DEVELOPMENT CONSTRUCTION SPECIFICATION

C230

SUBSURFACE DRAINAGE GENERAL

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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
Original	*Northern Rivers - Local Government Version*	*All*	*Original Edition*	*LCC*	*January 1999*
1	Major Revision as per Aus-Spec Bulletin Board Release 10	All	AMO	SPM	April 2003
2	Revisions as per Aus-Spec Bulletin Board releases 11 & 12	All	AMO	SPM	April 2003
3	Extent of Work deleted	230.03 (1)	O	SPM	March 2004
4	Reference Documents	230.04	M	MR	August 2013

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CLAUSE CONTENTS PAGE

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SPECIFICATION C230 : SUBSURFACE DRAINAGE - GENERAL

GENERAL

C230.01 INTRODUCTION

1. This is the general specification common and applicable to all types of subsurface drainage and shall be read in conjunction with subsurface drainage specifications: ***Purpose***

C231	-	Subsoil and Foundation Drains
C232	-	Pavement Drains
C233	-	Drainage Mats

as applicable to particular contracts.

C230.02 SCOPE

1. The work to be executed under this Specification consists of:

(a) preparation for subsurface drainage construction;

(b) siting of subsurface drainage facilities;

(c) the supply of all materials associated with the provision of the subsurface drainage system;

(d) all activities and quality requirements associated with the supply, placement and compaction of filter material;

(e) the provision of a detailed record of all subsurface drain installations;

(f) the marking on the ground of the location of all subsurface drains.

2. Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in the Specification Part for Quality Requirements. ***Quality***

C230.03 deleted

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C230.04 REFERENCE DOCUMENTS

Documents Standards Test Methods

1. Documents referenced in this specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated.

(a) Council Specifications

C211	-	Control of Erosion and Sedimentation
C213	-	Earthworks
C271	-	Minor Concrete Works

(b) Australian Standards

AS 1141.11.1	-	Methods for sampling and testing aggregates - Particle size distribution – Sieving method.
AS 1141.22	-	Methods for sampling and testing aggregates - Wet/dry strength variation.
AS 1289.5.5.1	-	Methods of testing soils for engineering purposes – Soil compaction and density tests - Determination of minimum and maximum dry density of a cohesionless material.
AS 1477	-	PVC pipes and fittings for pressure applications
AS 2439.1	-	Perforated plastics drainage and effluent pipe and fittings - Perforated drainage pipe and associated fittings
AS 2758.1	-	Aggregates and rock for engineering purposes - Concrete aggregates.
AS 3705	-	Geotextiles - Identification, marking and general data.
AS 3706	-	Geotextiles – Methods of test.
AS 3706.11	-	Geotextiles – Methods of test - Determination of Durability - Resistance to degradation by light and heat and moisture.

(c) Other

Austroads	-	Guide to Pavement Technology
ASTM-D2434.68	-	Test method for permeability of granular soils (constant head)

C230.05 TEMPORARY DRAINAGE DURING CONSTRUCTION

Erosion Control

1. All drainage works carried out by the Contractor shall comply with the Specification for CONTROL OF EROSION AND SEDIMENTATION.

Contractor's Responsibility

2. The Contractor shall make adequate provision for runoff flows at subsurface drainage works under construction 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 as a result of the Contractor's activities.

Location of Equipment

3. The Contractor's material and equipment shall be located clear of watercourses or secured so that they will not cause danger or damage in the event of large runoff flows.

C230.06 SITING OF WORK

Set-out

1. Before commencing construction of any subsurface drainage activity, the Contractor shall set out on site the position of the work to the location and levels shown on the Drawings, and shall present this set-out for inspection by the Superintendent.

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2. The P.C.A. may amend the locations or designed levels or the lengths to suit unforseen site conditions. Any activity resulting from such amendments by the Superintendent shall be deemed to be included as part of the work covered by the Schedule of Rates. Should the Superintendent require a change to the conditions of installation an appropriate variation shall be ordered.

Amendments to Planned Work

3. Should the Contractor propose changes to the location, length, designed levels, conditions of installation or cover to suit the Contractor's construction procedures, the Contractor shall present the proposed set-out in addition to the designed set-out for consideration by the Superintendent. No changes shall be made unless the prior written approval of the P.C.A. is obtained.

Proposed Changes by Contractor

C230.07 EXCAVATION

1. In undertaking trench excavation the Contractor shall provide any shoring, sheet piling or other stabilisation of the sides necessary to comply with statutory requirements.

Safety

2. Where public utilities exist in the vicinity of drainage works the Contractor shall obtain the approval of the relevant authority to the method of excavation before commencing excavation.

Approval by Public Utility Authorities

3. Excavation by blasting, if permitted, shall be carried out to ensure that the peak particle velocity measured on the ground adjacent to any previously installed drainage structure does not exceed 25 millimetres per second. The Contractor shall comply with other requirements concerning blasting operations in the Specification for EARTHWORKS.

Blasting Operation

4. Trenches shall be excavated to the line, grade, width and depth shown on the Drawings or as directed by the Superintendent. The bottom of the trench shall be constructed so that no localised ponding can occur. All loose material shall be removed by the Contractor.

Excavation Level

5. Any material at the bottom of the trench or at foundation level which the Superintendent deems to be unsuitable in accordance with this specification shall be removed and disposed in accordance with the Specification for EARTHWORKS by the Contractor and replaced with backfill material in accordance with the requirements of this Specification. The bottom of the excavated trench or foundation, after any unsuitable material has been removed and replaced, shall be parallel with the specified level or grade of the pipe.

Unsuitable Material

6. The excavated material shall be used in the construction of embankments backfilling or spoiled in accordance with the Specification for EARTHWORKS.

Spoil

C230.08 BACKFILLING

1. Backfilling shall be carried out in accordance with the requirements of the relevant subsurface drainage structures Specifications.

Detail

C230.09 OUTLET STRUCTURES FOR SUBSURFACE DRAINAGE

1. Subsurface drainage pipes shall be connected to discharge into gully pits or to outlet structures as shown on the Approved Drawings. As a salinity prevention measure, and where practicable, discharge shall be on the downhill side of the embankment or cut-fill area so as to reduce the risk of recharge to the subsurface water table.

Discharge

Salinity Prevention

2. Outlets shall be spaced at a maximum interval of 150m.

Spacing

3. Outlets, including those discharging into gully pits, shall be made rodent proof using galvanised wire netting in accordance with the Drawings.

Rodent Proof

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4. The outlet shall be located so that erosion of the adjacent areas does not occur or shall be protected by the placement of selected stone or similar treatment togeather with a marker to indicate location and assist maintenance. ***Erosion Control***

5. Outlet pipes from curtain drains shall be unslotted. At no point shall an outlet pipe be higher than the pipe at the end of the curtain drain. ***Outlet Pipe***

6. All concrete used in the construction of outlet structures shall conform to the requirements of the Specification for MINOR CONCRETE WORKS. ***Concrete Specification***

MATERIALS

C230.10 CORRUGATED PLASTIC PIPE

1. Corrugated plastic pipe shall be Class 1000 complying with AS2439.1 of 65mm or 100mm diameter as indicated on the Drawings. All pipe shall be slotted except where shown on the Drawings. ***Specification***

2. Joints, couplings, elbows, tees and caps shall also comply with AS2439.1 and only the manufacturer's recommended fittings shall be used. ***Fittings***

3. The Contractor shall obtain from the Manufacturer a Test Certificate demonstrating compliance with AS2439.1. ***Compliance***

C230.11 OTHER TYPES OF SUBSURFACE DRAINAGE

1. Where a Contractor wishes to use a subsurface drainage pipe other than corrugated plastic pipe, he shall submit full details of the type of pipe, certification from the manufacturer of its suitability and quality and written acceptance by the Council for its use in each particular application. Certification of the suitability of any pipe will address the crushing strength, flexural strength, jointing system and slotting details. ***Submit for Approval***

C230.12 FILTER MATERIAL

(a) General

1. The types of filter material covered by this Specification shall include: ***Types***

   (a) Type A filter material for use in trench drains and Type B drainage mats (as detailed in C233)

   (b) Type B filter material for use in trench drains and Type B drainage mats (as detailed in C233)

   (c) Type C filter material comprising crushed rock for use in Type A drainage mats (as detailed in C233)

   (iv) Type D filter material comprising uncrushed river gravel for use in Type A drainage mats (as detailed in C233)

2. All filter material shall consist of clean, hard, tough, durable particles.

(b) Type A Filter Material

1. Type A filter material shall be crushed rock complying with the following requirements: ***Grading***

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TEST METHOD	PROPERTY	REQUIREMENT
AS 1141.11	Material passing AS sieve	Per cent by mass
	6.7mm	100
	4.75mm	85 to 100
	2.36mm	0 to 40
	1.18mm	0 to 5
	425um	0 to 2

Table C230.1 - Type A Filter Material

(c) Type B Filter Material

1. Type B filter material shall be granular material complying with the following grading requirements: ***Grading***

TEST METHOD	PROPERTY	REQUIREMENT
AS 1141.11	Material passing AS sieve	Per cent by mass
	4.75mm	100
	2.36mm	95 to 100
	425um	20 to 80
	300um	0 to 30
	150um	0 to 2
	75um	0 to 0.1

Table C230.2 - Type B Filter Material

2. In addition to the above grading requirements, Type B filter material shall have a coefficient of saturated permeability, when compacted to its maximum dry density as determined by AS 1289.E5.1 and then tested in accordance with Test Method ASTM-D2434-68, of at least 8 metres per day after three hours of flow. ***Coefficient of Saturated Permeability***

3. Type B filter material shall not vary from its original grading as a result of compaction processes by more than the following amounts: ***Grading Variation***

AS Sieve	Variation From Grading Before Treatment (per cent of mass)
2.36mm	± 3
1.18mm	± 1
425um	± 1
300um	± 1
150um	± 0.5
75um	± 0.1

Table C230.3 - Type B Filter Material Variation

(d) Type C Filter Material

1. Type C filter material shall be crushed rock complying with the following requirements: ***Grading***

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TEST METHOD	PROPERTY	REQUIREMENT
AS 1141.11	Maximum particle size	37.5mm
	Maximum passing the 9.5mm AS Sieve	5% by mass
	Maximum (D90:D10)*	3
AS 1141.22	Minimum wet strength	100kN
	Maximum 10% fines wet/dry variation	30%
NOTE: The D90 value shall be determined by sieving the material using 75mm, 53mm, 37.5mm, 26.5mm, 19mm, 13.2mm and 9.5mm AS sieves, as appropriate, and then plotting the results on a graph of AS sieve size v percentage passing. The plotted points shall be joined by straight lines and the D90 value shall be determined as the theoretical sieve size corresponding to 90 per cent passing. D10 denotes the theoretical size of a sieve through which 10 per cent of the material would pass and shall be determined from the same graph used to determine the D90 value.		

Table C230.4 - Type C Filter Material

(e) Type D Filter Material

Grading

1. Type D filter material shall be uncrushed river gravel complying with the description of rounded aggregate in Table B1, Appendix B of AS2758.1 and the following requirements:

TEST METHOD	PROPERTY	REQUIREMENT
AS 1141.11	Maximum particle size	75mm
	Maximum passing the 9.5mm AS sieve	5% by mass
	Maximum (D90 : D10)	3
AS 1141.22	Minimum wet strength	100kN
	Maximum 10% fines wet/dry variation	30%

Table C230.5 - Type D Filter Material

C230.13 GEOTEXTILE

(a) General

Properties and Labelling

1. The geotextile, other than seamless tubular filter fabric, shall consist of either a woven or a non-woven type which shall be manufactured from synthetic materials other than polyamide. Rolls of geotextile shall be marked with product identification and supplied with data sheets and information in accordance with the requirements of AS 3705.

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2. The geotextile shall be bio-stable and resistant to attack by alkalis, acids, dry heat, steam, moisture, brine, mineral oil, petrol, diesel and detergents when tested in accordance with the appropriate parts of AS 3706.

Ultra Violet Light Resistant

3. The geotextile shall be resistant to ultra-violet light. No geotextile shall be left exposed to sunlight during storage and construction for a period longer than a total of twenty-one days. If exposure in excess of twenty-one days does occur, the geotextile shall be tested in accordance with AS 3706.11 and if its characteristics have deteriorated to or below 90 per cent of the characteristics claimed by the manufacturer or the characteristics determined on unexposed geotextile, whichever is the better, it shall be removed and replaced with a geotextile complying with this Specification.

4. The geotextile material type, strength rating "G", and minimum mass requirements shall be as shown on the Drawings.

5. The type, properties, functions, design and construction requirements for a particular application of geotextile installation shall be compatible with recommendations provided by the AUSTROADS Guide to Geotextiles as well as requirements indicated on the drawings.

Water Transmission Rate

6. In addition to the above mentioned requirements, geotextiles for curtain drains shall consist of either polyester, polypropylene or polyethylene. When subjected to a pressure of 200 kPa applied at right angles to the plane of the fabric and to a constant head of water no greater than 50 mm applied to the top edge of the fabric, geotextiles for curtain drains shall have a rate of water transmission not less than 20 litres per hour per metre width of fabric through a 300 mm length of the fabric.

RECORDING OF DRAINAGE

C230.14 RECORDING OF SUBSURFACE DRAINAGE INFORMATION

Work As Executed Plans

1. The Contractor shall keep a detailed record of all subsurface drainage pipes and the completed subsurface drainage systems shall be shown on the work-as-executed plans to be returned to the Superintendent upon completion of the Contract.

Information Sheet

2. In addition, the Contractor shall prepare a subsurface drainage information sheet or sheets at the completion of construction of each drain or drainage system and shall submit the subsurface drainage sheet or sheets to the Superintendent within five working days of the completion of the drain or drainage system.

Detail

3. The information to be included in the subsurface drainage information sheets shall include:

Date of completion of drain construction:

Drain Number:

Type of Drain:

Pipe Size:

Pipe Type:

Filter Type:

Grade of Drain:

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Locations of Cleanouts:

Locations of Outlets:

Geotextile-

Sheet	Yes/No
Seamless Tubular Filter Fabric	Yes/No

Response Time:

NOTE: Response Time shall be 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.

4. The costs associated with the preparation of Subsurface Drainage Sheets shall be borne by the Contractor. ***Contractor's Costs***

SPECIAL REQUIREMENTS

C230.15 RESERVED

C230.16 RESERVED

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LIMITS AND TOLERANCES

C230.17 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses in this Specification are summarised in Table C230.6 below.

Item	Activity	Tolerances	Spec Clause
1.	**Excavation by Blasting** Peak particle velocity	≤25mm/sec	C230.07
2.	**Outlets** Spacing	Max 150m	C230.09
3.	**Filter Material**		
	(a) Type A	Table C230.1	C230.12
	(b) Type B	Tables C230.2 and C230.3	C230.12
	(c) Type C	Table C230.4	C230.12
	(d) Type D	Table C230.5	C230.12
4.	**Geotextile** (a) Exposure to sunlight	<21 days If >21 days deterioration not to exceed 10% of claimed characteristics	C230.13
	(b) Curtain Drains Water Transmission	>20 litres/hr/m	C230.13

Table C230.6 - Table of Limits and Tolerances

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ANNEXURE C230A

SLOTTED PIPES FITTED WITH SEAMLESS TUBULAR FILTER FABRIC

1. PROCEDURE FOR FITTING SEAMLESS TUBULAR FILTER FABRIC TO SLOTTED PIPE

Seamless tubular filter fabric shall be fitted to slotted pipe immediately before the slotted pipe is to be laid in its final position in the work.

The filter fabric shall be initially pulled over and onto a short length of smooth pipe of internal diameter between 20mm and 30mm greater than the external diameter of the slotted pipe to be enclosed by filter fabric. The short, larger diameter pipe shall be referred to as the 'mandrel'.

The pipe to be enclosed by the filter fabric shall be passed through the mandrel. The filter fabric shall be slipped on to the pipe as the pipe emerges from the mandrel leaving enough overhang of the filter fabric to make a suitable joint with the filter fabric on the adjacent pipe. The filter fabric shall be firmly held to the forward end of the pipe so that it can not slip back along the pipe.

The pipe shall be pulled right through the mandrel allowing the filter fabric to progressively slip over the pipe. The filter fabric shall be restrained from easily slipping off the mandrel thus ensuring the filter fabric is stretch fitted onto the pipe.

When the end of the pipe emerges from the mandrel, the filter fabric shall be clamped to that end of the pipe so that the filter fabric can not slip down the pipe. The filter fabric shall remain clamped to each end of the pipe to ensure the filter fabric remains stretch fitted onto the pipe when the pipe is placed in its final position in the drain. The filter fabric shall be cut cleanly leaving enough overhang off the end of the pipe to make a fully covered join with the filter fabric on the adjacent pipe when the pipes are installed in the drain.

2. PRECAUTIONS TO BE TAKEN WHEN USING SLOTTED PIPE FITTED WITH SEAMLESS TUBULAR FILTER FABRIC

Slotted pipe fitted with seamless tubular filter fabric shall not be dragged over the ground. If carried, the pipe shall be lifted clear of the ground and the filter fabric shall be protected from damage at all times.

Seamless tubular filter fabric which has been so damaged as to affect its filtering properties shall be removed from the pipe and replaced with undamaged filter fabric.

If at any time during the installation of a slotted pipe it is found that the enclosed filter fabric has become loose on the pipe it shall be restretched to its correct position. If restretching causes any damage to the filter fabric, the damaged filter fabric shall be removed from the pipe and replaced with undamaged filter fabric.

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