

Technical Specification  
for  
Tender No. 2018-03

**SHIRE OF DALWALLINU**

**DALWALLINU RECREATION PRECINCT  
CONSTRUCTION WORKS**

**DECEMBER 2017**

Project No. 1706401



Suite 4, 414 Rokeby Road  
Subiaco WA 6008

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# 1. PRELIMINARY TECHNICAL CLAUSES

## 1.1 UTILITY CONNECTIONS AND AUTHORITY APPROVALS

Within one week from the award for tender the Contractor shall apply for all services connections including electrical and scheme water connections, Certificate of Building Compliance, all relevant building licences and all other Authority approvals as required to complete the works. The Contractor shall allow for all works to coordinate with service providers and pay all costs and fees as required.

Copies of all written applications are to be furnished to the Superintendent at the time of each application.

## 1.2 SCHEDULE OF WARRANTIES AND MANUALS

Prior to Date of Practical Completion, the Contractor shall supply the Superintendent works guarantees and operation manuals covering all works as executed and covered by the contract including electrical and irrigation as follows:

- Three (3) complete hard copy sets; and
- one (1) complete digital set on CD.

Copies of all written warranties duly completed and dated as may be required and made effective from the date of Practical Completion shall be included in the Operation and Maintenance Manual submitted to the Superintendent prior to Practical Completion.

The supply of fully comprehensive and fully complete works as executed guarantees and operation manuals forms part of the works and shall be a condition precedent to the Superintendents acceptance of Practical Completion.

## 1.3 AS CONSTRUCTED RECORDS

Prior to Date of Practical Completion, the Contractor shall supply to the Superintendent works as executed drawings shall clearly show all works and services as executed and covered by the contract as follows:

- one (1) set of Original Drawing size paper drawings;
- one (1) set of A3 size paper drawings;
- one (1) set of digital AutoCAD drawings on CD; and
- one (1) set of digital PDF drawing on CD.

All as executed documentation to be in O-Spec Format. Format to be approved in writing with the Shire of Dalwallinu before commencement of as executed documentation.

The supply of fully comprehensive and fully complete works as executed drawings forms part of the works and shall be a condition precedent to the Superintendents acceptance of Practical Completion.

## 1.4 PROTECTION OF EXISTING SERVICES

Prior to commencing works on site, the contractor shall contact all relevant Service Authorities and determine the location of all existing overhead and underground site facilities and services including those to adjacent sites. The Contractor shall engage a suitably qualified cable locator contractor, responsible for locating, marking out and digitally recording all existing facilities and services whether or not such information is shown on any contract drawings. The Contractor shall supply to the Principal, Two (2 no.) electronic copies in CAD format and two (2 no.) hard copies of all Services Survey drawings.

The location and nature of any facilities or services shown on contract drawings is not complete and where shown are approximate only and shall not be relied upon for construction purposes.

The contractor shall ensure all facility and service locations are defined on site by Chalk Lines and Temporary Bench Marks and are clearly shown on the site drawings and on existing services drawings and prominently displayed in the contractor's site office. The Contractor's workforce shall be made aware of the locations of all facilities and services and the need for their protection.

Particular care must be taken by the Contractor to avoid damage to all such underground and overhead facilities and services and all brackets, posts and fittings in connection therewith. It is the Contractors responsibility to ensure all facilities and services encountered are securely protected, supported, strutted and slung or otherwise protected at the Contractors expense.

The Contractor shall allow for excavating by hand in the close vicinity of all facilities and services. It should be understood that the location of facilities and services shown on the Drawings is only intended as a guide and that liaison must be maintained with the relevant Service Authority so that they can be located more accurately.



Where any facility, structure or service is damaged, displaced or otherwise interfered with, the Contractor is to give notice immediately to the Service Authority and the Superintendents Representative and afford all facilities to assist in early inspection and repair of the service. All costs associated with the necessary repair, and any other cost incurred through the damaged, displacement or otherwise interference with any service will be borne by the Contractor.

The Superintendent's representative reserves the right to have any poles, cables, ducts, etc. re-sited or diverted where he considers it inadvisable to allow them to remain in their present position. The Principal will pay for such re-siting or diversion but the Contractor must give every facility to enable them to carry out the alterations.

Negligence by the Contractor in managing and supervising the protection of services shall be sufficient cause for the Superintendent to direct the Contractor to remove relevant persons from the site or from any activity connected with the works, in accordance with Clause 26 of the General Conditions of Contract.

The Contractor shall have no claim for any extra payment due to interference with, or delay in, the carrying out of the Contract caused by any alteration to a facility, structure or services.

## **1.5 PROTECTION OF EXISTING TREES**

### **1.5.1 Tree Protection zones**

Under the works, all existing trees within the works site and all trees designated as "Tree to be Protected" within or external to the works site will have NO access, plant, equipment, preparation or works whatsoever within their Tree Protection Zone (TPZ), as defined under AS4970-2009 - Protection of Trees on Development Sites, without the approval of the Superintendent.

For any single breach of a TPZ by the Contractor or their representatives for any reason without the approval of the Superintendent, including from wind-blown or water borne materials such as cement, the following penalties will apply:

- Breach of a TPZ \$500.00 Per Event.

Should the Contractor or any of their representatives damage (including canopy, trunk and root system) any tree within a TPZ, including from wind-blown or water borne materials such as cement, the following penalties will apply for any single event:

- Damage to a Protected Tree \$5,500.00 Per Tree Per Event excluding GST.

All costs will apply and be borne solely by the Contractor by reduction in monies payable under the Contract.

### **1.5.2 Works Within Tree Protection Zones**

For approved works within Tree Protection Zones the following applies:

- Do not add or remove topsoil;
- Do not backfill around tree trunks to a height greater than 300mm above the original ground surface. Immediately after back-filling, thoroughly water the full extent of the Tree Protection Zone;
- Do not compact. If compaction is required, for example from the operation of heavy constructional plant, loosen the soil by coring;
- Air Spade all excavations such that root systems are preserved intact and undamaged;
- Open up excavations under tree canopies for as short a period as possible;
- Do not cut tree roots exceeding 25mm diameter unless permitted. Where it is necessary to cut tree roots, use means such that the cutting does not unduly disturb the remaining root system. Immediately after cutting, apply a bituminous fungicidal sealant to the cut surface to prevent the incursion of rot or disease.

## **1.6 WORKS WITHIN ROAD RESERVES**

### **1.6.1 General**

All works undertaken within road reserves shall comply with AS 1742.3 Part 3 – Traffic Control Devices for Works on Roads. The contractor shall ensure all conditions under this standard are satisfied.

Works within reserves under the control of Main Roads WA (MRWA) shall only be undertaken in accordance with an MRWA approved road management plan, approved in writing by the Superintendent prior to commencement of works on site. Notification of impending works on an MRWA controlled road shall be supplied to the relevant MRWA Road Maintenance Contractor as required prior to the works commencing.

## **1.7 WORKS BY OTHERS**

### **1.7.1 General**



The Contractor shall be aware and allow for in their tender price the co-ordination of works that will be built by others during the contract period, within the designated construction site of the works. Works that are being constructed by others are:

- Building Upgrade Works and Associated Landscape (Construction period approx. March 2018-Dec 2018)  
Contractor TBC

The Contractor shall allow for all costs associated with co-ordination of other works as listed included but not limited to programming and co-ordination of site access.

The contractor shall allow contractors undertaking other works sufficient access to the site and site services to ensure the completion of the works to programme.

## 1.8 SETTING OUT OF WORKS

The Contractor shall be responsible for setting out the works in accordance with issued hard copy and electronic set out drawings.

Set out of all works, including but not limited to, all earthworks, all hard works, all soft works, all structures, all above and below ground services, all built elements, and all other works under the contract. Set out works shall be undertaken by a Licensed Surveyor from the dimensions as indicated on the drawings and from electronic drawings issued by the Superintendent for set out purposes. Electronic drawings shall be in ACAD format. Datum to set out for surveyor will be Australian Height Datum and either Perth Coastal Grid or Perth Coastal Grid 94.

The Contractor shall maintain survey pegs undamaged and unaltered until such time as the works have been completed to the satisfaction of the Superintendent. The Contractor shall undertake all re-surveying as necessary to maintain the integrity of the survey set out.

The Contractor will provide:

- White painted timber stakes to define the position of all elements, including services, built elements, trees, paths, paving, garden beds and other construction elements as specified and or on the drawings,
- Relevant levels and bench marks for all set out points, and
- Stakes to define lot boundaries.
- Setting out shall be approved by the Superintendent prior to the commencement of construction.  
All discrepancies between the design levels and the existing site levels shall be brought to the immediate attention of the Superintendent for written direction prior to commencement of works.

Permanent survey pegs which have been damaged or moved during construction shall be reinstated by a Licensed Surveyor nominated or approved by the Superintendent and the cost of such work shall be paid for in full by the Contractor.

Should survey pegs or marks be in the line of construction operations, the Contractor shall advise the Superintendent prior to commencing work to enable their temporary removal or relocation of the works. Co-ordination shall include necessary approvals from Main Roads Department, Council, Service Authorities, other Contractors and the like, to make the contract run smoothly.

Due to the nature of landscape construction works, minor changes in the layout of the works may be instigated by the Superintendent on site.

The Contractor shall allow in their price for changes in the set out of the works. A variation to the contract shall only be issued where any change results in a change in the scope of works.

## 1.9 SAMPLES AND TESTING

### 1.9.1 Sample Schedule

#### 1.9.1.1 General

The contractor shall provide samples and sample panels to the Superintendent for approval for all materials and works as detailed in schedules. No works comprising samples or works items as listed in the schedules shall proceed without approval by the Superintendent.

Subject to approval by the Superintendent, samples and panels may be permitted to be incorporated into the works.

Approval of samples and panels by the Superintendent in no way absolves the Contractor of their obligations and responsibilities under the contract.

#### 1.9.1.2 Sample Schedule



ITEM	QUANTITY	REQUIRED BY
All soils and mulches	500 Grams	three (3) weeks prior to supply.
1.9.2 Sample Panel Schedule		
1.9.2.1 General		

The contractor shall prepare sample panels for the works as detailed in the sample panel schedule. Approved panels, if suitably located, may be permitted to be incorporated into the works to the approval of the Superintendent. Any panel not incorporated into the works shall be fully removed from site and the area made good at the completion of the works.

1.9.2.2 Sample Panel Schedule

ITEM	QUANTITY	REQUIRED BY
All Pavements	2 Square Meters	Three (3) weeks prior to supply.
All Wall Types	2 Linear Meters	Three (3) weeks prior to supply.
All Edge and Kerb Types	2 Linear Meters	Three (3) weeks prior to supply.

1.9.3 Testing

It is the Contractors responsibility to provide all materials, machinery and labour as required for the completion of this project and, to provide verification that all materials and workmanship comply with the requirements of this specification.

In addition it is the Contractors responsibility to undertake, at the Contractors expense, all necessary testing as specified and, as may be requested from time to time by the Superintendent for certification of the works, including materials and workmanship, to confirm conformance with the drawings and this specification.

All costs associated with testing and quantity certification shall be the responsibility of the Contractor and will be included in the appropriate lump sum schedule item.



## 2. TECHNICAL SPECIFICATION

### 2.1 SITE WORKS

#### 2.1.1 General

Provide all machinery and equipment necessary to complete minor excavation, levelling and grading to ensure the works conform to the levels and details in the landscape drawings and specification. All minor earthworks shall be carried out in accordance with finished contours, levels and details indicated on drawings, and to ensure water drains to sumps.

#### 2.1.2 Demolition

Demolish and remove from site all items as required to complete the works as specified including, but not limited to the following items:

- Road and Kerbs
- Paving;
- Planting; and
- Tree including grubbing out to 500mm below finished ground level.

Remove from the site all demolished material and dispose of in the correct manner off site at an approved rubbish tip.

#### 2.1.3 Salvage

The Contractor shall salvage from the works and reuse the following items:

- Irrigation controllers;

The contractor shall remove, store and reinstall all salvaged items to the locations and details as indicated on the drawings. All salvaged items shall be fully protected from damage during demolition, handling and re-installation. Protection shall be the full responsibility of the Contractor.

#### 2.1.4 Site Clean Up

Clean up all areas to be irrigated and landscaped prior to commencement of construction works. Remove from the site all deleterious material and rubbish including but not limited to building rubbish and vegetative refuse and the like and dispose of in the correct manner off site at an approved rubbish.

#### 2.1.5 Weed and Grass Eradication

After site clean up and prior to cut and fill and fine grading totally eradicate all existing grass and weeds throughout the full extent of soft landscape areas in this Contract.

Broad Spectrum Herbicide for the eradication of both weeds and grasses shall be a non-residual herbicide such as Glyphosate (e.g. "Round-Up) or an Approved equivalent.

Selective Herbicide for the eradication of grasses only shall be a non-residual, monocotyledon specific herbicide such as "Fusilade" or an Approved equivalent. Confirm that this product will be effective against the grasses on site prior to commencement of application.

Weed and grass eradication shall be undertaken prior to the commencement of any earthworks or installation of soil conditioner, either by physical or mechanical means or by the use of an approved non-residual herbicide as detailed below in this Specification.

Where physical or mechanical means are used to eradicate grass and/or weeds, excavate to a depth as required, to remove all roots, rhizomes, stolons and any other propagative material, to ensure that re-growth does not occur in the area.

Remove all resultant spoil, including all vegetative material, from site. Where it is necessary to reinstate levels, backfill with approved clean, weed-free sand.

Where the use of a non-residual herbicide is approved to eradicate grass and/or weeds, it shall be applied strictly in accordance with the manufacturers written directions.

Spraying shall only be carried out on windless days and the Superintendent shall be informed when this operation is to be undertaken.

Do not use Glyphosate near any waterways nor use any other herbicides near waterways unless such use is specifically approved by the Waters and Rivers Commission and the Relevant Local Authority.



The use of a herbicide will only be approved whilst there is active translocation occurring in the grass and/or weeds. This can be generally be judged by the presence of visible new growth, however approval shall be solely at the discretion of the Superintendent.

Where the application of herbicide is proposed between the months of April to October the application rate shall be increased by 30% to allow for the lower rate of plant translocation during these months.

The ratio for application shall be chosen to suit the hardiest weed species present.

Herbicide shall not be applied within six (6) hours of rain, nor shall the treated area be watered within six (6) hours of application. Re-apply herbicide, if the treated area is affected by rain or watering within six (6) hours of the initial application.

Following the application of the herbicide, the treated weeds shall be left undisturbed for a minimum of fourteen (14) days.

Following the fourteen (14) day "ingestion" period, the treated area shall be cultivated to a depth of 150mm, to expose all roots, stolons, rhizomes etc, to the atmosphere. The affected area shall be left in this condition for an additional two (2) days, prior to undertaking any further work.

If, in the opinion of the Superintendent, the use of a herbicide may constitute a threat to any existing habitat or vegetation, eradicate weeds by manual means only.

#### 2.1.6 Cut and Fill

##### 2.1.6.1 General

Undertake all excavation, cut and fill or fill operations as may be required for the construction of the works under the contract, including but not limited to excavation and back filling to all retaining walls and excavation for the importation of prepared soils and the like under the contract. No variation shall be issued for any earthworks, cut or fill operations, removal of excess material off site or importation of clean fill as may be required to complete the works under the contract.

##### 2.1.6.2 Imported Fill

Imported fill material shall be a clean granular material, sand as defined in AS1289.3.6.1-1995 and shall have a maximum particle size of 1mm.

Fill sand shall be free from rocks, clay, roots and other vegetative material and any other deleterious material.

Fill sand shall be certified free from all salt, pests, diseases and pathogens, including those not detrimental to plant growth. Independent testing certifying compliance shall be provided to the Superintendent within three days of request.

Place and compact filling in uniform layers of thickness. Layers shall extend for the full width of fill area. The maximum layer thickness generally shall be 150mm compacted. However, greater thicknesses will be permitted subject to the ability of compaction equipment to achieve specified densities. No layer shall be less than 100mm thick compacted. Each layer shall be compacted to not less than Eight (8) blows per 300mm with a Perth sand penetrometer as determined by AS1289.5.2.1-2003.

##### 2.1.6.3 Excess Material

All excess excavated material shall be loaded, hauled and disposed of off site in an approved tip in compliance with statutory requirements.

#### 2.1.7 Fine Grading

Undertake all minor levelling and grading to achieve final design levels to all areas under the works. Supply all the machinery and equipment necessary to complete the works in an efficient manner.

Fine grading shall including all excavation or fill as required for the provision of hard landscape works and prepared soils and mulch to achieve final design levels.

All final grading shall be carried out in accordance with finished contours and levels indicated on drawings, and to ensure water drains to sumps.

Finish all levels to neatly tie in and match up with existing work in adjoining areas to the satisfaction of the Superintendent. This shall include all works associated with roads and pavements carried out previously, to the areas covered by this contract.

Remove from the site all excess excavated material and deleterious material encountered during final grading and dispose of in the correct manner off site at an approved rubbish tip.

## 2.2 SOIL CONDITIONER – 'C-WISE HORTICUTURE'

### 2.2.1 General

After Site Works supply and install to all garden bed and turf grass areas designated on the drawings site soil conditioner, or equivalent approved, to the following specification:





- C-WISE 'HORTICULTURE'

As supplied by:

C-Wise

Nambeelup Road  
Nambeelup, Western Australia

Ph (08) 9581 9582

#### 2.2.2 Standards

Soil conditioner shall comply with AS4419-2003 Soils for Landscaping and Garden Use and AS4454-2003 Composts, Soil Conditioners and Mulches.

The conditioner shall have a pH range of 6.5 to 7.5 (i.e. slightly acid to neutral). The individual elements of this mix shall be combined thoroughly to form a balanced product free from lumps and any other deleterious matter.

#### 2.2.3 Placement

Prior to placement, ensure all base material is clean, free draining and free of all builders rubble, rubbish, deleterious material and contamination. All areas contaminated by the builder or others shall be removed and replace with clean fill sand to the approval of the Superintendent.

Place soil conditioner to a depth of 15mm over the full extent of areas to be conditioned.

Rotary-hoe, or spade dig where necessary, soil conditioner into existing site soil to a depth of 100mm to produce a fully homogeneous mix.

Remove all rubble or other extraneous and deleterious matter exposed as a result of cultivation, including any base course material and dispose of in the correct manner off site at an approved rubbish tip.

After placement, rotary hoeing, smudging boarding and planting, soil conditioner mix shall finish 80mm below adjacent kerbing, paving and turf areas.

#### 2.2.4 Samples

Prior to delivery of prepared soil, submit a 0.01 m<sup>3</sup> sample of the prepared soil to the Superintendent for approval. Allow for three (3) samples of the mix to be laboratory tested for pH, salt and major trace elements. A laboratory certificate may be required to accompany the initial sample at the instruction of the Superintendent. The Superintendent may select a further two (2) samples for analysis during the course of the Works.

All approvals shall be confirmed in writing. Subsequent conditioner used on the project shall conform to this sample. In the event that these tests prove unacceptable, the defective conditioner will be removed and replaced. If further testing is required, the cost of testing shall be borne by the Contractor.

## 2.3 ROCKWORK - BOULDERS

### 2.3.1 General

Transport and install all Principal supplied rocks as indicated on the drawings.

### 2.3.2 Rock Supply

All rocks for use in rockwork shall be Principal supplied and available from:

Kevin Jones

PO Box 229 Dalwallinu

Mobile: 0429 611 035

Rock are located on open farmland at:

1672 Dalwallinu North Road

Dalwallinu WA 6609

## 2.4 'NATURAL EARTH' BLOCK WALLS

### 2.4.1 General

Supply and construct free standing and retaining 'natural earth' block walls as indicated on the drawings including all excavation and back filling.

### 2.4.2 Materials

'Natural Earth' Blocks shall:

- be BGC BLOKSTONE RLB1000NE 'Natural Earth Range' Blocks or equivalent approved;



- be standard size: 1000mm long x 350mm deep x 165mm wide;
- be standard size: 1000mm long x 350mm deep x 350mm wide;
- Seating wall to have 400x200x60mm Brickmakers Flagstone Granite Pavers 'Storm Cloud' Capping;
- Skate wall to have HDG UA Edge;
- be in accordance with AS3700-2014 Masonry Structures;
- have a minimum characteristic compressive strength of 15 Mpa;
- have a minimum density of 2,000 Kg/M3; and
- be free of faults, fractures, chips and hollows.

#### 2.4.3 Tolerances - Units

##### 2.4.3.1 Units

The units shall conform to the following tolerances, to the approval of the Superintendent:

- Uniformity: The maximum deviation in any direction or plane, from a 350mm straightedge placed anywhere on the wearing surface of each unit, shall not exceed 2mm;
- All bevels, chamfers and radii on curved surfaces (including bull noses) shall be continuous, true and even; and
- Squareness of plan: Square angles to each corner.

The contractor shall confirm the unit supplier can comply with all tolerances prior to fabrication.

#### 2.4.4 Tolerances - Walls

For all walls the level at the top of the wall shall be -0mm to +10mm over the length of a 3m straight edge, and no more than -0mm to +15mm overall from the design level.

Wall faces shall not deviate from the design:

- Vertical 0.5% in layback slope
- Horizontal 25mm from design position
- Surface 20mm from 3m straight edge in any direction

#### 2.4.5 Quality Assurance

The Contractor shall produce, and submit weekly to the Superintendent, verified records to confirm that the specification requirements have been achieved as follows:

Component of Works	Type of Certification Required	Quantity
Foundation Compaction	Compaction Certificate	Test per 10m length of wall
Backfill Compaction	Compaction Certificate	Test per layer per 50m <sup>2</sup>
Finished Walls	As-constructed profiles (with tolerances and locations)	1 per 20m length of wall
Limestone Blocks	Density Certificate	3 tests per project
Mortar	Certificate of sand:cement:lime ratio	1 per wall
Anti Graffiti Coating	Supplier's Application Certificate	1 per coat
Independent Certification	Independent Engineering Certification of Retaining Wall Construction	1 per project

#### 2.4.6 Mortar

All cement mortars to be to AS3972-1997 Type GP.

Mortar Mix to be 6 parts sand: 1 part cement: 1 part lime unless otherwise specified.

For masonry more than three (3) courses below ground and in retaining walls use mortar mixes 3 part sand: 1 part cement: 0.25 part lime.



All sands shall be tested and certified as salt free, either independently or by the sand supplier. The contractor shall supply a complying copy of the certification to the Superintendent's Representative for approval prior to ordering materials.

The contractor shall ensure all sands used in the works shall be from the same source and provenance as the tested and certified source.

All cost associated with testing and certification shall be borne by the contractor.

Colour of all mortar to match natural earth block.

#### 2.4.7 Sub-Grade Preparation

##### 2.4.7.1 Moisture Content

Prior to compaction, bring the sub-grade under all walls to within 2% of the optimum moisture content determined to AS1289.5.1.1-2003 (standard) or AS1289.5.2.1-2003 (modified) as applicable to the material.

##### 2.4.7.2 Compaction

The sub grade under all walls shall be fully compacted with a mechanical vibrator to not less than Eight (8) blows per 300mm with a Perth sand penetrometer as determined by AS1289.5.2.1-2003 to a depth of 750mm.

#### 2.4.8 Block Work Workmanship

All block work shall comply to AS3700-2014.

Clean clockwork progressively as the work proceeds, removing mortar and other droppings as they occur. Clean face work to remove mortar smears, stains, discoloration, and the like. Stained or damaged surfaces or edging units shall be replaced not repaired, unless otherwise directed by the Superintendent.

Set out block work so as to maintain the specified rod and bond with bed joints and vertical joints of uniform width, and with the minimum muting of units.

Bonding Pattern shall be stretcher bond, unless otherwise shown on the Drawings.

Work with a jointing tool produce face work Joints: to a dense, smooth surface, to a flush profile.

#### 2.4.9 Waterproofing to Retaining Walls

##### 2.4.9.1 Coating

Location behind all retaining walls to within 100mm of finished ground level or as detailed.

Coating is to be liquid applied single component asphalt latex emulsion which cures by evaporation to form an elastomeric waterproofing membrane.

Waterproofing agent is to be 'ELASTOSEAL' by CROMMELIN CHEMICALS (WA).

##### 2.4.9.2 Application

Apply the emulsion in two coats at the rate of 1m<sup>2</sup> / litre / coat. Allow first coat to cure before application of the second coat. Apply each coat at right angles to each other in accordance with the manufacturer's recommendations.

#### 2.4.10 Wall Backfilling

Compacted structural fill to walls shall achieve a minimum density ratio of 95% of MMDD. Backfilling to be completed progressively in maximum layers of 500mm once the section of wall has achieved an age of 7 days since last block laid.

Contractor shall take care when backfilling to prevent damage to wall.

## 2.5 NATURAL STONE WALLS AND MOUND

### 2.5.1.1 General

Supply and construct natural granite walls and mounds as indicated on the drawings, and to match existing on site, including all excavation and back filling.

### 2.5.1.2 Stone Work Materials

### 2.5.1.3 Natural Stone Mound

Granite shall be:

Random Bush Hills grey granite, faceted exposed faces nominal 100mm – 250mm random laid with no visible mortar.

### 2.5.1.4 Natural Stone Walls

Granite shall be:



Random Bush Hills grey granite, nominal exposed faces 100 x 50mm min to 300 x 300mm max. Random Laid to match existing walls in adjacent car park;

- Be in accordance with AS3700 masonry;
- Have a minimum characteristic compressive strength of 2.7 Mpa;
- Have a minimum density of 1500Kg/M3; and
- Be free of faults, fractures, chips and hollows.

#### 2.5.1.5 Mortar

All cement mortars to be to AS 3972 Type GP.

Mortar Mix to be 6 part sand: 1 part cement: 1 part lime unless otherwise specified.

For masonry more than three (3) courses below ground and in retaining walls use mortar mixes 3 part sand: 1 part cement: 0.25 part lime.

Colour of all mortar to be natural grey.

#### 2.5.1.6 footings

To AS 3600 Section 19.

Ready Mix supply to AS 1379. Deliver in agitating trucks.

Supply concrete to comply with the following performance criteria:

- Class of Concrete: Normal Portland Cement (Type GP);
- Cement: To AS 3972 Type GP; and
- Strength Grade, Slump, Maximum Aggregate Size: 25MPa, 80mm, 20mm.

#### 2.5.1.7 Sub-Grade Preparation

#### 2.5.1.8 Moisture Content

Prior to compaction, bring the sub-grade under all walls to within 2% of the optimum moisture content determined to AS 1289 Method 5.1.1 (standard) or Method 5.2.1 (modified) as applicable to the material.

#### 2.5.1.9 Compaction

The sub grade under all walls shall be fully compacted with a mechanical vibrator to not less than Eight (8) blows per 300mm with a Perth sand penetrometers as determined by AS 1289.E2.1-1977 to a depth of 750mm.

#### 2.5.1.10 granite block setout

Stone bond and set out shall be random, to match existing dwarf granite walls on site.

#### 2.5.1.11 Stone Work Workmanship.

All stone works shall comply to AS 3700, Section 8.

All internal joints to be fully mortared.

Clean stonework progressively as the work proceeds, removing mortar and other droppings as they occur. Clean face work to remove mortar smears, stains, discoloration, and the like. Stained or damaged surfaces or edging units shall be replaced, not repaired, unless otherwise directed by the Superintendent.

Set out stonework so as to maintain the specified rod and bond with bed joints and vertical joints of uniform width, 10mm minimum to 20mm maximum.

## 2.6 ALUMINIUM

### 2.6.1 Introduction

This specification applies to the fabrication of aluminium components for Entry Signage

### 2.6.2 Referenced documents

Table 3 lists documents referenced in this technical specification.

Reference	Title
AS 1231	Aluminium and aluminium alloys – Anodic oxidation coatings



AS 1664	Aluminium Structures
AS/NZS 1665	Welding of Aluminium Structures
AS/NZS 1734	Aluminium and aluminium alloys – Flat sheet, coiled sheet and plate
AS/NZS 1865	Aluminium and aluminium alloys – Drawn wire, rod, bar and strip
AS/NZS 1866	Aluminium and aluminium alloys – Extruded rod, bar, solid and hollow shapes
AS/NZS 1867	Aluminium and aluminium alloys – Extruded rod, bar, solid and hollow shapes
AS 1874	Aluminium and aluminium alloys – Ingots and castings
AS/NZS 18273	Welding consumables – Wire electrodes, wires and rods for welding of aluminium and aluminium alloys – Classification
AS/NZS 3834.2	Quality requirements for welding – Fusion welding of metallic materials – Comprehensive quality requirements
AS/NZS 3834.3	Quality requirements for welding – Fusion welding of metallic materials – Standards quality requirements
AS/NZS ISO 9001	Quality management systems - Requirements
ISO 3834	Quality requirements for fusion welding of metallic materials
CTP – SM01	Procedures Manual: Register for Approved Fabricators of Steelwork, Aluminium and Stainless Aluminium Components

### 2.6.3 Quality system requirements

#### 2.6.3.1 Hold Points and Witness Points

General requirements for Hold Points and Witness Points are specified in Clause 5.2 of MRTS01 Introduction to Technical Specifications.

The Hold Points and Witness Points applicable to this specification are summarised in Table 4.1. There are no Milestones defined in the table.

#### Hold Points and Witness Points

Clause	Hold Point	Witness Point
6	1. Verification of welding procedure sheets for all welded components	
7.1	2. Approval of test certificates for aluminium	Test of aluminium where test certificates are not available
8.4.4	3. Verification of butt weld preparations	
8.4.5	4. Supply of Weld Maps	
8.4.6	5. Inspection of completed product	
8.5.5	6. Verification of butt weld preparations for product manufactured outside Australia	
8.5.6	7. Supply of weld maps for product manufactured outside Australia	
8.5.7	8. Verification of completed product manufactured outside Australia	

### 2.6.4 Construction procedures

The Contractor shall prepare documented procedures for all construction processes in accordance with the quality system requirements of the Contract.

Construction procedures for those activities listed in Table 4.2 shall be submitted to the Administrator in accordance with the quality system requirements of the Contract.

Table 4.2 – Construction procedures



Clause	Conformance Requirement
6.4.3	Weld procedure sheet

Documented procedures are critical as receipt is often accepted as a defacto approval. In every case a response should be made to the Contractor acknowledging receipt of the procedures.

#### 2.6.4.1 Conformance requirements

The conformance requirements which apply to lots of work covered by this specification are summarised in Table 4.3.

Table 4.3 – Conformance requirements

Clause	Conformance Requirement
7	Tolerances
8	Coatings

#### 2.6.5 Registered fabricator

Aluminium fabrication shall only be fabricated by an approved aluminium fabricator. Registration as an approved fabricator will be reviewed periodically or earlier if unsatisfactory performance is reported.

##### 2.6.5.1 Registered fabricator for aluminium components – in Australia

To be registered as an approved fabricator for aluminium components a fabricator shall:

- a) Operate a quality system certified to AS/NZS ISO 9001 or ISO 3834. The system will be audited by Transport and Main Roads to ensure that fabricators are working as stated in their system requirements and the system conforms to the requirements of Transport and Main Roads contracts.
- b) Demonstrate technical conformance to MRTS79 Fabrication of Aluminium Components.

##### 2.6.5.2 Registered fabricator for aluminium components – outside Australia

To be registered as an approved fabricator for aluminium components, a fabricator shall:

- a) Operate a quality system certified to AS/NZS ISO 9001 and ISO 3834. The system will be audited by an Auditor acceptable to Transport and Main Roads. The Auditor shall ensure that the fabricators are working as stated in their system requirements and the system conforms to the requirements of Transport and Main Roads contracts.
- b) Demonstrate technical conformance to MRTS79. The technical capability shall be audited by an Auditor acceptable to Transport and Main Roads. The Auditor shall ensure that the fabricators are able to comply with the requirements of MRTS79.

#### D.1.01 Welding procedure sheets

The Contractor shall supply the Welding Procedure Specification Sheets for the welding to be undertaken, in accordance with AS 1665 and a copy submitted to the Administrator.

Welding shall not be carried out until the appropriate Welding Procedure Specification Sheet has been approved by the Administrator. Hold Point 1

Appendix B shows a typical weld procedure sheet for the weld undertaken on an aluminium balustrade panel. The weld procedure outlines the way the welded joint needs to be prepared and the welding parameters for the placement of the welds.

The Administrator is required to ensure that the weld procedures supplied by the fabricator reflect the welding the designer has specified on the drawings. TMR Structures can review the weld procedures if the Administrator is unsure of the technical requirements.

#### 2.6.6 Materials

##### 2.6.6.1 Aluminium

Aluminium shall comply with the following standards, as relevant:

- a) Plate AS/NZS 1734
- b) Drawn bar and rod AS/NZS 1865
- c) Extruded bar and rod AS/NZS 1866
- d) Tube AS/NZS 1867



e) Castings AS 1874.

The grade of aluminium and/or the manufacturer's part number for fittings shall be as shown in the Drawing.

2.6.6.2 Welding electrodes

Welding electrodes shall be compatible with the parent metal and shall be classified and identified in accordance with the provisions of AS/NZS 18273.

2.6.6.3 Bolts, nuts and washers

Bolts, nuts and washers shall be stainless steel Grade 316 unless noted otherwise in the Drawing. Stainless steel bolts and nuts shall have an ISO coarse pitch metric thread. Bolts shall be supplied in accordance with MRTS78A Fabrication of Structural Stainless Steelwork.

2.6.7 Fabrication

2.6.7.1 General

All aluminium components shall be fabricated in accordance with AS 1664 and AS/NZS 1665.

2.6.7.2 Holes

All holes shall finish accurately to size and in the position shown in the Drawing and shall be cleaned of all burrs and rough edges.

The axis of the holes shall be at right angles to the surface through which they pass, except where otherwise shown in the Drawing.

All holes shall be drilled. Punching of holes shall not be permitted.

2.6.7.3 Bending of aluminium plate or sheet

Bending of aluminium plate or sheet shall be carried out in a press to produce clean straight bends with no distortion in the adjacent flat surfaces.

Prior to bending, any rags present on sheared edges shall be removed by grinding or filing to prevent the possibility of plate splitting on the outside corner.

2.6.7.4 Welding

GENERAL

Welding shall be carried out in accordance with the provisions of AS/NZS 1665 except as amended by the following Clauses.

WELDING SUPERVISOR

All work shall be carried out under the supervision of a welding supervisor who shall, in the opinion of the Administrator, conform to conditions (a) to (f) of Clause 4.5.2 of AS/NZS 1665.

All fabricators are required to have a welding supervisor who is responsible for the daily supervision of fabrication. In order for a fabricator to gain approval as an approved supplier Structural Materials ensures all welding supervisors are competent to supervise the fabrication of works.

Therefore the Administrator's role is to ensure that the welding supervisors are performing their role within the fabricator's organisation with the inspection of product.

WELDING PERSONNEL

All welders shall satisfy conditions A and B of Clause 4.5.3 of AS/NZS 1665.

WELDING

Not less than three working days prior to any welding commencing on any butt weld joints, the Fabricator shall notify the Administrator that the butt weld preparations are available for inspection. The Administrator shall ensure the butt weld preparations are prepared in accordance with the weld procedure sheets. Hold Point 3

Some fabricators in the past were not preparing the butt weld in accordance with the drawing requirements. Some fabricators also did not understand the welding symbols or felt the joint did not require the weld specified. This problem has been greatly reduced with the implementation of the Approved Suppliers List.

When fabrication commences, the welding procedure sheets are used to ensure the welded joint is prepared correctly and the welder is following the weld settings nominated on the weld procedure.

If the joint is not prepared in accordance with the procedure, then the Administrator shall order the fabricator to prepare the welded joint in accordance with the weld procedure sheet.

When the welding is being undertaken and the welder operates outside the parameters outlined on the



weld procedure sheet, then the Administrator shall do one of the following:

- order the welder to change back to the welding settings on the weld procedure sheet, or
- order all work to cease and the welder undertake a macro test using the revised welding parameters.

If you are unsure of the requirements, we recommend contacting Structures.

It is also recommended that when a full penetration butt weld is specified, the Administrator ensures that a full penetration butt weld has been placed. For all full penetration butt welds the first weld run

"root run" should be clearly visible when you look on the inside of the member.

#### WELD MAPS

The fabricator shall provide a weld map outlining the welding undertaken in the manufacture of the Aluminium components. The weld map shall outline the following:

- weld procedure number used for the welding undertaken
- welder's initials or welding number for each weld undertaken
- welding supervisor's initials or welding number for each weld inspected.

The weld map shall be submitted to the Administrator for approval before the product is dispatched for protective coating. Hold Point 4

It is critical that all fabricated aluminium components are documented correctly. It is important to record which staff member welded a joint and which staff member checked a particular joint. This section outlines the conformance requirement for the supply of the conformance documentation. This section is used to track product after the project is completed. This weld map will be used to validate

which welding staff were used for the fabrication of product in the event of a structural failure.

#### INSPECTION OF COMPLETED PRODUCT

Not less than 3 working days prior to any products being dispatched for protective coating. The fabricator shall notify the Administrator that product is available for inspection. For all aluminium products the Administrator shall ensure the following inspections are undertaken: Hold Point 5

- 100% of all products shall be visually examined.
- Any welding defects found during the inspection shall be repaired prior to the application of the protective coating.

Once all the welding is completed the welding is inspected to ensure that the welds are the correct size and the welds are free of weld defects. Figure 1 shows the way to inspect a fillet weld leg length which is the correct size.

One of the most common weld defects is the lack of fusion of the weld to the parent material - Refer to Figure 3 and Figure 4.

If there is a concern that the welding has a lack of fusion weld defect, it is recommended that the weld is inspected using dye penetrant testing. The dye penetrant highlights any weld defects.

#### QUALITY OF WELDS

Permissible levels of imperfection in fillet and butt welds shall conform to weld category B as defined in AS/NZS 1665.

#### 2.6.8 Welding undertaken outside Australia

##### 2.6.8.1 General

Welding shall be carried out in accordance with the provisions of AS/NZS 1665 except as amended by the following Clauses:

##### 2.6.8.2 Supervision of the overseas fabrication

All aluminium fabrication work undertaken overseas shall be supervised by the Administrator or by a person nominated by the Administrator who shall, in the opinion of Director (Bridge Construction, Maintenance and Asset Management), conforms to the following requirements:

- Clause 4.5.2 (a) of AS/NZS 1665
- Is from a culturally different back ground to the country undertaking the fabrication.

##### 2.6.8.3 Welding supervisor - outside Australia

All work shall be carried out under the supervision of a welding supervisor who shall, in the opinion of the Administrator, conform to at least one of the requirements of Clause 4.5.2 (a) to (c) of





AS/NZS 1665.

#### 2.6.8.4 Welding personnel - outside Australia

All welders shall satisfy conditions A and B of Clause 4.5.3 of AS/NZS 1665. All welding personnel require macro re-qualification on a 12 monthly basis for each weld procedure.

To ensure that the welders are suitably qualified for the welding to be undertaken on TMR projects

TMR requires all Structural Purpose (SP) welding to be undertaken by a welder who has a trade qualification equivalent to an Australian trade qualification.

#### 2.6.8.5 Welding – outside Australia

Prior to any welding commencing on any butt weld joints, the Fabricator shall notify the Administrator that the butt weld preparations are available for inspection. The Administrator shall ensure that the butt weld preparations are prepared in accordance with the weld procedure sheets. Hold Point 6

#### 2.6.8.6 Weld Maps – outside Australia

The fabricator shall provide a weld map outlining the welding undertaken in the manufacture of the aluminium components. The weld map shall outline the following:

- weld procedure number used for the welding undertaken welder's initials or welding number for each weld undertaken
- welding supervisor's initials or welding number for each weld inspected.

The weld map shall be submitted to the Administrator for approval before the product is dispatched for protective coating. Hold Point 7

#### 2.6.8.7 Inspection of completed product manufactured outside Australia

All product supplied from an overseas fabricator shall be inspected by the Administrator in Australia at a location suitable to Transport and Main Roads prior to the application of the protective coating.

Hold Point 8

The Contractor shall be responsible for covering all costs associated with carrying out the following inspections of the completed product:

- a) 100% of all products shall be visually examined
- b) A minimum of 50% of all welds shall be Non Destructively Tested. If any welds are found to be defective then 100% of the welds shall be Non Destructively Tested.

The Superintendent reserves the right to increase the minimum level of Non Destructive Testing.

Any welding defects found during the inspection shall be repaired by the Superintendent prior to the application of the protective coating.

#### 2.6.9 Quality of welds

##### 2.6.9.1 General

Permissible levels of imperfection in fillet and butt welds shall conform to weld category B as defined in AS/NZS 1665.

Once product is fabricated by an overseas fabricator there is a requirement for the completed product to be inspected in Australia prior to the application of a protective coating. The reason the product must be supplied without any protective coating is so non destructive testing of the welds can be performed.

#### 2.6.10 Tolerances

##### 2.6.10.1 General

The tolerances applicable to aluminium components other than bridge barrier shall be as stated in AS/NZS 1664.

#### 2.6.11 Coatings

##### 2.6.11.1 Powder coat

2.6.11.2 Top Coat using DULUX Powder coat to Manufacturers Recommendation.

##### 2.6.11.3 Anodised

Perforated sheets to be Anodised Aluminium to Australian Standards.



#### 2.6.11.4 Appendix A – Administrators checklist

To aid Administrators and ensure they are supplied with the correct information during the fabrication of aluminium components, a checklist has been developed. Table 1 outlines the Administrators check list.

Table 1 Administrator checklist

Hold Point Release	Reference	Comment	Yes/No
Weld Procedure Sheets	Clause 6 Hold Point 1	The review of the weld procedure sheets to ensure they correspond to the welding outlined on the drawings	
Material Test Certificates	Clause 7.1 Hold Point 2	Ensure the material test certificate: <ul style="list-style-type: none"> <li>• match the materials supplied the grade of the materials match the grade specified on the drawings</li> <li>• the chemical composition is within the specification of the Australian Standard</li> <li>• the Yield and Ultimate strength are within acceptable bounds as specified by the grade required</li> <li>• the elongation with above the minimum limit in the Australian Standards, and</li> <li>• the Charpy V-Notch impact testing is outlined on the test certificate for Hollow sections</li> </ul>	
Inspection of all butt weld preparations	Clause 8.4.4 Hold Point 3	The butt welds are inspected prior to welding commencing	
Weld Maps	Clause 8.4.5 Hold Point 4	The fabricator is responsible for providing a document which outlines the following: <ul style="list-style-type: none"> <li>• which weld procedure was used</li> <li>• who welded each joint</li> <li>• who checked the welded joint</li> </ul>	
Inspection of Completed Product	Clause 8.4.6 Hold Point 5	Product welded shall be inspected by the Administrator before being dispatched for protective coating	
Inspection of all butt weld preparations – outside Australia	Clause 8.5.5 Hold Point 6	The butt welds are inspected prior to welding commencing	
Weld Maps – outside Australia	Clause 8.5.6 Hold Point 7	The fabricator is responsible for providing a document which outlines the following: <ul style="list-style-type: none"> <li>• which weld procedure was used</li> <li>• who welded each joint</li> <li>• who checked the welded joint</li> </ul>	
Inspection of Completed Product – outside Australia	Clause 8.5.7 Hold Point 8	Product welded outside Australia is inspected by the Administrator in Australia before the application of the protective coating. All costs associated with the inspection are to be covered by the Contractor.	

#### 2.6.12 Perforated Aluminium

Supply and install, including fixings, rolling and structural certification "perforated aluminium screening" where indicated on the drawings.



### 2.6.13 Design Criteria

The panels and their fixings shall be designed and certified by a suitably qualified engineer (eligible for membership of IEAust) in accordance with AS/NZS 1170 and the relevant material design standards.

Serviceability limit state criteria shall be in accordance with standard industry practice to ensure fit-for-purpose performance. Mid-span screen deflection shall not exceed span/250 in response to serviceability wind.

### 2.6.14 Shop Drawings

Submit structurally certified shop drawings (4 copies) to the Superintendent for examination.

Obtain certified examined drawings from the Superintendent before manufacture or installation commences for all perforated aluminium fabricated items including all fittings and fixings and the like.

Submit shop drawings in a timely manner, allowing a minimum of 14 days for examination prior to return.

Shop drawings shall contain reference to all work, including all elements, transportation lugs, fittings and fixings as required by all trades.

All elements under the works including all fittings and fixings shall be referenced as to material, dimension and location within the works. Show on drawings single line schematics, plans, elevations, dimensions, equipment, fittings and fixings and the like detail, as required to fully describe the works to be supplied, installed and commissioned

Comments on "examined" shop drawings will apply to general principles of design only. Examination of the drawings by the Superintendent or Relevant Consultant will in no way relieve the Contractor's responsibility for any errors, omissions or necessity of furnishing such workmanship or materials as may be required for the completion of these works in accordance with the contract documents.

## 2.7 STEELWORK

### 2.7.1 Standards

The following standards shall apply to this Section:

AS1074-1989	Steel tubes and tubulars for ordinary service
AS1214-0983	Hot-dip galvanized coatings on threaded fasteners
AS1397-2001	Steel sheet and strip - Hot-dipped zinc-coated or aluminium/zinc-coated
AS 1428	Design for access and mobility
AS1450-2007	Steel tubes for mechanical purposes
AS 1538	Cold-formed steel structures code
AS 1554	Structural steel welding Part 1 - Welding of steel structures
AS1627.5-2003	Metal finishing - Preparation and pre-treatment of surfaces
AS/NZS4680:2006	Hot-dipped galvanized coatings on ferrous articles
AS 1725	Galvanised rail-less chain wire security fences and gates
AS 2105	Inorganic zinc silicate paint
AS2423-2002	Galvanised wire fencing products
AS 3715	Metal finishing - Thermoset powder coatings for architectural applications
AS 4100	Steel structures.

### 2.7.2 Shop Drawings

Submit shop drawings (4 copies) to the Superintendent for examination.

Obtain certified examined drawings from the Superintendent before manufacture or installation commences for all steel work and all steel fabricated items including all fittings and fixings and the like.

Submit shop drawings in a timely manner, allowing a minimum of 14 days for examination prior to return.

Shop drawings shall contain reference to all work, including all elements, galvanising ventilation holes, transportation lugs, fittings and fixings as required by all trades.

All elements under the works including all fittings and fixings shall be referenced as to material, dimension and location within the works. Show on drawings single line schematics, plans, elevations, dimensions, equipment, fittings and fixings and the like detail, as required to fully describe the works to be supplied, installed and commissioned



Comments on “examined” shop drawings will apply to general principles of design only. Examination of the drawings by the Superintendent or Relevant Consultant will in no way relieve the Contractor’s responsibility for any errors, omissions or necessity of furnishing such workmanship or materials as may be required for the completion of these works in accordance with the contract documents.

### 2.7.3 Transportation and Installation

The Contractor shall allow for all costs and administration associated with the transportation, craning and installation of all structures including any individual elements thereof, including the protection of all existing facilities, services and vegetation.

The Contractor is deemed to have, prior to tender, inspected the site in regard to transportation and installation of all works, in accordance with the tender preliminaries.

### 2.7.4 Materials

#### 2.7.4.1 Metals

Use metals suited to their required function, finish and method of fabrication, in sections of adequate strength and stiffness for their purpose.

#### 2.7.4.2 Steel

The contractor shall guarantee that all steel shall have silica levels of:

$$\% \text{ Si} < 0.04\%$$

$$\% \text{ Si} + (2.5 \times \% \text{ P}) < 0.09\%$$

The contractor shall guarantee that all steel shall be of like provenance and composition prior to galvanising.

#### 2.7.4.3 Stainless Steel

All Stainless Steel shall be Grade 4 Linished standard.

### 2.7.5 Workmanship

#### 2.7.5.1 Prefabrication

Fabricate and pre-assemble items in the workshop wherever practicable.

#### 2.7.5.2 Surfaces and Edges

Keep clean, neat and free from all imperfections including burs and indentations.

Remove all imperfections including all bumps and indentations, including all identification markings.

Remove all sharp edges without excessive radiusing.

#### 2.7.5.3 Joints

Fit joints to an accuracy appropriate to the class of work. Finish visible joints made by welding, brazing or soldering by grinding, buffing or the like methods appropriate to the class of work before painting, galvanizing, or the like further treatment.

Self-finished metals: Free of surface colour variations, after jointing.

#### 2.7.5.4 Tube Bends

Form bends in tube without unduly deforming the true cross section.

#### 2.7.5.5 Colours

Match colours of sheets, extrusions and heads of fastenings in colour finished work.

#### 2.7.5.6 Metal Separation

Separate incompatible metals by concealed interlayer’s of suitable materials and thicknesses.

#### 2.7.5.7 Thermal Movement

Make provision, sufficient to prevent harmful effects, for thermal movement in joints and fastenings.

#### 2.7.5.8 Steel Welding

To AS/NZS1554 Finished welds shall be free of surface and internal cracks, slag inclusion, and porosity.

### 2.7.6 Structural Steel

#### 2.7.6.1 Fabrication and Erection

Steel structures to AS4100-1998.

Cold formed steel structures to AS/NZS4600:2005.

#### 2.7.6.2 Beam Camber



If beam members have a natural camber within the straightness tolerance, fabricate and erect them with the camber up.

## 2.7.7 Fastenings

### 2.7.7.1 General

Provide fastenings, including bolts, anchors, screws, rivets, welds, and the like:

- sufficient to ensure the rigidity of the assembly;
- of types appropriate to the work;
- in materials of mechanical strength and corrosion resistance at least equal to that of the lowest resistant metal joined;
- capable of transmitting the loads and stresses imposed; and
- installed so as to prevent galvanic corrosion.

## 2.7.8 Protection

### 2.7.8.1 Generally

Protect metalwork during the work under the Contract as necessary to prevent damage or defacement.

## 2.7.9 Galvanized Coatings

### 2.7.9.1 General

Provide hot dipped galvanized coating to all steelwork including all fittings and fixings.

All galvanised coatings shall be of an Architectural Finish standard.

Finish shall be free from runs, dags, spikes, uneven surfaces and roughness or other defects that could affect appearance.

All HDG steel shall be inspected by the Superintendent's Representative, or Clerk of Works, at the galvaniser's premises and be approved for use prior to dispatch.

### 2.7.9.2 Fabrication

Complete welding, cutting, drilling and other fabrication before coating.

### 2.7.9.3 Surface Preparation

(General ferrous articles): Pickle to AS1627.5-2003

### 2.7.9.4 Coatings

Unless otherwise specified, zinc coatings shall be by the hot dip method as follows:

Ferrous articles generally: To AS/NZS4680:2006

Ferrous wire: To AS/NZS4680:2006, Section 4, Type A, unless otherwise specified.

Steel sheet: To AS1397-2001, coating class as specified for the particular item.

Threaded fasteners: To AS1214-1983.

### 2.7.9.5 Damaged Coatings

Repair damaged coating areas by power tool cleaning to AS1627.2-2002 and apply organic single component zinc coating of minimum 92% (weight) zinc in the dry layer cold galvanizing to provide protection equal to the original coating.

## 2.7.10 Inorganic Zinc Silicate Paint Coatings

### 2.7.10.1 Fabrication

Complete welding, cutting, drilling and other fabrication before coating.

### 2.7.10.2 Surface Preparation

Abrasive blast clean the metalwork, Class 2.5 to AS1627.4-2005

For galvanized steel finishes completely remove dipping residue by alkaline degreaser or

Detergent as recommended by the paint supplier.

### 2.7.10.3 Coating

Type 3 inorganic zinc silicate paint to AS/NZS3750.15:1998.

Dry film thickness (minimum): 75 microns.

### 2.7.10.4 Damaged Coatings



Repair damaged coating areas by power tool cleaning to AS1627.2-2002 and applying inorganic zinc silicate paint complying with AS/NZ3750.15 to provide protection equal to the original coating and a minimum dry film thickness of 100um.

#### 2.7.11 Powder Coatings

##### 2.7.11.1 Fabrication

Complete galvanized coating before powder coating.

##### 2.7.11.2 Coating

Prime using DULUX 953 Galvanize Primer to Manufacturers Recommendation, or equivalent approved.

Top Coat using DULUX colour as detailed to Manufacturers Recommendation, or equivalent approved.

##### 2.7.11.3 Standards

All coatings to comply with BS6497 (1984)

##### 2.7.11.4 Damaged Coatings

Repair damaged coating areas to Manufacturers Recommendation.

#### 2.7.12 Below Ground Steel

All steel works below finished ground level shall be coated with two (2) coats of asphaltic paint, to be approved by the Superintendent's Representative. Asphaltic coating shall be applied to the manufacturer's recommendations for site specific materials, conditions and use.

## 2.8 CONCRETE WORK – STRUCTURAL

### 2.8.1 Scope

Concrete works include all concrete footings, slabs and cavity fill.

### 2.8.2 Transportation and Installation

The Contractor shall allow for all costs and administration associated with the transportation, craning and installation of all structures including any individual elements thereof, including the protection of all existing facilities, services and vegetation.

The Contractor is deemed to have, prior to tender, inspected the site in regard to transportation and installation of all works, in accordance with the tender preliminaries.

### 2.8.3 Standards

The following standards shall apply to this Section:

AS1012 Methods of testing concrete

AS1379-2007/AS1379-2007 Ready mixed concrete (metric units)

AS/NZS2904:1995 Damp-proof courses and flashings

AS3600-2001 Concrete structures

AS3610-1995 Formwork for concrete

AS3972-1997 Portland and blended cements.

AS/NZS 4586 Classifications in Selecting Pedestrian Surface Materials.

### 2.8.4 Inspection

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

- Completed form work
- Reinforcement fixed in place
- Placing of concrete.

### 2.8.5 Testing

Concrete supplied for the Works shall be subject to production assessment and testing to AS1379-2007, Paragraph B3.

Testing Authority: Testing and assessment of concrete and concrete materials shall be carried out by an authority registered with the National Association of Testing Authorities Australia (NATA).

Production Assessment Records: To AS1379-2007. Register the project in accordance with AS1379-2007. Maintain records and reports of test results required by AS1012. Make the records available on request.

Rejection shall be to AS3600-2001 Clause 19.1.7. Remove rejected concrete from the site.



## 2.8.6 Materials

### 2.8.6.1 Concrete Materials

To AS3600-2001 Section 19.

Ready Mix supply to AS1379-2007. Deliver in agitating trucks.

Supply concrete to comply with the following performance criteria:

- Class of Concrete: Normal Portland Cement (Type GP).
- Cement: To AS3972-1997AS3972-1997AS3972-1997 Type GP,
- Strength Grade, Slump, Maximum Aggregate Size:
- Slabs on Ground: 32MPa, 80mm, 20mm.
- Footings: 25MPa, 80mm, 20mm.
- Blinding: 15MPa, 80mm, 20mm
- Cavity Fill: 25MPa, 200mm, 14mm.

### 2.8.6.2 Form Work

To AS3600-2001 Clause 19.6.

Design and construct form work so that concrete, when cast in the forms, will have the dimensions, shape, location and surface finish required by the Contract.

Dimension tolerances to AS3600-2001 Clause 19.5.

Form work removal to AS3600-2001 Clause 19.6.

### 2.8.6.3 Reinforcing

To AS3600-2001 Clause 19.2.

Supply and fix reinforcement, including the necessary tie wires, support chairs, spacers and the like.

Reinforcement shall be readily identifiable as to grade and origin.

Submit for approval details of proposed bending and splicing not shown on the Drawings.

## 2.8.7 Workmanship

### 2.8.7.1 Sub Grade

Compact sub-grade to the full extent of all footings and slabs on ground to a minimum of 8 blows per 300mm as measured with a Perth Sand Penetrometer to a minimum depth of 750mm.

### 2.8.7.2 Placing and Compaction

To AS3600-2001 clause 19.1.3.

Use placing methods which minimise plastic settlement and shrinkage cracking.

Movement may be by means of suitable clean chutes, troughs or pipes. Do not use water to facilitate the movement.

Place concrete in layers such that each succeeding layer is blended into the preceding one by the compaction process.

Concrete exposed to rain before it has set, including during mixing, transport or placing, shall be liable to rejection.

Use immersion and screed vibrators accompanied by hand methods as appropriate to remove air bubbles and compact the mix. Ensure concrete is fully compacted and entrapped air removed, but avoid over vibration that may cause segregation. Do not allow vibrators to come into contact with partially hardened concrete, or reinforcement embedded in it. Do not use vibrators to move concrete along the forms.

### 2.8.7.3 Curing

To AS3600-2001 clause 19.1.5.

Protect fresh concrete from premature drying and excessively hot or cold temperatures. Maintain the concrete at a reasonably constant temperature with minimum moisture loss for the curing period.

Commence curing immediately after finishing, and cure continuously for not less than seven (7) days.

Submit for approval the proposed method of curing, which may include the following:

- Ponding or continuous sprinkling with water (moist curing)
- An impermeable membrane



- An absorptive cover kept continuously wet.

#### 2.8.7.4 Finish

All off form step tread and pavement surfaces shall comply with AS/NZS 4586 Classifications in Selecting Pedestrian Surface Materials.

## 2.9 TIMBER WORK

### 2.9.1 Transportation and Installation

The Contractor shall allow for all costs and administration associated with the transportation, craning and installation of all structures including any individual elements thereof, including the protection of all existing facilities, services and vegetation.

The Contractor is deemed to have, prior to tender, inspected the site in regard to transportation and installation of all works, in accordance with the tender preliminaries.

### 2.9.2 Protection

Protect timber and timber products stored on site from excessive moisture and weather.

### 2.9.3 Identification

#### 2.9.3.1 Generally

Identify all timber by one or more of the following methods:

Brand the timber to show the grade, source of grading, and other branding or marking requirements of the applicable Australian standard.

Brand all structural timber, under the authority of a recognised quality assurance program applicable to the product. Include the following data:

Stress Grade

Method of Grading

"Seasoned" or "s"

The certification mark of the quality assurance program.

#### 2.9.3.2 Certification

Provide a supplier's certificate (which may be included on an invoice or delivery docket) showing that timber for use in the Works complies with the Specification.

#### 2.9.3.3 Inspection

Where neither branding nor certification is adopted, engage and pay for an independent testing authority to inspect the timber and certify that it complies with the Specification.

### 2.9.4 Materials

#### 2.9.4.1 Timber Materials

##### 2.9.4.1.1 *Moisture Content*

Make milled or dressed products from timbers seasoned, when tested to AS1080.1:1997

to within 3% of the equilibrium moisture content (EMC) appropriate to the timber and its intended conditions of use;

to not greater than 15% nor less than 10% moisture content; and

with no more than 3% difference between any two pieces in any one group.

Submit evidence of moisture content if requested.

##### 2.9.4.1.2 *Timber Grades and Finishes*

The grades of all natural and sawn timber specified shall be as defined in Australian standards where applicable, and unless otherwise specified shall be those normally used in the type of work for which the timber is intended.

All timber shall be hardwoods structurally visually stress-graded F14 to AS2082-2007, fully seasoned.

All timber sleepers shall be new, first Grade.

All logs shall be debarked finish and free of faults and hollows.

All swan timber shall be square dressed.

##### 2.9.4.1.3 *Timber Species*





Timber species shall be *Eucalyptus marginate* (Jarrah) Unless otherwise noted on the drawings. No timber substitutions shall be approved. Provide source certification upon the request of the Superintendent.

#### 2.9.4.1.4 *Dimensions*

Unless otherwise specified, the actual cross-sectional dimensions of timbers may vary from the dimensions stated herein or shown on the Drawings by the tolerances (if any) permitted in relevant Australian standards.

Framing timbers: Tolerances to AS1684.2-2006.

Finished Sizes: Use dressed or milled timbers with actual dimensions which are not less than the stated dimensions, except for dimensions qualified by a term such as "nominal" or "ex" or equivalent, to which normal machining and shrinkage tolerances shall apply.

#### 2.9.4.2 *Fastenings*

##### 2.9.4.2.1 *Generally*

Provide fixings and fastenings as necessary to transmit the loads imposed and to ensure the rigidity of the assembly.

Fastenings (for Timber Engineering Purposes): To AS1720.1-1997.

Steel nails and decking spikes: To AS2334-1980.

Nailing in frames: To AS1684.2-2006, Section 6.

Bolts: To AS111.1-2000.

Washers: To AS1237.1-2002. Provide washers to the heads and nuts of bolts and coach screws.

Masonry Anchors: Purpose-made proprietary expansion or chemical types.

##### 2.9.4.2.2 *Corrosion Protection*

Galvanise steel fastenings to AS1214-1983 or AS/NZS4680:2006 as appropriate where exposed to weather.

#### 2.9.5 *Workmanship*

##### 2.9.5.1 *Generally*

Perform necessary operations and provide the accessories necessary for the completion of woodwork items. Ease and adjust moving parts, lubricate hardware, and leave the completed work in a sound, clean, working condition.

##### 2.9.5.2 *Unseasoned Timber*

No unseasoned timber to be used.

##### 2.9.5.3 *Bolting*

Ensure that bolts and similar fixings are tight at Practical Completion.

#### 2.9.6 *Finish*

Finish all timber using:

CABOTS Deck and Exterior Stain 'Ironwood' to Manufacturers Application Rate, or equivalent approved.

ORGANOIL Garden Furniture Oil: Two (2) coats to Manufacturers Application Rate, or equivalent approved.

PAINTING TO TOP OF JARRAH UPRIGHTS: Dulux Exterior to Manufacturers Application Rate, or equivalent approved

## 2.10 **STONE PITCHING**

### 2.10.1 *General*

Supply and place Stone pitching to the areas as indicated on the drawings.

### 2.10.2 *Preparation of Sub-Grade*

Ensure the sub-grade is clean, free of all builders rubble, rubbish, deleterious material and contamination. All areas of sub-grade contaminated by the builder shall be removed and replace to the approval of the Superintendent.

The Contractor shall trim the sub-grade to ensure the achievement of levels indicated on the drawings after construction completion. Sub-grade shall be compacted to not less than Eight (8) blows per 300mm with a Perth sand penetrometer as determined by AS1289.5.2.1-2003 to a minimum depth of 400mm.

Any areas which require fill or are over excavated for trenching etc shall be filled by the landscape Contractor to achieve the levels shown on the drawings with a maximum tolerance  $\pm 50$ mm and compacted as specified.

### 2.10.3 *Stone Pitching*

All rocks for use in rockwork shall be Principal supplied and available from:



Kevin Jones

PO Box 229 Dalwallinu

Mobile: 0429 611 035

Rock are located on open farmland at:

1672 Dalwallinu North Road

Dalwallinu WA 6609

Stone Pitching shall:

- Be free of fractures and hollows
- Be type and Size: Generally rounded, 150mm Dia. minimum to 450mm Dia. maximum,

Cement mortars to be to AS3972-1997 Type GP. Mortar Mix to be 9 part sand: 1 part cement: 2 part lime.

Colour of all mortar to to match stones

#### 2.10.4 Stone Work Workmanship

All stone works shall comply to AS3700-2014.

Clean stonework progressively as the work proceeds, removing mortar and other droppings as they occur. Clean face work to remove mortar smears, stains, discoloration, and the like. Stained or damaged surfaces shall be replaced, not repaired, unless otherwise directed by the Superintendent.

Set out stonework so as to produce a continuous interlocking stonework face. Face joints to be a minimum size of 10mm and a maximum size of 30mm. Mortar bed is to be a minimum thickness of 30mm. All unsupported edges to have a mortar haunch 100mm deep, 100mm wide and finishing a minimum of two thirds up the face of the unsupported spalls.

Work with a jointing tool produce face work Joints: to a dense, smooth surface, to a 'Flush Joint' profile to the approval of the Superintendent.

### 2.11 IN-SITU CONCRETE PAVEMENT

#### 2.11.1 General

Supply and install in-situ concrete pavement where indicated on the drawings.

#### 2.11.2 Earthworks

Carry out earthworks and preparation to allow for levels to be achieved to finished grades as specified.

#### 2.11.3 Sub-Grade

##### 2.11.3.1 Preparation

Prior to compaction, bring the sub-grade to within 2% of the optimum moisture content determined to AS1289.5.1.1-2003 (standard) or AS1289.5.2.1-2003 (modified) as applicable to the material.

##### 2.11.3.2 Compaction

The pavement sub grade shall be fully compacted with a mechanical vibrator to not less than Eight (8) blows per 300mm with a Perth sand penetrometer as determined by AS1289.5.2.1-2003 to a depth of 450mm.

##### 2.11.3.3 Finished Sub-Grade Level Tolerances

Maximum deviation from the design level: + 10mm, - 0mm.

Maximum deviation from a 3 m straightedge laid anywhere on each plane surface: 20mm.

##### 2.11.3.4 Compaction Equipment:

Use approved rollers, appropriate to the materials and compaction requirements. Use approved plate compactors on areas inaccessible to rollers. To maintain moisture content, use water spraying equipment capable of distributing water uniformly in controlled quantities without washing fines from the sub-grade or base material.

#### 2.11.4 Base Course

##### 2.11.4.1 Preparation

The formation shall be to the profiles, dimensions, camber and depths shown on the accompanying plans. The width of formation shall be 300mm greater than the finished width of the pavement to accommodate the laying of adjacent pavements.

The formation shall be approved by the Superintendent or their representative prior to the laying of the foundation material.



#### 2.11.4.2 Limestone Base Course

##### 2.11.4.2.1 Limestone

The limestone shall be free of sand, loam, vegetation and/or other foreign matter. Limestone shall not contain large spalls or lumps in excess of 50mm diameter, or any excessive amounts of fine grain material.

When tested, material shall conform to the following requirements:

- Calcium Carbonate content shall be not less than 60%.
- The Los Angeles abrasion loss shall not be more than 60%.

Notwithstanding this Specification, any sample which, in the opinion of the Superintendent is composed of unsuitable material, or is composed of material which would break down with ageing or weathering to such an extent that it would then fall outside the limits of this Specification, shall be rejected.

##### 2.11.4.2.2 Base Course Spreading

Moisten the prepared sub-grade immediately before spreading base material. Spread base material in a uniform and continuous layer by direct tipping from trucks without disturbing the sub-grade.

Spread rate: To achieve a minimum compacted thickness of 200mm.

##### 2.11.4.2.3 Base Course Density

Compact, by watering and rolling, to not less than Eight (8) blows per 300mm with a Perth sand penetrometer as determined by AS1289.5.2.1-2003.

##### 2.11.4.2.4 Base Course Surface Tolerances

Finished surfaces shall be free draining and evenly graded between level points.

Maximum deviation from design level: + 5mm, - 10mm

Maximum deviation from a 3m straightedge laid anywhere on the surface: 10mm.

#### 2.11.5 Concrete

Concrete mixes shall be as follows:

##### Pavement Type P2:

Cement:	Grey, Portland Cement Type 'GP',
Oxide:	CCS Driftwood, or equivalent approved.
Aggregate:	Grey granite, nominal maximum size 14mm,
Maximum slump:	80mm,
Finish	Course Rock Salt Finish (no tooled edges or joints),
Compressive Strength:	25 M.Pa. Minimum at twenty eight (28) days.

##### Pavement Type P3:

Cement:	Grey, Portland Cement Type 'GP';
Oxide:	CCS Driftwood, or equivalent approved.
Aggregate:	Grey granite, nominal maximum size 14mm,
Maximum slump:	80mm;
Finish:	Course Rock Salt Finish (no tooled edges or joints); and
Compressive Strength:	32 M.Pa. Minimum at twenty eight (28) days.
Subbase:	150mm Limestone Roadbase

##### Pavement Type P4:

Cement:	Grey, Portland Cement Type 'GP',
Oxide:	Nil,
Aggregate:	Grey granite, nominal maximum size 14mm,
Maximum slump:	80mm,
Finish	Steel Float (no tooled edges or joints),
Compressive Strength:	32 M.Pa. Minimum at twenty eight (28) days.

##### Pavement Type P5:

Cement:	Grey, Portland Cement Type 'GP',
Oxide:	Nil,



Aggregate:	Grey granite, nominal maximum size 14mm,
Maximum slump:	80mm,
Finish	Stamped and Steel Float (no tooled edges or joints),
Compressive Strength:	32 M.Pa. Minimum at twenty eight (28) days.

The Contractor shall guarantee that all concrete shall be of like composition, i.e. utilising the same batch of sand and using the same proportional mix of materials.

All colour variations caused by variances in the composition of materials used, the lack of cleanliness of the site or truck, or failure to adequately protect concrete will be replaced by the Contractor, at the Contractor's expense.

#### 2.11.6 Form Work

Form work shall be of steel or suitable dressed seasoned timber planks, free of warps, bends or kinks.

Forms shall be staked with no less than 3 stakes and not more than 1.5m apart to prevent unspecified warps and bends. Forms shall be in one piece for the concrete pavement thickness specified.

#### 2.11.7 Placement

##### 2.11.7.1 Placement – Pedestrian Pavement

Lay concrete 100mm thick minimum between control joints and screened off to falls and finish with a steel hand trowel.

##### 2.11.7.2 Placement – Trafficable Pavement

Lay concrete 150mm thick minimum between control joints and screened off to falls and finish with a steel hand trowel.

#### 2.11.8 Expansion and Control Joints

##### 2.11.8.1 Expansion Joints

Provided 15mm All In One Lock Joint expansion joints in paving as indicated on the drawings and, as a minimum evenly spaced at intervals not exceeding 6000mm apart in any one direction in pavements or in lineal sections of paths.

All In One Lock Joints rubber top to match surrounding pavement materials.

Provided 15mm wide expansion joints with a backing of 15mm dia. closed cell polyethylene strip (colour to match surrounding pavements) in paving at all fixed edges including kerbs, adjoining pavement edges and walls, to the edges of all furniture and fittings, services lids and other pavement inserts and where two linear paths join or deviate in alignment. Set strip back sufficient distance so that sealing compound will finish flush with paving.

##### 2.11.8.2 Contraction Joints

Provided 30mm deep cut contraction joints as indicated on the drawings located as per the drawings, at a minimum evenly spaced at intervals not exceeding 2000mm apart in any one direction.

#### 2.11.9 Finishing

##### 2.11.9.1 General

All pavement surfaces shall comply with AS/NZS 4586 Classifications in Selecting Pedestrian Surface Materials.

##### 2.11.9.2 Broom Finish Concrete

After placing and compaction, concrete shall be finished monolithically to a smooth, even surface by means of steel floats or other suitable equipment.

On completion of steel floating and before initial set, the surfaces of concrete pavements shall be brushed to a "non-skid" texture. This shall be achieved by drawing a moistened nylon broom lightly across the surface in a continuous direction.

##### 2.11.9.3 Rock Salt Finish

After placing and compaction, concrete shall be finished monolithically to a smooth, even surface by means of steel floats or other suitable equipment.

Broadcast coarse salt particles over wet concrete and then press the grains into the surface with float or roller.

After the concrete sets, power wash the salt away, to reveal shallow indentations left by the dislodged salt particles.

##### 2.11.9.4 Exposed Aggregate Concrete



After placing and compaction, concrete shall be finished monolithically to a smooth, even surface by means of steel floats or other suitable equipment.

On completion of steel floating and before initial set, the surfaces of concrete pavements shall be washed to an exposed aggregate texture. This shall be achieved by water wash down to produce an even exposure of aggregate over the full extent of the pavement.

#### 2.11.9.5 Edges and Joints

Pavement finish shall be to full extent. There shall be no picture window treatment; no tooled edges or joints.

#### 2.11.10 Curing

To AS 3600 clause 19.1.5.

Protect fresh concrete from premature drying and excessively hot or cold temperatures. Maintain the concrete at a reasonably constant temperature with minimum moisture loss for the curing period.

Commence curing immediately after finishing, and cure continuously for not less than seven (7) days.

Submit for approval the proposed method of curing, which may include the following:

- Ponding or continuous sprinkling with water (moist curing)
- An impermeable membrane
- An absorptive cover kept continuously wet.

#### 2.11.11 Protection

Protect paving from staining and damage. Use sheeting or other screening as necessary. Do not use hardwood in contact with pavements.

Clean off all droppings as they occur. Stained or damaged pavements shall be replaced, not repaired, unless otherwise permitted by the Superintendent.

Protect adjoining surfaces during paving work. Finished surfaces in the vicinity of work being carried out shall be protected from staining and impact and all necessary precautions are to be taken to ensure that protection is provided and maintained.

Protect all paving as follows:

- exclude all foot traffic for 3 days;
- exclude all vehicles and heavy traffic for 21 days minimum; and
- provide barriers and planking to accommodate traffic.

#### 2.11.12 Tolerances

Works shall be undertaken to the following tolerances:

- Maximum deviation from design level: + 5mm, - 5mm
- Grade across pavement shall be 2% + or -0.5% or as indicated on the drawings.
- Pavement surface shall be true to line and not deviate more than 5mm under a 3m straight edge.
- Surface irregularities, including abutting to service authority manholes, etc. shall not exceed 2mm.
- Thickness: = or -5mm. A random testing programme will be used to check the thickness, and if any point is outside the tolerance, further testing shall be undertaken within that 5m section and the adjoining 5m sections on either side. Three or more additional thickness tests will be taken on each of the sections. If any of these show a reading that is outside the required tolerance, that section of the pavement shall be removed and replaced with new work to this specification.
- The pavement shall be constructed to the nominated width + or - 20mm.

Any sections of the pavement not meeting the requirements of this specification shall be removed from the site and replaced.

#### 2.11.13 Sample Panel

Construct a three (3) square metre sample panel for approval of the Superintendent prior to commencing works. All works shall comply with the finish of the approved sample panel.

The panel may be incorporated into the Works. Panel location is to be determined on site by the Superintendent.

## 2.12 PRE CASTE CONCRETE UNIT PAVEMENT



### 2.12.1 General

Supply and install pre-cast concrete paving, headers and concrete haunch.

Construct all paving and install headers to the details and limits shown in the drawings. The cost of paving and headers shall include all edging, paving, expansion joints, cutting, cleaning down and surface protection during construction.

It shall be the Contractor's responsibility to confirm orders and delivery times for paving units as early as possible to ensure that the Construction Program is maintained without delays due to late deliveries.

### 2.12.2 Pavement Types

Supply and lay the following pavement types where indicated on the drawings:

Paving Type P1 - 440x220x60mm Pre Cast Concrete Pedestrian Pavement

Brickmakers Flagstone Granite Collection or equivalent approved.

Pebble Beach 70%

Chert 10%

Stormcloud 20%

Paving Type P1 Header - 220x110x60mm Pre Cast Concrete Pedestrian Pavement

Brickmakers Easi cobble Granite Collection or equivalent approved.

Pebble Beach 70%

Chert 10%

Stormcloud 20%

### 2.12.3 Materials and Workmanship

All pavement surfaces shall comply with AS/NZS 4586 Classifications in Selecting Pedestrian Surface Materials.

All materials liable to deteriorate by exposure to the weather shall be kept undercover and the Contractor shall be held responsible for loss or deterioration occurring in the course of loading, unloading, transit or storage, no matter what the cause.

Quality of all workmanship, materials, and all construction methods shall conform to the relevant SAA code and shall be FIRST CLASS throughout.

Only workers or Sub-Contractors of proven competence for the type of work specified will be permitted to carry out the work of this Contract. Evidence of proven performance will be required by the Superintendent before approval will be granted.

### 2.12.4 Co-ordination

Co-ordinate all the work with the Superintendent, other Contractors and the paving manufacturer.

### 2.12.5 Supervision

The Contractor will be wholly responsible for executing the whole of the work of this Contract in the required positions to the requirements of the Specification under the supervision of a foreperson experienced in this work.

### 2.12.6 Standards

Materials and workmanship used in all construction shall conform with the relevant requirements of the applicable Australian Standards and Codes.

Tolerances shall be as per City of Perth standard.

### 2.12.7 Samples

Submit samples of various materials to be used, for approval. Subsequent work shall in all respects match the approved samples.

### 2.12.8 Responsibility

The Contractor shall accept all responsibility for paving units at all times after delivery and acceptance and it shall replace any damaged, defective or discoloured units, at its own expense when called upon by the Superintendent to do so.

All paving shall be protected from injury or staining after delivery until completion of the Contract.

### 2.12.9 Installation

#### 2.12.9.1 Construction Generally



The Contractor will be responsible for the supply of all materials and setting out the works and installing all paving as shown on the plans and details. This work includes laying pre-cast concrete paving units of various sizes in various patterns.

Ensure that each unit is accurately manufactured or saw cut and mitred to the required size and shape and face surfaces finished to specified requirements. Where metal fixings are required for construction, the concealed faces of each unit shall be specially shaped and recessed to suit the type of fixing used.

Shaped units shall be fitted to match with the paving and to conform to applicable details. Cut or shaped units shall not be less than one third of the original unit size.

Marks shall not be made on face surfaces. In face work, all units shall be carefully mixed to ensure an even overall blend of colour, tone, texture and figure.

All prepared units shall be packed for delivery in a manner which will protect them from damage and staining. Particular care shall be taken during loading, unloading and stacking to prevent damage and defacement. Under no circumstances shall unloading by tipping and/or dropping be permitted.

Units shall be stacked clear of the ground on pallets or other suitable supporting materials or structures which will insulate them from rising damp, and the stocks covered by suitable waterproof covers to prevent wetting.

#### 2.12.9.2 Workmanship

All work shall be carried out in the best recognized trade practice by approved firms specializing in the particular work and employing skilled experienced tradesmen.

Pre-cast paving units shall be carefully unloaded at site and stacked in an approved manner until set in position.

Provide all accessories and perform all operations necessary for the proper execution of first class paving including selecting, culling, bedding, setting, sawing, fixings, pointing, grouting, caulking, and the like.

Build in all necessary fixings as required. Provide all other fittings, as detailed.

Co-ordinate with other trades as required.

Inspect all areas to ensure that the surfaces are suitable to receive them.

Undertake all the necessary minor filling and/or minor grinding off of the adjacent surfaces i.e. kerbs, pram crossings etc. that it deems necessary prior to setting the paving.

#### 2.12.9.3 Samples

Submit representative samples of the paving units for approval prior to proceeding. Upon approval, allow to construct for further approval, a sample incorporating each type of paving to a minimum of 40m<sup>2</sup>. This work shall be reviewed by the Superintendent, to ensure compliance with the Specification and Drawings.

Once approved, ensure that all materials and workmanship comply with the approved samples. The approved samples may be incorporated into the finished work if appropriate.

#### 2.12.9.4 Paving

Blocks shall be laid to grades and lines as shown on the drawings.

#### 2.12.9.5 Sub-Grade

##### 2.12.9.5.1 Preparation

Prior to compaction, bring the sub-grade to within 2% of the optimum moisture content determined to AS1289.5.1.1-2003 or AS1289.5.2.1-2003 as applicable to the material.

##### 2.12.9.5.2 Compaction

The pavement sub grade shall be fully compacted with a mechanical vibrator to not less than Eight (8) blows per 300mm with a Perth sand penetrometer as determined by AS1289.5.2.1-2003 to a depth of 450mm.

##### 2.12.9.5.3 Finished Sub-Grade Level Tolerances

Maximum deviation from the design level: + 10mm, - 0mm.

Maximum deviation from a 3 m straightedge laid anywhere on each plane surface: 20mm.

##### 2.12.9.5.4 Compaction Equipment:

Use approved rollers, appropriate to the materials and compaction requirements. Use approved plate compactors on areas inaccessible to rollers. To maintain moisture content, use water spraying equipment capable of distributing water uniformly in controlled quantities without washing fines from the sub-grade or base material.

#### 2.12.9.6 Bedding Sand



Bedding sand shall be well graded sand passing a 4.75mm sieve and suited to concrete manufacture. The bedding sand shall be free of deleterious soluble salts or other contaminants likely to cause efflorescence. Bricklayers sand and single sized dune sands are not considered to be suitable.

The maximum depth of bedding sand shall be 30mm (+ - 5mm) after compaction of the paving. This shall be achieved by field trials. The bedding sand is to be spread loose in a uniform layer, screeded loose to a nominated level just ahead of the laying of the paving units. The Contractor is to ensure that only light compaction of the bedding sand occurs with a small plate compactor prior to placing of paving units. Only sufficient area is prepared as will be paved in that day.

#### 2.12.9.7 Placing of Paving Units

Paving units are to be placed on to the lightly compacted bedding sand to the nominated laying pattern. All joints are to be correctly aligned and the nominated joint width to be maintained, with a suitably approved sand retention adhesive i.e. sand stick or similar. Nominated joint width to be as follows:

'Urbanstone'	Nominal Joint Width 3-4mm (4mm when high aggregate content)
Concrete Block Paving Units	Nominal Joint Width 2mm

Closure units shall be fitted after all full paving units in a row have been positioned.

In-fill spaces and strips around boxes or manholes will be unit paving, or in approved concrete with a suitable colour additive to the satisfaction of the Superintendent. Allow for the preparation of sample concrete panels for approval by the Superintendent prior to incorporation in the work. Exposed aggregate finishes to match some forms of paving may be required and the Contractor is to make due allowance for this.

Cut unit size shall comprise a minimum of 30% of any unit type. Break bond as required to maintain minimal unit size in all situations, to the approval of the Superintendent.

Where it is necessary to adjust the position of paving units this shall be by adjustment of the bedding sand not by hammering of the units.

#### 2.12.9.8 Compaction

The paving units shall be consolidated to design levels with a minimum of three passes of a high frequency low amplitude plate compactor with a plate large enough to eliminate damage to the paving units.

Prior to carrying out compaction, sand for joint filling is to be spread over the paving units to a minimum depth of 20mm. Generally for paving units less than 60mm thick this will not provide adequate protection against damage to the paving units and the Contractor shall be required to provide additional protection to the underside of the plate compactor.

Any units damaged during the compaction process shall be immediately removed and replaced.

All sand for joint filling shall be free of soluble salts or contaminants with 100% passing the 2.36mm sieve and being uniformly graded. Shall be "Pavelock" joint filling sand only.

The whole of the area shall be swept clean at the completion of each day's work and the Contractor is to take all precautions against the filling sand becoming wind blown or spread by any means whatsoever.

No construction traffic shall be allowed onto the pavement until this stage has been achieved other than foot or barrow traffic.

#### 2.12.9.9 Clean Up

Upon completion of paving works, clean away all debris resulting from their works together with any accumulated debris along kerb lines and in storm water pits.

#### 2.12.9.10 Tolerances

Install paving within the following tolerances.

A cumulative effect of the tolerances for size, location and position in the horizontal or vertical plane is not permitted. The 3 dimensional variation of any point from its documented position shall be governed by the minimum single tolerance figure allowed.

- lipping (vertical deviation) between adjacent units  $\pm$  2mm;
- lipping (vertical deviation) between adjacent works i.e. kerbs  $\pm$  2mm;
- deviations from a 1500mm straight edge placed on the surface in any direction shall not exceed 3mm. Deviation from a straight edge shall conform to the previously stated tolerances but shall not exceed a maximum deviation of 25mm over the entire length of the paving;
- variation from the plumb in the lines and surfaces 6mm per 3000mm but not more than 25mm in total length;
- variation from the level or grades indicated on drawings,  $\pm$  5mm; and





- variations from plan position shown on drawings in 12000mm or more shall be no greater than 20mm thereof.

#### 2.12.10 Expansion Joints

##### 2.12.10.1 Expansion Joints

Provided 15mm wide expansion joints in paving as indicated on the drawings and, as a minimum evenly spaced at intervals not exceeding 8000mm apart in any one direction.

Provided 15mm wide expansion joints in paving at all fixed edges including kerbs, adjoining pavement edges and walls, to the edges of all furniture and fittings, services lids and other pavement inserts.

Set into expansion joints a backing of 15mm dia. closed cell cream polyethylene strip. Set strip back sufficient distance so that sealing compound will finish flush with paving.

Seal expansion joints with a polysulphide or polyurethane based sealing compound. Depth of sealing compound shall not exceed the width of the joint. Colour of sealing compound shall blend with colour of pavement.

Where polysulphide sealing compounds are used, coat surfaces of pavement in contact with sealing compound with a sealer recommended by the sealing compound manufacturer.

##### 2.12.11 Mortar Haunch

All unrestrained pavement edges and all pavement edges abutting service pits are to have a continuous mortar haunch to the full extent of all unrestrained edges and service pit edges.

Mortar shall be:

- all part sand mortars to AS3972-1997 Type GP, 4 part sand: 1 part cement;
- cement to be blended cement with fly ash content approximately 25%;
- sand must be clean, washed, medium to fine;
- gauge boxes for proportioning of the cement and sand must be used;
- a reasonably large powerful mixer capable of thorough mixing must be used; and
- contain cement aids "Caltite Water proofer" at the rate of one part water proofer to 5 parts water.

Mortar haunch to be as detailed on the drawing and, as a minimum be 100mm deep below underside of unit pavement, 200mm wide located central to unrestrained edge of pavement and finishing a minimum of two thirds up the face of the unsupported edge.

##### 2.12.12 Protection

Protect paving from staining and damage. Use sheeting or other screening as necessary. Do not use hardwood in contact with units.

Clean off all droppings as they occur. Stained or damaged units shall be replaced, not repaired, unless otherwise permitted by the Superintendent.

Protect adjoining surfaces during paving work. Finished surfaces in the vicinity of work being carried out shall be protected from staining and impact and all necessary precautions are to be taken to ensure that protection is provided and maintained.

Protect all paving as follows:

- exclude all foot traffic for 3 days;
- exclude all heavier traffic for 7 days;
- exclude all vehicles for 21 days minimum; and
- provide barriers and planking to accommodate traffic.

##### 2.12.13 Completion

On completion and following approval by the Superintendent of the work, all work shall be cleaned by means (approved by the Superintendent in writing) to give a uniform surface free from all foreign residues.

Clean away and remove from the site all rubbish and unwanted materials and leave the area of the work clean and tidy.

##### 2.12.14 Testing

The Superintendent reserves the right to take samples of any materials at any time for test or analysis.



Should the results indicate that the requirements of this Specification have not been complied with, action will be taken under the Contract regarding replacement, re-performance or compensation.

The costs of all failing tests or analysis will in all circumstances be paid by the Contractor.

## **2.13 CPMPACTED CRACKED PEA GRAVEL**

### **2.13.1 General**

Supply and place base course and consolidated gravel pavement as specified.

### **2.13.2 Sub-Grade Preparation**

#### **2.13.2.1 Grading**

Grade the sub-grade surface to follow finished levels so that the specified compacted thickness of the base course and pavement material is maintained.

#### **2.13.2.2 Sub-Grade Density**

Compact, by watering and rolling, to not less than Six (6) blows per 300mm with a Perth sand penetrometer as determined by AS1289.5.2.1-2003 to a minimum depth of 750mm and to a minimum of 300mm beyond edge of finished pavement edge or edge restraint.

#### **2.13.2.3 Finished Sub-Grade Level Tolerances**

Maximum deviation from the design level: + 10mm, - 0mm.

Maximum deviation from a 3 m straightedge laid anywhere on each plane surface: 20mm.

#### **2.13.2.4 Moisture Content**

Prior to compaction, bring the sub-grade to within 2% of the optimum moisture content determined to AS1289.5.1.1-2003 or AS1289.5.2.1-2003 as applicable to the material.

#### **2.13.2.5 Compaction Equipment:**

Use approved rollers, appropriate to the materials and compaction requirements. Use approved plate compactors on areas inaccessible to rollers. To maintain moisture content, use water spraying equipment capable of distributing water uniformly in controlled quantities without washing fines from the sub-grade or base material.

### **2.13.3 Lateritic Gravel Pavement**

#### **2.13.3.1 Pea Gravel**

Lateritic gravel shall be 100% cracked pea gravel

#### **2.13.3.2 Gravel Spreading**

Moisten the prepared sub-base immediately before spreading paving material. Spread material in a uniform and continuous layer by direct tipping from trucks without disturbing the sub-grade.

Spread rate: To achieve a minimum compacted thickness of 100mm.

#### **2.13.3.3 Paving Density**

Compact, by watering and rolling, to not less than Eight (8) blows per 300mm with a Perth sand penetrometer as determined by AS1289.5.2.1-2003.

#### **2.13.3.4 Paving Finish**

All pavement surfaces shall comply with AS/NZS 4586 Classifications in Selecting Pedestrian Surface Materials.

#### **2.13.3.5 Paving Surface Tolerances**

Finished surfaces shall be free draining with a central crown with even 2% falls away from crown and perpendicular to pavement edge.

Maximum deviation from design level: + 5mm, - 10mm

Maximum deviation from a 3m straightedge laid anywhere on the surface: 10mm.

Pavement surface is to finish flush with adjacent hard surfaces and kerbs.

### **2.13.4 Sample Panel**

Construct a three (3) linear metre sample panel for approval of the Superintendent prior to commencing works. All works shall comply with the finish of the approved sample panel.

The panel may be incorporated into the Works. Panel location is to be determined on site by the Superintendent.



## 2.14 IN SITU CONCRETE MOWING KERBS

### 2.14.1 General

Supply and install mowing kerbs in accordance with the drawings, details and as specified.

### 2.14.2 Setting Out the Works

Construct mowing kerbs to areas shown on drawings or as determined on site by the Superintendent.

### 2.14.3 Materials

Concrete mixes shall be as follows:

Cement:	Grey, Portland Cement Type 'GP',
Oxide:	CCS 'Driftwood', or equivalent approved.
Aggregate:	Grey granite, nominal maximum size 14mm,
Maximum slump:	80mm,
Finish	Steel float finish,
Compressive Strength:	20 M.Pa. Minimum at twenty eight (28) days.

### 2.14.4 Line and Level of Work

Kerbs shall be placed true to alignment in the horizontal plane as shown on the drawings or as may be directed by the Superintendent and it shall be placed true to grade in vertical alignment as shown on the drawings and without local irregularities within the following tolerances:

- The tolerance in finished surface level, when tested with a 3 metre long straight edge shall be  $\pm 3$ mm.
- The tolerance in top width of kerb shall be  $\pm 3$ mm.
- The tolerance in alignment and level over a length of not less than 15 metres shall be  $\pm 6$ mm.

### 2.14.5 Earthworks

Compact sub-grade, by watering and rolling, to not less than Eight (8) blows per 300mm with a Perth sand penetrometer as determined by AS1289.5.2.1-2003 to a minimum depth of 750mm. Sub grade compaction shall extend for a minimum of 150mm beyond edge of finished mowing kerb.

### 2.14.6 Installation

Kerbing shall be constructed using machine formed extruded in-situ concrete to have dimensions 300mm wide x 200mm deep. Kerbing is to be free from imperfections and irregularities in width and thickness and must be constructed in good straight line and/or smooth even radius curves, to the approval of the Superintendent.

Construct control joints at 3.0 metre maximum centres and at least one quarter of the depth of the kerb section.

Hand constructed mowing kerbs must be done using good quality framework capable of producing uniform, well finished kerbs in either straight and even lengths or smooth, even curves.

Top surface of all kerbing must finish flush with surrounding surfaces and/or ground level.

Finish all kerbing monolithically to a smooth, even surface by means of a steel trowel or other surface equipment.

Provide surface protection to kerbing as necessary to prevent cracking of the concrete due to temperature changes during curing periods. Make good to all poorly constructed and/or damaged lengths of kerb.

### 2.14.7 On Completion

Remove all excess concrete from site and backfill with soil flush with top of kerb.

## 2.15 SITE FURNITURE

### 2.15.1 Prefabricated Table Setting

Supply and install, including footings, where indicated on site table settings as supplied by:

Supplier: Commercial Systems Australia  
 42A Orchard St Kilsyth  
 VIC 3137  
 Telephone: (03)97234111

Model: **PM2045 Perforated Setting**

Finish: Powdercoated Dulux Monument 2729067S Satin



### Extended Legs Sub Surface

All footings, seat fixings and fixings to be vandal resistant, to manufacturer's recommendation, to the approval of the Superintendent.

#### 2.15.2 Prefabricated Litter Bin

Supply and install, including footings, where indicated on the drawings prefabricated Litter Bins as supplied by:

Supplier: Street Furniture Australia (DS Agencies)  
184 Beechboro Rd Bayswater  
WA 6053  
Telephone: 1300661801

Model: **Simple Bin LB6**

Finish: Body: Powdercoated Aluminium Holes – Dulux Satin Monument  
Spun metal lid is to be stainless steel, clear coating finish.

Bin liner is to be galvabond steel cylindrical liner with handle.

All rubbish receptacle footings fixings and fixings to be vandal resistant, to manufacturer's recommendation to the approval of the Superintendent.

## 2.16 BARBECUE AND SURROUND

### 2.16.1 General

Supply and install, including footings and surrounds, Unisite Group Electric Barbecues or equivalent approved and bench top as detailed and as specified as supplied by:

Supplier: **Unisite Group**  
Equipment: Grillex Inbench

All fixings and fixings are to be vandal resistant, to manufacturer's recommendation to the approval of the Superintendent.

Install strictly in accordance with the manufacturers instruction including all electrical connects.

## 2.17 UNIVERSAL ACCESS TOILET

### 2.17.1.1 General

Design, supply and install to the locations and details on the drawings prefabricated universal access toilet including push button potable water tap on external facade.

#### 2.17.1.2 Supplier

Supplier: Modus Australia or equivalent approved.

Model: Yarra 3 (with 1 No. custom s/s external push button water fill tap)

Colour: Colourbond Monument

Roof: Colourbond Shale grey

#### 2.17.1.3 Design and Certification

Prior to fabrication provide complete design including structurally certified shop drawings suitable for building license and the locality and all prevailing conditions, for review by the Superintendent.

Prior to fabrication provide complete hydraulic and electrical drawings suitable for building license and to the locality and all prevailing conditions, for review by the Superintendent.

#### 2.17.1.4 Building License

Provide Certificate of Building Design Compliance and apply for Building License including all fees and charges.

#### 2.17.1.5 Construction

Supply and install strictly in accordance with the manufactures instructions and signed structural engineer's drawings, and electrical and hydraulic consultant drawings including all footings and ground slabs, water, sewer and electrical connections to existing services.

## 2.18 POOL FENCE

### 2.18.1 General

Supply and erect pool fence to match existing on site.

All footing fixings and fixings to be to the recommendation of the fabricator.



## 2.19 PREFABRICATED PLAY EQUIPMENT

### 2.19.1 General

Supply and install prefabricated play equipment as follows:

#### **Double Slide**

Manufacturer: Playground Centre (or similar approved)  
 Type: Embankment Slide with Timber Platform  
 Code/Model: SC381  
 Installation: Subsurface to manufacturers specification  
 Contact:

Glenn Mars

Recreation Consultant

P1800 092 897 (Freephone)

[Eglenn.mars@playgroundcentre.com.au](mailto:Eglenn.mars@playgroundcentre.com.au)

#### **Musical Play 01**

Manufacturer: Playground Centre (or similar approved)  
 Type: Percussion Play Tubular Bells (Set of 7)  
 Installation: Surface Mounted to manufacturers specification  
 Finish: Standard to manufacturers specification  
 Contact:

Glenn Mars

Recreation Consultant

P1800 092 897 (Freephone)

[Eglenn.mars@playgroundcentre.com.au](mailto:Eglenn.mars@playgroundcentre.com.au)

#### **Musical Play 02**

Manufacturer: Playground Centre (or similar approved)  
 Type: Percussion Play Babel Drum Small  
 Installation: Subsurface to manufacturers specification  
 Finish: Standard to manufacturers specification  
 Contact:

Glenn Mars

Recreation Consultant

P1800 092 897 (Freephone)

[Eglenn.mars@playgroundcentre.com.au](mailto:Eglenn.mars@playgroundcentre.com.au)

#### **Arbor Dome**

Manufacturer: Lypa (or similar approved)  
 Type: Arbor Dome  
 Installation: Subsurface to manufacturers specification  
 Finish: Standard to manufacturers specification

### 2.19.2 Compliance

All playground equipment and their surrounds shall fully comply with the following standards:

- Australian Safety Standards for Playgrounds AS4685 (Parts 1-6) (2004), and amendments for Parts 1 to 6 (2006 & 2008);
- AS 4685.11 (2012) 'Playground Equipment - Additional specific safety requirements and test methods for spatial network'
- Australian and New Zealand Standard AS/NZS4422 (1996) Playground Surfacing – specifications, requirements and testing methods; and
- Australian and New Zealand Standard AS/NZS4486.1 (1997) Playgrounds and Playground Equipment Part 1: Development, Installation, Inspection, Maintenance and Operation.
- AS 4685.11-2012 'Playground Equipment - Additional specific safety requirements and test methods for spatial network'

### 2.19.3 Certification

#### 2.19.3.1 Equipment

Provide certification of compliance to Australian Standards for all play equipment to the Superintendent for review prior to play equipment fabrication.

#### 2.19.3.2 Set Out

Play equipment set out is indicative only. Provide certification of compliance to Australian Standards of the set out of all play equipment and their surrounds to the Superintendent for review prior to installation.

### 2.19.4 Installation

Install strictly in compliance with Australian Standards and accordance with the manufacturer's specification.

## 2.20 TREE, SHRUB AND PLANT (GREEN STOCK) SUPPLY AND PLANTING

### 2.20.1 Green Stock Supply

All green stock supplied by the Contractor shall be supplied by suppliers approved by the Superintendent, to the species, sizes and quality as specified in Specification and Plant Schedules.

### 2.20.2 Green Stock Supply and Report

#### 2.20.2.1 Supply Report

Within two (2) weeks of acceptance of tender, furnish to the Superintendent a PRELIMINARY GREEN STOCK SUPPLY REPORT covering all green stock under the works, including Principal supplied stock and stock from specified suppliers, detailing the following:

- Container and Green Stock Size for each species;
- Number of each species;
- Nursery Supplier for each Species;
- Contact Details for each Nursery Supplier;
- Holding Location and Details for each Species; and
- Green Stock not currently available as specified.

Within Four (4) weeks of acceptance of tender, furnish to the Superintendent a FINAL GREEN STOCK SUPPLY REPORT, including all species substitutions for unavailable green stock as determined by the Superintendent. The report shall detail the following:

- All Green Stock and Stock Substitution Species under the Works,
- Container and Green Stock Size for each species,
- Number of each Species,
- Nursery Supplier for each Species,
- Contact Details for each Nursery Supplier,
- Holding Location and Details for each Species,

#### 2.20.2.2 Green Stock Supply Guarantee and Penalties

Failure to provide to the Superintendent, in writing, a Preliminary Green Stock Supply Report and a Final Green Stock Supply report comprising all green stock species and sizes within the contract within the times specified within this contract will incur a penalty on the Contractor of One Thousand Dollars (\$1,000) per week per report



for every week, or part week for which the reports are not submitted, excluding Principal supplied stock and stock from specified suppliers. The penalty shall be deducted from the value of the Contract.

The Final Plant Supply Report shall constitute a written guarantee by the Contractor that each species listed in the report will be in good condition and available for use in the works, excluding Principal supplied stock and stock from specified suppliers.

A penalty on the Contractor of Two Thousand Dollars (\$2,000) shall apply for each species listed in the Final Green Stock Supply Report approved by the Superintendent that is subsequently found by the Superintendent to not be in good condition or not available for use in the works, excluding Principal supplied stock and stock from specified suppliers. The penalty shall be deducted from the value of the Contract.

The full cost of the supply and planting of all replacement species for plants that are subsequently found by the Superintendent to not be in good condition or not available for use in the works shall be borne by the Contractor, excluding Principal supplied stock and stock from specified suppliers. The Superintendent shall determine the species and stock to be used for substitution in the works.

#### 2.20.2.3 Green Stock Quality

All green stock shall:

- be true to species, subspecies and variety;
- be vigorous and healthy;
- be of good form consistent with species and variety;
- be well established in the plant container specified including having a large and healthy root system that occupies the full extent of the container while showing no evidence of restriction or having been restricted or damaged at any time during production;
- not be soft or produced using forced growing techniques;
- be hardened off;
- be fully self supporting without staking or guying;
- be free from disease, insect pests and other pathogens and;
- be free from damage from staking, tying or any other horticultural techniques used throughout production.

The Superintendent will reject any green stock which does not meet the required quality.

#### 2.20.2.4 Green Stock Labelling

Label at least one specimen of each species or variety with a durable, readable tag.

#### 2.20.2.5 Green Stock Storage on Site

Wherever possible, green stock shall be planted immediately after delivery to the site. If this is not possible, keep them in good condition by appropriate storage methods, or as may be directed. Prevent theft, drying out or damage from any cause including frost, wind, sun, rain, animals and the like. Provide an on-site nursery for holding green stock on site for more than 48 hours, of sufficient size, with provision for watering.

### 2.20.3 Planting Generally

#### 2.20.3.1 Setting Out of Works

Where underground services, manholes, cable pits, fire hydrants, lamp standards, retaining walls, kerbing, roads, paving and other obstructions occur, plant clear of such service and obstructions and protect services and obstructions from damage by machines and equipment.

#### 2.20.3.2 Planting Generally

Remove all plants from their containers, including all biodegradable containers and growing tubes, in such a manner as to do as little disturbance as possible to the roots. Where necessary, tease out root-balls before planting.

Place trees, shrubs and plants in holes in an up-right position and backfill level with top of root-ball. Compact soil by hand watering.

#### 2.20.3.3 Mass Planting Areas

Excavate a hole for each plant large enough to provide not less than 150mm all round the root system of the plant, or as shown on the Drawings.

#### 2.20.3.4 Individual Planting in Grassed Areas



Excavate a hole 100mm deeper and 600mm wider than plant containers of 5 Litre and over, or 450mm diameter x 300mm deep for pots small than 5 Litre, unless otherwise shown on the Drawings. Break up the base of the hole to a further depth of 100mm, and loosen compacted sides of the hole, as necessary to prevent confinement of root growth to the hole.

#### 2.20.3.5 Plant Locations

Do not vary the plant locations from those shown on the Drawings unless otherwise directed. If it appears necessary to vary the location and/or spacing to avoid service lines, or to cover the area uniformly, or for similar reasons, apply for directions.

#### 2.20.3.6 Planting Conditions

Do not plant in unsuitable weather conditions such as extreme heat, cold, wind or rain. Suspend excavation in other than sandy soils when the soil is wet, or during frost periods.

#### 2.20.3.7 Depth of Planting

When the plant is in its final position in its hole or bed the top soil level of the plant root-ball shall be level with the finished surface of the soil surrounding the hole or bed. Test the depth by measuring the sides of containers. If back filling is required to correct the depth, use soil as specified.

#### 2.20.3.8 Plant Placement

When the hole of bed appears to be of correct size and not before, remove the plant from the container with minimum disturbance to the root-ball, and place it in its final position, in the center of the hole and plumb.

#### 2.20.3.9 Fertilizer to Non Australian (Exotic) Plants

At time of back filling Exotic plants, all plants are to receive approved propriety item 'Eight to Nine Month Slow Release All Purpose Fertilizer' equal or equivalent to "Osmocote Pro" NPK 19-9-10+2MgO+TE

A sample of the fertilizer is required for approval by the Superintendent prior to commencement of works on site.

Fertilizer to be applied in backfill (below ground) during planting at the manufacturers recommended rate for the relative plant size, and at a minimum rate as follows:

- 200 to 100 Litre pot size plants to have thirty grams;
- 45 Litre pot size plants to have twenty grams;
- 25 to 15 Litre pot size plants to have twenty grams;
- 13 to 5 Litre pot size plants to have twenty grams;
- 200 to 170mm pot size plants to have ten grams;
- 150 to 130mm pot size plants to have five grams; and
- Tube pot size plants to have five grams.

#### 2.20.3.10 Fertilizer to Australian Native Plants

At time of back filling Australian native plants, all plants are to receive approved propriety item 'Eight to Nine Month Slow Release Fertilizer' equal or equivalent to "Macracote Grey" NPK 8-1-8+TE.

A sample of the fertilizer is required for approval by the Superintendent prior to commencement of works on site.

Fertilizer to be applied in backfill (below ground) during planting at the manufacturers recommended rate for the relative plant size, and at a minimum rate as follows:

- 200 to 100 Litre pot size plants to have thirty grams;
- 45 Litre pot size plants to have twenty grams;
- 25 to 15 Litre pot size plants to have twenty grams;
- 13 to 5 Litre pot size plants to have twenty grams;
- 200 to 170mm pot size plants to have ten grams;
- 150 to 130mm pot size plants to have five grams; and
- Tube pot size plants to have five grams.

#### 2.20.3.11 Back Filling to Plants

Backfill with soil as specified. Lightly tamp down the soil and water to eliminate air pockets.





### 2.20.3.12 Watering Basins with Mulch

Construct a watering basin around the base of each individually planted tree of 13 Litre pot size and above, consisting of a raised ring of soil of minimum diameter of 1000mm capable of holding a minimum of 10 litres of water. Supply and place 75mm mulch as specified to the extent of each watering basin, minimum diameter 1000mm.

### 2.20.3.13 Mulching

All plant stems shall be kept free from mulch.

Mulch shall not be placed within 100mm of all plant stems for less than 13 litre pot sized stock, and shall not be placed within 100-200mm of all plant stems for 13 litre pot size and greater.

### 2.20.3.14 Staking and Tying

Protect each tree of pot size 200 & 100 Litre with four (4) 50 x 50 x 2500mm pointed hardwood stake set 700mm into the ground. Protect each tree of pot size 45 & 15 Litre and above with two (2) 50 x 50 x 2000mm pointed hardwood stake set 500mm into the ground. Locate stakes parallel to prevailing wind direction on site. Do not pierce root ball.

All Stakes shall be painted Black using two coats of Dulux Timber colour Low Sheen Acrylic. Painting of stakes is to be carried out no less than 48 hours prior to installation to ensure that paint on all stakes is dry prior to installation.

All ties shall be approved flat rubber tree ties of minimum width of 10mm. Ties are to be located to provide additional support during adverse prevailing wind conditions only. All ties shall be placed in a loose figure of eight around stake and stem to provide adequate protection from damage without compromising natural plant growth.

### 2.20.3.15 Watering

At time of planting provide by hand watering a minimum of 10 litres of water to each plant. Repeat watering to each plant with 10 litres of water on each alternate day up to Practical Completion.

Watering of plants by sole reliance on the irrigation system will not be accepted until the irrigation system is practically complete or, unless approved in writing by the Superintendent..

## 2.20.4 Tree Planting

### 2.20.4.1 Planting

Remove tree bag or container carefully to prevent root damage. Edges of the root ball to be 'ruffled' to remove any root circling / girdling that may be occurring.

Backfill with improved soil media to occur in 100-150mm 'lifts' with firming of the back-fill occurring around the root ball of the tree after every lift.

Watering shall occur at the same time as the planting and firming.

Construction a 'bund' at the edge of the compost / mulch zone to aid in water retention where landscape surrounds allow.

After planting conditioned site soil shall finish 120mm below adjacent kerbing, paving and turf areas.

### 2.20.4.2 Compost

Directly after plating apply 40mm compost to the full extent of the root ball and conditioned soil mix and gently cultivate into the top 100mm to provide a homogeneous mix.

Compost shall be:

- Eclipse Soils 'Organic Soil Conditioner'.

Soil conditioner shall comply with AS4454-2003 Composts, Soil Conditioners and Mulches.

### 2.20.4.3 Humate

At time of compost application apply a Humate to the full extent of the rootball and conditioned soil mix.

Humate shall be:

- Eco-Growth's Humus 400.

Apply at the rate of 50g / square metre.

## 2.20.5 Clean Up

On completion of planting ensure that all plants are in first class, presentable condition by removing dead, damaged and unhealthy branches and trimming where necessary to result in balanced growth typical of their normal form.

After inspection by the Superintendent and on Practical Completion, remove labels from plants.



## 2.21 MULCH - ENVIROMULCH

### 2.21.1 General

Supply and apply 'Enviromulch' or equivalent approved to all areas as designated on the drawings. Mulch shall be applied to a depth, after tamping down, of 75mm Garden Bed Areas 1' and 20mm Garden Bed Areas 2' to the approval of the Superintendent.

Mulch shall be equivalent to that supplied by **AMAZON** Soils and landscaping supplies, Telephone 9302 1288

Mulch shall be applied:

- To the full extent of all areas indicated 'Garden Bed Areas 1' 'Garden Bed Areas 2' on the drawings;
- To the full extent of each individual tree watering basin in turf areas to a minimum diameter of 1000mm;

Mulch is to be completely free of all noxious weeds, seeds and fungus, insect pests and other deleterious material.

A sample of the mulch will be required for approval by the Superintendent prior to commencement of works on site.

Minor beds preparation including raking and removal of rubbish to produce an even and smooth surface at a constant depth of 75mm below finished surface of mulch will be the responsibility of the Landscape Contractor.

All plant stems shall be kept free from mulch.

Mulch shall not be placed within 100mm of all plant stems for less than 13 litre pot sized stock, and shall not be placed within 100-200mm of all plant stems for 13 litre pot size and greater.

The mulch will be consolidated, to produce smooth and even grades, finishing 10mm below surrounding hard surfaces.

### 2.21.2 Mulch Standards

Soil conditioner shall comply with AS4454-2003 Composts, Soil Conditioners and Mulches.

## 2.22 MULCH – PINE BARK

### 2.22.1 General

Supply and apply Course chipped 'Pine Bark' mulch to all areas as designated on the drawings. Mulch shall be applied to a depth, after tamping down, of 75mm.

Mulch shall be equivalent to that supplied **Amazon** Telephone 9302 1288.

Mulch shall be 100% pine bark equal or equivalent to that supplied by to the approval of the Superintendent.

Mulch shall be applied:

- To the full extent of all areas indicated 'Mulch Only' on the drawings.

Mulch is to be completely free of all noxious weeds, seeds and fungus, insect pests and other deleterious material.

A sample of the mulch will be required for approval by the Superintendent prior to commencement of works on site.

Minor beds preparation including raking and removal of rubbish to produce an even and smooth surface at a constant depth of 75mm below finished surface of mulch will be the responsibility of the Landscape Contractor.

All plant stems shall be kept free from mulch.

Mulch shall not be placed within 100mm of all plant stems for less than 13 litre pot sized stock, and shall not be placed within 100-200mm of all plant stems for 13 litre pot size and greater.

The mulch will be consolidated, to produce smooth and even grades, finishing 10mm below surrounding hard surfaces.

### 2.22.2 Mulch Standards

Soil conditioner shall comply with AS4454-2003 Composts, Soil Conditioners and Mulches.

## 2.23 MULCH – PLAY AREA MULCH SURFACE

### 2.23.1 General

Supply and install 'Play Ground Certified Pine Bark' mulch to all areas as designated on the drawings. Mulch shall be applied to a minimum depth, after tamping down, of 400mm and 50mm to top up areas.



The Contractor shall confirm the appropriate depth of soft fall mulch material required, in consideration of the play equipment to be installed and full compliance with AS/NZS4422, prior to excavating the site or installing mulch.

Mulch shall be equivalent to that supplied by **W A & J KING PTY LTD**, Phone: 08 9398 2595.

Mulch shall be applied:

- To the full extent of all areas indicated 'Pine Bark Mulch Impact Surface' on the drawings.

Mulch is to be completely free of all noxious weeds, seeds and fungus, insect pests and other deleterious material. Mulch is to be soft fall material for playground, it is imperative that it be free of deleterious materials.

A sample of the mulch will be required for approval by the Superintendent prior to commencement of works on site.

Excavate existing site soil, and carry out other minor preparation including raking and removal of rubbish, to produce an even and smooth surface at a minimum constant depth of 400mm below finished surface of mulch will be the responsibility of the Landscape Contractor.

The mulch will be consolidated, to produce smooth and even grades, finishing 25mm below surrounding hard surfaces.

#### 2.23.2 Mulch Standards

- certified free of pathogens including Phytophthora;
- free from plant material including weeds and their roots, bulbs or rhizomes;
- free from rocks and building rubble including bricks, concrete, plaster, timber and oil;
- free from detrimentally high salt content levels, and
- free of any other contamination or deleterious material.
- Installed to a depth appropriate for the play equipment installed and comply with all requirements of AS/NZS4422

shall comply with AS4454-2003 Composts, Soil Conditioners and Mulches.

## 2.24 GRAVEL MULCH

### 2.24.1 General

Supply and apply 12mm cracked pea gravel mulch or approved equivalent to all areas as designated on the drawings. Mulch shall be applied to a depth, after tamping down, of 30mm to the approval of the Superintendent.

Mulch shall be applied:

To the full extent of all areas indicated garden bed and mulch only on the drawings;

Mulch is to be completely free of all noxious weeds, seeds and fungus, insect pests and other deleterious material.

A sample of the mulch will be required for approval by the Superintendent prior to commencement of works on site.

Minor beds preparation including raking and removal of rubbish to produce an even and smooth surface at a constant depth of 10mm below finished surface of mulch will be the responsibility of the Landscape Contractor.

All plant stems shall be kept free from mulch.

Mulch shall not be placed within 50mm of all plant stems for less than 13 litre pot sized stock, and shall not be placed within 100-200mm of all plant stems for 13 litre pot size and greater.

The mulch will be consolidated, to produce smooth and even grades, finishing 5mm below surrounding hard surfaces.

### 2.24.2 Mulch Standards

Soil conditioner shall comply with AS4454-2003 Composts, Soil Conditioners and Mulches.

## 2.25 TURF GRASSING AND ESTABLISHMENT

### 2.25.1 Selected Grass Species

Grass species shall be:



- Kikuyu (*Pennisetum clandestinum*) turf rolls.

Obtain specified grass species from a specialist grower of cultivated turf. The turf shall be sourced from a turf farm and shall not be sourced from any active or passive area such as from a council park, school, golf course or other non specialist turf farm areas.

The turf shall:

- be certified as from an area in the turf farm that has either been newly established in the previous twelve months or which has been harvested in the previous twelve months;
- be free draining with total organic fines in the turf roll no greater than 5mm in depth;
- be certified by a ASPAC accredited laboratory that it is Sting Nematode and Phytophthora free. Contractor shall also provide a declaration from the supplier that the turf has not been treated with a Nematicide for the 12 months prior to testing.
- be free of all deleterious material including plastic reinforcing sod netting;
- be in rolls with clean cut edges and square ends;
- be in rolls all of the same dimensions (length, width and thickness);
- have a roll depth of thatch not exceeding 10mm;
- have the thickness of the soil portion of the roll not exceeding 15mm and be uniform over the entire roll; and
- have a uniform deep green foliage colour and not be discoloured.

Furnish a warranty from the grower that the grass is true to species and free from other grasses, weeds, fungus, insect pests and other deleterious matter.

## 2.25.2 Installation

### 2.25.2.1 Minor Preparation

Remove all rubbish, roots and stones greater than 10mm in diameter to a depth of 300mm and grade to true and even grades to the levels as indicated on the drawings or, grade out all depressions and humps less than 150mm from the general grade where contour or spot levels are not indicated.

All surfaces prepared for grassing to finish flush with adjoining kerbs to roads, parking and paved areas, and with foot pavements, terraces, verandas, mowing strips, manholes, pit and the like.

Where plumbing connector traps and rainwater relief overflows occur, finish ground level 75mm below overflow level.

All grading works shall be undertaken by hand work or by machine as is appropriate to the work however all grading and earthworks within a distance of 600mm radius of sprinklers or other fixed reticulation apparatus shall be hand worked to prevent damage to equipment.

Finish shall be smooth rolled, consolidated and smudge boarded to obtain a perfectly even, well consolidated surface.

No irregularities, depressions, hollows or abrupt changes in grades or falls will be accepted.

The cost of such minor preparation work shall be included in the unit rate per square metre tender price and no extras will be allowed for such preparation.

Before commencing work, inspect the site with the Superintendent to determine that grading can be achieved without providing additional filling sand from off-site sources.

If the Superintendent determines that additional filling sand is required, submit a written quotation which will be the subject of a variation to the contract as per the unit rate schedules.

### 2.25.2.2 Fertilizing

Prior to turf laying supply and spread to the full extent of area to be turfed pelletised organic fertilizer equal or equivalent to "Dynamic Lifter" at the rate of 100 grams per square meter to the approval of the Superintendent.

### 2.25.2.3 Watering

Supply all equipment necessary to adequately water the site during the Construction period.

Before commencing planting, ensure adequate watering services and equipment are available and properly functioning.



Areas to be planted shall first be watered to a depth of 100mm and the planting shall be carried out immediately after watering.

Throughout the contract up to Practical Completion, watering shall be properly undertaken, either by hand or irrigation system to keep the planted area moist to a depth of 100mm at not more than two (2) day intervals excepting Saturdays, Sundays and Public Holidays unless otherwise directed by the Superintendent.

Any faults or defects to the watering service and equipment during the construction period shall be immediately reported to the Superintendent.

#### 2.25.2.4 Turf Laying

Lay the turf along the land contours with staggered, close butted joints, and so that the finished turf surface is flush with adjacent finished surfaces of paving and the like. As soon as practicable after laying, roll the turf with a roller weighting not more than 90 kg/m of width or plate compactor. On slopes too steep for rolling, lightly tamp with turf into place.

#### 2.25.2.5 Making Good

Lift failed turf and relay with new turf. Turf of poor quality will be rejected.

#### 2.25.2.6 Top Dressing

Undertake top dressing as required to produce a true and even surface to the full extent of turf areas free of humps, hollows and depressions. Should top dressing be required, undertake when the turf is established, mow closely, remove cuttings and lightly top dress to a depth of 10mm with approved quality top dressing sand. Rub the dressing well into the joins and correct any unevenness in the turf surface.

### 2.25.3 Turf Establishment

#### 2.25.3.1 General

All turf grassing shall be fully established during Consolidation.

Undertake all establishment requirements including watering, fertilizing and mowing as specified to all newly grassed areas for the duration of the mowing and fertilizing programme specified and until such time as the turf grass is fully established.

For turf laid between the months of September to May inclusive a minimum of 6 weeks shall be allowed for full establishment. For turf laid between the months of June to October inclusive a minimum of 12 weeks shall be allowed for full establishment.

Completion of turf grassing consolidation will be subject to the successful establishment of turf grassing as solely determined by the Superintendent.

#### 2.25.3.2 Watering

Throughout the turf establishment period, ensure watering shall be properly undertaken, either by hand or irrigation system to keep the planted area moist to a depth of 100mm at not more than two (2) day intervals excepting Saturdays, Sundays and Public Holidays unless otherwise directed by the Superintendent.

Any faults or defects to the watering service and equipment shall be immediately reported to the Superintendent.

#### 2.25.3.3 Fertilizing (1st stage)

One week after laying turf, apply to the whole area a fertilizer mixed in the proportion of:

- Two parts AGRAN 34, one part Superphosphate No. 1 and,
- One part of MURIATE of Potash or such other lawn starter fertilizer as may be approved.

Evenly spread fertilizer at the rate of 50 grams/square metre and immediately thoroughly water in.

Fertilizing and watering shall be inspected by the Superintendent during each operation.

Give the Superintendent two (2) working days notice before the commencing of fertilizing and watering.

#### 2.25.3.4 Fertilizing (programme)

(2nd, 3rd, 4th, 5th and 6th Applications)

Apply a total of FIVE fertilizer applications to grassed areas after initial fertilizing.

Each application shall be at a maximum of four (4) and a minimum of three (3) weeks after initial fertilizing.

Each application is to be at the following rate:

- 50 grams/sq. metre of 12:2:6 NPK granulated fertilizer immediately thoroughly watered in.

Give the Superintendent two (2) working days notice before the commencement of each fertilizing and watering for site inspection.



### 2.25.3.5 Sample of Fertilizers

Submit to the Superintendent on request, sample of fertilizers used in the works.

The samples may be subjected to analysis. Fertilizer not in accordance with the Specification may be rejected.

Areas found to be not in accordance with the Specification shall be given an additional application of fertilizer in accordance with the Specification at their own expense.

### 2.25.3.6 Mowing

All newly grassed areas are to receive six mowings using a reel mower or an approved equivalent. When grass growth has exceeded 15mm a first light cut shall be made carefully avoiding damage to new turf. Cutting shall not remove more than 50% of growth and cuttings shall be caught and removed from the site.

Each additional cut (five in total) shall be made when turf has again reached 15mm. Repair all failed turf after mowing. Cuttings shall not remove more than 50% of growth and all cuttings shall be caught and removed from the site.

### 2.25.3.7 Weed, Insect and Fungus Control

The control and eradication of all weed growth, insect and fungus infestations shall be the total responsibility of the Contractor. During the establishment period all areas shall be managed to ensure minimal weed growth either by spraying or manual removal at all times until Practical Completion.

Where required, spray with insecticide, herbicide or fungicide in accordance with the manufacturers recommendations, to all Health Department and other statutory requirements. Submit proposal for approval prior to starting this work.

### 2.25.3.8 Rolling and Surface Finish

After the completion of second mowing the newly grassed areas shall be rolled with a heavy roller and finished to produce true and even grades and falls free of all wheel marks and ruts, waves, depressions and other irregularities. Maximum weight of roller is to be 500 kilograms.

### 2.25.3.9 Programme Inspections

Give the Superintendent not less than two (2) working days notice before completing each stage so that he may inspect the work.

Payment will only be made upon a satisfactory grass growth pattern being in evidence with sward in a healthy and vigorous condition at the initial inspection and continuing similar healthy growth being evident. Make repairs to each stage as are necessary to maintain full cover to the area.

The Contractor shall be fully responsible for all remedial works, including patching, to ensure a 100% full cover of grass is maintained at all times.

### 2.25.4 Consolidation

Turf grass consolidation shall commence from date of Practical Completion. Consolidation shall include grass establishment.

## 2.26 IRRIGATION – DESIGN AND CONSTRUCT

### 2.26.1 Scope

Design, supply and install an effective fully-automatic irrigation system to turf and garden bed areas serviced from the existing mains water supply.

The entry is currently serviced by a new, four (4) station controller and scheme water supply at the main entrance as indicated on the drawings servicing the entry garden beds.

A new four (4) station controller services the gardens to the Recreation Centre, connected to a Western Power meter box to the west of the driveway and a water supply located in the centre of the garden bed. One station only is currently used for the Recreation Centre garden beds.

The contractor shall determine the adequacy of the current controllers and programme, upgrade or replace controllers as required to adequately control the irrigation suitable for the works.

### 2.26.2 Materials and Works

Allow for all materials and works including but not limited to the following:

- Pipes, fittings and accessories including controllers;
- Coordination of conduits to carpark tree planting as required;
- Connection to water supply;
- Connection to power supply;



- Use for scheme systems]Back flow prevention device to gate valve;
- [Use if applicable] Allowance for future connection to existing WAWA scheme water supply without modification.

### 2.26.3 Irrigation Requirements

Include the following specific requirements in the design of the irrigation system:

- TREES: Irrigation Type: 1 No. flood bubbler.
- TREES IN PERMEABLE PAVING: Install 2 No x 2L/minute Hunter 'Root Zone Watering Systems' (RZWS-18-50-R) to each tree in permeable pavements.
- GARDEN BEDS: Irrigation Type: Pop-up sprays to beds adjacent to paving and grass areas and fixed-head sprinklers of size to suit the garden bed areas.
- LAWN AREAS: Irrigation Type: Pop-up sprays of size to suit the lawn areas.

### Related work

Co-ordinate and co-operate with the following trades:

- building contractors;
- Services installation contractors; and
- landscape contractors.

### 2.26.4 Quality Assurance

Contractor's Qualifications: Minimum five years experience in similar work as required by the Specification. Submit evidence of completed similar work with contact names and telephone numbers.

### 2.26.5 References

Comply with applicable portions of the following Australian Standards:

- AS1432-2004 Copper tubes for plumbing, gas fitting & drainage application;
- AS/NZS1477:2006 Unplasticised PVC (UPVC) pipes and fittings for pressure applications Parts 1,2,4 and 6; and
- AS/NZS2032:2006 Code of practice for installation of UPVC pipe systems.

### 2.26.6 Submissions

Submit for approval full irrigation drawings clearly showing all materials and their locations, all irrigation sleeves and penetrations, hydraulic calculations, i.e. flow rates required by the design and calculations of pressure requirements, sprinkler operating pressures, loss through mainline, loss through lateral line, loss through back flow preventer, loss through master valve, loss through sectional valve, loss through filter, loss through pressure regulator, rise to highest point, etc.

Submit samples of each component for approval of the Superintendent before ordering material.

### 2.26.7 Project Conditions

Inspect drawings and visit site. Check aspects of required work and refer any discrepancy to the Superintendent for direction.

### 2.26.8 Warranty and Maintenance

Maintain the system against faulty workmanship and materials for twelve (12) months after date of Practical Completion.

Replace any faulty component and restore to full operation at no cost to the principal.

### 2.26.9 Materials

UNDERGROUND PIPES: All under ground PVC piping, installed down stream of the master solenoid valve, shall be minimum class 9 PVC manufactured to AS/NZS1477:2006.1. Should PVC piping be used upstream of the master solenoid valve, this shall be minimum class 18

Each pipe to be marked with AS/NZS1477:2006

PIPE JOINTING: Solvent cements and cleaners shall be approved manufacture and shall be used in accordance with the manufactures recommendations. Cleaners must be coloured. Joints over 65mm dia. must be rubber ringed.

PVC FITTINGS: All PVC fittings for the installation shall be manufactured to AS/NZS1477:2006.2 and shall be compatible with PVC pipe produced in accordance with the Standard.



**GATE VALVES:** One to each supply line of size to suit end of main supply line.

**SPRINKLER RISERS:** Sprinklers shall be spring retractable, 6" pop up types preferably from the Toro, Rainbird or H.I.T. range. Risers may either be threaded polythene or polythene "funny pipe".

**SPRINKLER HEADS:** Compatible with delivery pressure of the main supply

**BUBBLERS TO TREES IN PERMEABLE PAVING:** Install 2 No x 2L/minute Hunter 'Root Zone Watering Systems' (RZWS-18-50-R) to each tree in permeable pavements. RZWS shall be connected to lateral pipe work with an articulated or flexible riser, minimum of 500mm in length. Install Hunter 'Filter Fabric Sleeve' (#RZWS-Sleeve) to each RZWS unit. Locking grated cap to RZWS to finish flush with finished permeable pavement level.

**FLOOD BUBBLERS:** Installed to each tree species

**SPRAY HEADS:** Compatible with delivery pressure of the main supply

**SOLENOID CONTROL VALVES:** Control valves shall be Bermad 200 series 24V A.C. solenoid valves, with flow control facilities, installed in adequately sized rectangular valve boxes. Solenoid valves which control dripper stations shall be of the pressure regulating type, or have separate pressure regulators.

**MASTER SOLENOID VALVE:** The master valve shall be a 'Watermark' approved 25mm 24V A.C solenoid valve approved by the Water Authority of Western Australia for this application.

**SOLENOID CONTROL WIRES:** Active control cables shall be a minimum of 1.5mm 5 multi-strand building wire, with the common wire being a minimum size of 2.5mm. Size the cable with the minimum sizes in mind, to ensure that voltage drop is kept to a minimum, and that the operation of the solenoid valves is not affected. Adequate spare wires must be installed to strategic locations to allow for the future extensions to the system.

**LOCKABLE PROTECTIVE BOXES:** One to each timer and gate valve.

**AUTOMATIC CONTROLLER:** The entry is currently serviced by a new, four (4) station controller and scheme water supply at the main entrance as indicated on the drawings servicing the entry garden beds.

A new four (4) station controller services the gardens to the Recreation Centre, connected to a Western Power meter box to the west of the driveway and a water supply located in the centre of the garden bed. One (1) station only is currently used for the Recreation Centre garden beds.

The contractor shall determine the adequacy of the current controllers and upgrade / replace controllers as required to adequately control the irrigation suitable for the works.

Supply and install an automatic irrigation controller as required with the following minimum features:

- Solid state operation;
- Multi-programme;
- Repeat cycle;
- Minimum eight (8) hours per station;
- Fourteen (14) day calendar;
- Rain switch;
- Manual, semi-auto and automatic operation;
- Transformer and back-up batteries; and
- Located within a lockable, hot dipped galvanized and powder coated weatherproof cabinet.

#### 2.26.10 Examination

Inspect site and compare conditions to those provided in specification and drawings. Notify Superintendent of any discrepancy for direction.

Commencement of works signifies full acceptance on behalf of the contractor of all existing site conditions.

#### 2.26.11 Preparation

Co-ordinate with other trades responsible for any site preparation or works as required prior to making final preparation before installation of materials.

#### 2.26.12 Trenches and Excavations

Prior to excavation of trenches, obtain approval of pipe runs. Minor adjustment in the system's layout will be permitted to clear existing underground obstructions. Repair costs to services damaged are the responsibility of the Contractor performing this work.

Excavate mainline trenches to a depth so as to allow a minimum of 400mm cover from the top of the pipe to the ground surface. Excavate trenches for lateral spray lines to a depth so as to allow a minimum of 300mm





cover from the top of the pipe to the ground surface. Excavate trenches to sufficient width to permit proper handling and installation of the pipe and fittings.

Obtain approval prior to back filling trenches. Pipes are to be firmly and evenly supported with clean backfill material free of rubble, stones and rocks.

Where rock and stone is incurred during the excavation works, back fill material over the pipe to be clean, white packing sand free of organic matter. Place sand layer 75mm depth from the top of the pipe.

Place trench backfill material in at least two equal layers. Each layer to be wheel-rolled with a backhoe or other approved compaction equipment and crown completed backfill 30mm higher than the surrounding surface to allow further consolidation.

Where solid rock is encountered in trench excavation, request an inspection of the open trench prior to further trench excavation in that area.

Rock are to be measured in the solid jointly by representatives of the Contractor and the Superintendent within the confines of the excavation and within the limits shown on the drawings or specified prior to back filling. No allowance will be made for over break.

The Contractor is responsible for the erection of all necessary barriers and safety signs to make trench work safe from public pedestrian entry. Under no circumstances are trenches to remain either open or partially open over night.

#### 2.26.13 Installing Pipes

Install sprinkler lines or mains with a minimum cover as specified above. Interior of pipes are to be kept free from dirt and debris. Open ends of pipe to be closed by approved means during the laying process.

Use red priming fluid and blue dyed solvent cement to joints. Ensure that excess solvent is carefully wiped free of joints and keep joints dry for 24 hours minimum to allow solvent cement to dry. Turn on valves to each station to flush lines out with water before fitting spray heads.

Ensure that no pipe lengths will carry water at greater than 1.5 metres/second velocity.

#### 2.26.14 Under Road Boring, Sleeve Pipes and Thrust Boring

Utilize under road or pavement boring techniques to facilitate road crossings which may be required for the placement of irrigation mainlines and control cabling under such infrastructure. All road crossings shall be accomplished utilizing an appropriately sized PVC sleeve for the placement of mainlines and/or control cables. Where control cables are to be installed within the same PVC sleeve as irrigation mainlines, install the cables within an appropriate size PVC low density electrical conduit.

PVC along entire width of pavement. Install top of PVC sleeve pipe 400mm below existing pavement level.

#### 2.26.15 Valves

Inform Superintendent of any proposed change made in supply and installation of Master Valve. Allow for connection of pipe work tees and junction elbows from the existing pipe work out of the valve.

#### 2.26.16 Sprinkler Risers

Install sprinklers on screwed 15mm schedule 80 PVC articulated risers. Set spray heads level with topsoil or at a level determined by the Superintendent.

Securely brace the riser against vibration where the sprinkler head is in operation.

Flush out mains, laterals and risers with water before fitting sprinkler heads to risers.

#### 2.26.17 Sprinkler Heads

Set sprinkler heads according to manufactures specification. Set half circle sprinklers flush to edge of grass and garden or paving and grass or kerb.

Set sprinkler heads perpendicular to finished surfaces. Set heads at grade on shrub beds.

Discharge of water from sprinkler heads to be compatible to the pipe layout and delivery pressure of the main. Refer to the Schedule which lists valve sprinkler types. Make adjustments for throw of individual spray heads prior to commissioning of service and Practical Completion. Adjust sprinklers to give complete even coverage at completion of installation. Install the spray heads as nominated on the Schedule.

#### 2.26.18 Commissioning

##### 2.26.18.1 General

The contractor shall be responsible for the testing and satisfactory performance of the complete irrigation system.

Give 48 hours notice to the Superintendent prior to testing.

##### 2.26.18.2 Commissioning Procedure



#### A. Static Tests

Prior to commissioning ensure valve stations close satisfactorily.

Pipe work and fittings to be tested to the satisfaction of the Superintendent to ensure there are no water leaks in the system.

#### B. Upon completion of the above static tests in the presence of the Superintendent commission the system in accordance with the following procedure:

1. Open each valve to test sprinkler operation. During this procedure only one valve station is to be open at any one time.
2. Test sprinkler operation by continuous operation for a minimum of 15 minutes for each valve.

#### C. Upon satisfactory completion of the above procedures the complete system is to be continuously operated for a minimum of one hour.

#### 2.26.19 'As Constructed' Irrigation Records.

Prior to Date of Practical Completion the Contractor shall supply to the Superintendent:

- one (1) set of Original Drawing size paper drawings;
- one (1) set of A3 size paper drawings;
- one (1) set of digital AutoCAD drawings on CD;
- one (1) set of digital PDF drawing on CD;
- three (3) sets of paper warranties and manuals; and
- one (1) set of digital warranties and manuals on CD.

Drawing/s to clearly show pipe sizes, valve types and locations, fittings and control cable routes. Clearly and accurately annotate dimensions of pipes.

The 'as constructed' drawings shall be supplied to the Superintendent in the following formats:

- Fully comply with Fully comply with O Spec drawing protocols as approved by the Superintendent;

Each separate service shall be on a separate drawing layer. Service invert level or depth of cover information shall be provided on a service by service basis on each drawing layer with point numbering reference.

The 'as constructed' drawings shall include grid co-ordinates to the same system as that used the Principals Surveyor and to Perth Coastal Grid.

Location of existing services which are exposed or located during trenching operations shall be shown on the 'as constructed' drawings and the type of service noted.

If the Contractor utilises drawing files provided for construction purposes, to prepare 'as constructed' records, then all notes and instructions shown on the drawings that refer to the scope of work to be undertaken shall be substituted with appropriate, accurate 'as constructed' information. As a reference for verification by the Superintendent's representative of the changes that have occurred on site, the Contractor shall provide on a single separate drawing layer, the scope of work drawings issued at the commencement of the Contract.

This shall be represented by AutoCAD.

Layer = Orig or similar

Linetype = Bylayer

Colour = 8 (grey)

Pen width = 0.18

Where more than two (2) pipes or services exist in a common trench, trench cross sections shall be provided showing the accurate position, type and depth of each service. Where sprinkler head numbers or nozzle configurations have changed during construction, the revised valve flows will be calculated by the Irrigation Sub-Contractor and will be shown on the 'As Constructed' drawing.

The drawings shall show accurate locations of sizes of pipe work, road crossings, valves, sprinklers, cables, controllers, main connections and other components relevant to the irrigation system.

Grid co-ordinates will be provided and shown in tabular form on the drawing, for the following:

- Mainline starting and finishing points.
- Changes in direction of mainline and sub-main.
- Isolating valves.
- Solenoid valves.



- Sub-main start and finish points.
- Lateral start and finish points.
- Road crossings.

Solenoid wire colour or wire code numbers for each valve shall be shown on the drawing.

The form of presentation shall be acceptable to the Superintendent. As a minimum requirement, the symbols used shall be the same as those used on the drawing issued for construction.

All measurements shall be in metres to the first decimal point.

The Irrigation Sub-Contractors shall submit a draft paper copy of the 'As Constructed' drawing for approval by the Superintendent, before finalizing the drawings.

The drawings shall show, at least the same level of site details as the construction drawings. Where landscape features (eg. pavements, garden beds) have changed from those shown on the construction drawing, the Irrigation Sub-Contractor shall indicate these changes on the drawing with a notation such as "pavement location shown not accurate".

Where multiple valves and fittings are installed in close proximity to each other, symbols can be repositioned schematically on the drawings for clarity and an enlarged installation detail drawn, showing installation detail and measurements between valves and fittings. Surveyed co-ordinates are to be provided for each item in this instance.

The provision of accurate 'as constructed' information forms an important component of this Contract and back-filling of services without 'as constructed' details will not be permitted. Failure to comply with the 'as constructed' requirements of the Contract will result in the Contractor being required to expose services, survey as stated and reinstate trenches and all other works, at the Contractors cost.

#### 2.26.20 Clean Site

Upon completion of the works, the site shall be left in a tidy condition, free from rubbish and surplus excavated materials to the satisfaction of the Superintendent.

#### 2.26.21 Completion

Complete all works in accordance with contract documents and written variation orders issued by the Superintendent.

### 2.27 PRACTICAL COMPLETION

#### 2.27.1 General

Reference is made to the General Conditions of Contract, definition of Practical Completion.

Give the Superintendent three (3) working days notice that the works are complete and that the works are ready for issue of the Certificate of Practical Completion and commencement of Consolidation.

Prior to Date of Practical Completion the Contractor shall supply to the Superintendent one A1 paper (or original drawing) size and one digital (CD) copy of the as constructed drawings clearly showing all works as executed and covered by the contract, including all warranties and manuals.

Prior to Date of Practical Completion the Contractor shall supply to the Superintendent one A1 paper (or original drawing) size and one digital (CD) copy of the irrigation and electrical works as executed drawings clearly showing all irrigation works as executed and covered by the contract, including all warranties and manuals.

The supply of approved as executed drawings, warranties and manuals forms part of the works and shall be a condition precedent to the Superintendents acceptance of Practical Completion.

### 2.28 CONSOLIDATION

#### 2.28.1 General

Consolidation shall mean the continuing care and consolidation of the works by accepted horticultural and landscape maintenance practices, as well as rectifying any defects that become apparent in the works.

The consolidation period for Hard Landscape and Planting works shall commence from the Date of Practical Completion and be for a period of Three (3) calendar months.

The consolidation period for Turf Grassing shall commence from the Date of Practical Completion of Turf Grassing (at completion of turf establishment programme to the sole discretion of the Superintendent) and be for a period of Three (3) calendar months.

Works to be consolidated include all the works under the contract including, but not limited to:

- Inspection and Reporting;



- Hard Landscape Works Consolidation;
- Soft Landscape Works Consolidation;
- Lighting System Operation (where lighting is within the landscape contract);
- Irrigation System Operation (where irrigation is within the landscape contract);
- Rubbish Removal; and
- Rectification of Defects, Vandalism and Theft.

#### 2.28.2 Consolidation Commencement

Works shall only be placed in consolidation when a certificate of practical completion has been issued for the full or separable portion of the works as stated in the contract.

#### 2.28.3 Inspection and Reporting

##### 2.28.3.1 Weekly Inspection

The Contractor shall inspect the full works at a minimum on a weekly basis and immediately report to the Superintendent any activities and conditions that in any way adversely affect the works including all damage and theft.

##### 2.28.3.2 Weekly Consolidation Reporting

Throughout the consolidation period the Contractor shall prepare and submit to the Superintendent on a weekly basis a consolidation report covering the following:

- Date and time of weekly inspections;
- Condition of pavements and hard landscape elements;
- Condition of garden structures, furniture and fixtures (including lighting where lighting is within the landscape contract);
- Playground Elements and Surfaces Maintenance;
- Condition of ornamental pools and associated hydraulics;
- Condition of irrigation;
- Condition of garden beds and turf grassing;
- Progress of establishment of green stock and turf grassing;
- Occurrence of vandalism, theft and graffiti throughout the works;
- Damage or disruption by others throughout the works, including sand drift from adjacent sites;
- Activities that have been completed throughout the month,
- Activities planned for the month ahead, and
- Upcoming capital outlays required to consolidate the works.

Payment of claims for consolidation shall be dependent upon the submission and approval by the Superintendent of compliant consolidation reports.

#### 2.28.4 Hard Landscape Works Consolidation

##### 2.28.4.1 General

Maintain all hard landscape works in a clean, neat and tidy condition for the full extent of the consolidation period. All defects shall be rectified at the Contractor's expense within one (1) week of detection.

Notify the Superintendent of any hard works or street furniture that have been stolen or damaged and await instructions from the Superintendent prior to repair or replacement.

##### 2.28.4.2 Barbecue Facilities

Maintain all barbecues and barbecue facilities in a clean condition at all times.

Barbecues and their surrounds shall be washed down to remove all dirt and grease twice weekly, on a Monday and a Friday, for the duration of the Consolidation period.

Rubbish bins associated with barbecue facilities shall be emptied twice weekly, on a Monday and a Friday, for the duration of the Consolidation period.

All barbecues shall be timed to cease operation at 9.00pm each night.



All defects shall be rectified at the Contractor's expense within one (1) week of detection.

## 2.28.5 Playground Elements and Surfaces Maintenance

### 2.28.5.1 General

Inspect all playground elements, equipment and surfaces as a minimum daily.

Upon detection of any broken or damaged elements immediately notify the Superintendent and immediately make safe by either isolation with appropriate fencing and no access signs or, if required make safe by removal of the item.

Generally, maintain play ground elements, equipment and surfaces in a safe, clean and neat condition at all times.

All soft fall areas to be inspected for partially buried foreign objects, including but not limited to rocks, glass and any other foreign objects and, excessive wear on a daily basis. All rubbish and deleterious material shall be immediately removed and excessive wear in soft fall to be repaired to restore the soft fall to its original depth.

All play equipment shall be kept free of all rubbish and deleterious material on a daily basis.

All play equipment shall be kept clean by washing down with appropriate cleaning methods and products on a monthly basis to ensure all equipment is kept clean and to prevent dirt and grime build up.

All graffiti is to be reported and removed as soon as practicable with appropriate methods that do not damage the item of play equipment.

All play equipment that is subject to a manufacturer's inspection and maintenance programme, schedule or regime shall be inspected or maintained strictly in accordance with that programme, schedule or regime.

Undertake a complete play ground audit including testing of all soft fall annually, in accordance with the relevant Australian Standards. Repair and rectify any play element or item of play equipment including soft fall that doesn't meet the required standard.

Should any failure or defect in any item of play element or equipment constitute a threat to public safety or a hazard at any time, the item will immediately be made safe including signage and barricading, and immediately reported to the Superintendent for direction.

## 2.28.6 Soft Landscape Works

### 2.28.6.1 General

The consolidation programme shall include, but not be limited to the following items where and as required:

- Turf Grassing Maintenance; and
- Mass Planting Area Maintenance.

### 2.28.6.2 Turf Grass Maintenance

Maintain turf grassing in a healthy, vigorous condition, free of weeds and pest and mown as required to maintain optimal health and suit seasonal requirements.

Undertake all testing and control as required to identify and control all pests and disease including Pythium root rot.

### 2.28.6.3 Weed Control

Maintain site and fence lines free of weeds and invasive plants. Eliminate all weed growth to landscaped areas using approved non-residual herbicide such as "Roundup". Control weeds growing in watering basins by means of suitable selective herbicide such as 'Roundup'.

### 2.28.6.4 Vermin, Pest and Disease Control

The Contractor shall maintain all plants free from pests, disease and attack and damage by vermin by approved methods at the Contractors expense.

Undertake all testing and control as required to identify and control all pests, disease and vermin including Phytophthora root rot.

Where chemicals are required preference will be given to biological control and low toxicity systemic products. Mechanical applicators will be precisely calibrated and care taken when applying to minimize over spray.

Chemicals used in plant maintenance shall be applied in accordance with all Health Department Regulations and relevant approved Safety Data Sheets for each chemical.

### 2.28.6.5 Re-Planting

Replace weekly all dead and dying plants, including plants damaged by vermin at the Contractor's expense.

On a weekly basis notify the Superintendent of the quantity and type of plants that have been stolen or damaged through vandalism and await instructions from the Superintendent prior to replacement.



#### 2.28.6.6 Pruning

Prune all dead wood or foliage from plants as required each week.

#### 2.28.7 Watering - Irrigated

Provide sufficient irrigation to maintain all plants in a healthy growing condition in accordance with the Irrigation Operation and Maintenance section of this specification for the duration of the Consolidation period.

#### 2.28.8 Lighting System Operation

Operate and the maintain the lighting system for the extent of the consolidation period to ensure the effective lighting of all lit areas under the contract. The Contractor shall be responsible for all cost associated with maintaining the lighting during the consolidation period.

During the consolidation period of the Contract the Contractor shall immediately repair, at the Contractors expense, any lighting component failure or malfunction.

During the consolidation period of the Contract, the Contractor shall immediately inform the Superintendent of any theft or wilful damage by others and await instruction. All cost associated with repairs due to vandalism and theft shall be borne by the Principal and be subject to an approved variation to the contract.

The contractor will make immediately make safe and undertake repairs as necessary to the lighting system when a failure of the system will present a public hazard and immediately notify the Superintendent of the actions taken.

After establishment of the landscaped areas, adjust the heights of all in ground and up lights, junction boxes and cable pits etc as and when instructed by the Superintendent.

#### 2.28.9 Irrigation System Operation

Operate and maintain the irrigation system for the extent of the consolidation period to ensure the effective watering off all irrigated areas under the contract under prevailing site conditions. The Contractor shall be responsible for all cost associated with maintaining the irrigation during the consolidation period.

Any plant material that has died or is set back due to the failure of the irrigation system shall be immediately replaced to original specification be the Contractor. All costs associated with replacement of dead or set back plant material shall be borne by the Contractor.

During the consolidation period of the Contract the Contractor shall immediately repair, at the Contractors expense, any irrigation component failure or malfunction including the repair of any erosion of soil due to sprinkler failure or malfunction.

During the consolidation period of the Contract, the Contractor shall immediately inform the Superintendent of any theft or wilful damage by others and await instruction. All cost associated with repairs due to vandalism and theft shall be borne by the Principal and be subject to an approved variation to the contract.

The contractor will make immediately make safe and undertake repairs as necessary to the irrigation system when a failure of the system will jeopardize public safety or the establishment of the landscape works and, immediately notify the Superintendent of the actions taken.

After establishment of the landscaped areas, adjust the heights of all sprinkler heads, valve boxes, cable pits etc as and when instructed by the Superintendent.

#### 2.28.10 Rubbish Removal

Maintain the site free of rubbish, rocks, branches etc for the full extent of the consolidation period.

Rubbish, including the emptying of refuse bins from the entire site shall be undertaken as required to maintain the site in good condition. As a minimum, rubbish removal shall be undertaken once per week on Friday or Saturday mornings. All rubbish shall be disposed of off site in an approved refuse tip at the contractor's expense.

#### 2.28.11 Rectification of Damage, Vandalism and Theft

Take all reasonable steps practicable to minimize the threat and occurrence of damage, vandalism and theft to the landscape generally. This shall include but not be limited to removal of unused equipment after hours, maintaining lighting, not leaving tools or piles of pruned or mowed vegetative material on site over weekends and immediately reporting suspicious activities to the Superintendent and, if deemed necessary the police.

During the consolidation period damage to the works due to vandalism and theft shall be repaired by the Contractor.

All cost for rectification of damage, vandalism and theft of the works, except those due to an act or omission on the part of the Contractor, shall be borne by the Principal and subject to an approved variation to the Contract. No rectification shall be completed without the written approval of the Superintendent. All rectification shall be completed by the Contractor within seven days of approval to proceed.



Any damage, vandalism or theft that renders the works unsafe shall be immediately made safe by the Contractor by barricading off or other appropriate means and immediately notified to the Superintendent.

Any damage, vandalism or theft to the landscape shall be reinstated as shown on the plans and as outlined in the contract documents.

## **2.29 CONSOLIDATION COMPLETION - PRINCIPAL HAND OVER**

### **2.29.1 General**

Fourteen (14) days prior to the dated of Completion of Consolidation, give the Superintendent written notice that the Consolidation Period is due to expire. The contractor shall be responsible for the ongoing consolidation of the works until such time that the notice has been served to the Superintendent.

Directly prior to consolidation completion 'top up' mulching to all garden beds and tree watering basins to conform to specification.

At time of consolidation completion grass areas shall have a healthy and vigorous grass sward.

At time of consolidation completion trees and shrubs shall show signs of healthy vigorous growth, be free of all pests and diseases and be appropriately pruned. Trees shall be appropriately staked and have a suitably sized watering basins intact.

At time of consolidation completion all hard works including paving, kerbing, lighting (where lighting is within the landscape contract) and street furniture shall be functional, oiled or painted as specified, free of damage, clean, neat and tidy.

At time of consolidation completion all irrigation works shall be fully automated, working efficiently and effectively and programmed to suit the current status of the landscape works. Maintenance personnel to whom the work are to be handed to shall be fully briefed on the operation of all systems to ensure they can operate the systems efficiently and effectively.

## **2.30 FINAL COMPLETION**

### **2.30.1 General**

Fourteen (14) days prior to date of Final Completion, give the Superintendent written notice that final completion is due.

