chloride, salts, chemicals or other material in the mix to lower the freezing point of the concrete.
- Frozen materials: Do not allow frozen materials or materials containing ice to enter the mixer, and keep free of frost and ice any forms, materials, and equipment coming in contact with the concrete.
- Maximum temperature of water: 60°C when it is placed in the mixer.
- Plastic concrete: Prevent plastic concrete from freezing, without using salts or chemicals.

Placing in hot weather

- Handling: Prevent premature stiffening of the fresh mix and reduce water absorption and evaporation losses. Mix, transport, place and compact the concrete in conformance with the Elapsed delivery time schedule.
- Placing: Concrete: Maintain the temperature of the freshly mixed concrete in conformance with the Hot weather placing table.
- Formwork and reinforcement: Before and during placing maintain temperature at ° 35°C.
- Severe weather: If ambient shade temperature > 38°C, do not mix concrete.
- Temperature control: Select one or more of the following methods of maintaining the specified temperature of the placed concrete:
 - Cool the concrete using liquid nitrogen injection before placing.
 - Cover the container in which the concrete is transported to the forms.
 - Spray the coarse aggregate using cold water prior to mixing.
 - Use chilled mixing water.

Hot weather placing table

Concrete element	Temperature limit
Normal concrete in footings, beams, columns, walls and slabs	35°C
Concrete in sections □ 1 m in all dimensions except for concrete of strength 40 MPa or greater, in sections exceeding 600 mm in thickness	27°C

Curing

General

Cure continuously from completion of finishing until the total cumulative number of days or fractions of days, during which the air temperature in contact with the concrete is above 10°C, is at least the following, unless accelerated curing is adopted:

- Fully enclosed internal surfaces/Early age concrete: 3 days.
- Other concrete surfaces: 7 days.

End of curing period: Prevent rapid drying out at the end of the curing period.

Protection: Maintain at a reasonably constant temperature with minimum moisture loss, during the curing period.

Cold weather curing

General: Maintain concrete temperature between 10 – 20°C for curing period.

Curing compounds

Application: Provide a uniform continuous flexible coating without visible breaks or pinholes, which remains unbroken at least for the required curing period after application.

Substrates: Do not use wax-based or chlorinated rubber-based curing compounds on surfaces forming substrates to applied finishes, concrete toppings and cement-based render.

Visually important surfaces: Apply curing compounds to produce uniform colour on adjacent surfaces.

Hot weather curing

Curing compounds: If it is proposed to use a curing compound provide details. Protection: Select a protection method as applicable.

- If the concrete temperature exceeds 25°C or if not protected against drying winds, protect the concrete using a fog spray application of aliphatic alcohol evaporation retardant.
- If ambient shade temperature is > 35°C protect from wind and sun using an evaporative retarder until curing is commenced.
- Immediately after finishing, either cover exposed surfaces using an impervious membrane or hessian kept wet until curing begins, or apply a curing compound.

Water curing

General: If water is used, pond or continuously sprinkle in such a way as to not cause damage to the concrete surface for the required curing period.

Evaporation control

Barriers: Erect barriers to protect freshly placed concrete from drying winds.

Concrete curing

Curing: Cure continuously from completion of finishing until the total cumulative number of days or fractions of days, during which the air temperature in contact with the concrete is above 10°C, is at least the following, unless accelerated curing is adopted:

- Fully enclosed internal surfaces/Early age concrete: 3 days.
- Other concrete surfaces: 7 days.

End of curing period: Prevent rapid drying out at the end of the curing period.

Protection: Maintain at a reasonably constant temperature with minimum moisture loss, during the curing period.

Product

Cement

Bagged cement

- Age: Less than 6 months old.
- Storage: Store cement bags under cover and above ground.

Chemical admixtures

Contents: Free of chlorides, fluorides and nitrates.

PRECAST CONCRETE

- Precast concrete members should be detailed on the drawings.
- Handling requirements, including lifting and transportation should be set out on the drawings.

General

Aims Responsibilities

Provide precast concrete elements that are:

- Independently designed and documented.
- Designed for handling, transport and erection by a professional engineer.
- Independently certified by a professional engineer for the design and the erected components.
- Undamaged by handling and installation.

Interpretation Definitions

For the purposes of this worksection the standard definitions and the following apply.

- Precast units: Concrete elements manufactured in other than their final position including elements manufactured on site but excluding tilt-up panels.
- Project design engineer: The engineer responsible for the design of the precast concrete elements as part of the overall design of the complete structure. This design is for in-service conditions and covers the performance of the precast concrete elements as part of the complete structure.
- Erection design engineer: The engineer responsible for the design aspects related to manufacture and construction including the handling, transportation, erection, bracing, and propping and lateral stability of the individual precast concrete elements.

Products

Precast Units Marking

Identification: Identify units by marks which are as follows:

- Remain legible until after the unit has been fixed in place.
- Are not visible in the completed structure.
- Show the date of casting.
- Show the correct orientation of the unit.
- On other than units manufactured as a standard product, indicate the locations within the structure in accordance with the marking plan.
- Show the weight of the unit.

Structural performance requirements

The STRUCTURAL ENG. specification shall override this section where inconsistencies occur.

Surfaces bonded to in situ concrete

Fully scabble and roughen all surfaces required to bond with in situ concrete to achieve a shear plane surface coefficient.

Tolerances

During manufacture restrict the variation from documented dimensions of a precast member to limits defined in relevant standards.

Lifting devices and bracing inserts

Provide proprietary lifting devices with published load data designed specifically for lifting concrete elements. Use face and edge lifters as required.

Requirements: Comply with the following:

- Mark the working load capacities on the exposed face so that it can be identified even after the unit has been cast into concrete.
- Do not use reinforcing bars as lifting hoops.
- Provide hot-dipped galvanizing finish with a coating thickness of 600 gm/m² to all cast-in lifting and bracing devices.
- Provide bracing inserts designed by the erection design engineer.

Attachments for handling

Sealing: Recess lifting attachments such as bracing ferrules, or other types of cast-in fixings, and provides plugs for sealing. Do not place lifting attachments, holes and other temporary fixings for handling purposes on visible faces of units.

Attachments for structural or architectural fixings

Ferrules: Provides ferrules anchored behind the reinforcing as shown on the drawings.

Dowel bars: Provide dowel bars loose, cast in or screwed into a ferrule or coupler and projecting from the precast unit. Alternatively, where dowels are cast into and project from in situ concrete, provide a mating sleeve without tube.

Grout tube: Provide grout tubes as documented, made from thin wall galvanised duct or similar cast into either in situ concrete or the precast unit into which a dowel bar will be grouted.

Cast in plates and bolts: Provide purpose made steel brackets with bars, bolts or studs welded to them.

Support and fixings: Provide supporting brackets (loose or cast in), ferrules, double inserts, bolts, nuts, packers and washers.

Restraint brackets: Provide all support or restraint brackets for the precast units as documented or as required.

Unformed faces

Provide a wood float or 'helicopter' travelling machine finish to all unformed faces such as the rear face of precast units that are not visible in their final state to give a smooth lightly textured surface.

Lifting points

Marking: Clearly mark all lifting points and the positions for temporary bearing for storage and transport. Lift or support members only at specified points. Do not use the fixing devices for lifting or hoisting.

Rejection

Assessment: Set aside for inspection any unit having damage such as cracking or deformation spalling, or exhibiting lack of adequate concrete cover. Repair or recast as instructed.

Veneered construction

Method: Use a method which ensures that delamination of the veneer will not occur.

Cover to reinforcement: Excludes applied finish or finishing layer that has thermal or chemical properties different from, and/or lesser water penetration resistance than, the main body of concrete in the unit. Provide clear cover from interface between layers

Execution

Formworks

Preferred location layout of formworks and boltholes as shown per drawings. If contractor wishes to provide alternative location, shop drawings of indication with variation are required for PAP approval.

If the PAP drawings do not indicate formworks and boltholes, the contractor should nominate the location. Approval required from PAP.

Handling

Manufacture the precast units so that they can be lifted into position and secured immediately before final adjustment.

Precautions

Lifting: Lift or support units only at designated points. Use handling methods which do not overstress, warp or damage the units.

Attachments

Remove temporary attachments after erection. Seal or otherwise make good residual recesses.

Lifting devices

Capacity: Provide reusable lifting devices with a capacity limit state factor of 5 in relation to the working load limit.

Installation

Work method statement: Prepare a work method statement specific to the project for the precast erection and submit on request.

Fixing: Fix the units securely and accurately in their final positions.

Ancillaries: Provide components and materials, including fasteners, braces, shims, jointing strips, sealant, flashings, grout and mortar, necessary for the installation of the units.

Protection

Protect the units against staining, discolouration and other damage until they are installed in their final location.

CONCRETE FINISHES

General

Aims Responsibilities

Provide finishes to formed and unformed concrete surfaces which are as follows:

- Appropriate to the importance (visual or physical) of the concrete elements.
- Compatible with following trades and finishes.

Standards General

Off-form concrete finishes: Comply with the recommendations of current CCAA Guide to Off-form Concrete Finishes.

Interpretations Definitions

For the purposes of this worksection, the following definition applies:

- Green concrete: Concrete which has set but not appreciably hardened.

Tolerances Surface quality

Formed surfaces: Confirm conformance with the surface finish requirements of current version of AS 3610 for the surface class.

Flatness

Unformed surfaces: Confirm conformance with the Flatness tolerance classes table for the class of finish nominated using a straight edge placed anywhere on the surface in any direction.

Flatness tolerance class table

Class	Measurement	Maximum deviation (mm)
A	3 m straight edge	3
B	3 m straight edge	6
C	600 mm straight edge	6

Products

Materials

Surface hardeners, sealants and protectors

Supply: If required by the project documentation, provide proprietary products in accordance with the manufacturer's written requirements.

Execution

Surface modifiers General

Application: Apply to clean surfaces in accordance with the manufacturer's requirements.

Unformed surfaces General

Strike off, screed and level slab surfaces to finished levels, to the tolerance class.

Surface finishes: Provide surface finishes in conformance with the finishes schedule.

Surface repairs: Surface repair method: If surface repairs are required, submit proposals.

Finishing methods – primary finish

Machine float finish:

- After levelling, consolidate the surface using a machine float.
- Cut and fill and refloat immediately to a uniform, smooth, granular texture.
- Hand float in locations inaccessible to the machine float.

Steel trowel finish: After machine floating finish as follows:

- Use power or handsteel trowels to produce a smooth surface relatively free from defects.
- When the surface has hardened sufficiently, retrowel to produce the final consolidated finish free of trowel marks and uniform in texture and appearance.

Burnished finish: Continue steel trowelling until the concrete surface attains a polished or glossy appearance, uniform in texture, appearance and free of trowel marks and defects.

Wood float finish: After machine floating use wood or plastic hand floats to produce the final consolidated finish free of float marks and uniform in texture and appearance.

Broom finish: After machine floating and steel trowelling draw a broom or hessian belt across the surface to produce a coarse even- textured transverse-scored surface.

Scored or scratch finish: After screeding, give the surface a coarse scored texture using a stiff brush or rake drawn across the surface before final set.

Sponge finish: After machine floating and steel trowelling, produce an even textured sand finish by wiping the surface using a damp sponge.

Finishing methods – supplementary finish

Bush hammered finish: Remove the minimum matrix using bush hammering to expose the coarse aggregate, recessing the matrix no deeper than half the aggregate size, to give a uniform texture.

Exposed aggregate finish: Wet the surface and scrub using stiff fibre or wire brushes, using clean water freely, until the surface film of mortar is mechanically removed, and the aggregate uniformly exposed. Do not use acid etching. Rinse the surface with clean water.

Final finish subject to sample panels.

Formed surfaces General

Provide formed concrete finishes in conformance with the finishes schedules 2.1.2 and 3.1.2

Damage: Do not damage concrete works through premature removal of formwork.

Edge Treatment

Location and type of edge treatment and chamfers are as shown on drawings. For technical instructions drawings should be read in conjunction with STRUCTURAL ENG. drwg./ specification.

Curing

If forms are stripped when concrete is at an age less than the minimum curing period, commence curing exposed faces as soon as the stripping is completed.

Evaluation of formed surfaces

If evaluation of formed surface tolerance or colour is required, complete the evaluation before surface treatment.

Finishing methods

If soffits of concrete elements or faces of concrete column are to have a finish other than off the form, provide details of proposed procedures.

Blasted finishes:

- Abrasive: Blast the cured surface using hard, sharp graded abrasive fine aggregate particles until the coarse aggregate is in uniform relief.
- Light abrasive: Blast the cured surface using hard, sharp graded abrasive fine aggregate particles to provide a uniform matt finish without exposing the coarse aggregate.

Bush hammered finish: Remove the minimum matrix using bush hammering to expose the coarse aggregate, recessing the matrix no deeper than half the aggregate size, to give a uniform texture.

Exposed aggregate finish: Remove the vertical face forms while the concrete is green. Wet the surface and scrub using stiff fibre or wire brushes, using clean water freely, until the surface film of mortar is mechanically removed, and the aggregate uniformly exposed. Do not use acid etching. Rinse the surface with clean water.

Floated finishes:

- Sand floated finish: Remove the vertical face forms while the concrete is green. Wet the surface and rub using a wood float. Rub fine sand into the surface until a uniform colour and texture are produced.
- Grout floated finish: Remove the forms while the concrete is green. Dampen the surface and spread a slurry, using hessian pads or sponge rubber floats. Remove surplus slurry and work until a uniform colour and texture are produced.

Smooth rubbed finish: Remove the vertical face forms while the concrete is green. Wet the surface and rub using a carborundum or similar abrasive brick until a uniform colour and texture are produced.

Final finish subject to sample panels.

Surface repairs

If surface repairs are required, submit proposals.

0.4.3. METALS

GENERAL

For all metal works specifications also refer to relevant worksections.

Consistency

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

Corrosion Resistance

General: Conform to the following corrosivity category with regard to worksection corrosion resistance tables.

Corrosivity category	Low	Medium	High
Location: Distance to mean high water mark	More than 10 km from water subject to breaking surf, or More than 1 km from salt water not subject to breaking surf	1 to 10 km from water subject to breaking surf, or 100 to 1000 m from salt water not subject to breaking surf, or Non-heavy industrial areas	200 to 1000 m from water subject to breaking surf, or 0 to 100 m from salt water not subject to breaking surf, or Heavy industrial areas

Situation

The following classification of situation applies to tables in the worksection corrosion resistance tables.

- External:
- includes external leaf and air spaces behind external leaf brickwork or blockwork walls.

Galvanizing

Severe conditions: Galvanize steel components (including fasteners) to relevant standards as documented and as appropriate, if:

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

PRODUCTS

Standards

All metals used are to be compliant with relevant Australian Standards.

Weathering Steel to be Galvanised Steel

Definition

Weathering means that due to their chemical composition these steels exhibit increased resistance to atmospheric corrosion compared to unalloyed steels. The corrosion retarding effect of the protective layer is produced by the nature of its structure components and the particular distribution and concentration of alloying elements in it.

The steel is used for various types of welded, bolted and riveted constructions e.g. steel frame structures, bridges, tanks and containers, exhaust systems, vehicles and equipment

constructions.

Welding

Ensure welding methods are compatible with weathering steel. If weld is to be visible ensure appropriate methods are used to obtain a finish that matches the final colour of the weathering steel.

Fixings & Hardware

Ensure all fixings & hardware are 316 stainless steel to ensure compatibility with weathering galvanized steel.

Stainless Steel

Definition

Stainless steel does not readily corrode, rust or stain with water as ordinary steel does. Stainless steels contain sufficient chromium to form a passive film of chromium oxide, which prevents further surface corrosion by blocking oxygen diffusion to the steel surface and blocks corrosion from spreading into the metal's internal structure, and due to the similar size of the steel and oxide ions they bond very strongly and remain attached to the surface.

Grades

304: The most widely used of stainless steels, offers good corrosion resistance to many environments. Has good formability and can be readily welded.

316: Better corrosion resistance as well as higher strength at elevated temperatures than 304. It resists ordinary rusting in virtually all architectural applications. Also known as Marine grade stainless.

Chemical Composition [%]

Grade	C	Si	Mn	P	S	Cr	Mo	Ni
304	0.08	1.00	2.00	0.045	0.03	18.0-20.0		8.0-10.5
316	0.03	0.75	2.00	0.045	0.03	16.0-18.0	2.0-3.0	0.1

Mechanical Properties

Grade	Tensile Strength	0.2% Proof Stress	Min Elongation [%]	Brinell Hardness	Rockwell hardness	Vickers Hardness
304	515MPa min.	205MPa	40	201HB max	92HRB max	210HV max
316	515MPa min.	205MPa	40	217HB max	95HRB max	

Aluminium

Definition

Aluminium is weather proof, corrosion resistant alloy and is immune to the harmful effects of UV rays. Its combination of properties mean that it can be easily shaped by rolling, extrusion, forging and casting. Aluminium is one of the lightest engineering metals, having a strength to weight ratio superior to steel.

Chemical Composition [%]

Alloy	Mg	Fe	Si	Zn	Mn	Cu	Ti	Cr	Other	Al
5005	0.50-1.10	0-0.70	0-0.3	0-0.25	0-0.2	0-0.2	0	0-0.1	0-0.2	Balance
6060	0.35-0.60	0.30-0.60	0.10-0.30	0-0.15	0-0.1	0-0.1	0-0.1	0-0.05	0-0.2	Balance

Mechanical Properties

Alloy	Tensile Strength	Proof Stress	Elongation A50mm [%]	Brinell Hardness	Elongation A	Uses
5005	145-185 MPa	120 MPa min	6 min	60HB	8 min	Roofing, Cladding, Signage, Road Signs, Furniture ANODISED parts Pipe & Tube
6060	160 MPa min.	120MPa		47HB		Arch Sections, doors, framing systems, irrigation

Aluminium Anodising

Anodising is an electro-chemical process used to create a protective film of aluminium oxide on the surface of aluminium extrusion or sheet. As the aluminium oxide film is created from the aluminium itself, it is integral to the aluminium and cannot crack or peel. Anodising is translucent giving the aluminium a deep metallic lustre and is extremely durable and continues to stand the test of time.

Electro Colouring –

After anodising, the metal is immersed in a bath containing inorganic metal salt. When current is applied metal salts are deposited into the base of the pores. This process offers colour versatility and the most technically advanced colour quality, from sandstone to dark bronze and black.

Interference colouring –

An additional colouring procedure, involves modification of the pore structure. The colours are caused by optical interference rather than light scattering as with the basic electro-colouring.

EXECUTION**Metal separation**

Incompatible sheet metals: provide separation by one of the following:

- Apply an anti-corrosion low moisture transmission coating such as zinc or barium chromate primer or aluminium pigmented bituminous paint to contact surfaces.
- Insert a concealed separation layer such as polyethylene film, adhesive tape, or bituminous felt.
- Incompatible fixings: Do not use.

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

Brazing

Ensure brazed joints have sufficient lap to provide a mechanically sound joint.

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

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. Ensure self-finished metals are without surface colour variations after jointing.

Preparation

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

Priming steel surfaces: If site painting is specified to otherwise uncoated mild steel or similar surfaces:

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

Powder Coating

Preparation

Use chemical pretreatments. If recommended, provide conversion coatings.

Galvanized steel: Clean by immersing in a suitable alkaline or acidic solution, apply a zinc phosphate chemical conversion coating, rinse and degas.

Unprotected steel: Remove rust to the recommendations of relevant standards. Clean by immersing in trichloroethylene or an alkaline solution, and apply a coat of iron phosphate.

Prepainted metal products

Product type: Not lower than the type appropriate to the field of application.

Two-pack liquid coating

- Application: Spray.
- Finish: Full gloss.
- Primer: Two pack epoxy primer
- External use: Proprietary polyurethane system.

Completion

Damage

If prefinishes are damaged, including damage caused by unauthorised site cutting or drilling, remove and replace the damaged item.

Repair

If a repair is required to metallic coated sheet or electrogalvanized or inline galvanized steel products, clean the affected area and apply a two-pack organic primer.

PROTECTIVE PAINT COATINGS

General

Aims

Responsibilities

Provide protective paint coatings to structural steelwork and steel products that control corrosion in the time to next scheduled maintenance.

All trafficable painted surfaces are to be slip resistance tested to the relevant current standards.

Interpretations

Abbreviations

For the purposes of this worksection the abbreviations given below apply.

- DFT: Dry film thickness.
- ITP: A series of formal Inspection and Test Plans, prepared by the coating contractor to reflect the specific inspection and testing that will be carried out on the surface preparation, coating application and the record keeping tasks to be undertaken.
- MSDS: The formal Material Safety Data Sheet, prepared in accordance with Worksafe Australia's requirements and distributed by the coating manufacturer to provide information on the safe handling, storage, personal protective equipment requirements, use and disposal of a coating product.

Definitions

For the purposes of this worksection the definitions given in relevant standards and below apply.

- Coating contractor: The protective coatings application contractor conducting the on or off site coating application works.
- Coating manufacturer: The supplier and/or manufacturer of the protective coating materials used.
- Poor performance: Any breakdown attributable to surface preparation, coating mixing or application, curing, stacking and/or handling.
- Product data sheet: The technical data sheet selected for the project.

Inspection

Notice

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

- Items after fabrication prior to commencing surface cleaning and preparation.
- Surfaces after preparation prior to application of first coating.
- Coating stages:
 - After application of primer or seal coats.
 - After application of each subsequent coat.

Submissions

Detailing of structural steelwork

If design and fabrication features of the items to be coated may lead to difficulties, advise prior to commencing surface preparation.

Quality

ITPs: Submit for each proposed coating system.

Quality supervisor: Submit the name and the experience record of the person nominated to oversee the implementation of the ITPs.

Removal of deleterious materials

Submit advice on suitability of marking paints, and removal of materials deleterious to coating processes such as grease, oil and paint.

Repair of coating damage

If the protective coating is damaged, submit a repair coating proposal that will ensure that the full corrosion protection ability of the system is reinstated.

Final coat reinstatement: If required due to variance, submit proposals for reinstatement of the visible final coating system to match the original coating system samples.

Records

Prepare and maintain records of all surface preparation and coating application works as follows:

- Reference the relevant parts of the ITPs, and record conformance.
- Identify any hold points required.

Conditions: Maintain records of the following:

- The ambient temperature.
- Steel surface temperature.
- Relative humidity.
- Dew point.
- Weather or site conditions such as dust, dirt, debris which may affect the specified finish.

Identification: Record the following:

- The batch numbers of all coatings.
- The items and areas coated with each batch.
- The date and time each item or area was coated.

Maintenance paint coating systems

Existing systems: Itemise areas of corrosion, damage, and other degradation to existing elements and structure.

Recoating systems: Supply coating systems for maintenance painting of previously coated items and structural elements, including surface preparation, to the Protective paint coating schedule.

Warranties

Provide warranties for the period to the first scheduled maintenance. If separate warranties are offered by the manufacturer and the applicator, ensure they are interlocking.

Products

General

Care: Handle, store, mix and apply all protective coatings strictly in accordance with the manufacturer's instructions and Product Data Sheets.

Original containers: Provide coating products in unopened containers bearing the brand name and name of the manufacturer with a clearly legible batch number.

Ambient temperature range for storage: 15°C to 25°C.

Use-by-date: Use products with limited shelf life before their use-by-date unless written authorisation from the coating manufacturer's technical services section is provided.

Proprietary products

Requirement: Provide all products in the Protective paint coating schedule from the one manufacturer's supply.

Material safety data sheets

Requirement: Keep on site copies of all relevant MSDSs.

Execution

General: Product warnings: Conform to the requirements and recommendations of product MSDS's.

Protection

Surroundings

Protection: Prevent the release of abrasive, overspray or paint waste debris to air, ground or to any watercourse. Repair or clean affected surrounding areas.

Damage: Prevent damage to other assets, services or equipment.

Contamination

Prevent contamination of coated surfaces which are not yet dry from blasting dust, abrasive or surface preparation debris.

Post application care

Provide protection to the coating against damage until all components are fully cured.

Care: Stack and handle all coated items using fabric slings or padded chains. Adopt soft packaging, carpet strips or other deformable materials between all coated items.

Water ponding: Stack coated items to prevent water ponding.

Repair of coating damage

Areas damaged without exposing the primer: Wash with a proprietary detergent solution and rinse with fresh water, followed by abrading and ensuring that edges of sound paint are feathered. Then coat the area with the appropriate intermediate and finishing coat materials.

Areas damaged to the primer or steel surface: Blast clean to the original standard. Prepare at least 50 mm into the sound coating and to a further feathering zone of approximately 50 mm.

Recoat with the specified system to restore the film thickness and integrity over the whole prepared surface including the feathered zone.

Aesthetic reinstatement: If required, repaint to a physical or discernable boundary line.

Surface preparation

Edge preparation

Prior to preparing the surface remove all sharp edges as follows:

- Grind all sharp weld metal, pits, edges and flame-cut or guillotined edges to a minimum 2 mm radius.
- Countersink or de-burr all bolt holes.
- Open out any mushroom-shaped pits using a countersinking or drill bit operated at slow speed to enlarge the pit opening without wasting metal.

Surface preparation

Repair: If post-surface preparation grinding or edge preparation is required, re-prepare the affected surfaces to the nominated standard of cleanliness and profile.

Priming

Prime coat all surfaces within the time nominated in the Protective paint coating schedule.

Subsequent deterioration: If there is any deterioration in the specified cleanliness standard by the time that the primer is scheduled to be applied, repeat the surface preparation.

Mixing

General

Requirement: Mechanically mix all batches over 5 litres in volume.

Components: If heavy bodied materials are incorporated, strain using an appropriate mesh size to collect any agglomerations, and maintain mechanical agitation of mixed components during application to prevent settling.

Special requirements

Carry out any special mixing requirements including thinner type and quantity, and any induction times, as noted on the Product Data Sheet.

Multi-package coating

Mix the total contents of each component package in their respective containers before blending together.

Splitting: Do not split the contents of component containers unless an accurate means of proportioning the components is provided.

Colour consistency: If colour consistency is required, prior to the addition of the curing agent or converter and before coating application, pre-mix the components of coating products that have been tinted to ensure colour uniformity.

Coating application

General

Conform to the Product Data Sheets.

Painting and coating colour: Verify all project finish colours with the retained samples.

Final surface preparation or coating application

Limits: If the following climatic/substrate conditions are present do not apply coating:

- The relative humidity is above 85%.
- The substrate temperature is less than 3C° above the dewpoint.
- The ambient air temperature is below 5°C or above 40°C.
- The substrate temperature is below 10°C or above 35°C.
- The surface to be coated is wet or damp.
- Where the full prime coat application cannot be carried out before the specified cleanliness of the surface deteriorates.

Exception: Preliminary blast or other surface preparations may be performed in conditions that are outside the limits providing the final surface preparation and all coating applications are undertaken under with conditions under the limits.

Procedure: Conform to the order shown in the Protective paint coating schedule.

Timing: Conform to the minimum and maximum recoat intervals and curing times.

Detail: Stripe coat all welds, bolt holes, corners and difficult to spray areas by brushing in with the prime coat and intermediate coat material prior to the full coating application.

Subsequent coats: Ensure that before any subsequent coating layer is applied, the surface condition of the preceding coat is complete and correct in all respects, including its DFT achievement, cleanliness, freedom from defects.

Correction: Correct any defect in a coating layer before the subsequent coating layer is applied.

Restrictions

Perform all painting under cover and/or protected from rain, condensation, dew, excessive wind, overspray or wind-blown dust.

Period: Continue protection where any of these conditions exist before the coating has cured to a sufficient degree so as to be unaffected.

GENERAL

Provide DULUX Metropolis, DULUX Flourosset & DULUX Duralloy applied to manufacturers specifications to steel where specified. Provide coats as per manufacturers specifications.

Where specified and documented apply Resene Anti Graffiti Uracryl 403 Gloss Polyurethane to all concrete walls and painted block walls in the Bourke Street Link.

Surface Preparation

Follow guidelines for surface preparation from the data sheet for the primer selected. The primer surface must be free from grease, oil, dirt, and other loosely adhering materials. Ensure the primer surface is free of any defects. When sanding work from coarse grades of paper to avoid sanding marks in the finish.

Application

Stir each can thoroughly until the contents are uniform. Use of a power mixer is recommended. Ensure bases have been tinted to the correct colour before use. Mix the contents of both packs together thoroughly using a power mixer and allow to stand for 10 minutes. Box all containers before use to ensure colour consistency. Remix thoroughly before using.

Conventional Spray

Up to 200ml/litre Dulux◆ Urethane Thinner can be used to aid atomisation and control the metallic effect achieved. Apply in multiple wet on wet coats overlapping each pass 50%. Colour and appearance are dependent on thinning levels, film build, spraying technique and gun set-up. Between two and four

wet on wet coats are required to achieve opacity for the tinted colours. A short flash time of approximately two minutes is required between coats.

Typical Set-Up

- Graco Delta Gun: 1.4mm (239542)
- Pressure at Pot: 65-100 kPa (10-15 p.s.i.)
- Pressure at Gun: 385-420 kPa (55-60 p.s.i.)

Resene Paint System for concrete & render – Uracryl Graffiti Shield Waterborne Clear

Application	Product	Data Sheet	Spread Rate	Dry Film	Dry Time	Re-coat Time
ONE	RESENE Uracryl GraffitiShield Clear Application brush, roller, Spray	RA58	8 Sq M/L	35 Microns	1 hour	3 hours
TWO	RESENE Uracryl GraffitiShield Clear Application brush, roller, Spray	RA58	8 Sq M/L	35 Microns	1 hour	3 hours

Surface Preparation

Ensure that the surface is dry and free of all contamination such as grease, dust, wax, silicones, mould etc. In the event of the substrate being contaminated the entire surface is to be thoroughly cleaned by way of washing with Resene Paint Prep & House Wash and when mould is present Resene Moss & Mould Killer, followed by rinsing off with clean water. This cleaning procedure may need to be repeated if the surface is deeply impregnated with bacterial ingress.

Efflorescence must be removed with calcium chloride prior to paint application. Fill imperfections with the appropriate grade filling compound, allow to cure, sand true and dust off. Surface cracking considered to be in excess of 1mm is to be filled with a premium exterior grade flexible caulking compound or similar.

Application

It is imperative to refer to the appropriate material data sheets as referred to within this specification in order to be fully informed about all aspects of the coatings listed for application. Reference to the material health & safety data sheets is imperative prior to product use. It is the responsibility of paint applicator to ensure that the coating system as specified is followed in order to provide the desired appearance along with the performance of the system in reference.

The paint applicator has the duty to provide an on-site reference sample prior to the commencement of the coatings specified in order to gain approval of the finishes intended.

HOT DIP GALVANIZED COATINGS [HOT DIP GAL]

General

Aim and responsibilities

Provide hot dip galvanized coatings to structural steelwork or steel products that control corrosion in the time to first maintenance.

Inspection

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

- Coating integrity, at the galvanizing plant.

Tests

Testing authority

NATA registered.

Testing venue

Galvanizing plant.

Submissions

Holes and lifting lugs

If holes and lifting lugs are required to facilitate handling, filling, venting and draining during galvanizing, submit details on size and location.

Detailing features

If design and fabrication features of the articles to be galvanized may lead to difficulties during galvanizing, identify these and submit details for improvement.

Execution

General

Care

Dimensional change: If design and fabrication features of articles to be galvanized are likely to lead to dimensional change or distortion, identify these and submit proposals for its minimisation.

Embrittlement: If steel is susceptible to embrittlement, take due care in processing in order to avoid this.

Mechanical properties: Avoid mechanical damage. Ensure that mechanical properties of the base metal do not change.

Surface preparation

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

Components in contact with concrete

Chromate passivate.

Chromate passivation process: Dip in 0.15 – 0.2% sodium dichromate solution.

Drilling after completion of hot dip galvanizing

Repair: Prime drill hole surfaces to relevant standards before the surfaces begin to corrode.

Structural sections

Cold worked items: Except for hollow sections, anneal to 650°C before galvanizing. Hollow sections: Provide seal plates with breather holes.

Surface finish

Coating quality: Coatings shall be continuous, adherent, smooth or evenly textured and uniform, free from defects detrimental to the end use of the finished article, such as lumps, blisters, gritty areas, uncoated spots, acids and black spots, dross and flux.

— Silicon killed steels: Dull grey is acceptable.

Friction-type bolted connections: Treat contact surfaces to achieve the required slip factor.

Contact surface preparation: See INGAL Specifier's Manual, Section 4.

Surplus zinc on fastener threads: Remove.

Coating repair

Rejection: If uncoated surfaces or areas damaged by handling at the galvanizing plant exceed the limits specified for repair in relevant standards, reject the galvanizing.

Preparation for architectural finishes

Coarse preparation: Remove spikes, and ensure edges are free from lumps and runs. Light sweep blasting prior to painting: Required.

- Maximum zinc removal: 10 µm.
- Abrasive grade (range): 150 – 180 µm.
- Abrasive type - clean ilmenite or garnet.
- Blasting angle to surface: 45°.
- Blast pressure (maximum): 275 kPa.
- Distance of nozzle from surface (range): 350 – 400 mm.
- Nozzle type: 10 – 13 mm minimum diameter venturi type.

Site work

Site welding

Grinding of edges: Permitted.

Weld areas: Reinstate coating.

Site coating reinstatement

Rejection: If any object has damaged areas exceeding the limits specified for repair, reject the object.

Extent: Areas damaged by transport, site welding, site flame cutting, site handling, or erection.

- Method: Wire brush or mechanically buff the surface and apply organic zinc-rich primer in two coats each of 75 µm dry film thickness. Stipple edges of the primed area.

0.4.4. STONE

GENERAL

Aims and responsibilities

General: Provide stones as follows and/or to the Type + Subtype Schedule :

- Consistent in colour and finish.
- Firmly secured to backgrounds for the expected life of the installation.
- Resistant to expected impacts in use.
- Set out with joints accurately aligned in both directions, level and plum as shown on drawings.

Interpretation

Definitions

For the purposes of this worksection the definitions given below apply.

- Stone cladding: Non-loadbearing facing units of natural stone or cast stone, mechanically fixed with structural fixings to the structural background or to precast concrete units.
- Cladding: Unless the context otherwise requires, the term cladding refers to both external cladding and internal lining.
- Structural fixings:
 - Loadbearing fixings: Supporting fixings that transfer the self weight of the cladding to the structure. Supports may also include a restraint function.
 - Restraint fixings: Fixings that tie back the cladding to the structure and resist variable lateral loads such as from wind actions, vibration, and imposed actions from cleaning equipment.

Inspection

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

- Proposed stone source (quarry, storage yard).
- Proposed mason's yard.
- Materials stored at the yard or on site.
- The prepared stone sample range.
- Stone in worked condition at the mason's yard.
- Stone laid out before fixing.
- Items to be built-in located in their correct positions, including damp-proof course, flashings, bolts, cramps, brackets, structural fixings and rainwater goods.
- Commencement of cast stone production.
- Completed stonework.

Tests

Stone

Obtain test samples, representative of each required type of stone, and have the tests carried out at the following stages:

- Before awarding a stone supply contract.
- On dimension stone prepared for the works, at intervals during the course of the works.

Nominate a specific authority, if required.

Conformance: Conform to the Natural stone tests schedule and Cast stone tests schedule.

Natural stone tests schedule

To be provided by Tenderer

Property to be tested	Test standard [CONFIRM ALL TEST STANDARDS WITH SUPPLIER]	Test criterion (if not in test standard)	Number and frequency of tests
Unconfined compressive strength (dry and saturated):			
Intact rock core specimens	ASTM D7012		
Dimension stone	ASTM C170		
Surface absorption rate	ASTM C97		
Porosity	ASTM C97		
Wet and dry density	ASTM C97		
Modulus of rupture	ASTM C99		

Property to be tested	Test standard [CONFIRM ALL TEST STANDARDS WITH SUPPLIER]	Test criterion (if not in test standard)	Number and frequency of tests
Sodium sulphate soundness			
Flexural strength	ASTM C880		
Efflorescent salt content			
Slip Resistance	AS NZS 4586-2004		
Other properties			

Cast stone tests schedule
To be provided by Tenderer

Property to be tested	Test standard [CONFIRM ALL TEST STANDARDS WITH SUPPLIER]	Test criterion (if not in test standard)	Number and frequency of tests
Compressive strength	BS 1217		
Drying shrinkage	BS 1217		
Initial surface absorption	BS 1217		
Slip Resistance	AS/NZS 4586-2004		
Other properties			

Mortar

Mortar tests schedule
To be provided by Tenderer

Property to be tested	Test standard [CONFIRM ALL TEST STANDARDS WITH SUPPLIER]	Test criterion (if not in test standard)	Number and frequency of tests
Compressive strength	AS 3700		
Bulk density			
Soluble silica and calcium oxide content	AS 2701		

Structural fixings tests

Sampling: Sample structural fixings at the rate of one item per 100 fixings, or part thereof, of each type.

Testing: Test to determine whether the fixings are of the material, grade or designation required, and to conform to the Structural fixings tests schedule.

Components

Corrosion resistance and durability

Compliance: Conform to the Corrosion resistance and durability tables, or provide proprietary products with metallic and/or organic coatings of equivalent corrosion resistance:

- Built-in products: Below damp proof course to be stainless steel 316 or engineered polymer.
- Mortar: Below damp-proof course use mortar grade M4 to the Mortar mix table.

Corrosion resistance and durability table – Low corrosivity category

Situation	Steel lintels	Wall ties, connectors and other structural steel accessories above damp proof course	Minimum cement content (mortar grade) above damp proof course
External	Galvanize after fabrication 300 g/m ²	Galvanize after fabrication 300 g/m ² Metallic-coated sheet Z600 Galvanized wire 470 g/m ²	M2

Corrosion resistance and durability table – Medium corrosivity category

Situation	Steel lintels	Wall ties, connectors and other structural steel accessories above damp proof course	Minimum cement content (mortar grade) above damp proof course
External	Galvanize after fabrication 600 g/m ²	Galvanize after fabrication 600 g/m ² Galvanized wire 470 g/m ²	M3

Corrosion resistance and durability table – High corrosivity category

Situation	Steel lintels	Wall ties, connectors and other structural steel accessories above damp proof course	Minimum cement content (mortar grade) above damp proof course
External	Stainless 316 Galvanize after fabrication 600 g/m ² plus organic coating	Stainless 316 Engineered polymer	M4

Samples*Stone samples*

Number: At least 3.

Stone units: For each type and grade of stone (including natural and cast stone), submit samples of each stone unit (e.g. block, panel, tile) as follows:

- Either the full size.
- Showing the expected range of variation of colour, pattern, texture, and surface finish in stone to be supplied.

Cast stone: Submit samples which consist of both facing and backing material, if different.

Associated materials and products

Sand: Submit a 2 kg sample of sand required to be from a particular source, and/or of a particular colour. Accessories: Submit 2 samples of each type of structure fixing.

Marking

Label samples for identification. Label natural stone samples to show the quarry source, section, bed and lift.

Prototypes

Provide at least 2 prototypes, of the full size of the unit, fixed in position, and including joint finishes (such as sealant, backing rod), refer to 0.3.4 Hold Points/ Shop Drawings/ Prototypes/ Samples/ Tests/ Submissions/ Inspection.

Submissions

Subcontractors: Submit name and contact details of proposed specialist stoneworker.

Shop drawings

Submit shop drawings (refer 0.3.4 Hold Points/ Shop Drawings/ Prototypes/ Samples/ Tests/ Submissions/ Inspection] and associated documents showing the following where applicable:

- Stonework setting out.
- Position and identifying number of each stone.
- Dimensions of each stone and lay of natural bed.
- Lifting detail and fixing detail of each stone.
- Fixings: Location and design of loadbearing and restraint fixings and their method of attachment to the cladding and structure, with calculations to verify the structural adequacy of the proposals.
- Joints: The size and shape of panel joints, including movement joints, showing:
 - The method of dealing with differential movements such as building structure creep and elastic shortening, drying shrinkage, thermal and moisture movements.
 - Provision for three way adjustment of the panel position.
- Jointing: Methods of jointing and pointing panel joints, including movement joints, with particulars of the materials to be used..
- Independent certification by a professional engineer of the design and documentation of the structural fixings.

Materials

Supplier's data: Submit statements from the stone supplier, with the following information:

- The supplier's experience in the required type of work.
- Production capacity for material of the required type, sizes and quantity.
- Particulars of established quality control procedures (if any), and the category of the procedures to the relevant standard.
- The physical properties of the required material.
- Lead times for delivery of the material to the site.

Tolerances

Face dimensions:

- Units $\square$ 50 mm thick: ± 2 mm.
- Units > 50 mm thick: ± 3 mm in dimensions up to 900 mm, thereafter ± 1 mm in 300 mm or part thereof.

Squareness (difference between diagonals): $\square$ 1.5 times the tolerance on a long edge.

Thickness:

- Generally: ± 3 mm.
- Stone panels in stone faced concrete units: $+ 3$ mm, $- 0$ mm.
- Curtain walling panels: $+ 4$ mm, $- 0$ mm.
-

Flatness:

- Polished or honed faces: ± 0.5 mm per metre.
- Sawn or sandblasted faces: ± 1.5 mm per metre.
- Flame exfoliated faces: ± 3 mm per metre.
- Fine tooled or hammered faces: ± 2 mm per metre.

Edge straightness: ± 0.5 mm per metre.

Anchor hole location: ± 1 mm.

Bow or twist

Maximum deviation of stone face from plane:

- Finishes: ± 1.5 mm in 1200 mm.
- Natural riven faces: ± 10 mm in 1200 mm.

PRODUCTS

Natural stone

General

Provide natural stone, which is as follows:

- Of the appropriate quality grade.
- Of uniform quality within that grade.
- Selected for the optimum matching of visual properties such as colour and pattern.
- Sound and free from defects liable to affect its strength, appearance, durability or proper functioning under the intended conditions of use.

Stone Types

Refer to Types + Subtypes Schedule.

Source of stone supply

Nominated source: refer to worksections

Mortar

Mortar materials

Cement type: GP.

White cement: Iron salts content $\square$ 1%. Lime

Sand: Fine aggregate with no clay content and free from efflorescing salts and selected for colour.

Crushed stone: Fine aggregate consisting partly or wholly of crushed stone, made from material of the same type as the stone facing. Admixture: Do not provide admixtures.

Colour mortar:

- To be confirmed upon samples.

Mortar mix

Batching: Batch by weight and machine mix.

Mix compressive strength: $\square$ compressive strength of the stone bedded on it. Mix permeability: $\square$ stone permeability.

Preparing lime putty:

- Using hydrated lime: Add lime to water in a clean container and stir to a thick creamy consistency. Leave undisturbed for at least 16 hours. Remove excess water and protect from drying out.
- Using quicklime: Run to putty as soon as possible after receipt of quicklime. Partly fill clean container with water, add lime to half the height of the water, then stir and hoe ensuring that no lime remains exposed above the water. Continue stirring and hoeing for at least 5 minutes after all reaction has ceased, then sieve into a maturing bin. Leave undisturbed for at least 14 days. Protect from drying out.

Grout

Composition: non shrunk grout

EXECUTION

General

Storing

Store stone so that it is protected from the weather and atmospheric pollution, clear of the ground on its natural bed, on supports which do not locally overstress it, and in conditions suitable to promote good seasoning without staining, marking or damage.

Visual variations

If the quality control sample panels have a range of variation in colour, pattern, texture or surface finish, distribute the production panels throughout the work so that local concentrations of similar variations do not occur.

Fixings

Provision of fixings

If the necessary fixings for stonework are not otherwise provided as part of the structure provide structural fixings sufficient to support and restrain each stone and effectively resist the structural design actions to which it will be subject in service.

Metals for fixings

Provide metal fixings to be:

- Corrosion resistant.
- Non-ferrous metal or stainless steel.
- Stamped for identification.
- Compatible with the materials with which they will be in contact.
- Effectively insulated from electrochemical reaction with incompatible materials.

Fixings

Do not provide block liners or resin bonded fixings.

Joints and cavity

Joint widths (mm) table

Stone	Joint width (mm)
Granite, marble, hard limestone and slate	3 – 13
Slate with riven finish	7 – 13
Soft limestone and sandstone	5 – 13

Jointing and pointing material: refer to CIVIL ENG.

Movement joints

Movement joint widths (mm) table

Stone	Joint width (mm)
Granite, marble, hard limestone and slate	5** – 30*
Slate with riven finish	5 – 30*
Soft limestone and sandstone	5 – 30*

Surface treatments Completion

Maintenance manual

On completion submit a maintenance manual setting out a program for regular maintenance cycles at not more than five-year intervals. Include stonework cleaning, desalination, inspection and repair of joints and flashings, checking rainwater goods for blockages and breakdown, and detection of potential failures arising from movement or other causes. Include particulars of stone source, type of stone, and jointing materials.

Cleaning

Leave the stonework clean on completion.

0.4.5. ADHESIVES, SEALANTS AND FASTENERS

GENERAL

For technical drawings and details also refer to CIVIL ENG.

Performance

Adhesives and sealants

Provide adhesives and sealants capable of transmitting imposed loads, sufficient to ensure the rigidity of the assembly, or integrity of the joint and which will not cause discolouration of finished surfaces.

Compatibility: Do not use sealants or adhesives that are incompatible with the products to which they are applied.

Movement: Where an adhered or sealed joint may be subject to movement, select a system accredited to accommodate the projected movement under the conditions of service.

Refurbishment: Use sealants that can be safely removed and prepared for refurbishment.

Fasteners

Provide fasteners accredited for the particular use, capable of transmitting imposed loads and maintaining the rigidity of the assembly.

PRODUCTS

Adhesives

High strength adhesive tape

General description: [complete\delete] 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: Ensure product suitability for the following substrates:

- Firm high strength foam tapes for high energy surfaces including most bare metals such as stainless steel and aluminium.
- Conformable high strength foam for medium energy surfaces including many plastics and paints, and bare metals.
- Conformable high strength foam for lower energy surfaces including many plastics, most paints and powder coatings, and bare metals.

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

Sealants

Fire rated control joints

Provide sealant materials to relevant Standards that maintain the nominated fire resistant rating.

Pointing and bedding

Provide sealants for fast moving joints in light weight building elements that are compatible with the contact materials.

Bond breaking backing:

- Bond breaking materials: To be non-adhesive to sealant, or faced with a non-adhering material.
- Foamed materials: be closed-cell or impregnated, not water-absorbing.
- Sealant colour: To be confirmed upon sample.

Floor movement joints

Provide trafficable sealants for that are compatible with the contact materials.

Bond breaking backing:

- Bond breaking materials: To be non-adhesive to sealant, or faced with a non-adhering material.
- Foamed materials: To be closed-cell or impregnated, not water-absorbing.
- Sealant colour: To be confirmed upon sample.

Fasteners*General*

All fasteners are to comply with relevant Standards.

Corrosion resistance

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 – low corrosivity category

Situation	Self drilling screws to AS 3566. 2 Class	Threaded fasteners and anchors		Powder actuated fasteners	
		Material	Minimum local metallic coating thickness (□m)	Material grade	Minimum local metallic coating thickness (□m)
Internal	1	Electroplated zinc	4	Electroplated zinc	4
External	3	Electroplated zinc or Hot-dip galvanized	30	Stainless steel 316	

Corrosion resistance table – medium corrosivity category

Situation	Self drilling screws to AS 3566. 2 Class	Threaded fasteners and anchors		Powder actuated fasteners	
		Material	Minimum local metallic coating thickness (□m)	Material grade	Minimum local metallic coating thickness (□m)
Internal	2	Electroplated zinc	12	Electroplated zinc	12
External	4	Hot-dip galvanized	50	Stainless steel 316	

Corrosion resistance table – high corrosivity category

Situation	Self drilling screws to AS 3566. 2 Class	Threaded fasteners and anchors		Powder actuated fasteners	
		Material	Minimum local metallic coating thickness (□m)	Material grade	Minimum local metallic coating thickness (□m)
Internal	3	Electroplated zinc or Hot-dip galvanized	30	Stainless steel 316	
External	Stainless steel 316	Stainless steel 316		Stainless steel 316	

Performance

Loads: Provide fasteners capable of transmitting the loads imposed, and sufficient to ensure the rigidity of the assembly.

EXECUTION*Adhesives**Preparation*

Substrates: Ensure substrates are:

- Clean and free of any deposit or finish which may impair adhesion.
- If framed or discontinuous, support members are in full lengths without splicing.
- If solid or continuous, excessive projections are removed.
- If previously painted, cracked or flaking paint is removed and the surface lightly sanded.

Contact adhesive

Precautions: Do not use 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.

Follow the recommendations of the manufacturer for application and completion including limitations on loads and timings. Completion: Do not apply loads to the assembly for 72 hours at 21° C.

Sealant Jointing

Preparation for jointing

Cleaning: Cut flush joint surface protrusions and make good. Mechanically clean joint surfaces free of any deposit or finish which may impair adhesion of the sealant. Immediately before jointing 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 jointing remove the tape and remove any stains or marks from the surface.

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 < 12 mm.
- 2:1 for joint widths > 12 mm.

STRUCTURALLY DESIGNED JOINTS: REFER TO STRUCTURAL ENG.

Sealant application

Apply the sealant to dry joint surfaces using a pneumatic applicator gun. Ensure the sealant completely fills the joint to the required depth; that it is in good contact with the full depth of the sides and that there is no air trapped 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: < 5°C or > 40°C.
- Humidity: To the manufacturer's recommendations.

Joint finish

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

Protection

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

Fasteners

General

Tightening

At the practical completion of the contract and again at the end of the maintenance period the contractor shall tighten all fasteners to the approval of the SUPERINTENDENT. Bolts that will be in-accessable after completion shall be re-tightened immediately before being concealed.

Timber

Bolt Holes

Holes for bolts shall be made oversize unless otherwise specified.

- Bolt ø 15mm or Less – 2mm oversize
- Bolt ø 16mm & greater – 3mm oversize

Shank & thread of fasteners

Grease shank & thread of fasteners with waterproof grease before inserting into timber – clean off excess and make sure no staining to visible surfaces.

1.0 PREPARATION, GROUNDWORKS + DRAINAGE

1.1 GENERAL

1.1.1. AIMS + SCOPE

STANDARDS AND AUTHORITY REQUIREMENTS

The contractor shall at all times observe recognised good practice and carry out all works in accordance with applicable standards, laws, ordinances and regulations required by authorities having jurisdiction over such work. Provide all inspections and permits required by Federal, State and Local Governments and Authorities in furnishing, transporting and installing materials. All materials and components used in the works shall meet all relevant standards.

DURING SITE EXCAVATION WORKS, CONTRACTOR SHALL PERFORM EXCAVATION IN MANNER THAT SANDSTONE FROM EXCAVATED FORM SITE CAN BE SALVAGE AND RE-USED AS PART OF MAIN WORKS. REFER TO LANDSCAPE DRAWINGS AND DETAILS FOR DESIGN INTENT.

GENERAL

Provide demolition works, groundworks and preparation, drainage and soil preparation that is:

- In conformance with the performance criteria documented.
- In conformance with the arborist requirements and the engineers plans.
- In conformance with the drawings.
- Perform all work in accordance with all applicable laws, ordinances and regulations required by authorities having jurisdiction over such work and provide all inspections and permits required by Federal, State and Local Governments and Authorities in furnishing, transporting and installing materials.

CROSS REFERENCES

General

Conform to the 0.3 Quality Requirements and 0.4 General Material Requirements.

Associated worksections

- 2.0 Walls + Edges
- 3.0 Pavements
- 4.0 Site Structures
- 5.0 Rails + Fencing
- 6.0 Water Elements
- 7.0 Furniture, Fittings + Lighting
- 8.0 Planting
- 9.0 Irrigation
- to be read in conjunction with the ARCHITECTS and CIVIL/ STRUCTURAL ENG. details and specification

1.1.2. HOLD POINTS/ SHOP DRAWINGS/ PROTOTYPES/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTION**HOLD POINTS**

Hold Points shall apply to the Contractor as required for the various elements of works listed below. Notification: 3 working days of Hold [H] Points required.

HOLD POINTS SCHEDULE	
Description	Comment
Set-out of major elements prior to commencement	LANDSCAPE ARCH & relevant Consultants to review and approve
Drainage lines in place prior to backfilling	CIVIL ENG. & STORMWATER ENG to inspect and approve
Pit locations set out prior to excavation	LANDSCAPE ARCH to inspect and approve
Cultivation of subgrade complete prior to soilworks	LANDSCAPE ARCH to inspect and approve
Soil samples submitted with test results	LANDSCAPE ARCH to approve
Earthworks south corner of the site	LANDSCAPE ARCH to inspect and approve
Sample/prototype of slot drain and civic link drain	LANDSCAPE ARCH to inspect and approve

SHOP DRAWINGS

Shop drawings shall be supplied by the Contractor as required below for approval. No work covered by the shop drawings should be commenced prior to review and formal written acceptance of the drawings by the LANDSCAPE ARCHITECT.

Not required	
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PROTOTYPES/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS

Prototypes/ Samples/ Tests/ Submissions/ Inspections shall be produced for the following works or materials: Other items may also be required as outlined in this specification.

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
Demolition			
Temporary support	Certification of it's design and installation from a professional engineer engaged by contractor	Submission	Submit if required
Permanent supports	Give notice and obtain instructions for permanent supports required for adjacent structures	Submission	Submit if required
Hazardous materials	Give notice immediately if hazardous materials or conditions are found	Submission	Submit if required

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
Inspections	Adjacent structures before commencement of demolition Services before disconnection or diversion When excavation works start. Excavated sandstone form site is intended to be re-used on site as part of main works. Quality of Sandstone to be verified during excavation, if sandstone suitable, Sandstone to be stored. Excavations remaining after removal of underground work Site after removal of demolished materials Services after reconnection or diversion	Inspection	Give not less than 48 hours notice so that inspection may be made
Notice of completion	Give notice of completion of demolition so that adjacent structures may be inspected Make good any damage arising out of demolition work. Obtain written acceptance from the owner of each adjoining property of completeness and standard of making good	Inspection	Give at least 7 working days notice
Preparation and Groundwork			
Soil testing	Representative test samples of each: existing soil type proposed soil type irrigation water	Test	Laboratory report shall be issued direct to the Superintendent
Tests	Compaction control tests and frequency. Imported fill tests Compaction tests	Test	To relevant Standards.
Soil erosion and sediment control plan	Include details outlined in this specification	Submission	Submit within 2 weeks of award of contract
Imported fill	Details of materials proposed including sources of imported fill	Submission	
Vegetation and fauna	Inspect trees to be removed to establish if nesting native fauna are present and give notice	Submission	Submit if required
Excavation near trees to be retained	Give notice and obtain instructions	Submission	

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
Inspections	Areas to be cleared and/ or stripped of topsoil. Areas stripped of topsoil. Excavation completed to contract levels or founding material. Proof roll subgrade prior to placing filling. Filling completed to contract levels. Stockpiled topsoil before spreading.	Inspection	Give not less than 48 hours notice so that inspection may be made
Services			
Existing services	Proposal for action to be taken in regards to existing services	Submission	
Service Trenching			
Shuttering and/or bracing	If shuttering and/or bracing of the sides of a trench are required for safety and stability provide proposals	Submission	
Inspections	Service trenches excavated before laying the service Services laid in trenches and ready for backfilling	Inspection	Give not less than 48 hours notice so that inspection may be made
Drainage			
Samples	Membrane protection Drainage medium Sample material Perforated drainage pipe Drainage cell Filter fabric Sand filter layer material	Sample	Submit representative samples for each item
Pre-completion tests	Before backfilling or concealing, carry out the following tests: Site stormwater drains and main internal drains: Air or water pressure test	Test	To relevant Standards.
Soil test certificate	Soil analysis of sand filter layer material	Test	Submit original copies of results prior to delivery to site
Inspections	Excavated surfaces prior to placing pipe bedding material Formwork and reinforcement prior to placing cast in- situ concrete Completion of trenching with pipes installed prior to backfilling Flushing of drains through flushing points following installation Pipe joints prior to covering Placing of cast in-situ concrete Upon completion	Inspection	Give not less than 48 hours notice so that inspection may be made
Soils and Cultivation			
Geotechnical site investigation	Give notice immediately and obtain instruction if bad ground, discrepancies, rock, springs, seepages or topsoil >100mm are encountered	Submission	Submit if required

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
Soil Tests Generally	General: to relevant standards Sampling: As recommended in relevant standards Laboratory: NATA registered.	Submission	Submit original copies of certificates prior to delivery to site
Soil Tests for Imported Soil	Imported topsoil tests: Submit the results of tests to topsoil, potting mixes as applicable. Submit a certificate noting the: Suitability of each soil type for its specified use. Similarity to naturally occurring local soil. Suitability for establishment and on-going viability of the site specified vegetation.	Submission	Tests to relevant standards Submit original copies of certificates prior to delivery to site
	Absence of any weed propagules or contaminants. Ameliorants recommendation: If required to include ameliorants, recommend the source of ameliorant material, rates and methods of incorporation.		
Soil Tests for Site Soil	Submit a certificate noting the: Suitability of the soil for its specified use. Suitability for establishment and on-going viability of the site specified vegetation. Presence of any weed propagules or contaminants.	Submission	Tests to relevant standards Submit original copies of certificates
Soil amelioration	Provide amelioration recommendations for the following: Bushland reconstruction areas Planting on grade Grass mixes	Submission	Submit recommendations prior to commencing works
Weed eradication	Species and eradication method	Submission	Submit recommendations prior to commencing works
Contaminant removal	Provide recommendations for removal of contaminants identified in site soils	Submission	Submit recommendations prior to commencing works
Soil samples	Representative samples of each material, packed to prevent contamination and labeled to indicate source and content (5kg sample of bulk materials)	Sample	Submit bulk material samples and test results at least 5 working days before bulk deliveries

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
Suppliers statements	Statements from suppliers of soils and other materials detailing experience, production capacity and lead times	Submission	
Suppliers data	Suppliers data including source of materials	Submission	
Compost certificate	Certificate stating pH value	Submission	
Work program	Bar chart work program for landscape works	Submission	
Inspections	Setting out completed Subgrades cultivated or prepared for placing topsoil Topsoil spread before planting Grassing bed prepared before turfing, seeding or temporary grassing	Inspection	Give not less than 48 hours notice so that inspection may be made

SOIL TESTING

Representative test samples of the existing and each proposed soil type and irrigation water shall be taken in accordance with NATA standards by the contractor. All testing shall be undertaken by a competent NATA registered laboratory for conformance to current version of AS 4419. The Contractor shall pay the cost of all tests including transport of samples to the laboratory. The laboratory report shall be issued direct to the Superintendent. The Contractor shall incorporate all necessary amendments to tested materials in order to achieve compliance with the laboratory recommendations for modification to the material. Soil conditioners recommended by the laboratory at the rates recommended shall be incorporated into the subgrade.

1.1.3. TYPES + SUBTYPES TABLE

— Type	— Description	— Subtype	— Description
Drainage Type			
DR01	Subsoil Drain Lawn	aggregate	Free draining backfill – recycled aggregate
		geotextile	Bidim non-woven geotextile
		pipe	50mm Slotted Ag-Pipe
DR02	Subsoil Drain Planting	aggregate	Free draining backfill – recycled aggregate
		geotextile	Bidim non-woven geotextile
		pipe	50mm Slotted Ag-Pipe
DR03	Flushing Point	Drain system 1	Planter Box Drain System to Engineer
		Drainage cell	ATLANTIS – 20mm drainage with Bidim non-woven geotextile
		sand	Washed River Sand
DR04	Retaining Wall Backfill	aggregate	Free draining backfill – recycled aggregate
		geotextile	Bidim non-woven geotextile
		pipe	Slotted Ag-Pipe to Engineer

— Type	— Description	— Subtype	— Description
DR05	Strip Drain	Drain system	RWS - 302 STRIP DRAIN Refer to Arch Plan & Engineer Detail
Pit Type			
PIT01	Infilled Pit Cover	Cover	Cast Iron – infill to match adjacent finish to Engineer Detail and Spec
PIT02	Raised Pit Grate	Cover	Galvanised – grated cover Refer to Civil Eng. Details
Soil Profile Type			
SO01	Native Mix at Grade	Mulch	ANL Forest Fines mulch 100% recycled grade A wood waste
		Soil Media	ANL Native 'Low P' mix or equal to AS4419
		Soil Conditioner	Refer to supplier
SO02	Native Mix on Structure	Mulch	ANL Forest Fines mulch 100% recycled grade A wood waste
		Soil Media	ANL Greenlife Lightweight Garden mix or equal to AS4419
		sand	Washed River Sand
		Drainage cell	ATLANTIS – 20mm drainage cell
		Rigid Insulation	Rigid Insulation to Engineers
SO03	Bioretention at Grade	Mulch	ANL Hawkesbury sandstone 20-40mm
		Soil Media	Native bioretention mix
		pipe	Slotted Ag-Pipe to Engineer
		Geotextile	BIDIM A34 GEOFABRIC
SO04	Lawn at Grade	Turf	Sir Walter Buffalo Turf
		Soil Media	ANL turf underlay
		Soil Conditioner	Refer to supplier

— Type	— Description	— Subtype	— Description
SO05	Lawn on Structure	Turf	Sir Walter Buffalo Turf
		Soil Media	ANL Greenlife Lightweight Garden mix or equal to AS4419
		sand	Washed River Sand
		Drainage cell	ATLANTIS – 20mm drainage cell
SO06	Native Mix in Planter	Mulch	ANL Forest Fines mulch 100% recycled grade A wood waste
		Soil Media	ANL Greenlife Lightweight Garden mix or equal to AS4419
		sand	Washed River Sand
			Void tanks
		Drainage cell	ATLANTIS – 20mm drainage cell
		Barrier	Moisture Barrier Primer Applied To Prevent Deterioration Of Membrane By Damp Substrate to Engineer Details
SO07	Native Mix on Terrace	Mulch	ANL Forest Fines mulch 100% recycled grade A wood waste
		Soil Media	ANL Native ‘Low P’ mix or equal to AS4419
		Soil Conditioner	Refer to supplier
Rock Type			
RO01	Sandstone Boulder	Stone	Sandstone Boulder salvaged from site excavation

1.2 PREPARATION AND GROUNDWORK

1.2.1. EARTHWORK

GENERAL

Cross references

Conform to the 0.3 Quality Requirements and 0.4 General Material Requirements.

Interpretation

Definitions

For the purposes of this worksection the definitions given below apply.

- Bad ground: Ground unsuitable for the purposes of the works, including fill liable to subsidence, ground containing cavities, faults or fissures, ground contaminated by harmful substances and ground which is or becomes soft, wet or unstable.
- Base: One or more layers of material usually constituting the uppermost structural element of a pavement and on which the surfacing may be placed, which may be

composed of fine crushed rock, natural gravel, broken stone, stabilised material, asphalt or Portland cement concrete.

- Discrepancy: A difference between contract information about the site and conditions encountered on the site, including but not limited to discrepancies concerning the following:
 - The nature or quantity of the material to be excavated or placed.
 - Existing site levels.
 - Services or other obstructions beneath the site surface.
- Line of influence: A line 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.
- Rock: Monolithic material with volume greater than 0.5 m³ which cannot be removed until broken up either by explosives or by rippers or percussion tools.
- Subbase: The material laid on the subgrade below the base either for the purpose of making up additional pavement thickness required, to prevent intrusion of the subgrade into the base, or to provide a working platform.
- Subgrade: The trimmed or prepared portion of the formation on which the pavement or slab is constructed. Generally taken to relate to the upper line of the formation.

Geotechnical and environmental site investigation

Report

The geotechnical and environmental site investigation report provided is for information only. The geotechnical information and information on contaminants given is information on the nature of the ground at each tested part. It is not a complete description of conditions existing at or below ground level.

Records of measurement

Excavation and backfilling

Agreed quantities: If a schedule of rates applies, provisional quantities are specified, or there are variations to the contract levels or dimensions of excavations, do not commence backfilling or place permanent works in the excavation until the following have been agreed and recorded:

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

Method of measurement: To be by registered surveyor unless otherwise agreed.

Rock

Level and class: If rock is to be measured for payment purposes, whether 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 the classes of rock have been determined.

Geotechnical testing authority

Use a NATA registered geotechnical testing authority.

Compaction control test frequency

- 1 test per layer per material type per 2500 m².
- 1 test per 500 m³ distributed evenly throughout full depth and area.
- 3 tests per lot.

Confined operations: 1 test per 2 layers per 50 m².

Tolerances

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

- Under building slabs and loadbearing elements: + 0, -25 mm.
- Pavement subgrades; + 0, - 40 mm.
- Batters: No steeper than the slope shown on the drawings. Flatter slopes shall 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 where required. Provide smoothness as normally produced by a scraper blade.

PRODUCTS

Fill materials

Fill material generally

General: Inorganic, non-perishable material.

Sulphur content: Do not provide filling with sulphur content exceeding 0.5% within 500 mm of cement bound elements (for example concrete structures or masonry) unless such elements are protected by impermeable membranes or equivalent means.

Excluded materials:

- Organic soils.
- Materials contaminated through past site usage.
- Materials which contain substances which can be dissolved or leached out, or which undergo volume change or loss of strength when disturbed and exposed to moisture.
- Silts or silt-like materials.
- Fill containing wood, metal, plastic, boulders or other deleterious material.

Re-use of material recovered from excavation

General: Re-use of excavated material: Excavated Sandstone to be Re-used.

EXECUTION

Removal of topsoil

General

Extent: Areas to be cut and areas to be filled and areas to be occupied by structures, pavements, embankments and the like. Maximum depth: 100 mm.

Re-use of removed topsoil

Only permitted if test results allow re-use, must be approved by PAP.

Disposal of excess topsoil

Remove excess topsoil from the site and dispose of legally.

Excavation

Extent

Site surface: Excavate over the site to give correct levels and profiles as the basis for structures, pavements, filling and landscaping. Make allowance for compaction or settlement.

Footings: Excavate for footings, pits, wells and shafts, to the required sizes and depths. Confirm that bearing capacity is adequate. Crawl space: Provide clear space under timber floor bearers.

- Minimum clearance: 400 mm.

Proof rolling

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

Rock excavation

Excavate the ground as found. No additional payment will be made for rock excavation.

Disposal of excess excavated material

Remove excess excavated material from the site and dispose of legally.

Bearing surfaces

Provide even plane bearing surfaces for loadbearing elements including footings. Step to accommodate level changes. Make the steps to the appropriate courses if supporting masonry.

Reinstatement of excavation

Requirement: If the excavation exceeds the required depth, or deteriorates, reinstate to the correct depth, level and bearing value.

Supporting excavations

Removal of supports

Remove temporary supports progressively as backfilling proceeds.

Voids

Guard against the formation of voids outside sheeting or sheet piling if used. Fill and compact voids to a dry density similar to that of the surrounding material.

Adjacent structures

Temporary supports

Provide supports to adjacent structures where necessary, sufficient to prevent damage arising from the works. Lateral supports: Provide lateral support using shoring.

Vertical supports: Provide vertical support where necessary using piling or underpinning or both.

Permanent supports

If permanent supports for adjacent structures are necessary and are not described, give notice and obtain instructions.

Preparation for filling

Prepare the ground surface before placing fill (including topsoil fill), ground slabs or load bearing elements. Shape to assist drainage. Remove materials which will inhibit or prevent satisfactory placement of fill layers, loose material, debris and organic matter. Compact the ground exposed after stripping or excavation in conformance with the *Compaction schedule*.

Placing fill

Layers: Place fill in near-horizontal layers of uniform thickness, deposited systematically across the fill area.

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

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, ensure that previously accepted layers still conform to requirements, including moisture content.

Protection: Protect the works from damage due to compaction operations. Where necessary, limit the size of compaction equipment or compact by hand. Commence compacting each layer at the structure and proceed away from it.

Protective covering: Do not disturb or damage the protective covering of membranes during backfilling.

Compaction requirements for fill and subgrade

Density

Other than rolled fill, compact the subgrade and each layer of fill to the required depth and density, as a systematic construction operation and to conform to the *Compaction table*. Shape surfaces to provide drainage and prevent ponding.

Compaction table

Location	Cohesive soils. Minimum dry density ratio (standard compaction) to AS 1289. 5. 4.1	Cohesionless soils. Minimum density index to AS 1289. 5. 6. 1

Pavements:	95	70
Fill to support pavements Subgrade to 300 mm deep	98	75

Excavated and stripped ground surface: After excavation and/or stripping, these surfaces should also be compacted in conformance with the *Compaction table* to a minimum depth of 150 mm.

Maximum rock and lump size in layer after compaction: 2/3 compacted layer thickness.

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

Moisture content

Adjust the moisture content of fill during compaction within the range of 85 – 115% of the optimum moisture content determined by relevant Standards, in order to achieve the required density.

Completion

Temporary works

Tree enclosures: Remove temporary tree enclosures at completion. Tree marking: Remove temporary marks and tags at completion.

Temporary supports: Remove temporary supports to adjacent structures at completion.

1.3 DRAINAGE

The CIVIL ENG. specification shall override this section where inconsistencies occur. For location refer to LANDSCAPE ARCHITECTS drwg./ 'Layout + Grading Plan'

1.3.1. SURFACE

GENERAL

Interpretation

Definitions

For the purposes of this worksection the definitions given below apply.

- Pipe surround: Includes pipe overlay, pipe side support, side zone and haunch zone.

PRODUCTS

Pits

Finish to exposed surfaces

Refer 1.1.3 Types and Subtypes Table and Landscape Details Drawing.

Metal access covers and grates

Refer 1.1.3 Types and Subtypes Table and Landscape Details Drawing.

Bedding material

Bedding material for the bed and haunch zones shall consist of a granular material having a grading, determined by relevant standards. For General refer to Engineer.

EXECUTION

Stormwater drains

Location

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

Downpipe connections: Turn up branch pipelines with bends to meet the downpipe, finishing 50 mm (nominal) above finished ground or pavement level. Seal joints between downpipes and drains.

Laying

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

Bedding

Grade the underlay evenly to the gradient of the pipeline.

Layers: All material shall be compacted in layers not exceeding 150 mm compacted thickness.

Trench backfill

The remainder of the trench to the underside of the subgrade shall be backfilled with fill material in accordance with the Earthwork worksection.

Anchor blocks

If necessary to restrain lateral and axial movement of the stormwater pipes provide anchor blocks at junctions and changes of grade or direction.

Encasement

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

Pits

In paved areas: Flush with the paving surface.

In landscaped areas: 25 mm above finished surface.

Gratings taking surface water runoff: Locate to receive runoff without ponding.

Testing

Pre-completion tests

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

Completion

Cleaning

Clean and flush the whole installation.

1.3.2. SUBSOIL

GENERAL

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

Conform to 1.1.3 Types and Subtypes Table and Landscape Details Drawing.

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

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

Scope

Work Included: Supply and install subsoil drainage works in accordance with this specification, the Contract drawings and Superintendent's instructions.

MATERIALS

General

Materials delivered to site shall be consistent with the approved samples. Additional samples may be requested at no additional cost to verify compliance with approved samples.

Membrane protection

Where drainage cell is not used over a membrane use the following protection materials:

Vertical surfaces - Fibre cement board sheet - 6mm thickness

Horizontal surfaces - Fibre cement board sheet, or 25 - 50mm mortar screed layed with falls to drainage inlet fittings or as shown on the drawings.

Drainage medium

Refer 1.1.3 Types & Subtypes Table

Material is to be washed and sieved free of silts, sands, gravels and rocks outside these sizes. Specify recycled medium if available.

Drainage cell

Horizontal drainage medium

Refer 1.1.3 Types & Subtypes Table or approved equivalent.

Vertical drainage medium

Refer 1.1.3 Types & Subtypes Table or approved equivalent.

Perforated drainage pipe

1.1.3 Types & Subtypes Table

Geotextile

1.1.3 Types & Subtypes Table

Proprietary item: A non-woven, continuous filament, spun bonded, needle punched geotextile.

Sand filter layer

1.1.3 Types & Subtypes Table

Washed and free of organic debris and silts, sands, gravels and rocks outside of specified sizes.

1.3.3. EXECUTION

MATERIAL DELIVERY, STORAGE AND HANDLING

Protect subsoil drainage material in transit between the point of supply and the project site. Actual Delivery Date/s shall be approved by the PAP. Give the PAP 7 days notice of the Actual Delivery Date , unloading times, locations and sequences. The Contractor shall confirm these conditions a minimum 24 hours before Actual Delivery.

Materials delivered to site shall be consistent with the approved samples. Additional samples may be requested at no additional cost to verify compliance with approved samples.

Subsoil drainage material stored on site shall be protected from adverse climatic conditions, watered to prevent dust nuisance and secured.

MATERIAL INSTALLATION

Membrane protection

Place and fix either drainage cell or membrane protection board in the locations detailed on the drawings. Carry out work in a sequence which eliminates the need to traverse unprotected areas of the waterproof membrane. Under no circumstances shall pedestrians or vehicles traverse the unprotected waterproof membrane.

Drainage medium

Place and compact material to the depths detailed on the drawings.

Drainage Cell

Horizontal drainage medium

Lay and join material to the grades and as detailed on the drawings. Install to manufacturers specification.

Vertical drainage medium

Lay and join material to the inside of all planter walls on structure and as detailed on the drawings. Install to manufacturers specification.

Perforated drainage pipe

Lay and join material to the grades and as detailed on the drawings.

Geotextile

Lay and join material as detailed on the drawings. Overlap all joins minimum 300 mm and dress up and/or over all vertical surfaces minimum 200 mm making sure it is finished flush against the surface following soil installation.

Sand filter layer

Place and compact material to the depths detailed on the drawings.

Finished surface shall be smooth. Saturate the sand mass, allow to drain and settle and add sand to meet required finished grades prior to installing soil mix.

Notify PAP of subsoil drainage placement completion and allow 48 hours for inspection prior to installing soil.

COMPLETION

Reinstatement of surfaces

Reinstate existing surfaces removed or disturbed by trench excavations to match existing and adjacent work at the Contractors expense.

1.4 SOILS + CULTIVATION

1.4.1. GENERAL

CROSS REFERENCES

Conform to the 0.3 Quality Requirements and 0.4 General Material Requirements.

STANDARDS

All soils shall comply with relevant Australian standards.

INTERPRETATION

Definitions

For the purposes of this worksection the definitions given below apply.

- Bad ground: Ground unsuitable for the purposes of the works, including fill liable to subsidence, ground containing cavities, faults or fissures, ground contaminated by harmful substances and ground which is or becomes soft, wet or unstable.
- Site rock: Rocks selected for salvage.
- Site topsoil: Soil excavated from the site which contains organic matter, supports plant life, conforms generally to the fine to medium texture classification to AS 4419 (loam, silt, clay loam) and is free from:
 - Stones > 25 mm diameter.
 - Clay lumps > 75 mm diameter.
 - Weeds and tree roots.
 - Sticks and rubbish.
 - Material toxic to plants.
- Native garden on structure soil mix: A soil which has a lower saturated weight suitable for use in areas of planting that are on structure.
- Native lawn on structure soil mix: A lawn soil mix which has a lower saturated weight suitable for use in areas of lawn planting that are on structure.
- Native garden soil mix: A soil which is suitable for native planting areas at grade.
- Native lawn soil mix: A soil mix which is suitable for native lawn planting areas at grade.
- Lawn underlay mix: A soil mix which is suitable for underlying turf areas.
- Lawn top dressing mix: A soil mix which is suitable for surface application to lawn.
- Native structural soil mix: A soil which has a reduced organic content suitable for use in areas where planting media is required below a hard surface finish.
- Native biofiltration soil mix: A permeable soil mix that allows the rapid transfer of moisture to underlying subsoil drainage.

GEOTECHNICAL SITE INVESTIGATION

Report

The geotechnical site investigation report provided is for information only. The geotechnical information and information on contaminants given is information on the nature of the ground at each tested part. It is not a complete description of conditions existing at or below ground level.

1.4.2. PRODUCTS

SOIL MIXES

Source

Provide soils as specified in the Types & Subtypes Table, the soil material recovered from the site for reuse must be tested and approved by the PAP prior to use.

General

Deliveries, additives and nitrogen drawdown to be consistent with relevant sections of AS 4419.

Compost: Provide well rotted vegetative material or animal manure, free from harmful chemicals, grass and weed growth.

SITE SOIL

Stockpiling

Requirement

Propose suitable stockpile locations.

Stockpile soil 1500mm high maximum and protect from traffic and erosion.

- Odour: No strong odour in all cases
- Biological Properties:
- Micro-organisms: Present in all cases
- Mycorrhizal Fungi: Present in all cases
- Pythium & Phytophthora: Absent in all cases
- Weeds & Vegetative/Reproductive Parts: Absent in all cases
- Heavy metals & Toxins: Not exceeding EPA Acceptable Levels in all cases
- (PCB, Phenols, Cd, Cu, Hg, Pb, Zn)

General soil characteristics

Site soil shall conform to Australian Standards. Soil shall be ameliorated as specified in soil testing results.

General Additives & Components

The following additives may be used for soil modifications.

Animal manures	Cow or sheep manure that is seedless, composted and of a fine dry texture.
Green manures	Rye, corn, beans, lupins, mustard etc.
Organic matter	Garden and food wastes that are seedless, odourless, composted and screened or approved Australian peat.
Soil liming	Lime stabilised recycled sewerage sludge.
Sand	Sharp washed sand 0.25mm to 2mm diameter shall include between 3% and 20% field soil of loamy sand to sandy loam texture.
Fieldsoil	To AS 4419.
Ash	Washed and graded without fine particles.

NATIVE SOIL MIXES

Delivery and stockpiling

Requirement

Prior to delivery, propose suitable stockpile locations.

Soil mixes must be delivered to site pre-blended. The soil mix must be transported in a moist condition to prevent segregation of components. Stockpile soil 1500mm high maximum and protect from traffic and erosion. Materials delivered to site shall be consistent with approved samples and performance criteria.

General schedule of soil characteristics

All soil mixes shall conform to Australian Standards and to the following general characteristics unless otherwise stated in this specification;

- Odour: No strong odour in all cases
- Biological Properties:
- Micro-organisms: Present in all cases

1 IVANHOE PLACE, MACQUARIE PARK NSW 2113

- Mycorrhizal Fungi: Present in all cases
- Pythium & Phytophthora: Absent in all cases
- Weeds & Vegetative/Reproductive Parts: Absent in all cases
- Heavy metals & Toxins: Not exceeding EPA Acceptable Levels in all cases
- (PCB, Phenols, Cd, Cu, Hg, Pb, Zn)

General Additives & Components

The following additives may be used for soil modifications, refer also individual soil specifications for recommended additives and ameliorants;

Animal manures	Cow or sheep manure that is seedless, composted and of a fine dry texture.
Green manures	Rye, corn, beans, lupins, mustard etc.
Organic matter	Garden and food wastes that are seedless, odourless, composted and screened or approved Australian peat.
Soil liming	Lime stabilised recycled sewerage sludge.
Sand	Sharp washed sand 0.25mm to 2mm diameter shall include between 3% and 20% field soil of loamy sand to sandy loam texture.
Fieldsoil	To AS 4419.
Ash	Washed and graded without fine particles.

NATIVE SOIL MIXES AT GRADE

Native Garden Soil Mix [P sensitive plants]

A sandy loam to clay loam topsoil mix designed for general purpose, on grade landscape garden bed planting of grasses, woody and herbaceous perennials and perennials that have a high nutrient requirement for sustained optimum growth and are not subject to compaction by pedestrian or other traffic. Material will have the general properties conforming to AS 4419 for a 'natural soil blend'. A typical conforming mix consists of:

Physical Properties

Property	Units	Target Range
Texture - preferred range	n/a	Sandy loam - clay loam
Organic matter	% dwb	3-6
Organic matter [organic soil variant]	% dwb	15-25
Permeability [@ 16 drops by McIntyre Jakobsen]	mm/h	>30
Wettability	mm/h	>5
Dispersibility in water		1 or 2 [AS4419] category
Large particles [naturally occurring]		
2-20mm	% w/w	<20
> 20mm	% w/w	<10
>50mm	% w/w	nil
Visible contaminants >2mm [glass, plastic & metal]	% w/w	<0.5

Chemical Properties

Property	Units	Target Range
pH in water [1:5] Std range	pH units	5.4-6.8
pH in CaCl ₂ [1:5] Std range	pH units	5.2-6.5
pH in water [1:5] Alkaline range	pH units	6.8-8.0
pH in CaCl ₂ [1:5]	pH units	6.5-7.5

Alkaline range		
Electrical conductivity	dS/m	<0.65
Phosphorus – P sensitive plants. Alkaline soils method 18F1	mg/kg	<30
Phosphorus – P sensitive plants. Acid soils method 9B1 or 9C1	mg/kg	<20
Exchangable sodium [Na]	% of ECEC	<7
Exchangable potassium [K]	% of ECEC	5-10
Exchangable calcium [Ca] method 18F1 or 15A1 in alkaline soils	% of ECEC	60-80
Exchangable magnesium [Mg]	% of ECEC	15-25
Exchangable aluminium [Al]	% of ECEC	<2
Exchangable Ca:Mg ration	Ratio	3-9
Available iron [Fe]	mg/kg	100-400
Available manganese [Mn]	mg/kg	25-100
Available zinc [Zn]	mg/kg	5-30
Property	Units	Target Range
Available copper [Cu]	mg/kg	1-15
Available Boron [B]	mg/kg	0.5-5
Available N [N as Nitrate]	mg/kg	>30

Base Level Requirements for Fertilisers [to be verified by laboratory testing and per agronomists report]

Lime &/or dolomite	2kg/m ³ at mixing
Balanced compound NPK turf starter fertiliser	1.0kg/100m ² after placement
Minor trace elements	300g/m ³ at mixing

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

Garden Soil Mix [P tolerant plants]

Material will have the general properties conforming to AS 4419 for a 'natural soil blend'. A typical conforming mix consists of:

Analysis

Physical Properties

Texture – preferred range	n/a	Sandy loam - clay loam
Organic matter	% dwb	3-6
Organic matter [organic soil variant]	% dwb	15-25
Permaeability [@ 16 drops by McIntyre	mm/h	>30

Jakobsen		
Wettability	mm/h	>5
Dispersibility in water		1 or 2 [AS4419] category
Large particles [naturally occurring]		
2-20mm	% w/w	<20
> 20mm	% w/w	<10
>50mm	% w/w	nil
Visible contaminants >2mm [glass, plastic & metal]	% w/w	<0.5

Chemical Properties

pH in water [1:5] Std range	pH units	5.4-6.8
pH in CaCl ₂ [1:5] Std range	pH units	5.2-6.5
Electrical conductivity	dS/m	<0.65
Phosphorus – P tolerant/standard plants. Acid soils method	mg/kg	50-150
Phosphorus – P tolerant/standard plants. Alkaline soils method	mg/kg	30-60
Exchangable sodium [Na]	% of ECEC	<7
Exchangable potassium [K]	% of ECEC	5-10
Exchangable calcium [Ca] method 18F1 or 15A1 in alkaline soils	% of ECEC	60-80
Exchangable magnesium [Mg]	% of ECEC	15-25
Exchangable aluminium [Al]	% of ECEC	<2
Exchangable Ca:Mg ration	Ratio	3-9
Available iron [Fe]	mg/kg	100-400
Available manganese [Mn]	mg/kg	25-100
Available zinc [Zn]	mg/kg	5-30
Available copper [Cu]	mg/kg	1-15
Available Boron [B]	mg/kg	0.5-5
Available N [N as Nitrate]	mg/kg	>30

Base Level Requirements for Fertilisers [to be verified by laboratory testing and per agronomists report]

Lime &/or dolomite
Balanced compound NPK turf starter fertiliser
Minor trace elements

2kg/m³ at mixing
1.0kg/100m² after placement
300g/m³ at mixing

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

Advanced Tree Subsoils

A sandy well drained medium with low organic matter for backfilling below 300mm from the surface in larger potted specimens over 45L or 400mm depth of rootball, semi advanced and advanced tree planting.

Physical Properties

Property	Units	Target Range
Texture – preferred range	n/a	Loamy sand - Sandy loam
Organic matter	% dwb	<5
Permaeability [@ 16 drops by McIntyre Jakobsen	mm/h	>50
Wettability	mm/h	>5
Dispersibility in water	category	1 or 2 [AS4419] category
Large particles [naturally occurring]		
2-20mm	% w/w	<20
> 20mm	% w/w	<10
Visible contaminants >2mm [glass, plastic & metal]	% w/w	<0.5

Chemical Properties

Property	Units	Target Range
pH in water [1:5] Std range	pH units	5.4-6.8
pH in CaCl ₂ [1:5] Std range	pH units	5.2-6.5
pH in water [1:5] Alkaline range	pH units	6.8-8.0
pH in CaCl ₂ [1:5] Alkaline range	pH units	6.5-7.5
Electrical conductivity	dS/m	<0.5
Phosporus – P sensitive plants. Alkaline soils method 18F1	mg/kg	<30
Phosporus – P sensitive plants. Acid soils method 9B1 or 9C1	mg/kg	<20
Exchangable sodium [Na]	% of ECEC	<7
Exchangable potassium [K]	% of ECEC	3-10
Exchangable calcium [Ca] method 18F1 or 15A1 in alkaline soils	% of ECEC	60-80
Exchangable magnesium [Mg]	% of ECEC	15-25
Exchangable aluminium [Al]	% of ECEC	<2
Exchangable Ca:Mg	Ratio	3-9

ration		
Available iron [Fe]	mg/kg	100-400
Available manganese [Mn]	mg/kg	25-100
Available zinc [Zn]	mg/kg	5-30
Available copper [Cu]	mg/kg	1-15
Available Boron [B]	mg/kg	0.5-5
Available N [N as Nitrate]	mg/kg	>20

Base Level Requirements for Fertilisers [to be verified by laboratory testing and per agronomists report]

Lime &/or dolomite or 2kg/m³ at mixing
Gypsum 2kg/m³ at mixing

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

Lawn Soil Mix – Active high-traffic turf

Material will have the general properties conforming to AS 4419 for a 'natural soil'. A typical conforming mix consists of:

Physical Properties

Property	Units	Target Range
2.0mm [fine gravel]	% retained by mass	<3
1.0mm [very coarse sand]	% retained by mass	<10
0.5mm [coarse sand]	% retained by mass	10-30
Property	Units	Target Range
0.25mm [medium sand]	% retained by mass	20-40
0.1mm [fine sand]	% retained by mass	20-30
0.05mm [very fine sand]	% retained by mass	<15 [max 20% combines vsf, Si + Cl]
0.002mm [silt]	% retained by mass	<8 [Si + Clay combined 5-8%]
<0.002mm [clay]	% retained by mass	2-6
Large particles	% by mass	2-10mm <2%, >10mm 0%
Wettability [AS4419]	mm/h	50-200 [@ 16 drops by McIntyre Jakobsen]
Dispersibility in water	Category	1 or 2 [AS4419] category

Chemical Properties

Property	Units	Target Range
pH in water [1:5] Std range	pH units	5.4-8.0
pH in CaCl ₂ [1:5] Std range	pH units	5.2-7.5
Electrical conductivity [1:5]	dS/m	<0.5
Exchangable sodium [Na]	% of ECEC	<7
Available Phosphorus - Acid soils method 18F1 - Alkaline Soils method 9B1 or 9C1	Mg/kg	50-150 20-50
Exchangable Ca:Mg ratio	Ratio	3-9

Available N [N as Nitrate]	mg/kg	>30
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Base Level Requirements for Fertilisers [to be verified by laboratory testing and per agronomists report]

Lime &/or dolomite	2kg/m ³ at mixing
Balanced compound NPK turf starter fertiliser	2.9kg/100m ² after placement
Minor trace elements	300g/m ³ at mixing

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

Native Biofiltration Soil Mix

General

Fit-for-purpose' performance description

A high permeability loamy sand medium for use as the growing and filtration layer in biofiltration bed installations. The specification is based on a modified version of 'Guidelines for filtration media in biofiltration systems' (FAWB 2009). The permeability requirements are quite strict and usually mean that naturally occurring materials will not meet the specifications and mixtures of sand with some soil are required. The FAWB recommendation is that only the surface 100 mm of filtration media must be fertilised to aid plant establishment.

The required properties of the drainage layer and transition layer (if needed) are also specified. When considering variation more emphasis must be placed on compacted permeability than on strict adherence to particle distribution. In practice, hydrologists may define the permeability rate more closely than is specified here following hydraulic loading calculations.

Product specification (technical parameters)

Generally, the soil must be free of 'unwanted material' and must meet all the requirements of the tables below. Where engineers have otherwise specified permeability that specification will over-ride permeability from these tables.

Physical Properties

Property	Units	Acceptable Range
Texture, preferred range	n/a	Loamy Sand
Permeability	mm/h	100–300

Particle Size Distribution		
2.0–3.35 mm fine gravel	% w/w	<3
1.0–2.0 mm coarse sand	% w/w	4–10
0.25–1.0 mm medium & coarse sand	% w/w	40–60
0.15–0.25 mm fine sand	% w/w	10–30
0.05–0.15 mm very fine sand	% w/w	5–30
< 0.05 mm silt plus clay	% w/w	<3

Chemical Properties

Property	Units	Acceptable Range
pH (1:5 in water)	pH units	5.5–7.5
Electrical conductivity (1:5)	dS/m	< 1.2
Phosphorus (Olsen)	mg/kg	< 80

Total nitrogen	mg/kg	< 1000
Organic matter	% w/w	2–5

Chemical properties of the surface layer are not subject to performance specifications by FAWB.

A transition layer is only needed where the following criteria are not met:

- D15 (drainage layer) $\leq 5 \times$ D85 (filtration media)
- D15 (drainage layer) = 5–20 $\times$ D15 (filtration media)
- D50 (drainage layer) < 25 $\times$ D50 (filtration media)
- D60 (drainage layer) < 10 $\times$ D10 (filtration media)

When a transition layer is needed ensure:

- D15 (transition layer) $\square 5 \times$ D85 (filtration media)

Do not use geotextile fabrics over drainage layer.

Example components for the soil supplier

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

Example Suggested components for Surface Layer	
Loamy sand or sandy loam soil	< 20% v/v
Medium sand	70–80% v/v
Composted soil conditioner conforming with AS4454	10–20% v/v
Example base level requirements for fertilisers for the surface layer (to be verified by laboratory testing and per agronomist's report)	
Organic fertiliser (e.g. poultry manure)	3 2 5 kg/m or 500 g/m
Compound fertiliser NPK 16:4:14)	3 2 0.4 kg/m or 40 g/m
Trace element mix	3 2 0.1 g/m or 10 g/m
Superphosphate	3 2 0.2 g/m or 20 g/m
Magnesium sulphate	3 2 0.3 g/m or 30 g/m
Potassium sulphate	3 2 0.2 g/m or 20 g/m
Example suggested components for the filtration layer	
Loamy sand or sandy loam soil	< 20% v/v
Medium sand	70–80% v/v
Composted soil conditioner conforming with AS4454	10–20% v/v
Example suggested components for the transition layer	
Medium sand	100% v/v
Example suggested components for the drainage layer	
2– 5 mm drainage gravel	100% v/v

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

NATIVE SOIL MIXES ON STRUCTURE**Low Density Container & Green Roof Mix**

Generally the soil must be free of 'unwanted material' and must meet all the requirements of AS 3743 and the specified requirements of AS 4419 landscape soils. However, conformance with AS 3743 does not demonstrate compliance with this specification. Where the requirements of this specification and AS 3743 conflict, properties specified here must take precedence. A typical conforming mix consists of:

Physical Properties

Property	Units	Target Range
Texture – preferred range	n/a	Gravelly loamy sand to organic sandy loam
Air filled porosity	%	≥5
Water holding capacity	%	≥45
Permaeability [@ 16 drops by McIntyre Jakobsen	mm/h	>100
Organic matter	% w/w	<25
Wettability	Min.	≤2
Dispersibility in water	category	1 or 2 [AS4419] category
Large particles in the largest dimension]		
<2	% w/w	30-50
Property	Units	Target Range
2-20mm	% w/w	15-30
> 20mm	% w/w	5-10
>50mm	% w/w	nil

Chemical Properties

Property	Units	Target Range
pH in water [1:5] Std range	pH units	5.4-6.8
Electrical conductivity [1:5]	dS/m	<2.2
Chloride	mg/L	≤200
Ammonium-N [NH ₄]	mg/L	≤100
Ammonium-N + nitrate-N [NH ₄ + NO ₃]	mg/L	≥50
Nitrogen draw down index	-	≥0.7
Toxicity index	mm	≥70
Phosphorus [p] std range	mg/L	8-40
Potassium [K]	mg/L	50-250
Sulphate [S ₀₄]	mg/L	≥40
Calcium [Ca]	mg/L	≥80
Magnesium [Mg]	mg/L	≥15
Ca:Mg ratio	Ratio	1.5-10
K:Mg ratio	Ratio	1-7
Sodium [Na]	mg/L	≥130
Iron [Fe]	mg/L	≥35
Zinc [Zn]	mg/L	0.3-10
Copper [Cu]	mg/L	0.4-15
Boron [B]	mg/kg	0.02-0.65
Manganese	mg/kg	1-15

Base Level Requirements for Fertilisers [to be verified by laboratory testing and per agronomists report]

Lime &/or dolomite	2kg/m ³ at mixing
Balanced compound NPK turf starter fertiliser	3.0kg/100m ² after placement
Minor trace elements	300g/m ³ at mixing

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

1.4.3. EXECUTION

PREPARATION

Vegetative spoil

Remove vegetative spoil from site. Do not burn.

Embankment stabilisation

Where necessary to prevent erosion or soil movement, stabilise embankments. Method: Either matting overlay or hydromulching.

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

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

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

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

MULCH

General

Responsibilities

Provide mulch which is free of deleterious and extraneous matter such as soil, weeds and sticks.

Standard: To AS 4454.

Organic mulches: Free of stones.

Mulch material: Aged brush chippings and leaf litter recovered from site clearing, if available; otherwise, aged pine bark.

Organic mulch types

Aged brush chippings and leaf litter: Vegetative material processed through a chipper to pieces not larger than 30 x 30 x 15 mm.

— 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 noxious weeds.

Pine bark: From mature trees, graded in size from 30 x 30 x 25 mm to 25 x 15 x 15 mm, free from wood slivers.

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

Use only aged, coarse grade mulch with no fines (minimum particle size 15mm). Mulch should be recycled, or as a minimum, a by- product of eg plantation industry, and NOT land cleared mulch passed as recycled mulch. Do not use soil conditioner mulch as ground cover mulch.

Replenish decomposed, washed-out and displaced mulch. Prior to application, remove all grass, weeds, rubbish and other deleterious matter. Mulch surface shall finish level with adjoining edging or pavement. Maintain depth of mulch at 75mm. Existing mulch areas deeper than 75mm shall be thinned-out and reused elsewhere.

Spread and lightly consolidate composted organic mulch to 75mm depth to all planting areas.

Do not mulch against stem bases.

Inorganic mulch types

Spread and lightly consolidate inorganic mulch to depth and areas indicated on the drawings.

EARTH MOUNDS

Construction

Placing: Place clean filling in layers approximately 150 mm thick compacted to 85% of the dry density ratio of the surrounding soil as determined by relevant standards. Minimise slumping and further internal packing down.

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.

BIORETENTION

Installation

It is recommended that filter media be lightly compacted during installation to prevent migration of fine particles. In small systems, a single pass with a vibrating plate should be used to compact the filter media, while in large systems, a single pass with roller machinery (e.g. a drum lawn roller) should be performed. Under no circumstance should heavy compaction or multiple-passes be made. Filter media should be installed in two lifts unless the depth is less than 500 mm.

SUBSOIL

Ripping

Rip parallel to the final contours wherever possible. Do not rip when the subsoil is wet or plastic. Do not rip within the dripline of trees and shrubs to be retained.

Ripping depths: Rip the subsoil to the following typical depths:

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

Planting beds

Excavated: Excavate to bring the subsoil to at least 300 mm below finished design levels.

Shape the subsoil to fall to subsoil drains where applicable. Break up the subsoil to a further depth of 150 mm.

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

Cultivation

Minimum cultivation depth: 150mm

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

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

ADDITIVES

Apply additives after ripping or cultivation and incorporate into the upper 100 mm layer of the subsoil. Gypsum: Incorporate at the rate of 0.25 kg/m².

Site topsoil preparation

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

Waste: Remove from site all clay lumps, balled compacted particles greater than 20 mm, stones and trash 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 it off the site.

Admixtures: During the screening process add:

- 15% by weight coarse sand minimum particle size 0.2 mm.
- Ameliorants if recommended in the soil tests specified in SUBMISSIONS.

Additives program: 8 weeks prior to stolonizing or turfing.

Placing topsoil

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

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

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

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

Finishing: Feather edges into adjoining undisturbed ground.

Consolidation

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

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

Topsoil depths

Spread topsoil to the following typical depths:

- Excavated planting areas: If using organic mulch, 375 mm. If using gravel mulch, 350 mm.
- Irrigated grassed areas generally: 200 mm.
- Irrigated grassed areas, heavy use (e.g. playing fields, playgrounds, public parks): 250 mm.
- Non-irrigated grass areas: 150 mm.
- Earth mounds:
 - Mass planted surfaces: 375 mm.
 - Grassed surfaces: 150 mm.
- Top dressing: 20 mm.

2.0 WALLS + EDGES

2.1 GENERAL

2.1.1.AIMS + SCOPE

STANDARDS AND AUTHORITY REQUIREMENTS

The contractor shall at all times observe recognised good practice and carry out all works in accordance with applicable standards, laws, ordinances and regulations required by authorities having jurisdiction over such work. Provide all inspections and permits required by Federal, State and Local Governments and Authorities in furnishing, transporting and installing materials. All materials and components used in the works shall meet all relevant standards.

GENERAL

Provide walls, edges and kerbs that are:

- In conformance with the performance criteria documented.
- Independently designed and documented.
- Independently certified by a professional engineer for technical information.
- Perform all work in accordance with all applicable laws, ordinances and regulations required by authorities having jurisdiction over such work and provide all inspections and permits required by Federal, State and Local Governments and Authorities in furnishing, transporting and installing materials.

CROSS REFERENCES

General

Conform to the 0.3 Quality Requirements and 0.4 General Material Requirements.

Associated worksections

- 1.0 Preparation, Groundworks + Drainage
- 3.0 Pavements
- 4.0 Site Structures
- 5.0 Rails + Fencing
- 6.0 Water Elements
- 7.0 Furniture, Fittings + Lighting
- to be read in conjunction with the ARCHITECTS and CIVIL/ STRUCTURAL ENG. details and specification

2.1.2. HOLD POINTS/ SHOP DRAWINGS/ PROTOTYPES/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTION

HOLD POINTS

Hold Points shall apply to the Contractor as required for the various elements of works listed below. Notification: 3 working days of Hold [H] Points required.

SHOP DRAWINGS

HOLD POINTS SCHEDULE	
Description	Comment
Set-out of walls and edges prior to commencement	LANDSCAPE ARCHITECT & STRUCTURAL ENG to inspect and approve
Shop drawings for concrete form joints and bolt hole spacings	LANDSCAPE ARCHITECT & STRUCTURAL ENG to review and approve
Shop drawings for precast concrete elements	LANDSCAPE ARCHITECT & STRUCTURAL ENG to review and approve
Completion of formworks prior to insitu concrete install	LANDSCAPE ARCHITECT & STRUCTURAL ENG to inspect and approve
Moulds of precast elements complete prior to concrete pour	LANDSCAPE ARCHITECT & STRUCTURAL ENG to inspect and approve

HOLD POINTS SCHEDULE	
Description	Comment
Joints set out for insitu concrete	LANDSCAPE ARCHITECT & STRUCTURAL ENG to inspect and approve
Prototype of each concrete walls type	LANDSCAPE ARCHITECT & STRUCTURAL ENG to inspect and approve

Shop drawings shall be supplied by the Contractor as required below for approval. No work covered by the shop drawings should be commenced prior to review and formal written acceptance of the drawings by the LANDSCAPE ARCHITECT.

Notice: [complete/delete]

SHOP DRAWINGS SCHEDULE	
Description	Comment
2.0 Walls + Edges	
Insitu concrete	Shop drawings showing set-out of all form board joints and bolt holes for approval by Landscape Architect
Precast concrete elements	Shop drawings for all precast concrete works showing proposed details for their design, manufacture, assembly, transport and installation for approval by Landscape Architect. Refer 2.2.1 General – Precast for full list of requirements for shop drawings.
Cores, fixings and embedded items in concrete	If the locations of these items are not shown or are shown diagrammatically, submit shop drawings showing the proposed locations, clearances and cover.
Stone	Submit shop drawings showing stonework setting out, position, dimensions, lifting and fixing details, panel dimensions, joints and cavities independently certified by a professional engineer
Stone Repair	Details of proposed replacements to existing stonework, mouldings and other enrichment.

PROTOTYPES/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS

Prototypes/ Samples/ Tests/ Submissions/ Inspections shall be produced for the following works or materials: Other items may also be required as outlined in this specification.

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
Concrete			
Curing compounds	Certified test results for water retention Evidence of compatibility with concrete and applied finishes, toppings, render Evidence that an acceptable final surface colour will be obtained	Test	Submit if it is proposed to use a liquid membrane-forming curing compound
Void formers	Test certificates confirming that the formers comply with requirements specified in 2.2.2 Products	Submission	
Design documentation	Certification by a qualified structural engineer experienced in form work design verifying conformance of the design	Submission	
Execution documentation	Certification by a qualified structural engineer experienced in form work design and construction for verifying conformance of the completed form work	Submission	
Construction proposals	Proposals for mixing, placing, finishing and curing the concrete Cutting or coring of hardened concrete Timing and sequence of sawing joints	Submission	Submit proposals
Reshoring – concrete	Proposal for reshoring	Submission	Submit if proposed
Pre-mixed concrete supply	Delivery docket listing information required by AS 1379	Submission	Submit for each batch

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
	For special class performance concrete; specified performance and type of cement binder For special class prescription concrete; details of mix, additives and type of cement binder Method of placement and climate conditions during pour The amount of water added at the plant and maximum amount permitted to be at the site. Amount of water added, if any, on site		
Subcontractors	Names and contact details of proposed pre-mixed concrete suppliers and alternative sources	Submission	
Placing records	Log book recording details of each placement of concrete	Submission	Keep on site and make available for inspection if requested
Construction joints	Report outlining the action taken during construction of emergency construction joints	Submission	Submit if required
Formed surface repairs	Proposal outlining surface repairs required	Submission	Submit if required
Unformed surface repairs	Proposal outlining surface repairs required	Submission	Submit if required
Inspections	Base or subgrade covering Membrane or film underlay installed on the base Completed formwork and reinforcement, cores, fixings and embedded items fixed in place Surfaces or elements to be concealed in the final work before covering Commencement of concrete placing	Inspection	Give minimum 48 hours notice so that inspection may be made
Insitu / Precast Concrete			
Insitu / Precast elements/units	Prototype/sample of precast elements/units to AS 3610	Prototype/ Sample	
Design documentation	Certification by a qualified structural engineer experienced in form work design verifying conformance of the design	Submission	
Veneered fabrication	Proposal for veneered fabrication	Submission	Submit if proposed
Contractor design	Independent verification by a professional engineer of compliance of the design with project criteria	Submission	

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
Lifting	Evidence to demonstrate that the unit has adequate strength to carry its own weight if it is proposed that units are to be lifted before 28 day strength has been achieved Proposal for attachments for handling purposes Proposal for lifting or supporting units at other than specified points	Submission	Submit if required
Insitu / Precast concrete manufacturer	Name and contact details of proposed manufacturer of precast concrete units	Submission	
Structural testing	Perform static load tests on the prototype to AS 3600		Submit if structural performance requirements are nominated for the precast unit
Colour	Details of how selected colour will be achieved	Submission	
Work method statement	Work method statement specific to the project for the precast erection	Submission	Submit on request
Inspections	Formwork dimensions and stability Panel edge details and penetrations Connection materials and inserts in place Reinforcement and/or pretesting tendons in place Evaluation of surface finish Waterproofing Stripping and storage Site erection including fixings, insitu topping	Inspection	Give minimum 48 hours notice so that inspection may be made
Formwork			
Design documentation	Submit certification by a qualified structural engineer experienced in formwork design verifying conformance of the design	Submission	
Execution documentation	Submit certification by a qualified structural engineer experienced in formwork design and construction for verifying conformance of the completed formwork	Submission	

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
Subcontractors	Names and contact details of proposed pre-mixed concrete suppliers and alternative sources	Submission	
Surface repair method	If required, submit details of the proposed method before commencing repairs	Submission	
Inspections	Set-out of form board joints and bolt holes prior to cutting and installation of formworks Completed formwork before concrete placing. Evaluation of the finish. Used formwork, after cleaning and before reuse	Inspection	Give minimum 48 hours notice so that inspection may be made
Reinforcement			
Execution proposals	Changes: If changes are proposed to reinforcement shown on the drawings, submit details. Damaged galvanizing: If repair is required, submit proposals to relevant standards. Provision for concrete placement: If spacing or cover of reinforcement does not comply give notice. Splicing: If splicing not documented is proposed, submit details. Welding: Give notice before welding reinforcement.	Submission	
Inspections	Cores and embedments fixed in place. Reinforcement fixed in place, with formwork completed.	Inspection	Give minimum 48 hours notice so that inspection may be made
Stone			
Prototypes	Prototype of the full size of the unit, fixed in position and including joint finishes	Prototype	Provide at least 2 prototypes
Stone Samples	Samples of each type and grade of stone unit and cast stone	Sample	Submit at least 3no. of each type
Associated materials and products	Samples of sand, and each type of structural fixing and fastener	Sample	Submit 2kg sample of sand and 2no. of each type of fixing and fastener

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
Tests	Refer Natural Stone Tests Schedule Refer Cast Stone Tests Schedule Refer Mortar Tests Schedule	Test	
Structural fixings tests	Sample structural fixings of each type to determine whether the fixings conform to requirements	Test	
Subcontractors	Name and contact details of proposed specialist stoneworker	Submission	
Supplier's data	Statements from the stone supplier including experience, production capacity, quality procedures, physical properties and lead times	Submission	
Maintenance manual	Maintenance manual setting out a program for regular maintenance cycles including cleaning, inspection, repair	Submission	Submit on completion
Inspections	Setting out before commencement of construction. Filter fabric and subsurface drainage in place before backfilling.	Inspection	Give minimum 48 hours notice so that inspection may be made
	Proposed stone source (quarry, storage yard) Proposed mason's yard Materials stored at the yard or on site The prepared stone sample range Stone in worked condition at the mason's yard Stone laid out before fixing Setting out before commencement of construction Filter fabric and subsurface drainage in place before backfilling Items to be built-in located in their correct positions including damp-proof course, flashings, bolts, cramps, brackets, structural fixings and rainwater goods Commencement of cast stone production Completed stone work		

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
Gabion			
Inspections	Setting out before commencement of construction. Filter fabric and subsurface drainage in place before backfilling.	Inspection	Give minimum 48 hours notice so that inspection may be made
Stone Repair			
Samples	Cleaning Agents: Submit a sample of the proposed cleaning agents, together with technical details. Synthetic stone restoration: Provide at least 2 restoration patches, each at least 300 x 300 mm, applied to selected existing material, showing typical mouldings to match existing. Repointing: Repoint the joints of a designated sample repointing area on the site, to demonstrate the suitability of the proposed pointing method. Before commencing cleaning operations test clean a designated area including final washing and testing of the surface for neutrality. Reused stone: If it is proposed to reuse sound matching stone recovered from the works for stone replacement, submit proposals on a stone- by-stone basis.	Sample	
Neutrality tests	Cleaning: After the final washing and before removing the scaffold, test the surface for acid/alkali neutrality. If the required pH is not achieved, repeat washing, and re-test.	Test	
Subcontractors	Submit name and contact details of proposed specialist stoneworker.	Submission	
Reused Stone	If it is proposed to reuse sound matching stone recovered from the works for stone replacement, submit proposals on a stone-by-stone basis.	Submission	
Stone scrubbing	If bronze bristle brushes are proposed for scrubbing particularly obstinate areas of heavy soiling, submit proposals.	Submission	

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
Cleaning records	Record the sequence of test cleaning operations, durations of pre-wetting, cleaning and scrubbing, water pressure, flow rate and temperature, result of neutrality test, and other relevant details, and submit a copy of the record	Submission	
Inspections	Proposed restoration stone source (quarry, storage yard). Proposed mason's yard. Materials stored at the yard or on site. The prepared restoration stone sample range.	Inspection	Give minimum 48 hours notice so that inspection may be made
	Restoration stone in worked condition at the mason's yard. Restoration stone laid out before fixing. Items to be built-in located in their correct positions, including damp-proof course, flashings, bolts, cramps, brackets, structural metalwork and rainwater goods. Joints prepared and ready for repointing. Completion of stone repairs before overflashing.		
Adhesives, Sealants and Fasteners			
Adhesives	Sample of each type of adhesive proposed	Sample	
Sealants	Colour samples of visible joint sealants	Sample	
Fasteners	Samples of each type of fastener proposed	Sample	2no. of each type of fastener
Installed Sealant Test	Samples of installed and cured sealant from completed joints	Test	For each sealant test take 3no. samples, submit results
Sealants documents	Technical data sheets	Submission	
Inspections	Joints and penetrations prepared for the application of sealants	Inspection	Give minimum 48 hours notice so that inspection may be made

2.1.3. TYPES + SUBTYPES TABLE

— Type	— Description	— Subtype	— Description
Wall Type			
WA01	Off-Form Insitu Concrete Wall	Concrete	Off-Form Insitu Concrete
		Finish	Refer to Arch Spec and Detail
		Letter Type	Futura Lt BT' font, 500pt size 190% letter tracking
		Letter Material	Letters / signage to be heavy sandblasted
WA02	Gabion Wall Concrete Capping	Gabion	Galvanized steel baskets filled with site-excavated sandstone
		Geotextile	Geotextile filter fabric to be installed behind gabion walls to prevent soil loss
		Capping	Gabion walls shall use new concrete capping as the primary material
WA02 Option 2	Gabion Wall Sandstone Capping	Stone	Galvanized steel baskets filled with site-excavated sandstone
		Geotextile	Geotextile filter fabric to be installed behind gabion walls to prevent soil loss
		Capping	Imported sandstone capping may be used as an alternative
Edge Type			
ED01	Steel Edge	Steel	Galvanised Steel 100x100x6mm
ED02	Steel Edge Planter	Steel	8mm Galvanised Steel with Protective Coating
		Finish	Dulux Duratec Eternity Matt Champagne Kinetic (to match steel balustrade)
ED03	Steel to Stone	Steel	Galvanised Steel for durability
ED04	Concrete to Sand	Concrete	Precast Concrete
		Finish	Exposed Aggregate

2.1.4. PERFORMANCE

All wall and edge details need to be read in conjunction with the CIVIL and STRUCTURAL ENG. dwgs and specification.

Set-out to be located on construction site through GPS coordinates. CAD file to be provided by Landscape Architect. Site boundaries to be confirmed by contractor and surveyor.

2.2 CONCRETE

2.2.1. GENERAL

Refer 2.1.2 Hold Points/ Shop Drawings/ Prototypes/ Samples/ Tests/ Submissions/ Inspection.

AIMS

Responsibilities

Provide cast concrete that has finishes to formed and unformed surfaces which are:

- Appropriate to the importance (visual or physical) of the concrete elements.
- Compatible with following trades and finishes.

Precast concrete: Provide elements that are:

- Undamaged by handling and installation.
- Independently designed and documented.
- Independently certified by a professional engineer for the design and the erected components.

Selections: As documented.

Design

Formwork: The design of the formwork is the contractor's responsibility, formwork panel joints and bolt [toby] holes to be laid out as shown on Landscape Architects drawings.

Environmental Requirements

Refer 0.2.2 Green Star Requirements

INTERPRETATIONS

Definitions

For the purposes of this worksection the definitions given below apply.

- Concrete class:
 - Normal: Concrete which is specified primarily by a standard compressive strength grade and otherwise in accordance with recognized standards.
 - Special: Concrete which is specified to have certain properties or characteristics different from, or additional to, those of normal-class concrete.
- Early age: A mean compressive strength at 7 days exceeding the values shown in relevant standards.
- Green concrete: Concrete which has set but not appreciably hardened.
- Precast units: Concrete elements manufactured in other than their final position including elements manufactured on site.
- Ambient temperature: The air temperature at the time of mixing and placing of concrete, and the predicted or likely air temperature at any time during the 48 hours following a concrete pour.
- Weather:
 - Cold: Ambient shade temperature < 10°C.
 - Hot: Ambient shade temperature > 32°C.

TOLERANCES

Surface quality

Formed surfaces: Confirm conformance with the surface finish requirements of relevant Australian Standards.

Flatness

Unformed surfaces: Confirm conformance with the Flatness tolerance classes table for the class of finish nominated using a straight edge placed anywhere on the surface in any direction.

Flatness tolerance class table

Class	Measurement	Maximum deviation (mm)
A	3 m straight edge	3
B	3 m straight edge	6
C	600 mm straight edge	6

SHRINKAGE SENSITIVE STRUCTURES

Concrete performance

Drying shrinkage (maximum including tolerances): 650 mm for concrete up to and including strength grade 32; 700 mm for higher strength grades.

— Duration of air drying: 56 days

SAMPLES AND PROTOTYPES

Conformance: Supply sample panels to relevant standards.

Manufacture: Cast the panels using the formwork, concrete, compaction equipment, form release agents, curing and formwork removal methods which are to be used in the final work.

Storage: Once accepted, maintain the panels on site undamaged and protected from the weather, as reference prototypes for future evaluation of completed work.

2.2.2. PRODUCTS

POLYMERIC FILM UNDERLAY

Location

Under slabs on ground including integral ground beams and footings, provide a vapour barrier or, in areas prone to rising damp or salt attack, a damp-proofing membrane.

Installation

Lay over the base, lap joints at least 200 mm and seal the laps and penetrations with waterproof adhesive tape. Face the laps away from the direction of concrete pour. Take the underlay up vertical faces past the damp proof course where applicable, and tape fix at the top. Patch or seal punctures or tears before pouring concrete. Cut back as required after concrete has gained strength and forms have been removed.

Base preparation

According to base type, as follows:

- Concrete working base: Remove projections above the plane surface, and loose material.
- Graded prepared subgrade: Blind with sufficient sand to create a smooth surface free from hard projections. Wet the sand just before laying the underlay.

VOID FORMERS

Submit test certificates to confirm that the formers comply with the following requirements under laboratory conditions, when placed on damp sand and loaded with a mass of wet concrete equal to at least the mass of the beams or slabs they are required to support:

- Deflection during placing and compaction of the concrete is less than the span of the beam or slab divided by 1000.
- Additional deflection between initial set and 7 days does not exceed span/400.
- Collapse and loss of load carrying capacity will occur not more than 48 hours after flooding with water, creating a void at least 60% of the original depth of the void former.

FORMWORK

Location: Location of formwork panel joints and boltholes as shown on drawings.

Form linings and facings: To be compatible with finishes to be applied to concrete.

Lost formwork: Not to contain timber or chlorides and not to impair the structural performance of the concrete members.

Release agents: To be compatible with finishes to be applied to the concrete.

Void formers: Material: To be cardboard or fibreboard, collapsible on absorption of moisture.

REINFORCEMENT

Protective coating

For concrete elements containing protective coated reinforcement, provide the same coating type to all that element's reinforcement and embedded ferrous metal items, including tie wires, stools, spacers, stirrups, plates and ferrules, and protect other embedded metals with a suitable coating.

Epoxy coating: To be high build, high solids chemically resistant coating.

- Thickness: 200 µm minimum.

Galvanizing:

- Sequence: If fabrication is to occur after galvanizing, submit proposals for galvanizing repair and coating of cut ends.
- Zinc-coating (minimum): 600 g/m².

Steel reinforcement

Standard:

- Ductility grade: Class N.

Surface condition: Free of loose mill scale, rust, oil, grease, mud or other material which would reduce the bond between the reinforcement and concrete.

Tie wire

To be annealed steel 1.25 mm diameter (minimum).

External and corrosive applications: Galvanized.

PRECAST UNITS

Concrete mix & Aggregates TB C

Submissions

Design documentation

Certification: Submit certification by a qualified structural engineer experienced in formwork design verifying conformance of the design. Precast:

- Contractor design: Provide independent verification by a professional engineer of compliance of the design with project criteria.
- Shop drawings: Submit shop drawings of units showing the proposed details for their design, manufacture, assembly, transport and installation, including the following:
 - Project title and manufacturer's name.
 - Shape or profile drawings (submit these before fabrication of moulds and tooling).
 - Calculations showing method of complying with nominated performance requirements.
 - Concrete mix and type of cement if special-class concrete.
 - Veneer details, if applicable.
 - Formwork type.
 - Locations, sizes, details, materials and stress grades of tendons and reinforcement.
 - Locations, sizes, details, materials, corrosion protection and grades of cast-in ferrules, locating plates, bolts, anchors, lifting devices.
 - Details of all joints.
 - Jack clearances, procedures, stressing sequence, initial tensioning forces gauge pressure, and tendon elongation.
 - Surface finish class and surface treatment, if applicable.
 - Curing and protection methods.
 - Marking plan.
 - Equipment and methods for handling, transport and installation, including lifting inserts and pick-up points.
 - Calculated maximum loadings on lifting and bracing inserts and attachments.
 - Evidence of load capacity of lifting and bracing inserts and attachments in the form of test reports or calculations.
 - Specification of plugs for sealing recesses for cast-in fixings.

Marking

Identify units by marks which are as follows:

- Remain legible until after the unit has been fixed in place.
- Are not visible in the completed structure.
- Show the date of casting.
- Show the correct orientation of the unit.
- On other than units manufactured as a standard product, indicate the locations within the structure in accordance with the marking plan.

Tolerances

Fixings and embedded items in precast units: to required standards.

Lifting and bracing inserts

Capacity: To to required standards.

Attachments

Sealing: Recess lifting attachments such as ferrules, or other types of cast-in fixings, and provide plugs for sealing.

Welding of connections

To required standards.

2.2.3. EXECUTION FORMWORK

Location of formwork panel joints and boltholes to be set out as shown on drawings.

Preparation

Cleaning: Before placing concrete, remove free water, dust, debris and stains from the forms and the formed space.

Corners

Work above ground: Finish as indicated in 2.1.3 Types and Subtypes Table.

Embedments

Fix embedments through formwork to prevent movement, or loss of slurry or concrete, during concrete placement.

Openings

In vertical forms provide form openings or removable panels for inspection and cleaning, at the base of columns, walls and deep beams. Access: For thin walls and columns, provide access hatches for placing concrete.

Release agents

Application: Before placing reinforcement, apply a release agent to form linings and facings.

Steel linings

Rust: Clean off any rust and apply rust inhibiting agent prior to reuse.

Visually important surfaces

For concrete of surface finish classes 1, 2 or 3, set out the formwork as shown on drawings to give a regular arrangement of panels, joints, bolt holes, and similar visible elements in the formed surface schedule. Approval by PAP.

Void formers

Use: Cast designated suspended ground floor slabs and beams on void formers.

Protection: Keep void formers dry until use, place them on a firm level surface and place reinforcement and concrete with minimum delay.

REINFORCEMENT

Tolerances

Fabrication and fixing: To required standards.

Dowels

Fixing: If a dowel has an unpainted half, embed this in the concrete placed first.

Tolerances:

- Alignment: 2 mm in 300 mm.
- Location: $\square$ half the diameter of the dowel.

Grade: 250 N.

Supports

Provide proprietary concrete, metal or plastic supports to reinforcement in the form of chairs, spacers, stools, hangers and ties, as follows:

- To be adequate to withstand construction and traffic loads.
- With a protective coating if they are ferrous metal extending to the surface of the concrete, or are used with galvanized or zinc-coated reinforcement.

Minimum spacing:

- Bars: $\leq 60\text{mm}$ diameters.
- Fabric: $\leq 800\text{ mm}$.

Supports over membranes: Prevent damage to waterproofing membranes or vapour barriers. If appropriate, place a metal or plastic plate under each support.

Projecting reinforcement

If 'starter' or other bars project beyond reinforcement mats or cages, through formwork or from cast concrete, provide a plastic protective cap to each bar until it is incorporated into subsequent work.

Tying

Secure the reinforcement against displacement by tying at intersections with either wire ties, or clips. Bend the ends of wire ties away from nearby faces of forms so that the ties do not project into the concrete cover.

Beams: Tie stirrups to bars in each corner of each stirrup. Fix other longitudinal bars to stirrups at 1 m maximum intervals.

Columns: Secure longitudinal column reinforcement to all ties at every intersection.

Mats: For bar reinforcement in the form of a mat, secure each bar at alternate intersections

Tolerances: to relevant standards

Welding

If welding of reinforcement is proposed, provide details.

CONCRETE

General

Conform to the 0.2 General Material Requirements and 2.1.3 Types and Subtypes Table.

Pre- mixed supply

Addition of water: If water is to be added, comply with required standards.

Transport: Mode must prevent segregation, loss of material and contamination of the environment, and must not adversely affect placing or compaction.

Site mixed supply

Emergencies: If mixing by hand is carried out, provide details. Plant: Mix concrete in a plant located on the construction site.

CORES, FIXINGS AND EMBEDDED ITEMS

Adjoining elements

For adjoining elements to be fixed to or supported on the concrete, provide for the required fixings. If required, provide for temporary support of adjoining elements during construction of the concrete.

Corrosion: If in external or exposed locations, galvanize anchor bolts and embedded fixings, or propose alternative materials such as stainless steel.

Position: Fix cores and embedded items to prevent movement during concrete placing. In locating cores, fixings and embedded items, reposition but do not cut reinforcement, and maintain cover to reinforcement.

Isolation: Isolate embedded items so that water cannot track to concrete providing minimum cover to reinforcement.

CONCRETE PLACING AND COMPACTION

Compaction

Methods: Use immersion and screed vibrators accompanied by hand methods as appropriate to remove entrapped air and to fully compact the mix.

Vibrators: Do not allow vibrators to come into contact with set concrete, reinforcement or items including pipes and conduits embedded in concrete. Do not use vibrators to move concrete along the forms. Avoid over-vibration that may cause segregation.

Placing

Use placing methods which avoid segregation and loss of concrete, and which minimise plastic settlement. Maintain a generally vertical and plastic concrete edge during placement.

Layers: Place concrete in layers $\square$ 300 mm thick, such that each succeeding layer is compacted before previous layer has taken initial set. Compact into previous layer.

Placing records

Keep on site and make available for inspection a log book recording each placement of concrete, including the following:

- Date.
- Specified grade and source of concrete.
- Slump measurements.
- The portion of work.
- Volume placed.

Rain

During placement and prior to setting, do not expose concrete to rain. Protection: Protect surface from damage by covering until hardened.

Time between adjacent placements

Conform to the *Minimum time delay schedule* 0.2 Common Requirements.

Vertical elements

In vertical elements, limit the free fall of concrete to 1500 mm per 100 mm element thickness, up to a maximum free fall of 3000 mm, using enclosed vertical chutes or access hatches in forms.

JOINTS

Construction joints

Location: Do not relocate or eliminate construction joints, or make construction joints not shown on the drawings. If emergency construction joints are made necessary by unforeseen interruptions to the concrete pour, submit a report on the action taken.

Finish: Butt join the surfaces of adjoining pours. In visually important surfaces make the joint straight and true, and free from blemishes impermissible for its surface finish class.

Preparation: Roughen and clean the hardened concrete joint surface. Remove loose or soft material, free water, foreign matter and laitance. Dampen the surface just before placing the

fresh concrete and coat with a neat cement slurry.

Slip joints

Requirement: If concrete slabs are supported on masonry, provide proprietary slip joints to ENGINEERS detail.

FORMED SURFACES

Conform to the 0.3 Quality Requirements and 0.4 General Material Requirements.

Finishing methods

General: If soffits of concrete elements or faces of concrete columns are to have a finish other than off the form, provide details of proposed procedures.

Blasted finishes:

- Light abrasive: Blast the cured surface using hard, sharp graded abrasive particles to provide a uniform matt finish without exposing the coarse aggregate.
- Exposed aggregate finish: Remove the vertical face forms while the concrete is green. Wet the surface and scrub using stiff fibre or wire brushes, using clean water freely, until the surface film of mortar is mechanically removed, and the aggregate uniformly exposed. Do not use acid etching. Rinse the surface with clean water.

Surface repairs

Surface repair method: If surface repairs are required, submit proposals.

UNFORMED SURFACES

General

Strike off, screed and level slab surfaces to finished levels, to the tolerance class noted in the *Unformed surface finishes schedule* following.

Surface finishes

Provide surface finishes in conformance with the *Unformed surface finishes schedule* following.

Surface repairs

If surface repairs are required, submit proposals.

Finishing methods – primary finish

- Machine float finish:
 - After levelling, consolidate the surface using a machine float.
 - Cut and fill and refloat immediately to a uniform, smooth, granular texture.
 - Hand float in locations inaccessible to the machine float.
- Steel trowel finish: After machine floating finish as follows:
 - Use power or handsteel trowels to produce a smooth surface relatively free from defects.
 - When the surface has hardened sufficiently, retrowel to produce the final consolidated finish free of trowel marks and uniform in texture and appearance.
- Burnished finish: Continue steel trowelling until the concrete surface attains a polished or glossy appearance, uniform in texture, appearance and free of trowel marks and defects.
- Wood float finish: After machine floating use wood or plastic hand floats to produce the final consolidated finish free of float marks and uniform in texture and appearance.
- Broom finish: After machine floating and steel trowelling draw a broom or hessian belt across the surface to produce a coarse even-textured transverse-scored surface.
- Scored or scratch finish: After screeding, give the surface a coarse scored texture using a stiff brush or rake drawn across the surface before final set.
- Sponge finish: After machine floating and steel trowelling, obtain an even textured sand finish by wiping the surface using a damp sponge.

Finishing methods – supplementary finish

- Abrasive blast: After steel trowelling, abrasive blast the cured surface to provide texture or to form patterns without exposing the coarse aggregate using hard, sharp graded abrasive particles.
- Exposed aggregate: After steel trowelling, grind the cured surface of the concrete to expose the coarse aggregate.

PRECAST UNITS

Handling

Lifting: Lift or support units only at designated or other approved points. Use handling methods which do not overstress, warp or damage the units.

Attachments

Remove temporary attachments after erection. Seal or otherwise make good residual recesses.

Installation

Fix the units securely and accurately in their final positions.

Ancillaries: Provide components and materials, including fasteners, braces, shims, jointing strips, sealant, flashings, grout and mortar, necessary for the installation of the units.

Protection

Protect the units against staining, discolouration and other damage until they are installed in their final location.

COMPLETION

Formwork removal

Extent: Remove formwork, other than steel reinforcement decking, including formwork in concealed locations, but excepting lost formwork.

Timing: Do not disturb forms until concrete is hardened enough to withstand formwork movements and removal without damage.

Loading

Do not erect masonry walls or other brittle elements on beams and slabs while they are still supported by formwork.

Unencased reinforcement

If 'starter bars' and other items project from cast concrete for future additions and are exposed to the weather, provide details of protection.

Protection

Protection: Protect the concrete from damage due to construction load overstresses, physical and thermal shocks, and excessive vibrations, particularly during the curing period.

Surface protection: Protect finished concrete surfaces and applied finishes from damage.

2.3 FORMWORK

2.3.1. GENERAL

Refer 2.1.2 Hold Points/ Shop Drawings/ Prototypes/ Samples/ Tests/ Submissions/ Inspection

AIMS

Responsibilities

General: Provide finishes to formed concrete surfaces that are as follows:

- Appropriate to the importance (visual or physical) of the concrete elements.
- Compatible with following trades and finishes.

Formwork: Design and construct formwork so that the concrete, when cast in the forms, will have the required:

- Dimensions.
- Location.
- Bolt hole locations.
- Profile.
- Shape.
- Surface finish.

Allowances: Allow for dimensional changes, deflections and cambers resulting from the following:

- Imposed actions.
- Concrete shrinkage and creep.
- Temperature changes.

Design

General: The design of the formwork is the contractor's responsibility, formwork panel joints and bolt holes to be set out as per Landscape Architects drawings.

2.3.2. PRODUCTS MATERIALS

Lost formwork

Not to contain timber or chlorides and not to impair the structural performance of the concrete members.

Void formers

Material: To be cardboard or fibreboard, collapsible on absorption of moisture.

Release agents

To be compatible with finishes to be applied to the concrete.

Form linings and facings

To be compatible with finishes to be applied to concrete.

2.3.3. EXECUTION PREPARATION

Cleaning

Before placing concrete, remove free water, dust, debris and stains from the forms and the formed space.

CONSTRUCTION

Conform to the 2.1.3 Types and Subtypes Schedule

Removable bolts: Remove the bolts without causing damage to the concrete.

Corners

Work above ground: Finish as indicated in 2.1.3 Types and Subtypes Schedule.

Embedments

Fix embedments through formwork to prevent movement, or loss of slurry or concrete, during concrete placement.

Openings

In vertical forms provide form openings or removable panels for inspection and cleaning, at the base of columns, walls and deep beams. Access: For thin walls and columns, provide access hatches for placing concrete.

Steel decking

Fixing: If sheeting cannot be fixed to structural steel supports with puddle welds, or with welded shear studs in composite construction, provide details

Steel linings

Rust: Clean off any rust and apply rust inhibiting agent prior to reuse.

Visually important surfaces

For concrete of surface finish classes 1, 2 or 3, set out the formwork as per construction drawings to give a regular arrangement of panels, joints, bolt holes, and similar visible elements in the formed surface. Approval by PAP.

Void formers

Use: Cast designated suspended ground floor slabs and beams on void formers.

Protection: If likely to be affected by (rain) water keep void formers dry until use, place them on a firm level surface and place reinforcement and concrete with minimum delay.

COMPLETION

Formwork removal

Extent: Remove formwork, other than steel reinforcement decking, including formwork in concealed locations, but excepting lost formwork.

Timing: Do not disturb forms until concrete is hardened enough to withstand formwork movements and removal without damage.

Stripping:

- Vertical forms: Remove formwork that does not support weight of concrete from faces of beams, walls and columns not less than a cumulative 24 hours after placing concrete during which the ambient outdoor temperature has been greater than 10°C.

Loading before stripping

Do not erect masonry walls or other brittle elements on beams and slabs while they are still supported by formwork.

2.4 INSITU CONCRETE

2.4.1. GENERAL

Refer 2.1.2 Hold Points/ Shop Drawings/ Prototypes/ Samples/ Tests/ Submissions/ Inspection

2.4.2. EXECUTION

POLYMERIC FILM UNDERLAY

Location

Under slabs on ground including integral ground beams and footings, provide a vapour barrier or, in areas prone to rising damp or salt attack, a damp-proofing membrane.

Installation

Lay over the base, lap joints at least 200 mm and seal the laps and penetrations with waterproof adhesive tape. Face the laps away from the direction of concrete pour. Take the underlay up vertical faces past the damp proof course where applicable, and tape fix at the top. Patch or seal punctures or tears before pouring concrete. Cut back as required after concrete has gained strength and forms have been removed.

Base preparation

- Graded prepared subgrade: Blind with sufficient sand to create a smooth surface free from hard projections. Wet the sand just before laying the underlay.

CONCRETE

CONCRETE MIX, AGGREGATES TBC

Placing

Concrete: Maintain the temperature of the freshly mixed concrete at $\pm 5^{\circ}\text{C}$.

Formwork and reinforcement: Before and during placing maintain temperature at $\pm 5^{\circ}\text{C}$.

GENERAL

Provide concrete in conformance with the following:

- Properties table – performance.

Pre-mixed supply

Addition of water: If water is to be added, comply with required standards.

Transport: Mode must prevent segregation, loss of material and contamination of the environment, and must not adversely affect placing or compaction.

Site mixed supply

Emergencies: If mixing by hand is carried out, provide details. Plant: Mix concrete in plant located on the construction site.

CORES, FIXINGS AND EMBEDDED ITEMS

Adjoining elements

For adjoining elements to be fixed to or supported on the concrete, provide for the required fixings. If required, provide for temporary support of adjoining elements during construction of the concrete.

Protection

Grease threads. Protect embedded items against damage.

Compatibility: Ensure inserts, fixings and embedded items are compatible with each other, with the reinforcement and with the concrete mix to be used.

Corrosion: If in external or exposed locations, galvanize anchor bolts and embedded fixings or propose alternate materials such as stainless steel.

Structural integrity

Fix cores and embedded items to prevent movement during concrete placing. In locating cores, fixings and embedded items, reposition but do not cut reinforcement, and maintain cover to reinforcement.

Isolation: Isolate embedded items so that water cannot track to concrete providing minimum cover to reinforcement.

Tolerances

Maximum deviation from correct positions:

- Anchor bolt groups for structural steel: comply to required standards.
- Cores and embedded items generally: 10 mm.
- Other fixing bolts: 3 mm.

PLACING AND COMPACTION

Compaction

Methods: Use immersion and screed vibrators accompanied by hand methods as appropriate to remove entrapped air and to fully compact the mix.

Vibrators: Do not allow vibrators to come into contact with set concrete, reinforcement or items including pipes and conduits embedded in concrete. Do not use vibrators to move concrete along the forms. Avoid over-vibration that may cause segregation.

Horizontal transport

Use suitable conveyors, clean chutes, troughs or pipes.

Placing

Use placing methods which avoid segregation and loss of concrete, and which minimise plastic settlement. Maintain a generally vertical and plastic concrete edge at faces during placement. Layers: Place concrete in layers maximum 300 mm thick, such that each succeeding layer is compacted before previous layer has taken initial set. Compact into previous layer.

Placing records

Keep on site and make available for inspection a log book recording each placement of concrete, including the following:

- Date.
- Specified grade and source of concrete.
- Slump measurements.
- The portion of work.
- Volume placed.

Rain

During placement and prior to setting do not expose concrete to rain. Protection: Protect surface from damage by covering until hardened.

Vertical elements

In vertical elements, limit the free fall of concrete to 1500 mm per 100 mm element thickness, up to a maximum free fall of 3000 mm, using enclosed vertical chutes or access hatches in forms.

CONSTRUCTION JOINTS

Location

Do not relocate or eliminate construction joints, or make construction joints not shown on the drawings. If emergency construction joints are made necessary by unforeseen interruptions to the concrete pour, submit a report on the action taken.

Finish at construction joints

Butt join the surfaces of adjoining pours. In visually important surfaces make the joint straight and true, and free from blemishes impermissible for its surface finish class.

Joint preparation

Roughen and clean the hardened concrete joint surface. Remove loose or soft material, free water, foreign matter and laitance. Dampen the surface just before placing the fresh concrete and coat with a neat cement slurry.

EXPANSION JOINTS

Joint filling

Fill with jointing materials. Finish visible jointing material neatly flush with adjoining surfaces.

Preparation: Before filling, dry and clean the joint surfaces, and prime.

Watertightness: Apply the jointing material so that joints subject to ingress of water are made watertight.

Jointing materials

Type: Provide jointing materials compatible when used together, and non-staining to concrete in visible locations.

Bond breaking: Provide back-up materials for sealants, including backing rods, which do not adhere to the sealant. They may be faced with a non-adhering material.

Foamed materials (in compressible fillers): Closed-cell or impregnated types which do not absorb water.

2.5 GABION

2.5.1. GENERAL

Refer 2.1.2 Hold Points/ Shop Drawings/ Prototypes/ Samples/ Tests/ Submissions/ Inspection

2.5.2. PRODUCTS

STEEL

Wire

Chainwire, cable wire, tie wire: TBC

Coating: TBC

ROCK

Sandstone

Gabion basket to be filled with sandstone from site excavation

FILTER FABRIC

General

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

Refer to 2.1.3 Types & Subtypes Table.

Protection

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

2.5.3. EXECUTION

GENERAL

Set out

Set out the positions of walls as shown on drawings.

Clearing

Extent: Except 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.

Assembly

Construction: Assemble the baskets and join them together by wiring along edges both horizontally and vertically before placing the rock fill. Fix the top of the basket by wiring to both the sides and the diaphragms.

Construction

Construct walls in conformance with the manufacturer's written requirements.

2.6 STEEL

2.6.1. GENERAL

Refer 2.1.2 Hold Points/ Shop Drawings/ Prototypes/ Samples/ Tests/ Submissions/ Inspection

2.6.2. PRODUCTS

GALVANISED STEEL EDGING

Galvanised edging, standard length 2440mm.

2.6.3. EXECUTION

PROPRIETARY STEEL EDGING – GALVANISED

Flush Edging

Profiles used: 100mm

Gauge: refer Types and Subtypes Table 3.1.3 Edge Buried: min 90%

Stake Spacing: 2 per length 600mm from each end Stake Length: refer Types and Subtypes Table 3.1.3

Stake Fixing: refer Types and Subtypes Table 3.1.3 for specified fixing, one per stake.

Connectors: use piece of edging equal in length to edging profile being used [eg. 100mm profile = 100mm long connector]. Invert connector and lock in place by inseting flat edge under lip of both edge lengths. Clamp connector in place and insert one screw per side of connector as shown on construction detail drawings.

Edge Staking Generally

Do not use sledge hammer to drive stakes as may cause top of stake to bend, instead use dead blow [ie rubber mallet] and if necessary protect top of stake.

In situations of extremely hard ground, use other methods [eg. hand auger] to start holes to avoid damaging stakes.

WELDING

All welding to be carried out appropriate to metal type, in accordance with relevant standards and in accordance with 0.4 General Material Requirements

HOT DIP GALVANIZED COATING

Provide hot dip galvanized coatings to structural steelwork or steel products that control corrosion in the time to first maintenance. Coating methods and thicknesses: Comply with the requirements of relevant standards.

3.0 PAVEMENTS

3.1 GENERAL

3.1.1. AIMS + SCOPE

STANDARDS AND AUTHORITY REQUIREMENTS

The contractor shall at all times observe recognised good practice and carry out all works in accordance with applicable standards, laws, ordinances and regulations required by authorities having jurisdiction over such work. Provide all inspections and permits required by Federal, State and Local Governments and Authorities in furnishing, transporting and installing materials. All materials and components used in the works shall meet all relevant standards.

GENERAL

Provide pavements, surfaces, stairs, ramps and joints that are:

- In conformance with the performance criteria documented.
- In conformance to do with the drawings.

CROSS REFERENCES

Conform to the 0.3 Quality Requirements and 0.4 General Material Requirements.

Associated worksections

- 1.0 Preparation, Groundworks + Drainage
- 2.0 Walls and Edges
- 4.0 Site Structures
- 5.0 Rails + Fencing
- 6.0 Water Elements
- 7.0 Furniture, Fittings + Lighting
- 8.0 Planting
- to be read in conjunction with the ARCHITECTS and CIVIL/ STRUCTURAL ENG. details and specification

3.1.2. HOLD POINTS/ SHOP DRAWINGS/ PROTOTYPES/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTION

HOLD POINTS

Hold Points shall apply to the Contractor as required for the various elements of works listed below.

Notification: 3 working days of Hold [H] Points required.

HOLD POINTS SCHEDULE	
Description	Comment
Set-out of pavement inclusive of joints prior to commencement of formwork	LANDSCAPE ARCHITECT to inspect and approve.
Completion of formwork prior to in situ concrete installation	LANDSCAPE ARCHITECT to inspect and approve.
Moulds of precast elements complete prior to concrete pour	LANDSCAPE ARCHITECT & STRUCTURAL ENG to inspect and approve.
Prototype of each precast unit for approval prior to manufacture	LANDSCAPE ARCHITECT & STRUCTURAL ENG to inspect and approve.
Samples of gravel types prior to commencement of gravel pavements	LANDSCAPE ARCHITECT to inspect and approve.

SHOP DRAWINGS

SHOP DRAWINGS SCHEDULE	
Description	Comment
Each precast pavement type noting proposed finishes, edge treatments and lifting locations.	Submit shop detail drawings certified by a professional engineer stating that the design has been carried out in accordance with documented project.

Shop drawings shall be supplied by the Contractor as required below for approval. No work covered by the shop drawings should be commenced prior to review and formal written acceptance of the drawings by the LANDSCAPE ARCHITECT.

PROTOTYPES/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS

Prototypes/ Samples/ Tests/ Submissions/ Inspections shall be produced for the following works or materials:

Other items may also be required as outlined in this specification.

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
General			
Slip Resistance Test	Slip resistance classification of new pedestrian surface materials to current version of AS/NZS 4586.	Test	All new pavement materials
Source of materials	Details of supplier including name, nature of work, nature of all materials and sources.	Submission	
Subcontractors	Name and contact details of proposed specialist paving contractor.	Submission	
Compliance of material	Certification and test results from a NATA laboratory confirming materials comply with requirements of specification.	Submission	
Pavement Base and Subbase			
Tests	Compaction control tests to relevant standards at the frequencies nominated in this specification.	Test	Refer section 3.2.1 for required test frequencies.
Proposals	Staging of the work, access and traffic control methods. Disposal of surface water, control of erosion, contamination and sedimentation of the site, surrounding areas and drainage systems. Methods and equipment for each operation. Sources of materials. Material stockpiles.	Submission	

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
Compaction	If it is proposed that a layer is to exceed 150 mm in thickness, submit evidence demonstrating that the proposed compaction equipment can achieve the required density throughout the layer.	Submission	
Inspections	Prepared subgrade. Proof rolling of subbase prior to spreading of base. Proof rolling of base prior to sealing.	Inspection	Give not less than 48 hours notice so that inspection may be made.
Coarse Aggregates			
Samples	Provide 5kg sample bag labelled to indicate source and content.	Sample	
Fine Aggregates			
Samples	Provide 5kg sample bag labelled to indicate source and content.	Sample	
Crushed Sandstone			
Samples	Provide 5kg sample bag labelled to indicate source and content.	Sample	
Concrete Precast Pavement			
Samples	Provide labelled concrete samples illustrating the range of variation in colour and finish. Isolation Joint & Expansion Joint samples illustrating the range of variation in colour and finish.	Sample	
Prototypes	Provide prototype of each unit type for approval prior to manufacture.	Inspection	Give not less than 48 hours notice so that inspection may be made.
Sample test Panels	Prepare a series of test trial set out for each area with the different concrete mix and finish for sign off on final pavement Sample test panel of base of Exoskeleton (to be developed over the next stage) Sample test panel with stairs tactiles and nosing in place	Sample	Panel size ≥ 2 m ² (allow for more than 5 test panels)

Traffic on Pavement	Give notice before opening the pavement to traffic before the work is completed.	Submission	
PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
Inspections – Concrete paving	Moulds manufactured prior to concrete pour. Base or subgrade before covering. Membrane or film underlay installed on the base or subgrade. Commencement of concrete unit installation. Completion of concrete unit installation.	Inspection	Give not less than 48 hours notice so that inspection may be made.
Concrete Precast Pavers – on pedestals			
Samples	Provide samples as requested with different finishes	Sample	
Prototypes	Provide prototype of each unit type for approval prior to manufacture.	Inspection	Give not less than 48 hours notice so that inspection may be made.
Inspections – Concrete paving	Setting out before commencement of construction. Set out of pedestals completed Bearers and joists completed before installation of precast units. Commencement of concrete unit installation. Completion of concrete unit installation.	Inspection	Give not less than 48 hours notice so that inspection may be made.
Pavers – Mortar Bed			
Samples	Labelled samples of pavers, grout and sealants, illustrating the range of variation in colour and finish.	Sample	
Sample Panels	Prepare a sample panel of each type of finish including samples of junction details and trim. Preserve each panel until related work is complete. The sample panel shall be the benchmark of quality of execution for the project.	Sample	Panel size $\geq 2 \text{ m}^2$
Grouting	Proposal for grouting methods and materials.	Submission	
Joints	If it appears that minor variations in joint widths or overall dimensions will avoid cut tiles, submit a proposal.	Submission	

Product conformity	Current assessments of conformity by an AS/NZS ISO 9001 quality management system certified supplier.	Submission	
PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
Inspections	Substrate immediately before paving. Trial set-outs before execution. Control joints before sealing and grouting.	Inspection	Give not less than 48 hours notice so that inspection may be made.
Pavers – Sand Bed			
Samples	Labelled samples of pavers illustrating the range of variation in colour and finish.	Sample	
Sample Panels	Segmental Paving Pattern: Prepare a trial set out for each area and pattern.	Sample	Panel size $\geq 2 \text{ m}^2$
Joints	If it appears that minor variations in joint widths or overall dimensions will avoid cut pavers, submit a proposal.	Submission	
Product conformity	Current assessments of conformity by an AS/NZS ISO 9001 quality management system certified supplier.	Submission	
Inspections	Substrate immediately before paving. Trial set-outs before execution. Control joints before sealing and grouting.	Inspection	Give not less than 48 hours notice so that inspection may be made.
Stone			
Samples	Labeled samples of tiles, grout and sealants illustrating the range of variation in colour and finish.	Sample	
Sample panels	Sample panel of each type of finish including junction details and trim.	Sample	Panel size $\geq 2 \text{ m}^2$
Grouting	Proposal for grouting methods and materials.	Submission	
Joints	If it appears that minor variations in joint widths or overall dimensions will avoid cut tiles, submit a proposal.	Submission	

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
Product conformity	Current assessments of conformity by an AS/NZS ISO 9001 quality management system certified supplier. Marking and Classification of tiles with regard to water absorption and shaping to relevant standards. Marking and Classification of tile adhesive to relevant standards. Weighted normalised impact sound pressure level to relevant standards as measured for the acoustic underlay as part of the entire tiling system.	Submission	
Inspections	Substrate immediately before tiling. Trial set-outs before execution. Control joints before sealing and grouting. Grout and caulking colours before application.	Inspection	Give not less than 48 hours notice so that inspection may be made.
Trial set-out	Trial setout of each area.	Inspection	Give not less than 48 hours notice so that inspection may be made.

3.1.3. TYPES + SUBTYPES TABLE

— Type	— Description	— Subtype	— Description
Pavement Type			
PA01	Stone Tile as per Existing	Stone	Colortile 'Mars' Porcelain Size: 600x600x20 mm
		Finish	P4 Slip Rating
		Colour	Mars Light
		Pedestal	As per Existing
		Supplier	Colortile
PA02	Stone Pavers – on structure	Stone	STONE - ERSKINE
		Finish	Hammered
		Mortar	Mortar base - refer CIVIL ENG
		Supplier	Stonekast

— Type	— Description	— Subtype	— Description
PA03	Stone Pavers – on Pedestals	Stone	STONE - ERSKINE
		Finish	Hammered
		Pedestal	KEKSIA – SE SERIES – with aluminium joist system
		Supplier	Stonekast
PA04	Compacted Aggregate at grade	Aggregate	Compacted ANL Deco-Gold gravel
		Base	Compacted Road Base - Refer Civil Eng.
		Supplier	ANL
PA05	Plain Grey Concrete Path 'Broom Finish'	Concrete	Plain Grey Concrete
		Finish	'Broom Finish'
		Base	Compacted Road Base - Refer Civil Eng.
		Base Near Tree	40mm Basalt (5 Parts) Filler Soil (1 Part) ANL Sandy Loam Greenlife® Fines
		Aggregate	Compacted ANL Deco-Gold gravel
		Supplier	Sareen Stone
PA06	Softfall Rubber	Softfall	Rosehill TPV Rubber
		Colour	Refer to TILT Design
		Finish	Recycle rubber wetpour softfall base – AS 4422:2016
		Supplier	Synthetic Grass
PA07	Play Sand	Supplier	Allscape Creations
PA08a	Stone Paving on Pedestal	Stone	SAM PAVING MAN – Honey Jasper & Mosaic Red 371x696x60 mm
		Finish	Exfoliated
		Pedestal	KEKSIA – SE SERIES – with aluminium joist system
		Supplier	Sam the Paving Man
PA08b	Stone Paving on Mortar	Stone	SAM PAVING MAN – Honey Jasper & Mosaic Red 371x696x60 mm
		Finish	Exfoliated
		Mortar	4 parts Nepean River Sand to 1 part Portland Cement
		Supplier	Sam the Paving Man

— Type	– Description	— Subtype	— Description
PA09	Stone Steppers	Stone	Sandstone
		Finish	Bush hammered
PA10	Playground Mulch	Mulch	Playground Mulch (Softfall®) in Bulka Bag
		Supplier	ANL
PA11	Rooftop Pebbles	Pebbles	River Gravel 10mm
		Drainage Cell	ATLANTIS – 20mm drainage cell
		Mortar	4 parts Nepean River Sand to 1 part Portland Cement
		Insulation	Rigid Insulation to Engineers
		Waterproofing	Waterproofing to Engineers
		Supplier	ANL
Tactile Type			
TAC01	Tactile Indicators	Tactile	Stainless Steel as documented
Stair Type			
ST01	Insitu Concrete	Concrete	In-situ Concrete
		Finish	Exposed Aggregate
		Nosing	CLASSIC-Arch FX Bass-INB033-H
		Tactile	DTAC Bronze top classic warning tactile (SPIKED) product code: BH60N
ST02	Concrete Capping-Gabion	Capping	Reinforced Concrete
		Gabion	Galvanized steel baskets filled with site-excavated sandstone
		Supplier	https://gosfordquarries.com.au/
ST03			Refer to Architectural Specification & Details

— Type	— Description	— Subtype	— Description
ST04	Concrete Capping Sandstone Log	Capping	Reinforced Concrete
		Sandstone	Imported Sandstone Log (500mm W x 500mm H x Varies in Length)
		Finish	Natural Split Face
		Additional	LED Strip Light to be recessed into concrete capping
		Supplier	https://gosfordquarries.com.au/
ST04 Option 2	Sandstone Capping Sandstone Log	Capping	Sandstone
		Sandstone	Imported Sandstone Log (500mm W x 500mm H x Varies in Length)
		Finish	Natural Split Face
		Additional	LED Strip Light to be recessed into sandstone capping
		Supplier	https://gosfordquarries.com.au/

For location refer to LANDSCAPE ARCHITECTS Materials and Levels Plan' For technical requirements refer to STRUCTURAL ENG. and CIVIL ENG. Plans.

3.1.4. PERFORMANCE SCOPE OF WORKS

This work section generally covers all works regarding pavement and stairs.

For location refer to LANDSCAPE ARCHITECTS plans and details.

Set-out to be located on construction site through GPS coordinates. CAD file to be provided by Landscape Architect. Site boundaries to be confirmed by contractor and surveyor.

3.2 PAVEMENT BASE AND SUBBASE

3.2.1. GENERAL

Refer 3.1.2 Hold Points/ Shop Drawings/ Prototypes/ Samples/ Tests/ Submissions/ Inspection

AIMS

Responsibilities

Provide base and subbase courses that are as follows:

- In conformance with the level tolerances specified.
- Tested by a geotechnical testing authority.
- In conformance with the compaction requirements supplied.

INTERPRETATION

Definitions

For the purposes of this worksection the definitions given below apply.

- Absolute level tolerance: Maximum deviation from design levels.
- Relative level tolerance: Maximum deviation from a 3 m straight edge laid on the surface.

TESTS

Frequency of compaction control tests

Not less than the following (whichever requires the most tests):

- 1 test per layer per 25 lineal metres for 2-lane roads.
- 1 test per layer per 1000 m² for carparks.
- 3 tests per layer.
- 3 tests per visit.

Source of material: State the supplier name, nature of material (crushed rock, natural gravel, recycled, etc.) and source quarry or recycling site.

Compliance of material: Provide certification and test results from a NATA registered laboratory confirming that the material complies with the requirements of the specification.

3.2.2. PRODUCTS

BASE AND SUBBASE MATERIAL

General

Base and subbase materials to be compliant with relevant standards and codes.

3.2.3. EXECUTION

SUBGRADE PREPARATION

General

Subgrade preparation to be undertaken in accordance with 1.2.1 Earthwork.

TOLERANCES

Surface level

Provide a finished surface which is free draining and evenly graded between level points. Edges abutting gutters: Within ± 5 mm of the level of the actual gutter edge.

Tolerances: The tolerances in the *Surface level tolerances table* apply to the finished level of each layer, unless overridden by the requirements (including tolerances) for the finished level and thickness of the wearing course.

Surface level tolerances table

Item	Level tolerance	
	Absolute	Relative
Subbase surface	± 10 mm	10 mm
Base surface	± 10 mm	10 mm

SUBBASE AND BASE COMPACTION

General

Compact each layer of fill to the required depth and density, as a systematic construction operation and to conform to the minimum relative compaction table.

Minimum relative compaction table

Item description	Minimum dry density ratio (modified compaction)
Subbase	95
Base	98

Unstable areas: Any unstable areas which develop during rolling or are identified by proof rolling shall be removed for the full depth of the layer and disposed of and replaced with fresh material. Materials used as replacement materials shall comply with the requirements of the specification. The placing and compaction of the replacement materials shall also comply with the requirements of the specification.

Compaction requirements

Apply uniform and sufficient compactive effort over the whole area to be compacted. Use rollers appropriate to the materials and compaction requirements.

Moisture content

During spreading and compaction, maintain materials at the optimum moisture content (modified compaction) within the range of -2% to +1% from the optimum moisture content.

Spraying: Maintain moisture content. Use water spraying equipment capable of distributing water uniformly in controlled quantities.

Rectification

If a section of pavement material fails to meet the required density or moisture content after compaction remove the non-complying material, replace with fresh material, and recompact.

Level corrections

Rectify incorrect levels as follows:

- High areas: Grade off.
- Low areas: Remove layers to a minimum depth of 75 mm, replace with new material and recompact.

PLACING BASE AND SUBBASE

General

Weak surfaces: Do not place material on a surface which has been so weakened by moisture that it will not support, without damage, the constructional plant required to perform the work.

Spreading: Spread material in uniform layers without segregation.

Moisture content: Maintain wet mixed materials at the required moisture content before and during spreading. Add water to dry mixed materials through fine sprays to the entire surface of the layer after spreading, to bring the material to the required moisture content.

Layer thickness: 150 mm maximum and 75 mm minimum (after compaction). Provide equal layers in multilayer courses.

Joints

Plan spreading and delivery to minimise the number of joints. Offset joints in successive layers by at least 300 mm.

Final trimming

Trim and grade the base course to produce a tight even surface without loose stones or a slurry of fines.

3.3 COARSE AGGREGATES

3.3.1. GENERAL

Refer 3.1.2 Hold Points/ Shop Drawings/ Prototypes/ Samples/ Tests/ Submissions/ Inspection

General: Provide a finished surface which is as follows:

- Free draining and evenly graded between level points.
- Even and smooth riding.

3.3.2. PRODUCTS MATERIALS

General

To be clean, sound, hard, angular, of uniform quality, free from deleterious matter in conformance with the 3.1.3 Types and Subtypes table.

Coarse Aggregate

To be clean, sound, hard, durable particles of natural sand or particles derived from crushed stone, gravel or slag, free from injurious coating or particles of clay, silt, loam or other deleterious matter. Single sized material greater than 5mm.

Recycled Aggregate

To maximise natural rock and promote environmental sustainability, recycled aggregates are produced from recycled materials which include recycled concrete, brick and masonry.

Recycled Concrete Aggregate [RCA]

- Crushed sound and clean waste concrete of at least 95% by weight of concrete with typical total contamination lower than 1% of the bulk mass. Class 1A RCA is a well graded RCA with no more than 0.5% brick content.

Recycled Concrete and Masonry [RCM]

- Graded aggregate produced from sorted and clean waste concrete and masonry. Class 1B RCA is a class 1A RCA blended with no more than 30% crush brick.

Reclaimed Aggregate (RA)

- Coarse aggregates reclaimed from returned concrete by separating the aggregates from the water- cement slurry.

Reclaimed Asphalt Pavement (RAP)

- Old asphalt concrete.

Used Foundry Sand

- Spent foundry sand.

Aggregate classifications

Natural aggregate

Construction aggregates produced from natural sources such as gravel and sand, and extractive products such as crushed rock.

Manufactured aggregate

Aggregates manufactured from selected naturally occurring materials, by-products of industrial processes or a combination of these.

Recycled aggregate

Aggregates derived from the processing of materials previously used in a product and/or in construction.

Reused by-product

Aggregates produced from by-products of industrial processes

3.3.3. EXECUTION

Finished levels

General: Provide a finished surface which is free draining and evenly graded between level points.

Edges abutting gutters: Within ± 5 mm of the level of the actual gutter edge.

Application

Coarse aggregate is to consist of approved material. The contractor is to submit a sample of the proposed aggregate for the LANDSCAPE ARCHITECTS approval, prior to ordering and delivery to site.

Layer thickness: If not indicated on drawings, 75mm, to an even surface with 1 in 150 cross falls. In areas above existing bedrock, coarse aggregate is to be laid in varying depths in order to achieve an even surface.

3.4 FINE AGGREGATE

3.4.1. GENERAL

Refer 3.1.2 Hold Points/ Shop Drawings/ Prototypes/ Samples/ Tests/ Submissions/ Inspection

General: Provide a finished surface which is as follows:

- Free draining and evenly graded between level points.
- Even and smooth riding.

**3.4.2. PRODUCTS
MATERIALS**

General

To be clean, sound, hard, angular, of uniform quality, free from deleterious matter in conformance with the 3.1.3 Types & Subtypes Table.

Fine aggregate

To be clean, sound, hard, durable particles of natural sand or particles derived from crushed stone, gravel or slag, free from injurious coating or particles of clay, silt, loam or other deleterious matter. Single sized material smaller than 5mm.

Recycled Aggregate

To maximise natural rock and promote environmental sustainability, recycled aggregates are produced from recycled materials which include recycled concrete, brick and masonry.

Recycled Concrete Aggregate [RCA]

- Crushed sound and clean waste concrete of at least 95% by weight of concrete with typical total contamination lower than 1% of the bulk mass. Class 1A RCA is a well graded RCA with no more than 0.5% brick content

Recycled Concrete and Masonry [RCM]

- Graded aggregate produced from sorted and clean waste concrete and masonry. Class 1B RCA is a class 1A RCA blended with no more than 30% crush brick.

Reclaimed Aggregate (RA)

- Coarse aggregates reclaimed from returned concrete by separating the aggregates from the water- cement slurry.

Reclaimed Asphalt Pavement (RAP)

- Old asphalt concrete.

Used Foundry Sand

- Spent foundry sand.

Aggregate classifications

Natural aggregate

Construction aggregates produced from natural sources such as gravel and sand, and extractive products such as crushed rock.

Manufactured aggregate

Aggregates manufactured from selected naturally occurring materials, by-products of industrial processes or a combination of these.

Recycled aggregate

Aggregates derived from the processing of materials previously used in a product and/or in construction.

Reused by-product

Aggregates produced from by-products of industrial processes

3.4.3. EXECUTION

Finished levels

Provide a finished surface which is free draining and evenly graded between level points. Edges abutting gutters: Within ± 5 mm of the level of the actual gutter edge.

Application

Fine aggregate is to consist of approved material. The contractor is to submit a sample of the proposed aggregate for the LANDSCAPE ARCHITECTS approval, prior to ordering and delivery to site.

Layer thickness: If not indicated on drawings, 75mm, to an even surface with 1 in 150 cross falls. In areas above existing bedrock, coarse aggregate is to be laid in varying depths in order to achieve an even surface.

3.5 CONCRETE PRECAST PAVEMENT

3.5.1. GENERAL

Refer 3.1.2 Hold Points/ Shop Drawings/ Prototypes/ Samples/ Tests/ Submissions/ Inspection

INTERPRETATION

Definitions

For the purposes of this worksection the definitions given in the relevant standards and the following apply.

- Absolute level tolerance: Maximum deviation from design levels.
- Relative level tolerance: Maximum deviation from a 3 m straightedge laid on the surface.
- Joint:
 - Construction: A joint provided to suit construction sequence with reinforcement continuous across the joint.
 - Contraction: An unreinforced joint with a bond-breaking coating separating the concrete joint surfaces.
 - Expansion: An unreinforced joint with the joint surfaces separated by a compressible filler.
 - Weakened plane: 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.

TOLERANCES

General

Rigid pavement surface:

- Absolute tolerance: ± 10 mm.
- Relative tolerance: 5 mm.

3.5.2. PRODUCTS

CONCRETE MIX

Design the mix to suit the methods of concrete manufacture, placing, compaction and finishing.

MIX

Final Mix to be agreed upon sample panels.

Mix design variation: Do not vary the design mix, method of production, or source of supply of constituents.

25MPa Off White Quartz

Cement – Portland

AGGREGATE

Course Aggregate – 20mm Quartz Fine Aggregates – Clarence Sands

Oxide – 6% (byweight of cement) Blizzard

Washing: Wash aggregate as necessary or as directed to achieve requirements for soluble salt content or removal of other impurities.

Concrete exposure classification (for durability assessment): Severe.

CEMENT

- Type: GP or GB as specified.

Inert form strip

To be polystyrene, foam or cork strip for use with preformed elastomeric seals. After forming, remove the upper section of the inert form strip and insert the preformed elastomeric seal.

Sealants

Resistance penetrating sealer that does not change the gloss level or appearance of concrete finish.

3.5.3. EXECUTION PREPARATION

Junctions with existing pavements

Trimming: Where the pavement is to be joined to an existing pavement remove a strip of the existing pavement at least 300 mm wide for its full depth and trim the edge vertically before placing new pavement material.

Existing sealed pavement: Trim the seal to a neat edge.

Fixed formwork

Description: To be as follows:

- Steel forms.
- Seasoned, dressed timber planks, free of warps, bends or kinks, with the full width of their top edges covered with steel angle sections finishing flush with the form face.

Depth: Equal to the edge thickness of the slab and in one piece.

Tolerances on position:

- Absolute level tolerance: ± 5 mm (maximum departure of top surface from the required level).
- Relative level tolerance: 5 mm (maximum departure of top surface from a 3 m straightedge).
- Horizontal tolerance: ± 10 mm (maximum departure of face from a plane surface).
- Verticality: 3 mm departure from vertical.

Staking: Stake forms in position using at least 3 steel stakes per form, not more than 1.5 m apart. Lock joints between form sections to prevent movement.

Release agent: Before placing reinforcement, apply a release agent compatible with the contact surfaces, to the interior of the formwork, except where the concrete is to receive an applied finish for which there is no compatible release agent. Clean the reinforcement to remove all traces of release agent.

Re-use: Clean and recoat the forms each time before placing concrete.

Keyways: Form the keyways of keyed construction joints using steel form strips accurately located at the mid-depth of the slab and securely fastened flush against the formwork face.

Dowels and tie bars

Location: Across joints at the required spacings and vertical locations correctly aligned parallel to the finished pavement surface and perpendicular to the joint in plan. If the construction methods require alterations to the designed spacing, space closer with additional dowels or tie bars.

Placing in fixed-form paving: Use the bonded-in-place method. Embed the unpainted half of the dowels in the slab placed first. Placing in longitudinal joints in slip-form paving: Place using machine or vibrate into the plastic concrete using a suitable template.

Movement: Do not distort or displace beyond the alignment tolerances under testing or during construction. Do not remove and replace dowels in pre-formed holes.

Horizontal and vertical location: $\pm$ half the diameter of the dowel.

Alignment: Locate bars in the joint within 2 mm in 300 mm and adjacent bars which do not differ in alignment by more than 2 mm in 300 mm.

Unit Installation on pedestals

Install precast units to achieve levels and falls shown on the contract drawings.

Maintain equal joints between each unit in a particular block and match as closely as possible all joint widths across the site. Ensure outside edges of units create a continuous straight line along top and bottom edges.

Max deviation between adjacent units 3mm.

COMPLETION

Protection

Keep traffic, including construction plant, off the pavement entirely during curing, and thereafter permit access only to necessary construction plant vehicles that do not load the pavement to greater than its capacity.

Cleaning

Remove all cementitious residues from all visible faces.

Traffic on pavement

Give notice before opening the pavement to traffic before the work is completed. Provide adequate means of protection.

3.6 CONCRETE PRECAST PAVERS

3.6.1. GENERAL

Refer 3.1.2 Hold Points/ Shop Drawings/ Prototypes/ Samples/ Tests/ Submissions/ Inspection

INTERPRETATION

Definitions

For the purposes of this worksection the definitions given in the relevant standards and the following apply.

- Absolute level tolerance: Maximum deviation from design levels.
- Relative level tolerance: Maximum deviation from a 3 m straightedge laid on the surface.
- Joint:
 - Construction: A joint provided to suit construction sequence with reinforcement continuous across the joint.
 - Contraction: An unreinforced joint with a bond-breaking coating separating the concrete joint surfaces.
 - Expansion: An unreinforced joint with the joint surfaces separated by a compressible filler.
 - Weakened plane: 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.

TOLERANCES

General

Rigid pavement surface:

- Absolute tolerance: ± 10 mm.
- Relative tolerance: 5 mm.

3.6.2. PRODUCTS

CONCRETE MIX

Mix to be agreed upon sample.

3.6.3. EXECUTION

Unit Installation on pedestals

Install precast pavers on the most appropriate pedestals according to manufacturer specification. Installation method might change according to areas and heights relative to slab.

COMPLETION

Protection

Keep traffic, including construction plant, off the pavement entirely during curing, and thereafter permit access only to necessary construction plant vehicles that do not load the pavement to greater than its capacity.

Cleaning

Remove all cementitious residues from all visible faces.

Traffic on pavement

Give notice before opening the pavement to traffic before the work is completed. Provide adequate means of protection.

3.7 STONE PAVERS

3.7.1. GENERAL

Refer 3.1.2 Hold Points/ Shop Drawings/ Prototypes/ Samples/ Tests/ Submissions/ Inspection.

AIMS

Responsibilities

Provide stone pavers as follow:

- Consistent in colour and finish.
- Firmly bonded to substrates for the expected life of the installation.
- Resistant to expected impact in use.
- Set out with joints accurately aligned in both directions.
- To direct all water flowing from supply points to drainage outlets without leakage to the substrate or adjacent areas.

INTERPRETATIONS

Definitions

For the purposes of this worksection the definitions given below apply.

- Adhesives:
 - Cementitious (C): Adhesives in which the binders are hydraulic, e.g. Portland cement, with aggregates and organic additives.
- Substrates: The surfaces on which tiles are bedded.
- Bedding: Mixtures of materials which are applied to substrates in a plastic state and dry and cure to adhere tiles to substrates.
- Adhesive bedding: Paving adhered by adhesives.
- Mortar bedding: Paving adhered in a cementitious mortar bed.
- Pavers: Slabs made from clays, stone, precast concrete and/or other inorganic raw materials generally over 20 mm thick used as coverings for floors and supported over continuous substrates.
- Lippage: Height deviation between adjacent pavers.
- Stepping: The relative surface level of adjacent paving elements within the expanse of the main pavement.

TESTS

General

Type tests: Submit as follows:

- Slip resistance to AS 4586 for all new pavements

Field test of completed pavement: Slip resistance to AS/NZS 4663.

TOLERANCES

Completed paving to conform to the surface level tolerances table below:

Property	Tolerance criteria
Alignment: Deviation of the finished paving from a 3 m straight edge laid against any joints	< 3 mm
Flatness: Deviation of any plane surface under a 3 m straight edge laid in any direction on an area of uniform grade	< 3 mm
Lippage: Unpolished pavers Polished pavers 300 x 300 mm or less Polished pavers over 300 x 300 mm	< 2 mm < 1 mm, with 5% not exceeding 1.5% < 1.5 mm, with 5% not exceeding 2%

3.7.2. PRODUCTS

Refer 0

Types + Subtypes Table and Landscape Architects details for stone types, dimensions, colours and finishes.

GRANITE PAVERS ADHESIVES

Type

Provide adhesives that are compatible with the materials and surfaces to be adhered. Prohibited uses: Do not provide the following combinations:

- Cement-based adhesives on wood, metal, painted or glazed surfaces, gypsum-based plaster.
- Organic solvent-based adhesives on painted surfaces.
- Organic PVC-based adhesives and organic natural rubber latex adhesives in damp or wet conditions.
- PVA (polyvinyl acetate) based adhesives in wet areas or externally.

MORTAR

Materials

Cement type: GP to relevant standards.

- White cement: Iron salts content $\leq$ 1%.
- Off-white cement: Iron salts content $\leq$ 2.5%.

Sand: Fine aggregate with a low clay content selected for grading, sharp and free from efflorescing salts.

Measurement of volume: Measure binders and sand by volume using buckets or boxes. Do not allow sand to bulk by absorption of water.

Bedding mortar

Proportioning: Select proportions from the range 1 cement:3 sand – 1 cement:4 sand: to obtain satisfactory adhesion. Provide minimum water.

Alternatively: Site gauged. Site gauged mixes are preferred by experienced tradesmen as it gives them the opportunity to make adjustments for moisture content.

Water

To be clean and free from any deleterious matter.

GROUT

Type

Cement based proprietary non-shrunk grout: Mix with water. Fine sand may be added as filler in wider joints. Portland cement based grout: Mix with fine sand. Provide minimum water consistent with workability.

- For joints < 3 mm: 1 cement: 2 sand.
- For joints ≥ 3 mm: 1 cement: 3 sand.

Pigments

Pigments for coloured grout: Provide colourfast fillers compatible with the grout material. For cement-based grouts, provide lime-proof natural or synthetic metallic oxides compatible with cement.

MOVEMENT JOINTS

Movement joint materials

Movement joint strip: A proprietary expansion joint consisting of neoprene filler sandwiched between plates with lugs or ribs for mechanical keying. Set flush with the finished surface.

Proprietary slide plate divider strip: An arrangement of interlocking metal plates grouted into pockets formed in the concrete joint edges. Sealant: One-part self-leveling non-hardening mould resistant, silicone or polyurethane sealant applied over a backing rod. Finish flush. Backing rod: Compressible closed cell polyethylene foam with a bond-breaking surface.

3.7.3. EXECUTION SUBSTRATES

Drying and shrinkage

Before tiling, allow at least the following times to elapse (for initial drying out and shrinkage) for these substrates:

- Concrete slabs: 42 days.
- Concrete blockwork: 28 days.
- Toppings on slabs and rendering on brick or blockwork: A further 21 days.

PREPARATION

Trial set-out

Prepare a trial tile setout to each area as follows to:

- Maximise the size of equal margins of cut tiles.
- Locate movement joints.
- Note minor variations in joint widths to eliminate cut tiles at margins.
- Walls noting accommodation of fittings

Ambient temperature

It the ambient temperature is < 5 or $> 35^{\circ}\text{C}$, do not lay tiles.

Substrates without wet area membranes

Ensure substrates are as follows:

- Clean and free of any deposit or finish which may impair adhesion or location of tiles.
- If framed or discontinuous, support members are in full lengths without splicing.
- If solid or continuous:
 - Excessive projections are removed.
 - Voids and hollows > 10 mm with abrupt edges are filled with a cement: sand mix not stronger than the substrate nor weaker than the bedding.
 - Depressions < 10 mm are filled with a latex modified cementations product with feathering eliminated by scrabbling the edges.

Absorbent substrates: If suction is excessive, control it by dampening but avoid over-wetting and do not apply mortar bedding to substrates showing surface moisture.

Dense concrete: If not sufficiently rough to provide a mechanical key, roughen by scrabbling or the like to remove 3 mm of the surface and expose the aggregate; then apply a bonding treatment.

Substrates with wet area membranes

Ensure substrates are as follows:

- Clean and free of any deposit or finish which may impair adhesion or location of tiles.
- Compatible with all components of the floor system.

TILES

Cutting and laying

Cut tiles neatly to fit around fixtures and fittings, and at margins where necessary. Rub edges smooth without chipping.

Laying: Return tiles into sills, reveals and openings. Butt up to returns, frames, fittings, and other finishes. Strike and point up beds where exposed. Remove tile spacers before grouting.

Variations

If necessary, distribute variations in hue, colour, or pattern uniformly, by mixing tiles or tile batches before laying.

Protection

Floor tiles: Keep traffic off floor tiles until the bedding has set and attained its working strength.

Cleaning: Keep the work clean as it proceeds and protect finished work from damage.

SETTING OUT

General

Joint widths: Set out tiles to give uniform joint widths as shown on drawings. If not indicated set joints out as follows:

- Floors:
 - Stone tiles □ 400 x 400 mm and with sawn edges: 3 mm.
 - Stone tiles □ 400 x 400 mm and all tiles with irregular edges: 6 mm or less than 12 mm.
 - Stone tiles: 1.5 mm or less than 4.5 mm.

Margins

Provide whole or purpose-made tiles at margins where practicable, otherwise set out to give equal margins of cut tiles. If margins less than half tile width are unavoidable, locate the cut tiles where they are least conspicuous.

Fixtures

If possible position tiles so that holes for fixtures and other penetrations occur at the intersection of horizontal and vertical joints or on the centre lines of tiles. Continue tiling fully behind fixtures which are not built in to the tiling surface. Before tiling ensure that fixtures interrupting the tile surfaces are accurately positioned in their designed or optimum locations relative to the tile layout.

FALLS AND LEVELS

General

Grade floor tiling as shown on drawings. If not indicated, grade tiles to even and correct falls to floor wastes and elsewhere as required. Make level junctions with walls. Where falls are not required lay level.

Fall, general: 1:100 minimums.

Change of finish: Maintain finished floor level across changes of floor finish including carpet.

BEDDING

Preparation of tiles

Adhesive bedding: Fix tiles dry; do not soak.

Mortar bedding: Soak porous tiles in water for half an hour and then drain until the surface water has disappeared.

Bedding

Use bedding methods and materials which are appropriate to the tile, the substrate, the conditions of service, and which leave the tile firmly and solidly bedded in the bedding material and adhered to the substrate. Form falls integral with the substrate.

Thin adhesive beds

Provide only if the substrate deviation is less than 3 mm when tested with a 2 m straight edge. Cover the entire tile back with adhesive when the tile is bedded.

Thickness: 1.5 – 3 mm.

Thick adhesive beds

Provide on substrates with deviations up to 6 mm when tested with a 2 m straight edge, and with tiles having deep keys or frogs. Nominal thickness: 6 mm.

Adhesive bedding application

Apply adhesive by notched trowel to walls and floors and direct to tiles if required, to provide evenly distributed coverage after laying as follows:

- Other wall and floors: > 90%.

Pattern of distribution of adhesive as illustrated by relevant standards. Verify by examining one tile in ten as work proceeds. Wall tile spacers: Do not use spacer types that inhibit the distribution of adhesive.

Allow the adhesive to cure for the period nominated by the manufacturer prior to grouting or allowing foot traffic.

Mortar beds

For floor tiles: Either lightly dust the screeded bed surface with dry cement and trowel level until the cement is damp, or spread a thin slurry of neat cement, or cement-based thin bed adhesive, on to the tile back. Do not provide mortar after initial set has occurred.

— Nominal thickness: 20 – 40 mm.

Thick reinforced beds: Place mortar bed in two layers, and incorporate the mesh reinforcement in the first layer.

MOVEMENT JOINTS

General

Provide movement joints as shown in drawings and as follows:

- Location:
 - Over structural (isolation, contraction, expansion) joints.
 - To divide complex room plans into rectangles.
 - Around the perimeter of the floor.
 - At junctions between different substrates.
 - At abutments with the building structural frame and over supporting walls or beams where flexing of the substrate is anticipated.
- Depth of joint: Right through to the substrate.
- Sealant width: 6 – 25 mm.
- Depth of elastomeric sealant: One half the joint width, or 6 mm, whichever is the greater.

Movement joint materials

Divider strip: A proprietary expansion joint consisting of a neoprene filler sandwiched between plates with lugs or ribs for mechanical keying. Set flush with the finished surface.

Proprietary slide plate divider strip: An arrangement of interlocking metal plates grouted into pockets formed in the concrete joint edges. Sealant: Two-pack self-leveling non-hardening mould resistant, one-part silicone or polyurethane sealant applied over a backing rod.

Finish flush with the tile surface.

— Floors: Trafficable, shore hardness > 35.

Backing rod: Compressible closed cell polyethylene foam with a bond-breaking surface.

GROUTED JOINTS

Commence grouting as soon as practicable after bedding has set. Clean out joints as necessary before grouting.

Face grouting: Fill the joints solid and tool flush. Clean off surplus grout. Wash down when the grout has set. When grout is dry, polish the surface with a clean cloth.

Edges of tiles: Grout exposed edge joints.

Epoxy grouted joints: Ensure that tile edge surfaces are free of extraneous matter such as cement films or wax, before grouting. Grouting cementations terrazzo tiles: Thoroughly work grout into tile joints by flood grouting.

JOINT ACCESSORIES

Adjustments

If the floor finish divider was installed by the wet area waterproof membrane applicator check that the height is sufficient for the topping and tile thickness. Adjust as required with a matching flat bar adhesive fixed to the divider angle.

COMPLETION

Spare tiles

Supply spare matching tiles and accessories of each type for future replacement purposes.

Store the spare materials on site. Quantity: At least 1% of the quantity installed.

Storage location: to be advised.

Cleaning

Clean tiled surfaces using an appropriate tile cleaning agent, and polish.

1 IVANHOE PLACE, MACQUARIE PARK NSW 2113

Operation and maintenance manuals

Submit a manual describing care and maintenance of the tiling, including procedures for maintaining the slip-resistance grading stating the expected life of the slip-resistance grad.

4.0 RAILS & BALUSTRADES

4.1 GENERAL

4.1.1. AIMS + SCOPE

STANDARDS AND AUTHORITY REQUIREMENTS

The contractor shall at all times observe recognised good practice and carry out all works in accordance with applicable standards, laws, ordinances and regulations required by authorities having jurisdiction over such work. Provide all inspections and permits required by Federal, State and Local Governments and Authorities in furnishing, transporting and installing materials. All materials and components used in the works shall meet all relevant standards.

GENERAL

Provide fences and barrier systems:

- Suitable for their function.
- In conformance with the drawings and details.

CROSS REFERENCES

Conform to the 0.3 Quality Requirements and 0.4 General Material Requirements.

Associated worksections

- 1.0 Preparation, Groundworks + Drainage
- 2.0 Walls + Edges
- 3.0 Pavements
- 4.0 Site Structures
- 7.0 Furniture, Fittings + Lighting
- to be read in conjunction with ARCHITECTS, STRUCTURAL ENG. and CIVIL ENG. details and specification

4.1.2. HOLD POINTS/ SHOP DRAWINGS/ PROTOTYPES/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTION

HOLD POINTS

Hold Points shall apply to the Contractor as required for the various elements of works listed below. Notification: 3 working days of Hold [H] Points required.

HOLD POINTS SCHEDULE	
Description	Comment
Set-out of rails prior to commencement	LANDSCAPE ARCHITECT to inspect and approve
Shop drawings submitted for approval	LANDSCAPE ARCHITECT to review and approve

SHOP DRAWINGS

Shop drawings shall be supplied by the Contractor as required below for approval. No work covered by the shop drawings should be commenced prior to review and formal written acceptance of the drawings by the LANDSCAPE ARCHITECT.

SHOP DRAWINGS SCHEDULE	
Description	Comment
Provide shop drawings for the following: Gate structure. Drop bolt and ferrule to each leaf of double gates. Latch to one leaf of double gates. Provision for locking by padlock. Hinges to ensure smooth operation.	Submit shop detail drawings certified by a professional engineer stating that the design has been carried out in accordance with documented project and AS/NZS 4600 requirements for the configurations and loadings

PROTOTYPES/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS

Prototypes/ Samples/ Tests/ Submissions/ Inspections shall be produced for the following works or materials:

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
General			
Inspections	Setout prior to construction. Footings prior to pouring concrete.	Inspection	Give not less than 48 hours notice so that inspection may be made.
Prototypes	Prototype of each balustrade and handrail type including fixings. Balustrade/Handrails to be fixed to documented materials.	Prototype	To be approved prior to manufacture
Samples	Sample of each documented steel type with documented finish.	Sample	Submit for approval before placing order or manufacture
Inspections	Setout prior to installation.	Inspection	Give not less than 48 hours notice so that inspection may be made.
Paint Coatings			
Painting and coating colour	Provide up to 10no. samples of the selected paint coating applied to the documented material for each different coating system.	Sample	400x400mm sample panel of documented material
Tests	Abrasive blast cleaning; Power tool cleaning; Hand tool cleaning; Surface profile; Chloride level testing; Wet film thickness; Dry film thickness; Slip resistance classification of new pedestrian surface materials.	Test	All tests to relevant standards
ITPs [Inspection and Test Plan]	Details for each proposed coating system. Name and experience record of the quality supervisor nominated to oversee the implementation of the ITPs.	Submission	
Removal of deleterious materials	Details on suitability of marking paints and removal of materials deleterious to coating processes.	Submission	

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
Repair of coating damage	Proposal for repairing the coating. Proposal for reinstatement of the visible final coating.	Submission	Submit proposal if the protective coating is damaged
Warranties	Warranties for the period to the first schedule maintenance.	Submission	
Inspections	Items after fabrication prior to commencing surface cleaning and preparation. Surfaces after preparation prior to application of first coating. Coating stages (after application of primer or seal coats and each subsequent coat.	Inspection	Give not less than 48 hours notice so that inspection may be made.
Hot Dip Galvanized Coatings			
Tests	Coating mass test, Magnetic method; Coating thickness tests; Sampling plan.	Test	All tests to relevant standards
Holes and lifting lugs	Details on size and location of holes and lifting lugs proposed to facilitate handling, filling, venting and draining during galvanizing.	Submission	
Inspections	Coating integrity at the galvanizing plant.	Inspection	
Adhesives, Sealants and Fasteners			
Adhesives	Sample of each type of adhesive proposed.	Sample	
Fasteners	Samples of each type of fastener proposed.	Sample	2no. of each type of fastener

Other items may also be required as outlined in this specification.

4.1.3. TYPES + SUBTYPES TABLE

— Type	— Description	— Subtype	— Description
Handrail Type			
RA01	Steel Handrail	Steel	Stainless Steel 316
		Finish	Powdercoat – Dulux Metropolis Bronze Pearl
RA02			Refer to Architectural Specification & Details

— Type	— Description	— Subtype	— Description
Balustrade Type			
BAL-01	Steel Balustrade to Street	Balustrade	Rhino-Stop® Elite – Type-1 Pedestrian Fence Baseplate Post
		Finish	Powdercoat - DULUX METROPOLIS BRONZE PEARL
BAL-02	Steel Balustrade at Upper Ground Level	Balustrade	Refer to Architectural Specification & Details

For location refer to LANDSCAPE ARCHITECTS Materials and Levels Plan and details.
All fixing dimensions and details to be confirmed by STRUCTURAL ENG.

4.1.4. PERFORMANCE

Set-out to be located on construction site through GPS coordinates. CAD file to be provided by Landscape Architect. Site boundaries to be confirmed by contractor and surveyor.

4.2 STEEL

4.2.1. GENERAL

Refer 4.1.2 Hold Points/ Shop Drawings/ Prototypes/ Samples/ Tests/ Submissions/ Inspection.

STANDARD

Conform to all relevant Australian Standards

5.0 FURNITURE, FITTINGS + LIGHTING

5.1 GENERAL

5.1.1. AIMS + SCOPE

STANDARDS AND AUTHORITY REQUIREMENTS

The contractor shall at all times observe recognised good practice and carry out all works in accordance with applicable standards, laws, ordinances and regulations required by authorities having jurisdiction over such work. Provide all inspections and permits required by Federal, State and Local Governments and Authorities in furnishing, transporting and installing materials. All materials and components used in the works shall meet all relevant standards.

CROSS REFERENCES

Conform to the 0.3 Quality Requirements and 0.4 General Material Requirements.

Perform all work in accordance with all applicable laws, ordinances and regulations required by authorities having jurisdiction over such work and provide all inspections and permits required by Federal, State and Local Governments and Authorities in furnishing, transporting and installing materials.

Associated worksections

Conform to the following: [complete/delete] add cross-reference

- 1.00 Preparation, Groundworks + Drainage
- 2.0 Walls + Edges
- 3.0 Pavements
- 4.0 Site Structures
- 5.0 Rails + Fencing
- 6.0 Water Elements
- 8.0 Planting
- to be read in conjunction with ARCHITECTS, STRUCTURAL ENG. and CIVIL ENG. details and specification

5.1.2. HOLD POINTS/ SHOP DRAWINGS/ PROTOTYPES/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTION

HOLD POINTS

Hold Points shall apply to the Contractor as required for the various elements of works listed below. Notification: 3 working days of Hold [H] Points required.

SHOP DRAWINGS

Shop drawings shall be supplied by the Contractor as required below for approval. No work covered by the shop drawings should be commenced prior to review and formal written acceptance of the drawings by the LANDSCAPE ARCHITECT.

HOLD POINTS SCHEDULE	
Description	Comment
Completion of formwork samples submitted prior to in situ concrete install.	
Shop drawings of all precast concrete elements submitted for approval.	LANDSCAPE ARCHITECT & STRUCTURAL ENG to approve.
Precast concrete moulds fabricated and ready for concrete pour.	LANDSCAPE ARCHITECT & STRUCTURAL ENG to inspect and approve.
Precast concrete prototype/s ready for inspection.	LANDSCAPE ARCHITECT & STRUCTURAL ENG to inspect and approve.
Preparation of metal work complete and ready for coatings.	LANDSCAPE ARCHITECT to inspect and approve.

Description	Comment
Lighting location set out	LANDSCAPE ARCHITECT& LIGHTING DESIGNER to inspect and approve

SHOP DRAWINGS SCHEDULE	
Description	Comment
Bespoke custom built furniture	Submit for approval prior to fabrication or manufacture Refer 7.3.1 for full list of items to be included on shop drawings.
Signage and Display	Submit shop drawings showing the following information where relevant: Layout, construction and fixing details for custom designed (non standard) sign systems. Large scale (full size if practicable) lettering layouts for individual letter signs. Computer generated graphic images. Full size spacing templates for individually mounted characters. Location template drawings for anchorages to permanent construction. Show type of anchorage. Wiring diagrams for illuminated signs.
Lighting	Submit electrical design shop drawings certified by an electrical engineer at an appropriate scale. Submit one paper and one digital copy (dwg format on disk) of the drawings. Refer 7.5.2 <i>Lighting Products</i> for complete list of items to be included on shop drawings.

PROTOTYPES/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS

Prototypes/ Samples/ Tests/ Submissions/ Inspections shall be produced for the following works or materials:

Notice: [complete/delete] and cross-reference

Other items may also be required as outlined in this specification.

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
Proprietary Furniture			
Samples	Sample of each proprietary furniture element or fixing item for approval prior to installation.	Sample	
Maintenance manual	Manufacturer's data including recommendations for service use, care and maintenance and a list of manufacturers and suppliers of replacement parts.	Submission	

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
Product data	Manufacturers product data for all proprietary items.	Submission	
Warranties	Manufacturer's warranties for all proprietary items.	Submission	
Subcontractors	Names and contact details of proposed suppliers and installers.	Submission	
Operation manuals for installations	Operation manuals for installations containing certificates, directories, drawings, descriptions, procedures, records.	Submission	Submit a draft copy then 3 final copies within 2 weeks after practical completion
Manufacturers drawings	Submit manufacturer's standard drawings and details showing methods of construction, assembly and installation; with dimensions and tolerances.	Submission	
Record drawings	Record drawings showing 'as installed' locations of elements and equipment.	Submission	Submit within 2 weeks after practical completion
CCA Treated Timber	If proposed to be used submit details.	Submission	
Inspections	Furniture items delivered to site before installation. Site locations or substrates prepared to receive furniture or fixtures before installation. Excavation of footings. Installation of furniture.	Inspection	Give not less than 48 hours notice so that inspection may be made.
Bespoke Furniture			
Custom built furniture	Prototype of each custom built furniture element or fixing item for approval prior to fabrication or manufacture.	Prototype	
Painting and coating colour	Provide up to 10no. samples of the selected paint coating applied to the documented material for each different coating system.	Sample	400x400mm sample panel of documented material
Tests	Stainless steel: Before fabrication commences, submit satisfactory evidence that relevant procedure test plates have passed the tests specified in relevant structural steel welding standards.	Test/ Submission	

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
Inspections	Shop fabricated or assembled items ready for delivery to the site. Custom built fixtures fabricated and ready to be delivered to the site. Commencement of shop or site welding. Site erected assemblies on completion of erection, before covering up by cladding and encasing. Site locations or substrates prepared to receive furniture or fixtures before installation. Excavation of footings. Completion of prototype. Surfaces prepared for, and immediately before, site applied finishes. Installation of furniture.	Inspection	Give not less than 48 hours notice so that inspection may be made.
Signage and Display			
Samples	Submit samples showing each colour and finish of exposed graphics materials and accessories.	Submission	If there is a range of colours and/or textures for a particular item, submit samples showing the extremes and mean of the range.
Inspections	Custom-built graphics items fabricated and ready to be delivered to the site. Graphics items delivered to site before installation. Building locations or substrates prepared to receive graphics items before they are installed.	Inspection	Give not less than 48 hours notice so that inspection may be made.
Lighting			
Samples	Submit one sample of each item listed in <i>7.5.2 Lighting Products</i> for approval within four weeks of contract execution allowing for lead times for product ordering. Notify the superintendent within 4 weeks of contract execution of any difficulties in obtaining specified items.	Submission	Refer sample item list in <i>7.5.2 Lighting Products</i> .

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
Certification	Submit a supplier's certificate (which may be included on an invoice or delivery docket) verifying that each product complies with the specification. Submit any relevant authority's certificate verifying that completed work under this subsection complies with Australian authority regulations.	Submission	
Inspections	Penetrations and set downs to take lights. Installation of cabling in trenches prior to backfilling.	Inspection	Give not less than 48 hours notice so that inspection may be made.
	Final positioning of tree mounted lights and proposed cable fixings on		

5.1.3. TYPES + MATERIALS TABLE

— Type	— Description	— Subtype	— Description
Furniture Type			
FU01	Bench Seat 01	Product	Mall Bench (CMM4)
		Material	Eco-certified hardwood battens, Precious Silver frame, Splay leg
		Supplier	https://streetfurniture.com
FU02	Bench Seat 02	Product	Concrete Sitting Platform
		Dimensions	1400mm diameter x 450mm height
		Finish	Exposed Aggregate
		Supplier	https://www.evolutionprecast.com.au
FU03	Bin Enclosure	Product	STREET FURN AUS – 80L Moonsoon Bin LB8
		Finish	Jarah Hardwood
		Colour	Dark Bronze 'Gy30BA'
		Finish	Powdercoat - DULUX METROPOLIS BRONZE PEARL
		Supplier	https://streetfurniture.com

— Type	— Description	— Subtype	— Description
FU04	Bicycle Stand	Product	Linea Bicycle Stand BST07 with batten insert
		Material	Aluminium Curly Birch batten insert
		Colour	Pale Eucalypt Green frames
		Dimensions	75W x 760H x 600L
		Fixing	Subsurface fixed
		Supplier	https://streetfurniture.com
FU05	Play Towers		REFER TILT
FU06	Drinking Fountain	Product	City of Sydney Bubbler
		Finish	Powdercoat Dulux Bronze
		Supplier	https://abud.com.au/
FU07	Softfall Sculptures		REFER TILT

Lighting Type			
Strip Lighting	LED Strip light to be Recessed into Concrete Capping		REFER TO LIGHTING ENGINEER

For location refer to LANDSCAPE ARCHITECTS Materials and Levels Plan.
For further information refer to LIGHTING ENGINEER Specification and Details.

5.2 PROPRIETARY FURNITURE

5.2.1. GENERAL

Refer 5.1.2 Hold Points/ Shop Drawings/ Prototypes/ Samples/ Tests/ Submissions/ Inspection

5.2.2. PRODUCTS

PROPRIETARY FURNITURE AND FITTINGS

This is to include all proprietary furniture items and fittings as detailed on the drawings. Include extra 5% or single item (which ever is greater) when ordering proprietary furniture items to replace items damaged during transport and installation. These can be returned at the Contractors expense if unused at completion of the project.

5.2.3. EXECUTION

Installation

Work included: Supply and installation of all furniture items and fixtures in accordance with this specification, the Contract drawings and Superintendent's instructions. This work is to include all external furniture.

Erection

Line and level: Install furniture items horizontal/vertical or as detailed on the drawings to manufacturers specification.. Erect furniture items level. Provide a level area around benches and seats where installed on slopes. Refer to engineers drawings for footing sizes.

Completion Requirement

On completion of installation, damaged items are to be replaced and all furniture surfaces are to be cleaned to manufacturers specification.

Maintenance manual

Submit the manufacturers' data as follows:

- Recommendations for service use, care and maintenance.
- List of manufacturers and suppliers of replacement parts.

Warranties

Provide manufacturers warranties for all proprietary items.

5.3 BESPOKE FURNITURE

5.3.1. GENERAL

Refer 5.1.2 Hold Points/ Shop Drawings/ Prototypes/ Samples/ Tests/ Submissions/ Inspection

SUBMISSIONS

Shop drawings

Submit shop drawings to a scale not smaller than 1:50, showing:

- Overall dimensions.
- Materials, thicknesses and finishes of elements including doors, divisions, shelves and benches.
- Type of construction including mitre joints and junctions of members.
- Temporary bracing, if required.
- Details of fabrication and components.
- Details of fabrication involving other trades or components.
- Procedures for shop and site assembly and fixing.
- Locations of benchtop joints.
- Locations of sanitary fixtures, stoves, ovens, sinks, and other items to be installed in the units.
- Relationship of fixture to adjacent building elements.
- Proposals for the break-up of large items as required for delivery to the site.
- Proposed method of joining the modules of large items.
- This is to include custom built items and fittings as detailed in the drawings.

5.3.2. PRODUCTS

METAL MATERIALS AND COMPONENTS

Performance: Provide metals suited to their required function, finish and method of fabrication, in sections of strength and stiffness adequate for their purpose.

METALWORK CONSTRUCTION GENERALLY

Metals

Performance: Provide metals so that they transmit the loads imposed and ensure the rigidity of the assembly without causing deflection or distortion of finished surfaces.

Incompatible metals: Separate using concealed layers of suitable materials in appropriate thicknesses.

Fasteners

Performance: Provide non-galvanic corrosion fasteners.

Materials: Provide fasteners in materials of mechanical strength and corrosion resistance at least equal to that of the lowest resistant metal joined.

To aluminium and aluminium alloys: Provide aluminium alloy or non-magnetic stainless steel fixing devices only.

To stainless steel: Provide appropriate stainless steel materials only.

Fabrication

Workshop: Fabricate and pre-assemble items in the workshop wherever practicable.

Edges and surfaces: Keep clean, neat and free from burrs and indentations. Remove sharp edges without excessive radiusing. Tube bends: Form bends in tube without visibly deforming the cross section.

Colour finished work: Match colours of sheets, extrusions and heads of fasteners. Thermal movement: Accommodate thermal movement in joints and fastenings.

Fabrication tolerances

Structural work generally: max. 2 mm from design dimensions.

Joints

Fit joints to an accuracy appropriate to the class of work. Finish visible joints made by welding, brazing or soldering using grinding, buffing or other methods appropriate to the class of work, before further treatment.

Self-finished metals: Free of surface colour variations, after jointing. Joints: Fit accurately to a fine hairline.

Marking

Provide suitable and sufficient marks or other means for identifying each member of site-erected assemblies, and for their correct setting out, location, erection and connection. Mark bolted connections to show the bolting category. Do not mark stainless steel by notching.

Splicing

Provide structural members in single lengths.

WELDING AND BRAZING

General

Quality: Provide finished welds which are free of surface and internal cracks, slag inclusion, and porosity.

Site welds: Avoid site welding wherever possible. If required locate site welds in positions for down hand welding. Butt weld quality level: Not inferior to the appropriate level recommended in AS 1665 Appendix A.

Welding

Submit details of proposed welding procedures before fabrication. Welding dissimilar metals:

Submit the following details:

- Type and thickness of materials to be welded.
- Proposed joint preparation and welding procedures.
- Proposed filler metal.
- Expected dilution (proportion of fused parent metal in the weld metal).

Fastenings to aluminium (including aluminium alloys): Stainless steel or aluminium.

Brazing

Ensure brazed joints have sufficient lap to provide a mechanically sound joint. Do not use butt joints relying on the filler metal fillet only. Filler metal: [complete/delete]

STAINLESS STEEL FABRICATION

Riveting

Riveting may be used only to join stainless steel sheet or strip less than 1 mm thick. Drill (not punch) the rivet hole, and drive the rivet cold. On completion, clean and passivate the riveted assembly.

Soldering

Do not solder stainless steel.

DELIVERY AND STORAGE

General

Deliver units to site in unbroken wrapping or containers and store so that its moisture content is not adversely affected. Do not store in areas of wet plaster. Keep storage to a minimum by delivering items only when required for installation.

Back prime surfaces concealed by backgrounds. Examine units for completeness and remedy deficiencies.

Acclimatisation

Acclimatise items by stacking it in the in-service conditions with air circulation to all surfaces after the following construction operations are complete:

- Airconditioning operational.
- Lighting operational.
- Site drainage and stormwater works are complete.
- Space fully enclosed and secure.
- Wet work complete and dry.

Background

Damp clean and vacuum background surfaces that will be permanently concealed.

COMPLETION

Maintenance manual

Submit manufacturer's published recommendations for service use.

Cleaning

Temporary coatings: On or before completion of the works, or before joining up to other surfaces, remove all traces of temporary coatings used as a means of protection.

General: Remove all dust, marks and rubbish from all surfaces and internal spaces. Clean and polish all self finished surfaces such as anodised and powdercoated metals, sanitaryware, glass, tiles and laminates.

5.4 SIGNAGE AND DISPLAY

5.4.1. GENERAL

Refer 5.1.2 Hold Points/ Shop Drawings/ Prototypes/ Samples/ Tests/ Submissions/ Inspection.

AIMS

Responsibilities

Allow for signage to be developed at next stage.

5.4.2. EXECUTION WORKMANSHIP

Production

Form graphics items accurately with clean, well defined edges or arises, free from blemishes.

Engraving to two layer plastic laminate: Lettering excavated to expose the lower laminate.

Engraved and filled: Lettering precision excavated and filled colouring material. Clean faces of all filling material. Casting: Produce shapes free of pits, scale, blow holes or other defects, hand or machine finished if necessary. Laser cut: Individual vinyl letters with self adhesive backing.

Printed lettering: Lettering and graphic images screen / digitally printed on:

- Film with self adhesive backing.
- Acrylic sheet.
- Aluminium plate.
- Stainless steel plate.

Large format digital printing: Lettering and graphic images screen printed film with self adhesive backing.

Signwriting: Lettering and graphic images hand painted direct to the background by a tradesman with recognised qualifications and demonstrated experience.

Fabricated: Three dimensional, formed as follows:

- Laser cutting from solid material and hand finished as necessary.
- Moulding: Individual plastic hollow three dimensional characters and shapes formed by:
 - Injection moulding.
 - Vacuum forming.
- Built-up individual shapes by fabricating the faces and edges from separate pieces neatly and securely joined.

Installation

Install signage level and plumb, securely mounted, with concealed theft-resistant fixings. Fix self adhesive signs free of bubbles and creases.

5.5 LIGHTING

5.5.1. GENERAL

Refer 5.1.2 Hold Points/ Shop Drawings/ Prototypes/ Samples/ Tests/ Submissions/ Inspections

Responsibilities

Allow for lighting to be further developed coordinated at next stage.

Perform all work in accordance with all applicable laws, ordinances and regulations required by authorities having jurisdiction over such work and provide all inspections and permits required by Federal, State and Local Governments and Authorities in furnishing, transporting and installing materials.

SCOPE

Works included: Provision of electrical and lighting works in accordance with this specification, the Contract drawings and Superintendent's instructions. This is to include materials and work to supply and install 240V and low voltage electrical, cabling, conduiting, connections, transformers, lights and weatherproof power outlets.

5.5.2. PRODUCTS CONTRACTOR'S SUBMISSION

Materials

Submit one sample of each of the following for approval within four weeks of contract execution allowing for lead times for product ordering. Notify the superintendent within 4 weeks of contract execution of any difficulties in obtaining specified items.

Design intent

Provide electrical design to provide optimal lamp beam output and photometrics as recommended by the lighting manufacturers for each of the lights and lamps specified. The design shall prevent voltage drop to lights and shall utilise correct distances and wattages for either drop cable or trunk and drop cable combination installations as recommended by the lighting manufacturers. Transformer locations shall not be directly accessible from public pathways. GPO outlets shall be concealed from view and shall be lockable.

Shop Drawings

Submit electrical design shop drawings certified by an electrical engineer at an appropriate scale. Submit one paper and one digital copy (dwg format on disk) of the drawings.

Shop Drawings shall locate the following for approval by the superintendent:

- type, location and arrangement of transformers.
- type and location of power boards, dimmers and switches.
- type, location and arrangement of lights - refer drawing
- type, location and arrangement of trenches for cables and wiring - refer detail
- location and arrangement of concealed cables and wires

5.5.3. EXECUTION

LIGHTING SITE ADJUSTMENTS

Practical Completion

At practical completion the Contractor shall meet with the superintendent, or their representative, at night to make final site adjustments to the direction of light fixtures.

6.0 PLANTING

6.1 GENERAL

6.1.1. AIMS + SCOPE

STANDARDS AND AUTHORITY REQUIREMENTS

The contractor shall at all times observe recognised good practice and carry out all works in accordance with applicable standards, laws, ordinances and regulations required by authorities having jurisdiction over such work. Provide all inspections and permits required by Federal, State and Local Governments and Authorities in furnishing, transporting and installing materials. All materials and components used in the works shall meet all relevant standards.

RESPONSIBILITIES

[complete/delete]

All plants will be supplied by the Principal and delivered to site. The installation contractor shall inspect these plants on the delivery vehicle and advise the PAP immediately of any stock in poor condition. Once the plants are off loaded from the truck onto the site, the plants become the novated responsibility of the installation contractor. The installation contractor warrants that all plants will be in a healthy condition at the completion of the maintenance period.

CROSS REFERENCES

- Perform all work in accordance with all applicable laws, ordinances and regulations required by authorities having jurisdiction over such work and provide all inspections and permits required by Federal, State and Local Governments and Authorities in furnishing, transporting and installing materials.

Associated worksections

Conform to the following: [complete/delete] add cross-reference

- 1.0 Preparation, Groundworks + Drainage
- 2.0 Walls + Edges
- 3.0 Pavements
- 4.0 Rails + Balustrades
- 5.0 Furniture + Fitting
- 7.0 Irrigation
- to be read in conjunction with ARCHITECTS, STRUCTURAL ENG. and CIVIL ENG. details and specification

6.1.2. HOLD POINTS/ SHOP DRAWINGS/ PROTOTYPES/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTION

HOLD POINTS

Hold Points shall apply to the Contractor as required for the various elements of works listed below. Notification: 3 working days of Hold [H] Points required.

HOLD POINTS SCHEDULE	
Description	Release of Hold Point
Pregrown <i>Ficus pumila</i> contractor selected and Methodology and Inspection Schedule submitted	LANDSCAPE ARCHITECT & CITY'S REPRESENTATIVE to review and approve.
Plant materials being grown for this contract inspected prior to site delivery.	LANDSCAPE ARCHITECT & CITY'S REPRESENTATIVE to inspect and approve. Plants shall be clearly visible and delineated. Plants shall be available for viewing at all times during normal working hours.
Plant materials inspected for compliance with contract documents.	LANDSCAPE ARCHITECT to inspect and approve. Non-conforming plant materials shall be removed promptly from site by and at the expense of the contractor.

Description	Release of Hold Point
Plant materials delivered to site for inclusion in the works	LANDSCAPE ARCHITECT to inspect and approve. Acceptance during course of works required for issue of Practical Completion and Final Completion Certificates.
Plant set-out prior to planting	LANDSCAPE ARCHITECT to inspect and approve. Acceptance during course of works required for issue of Practical Completion and Final Completion Certificates.
Planting, staking and tying completed	LANDSCAPE ARCHITECT to inspect and approve. Acceptance during course of works required for issue of Practical Completion and Final Completion Certificates.
Grassing or turfing completed	LANDSCAPE ARCHITECT to inspect and approve.
Completion of plant establishment work	LANDSCAPE ARCHITECT & CITY'S REPRESENTATIVE to inspect and approve.

SHOP DRAWINGS

Shop drawings shall be supplied by the Contractor as required below for approval. No work covered by the shop drawings should be commenced prior to review and formal written acceptance of the drawings by the LANDSCAPE ARCHITECT

SHOP DRAWINGS SCHEDULE	
Description	Comment
Not required	

PROTOTYPES/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS

Prototypes/ Samples/ Tests/ Submissions/ Inspections shall be produced for the following works or materials: Other items may also be required as outlined in this specification.

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
Sample plants	Sample plants selected at random from each group of like species, cultivar and size.	Sample/ Inspection	Sample number up to one [1] percent of the total for each group. Minimum sample number is one [1] per group.
External Inspection of Trees	Inspect trees before shipment– refer 8.2.1 External Inspection Sampling Table for details.	Inspection	Give not less than 48 hours so that inspection may be made.
Investigative Inspection of Trees	Inspect trees before shipment – refer 8.2.1 Investigative Inspection Sampling Table for details.	Inspection	Give not less than 48 hours so that inspection may be made.

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
Practical Completion	Issue of Certificate of Practical Completion – Plant materials shall be inspected for compliance with the contract specification and drawings. Materials rejected shall be removed promptly from the site by and at the expense of the Contractor.	Inspection	Give not less than 48 hours so that inspection may be made.
Final Completion	Issue of Certificate of Final Completion – Plant materials shall be inspected for compliance with the contract specification and drawings. Materials rejected shall be removed promptly from the site by and at the expense of the Contractor.	Inspection	Give not less than 48 hours so that inspection may be made.
Difficulty in obtaining plant materials	Notice of any difficulty in obtaining the plant materials.	Submission	Submit if required within 7 days of notice of contract.
Growing on of plant material	Proposal in writing if lead times allow and the Contractor proposes to grow on plant material. NOTE: Trees and shrubs must have been grown in their final containers for not less than eight weeks prior to delivery to site.	Submission	Submit if required within 7 days of notice of contract.
Evidence of purchase	Evidence of purchase of all plant material, names and addresses of the growers and details of orders.	Submission	Submit within fourteen [14] days of notice of contract.
Plant progress report	Report describing the status and progress of each species of plant material being grown or procured.	Submission	Submit at end of each calendar month.
Suppliers	Statements from suppliers of plants and other materials stating; Particulars of the supplier's experience in the required type of work. Production capacity for material of the required type, sizes and quantity. Lead times for delivery of the material to the site.	Submission	
Supplier's data	Supplier's data including material source of supply.	Submission	

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
Delivery of plant stock	Installation contractor to inspect plants on the delivery vehicle and advise Landscape Architect of any stock in poor condition.	Submission	Submit if any stock in poor condition.
Compost certificate	Certificate of proof of compost pH value.	Submission	
Certification	Supplier's written statement certifying that the plants are true to the required species and type and free from disease, pests and weeds.	Submission	
Log book	Log book recording details of maintenance work undertaken.	Submission	Make available for inspection on request.
Maintenance of plants	Recommendations for maintenance of plants.	Submission	
Certification	Certification by a local Herbarium to confirm compliance with the species scheduled.	Submission	Submit if requested.
Maintenance			
Trial samples	Small trial samples for correcting any nutrient deficiencies or herbicide and pesticide applications for approval of site-wide application	Sample	
Soil tests	Six (6) interpreted tests throughout maintenance period	Test	
Irrigation water	Two (2) interpreted tests throughout the maintenance period	Test	
Inspections	Completion of maintenance visit	Inspection	Give notice so that inspection may be made

6.1.3. TYPES + SUBTYPES TABLE

— Type	— Description	— Subtype	— Description
Turf Type			
Turf	Grass – at Grade	Turf	Sir Walter Buffalo
Staking Type			
Staking	Rootball Fixing System	Staking	PLATYPUS – Rootball fixing system or equal and approved

6.1.4. PLANTING SCHEDULE

Refer to CC-09 PLANTING SCHEDULES

6.1.5. PRODUCTS

Turf

Supplier: Obtain turf from a specialist grower of cultivated turf.

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

Supply

Elapsed time: Deliver the turf within 24 hours of cutting, and lay it within 36 hours of cutting.

Prevent it from drying out between cutting and laying.

6.1.6. PERFORMANCE TURFING

Fertilising

General: Mix the fertiliser thoroughly into the topsoil before placing the turf. Apply lawn fertiliser at the completion of the first and last mowings, and at other times as required to maintain healthy grass cover.

Laying

General: Lay the turf in the following manner:

- In stretcher pattern with the joints staggered and close butted.
- Parallel with the long sides of level areas, and with contours on slopes.
- To finish flush, after tamping, with adjacent finished surfaces of ground, paving edging, or grass seeded areas.
-

Strip turf laying: Close butt the end joints and space the strips 300 mm apart. Apply a layer of top dressing between the strips of turf. Finish with an even surface.

Tamping

General: Lightly tamp to an even surface immediately after laying. Do not use a roller.

Pegging

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. Continue watering to maintain moisture to this depth.

Mowing

Height: Mow to maintain the grass height within the required range. Do not remove more than one third of the grass height at any one time. Carry out the last mowing within 7 days before the end of the planting establishment period. Remove grass clippings from the site after each mowing.

Maintenance

General: Maintain turfed areas until the attainment of 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 relay with new turf.

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

Top dressing

General: When the turf is established mow, remove cuttings and lightly top dress to a depth of 10 mm. Rub the dressing well into the joints and correct any unevenness in the turf surface.

PLANTING

Individual plantings in grassed areas

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

Ripline planting

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

Locations

If it appears 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 such as extreme heat, cold, wind or rain. In other than sandy soils, suspend excavation when the soil is wet, or during frost periods.

Watering

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

Placing

Method: Remove the plant from the container with minimum disturbance to the root ball, ensure that the root ball is moist and place it in its final position, in the centre of the hole and plumb, and with the top soil level of the plant root ball level with the finished surface of the surrounding soil.

Fertilising

Pellets: In planting beds and individual plantings, place fertiliser pellets around the plants at the time of planting. Application rate (kg/ha): [complete/delete]

Backfilling

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

Watering basins for plants in grass

Method: Except in irrigated grassed areas and normally moist areas, construct a watering basin around the base of each individual plant, consisting of a raised ring of soil capable of holding at least 10 L.

MULCHING

Placing mulch

Place mulch to the required depth, clear of plant stems, and rake to an even surface flush with the surrounding finished levels. Spread and roll mulch so that after settling, or after rolling, it is smooth and evenly graded between design surface levels sloped towards the base of plant stems in plantation beds, and not closer to the stem than 50 mm in the case of gravel mulches.

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. **Extent:** To surrounds of plants planted in riplines and grass areas, provide mulch to 750 mm diameter.

Depths: Spread organic mulch to a depth of 75 mm, and gravel mulch to a depth of 50 mm.

STAKES AND TIES

Stakes

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

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

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

Ties

Provide ties fixed securely to the stakes, one tie at half the height of the main stem, others as necessary to stabilise the plant. Tie types:

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

Marker stakes

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

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

Location of marker stakes:

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

PLANTING ESTABLISHMENT

Period

Commencement: The planting establishment period commences at the date of practical completion. Required period: [complete/delete]

Existing planting and grass

Maintenance: Where existing grass or planting is within the landscape contract area, maintain it as for the corresponding classifications of new grass or planting.

Recurrent works

Throughout the planting establishment period, carry out maintenance work including, watering, mowing, weeding, rubbish removal, fertilising, pest and disease control, reseeding, returfing, staking and tying, replanting, cultivating, pruning, hedge clipping, aerating, reinstatement of mulch, renovating, top dressing, and keeping the site neat and tidy.

Replacements

Plants: Continue to replace failed, damaged or stolen plants.

Grassed areas

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

Log book

Records: Keep a log book recording when and what maintenance work has been done and what materials, including toxic materials, have been used. Make the log book available for inspection on request.

COMPLETION

Product warranty

Certification: Submit the supplier's written statement certifying that plants are true to the required species and type, and are free from diseases, pests and weeds.

Maintenance manual

General: Submit recommendations for maintenance of plants.

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.

6.2 PLANT SUPPLY

6.2.1. GENERAL

Refer 6.1.2 Hold Points/ Shop Drawings/ Prototypes/ Samples/ Tests/ Submissions/ Inspection.

AIMS

Responsibilities

Provide trees that have been grown to a standard that allows them to establish rapidly and grow to maturity.

CROSS REFERENCES

Associated worksections

Conform to the following: [complete/delete] add cross-reference

STANDARDS

Tree Stock Supply: Conform to the recommendations of AS 2303 *Tree Stock for Landscape Use* and the guidance given in the current edition of NATSPEC Guide: *Specifying Trees – a guide to assessment of tree quality*.

INTERPRETATION

Definitions

General: For the purposes of this worksection the definitions given in AS 2303 and the following below apply:

- Destructive inspection: 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.
- Investigative inspection may be waived if an accredited quality assurance system is in place.
AS 2303 Appendix B2(d) calls for investigative inspections, where necessary and AS 2303 Appendix A3 Step 3 notes that investigative rootball testing is not mandatory at dispatch but does not define the term.
- Known history: Supplier documentation, demonstrating and enabling verification that the product was grown by essentially the same processes and under essentially the same system of control.
- Large tree: A tree grown in a container not less than 20 L or ex-ground with a minimum rootball diameter not less than 400 mm.
- Partial inspection: A method of exposing a section of a root system to enable inspection of root development by washing the soil away in a wedge-shaped section from the stem to the extremity of the rootball. This soil can be gently replaced so the tree is not damaged.
- Shrub: A woody perennial plant smaller than a tree, usually having permanent stems branching from or near the ground.
- Small tree: A tree or shrub grown in a container less than 20 L (other than tubes or plant cells) or ex-ground of size index less than 35.

PRECOMPLETION TESTS

External inspection:

- Frequency: Inspect trees before shipment.
- Inspector: Supplier.
- Sampling: To the *External inspection sampling table* for each batch of trees. Select sample trees at evenly distributed intervals within each batch.

External inspection sampling table

Number of trees per batch	Number of trees to sample
0 – 20	4
21 – 50	8
51 – 100	15
101 – 500	15 for the first 100 + 5% of the balance of the order
501 – 2000	35 for the first 500 + 2% of the balance of the order
2001+	65 for the first 2000 + 1% of the balance of the order

Investigative inspection:

- Frequency: Inspect trees before shipment.
- Inspector: Qualified person authorised by contract administrator.
- Destructive inspection: Use for trees with rootballs/containers < 200 mm.
- Allowance: Allow for sample trees in addition to quantity ordered.
- Partial inspection: Use for trees with rootballs/containers > 200 mm.
- Sampling: To the *Investigative inspection sampling table* for each batch of trees. Select sample trees at evenly distributed intervals throughout each batch.

Investigative 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

SUBMISSIONS

Test results

General: Complete and return the Tree inspection form for each batch inspected. Rejection: Non-compliance may lead to rejection of the entire batch.

Corrective action: Comply with corrective action procedures for each order as instructed.

Substitution: If non-complying trees are proposed, submit a proposal in writing.

Authentication: Supply a copy of the written approval of substitution with any non-complying trees.

FORWARD ORDER CONTRACTS

Reports: Complete regular reports using the pro forma *Tree inspection form*. Include checks against specification requirements.

- Photographs: Provide current colour copies with date verification.
- Submissions: To the contract administrator.
- Inspection: Complete and return the attached pro-forma *Tree inspection form* before despatch of every batch, and at the following frequencies:
 - Inspections: At 3 monthly intervals.
 - Reports: At time of inspections.

6.2.2. PRODUCTS

General

Supply trees to AS 2303 and with the following properties:

- Stress: Free from stress resulting from inadequate watering, excessive shade or excessive sunlight experienced at any time during their development.
- Site environment: Grown and hardened off to suit anticipated site conditions at the time of delivery.

Labelling

General: To AS 2303 clause 2.2.1.

- Label type: To withstand transit without erasure or misplacement.

ABOVE-GROUND ASSESSMENT CRITERIA - TREES

General

Supply trees to AS 2303 clause 2.2 and with the following properties:

Pruning:

- Clean stem height: < 40% of total tree height, nom. 2m above soil level.
- Palms: 6m clear stem to base of crown shaft.
- Trunk position: Variation in distance from the centre of the trunk to the extremity of the rootball:
 - < 10%.
- 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.

BELOW-GROUND ASSESSMENT CRITERIA - TREES

General

Supply trees to AS 2303 clause 2.3 and with the following properties: Rootball occupancy: Soil retention:

- On shaking or handling the unsupported rootball, at least 90% of the soil volume is to remain intact.

BELOW-GROUND QUALITIES – SHRUBS

Root system

Requirement: Supply plant material with a root system as follows:

- Well-proportioned in relation to the size of the plant material.
- Conducive to successful transplantation.
- Free of any indication of having been restricted or damaged.

Root inspection: If inspection is by the removal of soil test such as destructive inspection, sample as follows:

- For > 100 samples: Inspect 1%.
- For < 100 samples: Inspect 1 sample.

Sample plants: Replace plants used in inspection. Rejection: Do not provide root bound stock.

BALANCE

BALANCE – ASSESSMENT CRITERIA

Large trees

Size Index range for trees grown in containers $\geq$ 20 L: To AS 2303 Appendix E Table E1.

Minimum rootball diameter for ex-ground trees: To AS 2303 Appendix E Table E2.

Trees outside the ranges of Common container sizes table and Ex-ground tree table and as follows:

Small trees

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 30° from the vertical, side to side.

Exempt: Species that naturally produce hard inflexible wood in the early stages of their development.

Small container-grown trees 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

Large trees

Conformance at inspection: To Balance (large trees) assessment requirements. Balance (large trees) assessment requirements:

- For trees grown in containers up to 20 L, the Size Index must lie within the range for the nominal container size shown in the *Common container volumes table*.
- Ex-ground trees with a Size Index up to 35 (e.g. 1.4 m high x 25 mm calliper) must have rootball diameters up to the minimum rootball diameters shown in the *Ex-ground trees table*.

Common container volumes table

Size Index	Nominal container volume (L)	Size Index	Nominal container volume (L)
26-33	20	371-480	450
32-41	25	412-518	500
45-58	35	453-587	550
57-74	45	495-640	600
77-99	60	533-716	700
83-107	75	632-818	800
111-143	100	711-921	900
154-200	150	791-1023	1000
194-251	200	842-1089	1100
227-314	250	918-1188	1200
273-353	300	1148-1485	1500
289-373	350	1530-1980	2000
330-427	400	1913-2475	2500

Ex-ground trees table

Size Index	Minimum rootball diameter (mm)	Size Index	Minimum rootball diameter (mm)
	350	341-383	850
56-72	400	384-429	900
73-106	450	430-530	1000
107-131	500	531-642	1100
132-156	550	643-732	1200
157-173	600	733-859	1300
174-228	650	860-1144	1500
229-249	700	1145-1507	1750
250-299	750	1508-1968	2000
300-340	800	1969-3075	2500

Trees outside the ranges shown in the Common container volumes table and the Ex-ground

trees table. Photographs: Provide current colour copies with date verification.

ABOVE-GROUND

Labelling

Clearly label individual trees and batches.

- Label type: To withstand transit without erasure or misplacement.

Health and vigour

Health: Supply trees with foliage size, texture and colour at time of delivery consistent with the size, texture and colour shown in healthy specimens of the nominated species.

Vigour: Supply trees with extension growth consistent with that exhibited in vigorous specimens of the species nominated.

Freedom from pests and disease

Pests and disease: Supply trees with foliage free from attack by pests or disease.

Native species with a history of attack by native pests: Restrict evidence of previous attack to < 15% of the foliage and ensure absence of actively feeding insects.

Supply

Supply only trees that:

- Are free from injury.
- Are self-supporting.
- Have the calliper at any given point on the stem greater than the calliper at any higher point on the stem.

Pruning

Specific form: [complete/delete]

Clean stem height: < 40% of total tree height.

Pruning wounds

Extent: Restrict fresh (i.e. recent, non-calloused pruning wounds) to < 20% of total tree height.

Type: Ensure a clean-cut at the branch collar.

Diameter of wound: < 50% of the calliper immediately above the point of pruning.

Apical dominance

Species with an excurrent form: Supply trees with a defined central leader and the apical bud intact.

Crown symmetry

Crown distribution: Difference on opposite sides of the stem axis < 20%.

Stem structure

Species with excurrent form: Supply trees with a single stem roughly in the centre of the tree with any deviation from vertical < 15°.

Species with decurrent form: Supply trees where the central stem is not divided at any point lower than the clean stem height nominated, and that the stem junction at the point of division is sound.

All species: Ensure that branch diameter is less than or equal to one-half of the calliper immediately above the branch junction.

Included bark

Supply trees where the branch/stem bark ridges at junctions between stems and branches and between co-dominant stems are convex, except for species prone to include bark that are known to remain strong.

Trunk position

Supply trees with the distance from the centre of the trunk to the extremity of the rootball not varying by > 10%.

Compatibility of graft unions

Supply trees where the union between the scion and rootstock is sound for the entire perimeter of the graft, and the diameter of the scion immediately above the graft is equal to the diameter

of the rootstock immediately below the graft ($\pm 20\%$).

Indication of north

Trees in containers > 100 L or of Size Index > 140: Indicate the northerly aspect during growth in the nursery to withstand transit without erasure or misplacement.

BELOW-GROUND

Root division

Trees in containers up to 45 L or ex-ground trees with a Size Index 70: Primary division of roots at < 100 mm intervals.

Trees in containers > 45 L or ex-ground trees with a Size Index > 70: Primary division of roots within the outer 50% of the rootball at < 100 mm intervals.

Root direction

Ensure that roots, from the point of initiation, generally grow in an outwards (radial) or downwards direction, and that any deviation from the established direction < 45°.

Trees with a calliper at ground level < 40 mm: Ensure that the diameter of any nonconforming roots at the extremity of the rootball < 25% of the calliper.

Trees with a calliper at ground level 40 mm3: Ensure that the diameter of any nonconforming roots at the extremity of the rootball < 10 mm.

Rootball occupancy

Soil retention: On shaking or handling the unsupported rootball at least 90% of the soil volume to remain intact.

Rootball depth

Rootball depth assessment for containers/rootballs 45 L or larger:

- Depth: maximum depth specified and no rootball (regardless of size) > 550 mm in depth.
- Diameter: mm3 depth.
-

Height of root crown

Ensure that root crown is at the surface of the rootball.

Non-suckering rootstock

Grafted cultivars/varieties: Supply trees grafted onto non-suckering rootstock.

6.2.3. EXECUTION TREE INSPECTION FORM

General

Date		Reference	
Purchaser			
Supplier		Inspected by (supplier/purchase r/agent)	
Species		Batch identification	
Number of trees in batch		Container/rootball size	
Height range		Calliper range	
Special requirements			

Above ground

Labelling	☐	
Health and vigour	☐	
Freedom from pests/disease	☐	
Freedom from injury	☐	
Self-supporting	☐	

Stem taper	☐	
Pruning	☐	
Apical dominance	☐	
Crown symmetry	☐	
Stem structure	☐	
Included bark	☐	
Trunk position	☐	
Compatibility of graft unions	☐	
Indication of north	☐	

Below ground

Inspection method used	☐	External only
	☐	External plus
	☐	investigative destructive ☐ partial
Number of trees in sample	☐	
Root division	☐	
Root direction	☐	
Diameter nonconforming roots at rootball extremity	☐	
Rootball occupancy	☐	
Rootball depth	☐	
Height of root crown	☐	
Non-suckering rootstock	☐	

Balance

Balance	☐	

Conformance with specification

Conforming	☐ Yes ☐ No
Comments	
Name and signature (inspector)	

6.3 TREES**6.3.1. GENERAL**

Refer 6.1.2 Hold Points/ Shop Drawings/ Prototypes/ Samples/ Tests/ Submissions/ Inspection

AIMS

The work generally includes sourcing, supply, and installation of semi-mature/mature plant specimens. These include stock sourced as in-ground, field, private garden, or nursery grown specimen trees/palms/tree ferns/specimen plants shown on the landscape drawings and as specified. The work generally includes the following stages:

- Sourcing of the scheduled specimens from appropriate locations
- Communicating the characteristics of each sourced specimen to the superintendent
- Obtaining approval from the superintendent of the suitability of each sourced specimen
- Organisation of purchase including provision of spares
- Preparation of specimens for transplant including spares
- Maintenance until transplant
- Containerisation, transplant, transfer to nursery or site
- Storage and maintenance at nursery if required
- Delivery and installation of specimens to the project site

6.3.2. PRODUCTS

GENERAL

Definitions

Refer to the semi-mature tree/palm definitions construction detail as a reference.

'Height' The vertical dimension between natural soil level and the top of the crown or highest limb
'Spread' The smallest dimension in any direction of the canopy diameter

'Trunk height' The dimension between natural soil level and the bottom of the palm crown shaft.

'Tree calliper' The diameter of the plant's main stem 300mm above the surface of the root ball.

'Palm calliper' The dimension of the plant's main stem 1000mm above the surface of the root ball.

Tree foliage density and distribution shall be as determined by the superintendent and will be characteristic of the typical healthy form of the species to be sourced.

GUARANTEES

The Contractor shall guarantee that all plants are true to species and type. Certification by a local Herbarium may be required to be performed by the Contractor at no addition to the contract value to confirm compliance with the species scheduled.

CONTRACTORS SUBMISSIONS

In addition to the submittals outlined in 8.1.2 Hold Points/ Shop Drawings/ Prototypes/ Samples/ Tests/ Submissions/ Inspection the following approvals are required for Issue of the practical completion certificate during the course of the Works:

- Acceptance of the transplant work program
- Acceptance of soil materials and test results
- Acceptance of root preparation excavation techniques
- Acceptance of crown pruning
- Acceptance of rootball wrapping
- Acceptance of rootball container designs
- Acceptance of lifting techniques
- Acceptance of loading and transporting methods
- Acceptance of each specimen delivered to Site.
- Acceptance of planting works set out prior to planting
- Acceptance of rootball strapping or guying
- Acceptance of planting works execution

TOLERANCES

The acceptable tolerances for tree and palm dimensions shall be at the discretion of the superintendent.

TREES

Trees/palms required for this Contract are listed and described in the planting schedule.

TREE CHARACTERISTICS

- Trees shall bear a growth habit typical of the species and/or cultivar, or as scheduled or specifically shown on the Drawings.
- Trees shall have an optimum habit of growth and be sound, healthy, vigorous and without pest damage, disease, injury or physiological disorders.
- Crown shall be well balanced with abundant canopy growth and/or bud formation and compatible with the intended use.
- Leaves shall be of normal size, shape and colour. Foliage shall be predominantly hardened off mature leaves.
- Trees shall be structurally stable with optimum trunk diameter and without weak "V" shaped crotches, stubs, incomplete callouses, suckers, watershoots, fruits or flowers.
- Trees with abrasions of the bark, sunscalds, disfiguring knots or fresh cuts of limbs over 20mm which have not completely calloused, will not be accepted.
- Trees shall have a branching habit that enables only the pruning of branches less than 50

- mm diameter to comply with the Scheduled characteristics.
- Trees shall have a symmetrical/radial pattern of well branched fibrous roots without circling the trunk.
- Trees sourced which are larger than the scheduled specimens may be accepted at the superintendents discretion but shall not constitute a variation to the contract.

IDENTIFICATION

All plants shall be true to species and/or cultivars. Label each specimen with both species nomenclature and a code number for reference. Labels shall be water resistant, secured to the plant and capable of lasting the term of the Contract.

SOIL MATERIALS

Refer 1.1.3 Types + Subtypes Table – Soil Media Type t[soil media]

FERTILISER

Apply granulated slow release fertiliser such as 'Nutricote' or 'Osmocote' appropriate for the requirements of each plant species to each planting hole to the manufacturers recommended application rates.

6.3.3. EXECUTION

PLANTING - SEMI MATURE TRANSPLANTS PROCUREMENT

Sourcing specimens

Locate semi-mature stock as scheduled and indicated on the drawings for inspection and approval of suitability. Submit the following information for preliminary approval prior to field inspection by the superintendent:

- coloured photographs of the specimen with a clearly visible measure of the size such as a metric measuring pole located next to the trunk
- details of overall height, trunk height and canopy spread measurements
- nature of root systems, detailing extent and location of major structural roots and calliper of tree bole 300mm above ground level.
- description of soil type, soil texture.

Submit the above information within fourteen (14) days of notice of Contract award. Failure to submit this information may result in termination of the Contract without compensation.

Proof of Purchase

Prior to commencement of transplant preparation work submit evidence of a mutual agreement between the vendor/s and the Contractor concerning all transplant material being procured for this contract.

Written evidence shall indicate:

- that the Contractor has purchased the trees and fulfilled all agreements and conditions of sale.
- terms of payment
- previous and new ownership
- protection of the vendor's property
- making good of damage
- means of access

Submit the evidence signed by the vendor/s and Contractor.

TRANSPLANT PREPARATION

Root Preparation

- Excavate a trench in two stages around the bole at a distance as shown on the drawings to create an appropriate size rootball for transplant.
- Excavate trenches to depths below the lowest lateral roots using high pressure water jet techniques. Excavation using machines may be allowed in special circumstances. Use of machine techniques shall be approved by the superintendent prior to commencement.
- Cleanly sawcut roots using industry recognised tree surgery techniques. Application of a

wound sealant is not required.

Trench Backfilling

Backfill trenches with clean washed sand.

Crown Pruning

Crown pruning shall be minimal and in accordance with AS 4373 and shall be approved prior to commencement. Cleanly cut dead wood, diseased branches and foliage, and crossover branches from the tree.

PRE TRANSPLANT MAINTENANCE

Provide maintenance following root preparation, continuing until the time of lifting and transporting to the nursery holding location or planting site.

Establish a vigorous, compact, fibrous root system within the rootball, capable of supporting the tree after transplant.

Field inspections may be required at any time. The Contractor or its delegated representative shall be present at such field inspections. A minimum of 48 hours notice will be given to the Contractor of this requirement.

Program and Written Records

Submit program of intended maintenance work for approval before commencement. Monitor the tree's response and submit a brief monthly log of the maintenance work executed. The log shall describe the maintenance activities carried out each week including : irrigation details, fungicide application, wetting agent application, root inducing hormone application, mulching, guying adjustments etc.

Irrigation

Establish a temporary drip irrigation system for the duration of the pre transplant maintenance period. Use measures including:

- berming around the edge of the rootball
- coring into the rootball
- digging shallow trenches in concentric circles out from the trunk.

Fungicides

Apply fungicide to the rootball, equivalent to 'Benlate' diluted in water in accordance the manufacturer's recommendations immediately after root pruning. Reapply 14 days after. Continue applications to prevent fungal growth.

Wetting Agents

Apply an anionic wetting agent to the rootball, equivalent to 'Lanes x 77' in accordance the manufacturer's recommendations immediately after root pruning.

Root Inducing Hormones

Apply 'Roche Formula 20' root inducing hormone to the rootball surface at a rate of 250mls dissolved in 10 litres of water immediately after root pruning and at 2 weekly intervals throughout the pre transplant period.

Fertilizing

No fertilizers are to be applied during this work.

Mulch

Apply and maintain the specified deep cover of an approved organic mulch throughout the pre transplant period.

Guying

Install and maintain guying to maintain the stability of the tree and its rootball if required.

Security and Access Restriction

Prevent pedestrian or vehicular access onto and over rootball.

LIFTING, LOADING AND TRANSPORTING

Time Limits

Time interval between completed root pruning and lifting of the rootball to the time of burlapping shall not exceed 24 hours.

Adverse Weather

Cease transplanting operations in adverse weather conditions.

Rootball Preparation for Lifting

Re excavate root trench to within 100mm of rootball perimeter. Prevent damage to new root growth. Continue excavation by hand techniques to undercut the rootball sufficient to allow wrapping of rootball, rigging of lifting apparatus and room for lifting operation. Trim rootball to correct sizes ready for wrapping/containerisation.

Wrapping/Containerisation

Wrap rootball with an approved method Wrapping may include hessian or selected fabric burlapping with min. 2 layers, structural support members, rope or cable lacing able to:

- provide secure packaging of the rootball during lifting, transporting, storage operations
- prevent bare rooting and fracture of the rootball
- provide integrated support between rootball and trunk when tree is lifted
- provide insulation and protection from water loss during transport caused by sun and wind exposure
- allow for removal of burlapping when tree is planted

Root ball containers or burlapping shall be removable/demountable or decomposable. The container or burlapping will be required to remain around the trees throughout planting installation.

Any lifting containers shall be designed and certified by a structural engineer at the Contractors expense for use in this contract.

Lifting

Adoption of one of the following lifting techniques is recommended.

- Rigging systems which lift from underneath a supported rootball
- Lifting by supported connection of rigging to the trunk

Rootball support lacing shall not be used as major load bearing rigging. Wrap, pad and secure the aerial parts of the tree to prevent damage during lifting and transporting. Provide craneage, hoisting and machinery facilities, including dogmen. The Contractor is responsible for all work associated with transplant operations.

Transport

When transporting trees ensure:

- trees are positioned in a horizontal or inclined position on the transport vehicle
- over hanging branches are tied in
- tree is protected from wind and sunburn with coverings
- an enclosed environment for the tree is provided on its transport vehicle

Unloading

Carry out all operations smoothly, efficiently, with coordinated handling using machine operators familiar with the specialised requirements of plant material.

During the unloading work ensure:

- extensive padding protection to all parts of the tree which are in contact with securing rigging or supports
- rootball is not crushed
- protective cover to underside of rootball is installed
- tree is protected from wind and sunburn with coverings
- rootball soil moisture is maintained at field capacity.

NURSERY HOLDING MAINTENANCE PROGRAMME

Refer pre-transplant maintenance section for requirements.

DELIVERY TO SITE

Provisional date/s for delivery shall be co-ordinated with the superintendent and or head Contractor.

Delays incurred in unloading the trees to the designated location on the delivery date directed by the superintendent shall be the responsibility of the Contractor. Fourteen (14) days notice shall be given by the superintendent.

Trees are to be carefully off loaded in a designated temporary location and held upright for inspection by the superintendent. Material not complying with contract requirements may be requested to be:

- Removed from site and replaced within 2 days at no additional cost
- Rectified to achieve compliance within 2 days at no additional cost
- Retained on site for revaluation

Characteristics of specimens at delivery

Trees shall conform to the following characteristics at the time of delivery to the site.

- Trees shall be acclimatised to the conditions of the site.
- Crown shall be without pest damage, disease, injury, physiological disorders, branch/frond dieback, flowers and fruit.
- Transpiration shall be minimised to prevent wilting and defoliation. Trees delivered displaying moisture stress will not be accepted irrespective of any previous acceptance.
- Foliage shall be 80-100% of the pre-transplant preparation characteristics. Density distribution shall be uniform over the crown.
- Trees shall be without sunscalds, fire damage, bark/tissue damage, cuts or abrasions, watershoots, stubs and suckers.
- Pruned roots shall exhibit callousing and/or root branching extending out from the original root ball. Roots shall be moist and without sunscalds or disease injury.
- Trees with rootbound conditions will not be accepted.
- Root ball soil moisture shall be at field capacity without disease, pest and weeds. Soil mass shall be homogeneous and securely contained and supported back to the trunk.

PLANTING - SEMI MATURE TRANSPLANTS INSTALLATION

Suspend planting operations when adverse weather conditions prevail.

Prepare planting holes to dimensions indicated on the drawings. Refer subsoil drainage and soilworks.

Remove plant containers/burlapping without damage to the tree crown and root system. Gently tease outer root growth if necessary to encourage new and continued outward root growth. Set plants to the levels shown on the drawings and backfill with Soil –refer soilworks. Make allowance for soil settlement. Align plant as directed by the superintendent. Set the plant vertical. Consolidate backfill soil in layers of 150mm deep around the rootball, saturate progressively with water to expel air pockets and finish with surface form shown on the drawings. Remove all containers from the site. Leave area tidy at end of days planting.

Rootball Strapping/Guying

Install strapping as shown on the Drawings. Notwithstanding the Drawing information, the work must provide secure support necessary for optimum tree growth and establishment of the tree's own root system. The Contractor may submit proposals for modifications to the systems shown on the Drawings for approval by the superintendent.

Watering

Hand water or establish a temporary drip irrigation system and/or provide measures to maintain the rootball at its field capacity for the duration of the pre transplant maintenance period.

Tree Surgery

Cleanly cut any damaged branches and attend to any damage or injuries in accordance with tree surgery practices described earlier.

COMPLETION

Careful monitoring of the tree is required during this period. Immediate remedial action is

required at the onset of any deleterious condition. Refer maintenance section for post planting requirements.

6.4 CONTAINERISED PLANTS

6.4.1. GENERAL

Refer 6.1.2 Hold Points/ Shop Drawings/ Prototypes/ Samples/ Tests/ Submissions/ Inspection

AIM

Work Included: Supply and installation of planting works in accordance with this specification, the Contract drawings and Superintendent's instructions. This encompasses all materials and installation of work to planting areas including containerised trees, palms, tree ferns, shrubs, groundcovers and lawn areas.

6.4.2. PRODUCTS

GENERAL

Definitions

'Height' The vertical dimension between natural soil level and the top of the crown or highest limb

'Spread' The smallest dimension in any direction of the canopy diameter

'Trunk height' The dimension between natural soil level and the bottom of the palm crown shaft.

'Tree calliper' The diameter of the plant's main stem 300mm above the surface of the root ball.

'Palm calliper' The dimension of the plant's main stem 1000mm above the surface of the root ball.

CONTRACTORS GUARANTEE

The Contractor shall guarantee that all plants are true to species and type. Certification by a local Herbarium may be required to be performed by the Contractor at no addition to the Contract value to confirm compliance with the species scheduled .

TOLERANCES

The acceptable tolerances for planting set out dimensions shall be ± 50 mm from the layout design indicated on the drawings.

PLANTS

Plant Materials

Plant materials required for this contract are described on the contract drawings.

Ordering

Place orders within fourteen (14) days of notice of contract award.

Material Delivery, Storage-Planting

Protect plant material in transit between the point of supply and the project site from sun and wind scorch.

Deliver plant material to the site a maximum of 24 hours prior to planting unless a secured compound has been installed on the site. Plant material stored on site shall be protected from adverse climatic conditions, watered and secured.

Plant material previously approved may be rejected if it is stored for more than 24 hours prior to planting without being protected, watered and secured to the satisfaction of the Superintendent.

Minimum characteristics

Plant materials shall bear strong stem and trunk growth, healthy foliage, undamaged, free of insect infestation and a growth habit typical of the species and/or cultivar, or as scheduled or specifically shown on the Drawings.

Minimum acceptable sizes for all plant materials freestanding and after trimming are as scheduled. Plant material larger than the scheduled ranges may be used subject to approval by

the Superintendent. The planting of larger size plant material will not constitute a variation to the Contract value.

Plant material shall be acclimatised to the site conditions.

Plant material which does not have a root system that can hold the root ball soil mass together when the container or wrapping is removed will not be accepted.

Tree and shrubs shall have been grown in their final containers for not less than eight weeks prior to delivery to the site. Plant material with root bound conditions will not be accepted.

Plant material which has been allowed to wilt and/or dry out following delivery to site, can be rejected irrespective of a previous acceptance.

Trees with abrasions of the bark, sunscalds, disfiguring knots or fresh cuts of limbs over 20mm which have not completely calloused, will not be accepted.

6.4.3. EXECUTION PLANTING

Adverse Weather

Suspend planting operations when adverse weather conditions such as extreme heat, cold, or strong winds prevail, or when directed by the Superintendent.

Installation

Prepare planting holes to dimensions and profile forms as shown on the Drawings. Remove plant containers without damaging the root system. Gently tease outer root growth if necessary to encourage new and continued outward root growth. Set plants to the levels shown on the Drawings, install fertiliser and backfill with soil. Lightly consolidate backfill soil in layers of 150mm deep around the root ball whilst saturating progressively with water to expel air pockets and finish with surface form shown on the Drawings. Spread mulch evenly to depths specified following planting.

REINSTATEMENT

Restore any adjacent areas to the site which have been disturbed by the work in this section to their original condition prior to the works under this contract commencing.

6.5 MAINTENANCE

6.5.1. GENERAL

Aim

Work Included: Provision of maintenance in accordance with this specification, the Contract drawings and Superintendent's instructions. This is to include materials and work to maintain all work covered in the contract.

It is the Contractor's responsibility to monitor the work and bring to the superintendent's attention any specific problems detected and the proposed remedial actions.

6.5.2. QUALITY

Period

The period shall commence immediately after the installation of the plant material and continue for the duration specified below after the granting of Practical Completion:

- Establishment maintenance period: 52 weeks

The Contractor may be required to continue maintenance beyond this time at agreed rates.

Inspection

Hold points

Give not less than 72 hours notice that the following shall be ready for inspection by the superintendent:

- Completion of maintenance visit

Contractors Submissions

Program

Submit a maintenance program for the works prior to commencement. Amend program as required until approved. The program shall include maintenance to new works, and storage areas. The program shall clearly show area concerned, procedure types and frequencies. Submit proposed format for approval prior to program drafting. Allow for all possible procedures necessary to maintain the plant material in a state of continuing healthy growth and in optimum physical and aesthetic condition. The program shall be accompanied by a brief resume of proposed maintenance staff's experience, qualifications and role for approval by the superintendent.

Testing

Representative test samples of the soil and irrigation water shall be taken in accordance with NATA standards. All testing shall be undertaken by a competent NATA registered laboratory for conformance to current version of AS 4419. The Contractor shall pay the cost of all tests including transport of samples to the laboratory. The laboratory report shall be issued direct to the Superintendent. The Contractor shall incorporate all necessary amendments to tested materials in order to achieve compliance with the laboratory recommendations for modification to the material.

Soil

Allow for six interpreted tests throughout the maintenance period. Results shall show:

- Ph (CaC12)
- EC (dS/m)
- N (ppm)
- P (ppm)
- K (ppm)
- Trace (ppm)
- Depth of root zone
- Infiltration rate.

Irrigation water

Allow for two interpreted tests throughout the maintenance period. Results shall show:

- Ph (CaC12)
- EC (dS/m)
- Toxins
- Sodium Absorption ratio.

Rectification

Maintenance work shall not include any cleaning or rectification necessary due to defects under this contract or damage by others if adequate protection had been initiated by the Contractor. Any work including detection, testing, research, staff supervision or remediation undertaken by others as a result of the Contractors' default shall be deducted from the contract sum.

6.5.3. MATERIALS

General plant replacement

The Contractor shall be responsible for the replacement of any plant due to theft, physiological degradation or damage, plant death, vandalism etc. during the maintenance period and defects liability period. The Contractor is not responsible to replace damaged plants affected by freak acts of nature such as cyclones, floods etc.

Equipment

Provide and/or have access to general and specific equipment to carry out the maintenance work as specified.

Equipment should include the following as a minimum:

- Hoses, sprinklers, Q.C.V. keys
- Watertruck
- Slasher
- Self-propelled cylinder and rotary mowers with catcher option
- Fertiliser/top dressing spreaders
- Mobile spray units with shields
- Safety wear and equipment
- Coring machine
- Vertical mower
- Spades, shovels, rakes
- Power trimmers
- pH. testing kit
- One and two handed secateurs
- Fine-toothed pruning saw and bow saw
- Hedge clippers
- Chainsaw
- Ladder and rope
- Lawn mower
- Turf edge trimmer
- Roller

All tools shall be disinfected, clean, sharp, lubricated in proper working order and shall be checked for safety before each job. Mobile machinery shall be of such a size and weight to minimise compaction and damage to grass areas.

Water

The Contractor is to satisfy himself as to water quality and install any equipment necessary to control or monitor water quality – refer Contractors submissions section.

Fertilisers

Lawn fertilisers

Granulated or powdered soluble fertilisers low in phosphorous appropriate to the application.

- Nitrogen and potassium ratios shall be adjusted according to season and rate of growth.
- No Ammonia-based fertiliser shall be used.

Planting fertilisers

A mix of slow release, granulated or powdered soluble fertiliser appropriate to the application.

- Store in durable airtight containers.
- Balance of nutrients shall be as determined by the soil tests.

Supplementary fertilisers

These shall include manure, composts, and liquid fertilisers. Obtain approval of fertiliser type and rate prior to applying.

Herbicide, Fungicide and Insecticides

Weeds shall be treated using steam and other non-chemical methods. Chemical handlers are not to be used without details of the proposed management system and agreement by the landscape architect.

If approved by the Landscape Architect, comply with relevant legislation dealing with horticultural chemicals. Use only appropriate chemicals mixed in strict accordance with the manufacturer's directions. Store and secure chemicals in sealed labelled containers. Herbicides shall be selective non-residual chemicals that do not effect microbiological activity. Obtain approval of chemical type and rate prior to applying.

Mulches

Mulch types shall match adjacent mulched area. Ensure mulch is free of deleterious fungus, pest, disease, soil, weeds and toxins. Mulch types include both organic and inorganic materials. Never use mulch from land clearing.

6.5.4. PERFORMANCE

Performance

Maintenance procedures shall meet the following performance criteria: Encourage garden areas, turf and trees that:

- are strong, vigorous and stable.
- have foliage of normal size, shade, density and colour.
- have deep symmetrical/radial, well-branched fibrous roots.
- are tolerant of irregular watering and water stress.
- have low susceptibility to pests and diseases.
- are resistant to weed invasion and establishment.
- are stable in strong winds.
- are without nutritional deficiencies and toxicities.
- reuse other landscape wastes.

Health Monitoring

Generally, monitor softscape areas.

Observe and record any concentrated and/or frequent occurrence of:

- Water stress
- Water logging
- Plant deaths
- Stunting and distortion
- Change in pH
- Pests and diseases
- Physiological disorders
- Turf thatch accumulation
- Broad-leaf and clover-like weeds
- Salt burn and surface crusting
- White curl grubs, grass moth, caterpillars
- Dollar spot and brown patch
- Compaction

Pests and diseases

The Contractor shall be responsible for all tests necessary to accurately identify pests and diseases.

Samples

Small trial samples for correcting any nutrient deficiencies, and for herbicide and pesticide applications shall be carried out. Obtain approval of sample prior to site-wide application.

Watering

Hydroseeded Areas

Areas that have been hydroseeded will require higher watering frequencies than other turfed and planted areas. Contractor is to ensure watering frequency is sufficient to promote vigorous growth of the hydroseeded lawn areas.

Turf

Water lawn and turf grass until bottom of root zone is saturated at a rate that approximates the infiltration rate of the soil. Watering shall occur infrequently and deeply prior to wilting point. Adjust watering program and procedures as necessary. Water when evaporation rate is low - early in the morning rather than evening or hot windy days. Do not water within 8 hours prior to any intense use of lawn and turf grass.

General

Seasons, degrees of exposure and individual species requirements shall be taken into consideration in the adjustment of watering program and procedures. Supplementary watering (by methods other than irrigation) shall be necessary for newly established and replacement plants, foliage washing, annuals and perennials, and unirrigated areas.

Fertilising

Organic fertilisers are to be prioritised. Chemical fertilisers are not to be used without details of the proposed management system and prior agreement by the Landscape Architect. Fertilise uniformly and evenly when air temperature is below 32 degrees Celsius, soil is at field capacity and leaves are dry. Within one hour of fertilising water-in with at least 10mm of water. Avoid application of fertiliser to non- target areas.

Garden Areas

Nitrogen shall be applied only to maintain normal leaf colour and vigour rather than lush rapid growth. Any one application of nitrogen shall not exceed 5.0 g/m². Fertilising program and procedures shall be adjusted for phosphorous and salt sensitive plants. Ensure plants are not damaged by salt burn from incorrect fertiliser application.

Weed eradication

Weeds shall be treated using steam and other non-chemical methods. Control weeds in garden areas primarily by mulching and fertilising procedures. Remove by hand sparsely spaced individual weeds, foliage and roots. Chemical handlers are not to be used without details of the proposed management system and prior agreement by the Landscape Architect. If approved by the Landscape Architect, comply with relevant legislation dealing with horticultural chemicals.

Herbicides

Chemical herbicides are not to be used without details of the proposed management system and prior agreement by the Landscape Architect. If approved by the Landscape Architect, herbicide application shall not take place in temperatures over 32 degrees celsius or in strong winds. Apply evenly and finely in strict accordance with manufacturer's recommendations. Repeat application if rain falls within 8 hours. Ensure adequate protection of non-weed species. Remove all inorganic litter from garden areas.

Pest and Disease Control

Chemical pesticides are not to be used without details of the proposed management system and prior agreement by the Landscape Architect. Diseases shall be controlled immediately upon accurate identification. Pests shall be controlled when they sufficiently alter the uniformity of the lawn and turf grass or threaten the health and appearance of isolated plants or group of plants, as determined by the Superintendent.

If approved by the Landscape Architect, fungicide and insecticide application shall not take place in temperatures over 32 degrees celsius or in strong winds. Apply evenly and in strict accordance with manufacturer's recommendations. Repeat application if rain falls within eight (8) hours. Biological control shall be attempted prior to insecticide application.

pH Correction

Additives used to correct soil pH problems identified by the soil tests shall be applied evenly during the growing season and thoroughly watered in. Use limestone or dolomite with a particle size less than 0.4mm at a rate of 1.5 kg/m² to raise pH. Use agricultural sulphur at a rate of 0.5 kg/m² to lower pH.

Pruning

Types and applications

"tip pruning" - remove growing tips of plants at any time of year other than flowering period.

"light pruning" - remove growing tips and immature woody growth after flower and fruiting for evergreen plants or during dormant period for deciduous plants.

"hard pruning" - remove growing tips, immature wood and mature wood late winter or early spring.

Technique

Generally, evaluate existing plant habit and form together with desired habit and form as determined by the Superintendent prior to any pruning. Minimise size and number of wounds resulting from pruning.

small branches and stems - cut obliquely just above outward facing node or bud without leaving any stubs. Do not treat wounds.

large branches - half-cut on underside of branch followed by second half-cut in topside. remove stub with final cut flush to branch collar and not to trunk. treat large wounds with fungicide and sealant.

annuals/perennials - remove spent flowers, tip prune after planting, flowering and light prune damaged and diseased growth. groundcovers - tip prune within edges, to uniform height and remove climbing stems.

climbers - tip prune to encourage dense even coverage with lateral branching. train to supports. remove spent flowers. hedges and pollards - regularly clip, light and hard prune the hedge.

shrubs - tip prune juvenile plants to encourage density, flowering and natural form. light and hard prune damaged and diseased growth.

trees - tip prune juvenile plants to encourage density, flowering and natural form. light prune to remove suckers and watershoots. light and hard prune damaged and diseased growth.

palms - remove spent fronds and bracts.

Mulch application

Use only aged, coarse grade mulch with no fines (minimum particle size 15mm). Mulch should be recycled, or as a minimum, a by- product of eg plantation industry, and NOT land cleared mulch passed as recycled mulch. Do not use soil conditioner mulch as ground cover mulch. Replenish decomposed, washed-out and displaced mulch. Prior to application, remove all grass, weeds, rubbish and other deleterious matter. Mulch surface shall finish level with adjoining edging or pavement. Maintain depth of mulch at 50mm. Existing mulch areas deeper than 50mm shall be thinned-out and reused elsewhere. Do not mulch against stem bases.

Soil Replenishment

Replenish washed-out, displaced and consolidated soil. Bring soil surface to a smooth even grade with rounded and gradual plane intersections and corners.

Stormwater and Subsoil Drainage Cleaning/Flushing

Stormwater pits and subsoil pipes shall be kept clean and clear of debris. Clear and remove debris by methods other than washing down. Flush outs and pipes after debris is removed. Pit grates shall be maintained in a serviceable condition.

Animal and Insect Control

The Contractor may be required to control and/or remove rodents, snakes, spiders and webs, wasp nests etc., on or adjacent to paths or seating areas. Protect birds, earthworms, lizards and predatory insects.

Maintenance Schedule

Garden Areas

Task	Description	Minimum Frequency
1.	Health Monitoring	Weekly
2.	Watering - Irrigation	As required
3.	Foliage washing	As required
4.	Fertilising	Quarterly
5.	Weeding & Litter Removal	As required
6.	Pest & Disease Control	As required
7.	Pruning	As required
8.	Flower/Frond/Fruit Removal	As required
9.	Mulch top up	As required
10.	Soil replacement	As required

Task	Description	Minimum Frequency
11.	pH Correction	As required
12.	Replacement Planting	As required
13.	Drainage Flushing	2/Year
14.	Animal & Insect Control	As required
15.	Composting	As required

Trees/Palms

Task	Description	Minimum Frequency
1.	Health Monitoring	Monthly
2.	Watering - Irrigation	As required
3.	Foliage Washing	As required
4.	Fertilising	Quarterly
5.	Weeding	As required
6.	Pest & Disease Control	As required
7.	Pruning	As required
8.	Flower/Frond/Fruit Removal	As required
9.	Mulching	As required
10.	Staking/Guying Checking	As required
11.	Replacement Planting	As required

7.0 IRRIGATION

This worksection is only to be used when no irrigation consultant is engaged in the project
Irrigation consultant to be engaged.

7.1.1. AIMS + SCOPE

STANDARDS AND AUTHORITY REQUIREMENTS

The contractor shall at all times observe recognised good practice and carry out all works in accordance with applicable standards, laws, ordinances and regulations required by authorities having jurisdiction over such work. Provide all inspections and permits required by Federal, State and Local Governments and Authorities in furnishing, transporting and installing materials. All materials and components used in the works shall meet all relevant standards.

RESPONSIBILITIES

General: Provide automatically controlled fixed irrigation systems as follows:

- Achieve the documented flow rates over the area to be irrigated.
- Meet statutory requirements for backflow prevention.
- Work included: Design, supply and installation of irrigation works in accordance with this specification, the Contract drawings and Superintendent's instructions. This is to include materials and work to provide optimum moisture levels to all garden and lawn areas.
- Perform all work in accordance with all applicable laws, ordinances and regulations required by authorities having jurisdiction over such work and provide all inspections and permits required by Federal, State and Local Governments and Authorities in furnishing, transporting and installing materials.

CROSS REFERENCES

General

Conform to the 0.3 Quality Requirements and 0.4 General Material Requirements.

Associated worksections

Conform to the following: [complete/delete] add cross-reference

- 1.0 Preparation, Groundworks + Drainage
- 6.0 Planting
- to be read in conjunction with ARCHITECTS, STRUCTURAL ENG. and CIVIL ENG. details and specification

STANDARDS

Water supply

To relevant Australian Standards and Green star compliance.

INSPECTION

Notice

Give notice so that inspection may be made at the following stages:

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

SUBMISSIONS

Shop drawings

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

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

7.1.2. HOLD POINTS/ SHOP DRAWINGS/ PROTOTYPES/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTION

HOLD POINTS

Hold Points shall apply to the Contractor as required for the various elements of works listed below. Notification: 3 working days of Hold [H] Points required.

HOLD POINTS SCHEDULE	
Description	Comment
Pipework and wiring installed prior to backfilling	
System ready for commissioning	During commissioning inspection the following shall be demonstrated by the contractor; Pressure testing Spray head operation Controller settings Backflow device operation

SHOP DRAWINGS

Shop drawings shall be supplied by the Contractor as required below for approval. No work covered by the shop drawings should be commenced prior to review and formal written acceptance of the drawings by the LANDSCAPE ARCHITECT.

SHOP DRAWINGS SCHEDULE	
Description	Comment
Refer to Irrigation Consultant	

PROTOTYPES/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS

Prototypes/ Samples/ Tests/ Submissions/ Inspections shall be produced for the following works or materials:

Notice: [complete/delete] and cross-reference

Other items may also be required as outlined in this specification.

PROTOTYPE/ SAMPLES/ TESTS/ SUBMISSIONS/ INSPECTIONS SCHEDULE			
Item	Description	Type	Requirement
9000	Irrigation		
	If the contract is a design + construct contract, provide design drawings in CAD dwrg. and PDF format.	Submission	Within 28 days of notice of contract
	Testing of water quality by a NATA registered laboratory.	Submission	Within 28 days of notice of contract

7.1.3. PERFORMANCE PERFORMANCE REQUIREMENTS

Coverage: to be head to head in all areas
 Precipitation rate: 20-25mm
 Watering period: to be determined with Superintendent during commissioning
 Backflow Prevention Device: to AS 3500 and local water authority regulations
 Controller: Controller to have provision for 4 spare stations

PRODUCTS

Automatic control valves

General

Type: 24 V solenoid actuated hydraulic valves with flow control and a maximum operating pressure rating ≥ 1 MPa.

Construction: Stainless steel bonnet holding down bolts and internal metal parts of stainless steel, able to be serviced without removal from the line.

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

Housing: House both valves in the same valve box.

Fixed location systems

Heads

Performance: Provide heads that:

- Maintain a preset arc of throw.
- Are adjustable for radius during watering operations
- Are appropriately vandal-resistant.

Pop-up type heads:

- Type: Designed to rise > 50 mm out of their housings under supply pressure.
- Construction: Provide wiper seals, stainless steel return springs and removable internal filters.
- Playing fields: Provide covers designed and constructed to prevent injury to players.

Provide pop up sprinklers to lawn areas.

Sprinkler heads:

- Type: Gear driven and spray sprinklers which have matched precipitation rates for the various areas of throw.
- Flow rate adjustment To be adjustable down to zero.

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

Provide shrub head sprinklers to garden areas to suit planting heights

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 valves to prevent low head drainage.

Pressure regulating valves: At off-take points provide pressure regulating valves as follows:

- Adjustable between 100 and 700 kPa.
- Complete with 800 μ m filter sized to suit the flow and installed immediately upstream from the pressure regulating valve
- Installed with gate valves upstream from the filter and downstream from the pressure regulating valve.
- Fitted for backflow prevention.
- Mount the assembly in an accessible position in a valve box, access pit or adjacent building.

Soil moisture sensors

Type: Fixed ceramic moisture sensors.

Connection: To the irrigation controller via moisture control units.

Irrigation controllers

Construction: Provide 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 (e.g. every second day, third day etc.).
- 240 V input and 24 V output capable of operating 2 control valves simultaneously.
- ≥ 24 hour battery program backup.
- Power surge protection.
- Cabinet: In external locations mount in a lockable cabinet minimum IP54 to AS 60529.
- Electrical connection: Provide 240 V supply and isolating switch at the controller.

Micro-irrigation systems

Components

Polyethylene micro-irrigation pipe:

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

Drippers: Turbulent flow types, easily dismantled for cleaning.

Valve boxes: In each box provide:

- Automatic control valve.
- Isolating valve.
- Filter:
- Microsprays: 200 mm.
- Drippers: 100 mm.
- Pressure reducing valve with 170 kPa outlet pressure.

Valve boxes

Construction: To be UV resistant high impact plastic with high impact snap lock plastic cover.

Location: Support on bricks at each side. Install with top:

- Within playing fields: 150 mm below the surface.
- Other locations: At finished ground level.

EXECUTION

Fixed location systems

Control wiring

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

- Cable type: Double insulated.
- Cable runs: Underground and laid alongside piping where 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

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.

Micro-irrigation systems

Connections: 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 pipe on finished ground surface under planting bed mulch and anchor at 1.5 m maximum intervals with U- shaped stakes.

Completion

On completion:

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