THE HILLS SHIRE COUNCIL

WORKS SPECIFICATION
SUBDIVISIONS / DEVELOPMENTS

September 2010

THE HILLS SHIRE COUNCIL

WORKS SPECIFICATION FOR SUBDIVISIONS/DEVELOPMENTS

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THE HILLS SHIRE COUNCIL

GLOSSARY

AS	Current Australian Standards published by the Standards Association of Australia.
Council	The Hills Shire Council as represented by its employees.
Council Engineer	Person carrying out inspections for Council.
CPEng	Chartered Professional Engineer
Developer	Any person/s, company or entity representing the Developer for the purpose of constructing the Works.
Documents	All expressed and implied; Specifications, standards, drawings and correspondence, which are related to the works and referred to by Council or approved by Council.
NATA	National Association of Accredited Testing Authorities.
RTA	Roads & Traffic Authority, New South Wales.
Site	The area of land being developed.
Supervisor	The person appointed by the Developer to supervise the construction of the Works and to represent the Developer.
Works	The development of land as described by the drawings and Specifications (the Documents) as proposed by the Developer and as cited and approved by Council.

1 GENERAL SPECIFICATION OF WORKS

1.1 GENERAL

1.1.1 This Specification has been compiled to outline Council's general procedures and practices in respect of all the associated construction requirements for drainage, roads, erosion control and ancillary details within The Hills Shire.

1.1.2 Council's basic objective is to preserve, enhance and develop the amenity of the Shire with specific reference to safety, convenience and long term cost effectiveness. This Specification has been prepared to assist the Developer to proceed with development by fully informing him of Council's requirements with respect to construction of assets which will eventually be vested into and maintained by Council.

1.1.3 The Documents referred to in this Specification shall include but not be limited to Engineering Plans approved by the Council, The Hills Shire Council's "Design Guidelines, "Australian Standards, "Australian Rainfall and Runoff, Institution of Engineers, 1987" and the Statutes, Acts and By-Laws of the Governments of New South Wales and Australia, including the Occupational Health and Safety Act (2000). All of these documents compliment each other and shall be referenced in conjunction with this Specification.

1.1.4 This Document is the Specification defining construction details and the obligations of Council and the Developer. This document provides details relevant to the Developer and is binding on all works carried out. Obligations between Council and the Developer are inherent and binding once the Developer's Engineering Plans or Engineering Construction Certificates have been approved and issued by Council.

1.1.5 Council's "Design Guidelines" as amended from time to time is the Specification defining the Engineering Design details required by Council which must be followed by the Developer or his Representative in order to obtain approved Engineering Plans or Engineering Construction Certificates.

1.1.6 No departure or change will be permitted from approved Engineering Plans during construction except by written consent or on-site approval from Council's Engineer.

1.1.7 The Documents including any written directions issued by Council to the Developer are binding on the Developer. Council neither accepts responsibility nor implies or guarantees any directions given to the developer for any subsequent physical or contractual damages received by the Developer.

1.2 RESPONSIBILITIES OF THE PARTIES

1.2.1 COUNCIL'S RESPONSIBLITIES

1.2.1.1 Council Inspections

Council will provide Subdivision Engineers to progressively review the work of the Developer. The provision of Council's Engineer in no way limits the Developer's full responsibility for completing the works in accordance with sound engineering practices and principles and in accordance with the intent and purpose of the Documents.

1.2.2 DEVELOPERS RESPONSIBILITY

1.2.2.1 The Documents

The Works shall be completed in accordance with the intent and purpose of the Documents. The latest copies of the Documents must be kept on-site at all times and be available for inspection by Council.

1.2.2.2 Access by Council

The Developer must allow complete and unhindered access of Council to the Work site for the purpose of inspecting materials and the Works.

1.2.2.3 Work by Service Supply Authorities and/or other Contractors

It should be anticipated by the Developer that the construction of mains and/or services by service Authorities and/or work by other Contractors may proceed during the currency of the Works.

The Developer must permit and maintain access by traffic to such construction and/or work and shall not obstruct the execution of work by the various Service Authorities and/or other Contractors and/or Builders.

1.2.2.4 Completion of Works

It is the Developer's responsibility to compete or to cause the completion of the Works in accordance with the Documents and in a workmanlike manner and to provide smooth transition between all existing and new works. Inspection by Council does not relieve the Developer of his responsibility to supervise or to arrange the supervision of the Works. Inspections are for the purpose of enabling Council to be satisfied that the Works have been properly carried out in accordance with the Documents and the Works are in a suitable state for Council to take over. Where works have been undertaken without inspection by Council's Engineer, the Developer is to arrange for a CPEng to certify that the works have been constructed in accordance with the approved documents.

Consequently, any defects that develop before the works are finally accepted by Council will be required to be adjusted even though the defective work may have previously been approved.

1.2.2.5 **Public Liability Insurance**

Contractors engaged on Development or Subdivision Works should take out Public Liability Insurance to the value of $10 million. The policy should specifically indemnify Council from all claims arising from the execution of the works. Council will annually check on each contractor's public liability insurance.

1.3 PRIOR TO COMMENCEMENT

1.3.1 GENERAL

1.3.1.1 Council must approve for construction all Documents prepared for the Works. The Developer must obtain consents from all relevant Statutory Authorities as required by Council prior to any works being commenced.

Where necessary, approval from adjoining landholders for works access and/or right of way must be obtained in writing prior to approval of the Documents.

A copy of this approval is to be forwarded to Council.

1.3.1.2 Council must be given 24 hours notice prior to the commencement of any Works.

1.3.1.3 A site meeting between the Council and Developer shall take place before construction activities commence.

1.3.2 ADEQUACY OF THE DEVELOPER'S SITE REPRESENTATIVE

Before construction is commenced the Developer shall ensure that adequately qualified supervisory staff are available to control the Works.

The Developer shall advise Council the name of the person appointed as his representative for the Works (hereinafter known as the Supervisor).

1.4 GENERAL REQUIREMENTS

1.4.1 PROVISION FOR TRAFFIC

The Developer shall not obstruct and shall be held responsible for, the safety of traffic, vehicular and pedestrian and must provide all watchmen, lights, barriers, signs and fences necessary to prevent any accident or public or private damage or loss and shall regulate traffic during the progress of the Work, in accordance with the requirements of AS 1742. If necessary, he shall provide for traffic by its diversion to an alternative route approved by Council or by the formation of side tracks alongside the Works, or by the construction of one half of the road at a time leaving the other half available for traffic. The Developer shall not, by his operations, obstruct any side road or branch track, nor shall he break down

any fences, or damage public or private utilities, nor obstruct any drain or watercourse. When such obstructions or breakages cannot be entirely avoided he shall at once remove such obstructions and make adequate provision for traffic or immediately repair such breakages. In the event of his failing to rectify any of the abovementioned causes, the Council reserves the right to do so after giving the Developer 24 hours notice in writing of its intention and the whole of the cost of such work incurred by the Council will be a legitimate charge payable by the Developer.

A traffic control plan, prepared by a suitably certified person and in accordance with AS1742 and Council's Traffic Control at Work Sites-1999, is to be submitted to Council for approval.

1.4.2 WORKING HOURS

The works shall be carried out within the hours of 7:00am to 5:00pm Mondays to Saturdays. No work shall be undertaken on Sundays or public holidays.

1.4.3 DAMAGE TO/OR ALTERNATIONS OF EXISTING SERVICES

The Developer shall exercise the greatest care during the progress of the Works to avoid damage to any utility service and shall be responsible for any damage caused by him or his agents directly or indirectly.

If, as a result of the Works, any alterations to existing utility services are considered necessary by Council, it shall be the responsibility of the Developer to make the necessary arrangements with the appropriate Authority at their total cost and at not cost to Council.

1.4.4 ENTRY UPON ADJOINING PROPERTY

The Developer or his representative shall not commit any act of trespass and shall effectively protect all adjoining properties and owners against any loss, damage or injury that may occur through the carrying out of the Works. If instructed by Council, the Developer shall remove from the site any employee offending against the provisions of this clause.

All property or access which has been disturbed or altered as a result of the Developer's activities shall be reinstated. The reinstated property, as in surface finishes or fences or other property, shall be reinstated to a finish similar to that which existed prior to disturbance and to the satisfaction of the property owner.

1.4.5 DEBRIS DISPOSAL

Burning off by open fire is prohibited by the provisions of the current Protection of the Environment Operation Act N.S.W. Advice on acceptable methods of debris disposal may be obtained from the Metropolitan Waste Disposal Authority.

1.4.6 USE OF APPROPRIATE STANDARDS FOR CONSTRUCTION

It is the responsibility of the Developer to complete all works according to Australian Standard except where the Documents specifically override the Australian Standard.

1.4.7 FENCING

It is the responsibility of the Developer to provide, erect and maintain suitable safety / construction fencing to the perimeter of the site, excavations, detention basins, dangerous obstructions etc as required by Work Cover NSW or as directed by Council.

1.4.8 SIGNAGE

The developer is to erect and maintain the necessary signs as required by Work Cover NSW and Council. All signs are to be removed on completion of works.

1.5 INSPECTION OF THE WORKS

1.5.1 GENERAL

The Developer shall at all and any time, give uninterrupted access and afford every facility for the inspection and examination of the Works or materials that may be required by Council, at any place where the said work or materials are being prepared. The Developer, when required by Council, shall provide all particulars as to the mode and place of manufacture and source of supply of any of the materials to be used.

1.5.2 SCHEDULE OF INSPECTIONS

1.5.2.1 General

The Developer shall give the following notices as listed in Table 1.1, to the relevant Council Officer who can be contacted by phone on work days on 9843 0555 between 8:00am to 4:00pm.

Table 1.1 TABLE OF INSPECTIONS

Inspection	Pre-requisite	Prior Notice Days Before Inspection
Prior to commencement of work	Erosion Controls in place	1 working day
Traffic control to AS 1742-3	Prior to opening of roads	1 working day
Bedding of pipes in trenches	Pipes laid and jointed	1 working day
Trench backfill within roads	Sand backfilled and compacted to subgrade level	1 working day
Formwork for concrete structures	Prior to pour	1 working day
Subgrade proof roller test	Subgrade placed, levelled and trimmed	1 working day
Proof roller test for kerb	Pavement placed, levelled and trimmed	1 working day
Sub-base course proof roller test	Pavement placed, levelled and trimmed, kerbs in place	1 working day
Base course proof roller test	Pavement placed levelled and trimmed	1 working day
Prior to placing of fill	Surface ready for filling, fill material inspected	1 working day
Road crossing	Service in excavated trench, bulkheads in place	1 working day
Final Inspection	All works practically complete and submission of W.A.E plans	5 working days
Asphaltic concrete surfacing	Road ready for surfacing	1 working day

1.5.5.2 FINAL INSPECTION

A preliminary final inspection will be arranged upon completion of the Works excluding deferred Works that are to be bonded. The works shall be fully in compliance with the Documents.

The following work shall be completed prior to the preliminary inspection.

a) Work-as-Executed Plans as required.

b) All lots pegged.

c) Lot boundaries marked on kerb

d) Street signs erected at approved locations.

1.6 INSPECTION AND TESTING OF MATERIALS

1.6.1 AVAILABILITY OF MATERIAL FOR TESTING

The Developer shall at the direction of Council submit any material or work for testing and shall “open up” and supply samples of any work which has been covered whether the work has or has not previously been approved by Council. All expenses incurred in providing such materials from the Works or in making good the Works after such removal shall be borne by the Developer. Such directions must be complied with within 24 hours, or such time frame as agreed by Council.

The cost of all tests and certifications required by Council shall be borne by the Developer.

1.6.2 QUALITY OF MATERIALS

All materials incorporated in the Works shall be new and comply with the relevant AS as listed in Table 1.2. All materials shall be subject to inspection, testing and approval by Council. If any materials fail to comply with the documents then that material represented by the failure and all materials of similar manufacture or supply will be rejected.

Table 1.2 **SCHEDULE OF MATERIAL TESTS**

Except where specifically overridden by the Documents

Material to be Tested	Standard to be complied with	Prior to Type of Work	Form of Test Verification
Compacted Subgrade	AS 1289	Placing Sub-Base	Proof rolling, (Note 1) NATA Certificate and Plan
Compacted Sub-Base	AS 1289	Placing Base Course	Proof rolling, (Note 1) NATA Certificate and Plan.
Compacted Base Course	AS 1289	Road Surfacing	Proof rolling, (Note 1) NATA Certificate and Plan.
Asphaltic Concrete Surfacing	AS 2891	Completion of Part of Work	NATA Certificate
Earth Fill	AS 1289	Spreading topsoil	NATA Certificate and Plan.
Supply and ordering ready mixed concrete	AS 1379	Concrete Pour	NATA Certificate
Concrete	AS 1012	Completion of Part of Work	NATA Certificate
Reinforcing Bars and Wires	AS/NZS 4671	Concrete Pour	Site Inspection
Interlocking concrete paving units	AS 1012	Completion of Part of Work	Site Inspection
Pre-cast reinforced concrete Box culvert	AS 1597	Taking delivery	Site Inspection
Pipes	As for relevant type of pipe	Taking delivery	Site Inspection
Crushed Rock & Recycled Material	RTA T114, T213, T215, RTA 3051 & RTA 3071	Taking delivery	NATA Certificate
Natural Gravel	RTA, T106, T171, T114, T108, T109, & T215	Taking delivery	NATA Certificate

Note 1 Proof rolling with 3 point self propelled static roller

Note 2 Depending on Works some of these Tests and Certificates may not be required.

1.7 TOLERANCES

1.7.1 SUB-GRADE

The tolerance on the Reduced Level of the Sub-grade shall be as follows:-

:minus, no limit
:plus 15mm.

1.7.2 PAVEMENT

1.7.2.1 The tolerances on completed pavement thickness, measured at time of preparation for bituminous surface treatment, shall be as follows:-

Total thickness	:Minus 5mm; plus no limit
Pavement thickness	:Minus 5mm; plus 5mm
Sub-Base	:Minus 5mm; plus 10mm

1.7.2.2 Pavement thicknesses shall be checked by drilling or digging of holes by the Developer in the finished pavement at positions determined by Council. Holes shall be filled after measurement with damp material as specified for the surface course, well rammed to the satisfaction of Council. The cost of digging and repairing the test holes shall be borne by the Developer.

1.7.2.3 Width of pavement
(Where not in contact with concrete gutter) :minus 25mm, plus 150mm

1.7.3 BITUMEN EMULSION SEAL

The tolerances of the finished surface of pavement (neglecting the thickness of the final layer of bituminous surface treatment) measured at the time of preparation for surface treatment shall be as follows:-

<u>Level</u>	
Finished level at any point	:minus 10mm, plus 10mm
Grading in any direction in 3m or less	:minus 10mm, plus 10mm
Grading in any direction	:minus 10mm
Per 3 metres	:plus 10mm
Width of seal (where not in contact with concrete gutter)	:minus 75mm, plus 150mm

1.7.4 **FINISHED SURFACE OF PAVEMENT (ASPHALTIC CONCRETE)**

1.7.4.1 The tolerances on the finished surface level shall be as follows:-

Wearing Course	:minus 5mm, plus 5mm
Grading in any direction in 3m or less	:minus 5mm, plus 5mm

1.7.4.2 On vertical curves, similar standards shall apply with an allowance made for the vertical curvature.

1.7.4.3 Width

Edge of bitumen surface (Where not in contact with concrete gutter)	:minus 50mm, plus 50mm

1.7.5 **KERBS, GUTTERS, FOOTWAY AND VEHICLE CROSSINGS**

1.7.5.1 Tolerances on the level of kerb, gutter and footway and vehicle crossings shall be :plus 10mm, minus 10mm

1.7.5.2 In all cases, variations in level shall not be local and shall be over a length of 15 metres or more.

1.7.5.3 The tolerances on the horizontal shall be as follows:-

Dimensions of vehicle crossing : 25mm

1.7.5.4 Cover to Reinforcement

Overall length	: minus 15mm
	:plus zero
Cover	: minus zero
	: plus 5mm

1.7.6 **DRAINAGE LINES**

The tolerances of the invert level of the drainage lines shall be as follows:-

Finished level of the invert at any point – minus 15mm, plus 15mm, provided that no point is at a higher level than a corresponding point upstream.

Grading – minus 0.2%, plus 0.2% at any point.

1.7.7 **PITS AND HEADWALLS**

The tolerances for pits and headwalls shall be as follows:

Finished level of inverts, soffits and upper surfaces	:minus 15mm, :plus 15mm
Other dimensions	:minus 25mm, :plus 25mm
Chainage of pit centre line of pits	:minus 150mm :plus 150mm
Deflection of exposed edges	:10mm
Cover to steel reinforcement	:minus Zero :plus 5mm

Longitudinal dimensions of steel reinforcement:-

Length overall as bent	:minus 15mm, plus zero
Other dimensions	:minus 15mm :plus 25mm

1.7.8 **OPEN EARTH DRAINS**

The tolerances for open earth drains shall be:-

Depth	:minus zero :plus 50mm
Width at all parts of cross-section	:minus zero :plus 300mm

1.7.9 **TOLERANCES BEING EXCEEDED**

In the event of the tolerances being exceeded, Council may at its absolute discretion, order the Developer to carry out any reconstruction or remedial measures considered necessary or desirable.

1.8 ALIGNMENT & SETTING OUT OF WORKS

The Developer shall arrange for the setting out of the works by a Registered Surveyor.

The centrelines of all roads together with all lot pegs, drainage easements and interallotment drainage lines, where appropriate, shall be marked and recovered by pegs or other marks as shown in the Documents.

The Developer shall construct the works in strict conformity with the surveyed centreline and location approved, except where otherwise shown in the Documents or instructed in writing by Council.

If at any time during the progress of the work, any error is discovered in the position, level, dimensions or alignment, the Developer shall immediately on discovery of the error notify Council and shall, unless Council otherwise directs, arrange for the error to be corrected by a Registered Surveyor.

1.9 CARE OF SURVEY MARKS

The Developer shall preserve and maintain in their true position all State Survey Marks (SSM) and Permanent Marks (PM) whether or not the marks are to be used for the purpose of setting out, checking or measuring the work.

Should any SSM or PM be disturbed or obliterated, the Developer shall immediately notify Council and shall, unless Council otherwise determines, arrange for a Registered Surveyor to rectify such disturbance or obliteration. The cost of rectification shall be borne by the Developer.

1.10 CARE/RELOCATION OF EXISTING SERVICES

Where existing public utility services are encountered within the pavement/drainage Works areas “Duty of Care” must be observed and the necessary arrangements be made with the relevant authority for their protection/relocation.

1.11 SERVICE CONDUITS

All conduit trenches shall be at a grade of not less than one percent (1%) in the direction nominated by the Relevant Service Authority.

Conduits under roads shall be laid prior to the construction of the initial course of the pavement and shall consist of 100mm diameter, UPVC heavy duty duct pipe jointed to the manufacturer’s requirements.

Backfill material under road pavements shall be stabilised sand or similar.

1.11.1 ELECTRICITY CONDUITS

Electricity service conduits shall be excavated for, supplied unless otherwise specified, bedded, laid, jointed and backfilled in locations directed by and to that Authority's requirements.

The ends of the conduits shall be plugged or suitably sealed to preclude entry of soil and shall be connected with approved fittings.

The Developer shall arrange for all conduits to be inspected and approved by the Authority.

NOTE: The Authority requires certification by a Registered Surveyor or Chartered Engineer.

Crossings may comprise single, multiple or multiple layer conduits.

Kerb faces shall be permanently marked at conduit crossings directly above the conduits in accordance with clause 11.10.

1.11.2 WATER SERVICE CONDUITS

The Developer shall supply, excavate for, lay, joint and backfill water service conduits in carriageways and pathways in accordance with the Authority's regulations as applicable.

The conduits shall be laid with a minimum cover of 300m below road subgrade level and shall extend to a point 300mm behind the kerb faces or concrete edges.

The location of the conduits shall be permanently marked in accordance with clause 11.10.

1.11.3 TELECOMMUNICATION CONDUITS

The Developer shall liaise direct with the local construction office of the Authority to ensure that the necessary conduits are installed by the Authority in conjunction with the Electricity Authority. Kerb faces shall be permanently marked in accordance with clause 11.10.

1.11.4 GAS SERVICES

The Developer shall make arrangements for the laying of conduits with the Gas Authority.

1.12 ENVIRONMENT

The Developer shall ensure at all times that the requirements of all the relevant Acts concerning noise, air, water, dust, and other pollutants are fully observed.

Trucks carting material to or from the site are to have their loads covered to prevent spillage.

In regard to dust nuisance, the Developer shall regularly water all haul roads, access tracks and construction areas.

Council may direct that work cease until such time as any particular dust nuisance has been controlled. All costs associated with control of dust shall be borne by the Developer.

1.13 REINSTATEMENT

Prior to final inspection by Council, all surplus material and rubbish shall be removed and the whole of the site left clean and neat in appearance. Any road pavement, footway or kerb and gutter disturbed or damaged during construction shall be reinstated to a condition at least equal to that existing before commencement of operations. Similarly, the whole work shall be left in a neat and tidy condition at the end of the Liability Period.

1.14 DIVERTING WATER AND DEWATERING

The Developer shall take all necessary action to prevent any surface and/or sub-soil water from interfering with the progress of the works. The work shall be kept free from such water. All reasonable measures shall be taken to prevent any damage to the works by water due to flood, seepage or other causes.

Any work or material damaged by water from any source shall be removed, replaced with fresh material and reconstructed by the Developer.

Provision shall be made for the temporary drainage of any road boxing excavation or pavement in the event of rain. The Developer shall ensure that this temporary drainage does not cause erosion or siltation of any pipelines.

Appropriate arrangements must be made to provide anti-siltation measurements to prevent any deleterious matters entering the stormwater system.

2. EROSION AND SEDIMENT CONTROL

2.1 DESCRIPTION

This specification provides measures for the erosion and sediment control that shall be undertaken during construction.

The Developer shall provide and maintain controls where shown on the Drawings or where directed by Council. Such controls shall be in accordance with this Specification and the Department of Housing Urban Erosion and Sediment Control Handbook and where applicable to the requirements of the Department of Water and Energy.

When designing for erosion and sediment control, due notice shall be taken of the relevant requirements and recommendations of the Department of Housing, the Environmental Protection Authority and where applicable, to the requirements of the Department of Water and Energy.

2.2 GENERAL

Perimeter control measures shall be placed prior to or in conjunction with the first phase of earthworks. Construction shall be phased if directed by Council so that land disturbance is confined to areas of workable size. This limits the duration for which disturbed areas are exposed to erosion. Stabilisation measures shall be applied on the first disturbed section prior to commencement of Works on the adjoining section.

Topsoil stockpiles shall be located outside hazard areas such as drainage depressions.

Where site regrading or filling is to be undertaken, surface water shall be directed away from the face of batters and stockpiles.

All areas not subject to construction works shall be retained free from disturbance or damage during the currency of the Works. Should these areas become disturbed or damaged they shall be reinstated by the Developer.

2.3 SEDIMENT AND EROSION CONTROL DEVICES

Where shown in the Document or otherwise specified, sediment and erosion control devices shall be constructed and maintained as directed by Council. Unless the device is a permanent structure, it shall be removed when the areas upstream of it have been stabilised. The control devices shall be constructed in the location shown in the documents unless an alternative location is directed by Council.

The following devices are to be constructed in accordance with the Department of Housing Urban Erosion and Sediment Control Handbook and where applicable to the requirements of the Department of Environment, Climate Change and Water.

2.3.1 TEMPORARY CONSTRUCTION EXIT (SHAKER RAMP)

The temporary construction exit shall be provided to shake off site material form exiting vehicles and shall consist of a pad of coarse crushed rock, (75mm to 150mm range) having a minimum depth of 200mm, a minimum length of 15m and a width as nominated on the Documents or be of precast “cattle grid” type.

2.3.2 SILT FENCE

Silt fences shall be placed downstream form all disturbed areas or as directed by Council.

The fabric shall be embedded 200mm into the ground and extend 600mm maximum above the ground. It shall be staked at a maximum of 3.0m intervals. Silt fences shall be placed prior to any earthwork construction.

2.3.3 DIVERSION CHANNELS/BANKS & OVERLAND FLOW PATHS

Diversion channels are earth channels with a minor ridge on their lower side constructed across the slope. The channel shall have side slopes not steeper than 1 in 3.

Where flows are too large to be contained by a simple channel, a diversion bank shall be constructed below the channel. The bank shall have a compacted height of a least 500mm with batter slopes no greater than 1 in 2 and a top width of 600mm. The channel behind the bank shall fall to the outlet point.

Diversions shall be stabilised by the method nominated on the Documents or otherwise specified and shall be located where directed by Council so that runoff will discharge onto stable disposal areas without causing erosion.

Overland flow paths are to be provided with turf laid in accordance with clause 12.9, 12.10 and 12.11 over the full width of the channel.

2.3.4 LEVEL SPREADER

Level spreaders shall be used as outlets for diversion channels or at other areas of concentrated flow of runoff where conversion to sheet flow onto stable areas is required. The level spreader shall be excavated at zero grade, the length shall be as shown in the Documents or otherwise specified. The approach grade of the diversion channel shall not exceed 1 per cent for at lease 6 metres before it enters the spreader. The Developer shall pay particular attention to the sill to ensure that it remains stable and a vigorous vegetative cover is maintained below it. The channel behind the sill shall be de-silted on a regular basis.

2.3.5 STRAW BALE BARRIER

Straw bale barriers shall consist of wire bound bales laid lengthwise in an excavated trench nominally 100mm deep. Each bale shall be securely anchored by two stakes or star pickets skewer driven through its centre into the ground such that the top of the stake or star picket is level with the top of the bale. The barrier shall be constructed on that part of the perimeter of the site or at other locations within the site where shown on the Documents or where directed by Council.

2.3.6 SEDIMENT TRAPS

Temporary de-silting structures shall be constructed at inlets to stormwater systems to trap sediment runoff. They shall consist of the following types:-

2.3.6.1 Surface Inlet

The surface inlet pit shall be competed to throat level and then topped off with one or more courses of standard masonry construction blocks, nominal 150mm thickness laid on side in accordance with the details shown on the Documents. Aggregate in the 50 to 75mm size range shall be placed around the outside of the blocks.

2.3.6.2 Kerb Inlet

Kerb inlet traps shall be provided to pits in areas of high erosion susceptibility and shall be constructed by modifying the kerb inlet to allow sediment filtration. Fabric silt bags (sausages), of a minimum 100mm diameter filled with aggregate in the 50 to 75mm size range shall be placed across the pit entry in accordance with the detail shown on the Documents.

2.3.6.3 Culverts

Existing road embankments with culverts beneath shall be converted to temporary sediment traps by building around the entrance to the culvert a box of unmortared standard masonry construction blocks nominal 150mm thickness, placed on side in accordance with the detail shown on the Documents. A filter of gravel or coarse aggregate (50 to 75mm size range) shall be placed against the modified inlet. The filter material shall batter at 3 to 1 from the top of the blockwork. The width and height of the blockwork shall be as specified in the Documents.

2.3.7 FILTER DAMS

Filter dams built of pervious materials such as straw bales, washed aggregate, gabions, or sandbags filled with aggregate and covered with suitable filter fabric shall be placed across minor drainage channels while ground cover is being established, to steady flow velocity and to trap sediment. In grassed channels they shall be embedded at least 100mm in the soil to prevent water tunnelling beneath them.

Aggregate filled sandbags shall be stacked in an interlocking fashion.

The Developer shall check the dam after each storm for structural damage or clogging by silt and other debris and make prompt repairs or replacements to the satisfaction of Council.

2.3.8 SEDIMENT BASINS

Sediment basins, where specified, shall be constructed to the details shown on the Documents. The basin shall be constructed as the first phase of the earthworks operation.

2.4 MAINTENANCE

All sediment and erosion control devices shall be maintained in a satisfactory working order throughout the Maintenance Period or until such earlier time as the area upstream has been stabilised and Council directs that the device be removed.

The Developer shall inspect the devices after each storm for structural damage or clogging by silt and other debris and make prompt repairs or replacement.

All sediment deposited within ponded areas shall be periodically removed to a disposal area as directed by Council.

Filter materials shall be cleaned and restacked or replaced when directed by Council to maintain effective performance.

In the case of the temporary construction exit, the contractor shall undertake weekly surface cleaning by drag broom or equivalent, to remove all build up of foreign material.

To control bank growth and to maintain healthy ground cover in channels and on banks, mowing shall be undertaken at regular intervals or when directed by Council.

2.5 STABILISATION OF DISTURBED AREAS

Stabilisation of disturbed areas shall be carried out in accordance with the Specification for Grassing.

Where practical the following principles shall be applied for the control of erosion and sedimentation:-

2.5.1 Stabilisation of denuded areas shall commence within fourteen (14) days of the areas being disturbed.

2.5.2 Stabilisation of the area over all stormwater drainage lines and sewer mains not within road reservations shall commence within fourteen (14) days of backfilling.

2.5.3 All temporary earth diversion channels/banks and sediment basin embankments shall be seeded within fourteen (14) days of completion of their earthworks.

2.5.4 Stabilisation of all cut and fill slopes shall be commenced within fourteen (14) days of completion of formation.

2.5.5 On completion of kerb and gutter and subsequent backfilling/trimming of the footpath areas, the Developer shall provide a strip of couch turf minimum 1m wide adjacent to the kerb and gutter. Turf shall be laid in accordance with clause 12.8 and 12.10.

Turf shall be maintained and groomed to provide a dense cover to act as a siltation barrier.

3. SITE CLEARING AND/OR GRUBBING

3.1 DESCRIPTION

The Specification provides for the clearing, grubbing and removal of prescribed materials from that part of the area of the site shown on the documents.

3.2 NOTICE

One days clear notice of the developers intention to commence clearing operation must be given. No work shall be commenced within that period unless approval to do so has been given by Council, as stated in clause 1.3.1.2.

3.3 CLEARING AND GRUBBING

For the full area of the road reserve, drainage easements or where otherwise shown in the Documents, all materials such as fences, concrete and/or brick foundations and/or floors, structures of all descriptions, trees, shrubs, scrubs, stumps, logs, boulders and roots except those items which Council may direct to be retained shall be cleared and/or wholly grubbed. All lying and fallen timber, rubbish and debris of every description shall be disposed of off site.

3.4 TREES TO BE RETAINED

Council's Tree Preservation Order and Tree Management Plan must be complied with.

Prior to the commencement of any works, the Developer shall mark or otherwise indicate to Council those trees and/or shrubs to be removed and approval granting this must be obtained.

All trees that are to be retained shall be adequately protected at all times and particular care shall be taken to avoid any damage to the roots, trunks and branches.

3.4.1 ROOTS

Before any excavation is carried out over the roots of trees and/or shrubs to be retained, the Developer shall obtain a direction from Council as to whether the levels in the vicinity of the tree can be adjusted to protect the roots.

When any excavation is required in the vicinity of trees to be retained, hand excavation first shall be made to locate any roots. Roots which are then seen to be affected by the line of the proposed work shall be cleanly severed clear of the work before machine excavation commences.

3.4.2 TRUNKS

Certain trees to be retained may have to be protected. This protection shall be given by lashing pine or other suitable off-cuts upright around the trunks leaving gaps of no more than 150mm. The off-cuts shall be 1.5 metres high and shall extend down to ground level so as to protect the boles. The flat side of the off-cuts shall face outwards and if necessary shall be pained white.

3.4.3 DAMAGE TO TRUNKS

Where the trunks of trees are damaged by plant and/or equipment, Council may direct the Developer to effectively cover the damaged portion of the trunk with approved tree paint. Alternatively Council may require advanced type replacement trees to be provided. Council's Tree Preservation Order shall be strictly observed.

3.5 REMOVAL OF TREES

The Council reserves the right to direct the Developer to clear, grub and remove any tree and/or shrub from the site. Dead trees are to be removed from the building blocks.

3.6 DISPOSAL OF MATERIAL

All material cleared and/or grubbed in accordance with this Specification shall become the property of the Developer, who shall adhere to the provisions of the current Protection of the Environment Operation Act N.S.W.

3.7 RESTORATION OF SITE

All holes or depressions caused by the clearing and/or grubbing work shall be backfilled with approved material and the area compacted to the satisfaction of Council. Prior to being back-filled the holes or depressions shall be inspected by Council.

3.8 PRIVATE PROPERTY

Every precaution shall be taken to prevent timber or other materials falling on and/or being deposited on private property and the Developer shall remove, at their cost, any timber or other materials so fallen and/or deposited.

3.9 DAMAGE

All damage of every kind, including damage to fencing, caused by the execution of the work shall be made good by the Developer at his expense and to the satisfaction of Council.

4. EARTHWORKS AND FORMATION

4.1 DESCRIPTION

This Specification provides for the formation by cut and/or fill of the earthworks for the construction or roads, pathways, miscellaneous works and concrete structures.

4.2 REMOVAL OF TOPSOIL

Topsoil shall be stripped from within the formation areas of roads, driveways, parking areas, pathways, miscellaneous pavements and other works inclusive of batters and shall be placed in stockpiles where shown in the Documents and/or in locations approved by Council for the later top dressing of formed footways, berms, batters and site regrading areas.

The thickness of the topsoil stripping shall be as specified in the Documents. Where not specified the thickness of topsoil stripping shall be not less than 100mm.

The Developer shall maintain all topsoil stockpiles in a neat and tidy condition and ensure that suitable silt control measures are provided until replacement of topsoil is carried out. Care shall be taken to avoid contamination by any other matter.

Replacement of topsoil shall be in accordance with the provisions of Clause 4.14.

4.3 REMOVAL OF UNSUITABLE MATERIALS

Following the stripping of topsoil as specified in Clause 4.2 and before excavation, filling or other works are commenced in any area, all exposed silt and other deleterious material, which in the opinion of a Geotechnical Engineer is unsuitable for the placing of filling, shall be removed and disposed of. Minor pockets of unsound material such as those caused by tree stumps etc shall be removed.

If in the opinion of Geotechnical Engineer, unsound or unsuitable material is encountered at the specified excavation level or embankment base in other than minor pockets, additional excavation and its replacement with compacted approved material shall be provided. All unsound or unsuitable material excavated in accordance with the provisions of this paragraph shall be disposed of by the Developer.

4.4 COMPACTION PRIOR TO PLACING OF FILL

On areas to be site regraded by filling and after removal of the materials as described in clause 4.2 and 4.3 and before any filling material is placed, the stripped surface shall be compacted for a depth of 200mm to a density not less than 95% of its standard maximum dry density as specified in Clause 4.9 “Placing and Compaction of Fill”.

4.5 EXCAVATION

"Excavation" shall mean excavation in all classes of materials and shall include the removal of loose earth, sand, clay, all vegetation, shale, igneous, metamorphic and sedimentary rock, ironstone, concrete, masonry, pipes, conduits, and any other obstruction, material, matter or substance.

The Developer shall excavate to the depths and dimensions shown or implied in the Documents, or to such greater depths and dimensions, as will ensure sound, permanent foundations. All excavation shall be passed by Council before any materials or structures are placed thereon.

Any additional excavation shall be made good by the Developer with granular or other approved filling placed in layers not exceeding 300mm thickness in loose measurement and compacted to 95% of the standard maximum dry density in accordance with the relevant Australian Standard.

Excavated material, if deemed suitable by Council, shall be used in the formation of embankments and for site filling.

No excavation shall be commenced until, in the opinion of Council, the necessary plant is on the site to ensure the uninterrupted progress and continuance of the cut and fill operation.

In carrying out excavation work, the Developer shall take all reasonable precautions against mishap or accident, whether arising form insufficient strength of timberings, bad workmanship, breakage of machinery or plant, inefficient caulking or packing of open joints or spaces, flood, or any other cause whatsoever and he shall be held solely responsible for all damage, injury, or loss that may occur to buildings, structures, bridges, railways, roadways, streets and other surfaces above and adjacent to the excavations, to all persons whether employed by the Developer, by Council or otherwise and to his own and other works and the cost of all such damage, injury and loss and any compensation shall be met by the Developer.

4.6 SURPLUS SPOIL

Surplus spoil shall be disposed of off site as specified in the document unless otherwise specified by the Council.

4.7 IMPORTED FILLING

All imported filling provided shall be approved by Council.

4.8 FORMATION EMBANKMENTS

Placing of filling on the prepared areas shall not commence until approval to do so has been obtained from Council.

Embankments shall be constructed from approved sound excavated material and shall be placed in horizontal layers extending across the full width of the embankment of not greater than 300mm in thickness, loose measurement and each layer shall be compacted in accordance with the provisions of clause 4.11.

Where the cross slope of the natural surface is steeper than 1:3 (that is one vertical in three horizontal), the base of the entire embankment shall be suitably stepped, scarified or roughened to the satisfaction of Council before the construction of the embankment is commenced. Natural ground adjoining an existing embankment together with the existing batter shall receive similar treatment before the embankment is widened.

4.9 PLACING AND COMPACTION OF FILL

Placing of filling on the prepared areas shall not commence until the authority to so do has been obtained from Council.

No fill is to be placed around base of trees.

Filling shall be carried up in horizontal layers, extending the full width of the areas being filled, not more than 300mm thick loose measurement.

The dry density of fill determined in accordance with the relevant Australian Standard shall be not less than 95%.

All fill areas shall be certified by a NATA registered Geotechnical Laboratory and the testing of such areas shall be carried out in accordance with AS 3798.

The moisture content of each layer shall be maintained near optimum during compaction. Where it is necessary to increase the moisture content, each layer shall be watered by means of an approved sprayer delivering a uniform distribution of water over the area to be wetted. Adequate watering equipment shall be available during all compaction operations.

4.10 BOXING

The formation of roads, accessways, parking areas, pathways and miscellaneous pavements shall be boxed out for the construction of the pavement as shown in the Documents.

The boxing shall extend 150mm behind the back of kerbs and vehicular crossings, edges of shoulders or edges for concrete pavements.

Boxing in excavations shall be formed by removal of material from the solid. Boxing in embankments may be formed by building up

and compacting by rolling the footway or shoulder areas and then trimming the inside edges vertically to correct line.

The developer shall make temporary provision for drainage and diversion of stormwater where water may tend to accumulate. Care shall be taken to guard against scour of any part of the construction. All temporary provisions for drainage, unless otherwise directed to be retained for use as catch or shoulder drains, shall be restored to the satisfaction of Council before pavement materials are placed.

4.11 TRIMMING AND COMPACTION OF FORMATION

The earthworks and subgrades shall be thoroughly compacted by rolling near optimum moisture content to achieve the specified compaction density. All soft or unstable patches that may develop during the compaction operation shall be removed, filled with approved sound material and blended into the surrounding material, moistened and rolled until thoroughly compacted.

Where rock or shale is exposed at subgrade level, it shall be ripped to a depth of 300mm below subgrade level, trimmed and compacted as specified.

A formal pavement design is to be submitted to Council for approval prior to the subgrade inspection. Where pavement has been constructed or commenced in contravention of this Clause, the Developer, when ordered by Council, shall remove the pavement so commenced or constructed.

Compaction of subgrades shall continue until a dry density has been achieved of not less than 100% of the standard maximum dry density when tested in accordance with Australian Standard AS 1289 Tests 5.1.1 or 5.2.1.

The Developer shall make available to Council a 3 wheeled self propelled roller and carry out proof loading by rolling the subgrade. Unless otherwise acceptable to Council the roller shall have rear rollers of at least 1200mm in diameter and an intensity of loading of at least 7000 kg per metre width of roller.

After compaction, the subgrade profile shall be prepared parallel to the finished surface at the specified depth below the detailed cross sectional and grade lines and over the required widths. The subgrade profile shall be inspected by Council. Any irregularities found shall be adjusted by the Developer by the addition or the removal of material followed by further trimming and rolling to achieve the specified profile shape and compaction.

All footpaths are to be excavated to a depth of 150mm below designed levels, and this deficiency in depth shall be made up with approved topsoil which shall be consolidated and trimmed to provide a crossfall of between 2% and 4%.

Footpath grading shall extend 300mm inside allotments for both cuts and fills. Where sewer mains are to be laid within allotments, the footpath grading shall be extended to 1,200mm inside allotments to facilitate the sewer construction.

4.12 BATTERS

Unless otherwise specified of directed by Council the sides of cuttings and embankments, shall be trimmed to a slope of two horizontal to one vertical.

Where batters are formed within proposed drainage reserves, drainage channels or overland flow paths the batters shall be trimmed to a slope of five horizontal to one vertical.

Where batters exceed 1.0m in height access ramps at a maximum slope of four and a half horizontal to one vertical, are to be provided opposite each kerb layback.

4.13 SITE REGRADING

Site regrading work shall be carried out as shown in the Documents by cut and/or fill operations and/or by utilisation of surplus approved spoil material available from road formation and drainage works. Where insufficient material is available from these sources for filling purposes, approved imported material shall be used to complete the site regrading work.

The areas specified to be regraded shall be finished to the levels, with allowances for topsoil replacement and/or grades shown in the Documents, without abrupt changes of slope and/or depressions, which may hold surface waters. The regraded surface after the specified compaction, shall present a good true surface, free from rocks, clods and rubbish of all description. A minimum 1% grade shall be provided to the proposed building lots.

All areas not subject to construction works shall be retained free from disturbance or damage during the currency of the works. Should these areas become disturbed or damaged they shall be reinstated by the Developer.

4.14 REPLACEMENT OF TOPSOIL

The Developer shall not commence placing the topsoil on the prepared areas until the authority to do so has been obtained from Council.

After Council has authorised the placing of topsoil, the Developer shall spread the stockpile and/or imported topsoil to the specified depth, or where no depth is specified, to a minimum depth of 100mm.

Topsoil, shall then be compacted with a light roller and trimmed so that the finished surface of the topsoil conforms to the design levels and grades.

Topsoiled areas, when finished, shall present smooth surfaces free of stones and lumps of soil and blend into adjoining undisturbed ground.

All areas denuded of vegetation shall be grassed by approved means as directed by Council. A dense grass cover must be established upon completion of the earthworks and be maintained.

4.15 ENTRANCE TO SIDE ROADS AND ADJACENT PROPERTY

Should any alteration to levels be made opposite entrances to side roads or opposite vehicular entrances to adjacent property, adjustment to restore access shall be carried out in accordance with the provisions of clause 1.4.4 of this Specification.

Adequate vehicular access shall be maintained to such side roads or adjacent properties at all times.

4.16 FIRE TRAILS

Fire trails are to be constructed where shown on the documents and to the requirements of Council's Engineer and the Rural Fire Service. Construction of the fire trail is to be in accordance with the Department of Water and Energy "Guideline for the planning, construction and maintenance of tracks." Where infall surfacing of the track is to be provided, drainage details are to be in accordance with Standard drawing.

5. STORMWATER DRAINAGE

5.1 DESCRIPTION

This Specification provides for the excavation and backfiling of trencbes and the supply, bedding, laying and jointing of reinforced concrete, fibre reinforced vitrified clay and uPVC pipe drainage lines and precast reinforced concrete box culverts.

Where indicated in the Documents, culverts and pipelines shall be constructed complete with connections to the required headwalls and/or pits.

5.2 DRAINAGE LINE LOCATION

The location of each drainage line shall be determined from the details in the documents, standard drainage structure drawings, longitudinal profiles of drainage lines and ancillary special drawings. The pegging of survey marks showing the location of drainage easements shall be arranged by a suitably qualified surveyor.

Drainage lines shall be constructed so that the prolongation of their centreline coincides with the centreline of the outlet pipe at the downstream internal face of the pit structure.

Drainage lines within proposed drainage easement shall be centrally located and no portion of a pipe, culvert or drainage structure shall be constructed outside the easement boundaries.

Should trees exist along the proposed drainage line, or so close to the trench that damage to trees would be unavoidable, the Developer shall seek direction from Council before excavation commences.

5.3 TYPE OF PIPES & BOX CULVERTS

Pipes and box culverts shall not be placed in position in the work until passed for this purpose by Council either with, or without testing, at Council's discretion. The fact that pipes are passed by Council shall in no way limit their rejection subsequently by Council in the event of it being found that they do not conform to the Specification.

5.3.1 Reinforced Concrete Pipes

Unless a particular class of type is specified, the pipes shall be precast reinforced concrete – Class "2" and shall be of the rubber ring joint type.

Pipes and specials such as bends and off-takes, shall conform to AS 4058 Precast Concrete Drainage Pipes for classes "2" "3" "4" and "6" etc respectively and Council reserves the right at any time to call for any or all of the specified tests, viz Load, Hydrostatic, or Absorption to be carried out on each size of consignment of pipes prior to the pipes being used in the work.

5.3.2 Fibre Reinforced Concrete Pipes

Pipes and fittings shall conform to the requirements of AS 4139 and shall be of the rubber ring joint type.

5.3.3 Vitrified Clay Pipes

Unless otherwise specified, all pipes shall be stormwater class, and all fittings shall be first quality conforming to the requirements of AS 1741. All vitrified clay pipes and fittings shall be jointed using rubber rings in accordance with clause 5.9.

5.3.4 uPVC Pipes

The use of uPVC pipe Class SH of diameters 100mm to 300mm inclusive shall be permitted in lieu of other pipes of similar size. Pipes and fittings shall conform to the requirements of AS 1260 and shall be of the rubber ring joint type. All stored PVC pipes shall always be protected from direct sunlight by stacking in the shade or under cover.

5.3.5 Precast Reinforced Concrete Box Culverts

Precast Box Culverts shall conform to the requirements, including load tests and water absorption tests to AS 1597. The Council reserves the right at any time to arrange for testing in accordance with this Australian Standard.

5.3.6 Other Pipe Types

Other pipe types shall be submitted to Council for consideration and approval.

5.4 EXCAVATION

Wherever appearing in the Specification, “excavation” shall mean excavation in all classes of material. Excavation shall be carried out in accordance with the provisions of clause 4.5 of the Specification for Formation. The Developer shall excavate drainage line trenches to the lines and levels shown in the Documents, with allowances for bedding in accordance with clause 5.6.

Should the Developer excavate trenches to depths greater than that necessary, the excess excavation shall be backfilled to the correct level with properly compacted approved bedding material.

Trenches shall be excavated to a sufficient width so that a minimum space of 150mm is created between the side of the trench and the outside of the pipe collar. Where necessary to allow the proper handling, jointing and placing of all types of pipes specified, additional excavation may be carried out.

Unless otherwise specified or directed by Council, the trench shall be excavated over its full width for bedding on rock or earth to a minimum of 100mm below the underside of the pipe barrel for pipes up to 1500mm diameter and 150mm for pipes over 1500mm diameter before bedding material is placed. All loose material shall

be removed from the bottoms of trenches prior to the placing of approved granular bedding material.

Subject to any Act of Parliament, Ordinance or Regulation, the Developer shall satisfy himself as to the necessity of timbering or shoring any excavation and shall accept the sole responsibility as to its being required and to its use in the works.

The execution of any additional excavation by benching or battering to offset the necessity of timbering or shoring may be approved by Council on written request.

Where pipes are required to be placed in filled ground, or in any case where the top of the pipe would be less than 300mm below the natural surface, filling shall first be placed and thoroughly compacted to at least 300mm above the top of the proposed pipeline. The trench shall then be excavated in the normal manner to the required levels and after laying and jointing of pipes, the line shall be backfilled in accordance with the requirements of clause 5.15 of this Specification.

5.5 EXCAVATION TOLERANCES

The following allowances shall be made for drainage excavation:

Width:

a) Single cell pipelines – 300 plus external collar diameter.

b) Multiple cell pipelines – 600mm plus external collar diameters.

Excavation level:-

a) 100mm below underside of pipe collar in other than rock.

b) 200mm below underside of pipe collar in shale or rock.

The surface level adjacent to the trench sides shall be:-

a) Excavated subgrade level for pipes under paved areas.

b) Finished surface level for pipes in open areas, open areas, open earth drains, retention basins and similar.

c) Natural surface level less stripped topsoil for pipes under embankment formation but fully contained in trenches below natural surface.

d) Finished embankment surface level for pipes partly or fully contained in embankment formation.

e)

5.6 PIPE BEDDING AND BACKFILL MATERIAL

The material used for bedding and backfilling of pipes and culverts shall be approved non-cohesive granular material having high permeability, high stability when saturated and free of organic material having a grading, determined by AS 1411.11 or 1289.3.6.1, complying with Table 5.1 and a Plasticity Index, determined by AS 1289.3.3.1 of less than 6.

Table 5.1 Grading Requirements For Bedding and Backfill Material

Sieve Size	% Mass Passing
19.0	100
2.36	50-100
0.60	20-90
0.30	10-60
0.15	0-25
0.075	0-10

Samples of the types of materials intended to be used shall be submitted to and approved by Council prior to their use.

No bedding material shall be placed until the excavation has been inspected and passed by Council. After acceptance by Council, bedding material shall be placed and compacted to the correct level for pipe laying.

Prior to placing of the pipes, the bedding material between pipe and trench edges shall be at least 50mm above the proposed pipe invert levels.

Unless otherwise specified or directed by Council's Engineer, the method of bedding shall be Type B. Where sand is encountered at bedding level, Type C bedding may be permitted.

Where the trench is excavated in waterlogged ground, a layer of crushed rock, 20mm to 40mm size, or other material approved by Council's Engineer, shall be laid 300m thick below the pipe and shall extend the full width of the trench and half way up the sides of the pipe. Where in the opinion of Council's Engineer, the crushed rock would not form a suitable foundation for the pipe, a concrete cradle (Type A bedding), may be used instead.

5.7 PIPE LAYING

Pipes shall be laid with lifting holes, if provided, to the top or in accordance with the manufactures requirements and shall have their full length in contact with the prepared bedding as specified, the pipes being placed to form drainage lines true to line, level and grade as shown in the Documents and/or as otherwise detailed and in a straight line.

Where two or more lines of pipe are to be laid in parallel the space between the outside of each pipe collar shall be a minimum of 300mm.

Any pipe which is not laid on true alignment or to design level and/or grade or which shows any settlement after laying or which is damaged during subsequent backfilling or compaction operation, shall be taken up by the Developer, replaced with a new pipe, if damaged and the drainage line completed to the satisfaction of Council.

Where a pipeline of 1050mm or larger in diameter is laid in a trench beneath an area to be paved and where the depth of backfill cover between the obvert of pipes and the subgrade level above is less than 0.5m, all pipes shall be temporarily strutted internally in the vertical axis at each pipe joint. Struts shall be of timber or other materials of dimensions approved by Council and shall bear against sills and caps tightly wedged against the pipes. Strutting shall be removed following completion of the construction of road, driveway or pathway pavement sub-base.

Where a drainage line is to be constructed on a curve, arc or an angled bend, standard and/or curved pipes and specials shall be supplied and laid to the details shown in the Document and in accordance with the provisions of this Specification.

5.8 SUBSOIL PIPES IN STORMWATER DRAINAGE TRENCHES

Subsoil drainage pipes 100mm diameter shall be provided adjacent to every inlet stormwater pipe for a distance of 2 metres upstream of each pit. The subsoil pipe shall be fitted with a filter sock and shall comply with the requirements of clause 5.17. The filter sock shall be appropriately tied at the upstream end of the subsoil pipe to preclude the entry of filter material.

For pipelines greater than 525mm subsoil drainage shall be provided on both sides of the trench.

Where shown in the Documents or directed by Council, subsoil pipes shall be laid for the full length along stormwater drainage lines between kerb inlet pits. The subsoil pipe shall be laid on the kerb side of the stormwater drainage trench unless otherwise directed. The subsoil pipe shall be fitted with a filter sock and shall comply with the requirements of clause 5.17. The pipe shall extend to the upstream pit and shall be connected through the pit wall at a level above the obvert of the outlet pipe.

5.9 METHOD OF JOINTING

All pipes shall be jointed in accordance with the manufacturers requirements. Where rubber ring joints are used care must be taken to ensure that the joint is free from dirt or other obstructions and that the rubber ring is placed evenly in the joint.

All holes provided in concrete pipes for lifting or handling purposes shall be plugged by precast concrete plugs set in mortar, PVC plugs or other approved method before backfilling of the trenches is commenced.

5.10 CONCRETE ENCASING

Concrete encasement, where shown in the Documents, or where directed, shall have a minimum thickness of 150mm above and below the pipe and shall extend the full width of the trench.

5.11 CONCRETE BULKHEADS

Where shown in the Documents or where the grade of the pipeline is / 15%, concrete bulkheads shall be constructed at every second joint. The axis of the bulkhead shall be vertical with a minimum top width of 200mm. Unless otherwise directed the top of bulkheads shall extend to within 300mm of finished surface level or to the subgrade level where the pipeline is under a road pavement. On each side of the pipe at the level of the trench invert 100mm dia pipes shall pass through the bulkhead. Such pipes shall be filled with fibreglass wool or other approved filter material. The bulkhead shall be located directly behind the downstream collar so as not the encase the joint.

5.12 DIRECT CONNECTIONS

Where direct pipe connections are shown in the Documents, both pipes shall be carefully cut or manufactured so that a neat junction is obtained. The inside joints shall be neatly and tightly finished off with cement mortar so that the internal shapes of the pipes are maintained. Bandage joints are to be lapped at least 100mm by the bandage. The maximum junction pipe diameter to be jointed by this method shall be 375mm.

Where PVC pipes are used for the direct connection a saddle, epoxied to the main pipeline shall be provided.

For junction pipes of 225mm to 375mm diameter, supporting concrete pedestals shall be constructed and founded on a solid foundation.

For junction pipes of 450mm diameter or greater, factory fabricated off-takes shall be supplied in accordance with this Specification. The Contractor may use fabricated off-takes in lieu of jointing on the site for smaller diameters. Concrete pedestals shall not be provided when factory fabricated off-takes are used.

5.13 PRECAST CONCRETE BOX CULVERTS

Crown units shall be positioned true to line, level and grade as shown in the Documents and the sections closely butted together. The sides and top of the crown units for the full length of the butt joint shall be covered with a 300mm wide strip of polypropylene fabric bonded to the crown units with coal tar, epoxy or similar. All joints shall be tightly fitted.

The crown unit legs shall be set on a nominal 5mm thickness of 3 to 1 wet cement mortar or other approved grouting material.

In all cases care shall be taken to ensure that the interior of the crown units have a neat, smooth and uniform surface at the joints.

The trenches at the sides of the Precast Crown Units shall be carefully packed and compacted with non cohesive sand or metal dust in uniform layers to the top of the precast section.

5.14 INSPECTION PRIOR TO BACKFILLING

All drainage lines shall be inspected and approved by Council after laying and jointing and prior to the placing of any backfilling.

5.15 BACKFILLING

Unless otherwise specified or directed, pipe trenches shall be backfilled and compacted with non cohesive granular material conforming to the requirements of clause 5.6 to a point not less than 150mm above the top of the pipe. Selected backfilling above this height shall be placed and compacted by mechanical means in layers not exceeding 300mm compacted thickness to a dry density equal to at least that of the surrounding undisturbed material.

Where drainage lines of any description are laid wholly or in part under road carriageways or kerb and gutter, the trench shall be backfilled with granular material conforming to the requirements of clause 5.6 in layers not exceeding 300mm compacted thickness, up to the subgrade level of the pavement.

Compaction shall be achieved by flooding of the backfilled trench and the effective use of a 75mm diameter concrete vibrator, plate compactor or other equipment approved by Council's Engineer to expel all trapped air voids within the bakcfilled material and to ensure that the granular material is adequately compacted around and under the barrels and collars of the pipes. The contractor shall take all precautions necessary to avoid possible flotation of pipelines. Compaction shall continue until a dry density ratio of not less than 100% standard has been achieved. Proof testing is to be undertaken by Council on the backfilled trench prior to covering with pavement material. During subsequent pavement construction, the Contractor shall ensure that the specified granular backfill is brought to the subgrade surface or a topping layer of pavement material is placed and compacted to complete the trench backfill, to final levels.

No lumps or layers of clay, silt or unsuitable material are to be left in place separating the pavement material from the granular trench backfill.

Upon completion of pipe laying, jointing and backfilling of the drainage line, the whole of the drainage line including junction pits, inlet pits, etc, shall be thoroughly cleaned to the satisfaction of Council's Engineer.

5.16 CCTV INSPECTION ON COMPLETION OF DRAINAGE SYSTEM

On completion of all earthworks, roadworks and provision of services the developer shall arrange for a CCTV recording to be undertaken of the road drainage system and submitted to Council prior to the release of the linen plan.

The developer shall rectify any damage evidenced by such imaging to the satisfaction of Council's Engineer.

5.16.1 CCTV Field Testers

CCTV Field Testers must have NATA accreditation under the Sydney Water Field Testing Services Program for CCTV inspections. Field Testers shall also have professional indemnity insurance adequate to cover the value of the works they are inspecting.

5.16.2 CCTV Inspection Procedure

The CCTV Inspection Procedure shall be carried out in accordance with the latest version of the Water Services Association of Australia (WSAA) "Conduit Inspection Reporting Code of Australia".

5.16.3 CCTV Reports

The CCTV Report shall consist of VHS Video Tape or DVD (WMA format) and a hard copy printout of the report.

5.17 INTERALLOTMENT DRAINAGE

Materials shall comply with the requirements of clause 5.3 and pipe joints shall be of the rubber ring type or other approved methods, jointing being carried out in accordance with clause 5.9.

Unless otherwise specified the pipes shall be laid centrally within the easement at a minimum grade of 1 percent and having a minimum cover of 300mm. Where OSD systems are required for the lots minimum cover to pipes is to be 1000mm. Grated pits shall be constructed at the lowest point of each lot and at a change of direction or grade.

Pipes as per clause 5.3 shall be laid on a minimum of 50mm of approved sand bedding.

Inspection pits of 600 x 600mm or 600mm diameter size for up to 800mm deep lines, 600 x 900mm or 900mm diameter for up to 1500mm deep lines and 900 x 900mm or 900mm diameter for deeper lines shall be constructed within the proposed drainage easement. Precast pits are acceptable on interallotment drainage

lines and step irons are to be provided where pits are deeper than 1200 mm.

Where the interallotment drainage line is to be connected to the kerb the conduit shall consist of a Rectangular Hollow Section (galvanised steel) of required size.

All lines shall be inspected and approved by Council after laying and jointing and prior to backfilling. Backfilling is to be undertaken in accordance with Clause 5.15.

5.18 SUB-SOIL DRAINS

Subsoil drainage shall be provided along the cut side of all new roads where no drainage is provided, along the centre line of half road construction works, at low spots, where required by the pavement design report, in all landscaped Islands / roundabouts and where directed by Council's Engineer.

5.18.1 Materials

Pipes:-

Perforated corrugated or smooth wall uPVC pipe, Class 400, conforming to the relevant Australian Standard for Perforated Drainage Pipes and Associated Fittings and are to be a minimum 100mm diameter.

Filter socks:-

Shall be stretch or non-stretch of approved manufacture.

Filter fabric:-

Shall be of woven or non-woven type of approved manufacture and shall comply with the relevant AS requirements.

Filter material:-

Shall be approved clean material of 10 – 20mm (nom) size.

5.18.2 Trench Excavation

Trenches shall be excavated to a width of 300mm and a depth of 600mm measured from the design level of the subgrade, or to a depth such that the pipe can be laid below any service conduit.

Trenches shall be excavated at a minimum grade of 1% with the trench bottom constructed so that no localised ponding of water occurs.

5.18.3 Laying of Pipe

The corrugated perforated plastic piping shall be laid on a filter material bed 50mm in thickness to the required line and grade.

Joints in the pipe line shall be kept to a minimum and where required shall be made using an approved external joint coupling.

The pipe shall be covered in a seamless tubular filter fabric.

The inlet end of the line shall be constructed to form a flushing point at a drainage pit or as shown on the Council's Standard drawings. Further flushing points are to be provided in the subsoil drainage line at approximately 60 metre intervals along the drain or elsewhere as directed by Council's Engineer.

Flushing points not located within drainage pits are to be fitted with a standard cover in accordance with Council's requirements and the location of each point is to be marked by cutting the letters "SS" 75mm high in the concrete kerb face and painted with an approved blue paint.

5.18.4 Backfilling

The trench shall be backfilled with the filter material to the level of the subgrade. The backfilled filter material shall then be covered with a double thickness filter fabric.

5.18.5 Other Type Systems

Other type systems shall be submitted to Council for consideration and may be approved.

6. CONCRETE

6.1 DESCRIPTION

This specification provides for the forming, reinforcing, mixing and placing of concrete used in the construction of drainage structures, kerb and gutter, other kerbs or edge strip, footpaths, driveways, medians and miscellaneous or special structures.

Where Council approves the use of "green concrete" ie recycled cement and aggregate for non-structural works", the twenty-eight (28) day characteristic strength is to be certified and guaranteed.

6.2 CONCRETE MATERIALS AND SLUMP

Ready mixed concrete shall be used for general works unless supply is not readily available to the site of the works or where the use of "green concrete" has been approved by Council.

Ready mixed concrete shall be obtained from a source acceptable to the Council and shall consist of a mixture of cement, fine and coarse aggregates and water complying in all respects with the requirements of AS 1379.

The nominal maximum size of aggregate in the ready mixed concrete shall be twenty (20) mm and the slump of the concrete at the time and place of delivery, when tested shall be as specified in Table 6.1 below.

Any batch of concrete of part thereof delivered to the site of the work and having a slump when tested in excess of that specified shall not be used in the work unless approved by Council. All concrete rejected by Council's Engineer shall be immediately removed form the site at the Developer's expense.

Table 6.1 Required Slump and Concrete

Item of Work	Slump (mm)
Machine moulded kerb and guttering or similar work	20 (maximum)
All other items	80

6.3 CONCRETE TESTING AND STRENGTH (Except Machine Kerb and Gutter)

Cylindrical test specimens 200mm long by 100mm in diameter prepared from concrete taken at the time and place of delivery into the forms and taken in accordance with the current Australian Standard AS 1379, shall develop a minimum compressive strength as scheduled in Table 6.2 when tested in accordance with the current AS 1012.9.

The strength of the concrete shall be determined from the average twenty eight day strength of not less than two test specimens moulded from each specified mix of ready mixed concrete actually placed in the work, selected to represent the whole of the concrete placed during the day of moulding. In general one pair of test

specimens shall be moulded from each twenty cubic metres of concrete or part thereof.

Additional specimens may be taken for testing at seven or twenty-eight days. In order that subsequent working operations may proceed, work represented by specimens may be accepted in the event that the seven day test is satisfactory. The cost of testing additional specimens shall be borne by the Developer.

Table 6.2 Required Minimum Compressive Strength of Concrete

Item of Work	Minimum Compressive Strength (Mpa)	
	At 7 Days	At 28 Days
Concrete drainage pits and special structures as detailed on the drawings	15	25
Concrete kerbing and guttering	15	25
Concrete driveways, footpaths and medians, etc	15	25
Mountable kerbing, Median Splitter & Kerb Blister Islands	19	32

If cylindrical specimens fail to achieve the specified twenty eight day strength, the Developer may arrange for cores to be extracted from the constructed work. In the event of the average strength of such cores, when tested, complying with the specified requirements, the work represented by the specimen cores may be accepted and the cost of extracting and testing of the cores shall be borne by the Developer.

6.4 FOUNDATIONS

Foundations and subgrades shall be prepared in accordance with the Specification for Formation.

The bases shall be dressed to a smooth and regular surface and thoroughly compacted to give a foundation of uniform bearing value throughout.

The bottom of foundations are to be compacted so that the relative compaction in accordance with the relevant Australian Standard is not less than 95%. Any material which cannot be so compacted shall be removed by the Contractor when directed by Council and replaced with 20mm gauge clean metal or other suitable approved material, compacted in accordance with the above requirement. No concrete shall be placed until the foundations have been inspected and approved by Council.

6.5 REINFORCEMENT

Reinforcing bars shall be of mild steel conforming to the current Australian Standard “Hard-drawn Steel Reinforcing Wire” and “Hard-drawn Steel Wire Reinforcing Fabric” and shall conform to the current Australian Standards AS/NZS 4671.

All steel reinforcement shall be free from mill scale, grease, tar, paint, oil, mud, mortar or other foreign substance and shall be true to size. If in the opinion of Council the steel is coated with more than a thin film of rust it may be rejected for use in the work and shall be immediately removed form the site by the Developer.

When required by Council, the Developer shall submit samples of the reinforcement cut to a suitable length or section for testing purposes.

All reinforcement shall be accurately spaced in situ to the spacing and positions shown in the Documents with bends and hooks located at the points shown.

Reinforcement shall be secured in position by being tied a sufficient number of times with suitable wire at laps and crossings to prohibit displacement during the pouring and working of the concrete.

Reinforcement in concrete slabs and similar work shall be supported on chairs of approved manufacture, height and spacing. No alternatives shall be accepted.

Where the use of fibre reinforced concrete is proposed, submission is to be made to Council for consideration and approval.

6.6 FORMWORK

Formwork shall be so designed and assembled that it can be removed without damage to the concrete. Materials used in the formwork shall be of approved timber free from loose knots and other defects, board or metal plate.

Timber forms for exposed surfaces shall be dressed on at lease one surface and shall be either dressed or tongued and grooved at connecting edges. Forms for unexposed surfaces of walls, slabs etc. may be of undressed timber, board or metal plate.

Metal plate forms for exposed surfaces shall be clean, smooth, undented and unmarked and devoid of holes. Where bolt, screw or rivet heads are used for connections, such connections shall be countersunk.

Forms shall be assembled true to line, level and grade, held rigidly to maintain position and shape and shall be butted so as to be mortar tight. Forms shall be chamfered or filleted to the details shown in the Documents.

Prior to the pouring and placing of concrete, the internal surfaces of the forms including chamfers, fillets, removable ducting and similar shall be uniformly coated with a thin film of oil, soap or

other approved formwork compound to avoid adhesion of cement mortar and the staining and discolouration of exposed surfaces of the concrete. Any oil, soap etc adhering to the reinforcement shall be thoroughly removed or the reinforcement taken from the forms and replaced with the specified quantity of clean, undamaged material all to the requirements of Council.

Any bolts, spacers or similar, supporting or seperating forms shall be suitably greased and placed so that they may be later removed without damage to the concrete.

Formwork and forms shall be inspected by Council immediately prior to the placing of concrete and any bulging, warping or displacement of any kind shall be rectified before pouring commences. If during the placing of any concrete the formwork or forms show any signs of displacement, that portion of the concrete shall be removed immediately, the formwork of forms re-secured rigidly to the satisfaction of Council and the concrete pour completed within the requirements of this Specifications.

6.7 CONCRETE PLACING

Subgrade, formwork, forms and reinforcement shall be approved by Council before concrete is ordered for placing. All sawdust, shavings, pools of water and debris shall be removed form the space to be occupied by the concrete.

Concrete shall be placed in the forms by chute in a uniform continuous flow, the length and inclination of the chute being such as to prevent separation of the concrete ingredients. Concrete shall not be dropped into place from a height greater than one and a half metres. Prior to placing, the full area to be occupied by the concrete shall be thoroughly moistened.

Concrete shall be deposited and spread in horizontal layers and shall be compacted by vibration or other approved means. Care shall be taken to fill every space in the forms, to work coarse aggregate uniformly throughout the mix and away from form faces and to force concrete under and around the reinforcement without it being displaced.

Any unplaced concrete which has developed initial set shall not be used in the work.

6.8 CONSTRUCTION JOINTS

Where a construction joint is necessary in a concrete pour, it shall be provided in accordance with the details shown on the Documents, or if not shown the joint shall be formed in a slab with rigid bulkhead and dowels in a manner approved by Council, or in the case of a vertical section, by finishing the concrete to a level plane with a roughened surface.

Prior to the resumption of a concrete pour, the surface of the joint shall be cleaned of all laitance, loose and foreign material, care being taken not to disturb reinforcement or to damage adjoining concrete surfaces. The joint shall be thoroughly saturated with water and fresh concrete shall be carefully worked against the

surface of the concrete previously placed and around reinforcement at the joint.

6.9 REMOVAL OF FORMS

All forms shall remain in position for a period not less than twenty four hours after concrete has been placed, earlier removal being permitted only on the authorisation of Council.

Should the air shade temperature fall below ten degrees or rise above twenty seven degrees Celsius, the minimum period may be varied as the Council directs.

Curing of concrete shall commence immediately forms are removed.

6.10 CONCRETE FINISHING

All concrete surfaces shall be finished true and even, free from air and stone pockets, depressions or projections. All arrises shall be sharp and true and moulding shall be evenly mitred, care being exercised in removing forms to ensure this result. Immediately on removal of formwork all rough surfaces, holes and honeycombed areas shall be repaired by removing loose material and defective work, wetting the affected area, filling depressions with fresh cement-sand mortar having the same proportions of cement and sand as used in the base concrete and brought to an even surface with a wooden or steel trowel as required to produce the specified finished surface.

Wire ties protruding from the concrete after removal of the forms shall be cut back and any chipping of the concrete in executing this requirement shall be repaired with cement-sand mortar as previously specified. Holes left by the removal of bolts, spreaders or the like shall be similarly treated. Additional treatment in some locations may be required as directed.

When directed, exposed surfaces shall be wetted with clean water and rubbed down with an approved carborundum or sandstone block until all repaired areas, rough surfaces and joint marks of forms are removed leaving the surfaces clean and smooth and uniform in colour and appearance. Finishing work shall be completed within two days following removal of the forms.

6.11 CURING

Where necessary, the completed concrete shall be protected from extremes of temperature for a period of seven days during which time the concrete shall be kept continuously moist and covered with canvas, plastic or Hessian sheets, chemical curing compounds, sand at least 50mm thick or other approved means.

New work shall be adequately protected from damage by weather conditions, traffic or other causes and all necessary barriers and signs for the control of vehicular and pedestrian traffic shall be erected and maintained for the specified period of concrete curing.

6.12 KERB AND GUTTER

6.12.1 BASE

Foundations are to be compacted in accordance with Clause 6.4.

The base for kerb and gutter shall be formed at the required depth, on an approved pavement sub-base in accordance with Part 7 of this Specification. A sub-base of compacted thickness not less than the road pavement sub-base shall be provided on the compacted subgrade. Immediately prior to the placing of the concrete, the surface shall be moistened, checked for uniformity and all irregularities made good. The sub-base materials under the kerb and gutter shall be protected from stormwater scour prior to backfilling and/or placing of the pavement materials. The sub-base shall extend to a point at lease 150mm beyond the back of the kerb to the satisfaction of Council.

6.12.2 KERB MOULDING MACHINES

Unless otherwise specified, kerb moulding machines are to be used for the construction of kerb and gutter and profiles are to be in accordance with the Standard Drawing.

The speed of the kerb moulding machine shall not exceed 2.5 metres per minute unless otherwise approved in writing by Council.

The Contractor may apply for approval to construct kerb and gutter by the use of formwork or to vary the kerb and gutter profile.

6.12.3 FINISH

All exposed concrete surfaces shall be finished clean, smooth and uniform in colour and appearance. All corners, joints and edges shall be left neatly rounded.

Service conduit markings are to be provided where required in accordance with Cl 11.10.

6.12.4 JOINTS

Vertical expansion joints of approved bitumen impregnated jointing material shall be placed at intervals of not more than 6.0 metres, at each end of vehicular crossings and access ramps, at the junctions with the existing old work and at the commencement of each 0.6 metre kerb transition adjacent to gully pits.

Weakened plane joints shall be cut at regular intervals approximately 3.0 metres apart and shall extend into the kerb and gutter faces, a minimum of 75mm.

Joints shall be located at least 0.5 metres clear from any drainage holes.

6.12.5 VEHICULAR CROSSINGS

Where kerb and gutter construction fronts proposed allotments or where else directed, the kerb shall be discontinued to allow for

vehicles crossing the footpath. At such points a layback shall be constructed as shown on the Standard Drawing. Crossings are to have a minimum separation of 1 metre.

All gutter crossings are to be constructed clear of service conduits, hydrants and pit lintels.

Where existing kerb is to be removed for the provision of laybacks, pedestrian ramps or the replacement of redundant laybacks, both the kerb and gutter tray shall be removed and replaced.

6.12.6 ACCESS RAMP

At all intersections or where directed, the kerb shall be discontinued and access ramps constructed in accordance with Standard Drawing.

6.12.7 CURING

Curing shall be carried out in accordance with clause 6.11 except that when kerb moulding machines are used, an approved chemical curing compound shall be applied to all exposed surfaces on the day of moulding.

6.12.8 PROVISION FOR DRAINAGE

Outlets through the kerb shall be provided as specified or directed for each house to drain roof water into the gutter.

One drainage outlet shall be provided on the lower side of each lot and clear of the vehicular entrance, where provided.

The Developer shall fit the outlets into the kerb in a workmanlike manner ensuring that they are firmly secured in the concrete and fall towards the gutter. The surface shall be refinished to match the balance of the work.

Where kerb moulding machines are used, the outlets shall be placed in position immediately after the passing of the kerb moulding machine.

Outlets in roll kerbs shall be of approved manufacture and made of extruded aluminium or galvanised steel. The shape and size of the outlets, shall conform to that shown on the relevant Standard Drawing.

Notwithstanding the levels shown on the Drawings for gully pits, kerb returns and low points, the Contractor shall ensure that the gutter near or adjacent to the gully pit is properly drained and under no circumstances shall the kerb and gutter be allowed to pond water.

6.12.9 **BACKFILLING**

After the concrete has set sufficiently, but no sooner than three days after placing, the area behind kerbs and/or gutters shall be backfilled with sound approved material. It shall be thoroughly compacted in layers not exceeding 150mm in thickness, without displacement of the adjacent construction and left in a neat and workmanlike manner. Backfilling and/or the placement of pavement material shall only be undertaken with the prior approval of Council.

6.12.10 **REPLACEMENT OF INCORRECT AND/OR DAMAGED CONSTRUCTION**

The Developer shall construct all kerbs and gutters or similar work in a sound workmanlike manner so that it will resist damage or displacement by weather conditions, road construction, builders and Service Authorities plant, or undermining by the scouring away of the sub-base materials.

Where kerbs and gutters are damaged or displaced by such agencies after construction due to fault by the Developer, or is not constructed to specified line and level, it shall be removed and reconstructed.

6.12.11 **TESTING**

Where kerbing and guttering is constructed using a self-prolled moulding machine, the developer accepts responsibility for the taking and testing of core samples in accordance with the relevant section of the current AS 1012, at maximum 100 metre spacing, the submission of results to Council and removal of all kerb and gutter where the minimum specified 28 days compressive strength of 25Mpa is not achieved. Cores shall be 75mm diameter and drilled vertically through the top of kerb. Following removal of the sample, the core hole is to be restored to the satisfaction of Council's Engineer.

6.13 **THRESHOLDS**

Thresholds are to be a minimum of ten (10) metres long and constructed in patterned full depth coloured concrete. Colours and finishes are to be submitted to Council for approval.

6.14 **FOOTPAVING, CYCLEWAYS & PAVEMENTS**

6.14.1 **GENERAL**

Footpaving and cycleways shall be located 600mm from the property boundary and fall to the top of kerb at between 2% and 4%.

Footpaving shall be 75mm thick, and cycleways 100mm thick with F62 mesh with (50mm cover). Where the construction is to be undertaken prior to the completion of the dwellings the footpaving / cycleways are to be 125mm thick with F62 mesh (50mm

cover).Where paving is to be coloured, full depth coloured concrete is required to the requirements of Council.

6.14.2 **SUB-BASE**

Approved sub-base material of the type shown in the Documents shall be spread, levelled and compacted on the prepared sub-grade in accordance with Part 7 of this Specification. The minimum compacted thickness of the sub-base material shall be 50mm or as indicated in the Documents. Immediately prior to placing of the concrete the sub-base shall be lightly watered.

6.14.3 **REINFORCEMENT**

Reinforcement shall be in accordance with Part 6 of this Specification and as shown in the Documents and shall be supported above the subgrade by approved chairs. All splicing of the reinforcement shall have a minimum overlap of 300mm and be securely tied.

6.14.4 **FINISH**

The concrete shall be struck off with a screed and finished with wooden floats, followed by light brooming at right angles to the alignment of the pavement to give a uniform non-slip surface. All edges and joints shall be finished off with an approved edging tool forming a minimum 50mm margin in a neat workmanlike manner.

6.14.5 **JOINTS**

In footpaving, transverse joints shall be constructed at intervals of 1.50 metres and expansion joints shall generally be at intervals of 6.0 metres. In cycleways, transverse joints shall be constructed at intervals of 3.0 metres and expansion joints at intervals of 6.0 metres.

6.14.6 **PROTECTION**

Where there is any likelihood of access by the public, barriers and lights shall be provided and erected at the start and end of the works in accordance with Australian Standard AS 1742.

6.14.7 **CLEANING UP**

All spoil shall be removed concurrently with the work of excavation and backfilling. Trimming of footpath areas shall be completed within seven days of the concrete being placed. An additional days deferment of backfilling at gateways may be permitted to avoid damage to footpaving by vehicular traffic.

All footpath areas for the full width adjacent to constructed paving shall be trimmed by cutting of filling where required and all areas of loose material lightly compacted to the specified crossfalls and grades as shown in the Documents.

6.15 PATTERN STENCILLED CONCRETE PAVEMENT FOR NON TRAFFICABLE MEDIAN ISLANDS & ROUNDABOUTS

Pattern Stencilled Pavement shall consist of a concrete base reinforced with F82 having 35mm cover and set on approved chairs laid on an approved subgrade of granular material. After screeding of the concrete the specified patterned paper moulding shall be set in place, according to the manufacturer's specification.

The colouring shall be applied at the application rate and method specified by the manufacturer to a nom. 3mm thickness, and shall be approved by Council prior to application.

Surplus colour agent shall be removed by mechanical means. A curing agent shall then be applied as required by the specific method of colour application followed by the sealer.

The sealer shall be of a non-slip type suitable for public roadways, and shall have a slip resistance greater than 50BPN when tested in accordance with AS/NZ4586 (wet surface).

Control joints shall be inserted by cutting of the slab to one quarter (1/4) of the slab thickness at nom. 3000 spacing.

Contraction, expansion and control joints shall be constructed where directed or shown of the plan.

6.16 DRAINAGE PITS

6.16.1 EXCAVATION

The foundations shall be excavated to the neat lines and formed at the required depth in accordance with the Drawings. All soft and yielding and other unsuitable material shall be removed and the bed shall be thoroughly compacted and finished to a firm smooth surface of uniform bearing value. For insitu pits, if the bed is dry it shall be sprinkled with as much water as it will readily absorb before concrete is placed.

6.16.2 STRUCTURE

a) Insitu

Where drainage pits exceed 1.8 metres in depth, the wall and floor thickness is to be increased and reinforcement provided as specified in Table 6.3 below.

b) Precast

Precast stormwater pits are acceptable and are to be in accordance with the following:

i)

- Fill height from invert of outlet to surface not to exceed 3m.
- AS1170 Loading Code Part 1 – Dead and Live Loads.
- AS3600 SAA Concrete Structures Code.
- AS5100 SAA – Bridge Code

ii) Pit components are to be designed by a company with a Design Quality System complying with AS9001. A Quality Assurance Certificate is required for the products indicating the issuers Registration Licence Number.

iii) Sites where the Precast alternative is intended to be used. Council is to be advised of the manufacturers name prior to any construction commencing. All components are to branded with the manufactures name internally.

Table 6.3

Depth of Pit	Floor and Wall Thickness	Floor and Wall Reinforcement
<1.8m	150	-
>1.8m	175	F82 mesh with 40 cover Y12 Starter bars @ 200 c/c (400 legs)
>3.0m	225	Y12@250 c/c both ways each face 40 cover Y12 Starter bars @ 250 c/c (500 legs)

Where drainage pits exceed 1.2 metres in depth, approved step irons must be installed to provide a 350mm vertical and 175mm offset horizontal spacing.

Subsoil drainage pipes, laid in accordance with Part 5 – Stormwater Drainage, clause 5.17, shall be connected through the upstream pit wall and shall extend through any mass concrete benching so as to provide a free outlet.

Where pits are constructed in sags, drainage holes shall be provided in the wall to drain the boxing as shown on Standard Drawing.

Inlet or outlet pipes shall be neatly finished off flush with the interior surfaces of the gullies.

Drainage pits shall not have sumps and are to be benched internally with mass concrete to not less than one third of the outlet pipe diameter, notwithstanding that such benching may not be shown in the relevant Documents.

6.16.3 STEEL FITTINGS

Steel gratings, frames and other fittings are to be to the requirements of AS 1657 Ordinary Structural Steels – Ordinary Weldable Grades, and they shall be hot-dipped galvanised in accordance with AS/NZS 4680 “Galvanised Coatings”.

Gully grates in kerb and gutter are to be supplied with a flat skirt base.

Fittings shall be to the grade and dimension shown in the Documents and/or Standard Drawings.

Mild Steel frames shall be firmly and evenly bedded and shall be placed so that the hinged grates can be fully opened.

Gratings shall be secured by means of an approved locking system.

Where drainage pits are located within public pathways or public access areas a “pedestrian safe mesh” is to be provided.

6.16.4 KERB INLETS

As shown on the appropriate Standard Drawing, the kerb inlets for extended kerb inlets pits are to be precast and in accordance with an approved design. Lintels with clear opening widths as shown on the approved engineering drawings are to be used. Where no opening width is specified, a lintel of nominal 1.8 metres opening is to be used on grade pits and 2.4 metre opening in sag pits.

Where pits are located on curves or bends, precast lintels shall be provided to suit the kerb radius.

6.17 PRECAST CONCRETE UNITS

Where indicated on the Drawings or where authorised by Council, precast concrete unit components shall be provided to the form and dimensions shown in the Documents and shall be constructed in the positions specified in all cases.

7. FLEXIBLE ROAD PAVEMENTS

7.1 DESCRIPTION

A formal pavement design shall be prepared by a registered N.A.T.A laboratory based on sampling and testing of the sub-grade materials from the site. Details of the pavement design, results of subgrade testing (including design California Bearing Ratio values for the subgrade) and design traffic loadings are to be submitted to Council for approval prior to commencement of pavement construction.

The minimum unbound granular pavement thickness shall be 300 mm, comprising of a 150mm thick sub-base and 150mm thick base.

The pavement materials for flexible roads shall consist of approved crushed or ripped sandstone, DGB 20, DGS20, DGS40 and/or other approved recycled materials. Alternatively the pavement may consist of “deep lift” asphaltic concrete laid on a bound or unbound base course. A.C shall conform with Councils Aus-Spec # 2 No. 245 Asphaltic concrete.

Materials designated as a Graded Macadam Base (GMB), a Graded Macadam Sub-base (GMS) or as a Macadam Sub-base (MS) are not approved as a component of any flexible pavement.

The materials shall be spread on the subgrade or sub-base in uniform layers to provide the specified pavement thickness.

A two coat hot bitumen seal shall be provided following the completion and testing of the base course.

Where recycled concrete materials are to be used for the base course layer of pavement and the unconfined compressive strength (UCS) is ≥ than 1%, a polymer modified bitumen binder (6% SBS) is to be provided for the second coat (10mm) hot bitumen seal.

The wearing course shall be a minimum of 40mm of asphaltic concrete placed three (3) months after installation of all services or seal whichever is the latter.

Final AC shall only be placed after inspection and approval by Council.

For rural road construction the base course is to be provided with a cut-back bitumen primer coat. Within 24 hours the wearing surface, comprising a two coat hot bitumen seal is to be applied.

7.2 SUB-BASE COURSE

All material shall be delivered from Council approved sources. Any approval given to the source of supply of materials may be withdrawn if a significant number of samples taken from the pavement after compaction fail to comply with this Specification.

Sub-base material shall comply with RTA Specification 3051 and 3071 or where crushed or ripped sandstone is to be provided the material shall be minus 125mm nominal size derived from sound, clean sandstone free from overburden, clay seams, shale and other deleterious material and shall meet the following requirements.

Material Requirements

a) Linear Shrinkage: Test Method AS1289.5.4.1
Max Linear Shrinkage 5%

b) Grading: Table 7.1 below sets out the desirable grading limits.

Table 7.1 **Grading Requirements for Crushed Sandstone**

Nominal Size	Percentage Passing
75.00 mm	85 – 100
53.00 mm	75 –100
37.50 mm	65 –100
26.50 mm	57 – 94
19.00 mm	50 – 88
9.50 mm	37 – 76
4.75 mm	27 – 65
2.36 mm	20 –52
1.18 mm	15 – 42
425 µm	10 – 28
75 µm	5 – 17
2 µm	0 - 5

Variations

Where the grading and linear shrinkage tests vary outside the above limits and there is evidence that the subject material (or material similar in composition to it) has given satisfactory performance under similar conditions to the construction in question, then the following requirements shall be applied.

% Passing 425µm	Maximum Limits	15 – 45
Linear Shrinkage % x % Passing 425µm	Maximum	160
Plasticity Index % x % Passing 75µm	Maximum	200

7.2.1 **SAMPLING AND TESTING OF CRUSHED OR RIPPED SANDSTONE**

The Developer shall arrange for a sample load of the proposed sandstone material from the approved source to be delivered and stored on site after approval of the source.

Samples for testing shall be taken from the sample load to assess the conformity with this Specification.

No other deliveries of sandstone shall be made without the Council's approval of the sample load meeting the Specification requirements.

Where in the opinion of Council any materials do not meet the requirements of this Specification the Developer shall, on instruction from Council, remove such materials from the site.

7.3 BASE COURSE – (DGB 20 & DGS20)

Crushed rock (DGB 20 & DGS20) shall be unbound granular material and may consist of a blend of two or more materials. When the primary material is deficient in fine particles, material may be added and blended as necessary to meet the requirement of the Specification. Material produced by blending shall be uniform in grading and physical characteristics. The material shall comply with RTA Specification 3051.

Table 7.2 Material Requirements

Test Method	Description	DGB20 20mm
AS1289.3.6.1	Coarse Particles Size Distribution % passing 53.0mm sieve % passing 37.5mm sieve % passing 26.5mm sieve % passing 19.0mm sieve % passing 6.7mm sieve % passing 2.36 mm sieve	 - - 100 95 – 100 50 – 70 35 – 55
AS1289.3.6.2	Fine Particle Size Distribution Ratios (for that portion of the material Passing 2.36mm sieve) A – Pass 425µm sieve (%) B – Pass 75µm sieve C – Below 13.5µm Pass 75µm sieve (%)	 35 – 55 35 – 55 35 – 60
AS1289.3.1.2	Liquid Limit (if non-plastic) – Max	*20
AS1289.3.2.1	Plastic Limit (if plastic) – Max	20
AS1289.3.3.1	**Plasticity Index – Max	6
RTA.T114	Maximum Dry Compressive Strength of fraction passing 19mm sieve	At least 1.7Mpa
RTA.T213	Particle shape by Proportional Caliper - % Misshapen (2:1) Max	35
RTA.T215	Minimum Aggregate Wet Strength ¢	100KN
RTA.T221	Dusting or falling unsoundness of Slag – Max	1 particle in 12
RTA.T215	Wet/Dry Strength Variation Dry-Wet % ¢ # Dry	Max 35

NOTES: (Applicable to Table 7.2)

(1)* The maximum value of the Liquid Limit may be increased to 23 for non-plastic material, provided that the value determined is not influenced by the presence of adverse constituents.

(2)** After being subjected to pre-treatment comprising 5 cycles of compaction (Test Method T102) and/or to artificial weathering (Test Method T103), the Plasticity Index shall not increase by more than 3 from that of the sample prior to any pre-treatment. For category 2(d) base materials the maximum plasticity index shall be 8.

(3)¢ Based on testing of any size fraction of the sample specified by Test Method T215. The material may be crushed to provide sufficient quantities of material for any particular size fraction.

(4)# For category 2(d) Class DGB 20 base materials the wet/dry strength variation shall not exceed 45%.

(5) Material consisting of rounded river stone have a minimum of two fractured faces on at least 75% of the particular larger than 6.70mm.

7.4 RECYCLED MATERIAL

Recycled material may be used as either a sub base material or a base course material providing such material is sourced from a Council approved supplier. Where the material is to be used as a base course material it shall comply with RTA Specification 3051 and this Specification. Where recycled material is to be used as a sub base material it shall comply with RTA Specification 3071 and this Specification.

The applicant must seek and obtain prior approval for the use of such material, and such material shall only be derived from a Council approved supplier and validated stockpile.

The limit of foreign materials for a sub base material shall be as set out in RTA Specification 3071 table 3071.2 and no other foreign materials are acceptable. The limit of foreign material that ay be incorporated into a base course material shall be as set out in the table below.

Foreign Material Type	**Maximum Limit by Mass (Test Method RTA T276) Base**
Type I: Metal, Glass, Asphalt, Stone, Ceramics and Slag (other than blast furnace slag)	1%
Type II: Plaster, Clay Lumps & Other Friable Material	0.1%
Type III: Rubber, Plastic, Bitumen, Paper, Cloth, Paint, Wood and Other Vegetable Matter	0.1%

7.5 DELIVERY

The pavement material shall be transported from the source to the work in vehicles which are constructed so as to prevent the loss of material. Material shall be supplied with a moisture content (uniformly distributed) between the optimum moisture content and 3% below the optimum moisture content.

7.6 SPREADING

Pavement material shall be spread in uniform layers of not more than 200mm nor less than 75mm so that after compaction the total pavement thickness is as specified. Spreading shall be undertaken by a method which will ensure that segregation does not occur.

Prior to compaction, the moisture content of material, shall be adjusted to optimum moisture content. Where necessary, water

shall be added by an approved method and shall be mixed uniformly with the pavement material by an approved mechanical device. If there is existing excess moisture in the material, it shall be dried to the specified moisture content by loosening and aerating.

Where the compacted surface is below the specified level the defective area shall be scarified to the full depth of the layer, new material added as required and the area recompacted to required levels.

Pavement material shall not be spread upon a water-logged subgrade or sub-base. If at any time the subgrade or sub-base material should become rutted, or mixed with the pavement material, the Developer shall remove the material, reshape and compact the subgrade or sub-base material and replace the pavement material with fresh material if required.

7.7 COMPACTING AND TRIMMING

During compaction operations the moisture content of the material of a layer or course shall be uniformly adjusted throughout, so as not to exceed Optimum Moisture Content or be less than Optimum minus 3%, or as otherwise approved. Water may be added in an approved manner to achieve or to maintain the required moisture content.

After the moisture has been brought to the specified moisture content, it shall be compacted immediately with approved equipment. The compaction shall begin at the sides and progress to the centre, parallel with the centre line of the roadway, uniformly lapping each preceding pass and covering the surface completely.

The surface of any compacted layer of material shall, on completion of compaction and immediately before preparation for the overlaying with the next layer, be of a roughened texture, free from compaction planes (false pavement), ridges, cracks, or loose material. All segregated or otherwise defective areas shall be removed to the full thickness of the layer, re-laid with new material and recompacted to the satisfaction of Council.

After the first course has been completed to the specified depth and tested, the second course shall be uniformly spread on the prepared surface and similarly treated. The top of each course shall be graded and trimmed generally to line and level and the profiles checked by Council.

Variations in the compacted thickness of each course shall be in accordance with clause 1.7.2.1.

Any irregularities in excess of the tolerances stated above shall be corrected by loosening the surfaces, removing or adding pavement material as required and compacting the area to a uniform surface conforming to the designed cross section and grade. In no case shall quarry dust or other fine materials be used to build up depressions.

Compaction of pavement material shall continue until there is no visible movement of the pavement under the proof roller as specified in clause 7.8.2.

7.8 PAVEMENT TESTING

The Developer shall arrange and bear the cost of all pavement testing as required by this Section.

Test results for each pavement layer shall be submitted to Council's Engineer for approval. Approval to construct subsequent pavement layers may be given only after Council's Engineer has reviewed the test results and Pavement thickness.

7.8.1 DENSITY TESTING

The pavement compaction requirements shall be as follows:-

Minimum Dry Density Ratios (AS1289 5.4.1):

Base Course	98% Modified
Sub-base Course	95% Modified
Subgrade	100% Standard

a) All testing shall be carried out by a NATA registered laboratory, or a Council approved laboratory.

b) All testing shall be in accordance with test procedures as detailed in AS 1289.

Density testing shall be carried out on the basis of :-

One (1) test every 50 metres of pavement, taken 1.0m from the face of kerb on alternate sides of pavement.

c) The approved thickness of the sub-base must be confirmed by potholing and the results submitted to Council prior to the base course being spread. One pothole is required every 40m alternating diagonally between the kerb on one side of the road, the road centreline, and the kerb on the other side of the road.

7.8.2 PROOF TESTING

The Developer shall make available an approved 3-wheeled self-propelled roller and shall carry out proof loading or each pavement layer to the satisfaction of Council's Engineer before proceeding to the next stage of construction.

7.8.3 **BENKLEMAN BEAM TESTING**

Benkleman Beam testing at 15m intervals per lane shall be carried out as required by Council in accordance with the requirements of ARRB Special Report number 41 at the top of the base course level. The maximum tolerable deflection at any point on top of the base course shall be as shown in Figure 20 ARRB Special Report 41, or for traffic loadings outside the range of Figure 20, as specified by Council's Engineer.

7.9 **DEFECTIVE MATERIAL**

If at any time during the progress of the work, any material supplied is found to be not in accordance with this Specification, Council will direct the Developer to remove the unsuitable material and replace it with satisfactory material. Previous acceptance of the whole or part of the material by Council, shall not restrict its right to direct removal and replacement of material subsequently found to be unsatisfactory. The Developer shall carry out such remedial work immediately.

7.10 **COMPLETED PAVEMENT SURFACE**

The completed pavement shall have a uniform, hard, monolithic surface, which shows no visible movement under the roller and in which the pavement particles are tightly and uniformly embedded in a gritty, cementitious matrix.

Final sweeping of the pavement shall be carried out immediately prior to the application of bituminous surfacing materials. The coarse particles of the surface course shall be bared but not dislodged and shall be free of all slurry and/or dust which, in the opinion of Council, may interfere with the proper adherence of the bituminous materials to the pavement surface.

Prior to the application of the bituminous wearing course, the Developer shall maintain the pavement in a smooth sound condition to the satisfaction of Council.

7.11 **OPENING PAVEMENT TO TRAFFIC**

If required during the progress of the works, the Developer shall freely and without undue obstruction permit traffic to use the constructed pavement prior to the preparation for and the application of bituminous surfacing material.

Where such use cannot be provided the Developer shall construct adequate side-tracks or detours.

7.12 MAINTENANCE

During the construction period and throughout the duration of the Maintenance Period, completed pavements shall be maintained by the Developer in a clean and sound condition.

In the event of any defect appearing in a pavement and whether before or after the application of surfacing material, the defect shall immediately be made good by the Developer. The defect area being scarified as required, shall have the defective material removed, fresh pavement material added and the area re-compacted and trimmed and surfaced to produce a pavement which conforms with the requirements of the Specification and which blends evenly in with adjoining construction, all to the satisfaction of Council.

7.13 RESTORATION OF TRENCHES

Upon completion of trench excavation for the installation of services and laying of ducts, all surplus material shall be removed from the site.

All footpath areas shall be returned to the standard crossfall and any vegetation replaced.

Where sewer and water crossings are to be provided in existing roads, the trenches shall be backfilled and compacted with stabilised sand to subgrade level, then 20mm base course material to within 50mm of the road surface.

The final 50mm shall be AC10 with a heavy emulsion tack coat applied to both the top and the sides of the trench.

All openings shall be saw-cut prior to backfilling to eliminate all irregular edges.

7.14 ROUNDABOUTS

Roundabouts shall consist of full depth asphaltic concrete on a concrete base, as specified below.

Concrete sub-base layer	**150mm thick 5 Mpa roller compacted concrete** (Conpave) in accordance with RTA Specification R82 (impervious working platform with a suitable design CBR)
Asphalt high bitumen layer	**50 mm thick AC 20 6% bitumen enriched, Class 320 binder** (fatigue resistant layer to withstand tensile strains at bottom of layer)

Asphalt base layer	**100mm thick AC 28, Class 320 binder** (Dense Grade) (Stiff structural layer to distribute traffic loads and resist deformation)
Asphalt surface layer	**50 mm thick AC 14 polymer modified** (5% EVA), Class A10E binder (textural layer to provide skid resistance, low noise levels and resist deformation).

8. SPRAYED BITUMINOUS SURFACING

8.1 DESCRIPTION

This specification provides for the spraying of hot bitumen and the application of suitable precoated aggregate to an existing sealed surface or an unsealed prepared surface in a two coat application.

Each application of binder shall be covered with aggregate and rolled as specified, before the subsequent application of binder.

Unless otherwise authorised, no sealing work shall be carried out while the pavement temperature is less than ten degrees (10^0C), twenty degrees (20^oC) for polymer modified bitumen, or during periods of wet weather, unless authorised by Council. Modified emulsion may be used where the temperature does not reach twenty degrees (20^oC)

Where recycled materials are used in the base course, and the UCS ≥ 1% modified seals such as 6% SBS polymer modified or modified crumb rubber S45R are to be used for the second coat application (weather dependent) RTA Specification R107.

8.2 QUALITY OF MATERIALS

8.2.1 BINDER

Bitumen shall conform to the AS 1160 Bitumen Emulsion for Construction and Maintenance of Pavements and RTA Specification 3253.

8.2.2 CUTTER OIL

Cutter Oil shall conform to AS 3568 and the RTA Specification for Oils for Reducing the Viscosity of Bitumen.

8.2.3 REFINERY CUTBACK BITUMEN

Refinery Cutback Bitumen shall conform to AS 2157 RTA 3261 Cutback Bitumen.

8.2.4 PRECOATING MATERIALS

Precoating materials shall conform to the RTA Specification for the Supply and Delivery of Cover Aggregate for Sprayed Bituminous Surfacing. These may be oil based materials with additives, bitumen based materials with additives or water based materials with additives.

8.2.5 AGGREGATE

Aggregate shall conform to the RTA Specification 3151 for the Supply and Delivery of Cover Aggregate for sprayed Bituminous Surfacing.

Unless specifically nominated elsewhere in this Specification and/or as directed in the Documents, nominal size(s) of the aggregate shall be 14mm for the first seal coat and 10mm for the second seal coate of a two coat application.

8.3 SAMPLING OF MATERIALS

The Developer may be required to supply at any time, adequate samples of any or all materials used or to be used in the work. The time of sampling may be either prior to dispatch of the material from source of supply or subsequent to its arrival at the job or both. The Developer shall supply all facilities, equipment and labour for obtaining the samples.

The methods of sampling and testing shall be those described under the relevant materials specification contained in clause 8.2 where applicable. If any samples fails to conform to the specification requirements, the whole of the material represented by such sample may be subject to rejection or other action as described in clause 8.15.

8.4 PLANT

The Developer shall provide all the plant and equipment necessary for carrying out the work in accordance with this Specification.

All plant and equipment used on the work shall be kept in good operating condition. The Developer shall remove from the work any plant or equipment considered by Council to by unsuitable for carrying out the work in accordance with this Specification.

8.5 PREPARATION OF PAVEMENT

The pavement surface shall be swept free of loose stones, dust, dirt and foreign matter so as to uncover, but not dislodge the stones of the pavement immediately before applying the first coat. Sweeping shall extend 250mm clear of the pavement.

A mechanically operated rotary broom shall be used for the sweeping provided it does not disturb the surface stones. If a satisfactory clean surface is not obtained thereby, additional sweeping shall be carried out by hand.

Any adherent patches of foreign materials shall be removed from the road surface.

Where the prepared pavement is recessed below the gutter lip, additional sweeping shall be carried out by hand adjacent to the gutter lip to remove all loose material.

No spraying shall be commenced until the pavement has been prepared to the satisfaction of Council.

8.6 CONTROL OF WORK

Council may direct the width, length, alignment and section of road to be sprayed at any time.

Provided the width of treatment does not exceed 7.4 metres, Council may direct whether spraying is to be carried out to the full width of the roadway or in part widths. Where part width spraying is carried out the work shall be arranged to provide for a continuous flow of at least one lane of traffic.

The sprayer shall be so guided that the edge of the spray conforms at all times to the required line. Any section of payment not adequately covered by binder shall be sprayed by the hand attachment.

Council may order work to temporarily cease on account of adverse weather, unsatisfactory condition of pavement or aggregate, or circumstances which are considered to adversely affect the work.

Variations in the proportion of cutter oil in the binder may be ordered by Council at any stage of the work.

The Bitumen Sprayer and all other equipment used on the work shall be kept in good operating condition and shall be operated by persons skilled and experienced in their respective duties. The Developer shall remove form the work any workman or equipment considered by Council to be unsuitable for carrying out the work in accordance with this Specification.

The Developer shall take all necessary precautions to prevent binder, aggregate or other materials from entering or adhering to kerbs and gutters, gully pits, hydrants, or valve boxes, manholes covers, bridge or culvert decks and similar road fixtures. Immediately after the aggregate has been spread over the binder, the Developer shall take steps to clean off any material and leave the site of work in a clean condition.

8.7 OPERATION OF SPRAYER

Unless otherwise authorised by Council and except as stated hereunder in this Clause, the application of binder shall be made by means of the mechanical sprayer.

Where the use of the mechanical sprayer is not practicable, the spraying of such areas as Council may approve shall be carried out by means of the hand spray equipment.

The spray nozzles shall be of the make and type endorsed on the sprayer certificate. The Developer shall measure and mark on the ground the length of the surface to be sprayed by each run of the sprayer. He shall indicate by marks on the road at intervals of not more than seven metres, the line to be followed by the sprayer for the spray to conform to the alignment ordered.

Binder shall be applied at the rate specified or ordered and shall be within the tolerances stated in the relevant RTA Form, or stated in other performance requirements acceptable to the Council. The spraying table referred to in that form, shall be available on the work site at all times and shall be used to determine the appropriate road speed and settings of sprayer controls prior to the commencement of each sprayer run.

After each sprayer run, the quantity of material sprayed shall be checked against the area covered and any necessary adjustments shall be made to ensure that the specified or ordered rate of application is maintained in subsequent runs.

Spraying shall cease immediately if any defect develops in the spraying equipment and it shall not recommence until the fault has been rectified.

8.8 HEATING OF BINDER

Binder shall be heated to a temperature necessary to carry out the operations of cutting (if required) and spraying. The temperature of the binder at the time of spraying, shall be within the limits given in Table 8.1.

At no time during heating shall the specified upper limit be exceeded.

Table 8.1 Heating and Spraying Temperatures

Type of Material	Grade	Dynamic Viscosity Range in Pa.s at 60°c	Range of Temperature for heating and spraying °c.
Cutback Bitumen	AMC4	2.0 – 4.0	110 – 135
	AMC5	5.5 – 11.0	120 – 150
	AMC6	13.0 – 26.0	135 – 160
	AMC7	43.0 – 86.0	150 – 175
Bitumen	Class 170	140.0 – 200.0	160 – 190
Polymer Modified	Class 170		180-200

Binders shall be heated in equipment which will permit uniform heating without damage to the content. The heating equipment and methods of operation shall be as approved by Council.

Quantities of binder in excess of requirements shall not be heated and such materials shall not be held at temperatures within the spraying range for periods in excess of ten hours.

All binders shall be sprayed as soon as possible after heating.

Temperatures shall be checked regularly by means of a suitable thermometer with the readings within plus or minus 2.5% of the correct temperature.

Two or more suitable fully-charged pressurised dry chemical fire extinguishers, shall be provided and shall be placed conveniently to the heaters at all times while heating is in progress. Suitable loose sandy materials shall also be provided at the heaters for use in the event of fire.

8.9 CUTTING BACK BITUMEN BINDER

The percentage of cutter oil to be used in the binder at any time during the course of the work shall be subject to the approval of the Council and shall generally be determined from the road

temperatures and Table 8.2. The Developer shall arrange for the binder in each sprayer load to be cutback as directed by Council and each sprayer load shall be accompanied by a certificate showing the volume of bitumen and cutter oil material respectively used.

8.10 APPLICATION OF BINDER

The binder shall consist of bitumen or cutback bitumen prepared in a bitumen refinery or other source of supply as scheduled in Table 8.2, or cutback bitumen prepared in the field.

The net cold rate of application of the binder unless otherwise specified and/or specifically nominated on the Documents shall be:-

Reseal	1.2 litre/sq m
Two coat Seal	
1st application	1.3 litres/sq m
2nd application	1.1 litres/sq m
Polymer Modified	1.6 lires/sq m

Council reserves the right to order variations in the specified rate(s) of application at any stage of the work.

When refinery cutback bitumen is used as the binder, the ordered rate for residual bitumen shall be increased, to allow for cutter oil in the mixture, in accordance with Table 8.2.

Table 8.2 Cutback Chart

Grade of Refinery Cutback	Approximate Amount of Cutter Oil	Increase in Ordered Rate (%)	Permissible Range of Road Temp (^{0}C) Aggregate Precoated	
			No Moisture on Aggregate	Moisture on Aggregate
AMC 4	16	19	-	10 - 15
AMC 5	11	12	12 – 17	12 - 28
AMC 6	7	8	22 – 27	22 – 38
AMC 7	3	3	32 - 37	32 - 48

When refinery cutback bitumen is in use and actual road temperature is outside the permissible range give in Table 8.1 the Developer shall defer spraying until the road temperature comes with that range. Alternatively, in the case when the road temperature is too low, the Contractor may add extra cutter oil to the binder as directed by Council. Any additional cutter oil shall be mixed uniformly with the binder.

The binder shall be applied to the prepared road surface in the manner specified at a rate of application within a tolerance of plus or minus 5% of that specified.

If binder is applied at a rate outside this tolerance, the section of work concerned may be rejected by Council.

The temperature of the binder at the time of spraying shall be within the range specified in Table 8.1.

At the time of spraying, the road surface shall be clean and free from loose materials and where the binder is to be applied to a primed or sealed pavement, the surface shall be dry. Where the binder is to be applied to a pavement not previously primed or sealed, the surface shall be slightly damp.

The area to be sprayed with the binder at any time shall be limited to that which can be covered with aggregate at the specified rate within 20 minutes of the time of spraying.

8.11 PRECOATING OF AGGREGATE

All cover aggregate shall be coated with an approved agent and at an application rate generally in the range of 6 to 15 l/m3.

Precoating material shall be thinly and evenly applied by means of a fine pressure spray to a moving stream of aggregate, in an approved mixing plant, so that all particles are fully coated, but do not contain excess material. Precoating shall be carried out to accepted industry standards.

When Precoated material is being applied, the aggregate may be dry or damp, but shall not contain excess moisture to cause uneven distribution of the precoating material on the aggregate particles.

8.12 APPLICATION, DISTRIBUTION AND INCORPORATION OF AGGREGATE

After spraying the binder, aggregate as specified shall be spread uniformly over the sprayed surface by an approved mechanical spreader.

The rate of application of the aggregate shall be:-

Reseal	1 cu.m per 120sq m (10mm nominal size)
Two coat seal	
1st Application	1 cu.m per 90 sq m (14mm nominal size)
2nd Application	1 cu.m per 120sq m (10mm nominal size)

Council may order variations in the specified rate(s) of application at any stage of the work. In all cases the following procedure shall be adopted.

Sufficient material shall be at the site to provide the full aggregate cover required for the quantity of binder to be sprayed at that time. Aggregate at the site shall be sufficient to re-run or hand cover bare or insufficiently covered places left after the first spreading.

The application of aggregate shall commence immediately after the spraying of the binder and shall be completed within twenty minutes of spraying. Bare or insufficiently covered places shall be re-run with the mechanical spreader or covered by hand as may be directed. Aggregate in excess of the rate of application specified or ordered shall be scattered and evenly distributed on the road.

Before the second course of binder is applied, the first course of aggregate shall be incorporated thoroughly into the binder by rolling and if there are any surplus loose particles on any portions of the sealed area, such portions shall be swept lightly, so as to remove the loose particles, but not disturb the aggregate bedded in the binder.

This work shall proceed as soon as the first course of aggregate is firmly held by the binder. After the second application of binder and aggregate, rolling shall proceed as specified.

8.13 COMPACTION

After the aggregate has been applied it shall be rolled with an approved pneumatic tyred roller followed by a vibratory rubber coated steel drum roller or similar.

Rolling of each section of the work shall commence immediately after the application of the aggregate thereto and shall continue until the aggregate is firmly embedded in the binder.

8.14 TRAFFIC

Traffic shall not be allowed on the new work until approved. If Council directs that the full width of pavement shall not be sprayed in one operation, traffic shall not be permitted on the adjacent strip of roadway while binder is actually being sprayed.

Any precautions required to ensure the safety of traffic during the progress shall be carried out in accordance with AS 1742.3 and Council's Guidelines on Urban Traffic Control.

Approved advisory signs indicating that the sealing work is in progress shall be erected at intervals of not more than 300 metres and in locations where directed by Council.

8.15 DEFECTIVE WORK OR MATERIALS

The Developer shall make good any work, that is not in accordance with this specification, whether caused by bad workmanship, or defective materials supplied, or by materials made defective by his operations.

8.16 WASTE MATERIALS

Waste aggregate, bitumen, empty containers or other materials remaining after completion of the work and during the maintenance period, shall be disposed of from site and the work shall be left in a neat and tidy condition.

8.17 MAINTENANCE

Should any defect occur in the surface during the Maintenance Period, the area affected shall be thoroughly cleaned and treated with binder and aggregate as specified and repaired to the satisfaction of Council's Engineer.

9. SUPPLY AND LAYING OF ASPHALTIC CONCRETE (AC)

9.1 DESCRIPTION

This Specification provides for the supply and spreading of asphaltic concrete on pavements for the areas, depths and nominal mix sizes indicated in the Documents and shall conform with Aus-Spec #2 No. 245 (With the exception of 0% RAP). The wearing course shall not contain any Reclaimed Asphalt Pavement

9.2 MINERAL AGGREGATES

Aggregates shall comply with the requirements of AS 2758.5. The mix is not to contain any Reclaimed Asphalt Pavement (ie 0% RAP).

9.3 MINERAL FILLER

The mineral filler shall comply with AS 2150.

9.4 BINDER

The binder shall be bitumen complying with the requirements of AS 2008-1980. The class of bitumen shall be 170 or as specified by Council.

Polymer Modified binders containing Styrene Butadiene Styrene (SBS) and Ethylene Vinyl Acetate (EVA) may be used subject to approval by Council.

9.5 PROPORTIONING OF MIXES

9.5.1 The use of a Residential Type B 'gap' graded 10mm Mix in accordance with Australian Asphalt Pavement Association's Advisory Note 5, shall be provided on all roads with design ESA's of 1×10^6 or less.

The Residential Mix, where required as a Surface Course, shall have the following properties:-

AS Sieve Size	**% Passing**
13.2 mm	100
9.5 mm	90 – 100
6.7 mm	65 – 85
4.75 mm	60 – 80
2.36 mm	55 – 75
1.18 mm	45 – 65
0.600 mm	30 – 50
0.300 mm	20 – 30
0.150 mm	10 – 18
0.075 mm	5 – 11

Bitumen Content	-	5.8% - 6.8%
Air Voids	-	3.0% - 5.0%
Stability (Marshall 35 blows)	-	4.0kN

Flow - 2mm – 5mm

9.5.2 Each mix shall be designed with bitumen content and aggregate grading within the general limits of AS 2150.

The properties for voids, stability and flow as determined by Marshall Compaction shall comply with AS 2150 Table 3.3.

9.5.3 The grading of the mix as produced shall not be varied more than the tolerances set out below.

Sieve Size	**Permissible Variation % by Mass of Total Mix**
19.0 mm and larger	+ or - 10
4.75 mm and larger	+ or – 7
2.36 mm and 1.18 mm	+ or – 5
600 µm and 300µm	+ or – 4
150 µm	+ or – 2.5
75µm	+ or – 1.5

The bitumen content of the mix produced shall not be more than 0.3% of that nominated in the mix.

9.6 MIXING PROCEDURE

9.6.1 GENERAL

Mixing shall be undertaken in an approved batch pugmill, continuous pugmill or drum mixing plant, capable of uniformly mixing coarse and fine aggregate, filler and binder to meet the specified requirements at all times.

9.6.2 TEMPERATURES

Thermometer elements of a suitable type, shall be placed in the flow of material from the dryer and in the binder, storage tank or supply line. Thermometer registrations shall be readable and accurate within plus or minus 2%.

Bitumen shall be at a temperature not exceeding 165^{o}C when introduced to the mix.

Aggregates shall be heated to such a temperature that, when filler and binder are added, the temperature of the mixed asphaltic concrete shall not exceed 165 ^{o}C.

The mix shall leave the pugmill, drum and/or the hot storage bin(s) at a temperature between 140 ^{o}C and 165 ^{o}C but in no circumstances shall the temperature of the mix at the time of laying be less than the minimum value specified in Table 9.1 for the appropriate road surface temperature and layer thickness.

9.6.3 MIXING TIME

Mixing time shall be such that all particles of mineral aggregate are uniformly coated with binder.

9.6.4 TESTING AND ACCEPTANCE OF MIX

Council reserves the right to test the mix at any time to determine its compliance with the Specification. The Developer shall be responsible for taking the samples and shall supply all facilities, equipment and labour for that purpose. The samples shall be taken by the Developer's representative at the point of production, along with control samples. The Developer will arrange for the testing of the samples and the results shall be made available to the Council in 7 – 14 days.

Control testing carried out by a NATA registered laboratory shall be considered as acceptance testing.

9.7 TRANSPORT

The asphaltic concrete shall be discharged into trucks, the bodies of which shall be kept thoroughly cleaned and coated with a thin film of a suitable release agent to prevent mix sticking to the body of the truck. Care shall be taken to remove surplus release agent before loading.

During transport the asphaltic concrete shall be covered with a canvas or other suitable cover which is held down.

When asphaltic concrete is to be transported over long distances or in cold conditions, the asphaltic concrete shall be covered with a heavy duty canvas or similar waterproof cover which overlaps the sides of the truck body by at least 250mm and is tied down securely. Council may direct that the bodies of all trucks be suitable insulated.

Delivery of the mix shall be at a uniform rate within the capacity of the spreading and compacting equipment. Transport shall be as expeditious as possible to minimise cooling of the asphaltic concrete.

The mass of all truck-loads of mix shall be measured on a weighbridge certified by the Department of Consumer Affairs.

9.8 PREPARATION OF PAVEMENT

The pavement shall be dry and thoroughly broomed immediately prior to commencement. Any foreign matter adhering to the pavement and not swept off by the broom shall be removed by other means. Existing bituminous surfaced pavements shall be hosed or otherwise washed to remove all foreign matter. Any areas significantly affected by oil contamination shall be cleaned by an approved method.

Where recycled material has been used in the base course, the sealed pavement shall be rolled with a smooth steel drum vibratory roller. A minimum of two (2) and no more than three (3) passes are to be undertaken over the entire pavement area prior to the commencement of asphalting.

Under no circumstances shall swept or waste material be placed on the footway or verge at any time.

Any depressions or uneven areas shall be tack-coated and brought up to the general level of the pavement with asphaltic concrete before the main course is laid. The correction course shall be laid and compacted in accordance with clauses 9.12 and 9.13 to the general level of the existing surface.

9.9 TACK COAT

The whole of the area to be sheeted with asphaltic concrete shall be lightly and evenly coated with rapid setting bitumen emulsion (cationic preferred) which shall meet the requirements of RTA Form 1254 Specification for Supply and Delivery of Bitumen Emulsion. The application rate of residual bitumen shall be 0.15 to 0.30 litres per square metre. For bitumen emulsion complying with RTA Form 1254, the application rate of undiluted bitumen emulsion shall be between 0.25 and 0.50 litres per square metre. If the bitumen emulsion is diluted, the application rate shall be adjusted to obtain the undiluted rate. As an alternative to dilution, Council may permit the use of an emulsion that has been manufactured with a lower bitumen content than is specified in RTA Form 1254, in which case the residual bitumen applied shall be equivalent to that stated above.

The tack coat shall be allowed to “break” (water separating from the bitumen) before the asphaltic concrete is laid. Over application of the tack coat, due to existing surface depression, shall be removed or dispersed by brushing.

The bitumen emulsion shall be applied by a mechanical sprayer with spray bar, unless the areas to be sprayed are small, irregular or inaccessible to mechanical sprayers, in which case application by hand spraying or brushing may be permitted.

All contact surfaces of gutters or other structures and all joints shall be painted with a thin uniform application of tack coat.

Care shall be taken to ensure that bitumen emulsion is not sprayed on, or allowed to coat any concrete kerbing adjacent to the pavement. Any material so sprayed shall be removed. The Developer shall be held responsible for any damage to adjacent property, vehicles or persons sprayed with tack coating material. When trucks or other vehicles are likely to move from tack coated areas onto adjacent finished surfaces, the finished surfaces shall be blinded with limestone dust or similar material to protect them from bituminous material carried over on truck tyres.

9.10 SPREADING

9.10.1 PAVER

Spreading shall be by an approved self propelled paving machine, having an effective spreading capacity of not less than 50 tonnes of mix per hour. The paver shall be of approved make and shall be capable of laying the asphaltic concrete into a true and even finish by use of a pre-compaction device.

9.10.2 PAVING PROCEDURES

Before commencing paving operations, the work shall be set out with the order of runs, position of joints and levels clearly defined.

The paver shall operate at a uniform speed and its output shall match the rate of delivery of asphaltic concrete such that, as far as practicable, continuous spreading of the mix is achieved.

When backing trucks against the paver, care shall be taken not to jar the paver out of its proper alignment.

The paver shall be so operated that material does not accumulate along the sides of the receiving hopper. Any mix in or under the paver which has become cool due to delay in the transport of mix or for any other reason shall be removed.

In the event of faulty operation of the paver causing irregularities in the spread material, work shall be suspended until the fault is rectified. If the irregularities are of a minor nature and the surface has not cooled below 115 ^{o}C, it will be permissible to spread a thin layer of fresh mix by hand, level it with lutes and roll immediately. Should this treatment fail to produce a surface of acceptable texture and regularity, or it the faults left by the spreader are of appreciable depth, then the defective surface shall be removed and fresh material shall be laid as previously described.

Unless otherwise approved by Council, asphaltic concrete shall not be spread by hand behind the paver. Workmen shall not stand or walk on hot asphaltic concrete except where necessary for correction of the surface.

Council may approve spreading asphaltic concrete by hand for the correction of minor irregularities and in areas inaccessible to mechanical pavers. Asphaltic concrete, so placed, shall be spread so as to produce a smooth even surface with uniform density to the correct level.

9.10.3 LAYING TEMPERATURE

The temperature of asphaltic concrete at the time of laying shall be as shown in table 9.1.

Table 9.1 Mix Laying Temperature

Road Surface Temperature in Shade C^{o}	Mix Temperatures ^{o}C			
	Layer Thickness Less than 30mm	Layer Thickness 30mm to 40mm	Layer Thickness 45mm to 100mm	Layer Thickness over 100mm
5 – 10	Not permitted	150*	145*	130 – 155
10 – 15	150*	145*	140*	125 – 150
15 – 25	145*	140*	135*	120 – 145
Over 25	140*	135*	130*	115 - 140

* Minimum laying temperature

The laying of asphaltic concrete will not be permitted when the surface of the road is wet or when cold winds chill the mix to such and extent that, in the opinion of Council, spreading and compaction are adversely affected.

Council may reject any part of any truck load which contains lumps of cooled asphaltic concrete which are liable to affect the quality of the finished surface.

The temperature of the mix shall be measured in the truck just prior to discharging into the power hopper. A suitable stem type thermometer readable and accurate to within 12 ^{o}C with a range from at lease 0 ^{o}C to 200 ^{o}C shall be used. The stem shall be inserted into the mix to a depth of approximately 200mm at a location of about 300mm from the side of the truck body. An average of at least two readings shall be adopted as a temperature of the mix.

9.10.4 LAYER THICKNESS

The minimum compacted thickness of mix shall be as specified in the Document.

9.11 JOINTS

Work shall be so arranged that the number of joints, both longitudinal and transverse, are kept to a minimum and the daily laying pattern shall be subject to approval by Council before work commences.

The density and surface finish at joints shall be similar to those of the remainder of the layer.

9.11.1 LONGITUDINAL JOINTS

Care shall be taken to provide positive bond between adjoining runs.

Longitudinal joints shall be continuous, parallel and coincide within 150mm of change of crossfall, where such occur. Joints in successive layers shall be offset by at least 150mm and be located away from traffic wheel tracks. Work shall be arranged to avoid longitudinal joint faces being left exposed overnight.

Hot joints shall be constructed by leaving an uncompacted strip approximately 150mm wide along the edge of the first run and after the adjoining run has been spread, both sides of the joint shall be rolled simultaneously.

In the case of cold longitudinal joints, the edge of the first run shall be butted and slightly elevated while hot using hand lutes. If the edge is left exposed overnight or longer, Council may direct that the edge be trimmed to a straight vertical face by cutting disc, rotary saw or pneumatic spade and lightly coated with tack coat material by brushing. The adjoining run shall be placed against the prepared edge with an ovelap of 25mm to 50mm. The overlap shall be pushed back using lutes, immediately after placing, to form a slight ridge along the joint which the roller shall compress adjacent

to the edge of the previously placed run. Any excess, overlapping or segregated material shall be discarded.

The compaction of the mix at a longitudinal joint shall be carried out immediately behind the paver, using either a static steel wheeled roller or a vibratory steel wheeled roller operated in a static mode. Compaction shall commence with the roller travelling on the cold lane, with a 150mm overlap on the hot lane, for the first forward and reverse pass. The second pass shall be made on the hot lane with 150mm overlap on the cold lane.

When thin layers are to be compacted, Council may allow the use of a vibratory steel wheeled roller operated in the vibratory mode. In this instance, the first forward and reverse pass shall be made with the roller travelling on the hot lane and with a 150mm overlap on the cold lane.

Rolling shall continue until the joint is smooth and dense.

9.11.2 TRANSVERSE JOINTS

When the end of the spread material has cooled due to disruption of the work, or when resuming work on the next day, a transverse joint shall be formed.

Transverse joints shall be approximately at right angles to the direction of paving. They shall be staggered by a least one metre between successive layers and adjacent runs.

Runs shall be ended either against a timber bulkhead to ensure a straight, vertical, well compacted edge or by feathering out and compacting. In the latter case, the feathered material shall be cut back to a line where the full thickness exists. The surface shape of the end of the run shall be checked by a straight edge to locate the line of cut.

The end of the previous run shall be lightly tack coated before the paving of the next run proceeds.

At the start of the run, care shall be taken to set the screed level with sufficient allowance for compaction so that the correct thickness of asphaltic concrete is placed. The screed shall be heated to the mix temperature.

The joint shall be rolled with a steel roller transversely for several passes, with the roller projecting about 150mm further onto the fresh mix in each pass. If a vibratory roller is used, it shall be operated in the static mode. At locations where it is difficult to roll the joint transversely, Council may direct that an alternative procedure be used.

Boards shall be used for off pavement movement of the roller to prevent rounding the edge of the mat. The joint shall then be rolled longitudinally.

When the asphaltic concrete layer is required to join and match the level of an existing pavement surface, sufficient of the existing

material shall be cut out to achieve the minimum specified layer thickness.

9.12 COMPACTION

9.12.1 PLANT AND EQUIPMENT

Compaction equipment shall be self-propelled and shall include any of the following types of equipment and various combinations of these types:-

9.12.1.1 Static steel rollers shall have a mass not less than 8 tonnes and a drum loading not less than 35kN per metre width of drum. Tandem rollers are preferred but three wheeled rollers may be used.

9.12.1.2 Vibratory rollers shall have a mass not less than 6 tonnes and a drum loading not less than 20kN per metre width of drum. Tandem, articulated rollers with vibration on both drums are preferred. They should be capable of vibration frequencies between 30Hz and 50Hz and amplitudes between 0.4mm and 1.0mm. They shall have provision for the vibration to be cut off when the roller is coming to a halt or changing direction.

9.12.1.3 Pneumatic rollers shall have a mass of ten tonnes to twenty tonnes ballasted and tyre inflation pressures variable up to 700kPa. Numbers of wheels may vary from seven to eleven. The tyres shall have wide, flat smooth rolling surfaces.

For compaction in confined areas or patching works, a small vibrating roller, or hand operated vibrating compactor acceptable to Council, shall be used.

9.12.2 COMPACTION PROCEDURES

Rollers shall travel at a uniform speed not exceeding 5km/hr for steel rollers and 10km/hr for vibratory steel and pneumatic tyred rollers. They shall not remain stationary on recently compacted mix.

Lateral changes in the direction of rolling shall be made on previously compacted mix. Sharp turns shall be avoided and any changes from forward to reverse shall be made smoothly. Vibrating rollers shall not be stopped or reversed while in the vibrating mode.

Vibratory steel rollers shall not be permitted to travel when operating in the vibratory mode on cement, concrete or previously compacted asphaltic concrete.

Compaction shall be considered in three stages; initial, secondary and final rolling:

9.12.1.1 Initial Rolling

Initial rolling shall be carried out using steel rollers. Vibratory steel rollers may be used, but they shall be operated in the static mode

for the initial passes. On deep lift asphaltic concrete, pneumatic tyred rollers may be used.

When compacting thin layers, Council may permit vibratory steel rollers to be operated initially in the vibratory mode.

Initial rolling shall commence as soon as possible after laying has commenced. Rollers shall be operated as close as possible to the paver, without damaging the mat, with their driving wheels closest to the paver except on very steep grades, where the rollers shall operate with their driving wheels on the partially compacted mix. When rolling unsupported edges, rollers shall overhang the edge by not more than 100mm. When the layer thickness is 100mm or more, rolling to within 200mm of an unsupported edge shall be delayed to minimise possible displacement of the asphaltic concrete. When compacting this 200mm wide strip, the first pass shall cover about half the width of the unrolled strip; the second pass shall cover the remainder of the width but shall not overhang the edge by more than 100mm.

The transverse and longitudinal joints and edges shall be compacted first as specified in clause 9.11. Rolling shall then proceed longitudinally with the roller moving parallel to the run and reversing along the same track.

The roller shall gradually progress from the lower to the higher edge of the new mat. Each track shall overlap the preceding one by about 150mm and shall terminate beyond the end of the preceding track by at least one metre.

Initial rolling shall be completed before the mix temperature falls below 105 ^{o}C.

9.12.1.2 **Secondary Rolling**

Secondary rolling shall immediately follow initial rolling. Either vibratory steel rollers, static steel rollers or pneumatic tyred rollers shall be used. The tyre pressures of pneumatic tyred rollers shall be between 500kPa and 600kPa. Rolling shall commence at the longitudinal joint side of the run, with the roller reversing along the same track on each pass and shifting across the run in full roller widths to the opposite side.

Secondary rolling shall be completed before the mix temperature falls below 80 ^{o}C.

9.12.1.3 **Final Rolling**

Final rolling shall be carried out by a pneumatic tyred roller with tyre pressures between 600kPa and 700kPa to eliminate all roller marks and to produce a uniform finish. If any tyre marks exist after final rolling, Council may direct that they be removed with a steel roller operated in a static mode.

If secondary rolling has been carried out with a pneumatic tyred roller, a steel roller may be used for final rolling.

Final rolling shall be competed before the mix temperature falls below
60 ^{o}C.

9.12.2 **COMPACTION REQUIREMENT**

The minimum Characteristic Value of Relative Compaction of a sample core, when tested in accordance with the relevant RTA Form, shall be 95% for a layer of thickness less than 50mm or 96% for a layer of thickness of 50mm or greater.

Mix with an actual Characteristic Value of Relative Compaction of less than 90% shall be removed from the site.

9.13 **FINISHED PAVEMENT PROPERTIES**

The asphaltic concrete surfacing shall comply with the requirements of AS 2150.

The finished surfaces shall be smooth, dense and true to shape, shall not vary more than 10mm from the specified plan level at any point and shall not deviate from the bottom of a three metre straight edge laid in any direction by more than 5mm for the asphaltic concrete course as laid. Sufficient measurements of thickness shall be taken before and after compacting to establish the relationship between the thickness of the uncompacted material and the completed work. The thickness shall then be controlled by measurements taken on the uncompacted material immediately behind the paver. When the measurements indicate that an area will not be within the allowable tolerances for the completed work, the uncompacted area shall be corrected while the material is still in a workable condition by adding or removing material. Otherwise the defective area shall be removed and replaced with fresh material. Irregularities exceeding the tolerances given above in a particular course shall be corrected before a subsequent course is placed.

Notwithstanding the foregoing tolerance, the Developer shall remain responsible for laying the minimum specified layer thickness of asphaltic concrete on all areas of the pavement.

The finished surface shall be lightly sprinkled with limestone dust, or other approved filler, sufficient to ensure the mix will not be tacky under traffic.

9.14 **WEIGHBRIDGE DOCKETS**

The Developer shall provide Council with numbered, dated weighbridge dockets in accordance with the weighing of truck loads specified in Clause 9.7 of this Specification. All dockets shall bear the supplier's letterhead or identifying mark.

9.15 **PROVISION FOR TRAFFIC**

All necessary signs, barriers, etc required for the control and protection of traffic, shall be provided by the Developer in accordance with AS 1742.3 and Council's Guidelines on Urban Traffic Control. Special care shall be taken to ensure that vehicles

and pedestrians are not sprayed with bitumen emulsion during tack-coating and that entry to areas treated with tack coat or hot asphaltic concrete is prevented.

9.16 CLEANING OF GUTTERS AND GULLY PITS

All gutters and gully pits located within the boundaries of the work shall be cleaned and kept clean of all silt, debris, rubbish and surplus aggregate arising out of the execution of the works.

9.17 MAINTENANCE

The pavement shall be maintained after completion for the specified period (Maintenance Period) and should any failure of the asphaltic concrete wearing course occur during this period, the area affected shall be removed and be replaced with similar material to that used on the work.

9.18 OTHER PAVEMENT SURFACE FINISHES

Other pavement surface finishes shall be submitted to Council for consideration and approval.

10. SEGMENTAL PAVEMENTS

10.1 DESCRIPTION

A formal pavement design shall be prepared by a registered N.A.T.A laboratory based on sampling and testing on the sub-grade materials form the site. Details of the pavement design, results of subgrade testing (including design California Bearing Ratio values for the subgrade) and design traffic loadings are to be submitted to Council for approval prior to commencement of pavement construction.

10.2 PAVING UNITS

10.2.1 CONCRETE

Paving units shall be 80mm thick Type A units complying with AS 4455 and shall have a characteristic compressive strength of 45 Mpa when sampled and tested in accordance with AS 4456, unless otherwise approved by Council.

10.2.2 CLAY (Private Roads & Driveways)

Paving units shall be 65mm thick fired Clay Pavers Class 4 and shall have round arises to (4) four sides of the wearing surface but not exceeding (5) five mm radius. The paving units shall comply with AS/NZS 4455, AS/NZS 4456 and Paver Note One "Specifying and Laying Clay Pavers."

10.2.3 OTHER MATERIALS

Paving units manufactured from other materials shall be submitted to Council for consideration and approval.

10.3 SUBGRADE

The subgrade shall be formed at the required depth and in general shall be cut from the solid. However, when over cut it may be built up to the correct level by the addition of material approved by Council. All subgrades shall be thoroughly compacted to the requirements of clause 4.11 and finished to a firm, smooth surface of uniform bearing value.

Pavement construction shall not proceed until the subgrade has been inspected and approved by Council.

10.4 SUB-BASE AND BASE COURSE FOR ROADS

10.4.1 SUB-BASE

The Sub-base shall consist of 5 Mpa concrete, rolled concrete, cement or lime/flyash stabilised material where subgrade CBR values are less than or equal to 4. For CBR values greater than 4, crushed sandstone may be used in accordance with the approved pavement design.

10.4.2 **BASE COURSE**

Road shall be joint reinforced concrete or steel fibre reinforced concrete (Minimum 20Mpa).

The base course and sub-base course shall extend to the rear face of all edge restraints, unless otherwise specified and shall be inspected and approved by Council prior to commencing the placement of the sand bedding course and the laying of units.

Control joints shall be constructed at 20m maximum intervals.

10.5 **EDGE AND CROSS RESTRAINTS**

Concrete kerbs and gutters, kerbs, edge and cross strips shall be constructed to the details shown on the Documents and in accordance with clause 6.12. 25mm drainage holes shall be provided where directed by Council in the concrete edge restraints.

10.6 **SURFACE DRAINAGE**

After compaction of the paving units, their upper surface shall finish sufficiently above the levels of adjacent surface drainage channels, edge strips or drainage inlet pits to ensure positive drainage from the grooves formed between adjacent units. Where this is not detailed in the Documents, the units shall be laid ensuring that the lower edges of chamfers finish not less than 10mm above the lip of edge restraints.

10.7 **BEDDING SAND**

10.7.1 **MATERIAL**

Bedding sand shall be well graded angular, non-cohesive sand passing a 4.75mm sieve and confirming to the following grading limits:-

Sieve Size:
9.52mm 4.75mm 2.36mm 1.18mm 600µm 300µm 150µm 75µm

% Passing:
100 95-100 80-100 50-85 25-60 10-30 5-15 0-10

The bedding sand shall be free of deleterious soluble salts or other contaminants likely to cause efflorescence, or otherwise leading to reduced skid resistance. A weed killer, approved by Council, shall be added to the bedding sand to avoid growth appearing through joints.

Bricklayers sand and single sized dune sands are not suitable.

10.7.2 **MOISTURE CONTENT**

The sand shall be of uniform moisture content when spread and shall be protected from rain when stockpiled on site prior to spreading. Moisture content shall be in the range 4% -8%.

10.7.3 **SPREADING**

The bedding shall be spread and screeded on a loose condition to the design profile and levels, plus the necessary surcharge to achieve a uniformly 20mm thick layer following final compaction of the pavement.

The spread sand shall be carefully maintained in a loose condition and protected against precompaction both prior to and following screeding. Any precompacted sand or sand left overnight shall be loosened before further paving units are placed. Sand shall be lightly screeded in a loose condition to the predetermined depths only slightly ahead of the laying of paving units. Under no circumstances shall the sand be screeded in advance of the laying face to an extent to which paving will not be completed on that day.

10.8 **PLACEMENT OF PAVING UNITS**

Paving units shall be placed so that they do not come into contact with adjoining units, whilst maintaining correct joint alignment using a grid of stringlines. Paving units shall be laid with a nominal joint width of 2mm to 3mm.

Should it be necessary to manipulate individual paving units to ensure correct joint alignment and that no paving units are in point contact with each other, a brick bolster shall be used. Under no circumstances shall screw drivers or other implements likely to cause edge damage to the paving units be used.

All full units shall be laid first. **It is the contractor's responsibility to ensure the best laying face is chosen** when laying double-faced units.
Paving units shall be blended from various packs to ensure uniform spread of colour.

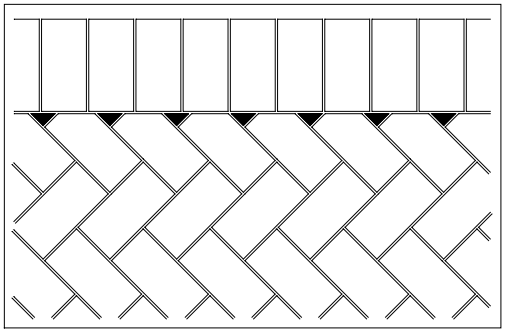
The first row shall be laid at a suitable angle to achieve the required orientation of paving units in the completed pavement. Edge or closure units shall be neatly cut to fill gaps. Such units shall consist of not less than 25% of full unit surface area. Cutting of units to less than 25% of size shall be avoided by using insertions of half or three quarter batts as shown in the following figures 1 and 2.

Pavers shall be laid in either 45 or 90 degree herringbone with a joint width of 2mm – 3mm.

All full pavers should be laid first. Closure pavers (cut to fill gaps adjacent to edge) should then be laid subsequently.

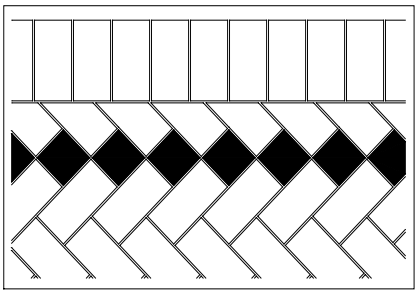
The finished pavement shall conform to the construction tolerances and be free draining at all times. The applicable finished surface tolerance is a maximum deviation of 10mm from the bottom of a 3m straight edge and the level of adjacent pavers shall not differ by greater than 2mm.

Figure 1 Trimming to avoid small edge infill pieces

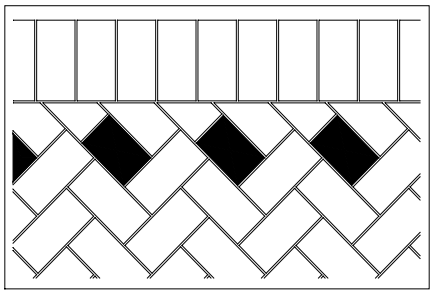


Small edge pieces not permitted

Figure 2



Recommended insertion of pavers cut to half length



Alternative recommendation; insertion of pavers cut to three quarter length

10.9 **COMPACTION OF PAVING UNITS AND JOINT FILLING**

A thin layer of joint filling sand should be spread evenly over the paving units prior to compaction to aid the movement of the compactor and minimise surface damage.

The paving units shall be compacted and brought to level using a high frequency, low amplitude, vibrating plate compactor. The plate shall be of sufficient size to simultaneously cover a minimum of 12 pavers. A suitable resilient material such as plywood (minimum thickness of 12mm) shall be placed between the vibrating plate and the paving units, to provide a cushioning effect. (NOTE: Direct contact of the steel plate of the compactor with the paving unit surfaces will weaken the edges of the paving units resulting in subsequent spalling).

After this, the whole sequence of spreading and brushing in jointing sand, removing the surplus and vibrating with two or three passes of the plate compactor is to be repeated. Compaction shall be undertaken as soon as reasonably practicable after placing paving units, through it should not be performed closer than one metre from any unrestrained edge. Compaction shall continue until lipping has been eliminated between adjoining paving units. To ensure

complete filling of the joints, both the joint filling sand and paving units shall be as dry as practicable. Ideally, joint filling shall be carried out prior to the completion of each day's laying.

Any paving units not complying with the acceptance criteria hereinafter described, or damaged during compaction, shall be immediately removed and replaced. In the case of double faced paving units, the paving units can be turned over if the alternative face meets the acceptance criteria. Where possible, pavers rejected should be used as closure units or infill pieces to minimise wastage.

The joint filling sand shall be clean fine-graded rounded sand, free from deleterious materials such as clay and soluble salts or other contaminants.

Approved joint sealers or additives are to be incorporated in the jointing sand to provide bound and pliable joints. Cement additives are not to be used.

The joint filling sand shall conform with the following grading:

Table 10.1

Sieve Size	**% Passing**
2.36mm	100
1.18mm	75-95
600 microns	50-80
300 microns	20-45
150 microns	5 – 15
75 microns	0-5

Under no circumstances should traffic, including construction traffic, be allowed onto the segmental pavement prior to the completion of the laying, cutting-in, compacting, joint filling and joint sealing processes.

Where traffic volumes and/or the frequency of heavy vehicles is anticipated to be high, additional compaction by approved multi-wheeled pneumatic tyre road rollers may be required.

10.10. PAVERS IN FOOTWAYS AND ISLAND INFILLS

Paving units shall be provided to areas shown in Documents.

10.10.1 PAVING UNITS

Pavers shall comply with the following requirements:-

10.10.1.1 DIMENSIONS

The pavers may be concrete or clay of rectangular shape and nominally 230mm long, 114mm wide and 65mm thick.

The actual dimensions measured shall be such that the following tolerances are not exceeded.

± 40mm on the length of 20 pavers
± 40mm on the width of 20 pavers
± 40mm on the depth of pavers

10.10.1.2 **EDGE TREATMENT**

The pavers shall have chamfered or rounded edges on all four sides in the finished pavement surface. The radius of the rounded edge however, shall not exceed 5mm.

10.11 **TESTING**

The pavers shall comply with the relevant Australian Standard and shall carry a certificate from a registered NATA laboratory to show the compliance with the following requirements:-

i) Abrasion Resistance – shall not exceed a loss of 3.0cm^3 on any one unit when tested in accordance with the South Sydney City Council test method.

ii) Characteristic Compressive Strength – shall be a minimum value of 45 Mpa.

iii) Cold Water Absorption – shall not exceed 8.0%.

iv) Efflorescence – shall be nil.

v) Lime Pitting – shall be nil.

vi) Polished Frictional Value (PFV) – shall achieve a minimum value of 45 or greater when tested in accordance with the South Sydney City Council test method.

vii) Slip/Skid Resistance – shall achieve a BPN of 50 or greater.

viii) Transverse Breaking Load – shall be a minimum value of 5.0KN.

11. STREET FURNITURE

11.1 STREET NAME SIGNS

11.1.1 GENERAL

Street name signs shall be erected in accordance with Council's Drawing "Standard Street Signs and Posts." Reference should also be made to AS 1742.5.

11.2 SIGN BLADES

11.2.1 Signs shall be manufactured from an approved marine grade high tensile strength aluminium 6.0mm minimum thickness, with a pointer shaped end.

11.2.2 The length of the signs shall not be less than 500mm or more than 1200mm.

11.2.3 The profile of the blade shall be flat.

11.2.4 The height of the blades shall be 200mm.

11.2.5 A 100mm high supplementary plate to display house numbers will be required at cross roads. This will apply where the same named street extends through the intersection.

11.2.6 Unless the name-sign is located opposite a road junction, the letters and background shall be provided on both sides of the plate. Where name signs are located opposite a road junction, the letters and background shall be provided on one side of the plate only.

11.3 POSTS

11.3.1 Metal posts shall be to AS 1074 galvanised with cap and 50mm nominal bore with 2.3mm wall thickness and cap. – length as per standard drawing.

Posts and caps shall be powder coated with PMS 357 Custom Tint (Green) or similar polyester outdoor application 70-120 microns thick.

11.3.2 The posts shall be sunk into the ground to a depth of 600mm below the existing finished surface. The excavation around the post shall be rammed and back filled with lean-mix concrete (proportions 1 part cement to 20 parts aggregate, by volume) to within 100mm of the finished ground surface. If located in the verge, the remaining 100mm shall be backfilled and rammed with top soil or selected excavated material free from rocks, etc. The surface shall be levelled and neatly trimmed.

11.4 STREET NAMES

11.4.1 BACKGROUND

The background sheeting shall be 3M Standard Green 3826 Class 1 high intensity reflective sheeting bonded to the prepared extruded aluminium blades by the 3M approved method to meet AS 1906.1, applicable for a 12 year warranty. The sheeting shall extend for the full length and depth of the blade and be unspliced along its length.

11.4.2 LEGEND

Letters shall be:-

i) made from 3M Silver 3870 Class 1 material.

ii) 25mm high lettering for suburb name located centrally.

iii) 100mm high lettering for street names with 4mm wide orange Class 2 reflective stripes top and bottom.

iv) 50mm high numerals for house numbering with 4mm wide orange Class 2 reflective stripes top and bottom.

11.4.3 LETTER SERIES

As a general rule, numerals and lettering shall be Series “D” up to 10 letters, Series “C” 11 to 13 letters and Series “B” 14 letters and over. The number of letters includes the suffix.

11.4.4 ABBREVIATIONS

Abbreviations for road suffixes are to be the same size and font as that used for the street name. Standard abbreviations to the requirements of clause 6.4 of AS 1742.5 shall be used.

11.4.5 DIRECTIONAL ARROW

Where single sided signs are required to identify through streets a directional arrow shall be placed at the post end of the sign in accordance with Council’s drawings.

11.5 FIXING OF BLADES AND BRACKETS

11.5.1 The sign blades shall be fixed at right angles to the post by mild steel brackets or cast aluminium brackets and secured to the post by an adequate number of galvanised nuts and bolts. Threads are to be burred after installation.

11.5.2 The top of the sign blade shall be at least 5mm clear from the top of the post (excluding cap).

11.5.3 Brackets shall be powder coated as per post.

11.5.4 Brackets are to be secured to the post by means of a self tapping screw.

11.6 GUIDE POSTS

11.6.1 Guide posts shall be erected at the ends of construction or where directed by Council. The guide posts shall consist of approved hardwood timber DAR 100mm x 50mm and 1.5 metres long, set vertically in the ground approximately 500mm deep or other types acceptable to Council. A uniform display of posts to a height of approximately 1 metre shall be provided with the tops boned in to compensate for irregularities in the shoulder contour.

Each guide post shall be provided with retro-reflective delineators 50mm x 50mm, red being use on the left hand side and white on the right hand side as viewed by the approaching driver. Where posts indicate the end of construction, red reflectors shall be used.

Where timber posts are to used the timber above ground shall receive one (1) undercoat and two (2) coats of approved white paint. The portion of post below ground level shall be creosote treated.

The earth backfilled around the post shall be well and solidly rammed in layers of not more than 150mm for the full depth and to ground level.

11.7 WARNING AND REGULATORY SIGNS, PAVEMENT MARKINGS AND CHEVRONS

11.7.1 Signs, markings, RPM's and chevrons shall be erected in accordance with the RTA Signs and Markings Manual and are to be located as shown on the Documents or as directed by Council.

11.8 PATHWAY BARRIERS, BOLLARDS, BICYCLE RAILS, HANDRAILING AND ACCESS GATES

11.8.1 Galvanised metal bollard posts provided with Dulux "Luxathane R" white finish and provided with Class 1 reflective tape shall be to AS 1074, with nominal bore, shape and dimensions complying with the relevant standard drawing.

11.8.2 Pathway barriers shall be placed at the ends of pedestrian access ways as per the standard drawing.

11.8.3 Bicycle rails shall be placed at the road end of cycleways and at road intersections as per the standard drawing.

11.8.4 Hand railing shall be provided where shown on the documents and in accordance with the standard drawing.

11.9 GUARD FENCE AND SAFETY FENCE

Fencing shall be provided where shown on the documents or as directed by Council in accordance with the standard drawing (guard fence) and AS 1926-1986 (safety fence).

11.10 SERVICE CONDUIT MARKINGS

The position of conduits shall be marked permanently by moulding either “W” (water) painted red, or “T” (Telecommunications) and “E” (Electricity) painted yellow into the kerb face. Where no kerbs are laid directly over the end of each conduit, the Developer shall supply and place a hardwood timber post as set out in Clause 11.6 with the upper 75mm painted the appropriated colour, and positioned adjacent to the edge of the pavement on the line of the conduit. The existence of conduits in a road shall be indicated by a sign 600mm x 600mm bearing the words:

T.H.S.C
SERVICE CONDUITS
LAID
OPENING OF ROAD
SURFACE PROHIBITED

in red lettering at least 50mm high on a white background. The signs shall be located where directed by Council.

12. GRASSING AND REGENERATION

12.1 DESCRIPTION

This Specification provides for the preparation, fertilising, sowing, turfing, watering, mowing and generally caring for grasses on defined areas so as to provide a dense uniform distribution of the various varieties of grasses specified.

12.2 PREPARATION

Areas to be grassed shall be ripped along the contour to a depth of 200mm prior to topsoiling to provide a key for the topsoil and improve infiltration of water. Following ripping, the areas shall be topsoiled in accordance with Part 4 – Formation.

On steep slopes and on other areas of high erosion hazard a rough surface shall be developed. A fine tilth shall be acceptable only on areas of low slope.

Light grading to effect the required surface profile may also be necessary and shall be carried out by the Developer if so directed.

The topsoil of areas to be grassed by turfing shall be compacted with a light roller.

All weeds and the roots of all noxious weeds shall be thoroughly cleared from the site. Trees existing on the site shall not be disturbed other than by being trimmed as directed.

12.3 GRASSING BY SEEDING

12.3.1 GRASS SEED

The seed used shall be of the best quality available, shall have good germination characteristics and be true to variety. The seed shall be obtained from reputable suppliers and the Developer shall produce satisfactory evidence that he has complied with these requirements.

Until used, any seed in the possession of the Developer shall be stored off the ground in a cool, dry place and shall not be stored any longer than possible before being used.

Seed mixture for reserves, footways, embankments, fill and disturbed areas:

a) Spring/Summer Mix

Lolium perenne (Perennial Rye)	60 kg/ha*
Cyclodon dactylon (Couch) Irrigation Hulled	30 kg/ha
Axonotus affanus (Carpet Grass)	30 kg/ha*
Trifolium (O'Connells Sub Clover)	3 kg/ha
Festuca Rubra (fine Fescue)	27 kg/ha
	150 kg/ha

* For drought conditions substitute Tall Fescue (15 kg/ha) for Perennial Rye (7.5 kg/ha) and Carpet Grass (7.5 kg/ha).

b) Autumn/Winter Mix

Lolium perenne (Perennial Rye)	90 kg/ha
Festuca rubra (fine Fescue)	30 kg/ha
Agrostis tenius (Bent)	7.5 kg/ha
Festuca arundinacea (Demeter Fescue)	22.5kg/ha
	150 kg/ha

Seed mixture for earth drainage channels

The following mixtures of seeds shall be used on inverts and batters of drainage channels and inlet and outlet drains:-

a) Spring/Summer Mix

Lolium perenne (Perennial Rye)	60 kg/ha
Festuca aruundinacea (Demeter Fescue)	45 kg/ha
Cyclodon dactylon (Couch) Irrigation Hulled	15 kg/ha
Axonotus affanus (Carpet Grass)	15 kg/ha
Trifolium Repens (White Clover)	3 kg/ha
Trifolium (O'Connells Sub Clover)	4.5 kg/ha
Echinochloa frumentacea (Japanese Millet)	7.5 kg/ha
	150 kg/ ha

b) Autumn/Winter Mix

Lolium perenne (Perennial Rye)	90 kg/ha
Festuca arundinacea (Demeter Fescue)	30 kg/ha
Puccinellia Distans (Saltol)	15 kg/ha
Trifolium repens (White Clover)	3 kg/ha
Trifolium (O'Connells Sub Clover)	4.5 kg/ha
Secale cereale (Ryecorn)	7.5 kg/ha
	150 kg/ha

12.4 SOWING

When the area to be sown has been bought to a condition suitable for the sowing of grass seed, the seedling mixture shall be

proportioned in accordance with the requirements of clause 12.3.2 of this Specification.

After proportioning, the various quantities of seeds shall be thoroughly mixed so that each variety will be uniformly distributed throughout the whole.

The seed mixture then shall be uniformly distributed at the prescribed rate of application per hectare and unless otherwise specified, the prescribed quantity per hectare of fertiliser shall be distributed at the same time.

After sowing, the whole of the area shall be uniformly watered. The volume of water to be applied at the time shall be equivalent to 10mm of rain unless weather conditions dictate otherwise, in which case Council shall determine the volume of water to be applied.

The Developer shall take care to avoid the formation of rills in the surface by a too rapid application of the water.

Sowing shall be carried out by the method indicated in the Documents or otherwise specified.

12.5 HYDROSEEDING

When sowing is to be carried out by hydroseeding, a hydromulching machine approved by Council shall be used to mix and spray a slurry of seed mixture, fertiliser, mulch and water onto the area to be grassed. Sufficient mulch material shall be contained in the slurry to carry and stick the seed mixture and fertiliser to prepare surface.

12.6 HYDROMULCHING

Where hydromulching is to be undertaken a heavy covering of mulch, usually hay/straw mulch and an anionic bitumen emulsion, is spread with the seed.

12.7 CONVENTIONAL SOWING AND MULCHING WITH BITUMEN

When sowing is to be carried out by conventional methods the seed and fertiliser may be distributed uniformly by means of a mechanical seed sower to be followed by an application of bitumen emulsion.

No area shall be sown with seed whilst it is in such a softened state due to excessive moisture that it cannot support the weight of the loaded bitumen sprayer.

The seed shall be covered by 5mm of soil by means of rolling or other methods acceptable to the Council.

As soon as practicable after the application of water, the area shall be sprayed with bitumen emulsion by means of an approved power sprayer fitted with a fixed spray bar set at the maximum width per row.

An approved solution of slow-breaking anionic bitumen emulsion and water mixed in the ratio 1:1 shall be used for this purpose. The application rate shall be 1.0 litre per square metre for general work and four litres per square metre for drainage channels subject to concentrated water flows.

In areas where it is impracticable to utilise the fixed spray bar of the sprayer, the bitumen emulsion may be applied by means of an approved hand spray attached to the power sprayer.

Any areas deformed and/or rutted shall be repaired and re-sown by the Contractor, at his expense, to the satisfaction of Council.

All concrete structures shall be protected from overspray with emulsion and any surfaces sprayed shall be cleaned to the satisfaction of Council.

12.8 GRASSING BY TURFING

The sods shall be of couch grass unless otherwise specified. They shall show healthy growth and to be of even thickness when delivered to site. The area from which the supply of grass is to be obtained shall be mowed before the sods are cut.

The placing of the sods shall be commenced immediately when the soil has been watered and fertilised.

On completion of the laying of the sods, they shall be compacted by watering and rolling with a 100 to 150 kg roller. Each sod shall be butted against the previously laid sod and no gaps shall remain between the sods after laying.

Sites too steep for this compaction treatment shall be covered with a locating mesh of a type approved by the Council.

Immediately after the sods have been rolled, approved topsoil shall be spread to a depth of 10mm over the whole area and thoroughly watered.

12.9 CARE OF GRASSED AREAS

The Developer shall regularly care for the sown and turfed areas and shall regularly maintain the moisture content of the ground at a level sufficient to allow, where applicable, proper germination of the seed to take place, to assist the rooting of the runners and generally to encourage the subsequent growth of the grasses.

12.10 ESTABLISHMENT

A uniformly distributed dense grass cover of the specific varieties of grass shall be established over the whole of the area specified to be grassed so as to eliminate wind and water erosion of the surface.

The Developer shall take all steps necessary to establish the dense grass cover and will not be regarded as having fully discharged

obligations until such time as the required dense grass cover has been established.

12.11 MAINTENANCE

The Developer shall maintain the grass cover and if necessary, take all action to re-establish areas of grass damaged or destroyed by adverse weather conditions, fire, floodwater, vandalism or any other cause.

The Developer shall make good of any damage that may be caused to any finished surfaces, fences or paved areas by his plant or trucks used during the progress of the work.

12.12 REGENERATION OF BUSHLAND AREAS

Where works are undertaken within bushland, restricted development areas or other areas as determined by Council, regeneration shall be carried out in accordance with Council's DCP Part D Section 3- Landscaping.

13. DEFECTS LIABILITY PERIOD

13.1 DESCRIPTION

The liability period shall have a duration of twelve (12) months.

At any time during the liability period, Council may direct the Developer to rectify any defects which become evident within the constructed works.

13.2 SUBDIVISIONS

The liability period shall commence from the date of release of the plan of subdivision.

Prior to the release of the plan of subdivision a maintenance bond in the form of a bank guarantee or cash security representing 5% of the total cost of the subdivision works, with a minimum amount of $5,000. is to be lodged with Council.

13.3 ALL OTHER DEVELOPMENTS

The liability period shall commence from the date of the final clearance by the Council's Engineer.

A maintenance bond shall be assessed and lodged with Council prior to the final clearance.