Muswellbrook Shire Council

CONSTRUCTION SPECIFICATION

AUS-SPEC (Cot 09)

1171 Subsurface Drainage

Version 01

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
0	No amendment has been made	all	Nil		14 June 2012

CONTENTS

1171 SUBSURFACE DRAINAGE

1 GENERAL

1.1 RESPONSIBILITIES

Objectives

General: Provide subsurface drainage.

Design

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *0152* Schedule of rates – supply projects
- *0161 Quality (Construction) or 0167 Integrated management*
- *0179 General requirements (Construction)*
- *0319 Minor concrete works.*
- *1101 Control of traffic.*
- *1102 Control of erosion and sedimentation.*
- *1112 Earthworks (Roadways).*

1.3 REFERENCED DOCUMENTS

The following documents are incorporated into this worksection by reference:

Standards

AS 1141	Methods for sampling and testing aggregates.
AS 1141.11.1-2009	Particle size distribution by dry sieving.
AS 1141.22-2008	Wet/dry strength variation.
AS 1289	Methods of testing soils for engineering purposes.
AS 1289.5.5.1-1998	Soil compaction and density tests - Determination of the minimum and maximum dry density of a cohesionless material - Standard method.
AS/NZS 1477-2006	PVC pipes and fittings for pressure applications.
AS 2439	Perforated plastics drainage and effluent pipe and fittings.
AS 2439.1-2007	Perforated drainage pipe and associated fittings.
AS 2758	Aggregates and rock for engineering purposes.
AS 2758.1-1998	Concrete aggregates.
AS 3705-2003	Geotextiles - Identification, marking and general data.
AS 3706	Geotextiles - Methods of test.
AS 3706.9 – 2001	Determination of permittivity and flow rate.
AS 3706.11-2004	Determination of durability—Resistance to degradation by light, heat and moisture.

Other publications

AUSTROADS	
Austroads 2008	Glossary of Austroads Terms
AGPT04G-2009	Guide to Pavement Technology Part 4G- Geotextiles and geogrids
AGPT10/09-2009	Guide to Pavement Technology Part 10– Subsurface drainage
ASTM	
D2434-68-2006	Standard Test method for permeability of granular soils (Constant head)

1.4 STANDARDS

General

Standard: To AGPT10/09.

1.5 INTERPRETATIONS

Definitions

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

Panel drain: Corrugated flat plastic pipe.

1.6 SUBMISSIONS

Acceptance criteria

General: All submissions will be subject to the approval of the Superintendent.

Documents

Submit the following for approval:

- Materials: Off-site certificates of components.
- Calculations: Survey set out of drainage works and quantity calculations.
- As-executed drawings: Include drainage system information sheets and works.
- Components: Pipes and fittings, and geotextiles.
- Samples: For conformity testing to relevant Standards.
- Technical data: System drainage information.
- Execution details: Refer to **HOLD POINTS**.

1.7 Inspection

Notice

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

Summary of HOLD POINTS

Item/Clause title	Requirement	Notice for inspection	Release by
MATERIALS			
Subsurface drainage pipes - General	Submit compliance certificates	7 days before proceeding to provide pipes	Superintendent
Other types of subsurface drainage pipes - Alternatives	Submit details of proposed alternative pipes and evidence of conformity for approval.	7 days before proceeding to provide pipes	Superintendent
Geotextile - General	Provide documentation of conformity of geotextile and installation process	14 days before proceeding to provide geotextile	Superintendent
EXECUTION			
Establishment - Set out	Submit the proposed set-out in addition to the designed set-out	7 days before planned execution	Superintendent
Excavation – Existing under ground services	Submit evidence of approval of the relevant authorities.	14 days before planned excavation	Superintendent
Excavation - Trenches	Approval of completed trenches required prior to installation of drainage work	1 working day prior to installation of drainage work	Superintendent
Recording of subsurface drainage - Information sheet	Progressive supply of subsurface drainage details	5 working days after completion of each drain or drainage system	Superintendent

Summary of WITNESS POINTS – Off-site activities

Item/Clause title	Requirement	Notice for inspection
MATERIAL		
Subsurface drainage pipes - Corrugated flat plastic pipe and fittings	Type of pipe and fitting	7 days prior to proceeding
Subsurface drainage pipes - Thick walled P.V.C. pipe	Certificate of compliance	7 days prior to proceeding

Summary of WITNESS POINTS – On-site activities

Item/Clause title	Requirement	Notice for inspection
EXECUTION		
Temporary drainage during construction, Equipment and material	Locate materials and equipment clear of water courses	7 days prior to positioning
Excavation, Blasting operation	Measure ground vibration resulting from blasting	Progressive
Outlet structures, Discharge and salinity prevention	Locate discharge to avoid recharge of water table	Progressive

2 PRE-CONSTRUCTION PLANNING

2.1 SCHEDULING

Program of works

General: Program the works as follows:

- Materials: Arrange the program for compliance and usage of component and materials.
- Authorities: Arrange approvals and confirm environmental requirements.

3 MATERIALS

3.1 SUBSURFACE DRAINAGE PIPES

General

Approval: Before providing pipes, submit compliance certificate and test results determined from AS 2439.1 as evidence that the pipes conform to the requirements of this worksection. This is a **HOLD POINT**.

Corrugated circular plastic pipe and fittings

Pipe: Conform to the following:

- Standard: To AS 2439.1.
- Class: 1000, for 65 mm or 100 mm diameter as shown on the drawings.
- Type: Slotted, except where shown otherwise on the drawings.

Fittings: Provide joints, couplings, elbows, tees and caps as follows:

- To AS 2439.1.
- To the manufacturer's recommendations.

Corrugated flat plastic pipe and fittings

Pipe: Conform to the following: This is a **WITNESS POINT**.

- Type: 'Stripdrain' or 'Megaflo' or approved equivalent enclosed in geofabric or seamless tubular filter fabric.
- Size: As shown on the drawings.
- Fittings: To the manufacturer's recommendations.

Thick walled PVC pressure pipe

Pipe: Conform to the following:

- To AS/NZS 1477.
- Size:
  - . Nominal diameter: 58 mm.
  - . Minimum wall thickness: 6.5 mm.
- Type: Slotted except where shown on the drawings. Details of slot sizes and spacings to Annexure A.

Joints: Square ends and butt jointed.

Certificate of Compliance: Submit a test certificate to AS/NZS 1477. This is a **WITNESS POINT**.

3.2 Other types of subsurface drainage pipes

Alternatives

Approval: Submit full details of the type of pipe, certification from the manufacturer of its suitability and quality for use in each particular application. Address the crushing strength, flexural strength, jointing system and slotting details. This is a **HOLD POINT**.

3.3 FILTER MATERIAL

General

Quality: Clean, hard, tough, durable particles.

Where subsoil drains are laid in or adjacent to planted area's: Ensure the PH of the filter material is within the range 6 – 7.

Type A filter material

Source: Crushed rock or granular material.

Grading: To the **Type A filter material table.**

Use: In trench drains and Type B drainage mats: To *1174 Drainage mats*.

Type A filter material table

Test method	Property		Requirement
	Material passing AS sieve		**% by mass**
AS 1141.11.1	6.7	mm	100
	4.75	mm	85 to 100
	2.36	mm	0 to 40
	1.18	mm	0 to 5
	425	µm	0 to 2

Type B filter material

Source: Granular material.

Grading: To the **Type B filter material table.**

Coefficient of saturated permeability: At least 8 m / day after three hours of flow when compacted to its maximum dry density in conformance with AS 1289.5.5.1 and then tested to conform with ASTM-D2434-68.

Grading variation as a result of compaction processes: To the **Type B filter material variation table.**

Use: In trench drains and Type A drainage mats: To *1174 Drainage mats*.

Type B filter material table

Test Method	Property		Requirement
AS 1141.11.1	**Material passing AS sieve**		**% by mass**
	4.75	mm	100
	2.36	mm	95 to 100
	425	µm	20 to 80
	300	µm	0 to 30
	150	µm	0 to 2
	75	µm	0 to 0.1

Type B filter material variation table

AS Sieve	Variation from grading before treatment (% of mass)
2.36 mm	± 3
1.18 mm	± 1
425 µm	± 1
300 µm	± 1
150 µm	± 0.5
75 µm	± 0.1

Type C filter material

Source: Crushed rock.

Grading: To the **Type C filter material table**.

Use: In Type A drainage mats: To *1174 Drainage mats*.

Type C filter material table

Test Method	Property	Requirement
AS 1141.11.1	Maximum particle size	37.5 mm
	Maximum passing the 9.5 mm AS Sieve	5% by mass
	Maximum (D90:D10)*	3
AS 1141.22	Minimum wet strength	100 kN
	Maximum 10% fines wet/dry variation	30%
Note: The D90 value is determined by sieving the material using 75 mm, 53 mm, 37.5 mm, 26.5 mm, 19 mm, 13.2 mm and 9.5 mm AS sieves, as appropriate, and then plotting the results on a graph of AS sieve size v percentage passing. The plotted points to be joined by straight lines and the D90 value determined as the theoretical sieve size corresponding to 90 % passing. D10 denotes the theoretical size of a sieve through which 10% of the material would pass and is to be determined from the same graph used to determine the D90 value.		

Type D filter material

Source: Uncrushed river gravel.

Description: Rounded aggregate to AS 2758.1 Table B1 Appendix B.

Grading: To the **Type D filter material table.**

Use: In Type A and Type B drainage mats: To *1174 Drainage mats*.

Type D filter material table

Test Method	Property	Requirement
AS 1141.11.1	Maximum particle size	75 mm
	Maximum passing the 9.5 mm AS sieve	5% by mass
	Maximum (D90 : D10)	3
AS 1141.22	Minimum wet strength	100 kN
	Maximum 10% fines wet/dry variation	30%

3.4 GEOTEXTILE

General

Conformity: Prior to placing geotextiles, produce documentary evidence that the geotextile and installation process conform to the requirements of this worksection. This is a **HOLD POINT**.

Properties

Material: A non-woven type manufactured from synthetic materials other than polyamide except seamless tubular filter fabric.

General properties: Bio-stable and resistant to attack by alkalis, acids, dry heat, steam, moisture, brine, mineral oil, petrol, diesel and detergents when tested to AS 3706.

Ultra violet light considerations: Conform to the following:

- Provide geotextile resistant to ultra violet light.
- Do not leave geotextile exposed to sunlight during storage and construction for more than 21 days.
- If exposure is in excess of 21 days provide annual test results to conform with AS 3706.11 to show percentage strength retained is in excess of 60 %.

Robustness and strength: Conform to the following:

- Conform to the classifications for robustness and strength cited in AGPT04G/09.
- Select material based on tests and subgrade conditions for the relevant location/function.

Properties: Material type and minimum mass requirements as shown on the drawings.

Installation: Properties, functions, design and construction requirements to AUSTROADS AGPT04B/09.

Water transmission properties: Conform to the following:

- Geotextile materials for curtain drains: Polyester, polypropylene or polyethylene.
- Rate of water flow: To AGPT04G/09 Table 4.1, under 100 mm constant head determined using the perpendicular flow test to conform with AS 3706.9.

Marking and storage

Labelling: Mark rolls with product identification and supply with data sheets and information to AS 3705.

Covering: Provide each roll of geotextile with a suitable covering to protect the fabric against moisture and ultraviolet radiation, and mark to conform with AS 3705.

Storage: Prior to installation store the geotextiles under a protective cover and supported off the ground. Protect the geotextile from damage and adhere to any other recommendations on method of storage set by the supplier/manufacturer.

Seamless tubular filter fabric

Material: Either polypropylene or polyester seamless knitted tubular filter fabric.

Arrangement: Enclose slotted pipe of 65 mm or 100 mm diameter.

Properties: Free of imperfections in weave or yarn, abrasion resistance and weave stability qualities such that it does not form holes, ladder, de-weave, tear or unravel more than 5 mm from a cut end.

Representative large opening size: Between 200 and 500 µm.

Fitting: To the requirements of **Procedure for fitting seamless tubular filter fabric to slotted pipe Annexure A**.

Damaged filter fabric: Remove and replace filter fabric that is torn, excessively stretched or otherwise damaged during transportation, storage, fitting of the fabric or pipe laying.

4 EXECUTION

4.1 PROVISION FOR TRAFFIC

General

Control of traffic: Conform to the following:

- Conform with worksection *1101 Control of traffic*.
- Conform with **Traffic Guidance Scheme** in *1101 Control of traffic*.

4.2 TEMPORARY DRAINAGE DURING CONSTRUCTION

Erosion control

Installation: To *1102 Control of erosion and sedimentation*.

Runoff overflows during construction

Works under construction: Provide for runoff to avoid damage or nuisance due to scour, sedimentation, soil erosion, flooding, diversion of flow, damming, undermining, seepage, slumping or other adverse effects to the Works or surrounding areas and structures.

Equipment and material

Location: Clear of watercourses and secured so that they will not cause danger or damage in the event of large runoff flows. This is a **WITNESS POINT**.

4.3 ESTABLISHMENT

Set-out

Approval : Set out the work to the location and levels shown on the drawings prior to construction. Mark any proposed changes that may arise due to actual site conditions. Seek a direction from the Superintendent for any changes that may effect the Schedule of rates. This is a **HOLD POINT**.

4.4 EXCAVATION

Existing underground services

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

Location: DIAL 1100 BEFORE YOU DIG is a free service, from anywhere in Australia, of locating underground pipe and cables (possible within two working days). See www.dialbeforeyoudig.com.au.

Public utility authorities: If public utilities exist in the vicinity of drainage works, obtain the approval of the relevant authority to the method of excavation before commencing excavation and submit. This is a **HOLD POINT**.

Safety

Stabilisation: Provide any shoring, sheet piling or other stabilisation of the sides of trench excavation necessary to conform with statutory requirements.

Blasting operation

Particle velocity: If excavation by blasting is permitted, ensure that the peak particle velocity measured on the ground adjacent to any previously installed drainage structure does not exceed 25 mm/sec. This is a **WITNESS POINT**.

Blasting operations generally: To *1112 Earthworks (Roadways).*

Trenches

Method: Excavate trenches as follows:

- To the line, grade, width and depth shown on the drawings or as directed.
- Construct the bottom of the trench so that no localised ponding can occur.
- Remove all loose material.

Approval: Required for completed trenches prior to installation of drainage works. This is a **HOLD POINT**.

Unsuitable material

Definition: Material that does not conform with *1112 Earthworks (Roadways)* as determined by the Superintendent.

Remedial actions:

- Remove and dispose of unsuitable material at the bottom of the trench or at foundation level.
- Replace with backfill material to conform with the requirements of this worksection.
- Trim the bottom of the excavated trench or foundation parallel with the specified level and slope of the work.

Excavated material

Generally: Reuse the excavated material in the construction of embankments, backfilling or spoiled to conform with *1112 Earthworks (Roadways)*.

Backfilling

Requirements: Backfill to the relevant subsurface drainage worksections.

Materials: As specified in this worksection and to *1112 Earthworks (Roadways)*.

4.5 OUTLET STRUCTURES

Discharge and salinity prevention

Subsurface drainage pipes: Connect discharge into gully pits or to outlet structures as shown on the drawings or as directed.

Salinity prevention: Discharge on the downhill side of the embankment or in the cut area so as to reduce the risk of recharge to the subsurface water table. This is a **WITNESS POINT**.

Outlets

Location intervals: 150 m maximum

Rodent proofing

Method: Secure outlets, including those discharging into gully pits, with galvanised wire netting to conform with the drawings.

Erosion control

Method: Locate the outlet so that erosion of the adjacent areas does not occur and/or protect the outlet by the placement of selected stone or approved similar treatment.

Locations: Provide marker posts to indicate the location and assist maintenance.

Outlet pipe

Type: Provide unslotted outlet pipes from curtain drains.

Levels: Ensure no point in an outlet pipe is higher than the pipe at the end of the curtain drain.

Concrete

Specification for outlet structures: Concrete to *0319 Minor concrete works*.

4.6 RECORDING OF SUBSURFACE DRAINAGE INFORMATION

Work as executed plans

Record: Keep a detailed record of all subsurface drainage pipes. Provide work-as-executed plans showing completed subsurface drainage systems.

Information sheets
Submit: Provide a subsurface drainage information sheet or sheets at the completion of construction of each drain or drainage system. This is a **HOLD POINT**.

Content: Include the following:

- Date of completion of drain construction.
- Drain number.
- Type of drain.
- Pipe size.
- Pipe type.
- Filter type.
- Grade of drain.
- Locations of cleanouts.
- Locations of outlets.
- Geotextile:
  . Sheet: Yes/No.
  . Seamless tubular filter fabric: Yes/No.
- Response Time: The time taken for water to travel from the inlet end of a drain or from a cleanout leading to a drain to the outlet end of the drain.

Costs: Borne by the Contractor.

4.7 LIMITS AND TOLERANCES

Application
Summary: The limits and tolerances applicable to this worksection are summarised in **Summary of limits and tolerances table**.

Summary of limits and tolerances table

Activity	**Limits/Tolerances**	**Worksection Clause/ subclause**
Filter material		
- Type A	**Type A filter material table**	**Filter material**
- Type B	**Type B filter material table and Type B filter material variation table**	**Filter material**
- Type C	**Type C filter material table**	**Filter material**
- Type D	**Type D filter material table**	**Filter material**
Geotextile		
- Curtain Drains Water Transmission	> 50 l/m^2/s	**Geotextile**
Excavation by Blasting		
Peak particle velocity	≤ 25 mm/sec	**Excavation**
Outlets		
Spacing	Max 150 m	**Outlet structures for subsurface drainage pipes**

5 MEASUREMENT AND PAYMENT

5.1 MEASUREMENT

General
Payment made to the schedule of rates: To *0152 Schedule of rates – projects*, this worksection, the drawings and Pay items 1171.1 to 1171.5 inclusive.

Lump Sum prices: Not acceptable.

Unpriced items: If any item, for which a quantity of work is listed in the Schedule of Rates, has not been priced by the Contractor, due allowance is made in the prices of other items for the cost of the activity which has not been priced.

Methodology

The following methodology will be applied for measurement and payment:

- Erosion and sedimentation control measures: To conform with *1102 Control of erosion and sedimentation*.
- Excavation and geotextile material: To conform with the worksection applicable to the particular activity.
- Removal of unsuitable material: To conform with *1112 Earthworks (Roadways)*.
- Concrete work for outlet structures: To conform with this worksection and not *0319 Minor concrete works*.
- Miscellaneous minor concrete work not included in the pay items in this worksection: To conform with *0319 Minor concrete works*.

5.2 PAY ITEMS

Pay items	Unit of measurement	Schedule rate scope
1171.1 Filter material Type A backfill	- Compacted m^3 - Calculate the volume from the actual length and depth of the trench or mat up to the level of the filter material multiplied by the design width of the trench.	- All costs associated with supply, placement and compaction of filter material and the 'capping' of the trench where shown on the drawings. - The schedule quantity is a provisional quantity.
1171.2 Filter material Type B backfill	- Compacted m^3 - Calculate the volume from the actual length and depth of the trench or mat up to the level of the filter material multiplied by the design width of the trench or mat.	- All costs associated with supply, placement and compaction of filter material and the 'capping' of the trench where shown on the drawings. - The schedule quantity is a provisional quantity.
1171.3 Filter material Type C backfill	- Compacted m^3 - Calculate the volume from the actual length and depth of the mat multiplied by the design width of the mat.	- All costs associated with supply, placement and compaction of filter material. - The schedule rate is a provisional quantity.
1171.4 Filter material Type D backfill	- Compacted m^3 - Calculate the volume from the from the actual length and depth of the mat multiplied by the design width of the mat.	- All costs associated with the supply, placement and compaction of filter material. - The schedule quantity is a provisional quantity.
1171.5 Outlet structures for subsurface drainage pipes	- 'Each' outlet structure..	- Outlet structures in conformance with this worksection excluding outlets into pits. - All costs associated with the construction of the outlet including forming of the structure, supply of concrete and, where directed by the Superintendent, the provision of erosion control measures. - The schedule quantity is a provisional quantity.

6 ANNEXURE A

6.1 SLOTTING DETAILS FOR THICK WALLED PVC PLASTIC PIPE

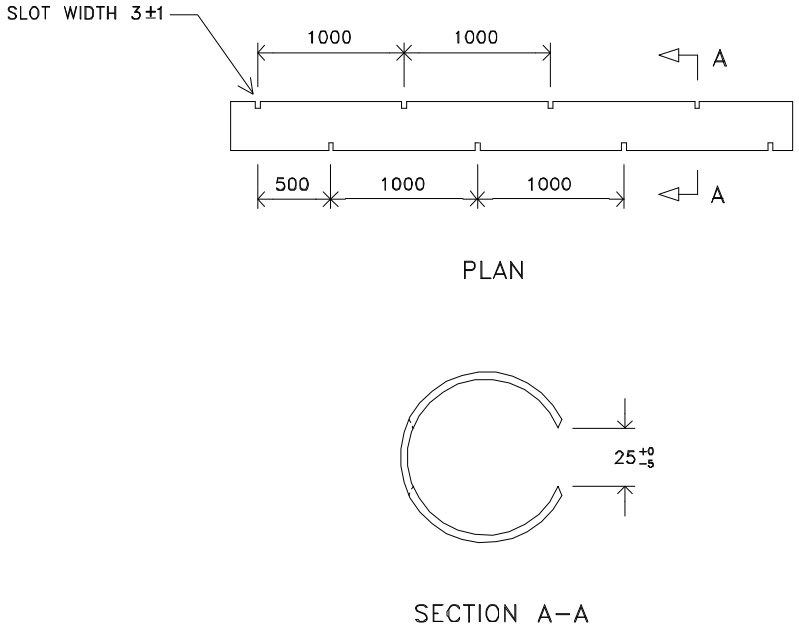

Figure A1 Slotting details for thick walled PVC plastic pipe

6.2 PROCEDURE FOR FITTING SEAMLESS TUBULAR FILTER FABRIC TO SLOTTED PIPE

Procedure

Sequence: Seamless tubular filter fabric may be fitted to slotted pipe on site immediately before the slotted pipe is to be laid in its final position in the work.

General: Conform to the following procedure for fitting seamless tubular filter fabric to slotted pipe:

- Pull the filter fabric over and onto the 'mandrel'. The 'mandrel' is short length of smooth pipe of internal diameter 20 mm - 30 mm greater than the external diameter of the slotted pipe being enclosed by filter fabric.
- Pass the slotted pipe through the mandrel.
- When the end of the slotted pipe emerges from the mandrel, clamp the filter fabric to the forward end of the slotted pipe so that it can not slip back along the pipe.
- Pull the remaining slotted pipe through the mandrel allowing the filter fabric to progressively slip and stretch fit over the slotted pipe as it emerges from the mandrel.
- After the slotted pipe has passed through the mandrel, cleanly cut the filter fabric leaving an overhang off the end of the pipe to allow for a fully covered join with an adjacent pipe when the pipes are installed in the drain.
- Clamp the filter fabric to the end of the slotted pipe to make sure the filter fabric remains stretch-fitted onto the pipe when the pipe is positioned in the drain.

Precautions to be taken when using slotted pipe fitted with seamless tubular filter fabric

Protection: Do not drag slotted pipe fitted with seamless tubular filter fabric over the ground. If carrying, lift slotted pipe fitted with seamless tubular filter fabric clear of the ground and protect from damage.

Damaged seamless tubular filter fabric: If the filter fabric is damaged and its filtering properties affected, remove from the pipe and replace with undamaged filter fabric.

Loose seamless tubular filter fabric: If, at any time during the installation, the filter fabric becomes loose on the slotted pipe re-stretch it to the correct position. If re-stretching causes any damage to the filter fabric, remove the damaged filter fabric from the pipe and replace with undamaged filter fabric.