



AUS-SPEC

Infrastructure Specifications

1354 Drainage structures

1354 DRAINAGE STRUCTURES

IMPORTANT: This document has been adapted from the NATSPEC suite of specification templates for use in the Cessnock City Council area by both Council and industry. NATSPEC regularly updates the base templates (currently in April and October each year), and Council may incorporate changes into its version of AUS-SPEC from time to time. To assist in highlighting any changes made by Council to the NATSPEC templates, the following conventions are used.

- See ANNEXURE M at the end of this document which contains (where practical) Cessnock City Council customisations (also known as 'office master' text). References to the Annexure are to also be inserted at relevant clauses in the main body of the document.
- Where content is added to the main body of the document, it is to be shown **in brown text like this**.
- Where content is deleted or excluded from the main body of the document, it is to be shown ~~struck through like this~~. Such clauses are to have no effect.

Where there is a conflict between main body text and Cessnock City Council specific clauses, Council's specific clauses shall prevail.

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide drainage structures as documented.

1.2 CROSS REFERENCES

General

Requirement: This worksection is not a self-contained specification. In addition to the requirements of this worksection, conform to the following:

- 0136 *General requirements (Construction)*.
- 0152 *Schedule of rates (Construction)*.
- 0161 *Quality management (Construction)*.
- 0319 *Auxiliary concrete works*.
- 1101 *Traffic management*.
- 1172 *Subsoil and formation drains*.
- 1351 *Stormwater drainage (Construction)*.

1.3 STANDARDS

Precast reinforced concrete box culverts: AS 1597

Large culverts: AS 1597.2

Fixed platforms, walkways, stairways and ladders (design, construction and installation): AS 1657

Concrete structures: AS 3600

Prefabricated concrete elements General AS 3850.01 2015

General purpose and blended elements: AS 3972

Access covers and grates: AS 3996

1.4 INTERPRETATION

Definitions

General: For the purposes of this worksection the following definitions apply:

- Drainage structures: Devices to control stormwater flowing into and through a stormwater drainage system including headwalls, wingwalls, pits, gully pits, inspection pits, junction boxes, drop structures, inlet and outlet structures, energy dissipators, batter drains and other supplementary structures such as grates, frames and step irons as well as subsurface drainage pipes at pits, headwalls and wingwalls.

1.5 TOLERANCES

General

Requirement:

- Horizontal position: ± 25 mm.
- Inlet and outlet invert levels: ± 10 mm of documented levels.
- Finished level of access cover: Flush with the finished level of the surrounding area ± 3 mm.

1.6 SUBMISSIONS

Products and materials

Minimum design life for manufacture and installation of drainage structures: 100 years unless otherwise required by DA consent conditions or REF recommendations.

Product conformity: Submit manufacturer's certificate of conformance for the precast drainage structures before dispatch to site. Identify the item, source and record the inspection and test records that verify conformity.

Manufacturer's data and installation recommendations: Submit in conformance with AS 3996 (2019) Appendix B for access covers.

Execution details

Precast drainage structures: If proposing to substitute precast units for in situ units, submit details of proposed proprietary items.

1.7 INSPECTIONS

Notice

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

- Foundation:
 - . At completion of excavation and compaction.
 - . Rock foundation to wingwalls and headwalls. Excavation of rock to levels.
 - . Rock foundation to gully pits and sumps. Excavation of rock for pits and sumps.
- Precast units: Installation of precast units.
- Backfilling: Before backfilling of in situ concrete drainage structures and precast units.

2 MATERIALS

2.1 IN SITU CONCRETE

General

In situ concrete: To *0319 Auxiliary concrete works* for the concrete and reinforcement for in situ drainage structures.

2.2 PRECAST DRAINAGE STRUCTURES

General

Standard: To AS 3850.3 (2021).

Requirement: Provide proprietary precast drainage structures as documented.

Handling, delivery and storage: To the manufacturer's recommendations.

Knockouts: Provide base units and other riser units to suit the design configuration of the particular pit with preformed knockouts only where required. Do not provide standard precast pit base units with thinned wall sections on all 4 sides.

Durability

Exposure classification: As documented and to AS 3600 (2018) Section 4.

Concrete cover: To AS 3600 (2018) clause 4.10.

Strength

Minimum compressive strength: 32 mPa or higher, as documented.

Marking

Identification marking: At the time of manufacture, clearly mark each precast unit with the following information:

- Date of manufacture.
- Manufacturer's name or registered mark and the location of manufacture.
- Mass of unit in kg.
- Batch number.
- Inspection status.

Height of letters: 75 mm.

Location of marking: Easily visible but hidden once the unit is installed.

2.3 CEMENT MORTAR

Materials

Cement: To AS 3972 (2010).

Water: Clean and free from any deleterious matter.

Sand: Fine aggregate with a low clay content and free from efflorescing salts, selected for colour and grading.

Proportions (water:cement:sand): 0.4:1:3 by mass.

2.4 FILL MATERIAL

Material

General: To AS 1597.2 (2013) clause 1.4.2.7.

2.5 ACCESS COVERS AND FRAMES

Specification

Access covers and frames: To AS 3996 (2019) and as documented in the **Access covers and frames schedule**.

Proprietary items: To the manufacturer's recommendations.

3 EXECUTION

3.1 ESTABLISHMENT

Locating drainage structures

Alignment to road: Construct headwalls and pits parallel to the road centreline and wingwalls at 135° to the headwall or as documented.

Non-parallel culverts: If the culvert is not perpendicular to the road centreline, splay the wingwalls and headwalls so that the front edge of the wing bisects the angle between the centreline of the culvert and the headwall.

Dissipaters: Construct with centreline on axis to the culvert.

Preparation

Foundation: Dewater and wash clean of contaminants before placing concrete.

3.2 EXCAVATION

Foundation

Requirement: Excavate and compact the foundation to *1351 Stormwater drainage (Construction)*.

Wingwalls and headwalls: If uniform sound rock is encountered at the bottom of excavations for wingwalls and headwalls, the documented depth of cut-off walls in uniform rock over the full width of the foundations may be reduced to 150 mm minimum.

Gully pits and sumps: If the full depth of the excavation is in sound rock, **optionally seek the Principal Certifier's (e.g. Council) approval to** construct a neatly formed pit of the required dimensions and omit the concrete lining except to the wall adjacent and parallel to the road.

Subsoil drainage: Provide subsoil drains for the pits and headwalls to *1172 Subsoil and formation drains*.

Mass concrete bedding: Dampen the surface of the foundation and place a layer of concrete not less than 50 mm thick over the excavated surface and finish to a smooth, even surface.

3.3 INSTALLATION

General

Timing: Install drainage structures no later than 14 days after the installation of associated pipes, box culverts or open drains.

Trash racks: If documented, construct trash racks with access for machine removal of accumulated debris.

Joints and seals

Isolation joints: Provide joints where a drainage structure abuts another structure or concrete pavements.

- Joint width: 10 mm wide.
- Material: Preformed jointing filler to manufacturer's recommendations.

Sealing: Seal joints and connection points against the ingress of water and other kinds of material with cement mortar.

Rung ladders and step irons

Pits and junction boxes over 600 mm deep: Install an individual rung ladder or step irons on one internal wall for the full depth of the structure to AS 1657 (2018) and as follows:

- The top of the uppermost rung: ≤ 600 mm below the top of the pit.
- The top of the bottom rung: ≥ 300 mm and ≤ 500 mm above the invert of the pit.
- Rung spacings: 300 mm ± 50 mm.

Installation: Fix step irons using one of the following methods:

- Within the formwork before placing the concrete for the pit walls.
- Provide blockout formers to make recesses in the concrete to receive the arms of the step irons.
- Drill holes using a rotary masonry bit in the pit wall after placing concrete. Do not use percussion tools to drill holes.

Fixing into recesses or holes: Fix step irons using epoxy resin to the manufacturer's recommendations. Protect step irons from movement until the epoxy resin has reached the specified strength.

Bulkheads

Requirement: If the gradient of the stormwater drainage pipeline is more than 5%, construct concrete bulkheads to the documented spacings and details.

3.4 HEADWALLS AND WINGWALLS

General

Batter retention: Construct the wingwalls to retain the batters as documented. **For skewed flow conditions make sure unlined drain batters in erodible material have protection.**

Precast units

Requirement: Provide headwalls and wingwalls to AS 3850.3 (2021) and as documented.

Weepholes

Backfill material: To *1351 Stormwater drainage (Construction)*.

Location: Provide weepholes as documented and place backfill material as follows:

- Height: > 450 mm above the bottom of the weephole.
- Plan area: > 600 mm along the wall and 300 mm out from the wall located centrally about the weephole.
- Enclose the backfill material with geotextile filter fabric in conformance with Austroads AGPT04G (2009).

Alternative to geotextile: Cover the face area of the structure with an equivalent area of geocomposite.

- **Type: As documented.**

3.5 PITS AND JUNCTION BOXES

General

Existing pits: Modify existing pits only if modification is documented.

Precast units

Requirement: Provide precast pit and junction boxes to AS 3850.3 (2021) and as documented.

In situ concrete units

Requirement: Construct all new pits to accept access covers, gully grates and frames as documented and as follows:

- Concrete: Conform to the following:
 - . Strength: > 32 MPa.
 - . Aggregate size: > 12 mm.

Inlet and outlet pipes: Cast ends of inlet and outlet pipes into the pit walls.

Access cover and pit: Locate so that removal of the cover is not obstructed by a wall, kerb or other fixed item.

For applications where back pressure is expected, document any additional reinforcing that is required to hold the frame and cover in position.

Access covers and frames

Proprietary access covers: To manufacturer's recommendations, including any infill requirements for the covers.

Matching covers and frames: Do not switch covers and frames.

Cleaning: Remove excavated or other material from between cover and frame.

3.6 BACKFILLING AND COMPACTION**Backfilling**

Requirement: Do not backfill against in situ concrete drainage structures within 14 days of concrete placement or before the compressive strength is more than 15 MPa.

Backfilling: Place selected fill against the full height of the vertical faces of structures for a horizontal distance equal to one-third the height of the structure, or as documented.

Sequence: Start backfilling and compaction at the drainage structure wall. Prevent excessive surcharge loading against vertical surfaces during the backfilling.

Balance: Backfill on both sides of the structure alternately in layers to avoid unbalanced forces on the structure.

Horizontal terraces: If the sides of the excavation are steeper than 1V:4H, cut benches in the form of horizontal terraces at least 600 mm in width, before placing backfill.

Compaction

Compaction: To *1351 Stormwater drainage (Construction)*.

3.7 COMPLETION**General**

Requirement: Remove and replace drainage structures if required for any of the following reasons:

- Not within the tolerances.
- Settlement after installation.
- Damage during backfilling, compaction or subsequent operations.

4 ANNEXURE A**4.1 ANNEXURE - SELECTIONS****Precast drainage structures schedule**

	A1	A2	A3
Headwalls			
Wingwalls			
Gully pits			
Inspection pits			
Junction pits			
Drop structures			
Inlet and outlet structures			

	A1	A2	A3
Energy dissipators			

Notes to schedule:

A1, A2, A3 and A4: These designate each location of precast drainage structures. Edit to align with the project's codes or tags. Edit codes in the Schedule to match those on drawings.

Access covers and frames schedule

	A1	A2	A3
Cover number			
Load class			
Size			
Cover type			
Security			
Ventilation or sealing			
Cover orientation			
Handling			

Notes to schedule:

A1, A2, A3 and A4: These designate each location of access covers. Edit to align with the project's codes or tags.

Edit codes in the **Schedule** to match those on drawings.

Cover number: Align cover numbers in the schedule to the drawings.

Load class: A to G to AS 3996 (2019) clause 3.1.

Size: Unobstructed opening inside the frame W (width) x L (Length).

Cover type: Lift-out, tilt-up or hinged.

Security: Locking requirements and preferred type of locking mechanism e.g. locking bolt.

Ventilation or sealing: Ventilated, unsealed, sealed (watertight and gas-tight). Requirements for specialised seals pressure tight (requirement over 1 kPa), single or double seals.

Cover orientation: Direction of traffic flow to prevent cover lifting.

Handling: Note whether the lifting is manual unassisted < 55 kg, assisted or lifting keys.

4.2 ANNEXURE – SUMMARY OF HOLD AND WITNESS POINTS

For private developments, certain Hold and Witness Points where specifically noted below require representatives of both the Superintendent and the Principal Certifier (e.g. Council) to authorise release.

Clause and description	Type	Submission/ Inspection details	Submission/Notice times	Process held
SUBMISSIONS Products and materials Product conformity	H	Manufacturers certificates of conformance for precast units	5 days before delivery	Delivery of drainage structures.
SUBMISSIONS Products and materials Manufacturer's data and installation recommendations	H	Access covers to AS 3996 (2019) Appendix B	5 days before delivery	Delivery and installation of access covers
SUBMISSIONS Execution details Precast drainage structures	H – Superintendent and Principal Certifier	Substitution of precast units for in situ units or vice versa where this varies from the Drawings.	5 days before commencing installation	Substitution of precast units. Precast drainage structures

Clause and description	Type	Submission/ Inspection details	Submission/Notice times	Process held
		Submit details of proprietary items		
INSPECTIONS Notice Foundation	H – Superintendent and Principal Certifier	Completed excavation and compaction of foundations	1 day	Commencement of drainage structure installation/constructions
INSPECTIONS Notice Foundation	W	Rock foundation to wingwalls and headwalls	1 day	Excavation of rock for wingwalls and headwalls
INSPECTIONS Notice Foundation	W	Rock foundation to gully pits and sumps	1 day	Excavation of rock for pits and sumps
INSPECTIONS Notice Precast units	W	Installation of precast units	5 days	Backfilling of precast drainage structures
INSPECTIONS Notice Backfilling	W – Superintendent and Principal Certifier	Before backfilling of in situ concrete drainage structures	1 day	Document and survey measure

Note: H = Hold point, W = Witness point

4.3 ANNEXURE – PAY ITEMS

This Annexure applies to Council projects. For private development works use of this schedule is optional, at the Superintendent's discretion.

Pay items	Unit of measurement	Schedule rate scope
1354.1 Supply and placement headwalls and wingwalls	m ³ of concrete in place. Volume calculated from the documented dimensions.	All costs associated with supply and placing of in situ concrete/precast concrete including reinforcement in place including joints or backfilling.
1354.2 Supply and place pits, dissipators, channel basins and other supplementary structures	Each completed structure as documented.	All costs associated with the structures including cast in metal work, precast items, frames, grates, lintels, lids, backfilling.
1354.3 Supply and place bulkhead structures	Each completed bulkhead as documented.	All costs associated with bulkhead structures including reinforcement and backfilling.
Traffic management	Lump sum.	To 1101 <i>Traffic management</i> .
Concrete works		To 0319 <i>Auxiliary concrete works</i> .
Excavation and compaction		To 1351 <i>Stormwater drainage (Construction)</i> .

Alternatively the Superintendent may use a single pay item.

Pay items	Unit of measurement	Schedule rate scope
1354.1 Supply and place drainage structures	Each completed structure as documented.	All costs associated with supply and placing of in situ concrete including reinforcement in place including joints or backfilling. All costs associated with the structures including cast in metal work, precast items, frames, grates, lintels, lids, backfilling.

Traffic management	Lump sum.	To 1101 <i>Traffic management.</i>
Concrete works		To 0319 <i>Auxiliary concrete works.</i>
Excavation and compaction		To 1351 <i>Stormwater drainage (Construction).</i>

4.4 ANNEXURE - REFERENCED DOCUMENTS

The following documents are incorporated into this worksection by reference:

AS 1597		Precast reinforced concrete box culverts
AS 1597.2	2013	Large culverts (exceeding 1200 mm span or 1200 mm height and up to and including 4200 mm span and 4200 mm height)
AS 1657	2018	Fixed platforms, walkways, stairways and ladders - Design, construction and installation
AS 3600	2018	Concrete structures
AS 3850		Prefabricated concrete elements
AS 3850.3	2021	Civil construction
AS 3972	2010	General purpose and blended cements
AS 3996	2019	Access covers and grates
Austrroads AGPT		Guide to pavement technology
Austrroads AGPT04G	2009	Geotextiles and geogrids
EN 15804	2012	Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
ISO 14025	2006	Environmental labels and declarations - Type III environmental declarations - Principles and procedures
ISO 21930	2017	Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services
AS 1597		Precast reinforced concrete box culverts
AS 1597.2	2013	Large culverts (exceeding 1200 mm span or 1200 mm height and up to and including 4200 mm span and 4200 mm height)
AS 1657	2018	Fixed platforms, walkways, stairways and ladders - Design, construction and installation
AS 3600	2018	Concrete structures
AS 3850		Prefabricated concrete elements
AS 3850.3	2021	Civil construction
AS 3972	2010	General purpose and blended cements
AS 3996	2019	Access covers and grates
Austrroads AGPT		Guide to pavement technology
Austrroads AGPT04G	2009	Geotextiles and geogrids
EN 15804	2012	Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
ISO 14025	2006	Environmental labels and declarations - Type III environmental declarations - Principles and procedures
ISO 21930	2017	Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services
NP PCH	2009	Precast concrete handbook

5 ANNEXURE M – CESSNOCK CITY COUNCIL SPECIFIC CLAUSES

M1.	Variations to or non-conformances with Council's AUS-SPEC are to be evaluated with reference to the procedure in Council's <i>Development Engineering Handbook</i> . Acceptance is to be obtained in writing from: an authorised representative of Council's Director of Infrastructure and Engineering Services.	Variation procedure
M2.	This specification applies in addition to any development consent (DA) conditions. If there is any inconsistency, the conditions of consent shall prevail.	DA Conditions
M3.	Refer to the Cessnock City Council <i>Development Engineering Handbook</i> for final inspection, works-as-executed and handover requirements.	Completion

6 AMENDMENT HISTORY

0	15/01/2024	First Published
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