TWEED SHIRE COUNCIL

DEVELOPMENT CONSTRUCTION SPECIFICATION

C224

OPEN DRAINS
INCLUDING KERB & GUTTER

VERSION 1.2

SPECIFICATION C224 - OPEN DRAINS, INCLUDING KERB AND GUTTER

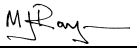
CITATION

This document is named “Tweed Shire Council, Development Construction Specification C224 - Open Drains, Including Kerb & Gutter”.

ORIGIN OF DOCUMENT, COPYRIGHT

This document was originally based on AUS-SPEC - Development Construction Specification C224 - Open Drains, Including Kerb & Gutter, January 2002 (Copyright SWR-TM). Substantial parts of the original AUS-SPEC document have been deleted and replaced in the production of this Tweed Shire Council Development Specification. The parts of the AUS-SPEC document that remain are still subject to the original copyright.

VERSIONS, C224 OPEN DRAINS, INCLUDING KERB & GUTTER

VERSION	AMENDMENT DETAILS	CLAUSES AMENDED	DATE ISSUED (The new version takes effect from this date)	Authorised by the Director of Engineering Services
1.1	Original Version		1 July 2003	
1.2	Replace all references to SWAC with "Certifying Engineer" Remove reference to AS 1289.5.7.1	Various C224.03, 07	5 February 2016	

DEVELOPMENT CONSTRUCTION SPECIFICATION C224

OPEN DRAINS, INCLUDING KERB AND GUTTER

GENERAL

C224.01 SCOPE

1. This Specification is for the construction, lining and protection of all types of open drains including the construction of rock filled wire mattresses and gabions.

2. This Specification should be read in conjunction with the Specification for STORMWATER DRAINAGE - GENERAL, and other drainage Specifications as applicable:

C221	-	Pipe Drainage
C222	-	Precast Box Culverts
C223	-	Drainage Structures

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

C224.02 DEFINITION

1. Open drains are all drains other than pipe and box culverts and include catch drains, contour drains, diversion drains, table drains, batter drains, swales, channels, gutters and kerbs and gutters. ***Definition***

C224.03 REFERENCE DOCUMENTS

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

(a) Council Specifications

C211	-	Control of Erosion and Sedimentation
C220	-	Stormwater Drainage - General
C221	-	Pipe Drainage
C222	-	Precast Box Culverts
C271	-	Minor Concrete Works
C273	-	Landscaping

(b) Australian Standards

AS 1141.22	-	Wet/dry strength variation
AS 1289.5.4.1	-	Compaction control test - Dry density ratio, moisture variation and moisture ratio
AS 2758.4	-	Aggregate for gabion baskets and wire mattresses
AS 2876	-	Concrete kerbs and channels (gutters) - Manually or machine placed
AS/NZS 4534	-	Zinc and zinc/aluminium-alloy coatings on steel wire

(c) Other

AUSTROADS - Guide to Pavement Technology Part 4G: Geotextiles and Goegrids

(d) Standard Drawings that apply to this Section:

UNLINED OPEN DRAINS

C224.04 GENERAL

1. Unless shown otherwise on the design plans, drains shall be vee shaped or of trapezoidal cross section and shall not be less than 300mm deep and have a minimum waterway area of 0.2 square metres. ***Shape***

2. Open drains shall be graded to ensure free flow of water and, shall not have a grade of less than 1 per cent. ***Grade***

3. Where trees marked for preservation or rock outcrops occur in the line of a drain, the drain may be neatly diverted if approved by the Certifying Engineer. ***Trees and Rock Outcrops***

4. Open drains shall be extended as necessary to lead the water clear of the work to natural drainage depressions, culverts, or pits connected to underground drainage systems. The drains shall follow existing watercourses and depressions in the natural surface, unless other locations are shown on the design plans ***Open Drains***

5. All work shall be undertaken in accordance with the requirements of the Specification for CONTROL OF EROSION AND SEDIMENTATION. ***Control of Erosion***

C224.05 TYPES

1. Catch drains shall be provided above the tops of cuttings or the toes of embankments where shown on the design plans before construction of the adjacent roadway. The edges of catch-drains shall be positioned not be less than 2m from the tops of cuttings or the toes of embankments nor more than is necessary to maintain the fall of the drains. ***Catch Drains***

2. Minor diversion and contour drains shall be constructed where shown on the design plans or directed by the Certifying Engineer. Minor diversion drains shall have the same capacity as the nearest pipe culvert on the line of the drain unless otherwise approved by the Certifying Engineer. ***Diversion & Contour Drains***

3. Table drains, swales and depressed medians shall be constructed to the line and level shown or calculated from the design plans. Their construction is deemed to be part of earthworks. ***Table Drains***

4. Inlet, outlet and diversion channels shall be excavated as shown on the design plans and, unless indicated otherwise, shall extend to join the existing stream bed in a regular manner, avoiding disturbance in stream flow. The channel shall be excavated to the full width of the structure but the existing stream-bed shall be preserved as far as possible outside the limits of the excavation. ***Channels***

C224.06 CONSTRUCTION

1. Material excavated from drains shall be placed on the lower sides of the drains and formed as banks with slopes not steeper than 4h:1v on the cross section of the bank to increase the capacity of the drains. This material shall be compacted in accordance with AS 1289.5.4.1 and shall be not less than 95 per cent for standard compactive effort. ***Excavated Material***

2. The Subdivider shall ensure that none of the activities associated with the work disturbs any watercourse outside the site. Any excavation below the level of the natural channel shall be backfilled with suitable material compacted to a density equal to and compatible with that existing naturally. ***Subdivider's Responsibility***

3. Any excess material shall be legally and responsibly disposed of by the Subdivider. ***Excess Material***

4. Unlined drains and areas adjacent to open drains shall be revegetated immediately after the drains are complete, in accordance with the Specification for LANDSCAPING. ***Revegetation***

LINED OPEN DRAINS

C224.07 GENERAL

1. Lined open drains shall be formed as for unlined open drains with the inclusion of a lined invert in accordance with the design plans. ***Shape***

2. Lining shall conform to the profile of the drain and shall be provided as soon as possible after forming the drain. ***Profile***

3. Before placing any lining material, the foundation material shall be shaped and compacted to form a firm base for the lining. Other than for kerb and gutter constructed on pavement courses, the relative compaction, as determined by AS 1289 5.4.1 shall not be less than 95 per cent for standard compactive effort. ***Compaction of Foundations***

C224.08 CONCRETE LINING

1. Concrete lining for open drains shall be cast-in-situ or sprayed concrete supplied and placed in accordance with the Specification for MINOR CONCRETE WORKS. Weepholes shall be provided in the concrete at intervals of 2m or as determined by the Certifying Engineer. ***Method***

2. Contraction joints in concrete lining, consisting of narrow transverse and vertical grooves, 20mm deep, shall be formed neatly in the surface of the freshly placed concrete at intervals of 3m unless otherwise specified by the Certifying Engineer. Expansion joints shall be placed at intervals not more than 15m and shall consist of a preformed jointing material of bituminous fibreboard and shall be of sufficient depth to fill the joint. ***Jointing***

C224.09 STONE PITCHING

1. Stone Pitching shall consist of sound durable rock not less than 100mm thick, properly bedded on approved loam or sand and mortared to present a uniform surface. The exposed surface of each stone or block shall be approximately flat and not less than 0.05 square metres in area. Spaces between adjacent stones or blocks shall not exceed 20mm in width. ***Rock Quality and Placing***

C224.10 BATTER DRAINS

1. Batter drains shall be constructed using either half round steel pipes or precast nestable concrete units as shown and detailed on the design plans. ***Type***

2. The units shall be installed in carefully excavated and template controlled trench to produce an even rim line of +0mm to –50mm from the batter line at the underside of topsoil. ***Installation***

3. Any over excavation and undulations in the batter line shall be backfilled and both sides of the drain compacted over the full length to form a firm shoulder against the rim of the batter drain. ***Compaction***

4. When topsoil is placed it shall be tapered over a width of 1m to zero thickness at the rim of the drain. Both sides of the drain shall then be turfed for minimum width of 600mm and pinned down as provided in the Specification for LANDSCAPING. ***Topsoil and Turfing***

C224.11 PROPRIETARY PRODUCTS

1. Unless shown on the design plans, proprietary products may only be used with the approval of the Certifying Engineer. Where specified, they must be used strictly in accordance with the manufacturer's instructions. ***Manufacturer's Instructions***

C224.12 KERB AND GUTTER

1. Kerb and/or gutters may be constructed in fixed forms, by extrusion or by slip forming, in accordance with AS 2876. ***Method***

2. The foundation, concrete quality, curing and testing details shall be in accordance AS 2876. ***Construction Details***

3. The top and face of the finished kerb and gutter shall be true to line and the top surface shall be of uniform width, free from humps, sags or other irregularities. Kerb and gutter shall have a steel float finish. ***Finish***

4. The level at any point on the surface of the gutters shall be within ±10mm of design levels. When a straight edge 3m long is laid on top of or along the face of the kerb or on the surface of gutters, the surface shall not vary more than 5mm from the edge of the straight edge, except at kerb laybacks, grade changes or curves or at gully pits requiring gutter depression. ***Tolerances***

5. Unless shown otherwise on the design plans, contraction joints, shall be formed every 3m of gutter length for a minimum of 50 per cent of cross sectional area. The joint shall be tooled 20mm in depth to form a neat groove of 5mm minimum width. ***Contraction Joints***

6. Unless shown otherwise on the design plans, expansion joints, 15mm in width for the full depth of the kerb and gutter, shall be constructed at intervals not exceeding 15m and where the gutter abuts against gutter pits, retaining walls and overbridges. Expansion joints shall consist of a preformed jointing material of bituminous fibreboard. ***Expansion Joints***

7. Where kerbs and/or gutters are cast adjacent with a concrete pavement the same type of contraction, construction and expansion joints specified in the concrete base shall be continued across the kerb and/or gutter. ***Adjacent Concrete Pavement***

8. All house stormwater outlets shall be provided and/or extended, to match the existing type and size of pipe, through the kerb as shown on the design plans. Pipework shall be in accordance with the requirements for UPVC pipes in the Specification for PIPE DRAINAGE, or as directed by the Certifying Engineer for other types of pipe. ***Stormwater Outlets***

9. Opposite all driveways, where shown on the design plans or where directed by the Certifying Engineer, barrier kerb shall be discontinued to provide for vehicular or pedestrian access. At such locations, kerb laybacks shall be constructed in accordance with the design plans. Footpath crossovers shall be constructed to meet the laybacks as shown on the design plans, or reinstated to match existing materials where not otherwise shown. ***Vehicular or Pedestrian Access***

10. After the new kerb and gutter has been constructed and not earlier than three (3) days after placing, the spaces on both sides of the kerb and/or gutters shall be backfilled and reinstated in accordance with the design plans, or as instructed by the Certifying Engineer. ***Backfill Timing***

11. Backfill material behind the kerb shall consist of granular material, free of organic material, clay and rock in excess of 50mm diameter, or material as approved by the Certifying Engineer. ***Backfill Material***

12. Backfill material behind the kerb shall be compacted in layers not greater than 150mm thick, to a relative compaction of 95 per cent when tested in accordance with AS 1289.5.4.1, for standard compactive effort. The whole of the work shall be finished in a neat and workmanlike manner, free draining and free from surface undulations and trip hazards. ***Behind Kerb***

13. Pavement material adjacent to new gutter shall be backfilled in accordance with the design plans or as directed by the Certifying Engineer. ***Pavement***

ROCK FILLED WIRE MATTRESSES AND GABIONS

C224.13 GENERAL

1. Rock-filled wire mattresses and gabions shall be placed at the locations shown on the design plans. Installation shall be in accordance with the manufacturer's instructions. A geotextile, as shown on the design plans, shall be placed between the wire cage and the material being protected. ***Geotextile and Location***

C224.14 MATERIALS

1. For wire mattresses and gabions, the galvanising requirements for wire of circular cross section cited in this Clause as 'heavily galvanised' shall complying with the coating mass requirements for round wire, Class W10, in AS/NZS 4534.

(a) Gabions ***Dimensions***

1. The gabions shall be of the sizes shown on the design plans and fabricated of woven heavily galvanised wire mesh and PVC coated where specified on the design plans. Each gabion shall be divided by diaphragms into cells whose length shall not be greater than the width of the gabions plus 100mm. Gabions shall have a nominal mesh size of 80mm x 100mm and body wire shall be a minimum diameter of 2.7mm heavily galvanised with an additional thickness of 0.4mm PVC coating where specified on the design plans. The minimum core diameters of heavily galvanised selvedge wire and lacing wire shall be 3.4mm and 2.2mm respectively.

(b) Wire Mattresses

1. Unless specified otherwise, the wire mattresses shall be supplied in units having dimensions of 6m x 2m x 230mm, and shall be cut to suit areas as shown on the design plans. The mattresses shall be divided by diaphragms into cells of length not exceeding 600mm. Unless otherwise specified, they shall be fabricated of woven heavily galvanised wire and PVC coated where specified on the design plans. ***Mattress Dimension***

2. Mattresses shall have a mesh size of 60mm x 80mm and body wire shall be a minimum diameter of 2.0mm heavily galvanised with an additional minimum thickness of 0.4mm PVC coating where specified on the design plans. The minimum core diameters of heavily galvanised selvedge wire and lacing wire shall be 2.7mm and 2.2mm respectively. ***Wire Dimensions***

(c) Geotextile

1. A chemically and biologically stable geotextile with a minimum strength rating (G) of 1350 and minimum mass of 180 grams per square meter, in accordance with AUSTROADS Guide to Pavement Technology Part 4G: Geotextiles and Goegrids, shall be used. ***Type***

2. Samples, manufacturer's specification and instructions on installation shall be submitted to the Certifying Engineer seven (7) days before the intended use of geotextile. ***Sample***

(d) Rock Fill Material

1. The rock fill shall consist of clean hard rock complying with the requirements of AS2758.4. ***Rock Quality***

2. Rock fill for gabions shall have particle sizes between 100mm and 250mm and preferably not greater than 200mm. Rock fill material may be placed by hand or suitable mechanical device to ensure fill is tightly packed with a minimum of voids. Fill material shall be levelled off 25mm to 50mm above the top of the mesh to allow for settlement. ***For Gabions***

3. Rock fill for wire mattresses shall have particle sizes between 75mm and two-thirds of the mattress thickness, or 250mm, whichever is the lesser. When the mattress is on a slope, rock fill material shall be placed into the units starting from the low end. Units shall be filled slightly overfull by 25mm to 50mm to allow for settlement and to provide an even tight and smooth surface of the required contour. ***For Wire Mattresses***

C224.15 ASSEMBLY AND ERECTION

1. Before laying out the gabions or wire mattresses, geotextile shall be placed on the founding material. The edges of wire mattresses shall be firmly tied to galvanised star pickets driven a minimum of 900mm into the surrounding ground at 1m maximum intervals and the star pickets cut off level with the top of the mattress. The upstream edge of wire mattresses shall be folded down into a trench of minimum depth 300mm and filled with rock fill. This edge shall be tied to star pickets. ***Procedure***

LIMITS AND TOLERANCES

C224.16 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses in this Specification are summarised in Table C224.1 below.

Item	Activity	Limits/Tolerances	Spec Clause
1.	**Open Drains – General**		
	(a) Grading	Grade >1%	C224.04
	(b) Depth	>300mm	C224.04
	(c) Waterway Area	>0.2 sq m	C224.04
	(d) Catch Drain Location	>2m from top of cuttings or toes of embankments	C224.05
	(e) Compaction	>95% (standard compaction)	C224.06
2.	**Open Drains - Lining**		
	(a) Compaction of Foundation	>95% (standard compaction)	C224.07
3.	**Stone Pitching**		
	(a) Rock Dimensions	>100mm thickness	C224.09
	(b) Exposed Surface Area	>0.05 sq m	C224.09
	(c) Spaces between Stones	<20mm width	C224.09
4.	**Batter Drains**		
	(a) Rim line	+0, -50 from batter line	C224.10
5.	**Kerb and Gutter**		
	(a) Compaction of foundation	To AS 2876	C224.12
	(b) Level of gutter surface	Level ≤±10mm of design level	C224.12
	(c) Surface uniformity	Deviation of kerb and gutter surface from 3m straight edge ≤5mm	C224.12
	(d) Contraction Joints		
	(i) Area	≥50% of CS area	C224.12
	(ii) Groove Width	≥5mm	C224.12
	(e) Expansion Joint Interval	≤15m	C224.12
	(f) Backfill behind Kerb		
	(i) Layer thickness	≤150mm	C224.12
	(ii) Compaction	>95% (standard compaction)	C224.12

Item	Activity	Limits/Tolerances	Spec Clause
6.	**Rock Fill for Gabions and Wire Mattresses**		
	(a) Wet Strength	>100kN	C224.14d
	(b) Wet/Dry Strength variation	<45%	C224.14d
	(c) Particle size for Gabions	>100mm <250mm	C224.14d
	(d) Fill Level	>25mm <50mm above top of mesh	C224.14d
	(e) Particle size for Wire Mattresses	>75mm <150mm	C224.14d
7.	**Erection of Wire Mattresses**		
	(a) Star pickets for ties	Depth in ground >900mm Spacing <1m	C224.15
	(b) Trench Depth for upstream edge	Depth >300mm	C224.15

Table C224.1 - Summary of Limits and Tolerances

SPECIAL REQUIREMENTS

C224.17 RESERVED

C224.18 RESERVED

C224.19 RESERVED