CONSTRUCTION SPECIFICATION FOR

DEVELOPMENTS AND SUBDIVISIONS

C230 – Subsurface Drainage

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ORIGIN OF DOCUMENT, COPYRIGHT

This document was originally based on AUS-SPEC - Development Construction Specification C230 - Subsurface Drainage, General. Substantial parts of the original AUS-SPEC document have been deleted and replaced in the production of this Tamworth Regional Council Specification. The parts of the AUS-SPEC document that remain are still subject to the original copyright.

REVISIONS: C230 - SUBSURFACE DRAINAGE

VERSION	AMENDMENT DETAILS	CLAUSES AMENDED	DATE ISSUED (The new version takes effect from this date)	Authorised - Director Regional Services
0	Original Issue		30/11/2018	

GENERAL

C230.01 INTRODUCTION

Purpose

This Specification is common and applicable to all types of subsurface drainage and shall be read in conjunction with the following subsurface drainage specifications:

C231 - Subsoil and Foundation Drains.

C232 - Pavement Drains.

C233 - Drainage Mats.

C230.02 SCOPE

This Specification is for:

(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; and

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

Quality

Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in *CQC-Quality Control Requirements Sub-Annexure B3.*

C230.03 REFERENCE DOCUMENTS

Documents Standards Test Methods

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

Currency

Where not otherwise specified in the relevant Tamworth Regional Council (TRC) Construction Specifications or the approved design drawings, the Constructor shall use the latest versions of the Reference documentation, including amendments and supplements, listed in the TRC Construction Specifications at the time of the Works approval.

(a) Tamworth Regional Council (TRC) Specifications

C211 - Control of Erosion and Sedimentation

C213 - Earthworks

C271 - Minor Concrete Works.

CQC - Quality Control Requirements.

(b) Australian Standards

References in this Specification or on the approved design drawings to Australian Standards are noted by their prefix AS or AS/NZS.

AS 1141.11	-	Particle size distribution -Sieving method.
AS 1141.22	-	Wet/dry strength variation.
AS 1289.5.5.1	-	Determination of minimum and maximum dry density of a cohesionless material - Standard method.
AS 1477	-	PVC pipes and fittings for pressure applications.

AS 2439.1	-	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	-	Determination of durability - Resistance to degradation by light heat and moisture

(c) Other Publications

AUSTROADS	-	Guide To Pavement Technology Part 4G: Geotextiles and Geogrids..
ASTM-D2434-68		Test method for permeability of granular soils (Constant Head).

NSW Workcover Excavation Work Code of Practice

(d) TRC Standard Drawings Applicable to this Section

SW010 - Subsoil Drainage

TRC Standard Drawings shall take precedence over ALL other drawings related to the Works.

Where any TRC Standard Drawings conflicts with this Specification, the requirements of this Specification shall take precedence. Proposals to deviate from this Specification shall constitute a **HOLD POINT**.

TRC HOLD POINT

All proposed deviations from the approved design drawings, TRC Standard Drawings, this Specification or the documents referenced within it, shall be submitted for approval to the TRC Representative with supporting evidence at least five (5) working days prior to the work being undertaken.

PROCESS HELD: The lot or element affected by the proposed deviation.

TRC Hold Point

C230.04 TEMPORARY DRAINAGE DURING CONSTRUCTION

Erosion Control

All drainage works carried out by the Constructor shall comply with *C211 - Control of Erosion and Sedimentation*.

Constructor's Responsibility

The Constructor 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 Constructor's activities.

Location of Equipment

The Constructor'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.

C230.05 SETTING OUT OF WORK

Set-out

Before commencing construction of any subsurface drainage activity, the Constructor shall set out on site the position of the work to the location and levels shown on the approved design drawings and shall present this set-out for inspection by the TRC Representative.

If amendments are required to the location of the subsurface drains the Constructor shall propose an alternative alignment to the TRC Representative. Sufficient supporting evidence shall be submitted justifying the relocation and verifying the suitability of the revised position.

Proposed Changes by Constructor

C230.06 EXCAVATION

In undertaking trench excavation, the Constructor shall provide any shoring, sheet piling or other stabilisation of the sides necessary to comply with statutory requirements including the *NSW Workcover Excavation Work Code of Practice*. Records documenting compliance with this Code, and other Statutory requirements shall be kept on the Works site.

Safety

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

Approval by Public Utility Authorities

Trenches shall be excavated to the line, grade, width and depth shown on the approved design drawings. The bottom of the trench shall be constructed so that no localised ponding can occur. All loose material shall be removed by the Constructor.

Excavation Level

Any material at the bottom of the trench or at foundation level which the TRC Representative deems to be unsuitable shall be removed and disposed in accordance with for *C213 - Earthworks* by the Constructor 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

The excavated material shall be used in the construction of embankments backfilling or spoiled in accordance with *C213 - Earthworks*.

Spoil

C230.07 BACKFILLING

Backfilling shall be carried out in accordance with the approved design drawings.

Detail

TRC WITNESS POINT

Backfilling over the subsoil drainage shall be held until the TRC Representative has had the opportunity to inspect the subsoil drain. Evidence that the drains are appropriately located and have adequate fall to drain shall be made available on request.

PROCESS HELD: Backfilling over subsoil drains.

TRC Witness Point

C230.08 OUTLET STRUCTURES FOR SUBSURFACE DRAINAGE

Subsurface drainage pipes shall be connected to discharge into gully pits or to outlet structures as shown on the approved design drawings.

Discharge

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

Spacing

Outlets, including those discharging into gully pits, shall be made rodent proof in accordance with the approved design drawings.

Rodent Proof

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 together with a marker post to indicate location and assist maintenance.

Erosion Control

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

All concrete used in the construction of outlet structures shall conform to the requirements of *C271 - Minor Concrete Works*.

Concrete Specification

MATERIALS

C230.09 CORRUGATED PLASTIC PIPE

Specification

Corrugated plastic pipe shall be Class 400 complying with AS 2439.1 of 65mm or 100mm diameter as indicated on the approved design drawings. All pipe shall be slotted except where shown on the approved design drawings.

Fittings

Joints, couplings, elbows, tees and caps shall also comply with AS 2439.1 and only the manufacturer's recommended fittings shall be used.

The Constructor shall obtain from the Manufacturer a Test Certificate demonstrating compliance with AS 2439.1.

C230.10 OTHER TYPES OF SUBSURFACE DRAINAGE

Submit for Approval

Where a Constructor wishes to use a subsurface drainage pipe other than corrugated plastic pipe, the Constructor shall submit full details of the type of pipe, certification from the manufacturer of its suitability and quality and written acceptance by the TRC Representative 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.

TRC HOLD POINT

Where an alternative subsurface drainage pipe is proposed, the Constructor shall submit all relevant details including a certification from the manufacturer that the proposed alternative is suitable for the intended application to the TRC Representative for approval. Details pertaining to the alternative subsurfcae drainage pipe shall be submitted at least ten (10) working days prior to installation.
PROCESS HELD: Procurement of subsurface drainage pipe.

TRC Hold Point

C230.11 FILTER MATERIAL

(a) General

Types

The types of filter material covered by this Specification shall include:

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

(b) Type B filter material for use in trench drains and Type B drainage mats;

(c) Type C filter material comprising crushed rock for use in Type A drainage mats; and

(d) Type D filter material comprising uncrushed river gravel for use in Type A drainage mats.

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

(b) Type A Filter Material

Grading

Type A filter material shall be crushed rock complying with the following requirements:

Test Method	Property	Requirement
AS 1141.11	Material passing AS sieve	% by mass
	6.7mm 4.75mm 2.36mm 1.18mm 425um	100 85 to 100 0 to 40 0 to 5 0 to 2

Table C230.1 - Type A Filter Material

(c) Type B Filter Material

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	% by mass
	4.75mm 2.36mm 425um 300um 150um 75um	100 95 to 100 20 to 80 0 to 30 0 to 2 0 to 0.1

Table C230.2 - Type B Filter Material

Coefficient of Saturated Permeability

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 1289.5.5.1 and then tested in accordance with Test Method ASTM-D2434-68, of at least 8 metres per day after three (3) hours of flow.

Grading Variation

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

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

Grading

Type C filter material shall be crushed rock complying with the following requirements:

Test Method	Property	Requirement
AS 1141.11	Maximum particle size	37.5mm
AS 1141.22	Maximum passing the 9.5mm AS Sieve	5% by mass
	Maximum (D90:D10)*	3
	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%t passing. D10 denotes the theoretical size of a sieve through which 10% 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

Type D filter material shall be uncrushed river gravel complying with the description of rounded aggregate in Table B1, Appendix B of AS 2758.1 and the following requirements:

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

Table C230.5 - Type D Filter Material

C230.12 GEOTEXTILE

(a) General

Properties and Labelling

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.

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

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 21 days.

Strength Rating

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

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 Pavement Technology Part 4G: Geotextiles and Geogrids as well as requirements indicated on the approved design drawings.

(b) Seamless Tubular Filter Fabric

Specification

Seamless knitted tubular filter fabric shall be used to enclose all slotted pipes and shall be manufactured from either polypropylene or polyester. The fabric shall be free of imperfections in weave or yarn and have abrasion resistant and weave stability qualities such that it shall not form holes, ladder, deweave, tear or unravel more than 5mm from a cut end.

Fitting

Fitting of the seamless tubular filter fabric shall be in accordance with the requirements of **Annexure C230A**. Filter fabric that is excessively stretched, torn or otherwise damaged during fitting of the fabric, storage, transportation or pipe laying will be removed and replaced so as to eliminate any damaged lengths.

RECORDING OF DRAINAGE

C230.13 RECORDING OF SUBSURFACE DRAINAGE INFORMATION

Work As Executed Plans

The Constructor shall keep a detailed record of all subsurface drainage pipes and the completed subsurface drainage systems shall be shown on Work-As-Executed plans.

Information Sheet

In addition, the Constructor 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 TRC Representative within five (5) working days of the completion of the drain or drainage system.

Detail

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
- 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.*

Constructor's Costs

The costs associated with the preparation of Subsurface Drainage Sheets shall be borne by the Constructor.

LIMITS AND TOLERANCES

C230.14 SUMMARY OF LIMITS AND TOLERANCES

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

Item	Activity	Limits/Tolerances	Spec Clause
1	**Outlets**		
	Spacing	Max 150m	C230.07
2	**Filter Material**		
	(a) Type A	Table C230.1	C230.11
	(b) Type B	Tables C230.2 and C230.3	C230.11
	(c) Type C	Table C230.4	C230.11
	(d) Type D	Table C230.5	C230.11
3	**Geotextile**		
	(a) Exposure to sunlight	<21 days	C230.12

Table C230.6 - Summary of Limits and Tolerances