COONAMBLE
SHIRE COUNCIL

COONAMBLE DESIGN SPECIFICATION

AUS-SPEC #1

DEVELOPMENT SPECIFICATION SERIES

CONSTRUCTION

RECOMMENDED FOR ISSUE

DIRK JOL
(MANAGER ROADS)

APPROVED

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(EXECUTIVE LEADER - INFRASTRUCTURE)

AUS-SPEC #1
DEVELOPMENT SPECIFICATION SERIES
DESIGN - COONAMBLE

Specification No.	Specification Title	TRIM CONTAINER SF130198	
		Reference No.	Revision No.
DQS	Quality Assurance Requirements for Design	C1312391	1
D1	Geometric Road Design (Urban and Rural)	C1312348	1
D2	Pavement Design	C1312354	1
D3	Structures/Bridge Design	C1312356	1
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COONAMBLE DEVELOPMENT DESIGN SPECIFICATION

DQS

QUALITY ASSURANCE REQUIREMENTS FOR DESIGN

VERSION 3.1 – JANUARY 2022

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
VERSION 3.1					
1	NSW RTA referenced, WSA codes updated, Design Checklist 12 added	DQS.01	A	KD	04/10
2		DQS.03	A	KD	04/10
3		DQS.04	A	KD	04/10
4		DQS.07	A	KD	04/10
5		DQS-A	A, M	KD	04/10

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ANNEXURES

QUALITY ASSURANCE REQUIREMENTS FOR DESIGN

DQS.01 SCOPE

1. This Design Specification sets out the process for quality assurance of Designs required by Council for development consents. The requirements are applicable to all design work whether undertaken by the Developer, the Developer's Project Manager, Consultant or a Sub-consultant.

Quality Assurance

2. The Specification refers to Engineering Design processes. Requirements which refer to the Concept Design of developments are generally covered in Council's COONAMBLE Development Control Plan (QDCP) 2012. The requirements of the DCP are a prerequisite to the quality requirements for Engineering Design provided in this Specification (DQS).

Prerequisite

3. The Specification refers also to engineering design processes for developments that do not involve subdivision.

DQS.02 OBJECTIVES

1. This Specification aims to set standards and document requirements for the execution and recording of design processes in order that the infrastructure associated with any development is designed to be fit for service and of a standard reasonably maintainable when it is accepted by Council as a community asset.

Maintenance

2. It is also an objective that these qualities be readily demonstrable by clear records of key design processes and that data relevant to the upkeep of the assets is available to Council's management.

Records

DQS.03 REFERENCE AND SOURCE DOCUMENTS

(a) Council Specifications

All Specifications for Design and Construction
Council's Codes and Policies

(b) Australian Standards

AS/NZS 3905.2	Guide to quality system Standards AS/NZS 9001, AS/NZS 9002 and AS/NZS 9003 for construction.
AS/NZS 3913	Quality manuals - Guide to preparation.
AS/NZS ISO 8402	Quality management and quality assurance - Vocabulary.
AS/NZS ISO 9001	Quality systems - Model for quality assurance in design, development, production, installation and servicing.
AS/NZS ISO 9004.1	Quality management and quality system elements - Guidelines.

(c) Other

Section 79 (EP&A ACT)
Local Government Act (1993)
Technical Publications used as Engineering Standards (AR&R)
Interim Policies and Guidelines

DQS.04 CERTIFICATION

1. The Developer shall present all engineering drawings to Council for acceptance. Each set of drawings shall be accompanied by a Certification Report which will be signed by the Developer's Engineer or suitably qualified person. The Certification Report will comprise the certificate and check lists set out in Annexure DQS-A.

Certification Report

2. Certification Reports shall be required with preliminary drawings and shall require resubmission with updates when final drawings are submitted. Certification is not required with sketch plans or concept plans.

Certification of Preliminary Drawings

3. The Certification Report shall indicate on check lists any aspects of design which do not meet requirements or tolerances set out in Council's Design and Construction Specifications and QDCP.

Design Non-conformance

4 A copy of the relevant Certification Report must accompany each Construction Certificate issued by Council or an Accredited Private Certifier.

Construction Certificate

DQS.05 MINIMUM ING REQUIREMENTS

1. Design drawings shall be definitive and clearly set out so as to present the design concepts in such a way that the project can be understood, specified for construction and satisfactorily built.

Criteria

2. All design drawings should be clearly numbered by the designer with separate sheets numbered as part of a set. All drawing sheets shall have an allocated space in the bottom right hand corner for an assigned number provided by Council (18 characters).

Sheet Numbers

3. The information shown on the drawings shall be logically collected on discrete sheets to avoid illogical and onerous effort in cross referencing between sheets in order to find information. Drawings should not be overcrowded with information and should not rely on colour printing or colour wash to impart information. Drawings should be on A1 or A2 size sheets and be suitable for black and white copying and photo reduction to A3 paper size without loss of clarity.

Logical Drawing Sheets

4. Drawings shall also be submitted electronically in a format agreed with Council which is consistent with the Asset Register and spatial recording adopted by Council.

Electronic Submission

5. Annexure DQS-B provides guidelines for grouping information in design drawings.

DQS.06 DESIGNER'S QUALIFICATIONS

1. A Civil Engineer deemed to be suitably experienced by Council and qualified so as to be accepted as a member of the Institution of Engineers, Australia or a Registered Surveyor deemed to be suitably experienced by Council shall be accepted as qualified to prepare plans for roadworks, drainage works, water supply, sewerage works (excluding pumping stations), canal works (excluding flood control structures and bridges).

Engineer Surveyor

2. A Civil Engineer qualified as detailed above shall be accepted as qualified to prepare plans for bridges, retaining walls, miscellaneous structures, buildings, pumping stations and flood control structures.

Structural Design by Engineer

DQS.07 RECORDS

1. The Designer shall retain appropriate design records in a format such that they can be understood readily by design staff with no prior knowledge of the particular design.

2. Calculations which can readily be re-done need not be kept once the construction maintenance period of the project has expired. ***Calculation Record Retention***

3. A design file shall be maintained by the Developer or the Developer's Consultant containing records of calculations, approvals and decisions, geotechnical data and other design data which could be relevant in reviewing aspects of the design or planning future maintenance responsibilities. ***Design File to be kept***

4. Particular requirements apply to hydrological and hydraulic design data. (Refer to Council's Stormwater Drainage Design Specification). ***Hydrologic, Hydraulic Design***

5. Copies of records will be made available to Council on request and without charge.

DQS.08 AUDIT

1. Council shall have the right of audit of all processes and documents related to the project design. The Developer, the Developer's Consultant and the Developer's Accredited Certifier shall provide Council's Officers all reasonable assistance in inspecting records of designs submitted to Council for acceptance. ***Provide Assistance***

2. In order to provide for such audit, access to the premises of the Developer, the Developer's Consultant and the Developer's Accredited Certifier will be provided to Council on a 24 hour notice basis. ***Notice of Access***

DQS.09 DEEMED TO COMPLY

1 Section DQS shall be Deemed to Comply if carried out in accordance with the requirements of Section DQS, as amended by COONAMBLE SHIRE Council.

ANNEXURE DQS-A

COONAMBLE SHIRE COUNCIL
DESIGN CERTIFICATION REPORT - COONAMBLE

Project Title: _____

DA No: _____

Consultant's Drawing No: _____

Name of Consultant: _____

Name and Address of Developer: _____

_____

I certify that the subject drawings represent a design for which the attached design check lists provide a valid record.

I certify that this Design has been carried out in accordance with current standards of good industry practice and in accordance with COONAMBLE SHIRE Council's COONAMBLE Design Specifications – VERSION 3.1, and specific instructions received with the exception of departures cited in the attached design check lists for Council's advice.

I certify that this Design will not significantly impact on the environmental factors of the area as interpreted under Part V of the Environmental Planning and Assessment Act.

I certify that this Design is in strict compliance with the development consent conditions and where a variance to the consent is found, written confirmation has been received from Council approving of the variance prior to the lodgement of Design Drawings (this includes designs for staged construction).

I certify that all structural elements of the Design have been designed by a competent qualified practicing Civil or Structural Engineer.

Contact Phone: _____

Contact Postal Address: _____

_____

_____

_____

_____
Design Engineer/Surveyor Date

_____
Qualifications

Design Check List 1 BASE PLOT OF EXISTING FEATURES

		Check Completed By *(initials)*	Date	Not Applicable *(tick)*
1.1	Initial plot verified by site inspection for existing drainage.		/ /	☐
1.2	Initial plot verified by site inspection for existing property descriptions, boundaries and accesses.		/ /	☐
1.3	Initial plot of contours verified as representative of site terrain.		/ /	☐
1.4	Trees and significant environmental features affected by development are clearly indicated and annotated.		/ /	☐
1.5	Features significant to heritage considerations within the development boundaries are clearly indicated and annotated.		/ /	☐
1.6	Existing public and private property likely to be affected by these Designs are clearly indicated and annotated.		/ /	☐
1.7	Survey and bench-marks clearly indicated and annotated.		/ /	☐

DEPARTURES FROM COUNCIL OR STATE ROAD AUTHORITY NORMAL REQUIREMENTS OR SPECIAL FEATURES TO BE NOTED:

Design Check List 2 HORIZONTAL ROAD ALIGNMENT

		Check Completed By *(initials)*	Date	Not Applicable *(tick)*
2.1	Alignment compatible with design speed.		/ /	☐
2.2	Alignment is adequate in relation to clearance of roadside hazards.		/ /	☐
2.3	Driver and pedestrian sight distance is adequate.		/ /	☐
2.4	Conflict with existing services is minimised.		/ /	☐
2.5	Road widths and lanes meet Councils requirements and design traffic requirements.		/ /	☐
2.6	Alignment of bridges suits road alignment.		/ /	☐
2.7	Pedestrian, bicycle and parking requirements are met.		/ /	☐
2.8	Provision for large vehicles such as buses, garbage trucks and emergency vehicles is adequate.		/ /	☐
2.9	Intersection layouts meet turning requirements of design traffic including emergency vehicles.		/ /	☐
2.10	Pavement width tapers and merges are adequate.		/ /	☐
2.11	Pedestrians and prams are catered for.		/ /	☐
2.12	Conflict with existing public utility services has been identified and resolved.		/ /	☐
2.13	Horizontal road alignment has been provided in accordance with any conditions of development consent.		/ /	☐
2.14	Horizontal road alignment setout data is clearly defined and tabulated.		/ /	☐

Design Check List 2 HORIZONTAL ROAD ALIGNMENT (continued)

DEPARTURES FROM COUNCIL OR STATE ROAD AUTHORITY NORMAL REQUIREMENTS OR SPECIAL FEATURES TO BE NOTED:

Design Check List 3 VERTICAL ROAD ALIGNMENT

		Check Completed By *(initials)*	Date	Not Applicable *(tick)*
3.1	Grades meet maximum and minimum requirements.		/ /	☐
3.2	Vertical clearances to bridges and services meet standards.		/ /	☐
3.3	Vertical sight distance is adequate for drivers and pedestrians.		/ /	☐
3.4	Cover to drainage structures or services is adequate.		/ /	☐
3.5	Vertical alignment is adequate for disposal of surface drainage from properties and from road.		/ /	☐
3.6	Grades are satisfactory for 1:100 year flood levels.		/ /	☐
3.7	Vertical alignment is compatible with property access.		/ /	☐
3.8	The gradient on an intersecting road is not significantly greater than the cross slope of the through pavement and no greater than 3% at give way and stop signs.		/ /	☐
3.9	Sight distance is acceptable for all accesses to roundabouts.		/ /	☐
3.10	Alignment coordination with horizontal alignment is in accordance with the AUSTROADS design guides as referenced in the AUS-SPEC specifications.		/ /	☐
3.11	Conflict with existing public utility services has been identified and resolved.		/ /	☐
3.12	Vertical road alignment setout data is clearly defined on the longitudinal sections.		/ /	☐

Design Check List 3 VERTICAL ROAD ALIGNMENT (continued)

DEPARTURES FROM COUNCIL OR STATE ROAD AUTHORITY NORMAL REQUIREMENTS OR SPECIAL FEATURES TO BE NOTED:

Design Check List 4 ROAD CROSS SECTIONS

		Check Completed By *(initials)*	Date	Not Applicable *(tick)*
4.1	Typical cross sections have complete dimensions.		/ /	☐
4.2	Typical cross sections have kerb & gutter, road safety barrier and surface drainage indicated.		/ /	☐
4.3	Batter slopes are indicated and batter treatment is indicated where appropriate.		/ /	☐
4.4	Property boundaries, service allocations and location of known existing underground services and pathway treatments are indicated.		/ /	☐
4.5	Sufficient cross sections are shown to define all variations and width transitions.		/ /	☐
4.6	Cross sections are of sufficient width to fully assess impact of road level on adjoining property.		/ /	☐
4.7	Stability of embankment slopes, batters and retaining walls has been verified as satisfactory.		/ /	☐
4.8	Cross section reference level conforms with vertical road alignment.		/ /	☐

DEPARTURES FROM COUNCIL OR STATE ROAD AUTHORITY NORMAL REQUIREMENTS OR SPECIAL FEATURES TO BE NOTED:

Design Check List 5 ROAD AND INTERALLOTMENT DRAINAGE

		Check Completed By *(initials)*	Date	Not Applicable *(tick)*
5.1	Drawings indicate existing surface drainage.		/ /	☐
5.2	Hydrological data is the most current available.		/ /	☐
5.3	Hydrologic and hydraulic design calculations are complete and fully recorded and available for audit.		/ /	☐
5.4	Underground drainage and structures do not conflict with services.		/ /	☐
5.5	The designed drainage lines are compatible with existing incoming lines and outgoing lines.		/ /	☐
5.6	The length of line, type of pipe, size, class and bedding requirements are indicated for each drainage line on the schedule of drainage elements.		/ /	☐
5.7	Height of fill over drainage lines is within allowable limits.		/ /	☐
5.8	Drainage is provided for local depressions eg median areas or areas adjacent to fills.		/ /	☐
5.9	The effect of headwater and back-up water on private property has been assessed.		/ /	☐
5.10	Subsurface drainage has been provided when required and clearly located by line and level, with details provided..		/ /	☐
5.11	The need for batter drains has been considered for fills and cuttings.		/ /	☐
5.12	The height and energy level of downstream drainage has been considered.		/ /	☐
5.13	Drainage structures and flowpaths are located so as to ensure safe vehicular and pedestrian transit.		/ /	☐

Design Check List 5 ROAD AND INTERALLOTMENT DRAINAGE (continued)

		Check Completed By *(initials)*	Date	Not Applicable *(tick)*
5.14	Drainage structure number, setout, type and pipe details indicated on the drainage plans and schedule of drainage elements.		/ /	☐
5.15	Emergency flowpaths are located so as to minimise impact on private property.		/ /	☐
5.16	Road drainage has been provided in accordance with any conditions of development consent.		/ /	☐
5.17	Interallotment drains have been designed in accordance with Council's Specification and/or Australian Rainfall and Runoff (Edition 1987).		/ /	☐
5.18	Appropriate land stabilisation and velocity controls have been implemented to pipe systems, open channels and embankments.		/ /	☐
5.19	For allotments affected by flood controls, the floor height controls are to be compatible with road and drainage levels.		/ /	☐

DEPARTURES FROM COUNCIL OR STATE ROAD AUTHORITY NORMAL REQUIREMENTS OR SPECIAL FEATURES TO BE NOTED:

Design Check List 6 SIGNS AND MARKINGS

		Check Completed By *(initials)*	Date	Not Applicable *(tick)*
6.1	Sign types, sizes, locations and support structure details are shown on the drawings in accordance with AS 1742 (All parts).		/ /	☐
6.2	Pavement linemarking and pavement marking type and setout is indicated on the drawings to meet the requirements of AS 1742.2.		/ /	☐
6.3	Signs and linemarking have been designed in accordance with any conditions of development consent.		/ /	☐

DEPARTURES FROM COUNCIL OR STATE ROAD AUTHORITY NORMAL REQUIREMENTS OR SPECIAL FEATURES TO BE NOTED:

Design Check List 7 PAVEMENT DESIGN

		Check Completed By *(initials)*	Date	Not Applicable *(tick)*
7.1	The pavement design and surface treatment is shown clearly on the drawings and any variations are indicated on appropriate cross sections.		/ /	☐
7.2	The pavement design complies with Council's Pavement Design Specification – COONAMBLE – VERSION 3.1.		/ /	☐
7.3	Pavement design is in accordance with any conditions of development consent.		/ /	☐
7.4	Geotechnical data is assessed as adequate and is held on the design file.		/ /	☐

DEPARTURES FROM COUNCIL OR STATE ROAD AUTHORITY NORMAL REQUIREMENTS OR SPECIAL FEATURES TO BE NOTED:

Design Check List 8 BRIDGE/MAJOR CULVERT DESIGN

		Check Completed By *(initials)*	Date	Not Applicable *(tick)*
8.1	The design has been performed by a competent practicing Civil or Structural Engineer.		/ /	☐
8.2	Geotechnical data is assessed as adequate and is held on the design file.		/ /	☐
8.3	The type and functional dimensions of the bridges meet AUSTROADS Bridge Design Codes 1992, AS 3600, AS 1684, AS 1170, AS 4100.		/ /	☐
8.4	The type and class of all materials are indicated on the drawings.		/ /	☐
8.5	Records of all significant design calculations are available for audit.		/ /	☐
8.6	The design complies with any conditions of development consent.		/ /	☐

DEPARTURES FROM COUNCIL OR STATE ROAD AUTHORITY NORMAL REQUIREMENTS OR SPECIAL FEATURES TO BE NOTED:

Design Check List 9 EROSION/AND SEDIMENTATION CONTROL PLANS

		Check Completed By *(initials)*	Date	Not Applicable *(tick)*
9.1	Both short term and long term erosion control plans have been prepared using the guidelines within Council's Design Specification D7-COONAMBLE – VERSION 3.1 and Construction Specification C211 – Version 3.2.		/ /	☐
9.2	Erosion and sedimentation control has been designed in accordance with any conditions of development consent.		/ /	☐

DEPARTURES FROM COUNCIL OR STATE ROAD AUTHORITY NORMAL REQUIREMENTS OR SPECIAL FEATURES TO BE NOTED:

Design Check List 10 WATER RETICULATION

		Check Completed By *(initials)*	Date	Not Applicable *(tick)*
10.1	The design has been performed by a practicing registered Civil Engineer.		/ /	☐
10.2	The survey has been performed by a practicing registered Surveyor.		/ /	☐
10.3	Geotechnical data is assessed as adequate and is held on the design file.		/ /	☐
10.4	The type and functional dimensions of the reticulation meet the appropriate Australian Standards and is compatible with the Water Supply Code of Australia WSA 03-2011 (Version 3.1)		/ /	☐
10.5	The type and class of all materials, fittings, joints, and special requirements for crossings and protection are indicated on the drawings.		/ /	☐
10.6	Records of all significant design calculations are available for audit.		/ /	☐
10.7	The design meets the requirements of all Statutory Authorities.		/ /	☐
10.8	The design complies with any conditions of development consent.		/ /	☐

DEPARTURES FROM COUNCIL OR WATER AUTHORITY NORMAL REQUIREMENTS OR SPECIAL FEATURES TO BE NOTED:

Design Check List 11 SEWERAGE SYSTEM

		Check Completed By *(initials)*	Date	Not Applicable *(tick)*
11.1	The design has been performed by a practicing registered Civil Engineer.		/ /	☐
11.2	The survey has been performed by a practicing registered Surveyor.		/ /	☐
11.3	Geotechnical data is assessed as adequate and is held on the design file.		/ /	☐
11.4	The type and functional dimensions of the reticulation meet NSW Department of Public Works and Services guidelines, the appropriate Australian Standards and is compatible with the Sewerage Code of Australia WSA 02-2003 (Version 2.3).		/ /	☐
11.5	The type and class of all materials, fittings, joints, and special requirements for crossings and protection are indicated on the drawings.		/ /	☐
11.6	Records of all significant design calculations are available for audit.		/ /	☐
11.7	The design meets the requirements of all Statutory Authorities.		/ /	☐
11.8	The design complies with any conditions of development consent.		/ /	☐

DEPARTURES FROM COUNCIL OR SEWER AUTHORITY NORMAL REQUIREMENTS OR SPECIAL FEATURES TO BE NOTED:

Design Check List 12 VEHICULAR ACCESS DESIGN

		Check Completed By *(initials)*	Date	Not Applicable *(tick)*
12.1	The design has been performed by a practicing registered Civil Engineer.		/ /	☐
12.2	The access complies with the requirements of Table D13.1.		/ /	☐
12.3	The access is not in a prohibited location – Figure D13.1		/ /	☐
12.4	The driveway requirements comply with Table D13.2		/ /	☐
12.5	The type of crossing, materials, grades and any special requirements for crossings are indicated on the drawings.		/ /	☐
12.6	Driveway longsections provided where required by Clause D13.11		/ /	☐
12.7	Records of all significant design calculations are available for audit.		/ /	☐
12.8	The design meets the requirements of all Statutory Authorities.		/ /	☐
12.9	The design complies with any conditions of development consent.		/ /	☐

DEPARTURES FROM COUNCIL OR NSW ROADS AND TRAFFIC AUTHORITY NORMAL REQUIREMENTS OR SPECIAL FEATURES TO BE NOTED:

ANNEXURE DQS-B

EXAMPLE COMPILATION OF DRAWINGS

A. ROADWORKS PLANS

An example of the sequence of drawing sheets acceptable to Council in the compilation of a full set of Roadworks Drawings is set out as follows.

Sheet №	TOPIC
1	Development Consent Number Locality Sketch and Index of Sheets.
2	General Subdivision Plan with contour details and a clear indication of the extent of work.
3	Typical Road Cross Sections showing road widths, pavement (design) configuration, batter slopes, kerb and gutter types.
4.	Plan and Longitudinal Section of each road showing setout data and services.
5.	Drainage Plan and Schedule of Drainage Elements (Pipe lines and structures).
6.	Drainage Profiles.
7.	Drainage Structure Details.
8.	Road Cross Sections.
9.	Intersection Layout Details.
10.	Pavement Marking and Signposting.
11.	Erosion and Sedimentation Control Plans (short term and long term treatment).
12.	Structure Details – Bridges, Retaining Walls, etc.
13.	Erosion and Sediment Control
14.	Traffic Management

NOTE

1. Any one set of Roadworks Plans may require more than 1 sheet for each of the topics listed and may also require supplementary sheets for site specific details.
2. Scales are required to be nominated on all drawings and north points shown on all plan views.

COONAMBLE SHIRE COUNCIL

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COONAMBLE DEVELOPMENT DESIGN SPECIFICATION

D1

GEOMETRIC ROAD DESIGN (Urban and Rural)

VERSION 3.1 – JANUARY 2022

Amendment Record for this Specification Part

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Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
1	Street Lighting	D1.34	A	BP	1/06
2	Standards updated	D1.03	M	MC	05/02/13
3	Function of road types, intersection control,	D1.08	M	MC	05/02/13
4	Additional design speeds	D1.09.3	A	MC	05/02/13
5	Austroads reference	D1.11	A	MC	05/02/13
6	Austroads reference	D1.12	A	MC	05/02/13
7	Standard amended	D1.16.4	M	MC	05/02/13
8	Authorities amended	D1.17.2, 3 & 9	M	MC	05/02/13
9	Council referenced	D1.19.1	M	MC	05/02/13
10	AUSTROADS reference	D1.19.2	M	MC	05/02/13
11	DCP reference	D1.20.2	M	MC	05/02/13
12	Large Lot Residential reference	D1.22.1	M	MC	05/02/13
13	AUSTROADS reference	D1.22.2	M	MC	05/02/13
14	AUSTROADS and RTA reference added.	D1.23	M	MC	05/02/13
15	AUSTROADS reference	D1.24.1	M	MC	05/02/13
16	Property Access requirements added	D1.27	A	MC	05/02/13
17	AUSTROADS reference	D1.229	M	MC	05/02/13

18	Urban areas referenced	D1.31	M	MC	05/02/13
19	Council reference updated	D1.33	A	MC	05/02/13
20	Hold Point added, standards included	D1.35	M	MC	05/02/13
21	Standard drawings added	D1-A	A	MC	05/02/13

DEVELOPMENT DESIGN SPECIFICATION D1 - GEOMETRIC ROAD DESIGN

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DEVELOPMENT DESIGN SPECIFICATION D1
GEOMETRIC ROAD DESIGN (Urban and Rural)

GENERAL

D1.01 SCOPE

1. This section sets out the specifications developed specifically for the design of subdivision roadworks using principles of street design to ensure safety and improved amenity and to reduce pedestrian/vehicular conflicts.

Subdivision Roadworks

2. A fundamental requirement of the design process is for designers to determine the vehicle speed which is deemed acceptable for a particular subdivision or section of road. The concept of designing to regulatory street speeds is contrary to the current principles of subdivision road design.

Acceptable Vehicle Speed

3. All relevant design principles must be integrated in the development of the road network. A careful balance is required between maximising amenity, safety and convenience considerations and those related to the drivers' perception of driving practice.

Integrated Design Principles

4. The words "street" and "road" are interchangeable throughout all parts of this Specification.

5. For the purpose of this Specification the definition of terms used to define the components of the road reserve shall be in accordance with AS 1348.1 and AMCORD.

Road Reserve Component Definitions

AS 1348.1 terms:

Carriageway - That portion of the road or bridge devoted particularly to the use of vehicles, inclusive of shoulders and auxiliary lanes.

Footpath - The paved section of a pathway (verge).

Pathway - A public way reserved for the movement of pedestrians and of manually propelled vehicles (AMCORD verge).

Pavement - That portion of a carriageway placed above the subgrade for the support of, and to form a running surface for, vehicular traffic.

Shoulder - The portion of the carriageway beyond the traffic lanes and contiguous and flush with the surface of the pavement.

AMCORD term:

Verge: - That part of the road reserve between the carriageway and the road reserve boundary. It may accommodate public utilities, footpaths, stormwater flows, street lighting poles and plantings.

D1.02 AIMS

1. The provision of a road system within a subdivision is to be designed so as to achieve the following aims:

- Provide convenient and safe access to all allotments for pedestrians, vehicles and cyclists.

- Provide safe, logical and hierarchical transport linkages with existing street system.
- Provide appropriate access for buses, emergency and service vehicles.
- Provide for a quality product that minimises maintenance costs.
- Provide a convenient way for public utilities.
- Provide an opportunity for street landscaping.
- Provide convenient parking for visitors.
- Have appropriate regard for the climate, geology and topography of the area.

D1.03 REFERENCE AND SOURCE DOCUMENTS

(a) Council Specifications

All Specifications for Design and Construction.
Development Control Plan No. 1 – Car Parking Policy (Edition 6 – Jan 2006)
Development Control Plan No. 52 – Safe design Guidelines for the SHIRE of COONAMBLE.

(b) Australian Standards

AS 1348.1:2002	-	Road and traffic engineering – Glossary of terms, Road design and construction.
AS 2890	-	Parking facilities:
AS/NZS 2890.1:2004	-	Off-street car parking
AS 2890.2-2002	-	Off-street commercial vehicle facilities
AS 2890.5	-	On-street parking
AS/NZS 2890.6:2009	-	Off-street parking for people with disabilities
SAA HB69.14	-	Guide to traffic engineering practice - Bicycles.
AS/NZS 1158	-	Lighting for roads and public spaces.
AS/NZS 3845	-	Road safety barrier systems.

(c) State Authorities

Roads and Traffic Authority NSW –

Road Design Guide.
NSW Bicycle Guidelines, 2003
Guide to Traffic Generating Developments – Version 2.2 (Oct 2002)
RTA Austroads Guide Supplements (Jan 2011)
RTA Australian Standard Supplements (Jan 2011)

Department of Housing - *Road Manual*, 1987.
Department of Urban Affairs (formerly Environment) and Planning (NSW)- Technical Bulletin 12 (1981), *Residential Road Widths*.

(d) Other

AUSTROADS

AGTM06-2007	Guide to traffic management Part 6: *Intersections, interchanges and crossings*.
AGTM08-2008	Guide to traffic management Part 8: *Local area traffic management.*
AP-G1-2003	Rural road design—*guide to the geometric design of rural roads.*

AP-G34-2006	Design vehicles and turning path templates.
AP-G69-2002	Urban road design - *Guide to the geometric design of major urban roads.*
AP-G11-2005	Guide to traffic engineering practice.
AP-G11.6-1993	Roundabouts.
AP-G11.13-1995	Pedestrians.
AP-G11.14-1999	Bicycles.

Guide to Traffic Engineering Practice: - PART 5: *Intersections at Grade*

Design Single Unit Truck / Bus template.

The Institute of Municipal Engineering Australia, Qld Division - 1993: *Design Guidelines for Subdivisional Streetworks.*

ARRB Special Report No. 33, L E Comerford: A Review of Subdivision Road Design Criteria.

Commonwealth Department of Housing and Regional Development – 1995: *Australian Model Code for Residential Development*. (AMCORD). A National Resource Document for Residential Development.

Stapleton, C 1984: *Streets Where We Live – A Manual for the Design of Safer Residential Estates.*

Stapleton, C 1988, Dept of Transport South Australia: *Planning & Road Design for New Residential Subdivisions.*

Brindle, R 1988, ARRB: *Planning & Design of the Local Distributor*.

Colman, J 1978, ARRB: *Streets for Living*.

Pak-Poy Kneebone – 1989: *Research Study into Road Characteristics for Residential Development.*

D1.04 CONSULTATION

Council, Other Authorities

1. Designers are encouraged to consult with the Council and other relevant authorities prior to or during the preparation of design. Designers should in addition to requirements of this Specification ascertain specific requirements of these authorities as they relate to the designs in hand.

Public Consultation

2. Public consultation on designs shall be provided where such action is required by Council's current policy.

Public Utilities

3. The Designer shall obtain service plans from all relevant public utility authorities and organisations whose services may exist within the area of the proposed development. These services are to be plotted on the relevant drawings including the plan and cross-sectional views.

D1.05 PLANNING CONCEPTS

Road Pathway and Cycleway Hierarchy

1. Roads

In new areas (as distinct from established areas with a pre-existing road pattern) each class of route should reflect its role in the road hierarchy by its visual appearance and related physical design standards. Routes should differ in alignment and design standard according to the volume of traffic they are intended to carry, the desirable traffic speed, and other factors.

Pathways and Cycleways

A network of pedestrian and bicycle routes shall be provided to allow safe and convenient movement of pedestrians and cyclists. The network shall be determined at the Development Application Stage.

2. The road, pathway and cycleway patterns and widths must be in conformity with that shown on any relevant Development Control Plan. In areas not covered by these plans, the pattern and width(s) will be determined by Council on their merits, at the Development Application Stage. Each allotment must have a boundary adjoining a public road. ***Conformance with DCP***

3. The road network for residential developments should have clear legibility. ***Legibility***

4. The road network should reinforce legibility by providing sufficient differentiation between the road functions. ***Differentiation***

5. Distinct landmark features such as watercourses, mature vegetation or ridge lines should be emphasised within the structural layout so as to enhance the legibility. ***Landmark Features***

6. Whilst legibility can be enhanced by introduced physical features such as pavement and lighting details, the road network should by its inherent design and functional distinction provide the necessary legibility. ***Introduced Features***

7. The maximum number of turning movements at intersections or junctions that a driver should be required to undertake to reach a particular address within the development should be minimised. ***Intersection Turning Movements***

8. There will be special constraints and costs associated with the design of roads through or adjacent to land known to be salt affected. Early planning shall consider avoiding detrimental interference with land known to be salt affected. Adjustments in horizontal and vertical line shall be considered to avoid recharge of subsurface water within or adjacent to the road reserve. Consultation with the relevant land and water resource authority shall be mandatory under the above circumstances. ***Salinity Prevention, Early Planning, Mandatory Consultation***

9. Appropriate native deep-rooted species should be selected for plantings in association with road reserve works. Plantations should be of sufficient size and density, multiple row belts and relatively close spacings are recommended, to be effective in their desired role of lowering the groundwater table. ***Landscaping, Salinity Prevention***

10. All roads and road intersections, including roundabouts, within the road network shall be provided with street lighting to the appropriate lighting category in accordance with AS/NZS 1158. ***Road and Path Lighting***

All footpaths, pathways, cycleways and shared paths in parks and reserves shall be provided with lighting to Category P2 in AS/NZS 1158.3.1 consistent with COONAMBLE DCP 2012 Section 2.9 -Safe Design'.

D1.06 DRAWING REQUIREMENTS

(a) Reduction Ratios

1. All plans for urban design are to be reduced to 1:500. Rural designs may be reduced to 1:1000.

Longitudinal Sections	Urban	1:500 Horizontal 1:100 Vertical
	Rural	!:1000 Horizontal 1:200 Vertical
Cross Sections	Urban	1:100 Natural
	Rural	1:200 Natural
Intersection and Cul De Sac	Grading Drawings	1:200, with contours at 0.1m intervals

(b) Drawing Sheets

1. Separate sheets should be provided for

   a. Cover sheets
   b. Plan views
   c. Longitudinal sections
   d. Cross sections
   e. Structural details
   f. Standard drawings
   g Intersection Grading Drawings

(c) Drawing Presentation

1. Drawings are to be presented on A1 sheets unless otherwise authorised. They are to be clear and legible and prepared in consistent lettering and style. The Accredited Certifier has the authority to refuse drawings that do not meet these drafting requirements. Drawings copied from other works will not be accepted. All drawings shall be clearly referenced with notations and tables as appropriate. The Designer should always be mindful that apart from being a permanent record and legal document, drawings should be easily read and understood by the Contractor, and others involved in the construction of the Works. Terminology should be kept in 'plain English' where possible. ***Clear and Legible, Permanent Record, Legal Document***

2. The scope and sequence of drawing sheets shall comply with the example provided in Annexure DQS-B of the Specification for QUALITY ASSURANCE REQUIREMENTS FOR DESIGN. ***Compliance***

(d) Certification

1. Drawings shall bear the signature of the design consultant and shall be certified as complying with the appropriate design specifications (D1 to D12). The certificate shall be in the format detailed in Annexure DQS-A of the Specification for QUALITY ASSURANCE REQUIREMENTS FOR DESIGN. ***Design Consultant***

URBAN DESIGN CRITERIA

D1.07 ROAD HIERARCHY

1. A hierarchical road network is essential to maximise road safety, residential amenity and legibility. Each class of road in the network serves a distinct set of functions and is designed accordingly. The design should convey to motorists the predominant function of the road. A typical hierarchy is shown on Figure D1.1. ***Functionality***

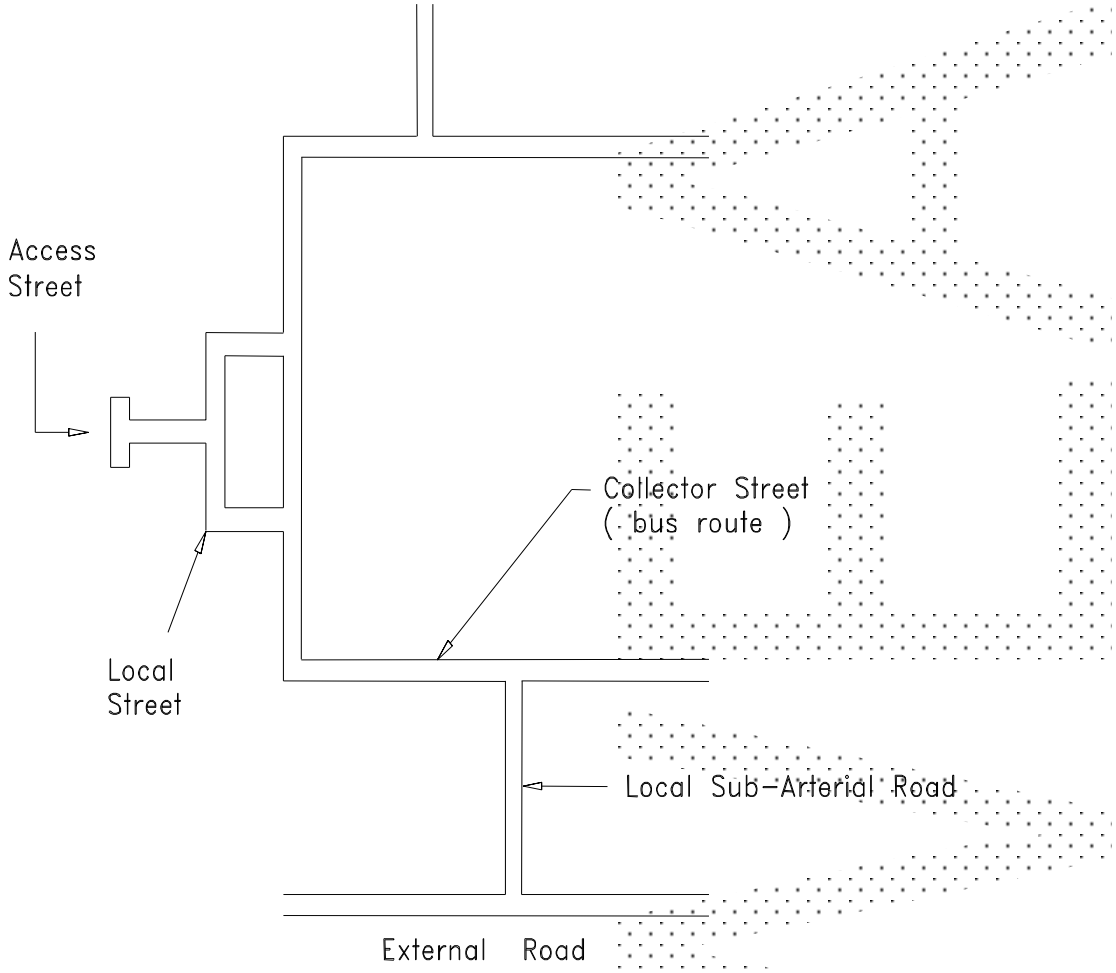

Figure D1.1 - Typical Road Hierarchy

2. Four distinct levels of roads are identified for residential neighbourhoods:

- Access Street
- Local Street
- Collector Street
- Local Sub-Arterial Road.

3. The lowest order road (access street) having as its primary function, residential space - amenity features which facilitate pedestrian and cycle movements, and where vehicular traffic is subservient in terms of speed and volume, to those elements of space, amenity, pedestrians and cyclists. The features of a typical access street are shown in Figure D1.2. ***Access Street***

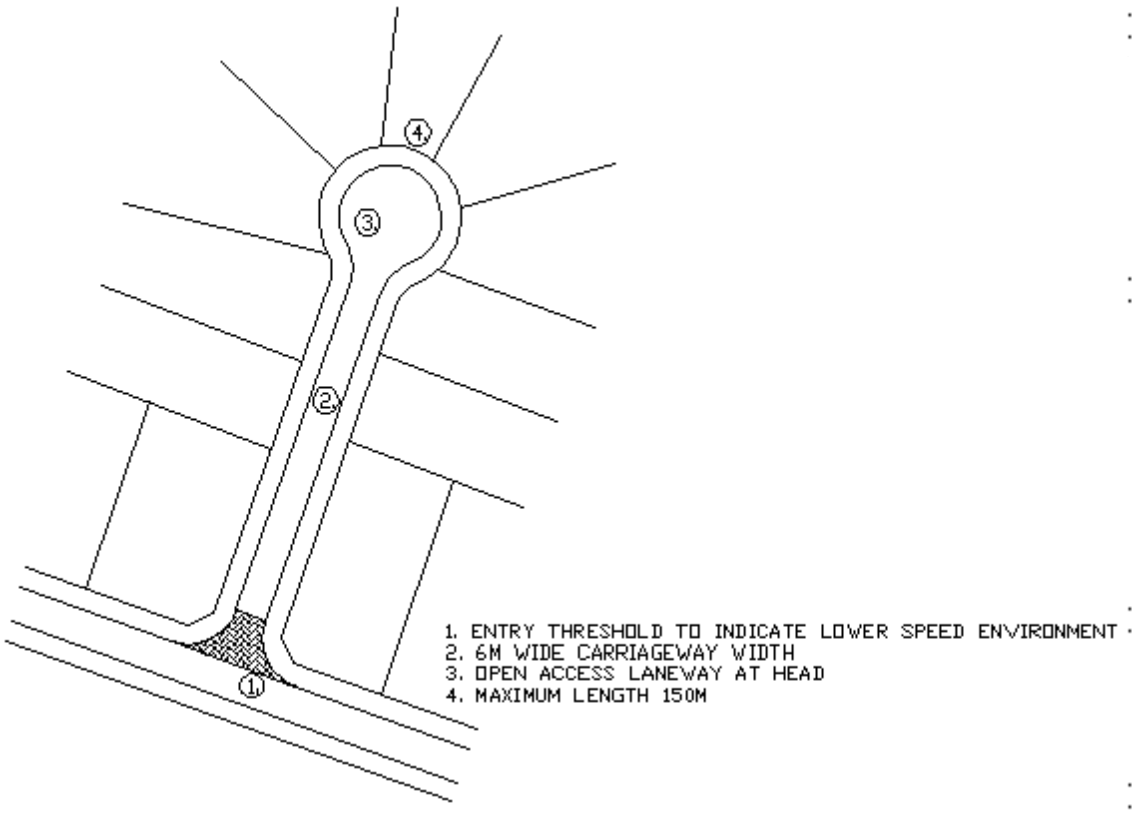

Figure D1.2 - Access Street

Local Street

4. The next level road (local street) as a local residential street should provide a balance between the status of that street in terms of its access and residential amenity functions. Resident safety and amenity are dominant but to a lesser degree than access streets. A typical local street is illustrated in Figure D1.3.

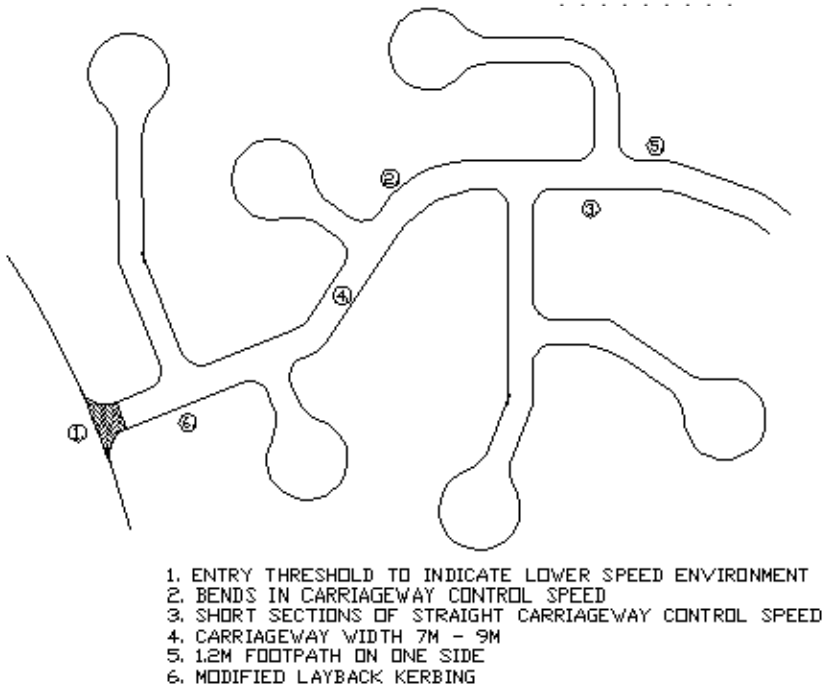

Figure D1.3 - Local Street

Collector Street

5. The second highest order road (collector street) has a residential function but also carries higher volumes of traffic collected from lower order streets. A reasonable level of residential amenity and safety is maintained by restricting traffic volumes and speeds, however, amenity and resident safety do not have the same priority as access or local streets. A typical collector street is shown in Figure D1.4.

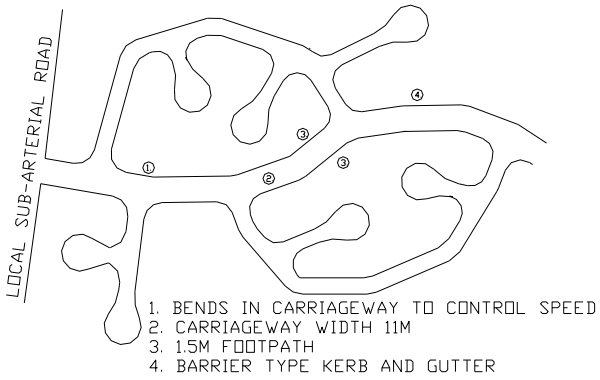

Figure D1.4 - Collector Street

Local Sub-Arterial Road

6. The highest order road (local sub-arterial road) within a residential development should have as its main function the convenient and safe distribution of traffic generated by the development. Direct access should not be provided for single dwelling allotments but access can be provided to multi-unit developments and non-residential land uses. The local sub-arterial should serve only the development and should not attract through traffic. Figure D1.5 shows the layout of a local sub-arterial road.

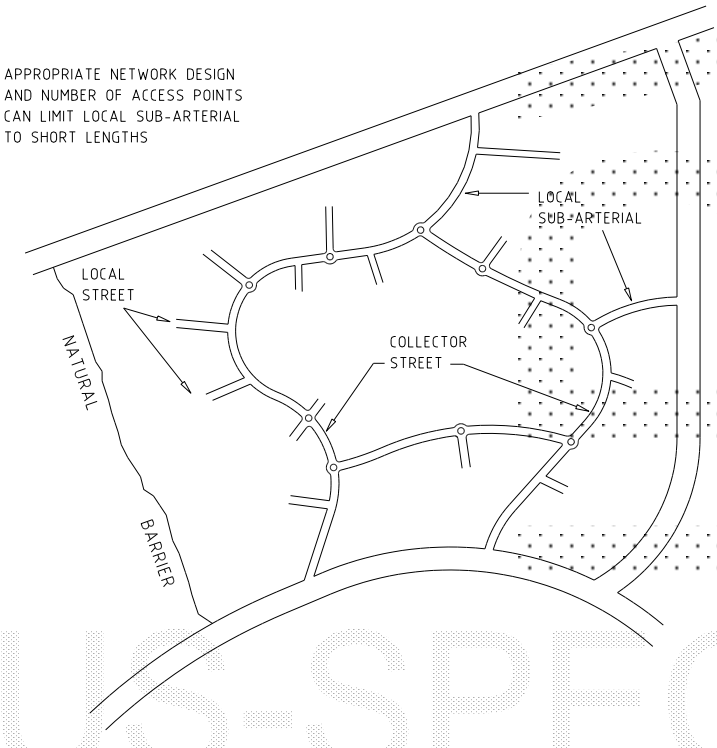

Figure D1.5 - Local Sub-Arterial Road

D1.08 ROAD NETWORK

1. The design features of each type of road convey to the driver its primary functions and encourage appropriate driver behaviour (refer Figure D1.2 to D1.5).

2. Traffic volumes and speeds on any road should be compatible with the residential functions of that road. ***Compatibility***

3. The maximum length of an access street should ensure its status as a residential place is retained, where the traffic, in terms of speed and volume will enable the integration of pedestrian, bicycle and vehicular movements. This length will also ensure that residential convenience is not unduly impaired as a result of speed restraints. ***Access Street***

4. The length of local sub-arterial within a development should be minimised. ***Local Sub-Arterial***

5. The time required for drivers to travel on all streets within the development should be minimised. ***Travel Time***

6. Where access streets form part of a pedestrian or bicycle network, access links should provide suitable connectivity with adjoining access streets or open space systems so as to ensure such pedestrian and bicycle network are functionally efficient. ***Pedestrian or Bicycle Network***

7. The road network should ensure that no road links with another road which is more than two levels higher or lower in the hierarchy. In exceptional circumstances roads may link with others that are more than two levels apart, however, no access street or local street should have access to an access-controlled arterial road. ***Road Links***

8. Connections between internal roads shall be T-junctions or controlled by roundabouts or other treatments that slow travel speed and deviate the travel path across the intersection for the lower priority legs of the intersection. ***Internal Road Connections***

9. The road layout should conform to the requirements of the external road network and satisfy the transport provisions of an outline development plan. ***Transport Provisions***

10. The external road network should be designed and located to provide routes which are more convenient for potential through traffic within the network. Major roads should be provided at intervals of no more than 1.5 km and should be complete and of adequate capaSHIRE to accommodate through network movements. The internal road system should not provide through routes that are more convenient than the external road network. ***External Road Network***

D1.09 DESIGN SPEED

1. Design speed is generally used as the basic parameter in the specification of design standards, determining the minimum design value for other elements. The NSW Roads and Traffic Authority bases its current design standards on a travel speed rather than a design speed. Travel speed identifies a speed/horizontal radius relationship. This approach is intended for roads of a minimum travel speed of 60 km/h. The maximum speed limit in NSW for built-up areas is 60 km/h and this should be used in calculating design values which depend on speed, (e.g. collector and sub-arterial roads) however, in difficult topography, the design speed may be reduced. Vehicular speeds are also limited by road intersections as well as changes in horizontal and vertical alignment. ***RTA Guidelines***

2. Adoption of a low design speed discourages speeding, however, where vertical or horizontal curves of low design speed are located in otherwise high speed sections (tangents) the result is a potentially dangerous section of road. It should be recognised that in low standard roads, operating speeds will tend to be in excess of arbitrary speed standards. Attention should be given to ensuring that potentially hazardous features are ***Low Speeds*** ***Hazardous Features***

visible to the driver and adopting traffic engineering measures which will help a driver avoid errors of judgement.

3. Generally the following design speeds should be adopted:

Access Street	25 km/h
Local Street	40 km/h
Collector Street	50 km/h
Local Sub-Arterial Road	60/80 km/h

4. The need for road safety barriers shall be assessed and designed in accordance with AS/NZS 3845. ***Road Safety Barriers***

D1.10 LONGITUDINAL GRADIENT

1. A general minimum gradient of 0.5 per cent should be adopted. In very flat conditions it may be reduced to 0.3 per cent. Where underground drainage with gully pits or other special works are used it is preferable to allow near level grades rather than reverting to the unsatisfactory device of introducing artificial undulations. Variable crossfall may be necessary to produce the required grade in the gutter. Maximum recommended grades are shown in Table D1.1. ***Flat Terrain***

Table D1.1

	Local and Access	Collector	Local Sub-Arterial	Rural
Desirable maximum percentage*	12	10	8	10
Absolute maximum percentage*	16	12	10	12

* maximum length 150 m on straight alignment.

2. Longitudinal grade of the minor street on the approach to an intersection should not exceed 4 per cent, the actual gradient being dependent on the type of terrain. Design of the road alignment and the grades used are interrelated. A steep grade on a minor side street is undesirable if vehicles have to stand waiting for traffic in the major road. ***Intersections***

3. Turning circles in cul-de-sacs on steep grades should have grades less than 5 per cent. ***Cul-de-Sacs***

D1.11 HORIZONTAL CURVES AND TANGENT LENGTHS

1. The horizontal alignment of a road is normally in a series of tangents (straights) and curves which may be connected by transition curves. The choice of the horizontal alignment is normally determined from the design speeds for a particular street within the road hierarchy as described in Clause D1.09. Designers should ensure that, for a given design speed, the minimum radius of curvature utilised is such that drivers can safely negotiate the curve. Curves which progressively tighten produce an uncomfortable sense of disorientation and alarm. Sudden reverse curves which drivers cannot anticipate also have a potential to cause similar conditions. ***Speed/Radius Relation***

2. Where speed restriction is provided by curves in the street alignment the relationship between the radius of the curve and the desired vehicle speed is given in Table D1.2(a). ***Speed Restriction***

3. To determine appropriate lengths for tangents between speed restrictions, which may be curves, narrow sections or other obstructions, Table D1.2(b) is recommended. ***Tangent Length***

4. Sight distance on curves is determined by formula, values of which are tabulated in AUSTROADS.

Table D1.2(a)
Speed/Radius Relationship

Desired Vehicle Speed (km/h)	Curve Radii (m) on Road Centreline	
	Curvilinear Alignment (no tangents)	Isolated Curve Alignment (with tangent sections)
20	15	10
25	20	15
30	30	20
35	50	30
40	90	40
45	105	50
50	120	60
55	140	70
60	160	80

Table D1.2(b)
Speed/Tangent Length Relationship

Desired Vehicle Speed in Curve (km/h)	Maximum Advisable Tangent Length (m) between Curves or Restrictions Appropriate to a Selected Design Speed. DESIGN SPEED						
	25	30	35	40	45	50	60
20 or less	40	75	100	120	140	155	180
25	-	45	75	100	120	140	165
30	-	-	45	80	100	120	150
35	-	-	-	50	80	100	135
40	-	-	-	-	55	80	120
45	-	-	-	-	-	60	105

NOTE:
Tables D1.2(a) and D1.2(b) are derived from AMCORD.

D1.12 VERTICAL CURVES

1. Vertical curves will be simple parabolas and should be used on all changes of grade exceeding 1 per cent. The desirable minimum design speed is 60 km/h. The length of the crest vertical curve for stopping sight distance should conform with RTA Road Design Guide. These standards are based on 1.5 second's reaction time which provides a reasonable safety margin for urban conditions, where drivers' reaction time is usually considered to be lower than in rural conditions. ***Criteria***

2. For adequate riding comfort, lengths of sag vertical curves should conform to AUSTROADS. As residential roads are usually lit at night, the criterion for designing sag vertical curves is a vertical acceleration of 0.05g for desirable riding comfort, and 0.10g ***Riding Comfort***

for minimum riding comfort. The minimum length for sag vertical curves are shown in Table D1.3.

Table D1.3 Minimum Length of Sag Vertical Curves

	Local and access (m)	Collector (m)	Local Sub-Arterial (m)
Minimum vertical curve	25	35	50
Absolute minimum vertical curve (to be applied at road junctions only)	6	12	20

3. Junctions of roads should be located at a safe distance from a crest, determined by visibility from the side road. Location of a side road at a crest should only occur if there is no suitable alternative. ***Side Road Junctions***

4. Drainage poses a practical limit to the length of sag curves and a maximum length (in metres) of 15 times the algebraic sum of the intersecting vertical grades (expressed as a percentage) has been suggested. This is to avoid water ponding in excessively flat sections of kerb and gutter. A minimum grade of 0.5 per cent should be maintained in the kerb and gutter. This may require some warping of road cross sections at sag points. ***Sag Curves***

5. The three dimensional coordination of the horizontal and vertical alignment of a road should be aimed at improved traffic safety and aesthetics. Economic considerations often require a compromise with aesthetic considerations. The following principles should be applied: ***Horizontal and Vertical Alignment Coordination***

- The design speed of the road in both horizontal and vertical planes should be of the same order.
- Combined horizontal and vertical stopping sight distance and minimum sight distance should be considered three dimensionally.
- Sharp horizontal curves should not be introduced at or near the crest of a vertical curve. A horizontal curve should lead the vertical curve and be longer than the vertical curve.
- A short vertical curve on a long horizontal curve or a short tangent in the gradeline between sag curves may adversely affect the road's symmetry and appearance.

D1.13 SUPERELEVATION

1. The use of superelevation in association with horizontal curves is an essential aspect of geometric design of roads with design speeds in excess of 60 km/h. Local and access roads which are designed for speeds of 40 km/h or less and with curves of 60m radius or less generally have the pavement crowned on a curve instead of superelevation. Design standards for such curves have little meaning as drivers usually cut the corners and rely on friction to hold them on a curved path. As the radius of the curve falls, friction becomes more important than superelevation. ***Low Design Speed, Crowned Pavement***

2. The maximum superelevation for urban roads of higher design speeds should be 6 per cent. Any increase in the longitudinal grade leading to excessive crossfall at intersections should be considered with caution. While it is desirable to superelevate all curves, negative crossfall should be limited to 3 per cent. ***High Design Speed***

3. In general, curve radii larger than the minimum and superelevation rates less than the maximum should be used where possible. The minimum radius of curves is determined by the design speed, the minimum superelevation (or maximum adverse crossfall) at any point on the circular portion of the curve, and the maximum coefficient of side friction which allows safe lane changing. This is 0.15 where there is positive superelevation and 0.12 where there is adverse crossfall. The coefficient of side friction depends upon the type and condition of tyres, the pavement, and on speed. ***Criteria***

4. Recommendations for minimum curve radii (in metres) on major urban roads under varying superelevation/crossfall are shown in Table D1.4.

Table D1.4 Minimum Radius of Curvature

	Design Speed km/h	60	70	80
Minimum Superelevation (%)	5	145	195	255
	4	150	205	265
	3	160	215	280
	2	170	230	300
	1	180	245	315
Maximum Crossfall (%)	0	190	260	340
	1	260	355	460
	2	285	390	505
	3	315	430	560

(Source: NAASRA (Now AUSTROADS), Guide policy for the geometric design of major urban roads.)

5. Plan transitions are desirable on superelevated curves for appearance and to provide a convenient length in which to apply the superelevation. On urban roads, superelevation may be conveniently applied to the road cross section by shifting the crown to 2m from the outer kerb. The axis of rotation of the cross section for urban roads will normally be the kerb grading on either side which best enables access to adjacent properties and intersections. On the outside of superelevation, or where the longitudinal grade of the gutter is less than 0.5 per cent, a crossfall of 63mm in a 450mm wide gutter may be adopted. ***Transitions, Offset Crowns***

D1.14 ROAD RESERVE CHARACTERISTICS

1. The cross section of the road reserve must provide for all functions that the road is expected to fulfil, including the safe and efficient movement of all users, provision for parked vehicles, acting as a buffer from traffic nuisance for residents, the provision of public utilities and streetscaping. Table D1.5 details characteristics of the road reserve. ***Cross Section Provisions***

Table D.1.5 Characteristics of Roads in Residential Subdivision Road Networks

Road Type	Maximum Traffic Volume (vpd) [1]	Maximum Speed [2] (km/h)	Carriageway Width (m)[3]		Parking Provisions Within Road Reserve	Kerbing [4]	Footpath Requirement	Bicycle path Requirement	Verge Width (each side)
			Minimum	Maximum					
Access Street[5]	100	25	6.0	6.0	Carriageway	Modified Layback	No	No	See Note[6]
Local Street[5]	2,000	40	7.0 (up to 1,000 vpd)[10]	9.0	Carriageway. Indented bus stops may be required	Modified Layback	1.2m wide [7] footpath(s)	No	Minimum 4.0m
			9.0 (1,000 to 2,000 vpd)[10]	9.0	As above	As Above	As Above	No	Minimum 4.0m
Collector Street	3,000 (with access to residential allotments)	50 [8]	11.0	13.0	Carriageway	Barrier	1.5m wide footpath both sides.	No 1.0m gap in protuberances required for cyclists [10]	Minimum 4.0m[14]
Local Sub-Arterial Road	6,000 (no access to single dwelling residential allotments	60 [11]	13.0	13.0	Parking not permitted on carriageway [12]	Barrier	If required 1.5m wide footpath, and/or 2.0m bicycle path one side only[13]	If required 2.0m bicycle path one side only in the verge or two 1.5m wide bicycle lanes marked on carriageway [13].	Minimum 4.5m.

Derived from AMCORD

NOTES:

1. For single dwelling allotments apply traffic generation rate of 10 vehicles per day (vpd)/allotment (equivalent to approximately one vehicle per hour (vph) in the peak hour) unless a lower rate can be demonstrated. Lower rates can be applied to multi-unit dwellings based on locally derived rates.

2. See Clauses D1.09 and D1.11 on designing for specific operating speeds.

3. Widening required at bends to allow for wider vehicle paths (using AUSTROADS Turning Templates).

4. Carriageway widths are measured between nominal kerb lines. Refer to COONAMBLE SHIRE Council standard drawing SR1 for nominal kerb line locations.

5. Cul de sacs with carriageway widths less than 9.0 metres shall not exceed 150 metres in length.

6. Minimum width required to provide for pedestrians, services, drainage, landscape and preservation of existing trees. The combined minimum width of both verges shall be 8.0 metres.

7. A minimum of one footpath on one side of the street to be constructed initially with provision to construct a second footpath if required by residents in the future.

8. Reduced speeds are required at designated pedestrian/bicycle crossing. A speed of 20 km/h is desirable, achieved by the road design principles outlined in this Specification.

9. Not used.

10. On bus routes, 7.0m travelled way with 2.0m wide indented parking and bus bays defined by kerbed protuberances. Where bicycle way can be anticipated, a bicycle lane is required along the kerb.

11. Speed on local sub-arterial road not to exceed legal limit.

12. If required, to be provided in parking areas which can be exited in a forward direction.

13. Required only if part of a pedestrian/bicycle network.

14. Provide adequate road reserve width for widening of carriageway for future bus route if required.

* Many elements are inter-related. Therefore variations from any particular recommended characteristic may require changes to others.

2. The carriageway width must allow vehicles to proceed safely at the operating speed intended for that level of road in the network and with only minor delays in the peak period. This must take into consideration the restrictions caused by parked vehicles where it is intended or likely that this will occur on the carriageway. Vehicles include trucks, emergency vehicles and, on some roads, buses. (Refer to Clause D1.21 for bus routes.)

Operational Aspects

3. The safety of pedestrians and cyclists where it is intended they use the carriageway must also be assured by providing sufficient width. ***Pedestrians, Cyclists***

4. The carriageway width should also provide for unobstructed access to individual allotments. Drivers should be able to comfortably enter or reverse from an allotment in a single movement, taking into consideration the possibility of a vehicle being parked on the carriageway opposite the driveway. ***Access to Allotments***

5. The design of the carriageway should discourage drivers from travelling above the intended speed by reflecting the functions of the road in the network. In particular the width and horizontal and vertical alignment should not be conducive to excessive speeds. ***Discourage Speeding***

6. Appropriate verge width should be provided to enable the safe location, construction and maintenance of required footpaths and public utility services (above or below ground) and to accommodate the desired level of streetscaping. Wherever possible services should be located in common trenches. ***Verge Width***

7. The verge when considered in conjunction with the horizontal alignment and permitted fence and property frontage treatments should provide appropriate sight distances, taking into account expected speeds and pedestrian and cyclist movements. ***Sight Distance Across Verge***

8. Stopping sight distances and junction or intersection sight distances, provided by the verge, should be based on the intended speeds for each road type. For infill development, stopping sight distances and junction or intersection sight distances shall be based on the higher of the design speed for the road, if known, or the 85th percentile vehicle operating speed.

9. Roads within Industrial subdivisions shall be designed to the road reserve characteristics shown in Table D.1.5 for Local Sub-Arterial Road. ***Industrial Subdivisions***

D1.15 CROSSFALL

1. Desirably, roads should be crowned in the centre. Typical pavement cross falls on straight roads are:

Pavement Type	*Crossfall*
Bituminous seal coat	3 per cent
Bituminous concrete pavement	2.5 per cent
Cement concrete pavement	2 per cent

(Source: NAASRA (Now AUSTROADS), *Guide policy for geometric design of major urban roads*.)

2. There are many factors affecting levels in urban areas which force departures from these crossfalls. Differences in level between road alignments can be taken up by offsetting crown lines or adopting one way crossfalls. Sustained crossfalls should not exceed 4 per cent, although up to 6 per cent may be used where unavoidable. The rate of change of crossfall should not exceed: 6 per cent per 30m for through traffic; 8 per cent per 30m for free flowing turning movements; or 12 per cent per 30m for turning movements for which all vehicles are required to stop. ***Offset Crown Lines*** ***Rate of Change***

3. The crossfall on a collector or local sub-arterial road should take precedence over the grade in minor side streets. Standard practice is to maintain the crossfall on the major road and adjust the minor side street levels to suit. The crossfall in side streets should be warped quickly either to a crown or a uniform crossfall depending on the configuration of the side street. A rate of change of grade of two per cent in the kerb line of the side street relative to the centre line grading is a reasonable level. ***Precedence***

D1.16 VERGES AND PROPERTY ACCESS

1. A suitable design for the verge will depend on utility services, the width of footpath, access to adjoining properties, likely pedestrian usage and preservation of trees. Low level footpaths are undesirable but may be used if normal crossfalls are impracticable. Crossfalls in footpath paving should not exceed 2.5 per cent, in accordance with AUSTROADS *Guide to Traffic Engineering Practice*, Part 13, *Pedestrians*. Longitudinal grade usually parallels that of the road and this may be steeper than 5 per cent. ***Criteria***

2. Differences in level across the road between road reserve boundaries may be accommodated by: ***Options***

- Cutting at the boundary on the high side and providing the verge at normal level and crossfall. A retaining wall may be constructed at the boundary, and located wholly outside of the road reserve if the extent of batters is excessive. The height of the retaining wall shall not exceed 1.2 metres.
- A uniform crossfall across the carriageway or offsetting the crown of the carriageway.
- The lower verge being provided at normal level and crossfall. A retaining wall may be constructed at the boundary and located wholly outside of the road reserve if the extent of the batters is excessive. The height of the retaining wall shall not exceed 1.2 metres and all retaining walls greater than 0.9 metres shall be provided with a handrail.

3. The above measures can be used singularly or combined. The verge formation should extend with a 0.5m berm beyond the road reserve boundary.

4. The Designer shall design a vehicular driveway centreline profile for the property access and check this design using AS/NZS 2890.1:2004, to ensure that vehicles can use the driveway satisfactorily. Gradient requirements are given in Specification for VEHICULAR ACCESS DESIGN. ***Driveway Profile***

5. Batters outside of the road reserve shall not exceed 1 vertical to 4 horizontal in cutting and embankment. ***Batter Slope***

D1.17 INTERSECTIONS

1. The design of intersections or junctions should allow all movements to occur safely without undue delay. Projected traffic volumes should be used in designing all intersections or junctions on local sub-arterial roads. ***Traffic Volumes***

2. Intersection design for the junction of subdivision roads with existing state rural or urban roads and national highways should generally be in accordance with AUSTROADS and the NSW RTA Austroads Supplement. ***State Roads, National Highways***

3. Intersections with state roads or national highways are to be designed, approved and constructed in accordance with the requirements of the NSW Roads and Maritime Services. ***NSW Roads and Maritime Services Concurrence***

4. Where major intersections are required to serve a development complete reconstruction of the existing road pavements will be necessary where the speed environment and irregularity of the existing road pavement may endanger the safety of traffic in the locality. ***Existing Road Pavement***

5. Intersections should be generally located in such a way that: ***Criteria***

- The streets intersect preferably at right-angles and not less than 70°.
- The landform allows clear sight distance on each of the approach legs of the intersection.
- The minor street intersects the convex side of the major street.
- The vertical grade lines at the intersection do not impose undue driving difficulties.
- The vertical grade lines at the intersection will allow for any direct surface drainage.
- Two minor side streets intersecting a major street shall have a minimum centreline spacing of 50m.
- A right-left manoeuvre between the staggered streets is preferable, avoiding the possibility of queuing in the major street.

6. Adequate stopping and sight distances are to be provided for horizontal and vertical curves at all intersections. Stopping sight distances and junction or intersection sight distances, shall be based on the intended speeds for each road type. For infill development, stopping sight distances and junction or intersection sight distances shall be based on the higher of the design speed for the road, if known, or the 85th percentile vehicle operating speed. ***Sight Distance***

7. Where required, appropriate provision should be made for vehicles to park safely. ***Parking***

8. The drainage function of the carriageway and/or road reserve must be satisfied by the road reserve cross-section profile. ***Drainage***

9. All vehicle turning movements are accommodated utilising AUSTROADS *Design Vehicles and Turning Templates*, as follows: ***Turning Movements***

- For intersection turning movements involving local sub-arterial roads, the "design semi-trailer" with turning path radius 15.0m.
- For intersection turning movements involving local streets or collector streets, but not local sub-arterial roads, the "design single unit" bus with turning path radius 13m.
- For intersection turning movements on access streets but not involving local sub-arterial roads, collector streets or local streets, the garbage collection vehicle used by the local authority.
- For turning movements at the head of cul-de-sac access streets sufficient area is provided for the "design single unit" truck to make a three-point turn or, where the length of the cul-de-sac is less than 60m for the "design car" to make a three-point turn. Where driveway entrances are to be used for turning movements, the required area is to be designed and constructed to withstand the relevant loads.

10. Turning radii at intersections or driveways on local sub-arterial road accommodate the intended movements without allowing desired speeds to be exceeded. ***Turning Radii***

11. On bus routes 3-centred curves with radii 7.0m, 10.0m, 7.0m are used at ***Bus Routes***

junctions and intersections.

12. Channelisation shall be provided at all intersections involving Local Sub-Arterial Roads. For infill development and all other cases, channelisation shall be provided where resolved by the Local Traffic Committee, or directed by Council, at the development application stage, to reduce the general area of conflict at intersections. ***Channelisation***

D1.18 ROUNDABOUTS

1. Roundabouts are to be approved by the Council and NSW Roads and Maritime Services. Roundabouts are to be provided at all four way intersections not controlled by traffic signals. In all other cases roundabouts are to be provided where resolved by the Local Traffic Committee, or directed by Council, at the development application stage. ***Approval***

2. Roundabouts shall be designed in accordance with the current guidelines published by NSW Roads and Maritime Services. Designs adopting alternative criteria will be considered on their merits. Roundabout design should generally comply with the following: ***Criteria***

- entry width to provide adequate capaSHIRE
- adequate circulation width, compatible with the entry widths and design vehicles e.g. buses, trucks, cars.
- central islands of diameter sufficient only to give drivers guidance on the manoeuvres expected
- deflection of the traffic to the left on entry to promote gyratory movement
- adequate deflection of crossing movements to ensure low traffic speeds
- a simple, clear and conspicuous layout
- design to ensure that the speed of all vehicles approaching the intersection will be less than 50 km/h.

D1.19 TRAFFIC CALMING

1. Traffic calming devices are to be provided where resolved by the Council at the development application stage. Traffic calming devices are to be approved by the Council. ***Approval***

2. Calming devices such as thresholds, slowpoints, speed humps, chicanes and splitter islands should be designed in accordance with the requirements of the publication AUSTROADS AGTM08-2008 *Guide to Traffic Management Part 8; Local Area Traffic Management.* Devices designs should generally comply with the following: ***Criteria***

(a) Streetscape

- reduce the linearity of the street by segmentation
- avoid continuous long straight lines (e.g. kerb lines)
- enhance existing landscape character
- maximise continuity between existing and new landscape areas

(b) Location of Devices/Changes

- devices other than at intersections should be located to be consistent with streetscape requirements
- existing street lighting, drainage pits, driveways, and services may decide the exact location of devices
- slowing devices are optimally located at spacings of 100-150m.

(c) Design Vehicles

- emergency vehicles must be able to reach all residences and properties
- local streets with a 'feeding' function between arterial roads and minor local streets shall be designed for a AUSTROADS *Design Single Unit Truck/Bus*
- where bus routes are involved, buses should be able to pass without mounting kerbs and with minimised discomfort to passengers
- in newly developing areas where street systems are being developed in line with LATM principles, building construction traffic must be provided for

(d) Control of Vehicle Speeds

- maximum vehicle speeds can only be reduced by deviation of the travelled path. Pavement narrowings have only minor effects on average speeds, and usually little or no effect on maximum speeds
- speed reduction can be achieved using devices which shift vehicle paths laterally (slow points, roundabouts, corners) or vertically (humps, platform intersections, platform pedestrian/school/bicycle crossings)
- speed reduction can be helped by creating a visual environment conducive to lower speeds. This can be achieved by 'segmenting' streets into relatively short lengths (less than 300m), using appropriate devices, streetscapes, or street alignment to create short sight lines

(e) Visibility Requirements (sight distance)

- adequate critical sight distances should be provided such that evasive action may be taken by either party in a potential conflict situation. Sight distances should relate to likely operating speeds
- sight distance to be considered include those of and for pedestrians and cyclists, as well as for drivers
- night time visibility of street features must be adequate. Speed control devices particularly should be located near existing street lighting if practicable, and all street features/furniture should be delineated for night time operation. Additional street lighting shall be provided by the Developer at proposed new speed control devices located away from existing street lighting.

(f) Critical Dimensions

Many devices will be designed for their normal use by cars, but with provision (such as mountable kerbs) for larger vehicles. Some typical dimensions include:

- pavement narrowings
  - single lane 3.50m between kerbs

  - 3.75m between obstructions
  - two lane 5.50m minimum between kerbs

- bicycle lanes (including adjacent to pavement narrowings) - 1.2m absolute minimum (1.0m in special circumstances in accordance with AUSTROADS AP-G11.14-1999, *Bicycles*.)

- plateau or platform areas
  - 75 mm to 150 mm height maximum, with 1 in 15 ramp slope

- width of clear sight path through slowing devices

  - 1.0m maximum

  (i.e. the width of the portion of carriageway which does not have its line of sight through the device blocked by streetscape materials, usually vegetation)

- dimensions of mountable areas required for the passage of large vehicles to be determined by appropriate turning templates.

D1.20 PARKING

1. The parking requirements for normal levels of activity associated with any land use should be accommodated on-site. ***On-Site***

2. All on-site parking should be located and of dimensions that allow convenient and safe access and usage. All on-site parking shall be provided in accordance with COONAMBLE Development Control Plan 2012 Section 2.2 – *Car Parking* (as applicable) and to the requirements of AS 2890.

3. The availability of parking should be adequate to minimise the possibility of driveway access being obstructed by cars parked on the opposite side of the street. ***Obstruction***

4. On street parking and verge parking shall be designed in accordance with AS *2890.5 – On-street parking*. ***On-street Parking***

5. Parking spaces provided on the verge or carriageway should be of adequate dimensions, convenient and safe to access. Parallel parking is the preferred method of on-street parking in public roads. Angle parking is generally not supported by Council in public roads. Use of angle should be limited to streets with traffic volumes <2,000 vpd. Angle parking is subject to approval by the Local Traffic Committee and is required to be signposted as angle parking.

D1.21 BUS ROUTES

1. Bus routes will normally be identified by Council. It is important that the road hierarchy adequately caters for buses. The main criteria in determining the location of bus routes is that *no more than 5% of residents should have to walk in excess of 400 metres* to catch a bus. Normally roads above the local street in the hierarchy are designed as bus routes. Table D1.2 details minimum criteria for bus route design. ***Criteria***

Table D1.6 Bus Route Criteria

Road	Carriageway Width (min)	Stops (Spacing)	Bays

Local*	7.0m	400 metre**	2.0m indented bay if carriageway less than 9.0m.
Collector	11m	400 metre **	Shelters***
Local Sub-Arterial	13m	400 metre	Shelters***
Arterial	13m	400 metre	Shelters and Bays

* Local roads identified as bus routes may have 7m carriageways provided indented bays are provided. (see Table D1.5)

** Loop roads with single entry/exit only require stops and bays on one side road.

*** At identified bus stops shelters shall be provided. Shelters are subject to Council's requirements and will include a concrete or paving slab to the floor area.

RURAL DESIGN CRITERIA

D1.22 GENERAL

1. In addition to the foregoing sections this section specifically applies to all those sites identified as being suited to large lot residential developments and rural subdivisions inclusive of rural home sites and hobby farms types of developments.

2. Operating speed is to be generally used as the basic parameter of design standards and the determination of the minimum design value for other elements in rural subdivisions is to be based on the concept of a "speed environment" as outlined in AUSTROADS – AP – G1-2003 – *Rural Road Design*. ***Design Speed***

3. Where appropriate superelevation, widening and centreline shift and their associated transitions are to comply with the AUSTROADS Guide.

4. Where the table drain is likely to scour a RTA Type SH dish drain, or similar structure is to be constructed along the invert. Also for grades of less than 0.8%, the inverts of the drain are to be lined to prevent siltation. ***Table Drain***

5. All rural subdivisions should be designed to restrict access to major roads.

6. All large lot residential and rural residential subdivisions will be required to provide drainage in accordance with the specification for STORMWATER DRAINAGE DESIGN. Watercourses crossing the road shall be conveyed by culverts. ***Drainage***

7. Access should be limited to one point on to local, collector, local sub-arterial or arterial road networks. ***Access***

D1.23 SIGHT DISTANCES

1. Sight Distances for all unclassified roads will be determined in accordance with AUSTROADS - AP-G1-2003 - *Rural Road Design*. Sight distance for Classified State and Regional Roads will be determined in accordance with NSW RMS *AUSTROADS Guide Supplements (*Jan 2011*)*. ***Standards applied***

2. Minimum sight distance to be provided on all roads will be the Stopping Sight ***Minimum Sight***

Distance for the appropriate design speed. ***Distance***

3. Sufficient sight distance shall be provided at the approaches to horizontal curves on Access, Local, Collector, and Sub-arterial Roads to provide Horizontal Curve Perception Distance. ***Horizontal Curve Sight Distance***

4. Overtaking sight distance shall be provided on Rural Collector Roads And Rural Sub-arterial Roads at least once in each 4 kilometres. Alternatively overtaking lanes may be constructed. ***Overtaking Sight Distance***

D1.24 HORIZONTAL AND VERTICAL ALIGNMENT

1. Horizontal and vertical curves are to be designed generally to the requirements of AUSTROADS - AUSTROADS - AP-G1-2003 - Rural Road Design - *Guide to Geometric Design of Rural Roads* for local roads and to NSW RMS *Austroads Guide Supplements* (Jan 2011) for State and Regional Roads. These requirements are essential to satisfy the safety and performance of proper road design. Roads having both horizontal and vertical curvature should be designed to conform with the terrain to achieve desirable aesthetic quality and being in harmony with the landform. ***Criteria***

D1.25 INTERSECTIONS

1. Intersections should generally be designed in accordance with the publication AUSTROADS *Guide to Traffic Engineering Practice - Part 5, Intersections at Grade.* Generally intersections with existing main and local roads will conform to the layouts shown in Figure D1.6 below. The type of intersection required will depend on existing and planned connecting roads. Intersections with State or Regional Roads shall generally meet the requirements of the NSW RTA Road Design Guide and will require the approval of the NSW Roads and Maritime Services. ***Criteria***

2. Adequate sight distance should be provided at intersections both horizontally and vertically. Each intersection location shall be examined for conformance with the criteria for Approach Sight Distance (ASD), Entering Sight Distance (ESD) and Safe Intersection Sight Distance (SISD). ***Sight Distance***

ASD relates to the ability of drivers to observe the roadway layout at an anticipated approach speed.

ESD relates to the driver entering the intersection from a minor road and ability to observe the roadway layout and assess traffic gaps.

SISD relates to an overall check that vehicles utilising the intersection have sufficient visibility to allow reaction and deceleration so as to provide adequate stopping distance in potential collision situations.

Tabulated speed/sight distance requirements together with detailed explanations for each of the sight distance criteria are given in Part 5 of the AUSTROADS Guide, *Intersections at Grade*. Repositioning of an intersection may be required to obtain conformance with the sight distance criteria.

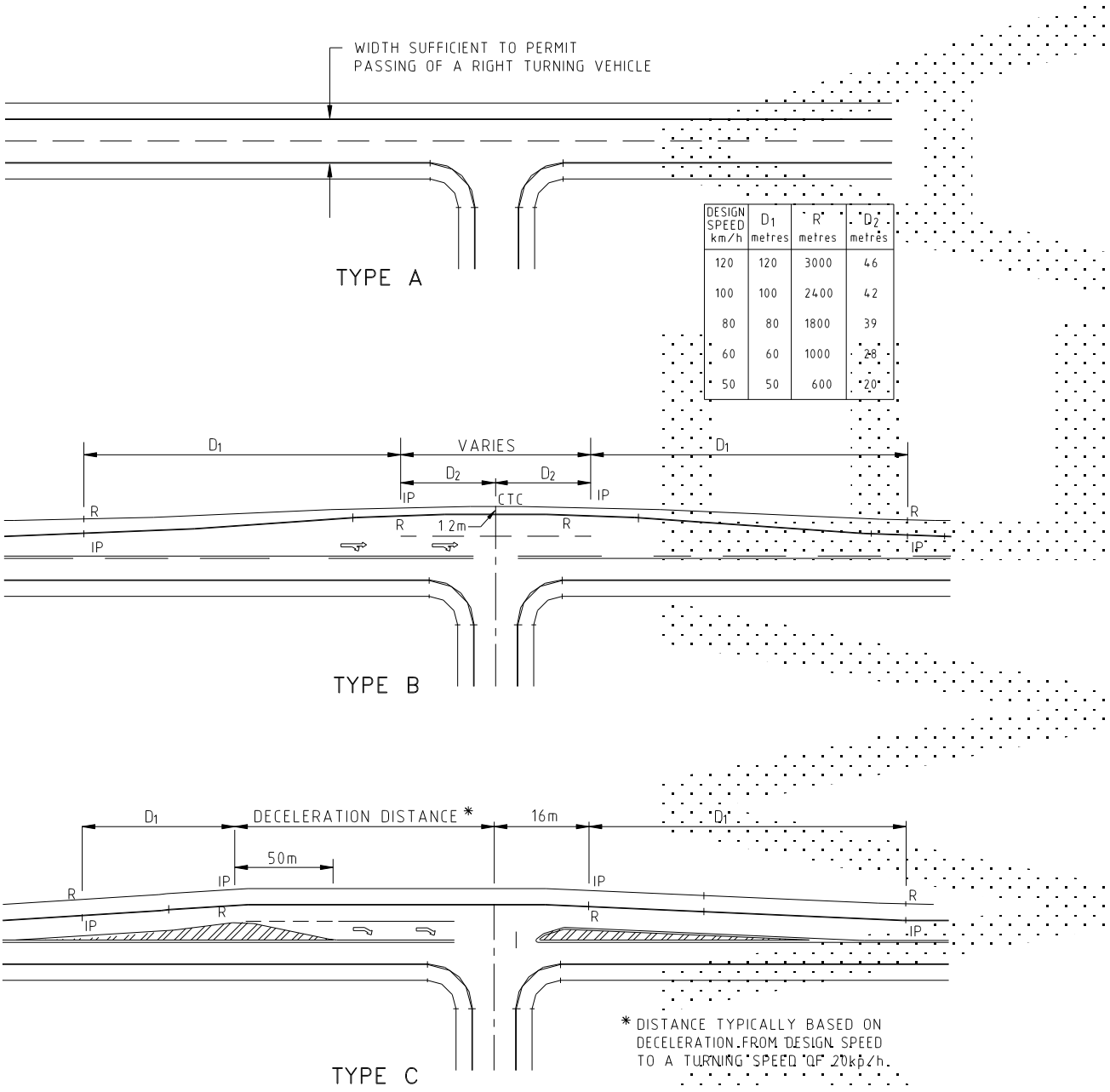

Figure D1.6 Typical Rural Intersection Treatments

Source: AUSTROADS Guide to Traffic Engineering Practice PART 5, Intersections at Grade

3. Staggered-T arrangements proposed for rural cross-intersections should preferably be of the “right to left” type. This arrangement eliminates traffic queuing in the major road, the need for additional pavement for right turn lanes and greater stagger length associated with “left to right” T-intersections. Figures and discussion on staggered-T treatments are given in Part 5 of the AUSTROADS Guide, *Intersections at Grade.*

Staggered-T Intersections

D1.26 PLAN TRANSITIONS

Widening and Shift on Curves

1. A plan transition is the length over which widening and shift is developed from the "tangent-spiral" point to the "spiral-curve" point; i.e., the length between the tangent and the curve. In urban road design it is often impracticable to use plan transitions as kerb lines are fixed in plan and any shift requires carriageway widening. Widening on horizontal curves compensates for differential tracking of front and rear wheels of vehicles; overhang of vehicles; and transition paths. Where proposed roads are curved, the adequacy of carriageway width should be considered.

Crossfall Changes

2. Abrupt changes in crossfall, can cause discomfort in travel and create a visible kink in the kerb line. A rate of change of kerb line of no more than 0.5 per cent relative to the centreline should ensure against this. The wider the pavement the longer the transition. Superelevation transitions should be used at all changes in crossfall, not just for curves. Drainage problems can arise with superelevation transitions which may require extra gully pits and steeper gutter crossfalls. Where crossfalls change at intersections, profiles of the kerb line should be drawn. Calculated points can be adjusted to present a smooth curve.

D1.27 CARRIAGEWAYS

1. Carriageway widths for rural roads shall be designed in accordance with the road characteristics given in Table D.1.7.

Table D.1.7 Characteristics of Roads in Rural Residential Subdivision Road Networks

Road Type	Maximum Traffic Volume (vpd) (1)	Minimum Design Speed (2) (km/h)	Minimum Horizontal Curve Radius (m)	Number of Lanes	Lane Width (m)(3)	Shoulder Width (m)	Shoulder Sealing (m)(4)	Verge Width (m)(5)	Reserve Width (m)(6)
Private Access	12	-(7)	-	1	3.5 unsealed	1.0	0.0	Not required	Not Applicable
Private Access – Crown Reserve or R.O.W.	30	40	-	2	3.0	1.0	0.0	Not required	20
Access Road	150	60	90	2	3.0	1.0)(8)	0.5	0.5 embankment 2.0 cutting	25
Local Road	500	70	150	2	3.0	1.0)(8)	0.5	0.5 embankment 2.0 cutting	30
Collector Road	2000	80	240	2	3.5	2.0)(8)	1.0	1.0 embankment 2.0 cutting	30
Rural Sub-Arterial Road	>2000	80	240	2	3.5	3.0	1.0	1.0 embankment 2.0 cutting	30

NOTES:

1. End of design life of road pavement (generally 20 years). For single dwelling allotments apply traffic generation rate of 6 vehicles per day (vpd)/allotment.

2. See Clauses D1.09 on designing for specific operating speeds.

3. Widening required at curves to allow for wider vehicle paths (using AUSTROADS Turning Templates) and to maintain appropriate sight distances.

4. Shoulder sealing is measured from the edge of the sealed lane. A full width shoulder seal should be provided under the following conditions:

   Adjacent to a lined table drain, kerb or dyke, and on floodways;

   Where a safety barrier is provided adjacent to a 1.0m wide shoulder;

   Outer shoulder of a superelevated curve; and

   Where rigid pavement is proposed.

5. Verge width adjacent to carriageway as defined in RTA *Road Design Guide* Section 3. Where not specified, keep to minimum practicable.

6. Minimum width required to provide for road formation, cut and fill batters, drainage, lateral clearances at top and bottom of batters of at least 2.5m, services and necessary horse trails.

7. Design speed, horizontal and vertical geometry are not specified for Private Access roads. These roads are to be aligned to minimise impact on native vegetation, water courses, rock outcrops, archaeological and heritage sites. Road geometry is to follow the natural surface and avoid cuts/fills of more than 0.5 metres as for as practicable. Longitudinal table drains where needed are to be as small as practicable and are to be turned out to level spreaders at 20 metre maximum intervals or terminate at cross drainage culverts and causeways at 50 metre maximum intervals.

8. Shoulders 3.0 metres wide shall be provided adjacent to all barrier lines and as required at intersections and merge areas.

* Many elements are inter-related. Therefore variations from any particular recommended characteristic may require changes to others.

D1.28 SUPERELEVATION

Design Speed

1. Use of maximum superelevation will be considered where the radius of the curve in approaching the minimum speed environment. Reference should be made to AUSTROADS AP-G!-2003 – *Guide to Geometric Design of Rural Roads* for superelevation calculation. At low and intermediate ranges of design speed (i.e. below 80 km/h) it is desirable to superelevate all curves at least to a value equal the normal crossfall of straights.

D1.29 SCOUR PROTECTION

Roadside Drainage and Table Drains

1. Scour protection of roadside drainage and table drains is required. The level of protection will depend on the nature of the soils, road gradients and volume of stormwater runoff. Protection works may involve concrete lined channels, turfing, rock pitching, grass seeding, individually or any combination of these. Geotechnical investigations should be carried out of determine the level and extent of any protection works prior to proceeding to final design stage.

2. For rural roads with longitudinal gradients greater than 5%, the roadside drainage and table drains will be stabilised in accordance with NSW RTA *Road Design Guide*.

SPECIAL REQUIREMENTS

D1.30 CUL DE SACS

1. A cul de sac head shall be provided at all road terminations. The kerb line radius of the cul de sac head shall not be less than 10 metres radius centrally located in the roadway.

Sloping Terrain

2. In sloping terrain, consideration may be given to the provision of an offset cul de sac with the head radius being tangential to the left hand or right hand kerbline.

Courtyard Housing

3. Where the roadway is serving allotments which have been approved for Courtyard Housing Development, the cul de sac head treatment may be designed in accordance with Figure D1.7

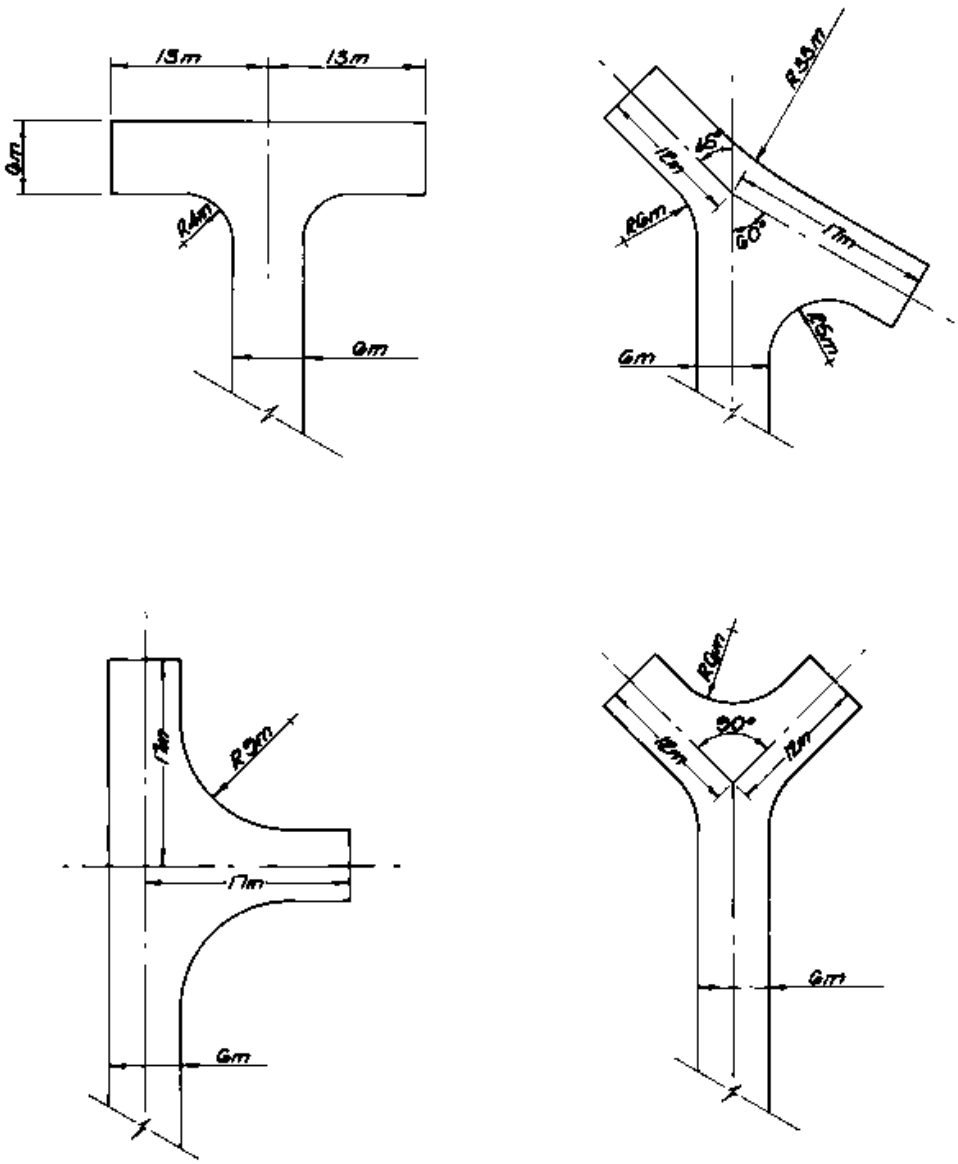

Figure D1.7
Cul de Sac Head Design for Courtyard Housing Development

D1.31 PUBLIC PATHWAYS AND LANEWAYS

1. An open access lane shall be provided between the closed end of Cul de sacs and a public road or public reserve where directed by Council at the development application stage. The width of the access lane shall provide for a useable open space which is able to be cater for a variety of future needs, and have multiple uses such as pedestrian access and service provision. The requirements of COONAMBLE DCP 2012, Section 2.9 – *Safe Design* shall be taken into account in designing the lane. ***Open Access Lane***

2. The access lane shall be cleared and formed with a minimum 1.2m metre wide concrete path, designed and located in accordance with design specification CYCLEWAY AND PATHWAY DESIGN. Provision shall be made for drainage within the access lane connected to the trunk drainage system.

3. The area between the concrete path and reserve boundaries shall be suitable landscaped in accordance with construction specification LANDSCAPING – Version 3.2. ***Landscaping***

D1.32 SIGNS AND PAVEMENT MARKINGS

1. Signs and pavement markings shall be designed in accordance with AS 1742 and current guidelines published by NSW Roads and Maritime Services. All traffic control signs and pavement markings require the approval of the Local Traffic Committee prior to their installation.

AS 1742

2. Street name signs are to be cream reflectorised aluminium blades. Beaded top and bottom, with upper case wineberry letters 100mm high and shall be erected at all intersections. Where the signs are erected in footways, the minimum and maximum heights shall be 2.7 m and 3.0 m respectively, measured to the underside of the sign. The street name is to be obtained from Council's Sustainability and Better Living Group.

Street Signs

D1.33 DEEMED TO COMPLY

1. Section D1 shall be Deemed to Comply if carried out in accordance with the requirements of Section D1, as amended by COONAMBLE SHIRE Council, with the exception of the following clauses:

- Clause D1.09 shall be ***Deemed to Comply*** if the design speed used is 80 km/h for Local Sub-arterial roads, 60 km/h for Collector streets and 40 km/h for all other roads.
- Clause D1.10 shall be ***Deemed to Comply*** if the minimum longitudinal grade is 1.00 % and maximum longitudinal grades are in accordance with Table D1.1.
- Clause D1.14 shall be ***Deemed to Comply*** if designed in accordance with Table D1.8.

D1.34 STREET LIGHTING

1. Street lighting proposals are to be submitted to Council for concurrence prior to implementation. This action constitutes a **HOLD POINT.**

2. Street lighting proposals shall specify the types of luminaries and columns to be utilised.

Street Lighting

3. Street lighting shall be provided in accordance with AS/NZS 1158 and shall utilise best practice energy efficient globes approved by Essential Energy.

(HP)

4. Street lighting columns shall be frangible.

Table D1.8

Classification	Road Reserve	Footway	Carriageway	Kerb Type	AADT
Arterial	40 m min.	see note 1	-	-	-
Local Sub-arterial	21 m	Combined 8 m	13 m	Barrier	3000-7000
Collector Street	19 m	Combined 8 m	11 m	Barrier	1200-3000
Local Street	17 m	Combined 8 m	9 m	Layback	<1200
Local Street (Incl. Major Cul-de-sac)	16 m	Combined 8 m	8 m	Layback	<800
Access Street (Minor Cul-de-sac)	14 m	Combined 8 m	6 m	Layback	<100
Industrial	21 m	Combined 8 m	13 m	Barrier	

NOTES:

1. Arterial roads to be designed in accordance with the following: RTA *Road Design Guide* - March 1988; Austroads *Geometric Design of Rural Roads*; Austroads *Interim Guide for Design of Intersections at Grade*, Part 5 and RTA *Austroads Guide Supplements (Jan 2011).*

2. A trip generation factor of 10 is assumed for each dwelling.

3. Roads intended as bus routes should be designed to local distributor standard. However, collector streets may be designed to enable a bus route.

4. T-junctions are preferred at intersections of roadways rather than 4 way junctions which require a roundabout.

5. The minimum footway width on any one side is 2m. The sum of the footway widths on both sides of the road carriageway must equal the width specified in Table D1.8 above.

ANNEXURE D1-A

STANDARD DRAWINGS

The following ACT Territory & Municipal Services (TAMS) standard drawings, as amended by COONAMBLE SHIRE Council (QCC), are deemed to comply for the purposes of this specification.

Design Standards for Urban Infrastructure: Standard Drawings

DRAWING NUMBER	DATE / REVISION	TITLE	QCC AMENDMENT / COMMENT
DS3 ROAD DESIGN			
DS3-01	Aug 02	Kerb & Gutter Standard Details – Sheet 1	Adopted by QCC.
DS3-02	Aug 02	Kerb & Gutter Standard Details – Sheet 2	Adopted by QCC.
DS4 ROAD VERGES			
DS4-01	Aug 02	Service Modules – Sheet 1 of 2	Adopted by QCC.
DS4-02	Aug 02	Service Modules – Sheet 2 of 2	Adopted by QCC.
DS4-03	Aug 02	Verge Gradients	Adopted by QCC.
DS4-04	Aug 02	Footpaths Service Modules	Adopted by QCC.
DS5 DRIVEWAYS			
DS5-01	Oct 09	Domestic Driveways	Driveways shall be provided with both edges perpendicular to the property boundary from the lot frontage to the kerb unless otherwise approved by QCC. Grade across footway shall be 4% unless otherwise approved by QCC

DS5-02	Oct 09	Heavy Duty Driveways	Driveway Type HD1 shall be provided with both edges perpendicular to the property boundary from the lot frontage to the kerb unless otherwise approved by QCC. Driveway Type HDR not used. Driveway Type HD2 used for commercial and industrial driveways only
DS5-03	Oct 09	Driveway Levels for 1 and 2 Metre Vertical Curves.	Adopted by QCC.
DS9 TRAFFIC CONTROL DEVICES			
DS9 Series not used by QCC. Refer to AUSTROADS and RTA *Austroads Guide Supplements* (2011) for details.			
DS11 FENCES, GUARDRAILS AND BARRIERS			
DS11-01	Aug 02	Standard Ranger Gate	Adopted by QCC.
DS11-02	Aug 02	Vehicle Access Gate (Heavy Duty)	Adopted by QCC.
DS13 PEDESTRIANS AND CYCLE FACILITIES			
DS13 Series not used by QCC. Refer to AUSTROADS and RTA *Austroads Guide Supplements* (Jan 2011) for details.			

COONAMBLE SHIRE COUNCIL

COONAMBLE SHIRE COUNCIL

COONAMBLE DEVELOPMENT DESIGN SPECIFICATION

D2

PAVEMENT DESIGN

VERSION 3.1 – JANUARY 2022

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
1	Asphalt only in urban areas	D2.16.1	A, M, O	BP	1/06
2	Standards Updated	D2.03	M	MC	04/02/13
3	AUSTROADS APRG-21 reference	D2.05.4	M	MC	04/02/13
4	Additional street types	D2.05.5	A	MC	04/02/13
5	Street types amended	D2.16	M	MC	04/02/13
6	Street types amended	D2.19	M	MC	04/02/13
7	Street types amended	D2.22.1	M	MC	04/02/13

CONTENTS

PAVEMENT DESIGN

GENERAL

D2.01 SCOPE

1. The work to be executed under this Specification consists of the design of the road pavement to meet the required design life, based on the subgrade strength, traffic loading and environmental factors, and including the selection of appropriate materials for select subgrade, subbase, base and wearing surface. ***Design Criteria***

2. The Specification contains procedures for the design of the following forms of surfaced road pavement construction: ***Surfaced Pavement Types***

   (a) flexible pavements consisting of unbound granular materials;

   (b) flexible pavements that contain one or more bound layers, including pavements containing asphalt layers other than thin asphalt wearing surfaces;

   (c) rigid pavements (ie. cement concrete pavements);

   (d) concrete or clay segmental pavements.

3. Consideration to the design of unsealed (gravel) pavements will only be given for minor rural subdivisions/developments in isolated rural areas where the access to the subdivision is via an existing unsealed road. ***Unsealed Pavements***

D2.02 OBJECTIVES

1. The objective in the design of the road pavement is to select appropriate pavement and surfacing materials, types, layer thicknesses and configurations to ensure that the pavement performs adequately and requires minimal maintenance under the anticipated traffic loading for the design life adopted. ***Pavement Performance***

D2.03 REFERENCE AND SOURCE DOCUMENTS

(a) Council Specifications

D1	-	Geometric Road Design – COONAMBLE – VERSION 3.1
D4	-	Subsurface Drainage Design – COONAMBLE – VERSION 3.1
C242	-	Flexible Pavements – Version 3.2 C244 - Sprayed Bituminous Surfacing – Version 3.2
C245	-	Asphaltic Concrete – Version 3.2
C247	-	Mass Concrete Subbase – Version 3.2
C248	-	Plain or Reinforced Concrete Base – Version 3.2
C254	-	Segmental Paving – Version 3.2
C255	-	Bituminous Microsurfacing – Version 3.2

(b) State Authorities

Roads and Traffic Authority, NSW - *Sprayed Sealing Guide*, 1992.
Roads and Traffic Authority, NSW – *Concrete Roundabout Pavements*, 1996.

(c) Other

AUSTROADS -

Pavement Design, A Guide to the Structural Design of Road Pavements, 1992.
AP-T36: 2006 Pavement design for light traffic: A supplement to Austroads Pavement Design guide.
AP-T68: 2006 Update of the Austroads sprayed seal design method
AGPT02-2008 Pavement structural design.
Guide to Control of Moisture in Roads.

ARRB-SR35 Subsurface Drainage of Road Structures.

APRG - 21 A guide to the design of new pavements for light traffic

Cement and Concrete Association of Australia -
CACA - T51 - Concrete Pavement Design for Residential Streets, 1997.

Concrete Masonry Association of Australia.
CMAA - T44 - Concrete Segmental Pavements - Guide to Specifying, 1997
CMAA - T45 - Concrete Segmental Pavements - Design Guide for Residential Access Ways and Roads, 1997.
CMAA - T46 - Concrete Segmental Pavements - Detailing Guide, 1997.

Clay Brick and Paver Institute
- Design Manual 1 - Clay Segmental Pavements, A Design and Construction Guide for Sites Subjected to Vehicular and Pedestrian Traffic, 1989.

PAVEMENT DESIGN CRITERIA

D2.04 DESIGN VARIABLES

1. Regardless of the type of road pavement proposed, the design of the pavement shall involve consideration of the following five input variables:

(a) Design Traffic
(b) Subgrade Evaluation
(c) Environment
(d) Pavement and Surfacing Materials
(e) Construction and Maintenance Considerations

D2.05 DESIGN TRAFFIC

1. The design traffic shall be calculated based on the following minimum design lives of pavement:-

Minimum Pavement Design Life

(a) Flexible, Unbound Granular - 25 years
(b) Flexible, Containing one or more bound layers - 25 years
(c) Rigid (Concrete) - 40 years
(d) Segmental Block - 25 years

2. Design traffic shall be calculated in equivalent standard axles (ESAs) for the applicable design life of the pavement, taking into account present and predicted commercial traffic volumes, axle loadings and configurations, commercial traffic growth and street capaSHIRE. For new subdivisions, the design traffic shall take account of both the construction traffic associated with the subdivision development and the in-service traffic for the subdivision and any future developments linked to that subdivision. For interlocking concrete segmental pavements, the simplification of replacing ESA's with the number of commercial vehicles exceeding 3 tonne gross contained in CMAA - T45 is acceptable up to a design traffic of 10^6. Beyond this, ESAs should be calculated. ***Equivalent Standard Axles***

3. The pavement design shall include all traffic data and/or assumptions made in the calculation of the design traffic. ***Traffic Data***

4. In general, reference should be made to APRG-21 for the calculation of design traffic volumes up to 10^6 ESAs and AUSTROADS *Pavement Design* for design traffic volumes approaching or exceeding 10^6 ESAs. ***Design Traffic Volumes***

5. In the absence of other traffic data, the following traffic values (in ESAs) may be taken as a guide to the design traffic, but shall be subject to variation depending on the circumstances for the particular development. ***Guide to Design ESAs***

Street Type:		**Design ESA's - 25 year design life**
Urban Residential	- Access Street	6×10^4
	- Local Street	3×10^5
	- Collector Street	1×10^6
	- Local Sub-Arterial	2×10^6
Large Lot Residential	-	3×10^5
Rural Residential	-	3×10^5
Commercial and Industrial		5×10^6

D2.06 SUBGRADE EVALUATION

1. Except where a mechanistic design approach is employed using AUSTROADS *Pavement Design*, the measure of subgrade support shall be the California Bearing Ratio (CBR). Where a mechanistic design approach using linear elastic theory is employed for flexible pavements, the measure of subgrade support shall be in terms of the elastic parameters (modulus, Poisson's ratio). ***California Bearing Ratio***

2. The following factors must be considered in determining the design strength/stiffness of the subgrade: ***Design Considerations***

(a) Sequence of earthworks construction

(b) The compaction moisture content and field density specified for construction

(c) Moisture changes during service life

(d) Subgrade variability

(e) The presence or otherwise of weak layers below the design subgrade level.

Design CBR Considerations

3. The subgrade Design CBR adopted for the pavement design must consider the effect of moisture changes in the pavement and subgrade during the service life, and hence consideration must be given to the provision of subsurface drainage in the estimation of equilibrium in-situ CBRs, and hence in the design of the pavement structure. Warrants for the provision of subsurface drainage are given in Specification for SUBSURFACE DRAINAGE DESIGN. If subsurface drainage is not provided, then the Design CBR adopted must allow for a greater variability in subgrade moisture content during the service life of the pavement, and hence a Design Moisture Content above the Optimum Moisture Content.

Calculation of Design CBR

4. The calculation of the Design CBR shall be based on a minimum of three 4 day soaked CBR laboratory samples for each subgrade area, compacted to the relative density specified for construction, and corrected to allow for the effects of subsurface drainage (or lack of), climatic zone, and soil type if appropriate (as per the guidelines in ARRB SR41) to give an estimated equilibrium in-situ CBR. The Design CBR for each subgrade area is computed by using the appropriate formulae as follows:

Design CBR = Least of estimated CBRs, for less than five results

Design CBR = 10th percentile of all estimated CBRs, for five or more results

= C - 1.3S

Where C is the mean of all estimated CBRs, and
S is the standard deviation of all values.

Field Confirmation

5. Where practicable, the Design CBR obtained from laboratory testing should be confirmed by testing performed on existing road pavements near to the job site under equivalent conditions and displaying similar subgrades.

Summary of Results

6. The pavement design shall include a summary of all laboratory and field test results and assumptions and/or calculations made in the assessment of Design CBR.

D2.07 ENVIRONMENT

Moisture and Temperature

1. The environmental factors which significantly affect pavement performance are moisture and temperature. Both of these factors must be considered at the design stage of the pavement. Reference should be made to AUSTROADS *Pavement Design*, ARRB-SR41, and to NAASRA (Now AUSTROADS) - *Guide to Control of Moisture in Roads*.

Moisture Considerations

2. The following factors relating to moisture environment must be considered in determining the design subgrade strength/stiffness and in the choice of pavement and surfacing materials:

(a) Rainfall/evaporation pattern
(b) Permeability of wearing surface
(c) Depth of water table and salinity problems
(d) Relative permeability of pavement layers
(e) Whether shoulders are sealed or not
(f) Pavement type (boxed or full width)

Evaluate Design CBR

3. The effect of changes in moisture content on the strength/stiffness of the subgrade shall be taken into account by evaluating the design subgrade strength parameters (ie. CBR or modulus) at the highest moisture content likely to occur during the design life, ie the Design Moisture Content. The provision of subsurface drainage may, under certain circumstances, allow a lower Design Moisture Content, and hence generally higher Design CBR.

4. The effect of changes in temperature environment must be considered in the design of pavements with asphalt wearing surfaces, particularly if traffic loading occurs at night when temperatures are low, thus causing a potential reduction in the fatigue life of thin asphalt surfacing. The effect of changes in temperature environment should also be considered for bound or concrete layers. ***Temperature Change***

5. The pavement design shall include all considerations for environmental factors, and any assumptions made that would reduce or increase design subgrade strength, or affect the choice of pavement and surfacing materials.

D2.08 PAVEMENT AND SURFACING MATERIALS

1. Pavement materials can be classified into essentially four categories according to their fundamental behaviour under the effects of applied loadings: ***Pavement Classification***

(a) Unbound granular materials, including modified granular materials

(b) Bound (cemented) granular materials

(c) Asphaltic Concrete

(d) Cement Concrete

2. Surfacing materials can also be classified into essentially five categories or types:- ***Surfacing Classification***

(a) Sprayed bituminous seals (flush seals)

(b) Asphaltic concrete and bituminous microsurfacing (cold overlay)

(c) Cement Concrete

(d) Concrete Segmental Pavers

(e) Clay Segmental Pavers

3. Unbound granular materials, including modified granular materials, shall satisfy the requirements of the Construction Specification for FLEXIBLE PAVEMENTS – VESRION 3.2.

4. Bound (cemented) granular materials shall satisfy the requirements of the Construction Specification for FLEXIBLE PAVEMENTS – VERSION 3.2.

5. Asphaltic concrete shall satisfy the requirements of the Construction Specification for ASPHALTIC CONCRETE.

6. Cement concrete shall satisfy the requirements of the Construction Specifications for MASS CONCRETE SUBBASE – VERSION 3.2, PLAIN OR REINFORCED CONCRETE BASE – VERSION 3.2, or FIBRE REINFORCED CONCRETE – VERSION 3.2, as appropriate.

7. Sprayed bituminous seals shall satisfy the requirements of the Construction Specification for SPRAYED BITUMINOUS SURFACING – VERSION 3.2.

8. Concrete and clay segmental pavers shall satisfy the requirements of the Construction Specification for SEGMENTAL PAVING – VERSION 3.2.

9. Bituminous microsurfacing (cold overlay) shall satisfy the requirements of the Construction Specification for BITUMINOUS MICROSURFACING – VERSION 3.2.

D2.09 CONSTRUCTION AND MAINTENANCE CONSIDERATIONS

1. The type of pavement, choice of base and subbase materials, and the type of surfacing adopted should involve consideration of various construction and maintenance factors as follows:

(a) Extent and type of drainage
(b) Use of boxed or full width construction
(c) Available equipment of the Contractor
(d) Use of stabilisation
(e) Aesthetic, environmental and safety requirements
(f) Social considerations
(g) Construction under traffic
(h) Use of staged construction
(i) Ongoing and long-term maintenance costs

These factors are further discussed in AUSTROADS *Pavement Design*.

PAVEMENT THICKNESS DESIGN

D2.10 PAVEMENT STRUCTURE - GENERAL

1. The pavement thickness, including the thickness of surfacings, shall not be less than 250mm for roads in which kerb and guttering is to be constructed, 200mm for unkerbed roads and 150mm for carparks. ***Minimum Pavement Thickness***

2. Notwithstanding subgrade testing and subsequent pavement thickness design, the thickness of subbase and base layers shall not be less than the following:-

(a) Flexible pavement: Subbase 100mm, Base 100mm
(b) Rigid pavement: Subbase 100mm, Base 150mm

3. The subbase layer shall extend a minimum of 150mm behind the rear face of any kerbing and/or guttering. ***Subbase Extent***

4. The base and surfacing shall extend to the face of any kerbing and/or guttering. Where the top surface of the subbase layer is below the level of the underside of the kerbing and/or guttering, the base layer shall also extend a minimum of 150mm behind the rear face of the kerbing and/or guttering. ***Base Extent***

5. For unkerbed roads, the subbase and base layers shall extend at least to the nominated width of shoulder. ***Unkerbed Roads***

6. The pavement designer shall make specific allowance for traffic load concentrations within carpark areas (eg entrances/exits). ***Carparks***

7. The pavement designer shall make provision for pavement layer drainage on the assumption that during the service life of the pavement ingress of water will occur. ***Drainage***

D2.11 UNBOUND GRANULAR FLEXIBLE PAVEMENTS (BITUMINOUS SURFACED)

1. Unbound granular flexible pavements with thin bituminous surfacings, including those with cement or lime modified granular materials, with design traffic up to 10^6 ESAs shall be designed in accordance with ARRB-SR41, using Figure 7 (95% confidence limit curves).

2. For design traffic above 10^6 ESAs, the design shall be in accordance with AUSTROADS *Pavement Design*.

D2.12 FLEXIBLE PAVEMENTS CONTAINING BOUND LAYERS (BITUMINOUS SURFACED)

1. Flexible pavements containing one or more bound layers, including cement stabilised layers or asphaltic concrete layers other than thin asphalt surfacings, shall be designed in accordance with AUSTROADS *Pavement Design*.

2. As an alternative to AUSTROADS *Pavement Design* for design traffic up to 10^6 ESAs, bound layers may be assumed to be equivalent to unbound layers of the same thickness, and the pavement designed in accordance with ARRB-SR41, using Figure 7 (95% confidence limit curves).

D2.13 RIGID PAVEMENTS

1. Rigid (concrete) pavements, with design traffic up to 10^6 ESAs shall be designed in accordance with either CACA -T51 or AUSTROADS *Pavement Design*.

2. Rigid (concrete) pavements for design traffic above 10^6 ESAs, shall be designed in accordance with AUSTROADS *Pavement Design*.

3. Fibre reinforced rigid (concrete) pavements shall be used in roundabouts and roundabout approaches and shall be designed in accordance with current RMS Guidelines. ***Roundabouts***

D2.14 CONCRETE SEGMENTAL PAVEMENTS

1. Concrete segmental pavements with design traffic up to 10^6 estimated commercial vehicles exceeding 3T gross shall be designed in accordance with CMAA-T45.

2. For design traffic above 10^6 estimated commercial vehicles exceeding 3T gross the design shall be in accordance with AUSTROADS *Pavement Design*, with the calculation of design traffic in terms of ESAs.

D2.15 CLAY SEGMENTAL PAVEMENTS

1. Clay segmental pavements with design traffic up to 10^6 ESAs shall be designed in accordance with Design Manual 1 - Clay Segmental Pavements.

2. For design traffic above 10^6 ESAs and up to 10^7 ESAs the design shall involve consideration of both Design Manual 1 - Clay Segmental Pavements and AUSTROADS *Pavement Design*, with the thicker and more conservative design of each of the two methods adopted.

3. For design traffic above 10^7 ESAs, the pavement shall be designed in accordance with AUSTROADS *Pavement Design*.

SURFACING DESIGN

D2.16 CHOICE OF SURFACE TYPE

1. Except where the pavement is designed for concrete or segmental block surfacing, the wearing surface shall be a bituminous wearing surface as follows:- ***Bitumen Wearing Surface***

(a) Large Lot Residential

- Primer seal plus two coat flush seal

(b) Rural streets:

- primer seal plus two coat flush seal

or

- primer seal, plus one coat flush seal, plus bituminous microsurfacing

or

- primer seal, plus asphalt.

(c) Urban streets:

- primer seal, plus asphalt only.

2. At intersection approaches and cul-de-sac turning circles on residential streets with flush seals, either bituminous microsurfacing or asphalt surfacing shall be provided within the vehicle braking and turning zones. ***Braking and Turning Zones***

3. At roundabouts and roundabout approaches the pavement type shall be rigid (fibre reinforced concrete) pavement. ***Roundabouts***

4. Variations to these requirements may be approved by Council in special circumstances. ***Approval***

D2.17 SPRAYED BITUMINOUS SEALS (FLUSH SEALS)

1. The design of sprayed bituminous (flush) seals, including primer seals, shall be in accordance with the RTA *Sprayed Sealing Guide*. ***Seal Design***

2. 7mm primer seals shall be indicated on the Drawings below all flush seals, bituminous microsurfacing, and asphalt surfacings. Where a 7mm primer seal is impractical, a 10mm primer seal shall be indicated in lieu. ***Primer Seal***

3. Two-coat flush seals shall be double-double seals, comprising a minimum of two coats binder and two coats of aggregate. The preferred seal types are: ***Two- Coat Flush Seals***

1st coat	14mm
2nd coat	7mm

4. Single coat flush seals shall be allowable if bituminous microsurfacing (or asphaltic concrete) is to be applied as the finished surface. The preferred seal type is either 14mm or 10mm. ***Single Coat Flush Seal***

D2.18 BITUMINOUS MICROSURFACING (COLD OVERLAY)

1. Bituminous microsurfacing, also referred to as 'cold overlay', shall be designed to provide a nominal compacted thickness of not less than 8mm. ***Minimum Thickness***

2. As a minimum, a 7mm primer seal and a single coat flush seal shall be indicated on the Drawings below the bituminous microsurfacing. ***Primer Seal and Single Coat Seal***

D2.19 ASPHALTIC CONCRETE

1. In urban residential access and local streets, large lot residential, rural or light trafficked commercial streets (design traffic up to approximately 3 x 10^5 ESAs), the asphalt mix design shall be either a 'high-bitumen content' mix or the ARRB Gap-graded mix in accordance with ARRB-SR41 and the Construction Specification for ASPHALTIC CONCRETE – Version 3.2. ***Light to Medium Traffic***

2. In urban residential collector and sub-arterial roads, medium to heavily trafficked commercial streets and in all industrial roads, the asphalt mix design shall be a dense graded mix in accordance with the Construction Specification for ASPHALTIC CONCRETE – Version 3.2. ***Medium to Heavy Traffic***

3. Asphaltic concrete surfacings shall be designed to provide a nominal compacted layer thickness of not less than 25mm on light to medium trafficked residential, rural and commercial streets, and 40mm on medium to heavily trafficked residential, rural or commercial roads and on all industrial and classified roads. ***Minimum Thickness***

4. As a minimum, a 7mm or 10mm primer seal shall be indicated on the Drawings below the asphalt surfacing. ***Primer Seal***

D2.20 SEGMENTAL PAVERS

1. Concrete segmental pavers shall be 80mm thick, shape Type A, and designed to be paved in a interlocking pattern. ***Size and Shape***

2. Clay segmental pavers shall be 65mm thick, Class 4, and designed to be paved in a interlocking pattern.

3. The edges of all paving shall be designed to be constrained by either kerbing and/or guttering, or by concrete edge strips. ***Edge Constraint***

DOCUMENTATION

D2.21 DESIGN CRITERIA AND CALCULATIONS

1. All considerations, assumptions, subgrade test results, and calculations shall be submitted with the pavement design for approval by Council. ***Submission Details***

2. The Drawings shall clearly indicate the structure, material types and layer thicknesses of the proposed pavement and surfacing. ***Drawings***

SPECIAL REQUIREMENTS

D2.22 DEEMED TO COMPLY

1. Section D2 shall be Deemed to Comply if carried out in accordance with the requirements of Section D2, as amended by COONAMBLE SHIRE Council, with the exception of the following clauses:

    - Clause D2.16 shall be **Deemed to Comply** if the bituminous wearing surface on Access, Local, Collector, and Local Distributor Streets is primer seal plus asphaltic concrete, and on large lot residential or rural residential roads is primer seal plus two coat flush seal.

D2.23 RESERVED

D2.24 RESERVED

D2.25 RESERVED

COONAMBLE SHIRE COUNCIL

COONAMBLE SHIRE COUNCIL

COONAMBLE DEVELOPMENT DESIGN SPECIFICATION

D3

STRUCTURES BRIDGE DESIGN

VERSION 3.1 – JANUARY 2022

STRUCTURES/BRIDGE DESIGN - COONAMBLE

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
VERSION 3.1					
1	Standards Updated	D3.04	M	MC	04/02/13
2	Requirement for fencing of dams clarified	D3.08	A	MC	04/02/13

DEVELOPMENT DESIGN SPECIFICATION D3
- STRUCTURES/BRIDGE DESIGN - COONAMBLE

CONTENTS

CLAUSE **PAGE**

DEVELOPMENT DESIGN SPECIFICATION D3
STRUCTURES/BRIDGE DESIGN

GENERAL

D3.01 SCOPE

1. This section sets out design considerations to be adopted in the design of structural engineering elements for land subdivisions. Such activities will include:

- Road traffic bridges
- Pedestrian bridges
- Structures other than bridges, but associated with roads (eg major culverts, retaining walls, major sign support structures)
- Small earth dams, detention basins
- Structures used for public safety (road safety barriers, pedestrian safety rails, street lighting)
- Temporary works

Such structures may be of concrete, timber or steel constructions, but with emphasis placed on low maintenance.

D3.02 OBJECTIVE

1. The aim of design shall be the achievement of acceptable probabilities that the structure being designed will not become unfit for use during its design life, having regard to economic, physical, aesthetic and other relevant constraints. ***Design Life***

D3.03 BASIS OF DESIGN

1. The design shall be based on scientific theories, experimental data and experience, interpreted statistically as far as possible. The safety and service performance of a structure depends also on the quality control exercised in fabrication, supervision on site, the control of unavoidable imperfections and the qualifications, experience and skill of all personnel involved. Adequate attention shall therefore be given to these factors. In addition, adequate management control and supervision by experienced engineers shall be required at all stages of design and construction to prevent the occurrence of gross errors. ***Safety Quality Qualifications***

2. Specifications shall be notated on the Drawings with sufficient detail to ensure that the above described strategies are able to be effectively implemented at the construction stage.

D3.04 REFERENCE AND SOURCE DOCUMENTS

(a) Council Specifications

D1	-	Geometric Road Design – COONAMBLE – VERSION 3.1
D5	-	Stormwater Drainage Design – COONAMBLE – VERSION 3.1
D7	-	Erosion Control and Stormwater Management – COONAMBLE – VERSION 3.1

(b) Australian Standards

AS1158	-	The lighting of urban roads and other public thoroughfares (SAA Public Lighting Code)
AS 1428		Design for access and mobility
AS 1428.1-2001		General requirements for access—New building work
AS1170	-	Minimum design loads on structures (SAA Loading Code)
AS1684	-	National Timber Framing Code
AS/NZS 2041-1998		Buried corrugated metal structures
AS3600	-	Concrete structures
AS3700	-	Masonry in buildings (SAA Masonry Code)
AS/NZS 3845:1999		Road safety barrier systems
AS4100	-	Steel structures
AS 4678-2002		Earth-retaining structures
AS 5100- various		Bridge design

Other relevant codes and guidelines with the above.

(c) Other

AUSTROADS	-	Bridge Design Code
Inst. of Eng.	-	Australian Rainfall and Runoff
KD Nelson	-	Design and Construction of Small Earth Dams

D3.05 ROAD TRAFFIC AND PEDESTRIAN BRIDGES

1. Bridge design shall only be carried out by properly qualified persons whose Association of Consulting Engineers Australia (ACEA) listing includes structural design of bridges in its claimed area of competency. Such designers shall submit evidence of these qualifications to Council prior to approval of any bridge design. ***A.C.E.A. Listing***

2. However, this does not preclude submissions by other qualified persons in which cases Council reserves the right to call for evidence of the qualifications and experience of the responsible designer; or to seek referral of the design calculations to an appropriate A.C.E.A. firm for checking. The latter requirement will be at the Developer's cost, if directed. ***Design Checking***

3. The AUSTROADS *Bridge Design Code* shall be used for all bridge design.

4. Bridges shall have low maintenance finishes. Adequate precautions shall be taken for protection of the materials used in the bridge design; for example, timber and steel require special consideration. Heavy debris and bed loads may be characteristic of some streams so that large spans with slender piers are encouraged. If overtopping is permitted, pedestrian safety rails and road safety barriers are usually omitted. Flood depth indicators and appropriate signposting will be provided in such cases. ***Finishes*** ***Debris, Overtopping***

5. Preventative maintenance is a key issue affecting the design life of the structure. The Drawings shall specify the design life of the structure together with the relevant maintenance programs to be adopted upon which the design life is based. Parameters used in the design shall also be shown on the Drawings. ***Design Life*** ***Maintenance***

6. Hydraulic design of bridges shall be in accordance with the requirements for major structures in the Specification for STORMWATER DRAINAGE DESIGN – COONAMBLE – VERSION 3.1. ***Hydraulic Design***

7. Where structures are designed to be inundated, the effect of the backwater gradient on upstream property shall be identified on the Drawings. ***Inundation***

8. Where no inundation is permitted, appropriate afflux shall be adopted together ***Freeboard***

with a 500mm freeboard to the underside of the bridge deck.

9. Designers should enquire regarding current or likely provision for public utilities in bridges. These should be concealed for aesthetic reasons. ***Public Utilities***

D3.06 PROVISION FOR PEDESTRIANS ON ROAD BRIDGES

1. Provision for pedestrians on bridges is required in rural residential as well as urban areas. The minimum provision is a 1.5m footpath with kerb at the road traffic edge and pedestrian safety rails at the external edge. ***Minimum Provision***

2. Council may require the provision of separate pedestrian footpaths in other situations should the anticipated traffic warrant it. ***Separate Footpaths***

3. Disabled access shall be considered in the design. ***Disabled Access***

4. Urban bridge approaches should be lit in accordance with AS1158. ***Lighting***

D3.07 STRUCTURES OTHER THAN BRIDGES, ASSOCIATED WITH ROADS

1. Public utility structures, major culverts, major sign support structures, retaining walls, and the like will be designed by a competent, practicing engineer, accredited in the design of such structures. The design shall be in accordance with the AUSTROADS code, all relevant Australian Standards, and the requirements of any utillty owners that may be relevant.

D3.08 SMALL EARTH DAMS/DETENTION BASINS

1. Small earth dams shall be designed following the guidelines in "*Design and Construction of Small Earth Dams*" by K D Nelson together with relevant geotechnical recommendations. The structural design of weir outlets to resist failure shall be considered in design. Refer also to the Retarding Basin and Stormwater Detention sections in the Specification for STORMWATER DRAINAGE DESIGN.

2. Childproof fencing shall be nominated where water depth in the dam/basin will exceed 300mm and side slopes are greater than 1 in 6.or where unacceptable risk exists due to the location of the dam/basin in relation to the urban nature of the area. ***Fencing***

3. The Designer shall carry out the design with recognition of the potential risk on existing and planned infrastructure downstream, assuming the probability of dam/basin failure. ***Risk of Failure***

4. The Designer shall be a qualified civil or structural engineer having accreditation in the design of such structures. ***Qualification***

5. The Designer shall be required to certify the design and ultimately certify the work-as-executed Drawings for compliance with the design. All relevant details shall be shown on the Drawings. ***Certification***

D3.09 STRUCTURES USED FOR PUBLIC SAFETY

1. Since the requirement of road safety barriers and pedestrian safety rails on bridges are different, the design engineer shall consider whether separate traffic and pedestrian barriers can be detailed to satisfy the major functional requirements. ***Barriers and Rails***

2. The AUSTROADS *Bridge Design Code* and AS/NZS 3845 are recommended references in this regard.

3. It is essential that all safety barriers and rails have been fully tested and accredited for the intended use under quality assurance provisions.

4. Bridge crossings in urban and rural residential areas shall be provided with street lighting in accordance with AS 1158. Such requirements will be noted accordingly on the Drawings.

Lighting

D3.10 TEMPORARY WORKS

1. Structures which are proposed for the temporary support of roads, services and the like shall be designed by a qualified Engineer experienced and accredited in the design of such structures and designed in accordance with the AUSTROADS *Bridge Design Code*. A construction programme, indicating the sequence of events leading to the implementation and removal of the temporary structures shall be specified on the Drawings.

Programme of Temporary Provisions

SPECIAL REQUIREMENTS

D3.11 DEEMED TO COMPLY

1. Section D3 shall be deemed to comply if carried out in accordance with the requirements of Section D3, as amended by COONAMBLE SHIRE Council.

D3.12 RESERVED

D3.13 RESERVED

COONAMBLE SHIRE COUNCIL

COONAMBLE DEVELOPMENT DESIGN SPECIFICATION

D4

SUBSURAFCE DRAINAGE DESIGN

VERSION 3.1 – JANUARY 2022

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
A	**Initial issue**			**DJ**	**JAN 2022**

CONTENTS

DEVELOPMENT DESIGN SPECIFICATION D4
SUBSURFACE DRAINAGE DESIGN

GENERAL

D4.01 SCOPE

1. The work to be executed under this Specification consists of the design of the subsurface drainage system for the road pavement and/or subgrade.

2. This Specification contains procedures for the design of subsurface drainage, including:
   (a) Subsoil and Foundation Drains
   (b) Sub-Pavement Drains
   (c) Drainage Mats, including Type A and Type B Mats.

3. Reference guidelines for the application and design of subsurface drainage include ARRB Special Report 35, *APRG Report 21*, and the AUSTROADS publication – Guide to the Control of Moisture in Roads (refer to references below for the full titles of these guidelines).

D4.02 OBJECTIVES

1. The objective in the design of the subsurface drainage system is to control moisture content fluctuations in the pavement and/or subgrade to within the limits assumed in the pavement design. ***Control Moisture Content***

D4.03 TERMINOLOGY

1. Subsoil drains are intended for the drainage of ground water or seepage from the subgrade and/or the subbase in cuttings and fill areas. ***Subsoil Drains***

2. Foundation drains are intended for the drainage of seepage, springs and wet areas within and adjacent to the foundations of the road formation. ***Foundation Drains***

3. Sub-pavement drains are intended for the drainage of the base and subbase pavement layers in flexible pavements. They may also function to drain seepage or groundwater from the subgrade. ***Sub-pavement Drains***

4. Type A drainage mats are intended to ensure continuity of a sheet flow of water under fills, to collect seepage from a wet seepage area, or for protection of vegetation or habitat downstream of the road reserve where a fill would otherwise cut the flow of water. ***Type A Drainage Mats***

5. Type B drainage mats are constructed to intercept water which would otherwise enter pavements by capillary action or by other means on fills and to intercept and control seepage water and springs in the floors of cuttings. ***Type B Drainage Mats***

6. Drainage pipe within pavement. Refer to RTA Roadworks QA Specification R37 - Intra-pavement Drains and R32 - Subsurface Drainage- Materials for further definition. ***Intra Pavement Drain Pipe***

D4.04 REFERENCE AND SOURCE DOCUMENTS

(a) Council Specification

C230	-	Subsurface Drainage – General
C231	-	Subsoil and Foundation Drains
C232	-	Pavement Drains
C233	-	Drainage Mats
SD305	-	Subsoil Drainage Details
SD316	-	Subsoil Drainage Outlet Details

(b) Australian Standards

AS2439.1	-	Perforated drainage pipe and associated fittings.
AS/NZS 1477	-	Unplasticised PVC (UPVC) pipes and fittings for pressure applications.

(c) Reserved

(d) Other

AUSTROADS - Guide to the Control of Moisture in Roads, 1983

ARRB-SR35 - Australian Road Research Board, Special Report No. 35 - Subsurface Drainage of Road Structures, Gerke R.J., 1987.

APRG Report 21 - *AUSTROADS – A Guide to the Design of New Pavements for Light Traffic.*

RTA Roadworks QA Specification
R37 - Intra-pavement Drains
R32 - Subsurface Drainage

SUBSOIL AND SUB-PAVEMENT DRAINS

D4.05 WARRANTS FOR USE

1. Subsoil drains are designed to drain groundwater or seepage. ***Subsoil Drains***

2. Sub-pavement drains shall be designed to drain: ***Sub-pavement Drains***

a) water from base and subbase pavement layers in flexible pavements, and

b) Seepage or groundwater from the subgrade.

3. Subsoil or sub-pavement drains shall be provided on both sides of the formation. Exceptions to the above will be accepted, after discussion with Council, when any of the following occur: ***Geotechnical Survey***

a) the pavement has been specifically designed to allow for variations in subgrade and pavement moisture contents,

b) the table drains are constructed with an invert level lower than the subgrade level,

c) the water tables do not rise to within 300mm of the subgrade level after

prolonged rainfall, and/or

d) only one side of the formation is in cut, and the other side in fill.

4. Additional subsoil and sub-pavement drains shall be constructed, if, during the construction phase, changes in site moisture conditions or areas of poorer subgrade are uncovered, that were not identified in the geotechnical investigation. ***During Construction***

D4.06 LAY0UT, ALIGNMENT AND GRADE

1. A cross section of typical subsurface drain in a kerbed road is shown below in Figure D4.1. ***Typical Cross Section – Kerbed Road***

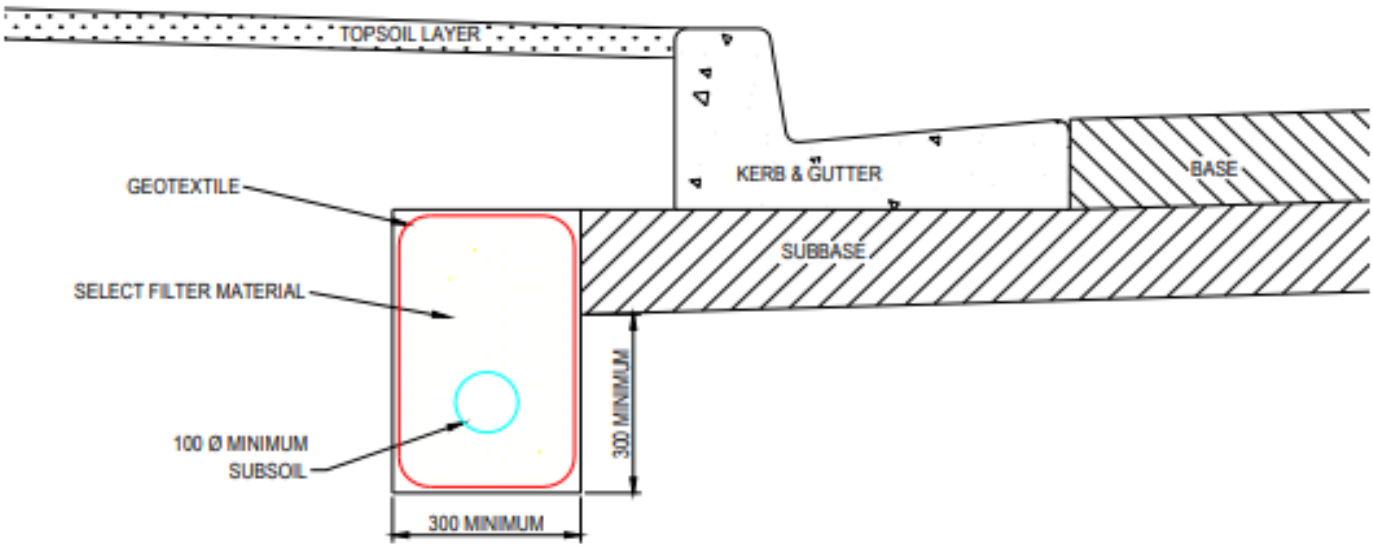

Figure D4.1 Typical Subsurface Drainage

2. In unkerbed roads, subsoil and sub-pavement drains shall be located within the shoulder, at the edge of the pavement layers. ***Unkerbed Roads***

3. The minimum longitudinal design grade for subsurface drains shall be 1.0%. ***Grade***

4. Trench details shall be in accordance with manufactures details for the particular product. In the absence of manufacturers details to the contrary, trench details shall be in accordance with Council Standard Drawing ASD 305 and the following: ***Trench Dimensions***

a) minimum depth below subgrade – 600 mm in earth;

b) minimum depth below subgrade – 450 mm in rock; and

c) trenches near public utilities shall be in accordance with C230.07

5. Outlets shall be spaced at maximum intervals of 100 metres. Where possible, subsoil and sub-pavement drainage pipes shall discharge into gully pits or other stormwater drainage structures. Where not possible, outlets shall be provided through fill batters. Refer to Council Standard Drawing ASD 305 and ASD 314. ***Outlets***

6. Cleanouts are to be provided at the commencement of each run of drain, and at intervals not exceeding 50 metres. Cleanouts shall be located directly at the rear of kerb or at the edge of shoulder, as applicable. Refer to Council Standard Drawing ASD 305. ***Cleanouts***

FOUNDATION DRAINS

D4.07 WARRANTS FOR USE

1. Foundation drains are designed to drain excessive ground water areas within the foundation of an embankment or the base of cutting, or to intercept water from entering these areas. ***Foundation Drains***

2. Foundation drains shall be designed and detailed on the drawings where geotechnical investigation indicates the presence or potential presence of excess groundwater. ***Geotechnical Survey During Construction***

D4.08 LAYOUT, ALIGNMENT AND GRADE

1. Typical cross-sections of foundation drains are shown below in Figure D4.2. ***Typical Cross Section***

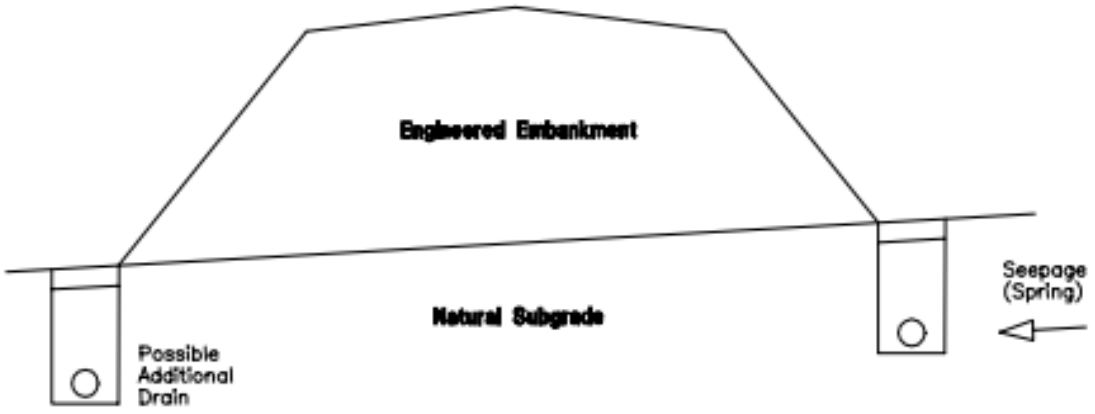

Figure D4.2 - Foundation Drains

2. The minimum design grade shall be 1.0%. ***Grade***

3. Foundation drains shall be a minimum trench width of 150mm, with a variable trench depth to suit the application and ground conditions on site. Refer to Council Standard Drawing ASD 305. ***Trench Dimensions***

4. Outlets shall be spaced at maximum intervals of 100 metres. Refer to Council Standard Drawing ASD 305 and ASD 314. ***Outlets***

5. Cleanouts are to be provided at the commencement of each run of foundation drain and at intervals not exceeding 50 metres. ***Cleanouts***

DRAINAGE MATS (BLANKETS)

D4.09 WARRANTS FOR USE

1. Type A drainage mats are designed where there is a need to ensure continuity of a sheet flow of water under fills, to collect surface seepage from a wet seepage area, or for protection of vegetation or habitat downstream of the road reserve where a fill would otherwise cut the flow of water. Type A drainage mats are constructed after the site has been cleared and grubbed and before commencement of embankment construction. ***Type A Mats***

2. Type B drainage mats are designed where there is a need to intercept water which would otherwise enter pavements by capillary action or by other means on fills and to intercept and control seepage water and springs in the floors of cuttings. Type B drainage mats shall be constructed after completion of the subgrade construction and before construction of the pavement. ***Type B Mats***

3. The geotechnical survey should address the need for the provision of the drainage mats along the proposed road alignment. ***Geotechnical Survey***

4. Information on drainage mats is contained in the construction specification, DRAINAGE MATS CONSTRUCTION – C233N. ***Other relevant Aus-Spec Specifications***

MATERIALS

D4.10 SUBSOIL AND SUB-PAVEMENT DRAIN PIPE

1. Pipes designated for subsoil, foundation and sub-pavement drains shall be *minimum* 100mm diameter or 150 x 50 slotted pipe equivalent. ***Minimum Pipe Diameter***

2. Corrugated plastic pipe shall conform with the requirements of AS2439.1. The appropriate class of pipe shall be selected on the basis of expected live loading at the surface. Joints, couplings, elbows, tees and caps shall also comply with AS2439.1. ***Corrugated Plastic Pipe***

3. Slotted rigid UPVC pipe shall comply with AS 1254. ***Slotted UPVC Pipe***

4. All pipe shall be slotted, and fitted with a suitable geotextile filter tube, except for cleanouts and outlets through fill batters which shall be unslotted pipe.

5. Other types of subsoil drainage systems may be permitted in consultation with Council. ***Other Drainage System***

D4.11 INTRA PAVEMENT DRAIN PIPE

1. Pipes designated for intra pavement drains with crushed rock subbases having layer thicknesses neither less than 150mm nor more than 200mm shall be slotted thick walled UPVC pressure pipe complying with AS/NZS 1477. ***Slotted UPVC Pipe***

2. Pipes designated for intra pavement drains with crushed rock subbases having layer thicknesses exceeding 200mm shall be slotted pipe of a type and class approved by Council.

3. Pipes for use in Type B drainage mats shall be slotted thick walled UPVC ***Type B Mats***

pressure pipe complying with AS/NZS 1477.

D4.12 FILTER MATERIAL

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

Type A Filter

(a) Type A filter material for use in subsoil, foundation, and sub-pavement (trench) drains and for Type B drainage mats.

(b) Type B filter material for use in subsoil, foundation and sub-pavement (trench) drains.

Type B Filter

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

Type C Filter

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

Type D Filter

Grading

2. Material requirements and gradings for each type of filter material are included in the Construction Specification, SUBSURFACE DRAINAGE GENERAL – C221, and shall be noted on the design drawings.

Permeability

3. The type of filter material specified to backfill the sub-surface drainage trenches (subsoil, foundation and sub-pavement drains) shall depend on the permeability of the pavement layers and/or subgrade and the expected flow rate. Generally, Type A filter material is used for the drainage of highly permeable subgrade or pavement layers such as crushed rock or coarse sands, while Type B filter material is used for the drainage of subgrade and pavement layers of lower permeability such as clays, silts or dense graded gravels. Further guidance to the selection of appropriate filter material is contained in ARRB Special Report 35.

D4.13 GEOTEXTILE

Separation

1. Geotextile shall be provided, and detailed on the drawings, to provide separation (ie. prevent infiltration of fines) between the filter material in the trench and the subgrade or pavement material. Geotextile shall be designated to encapsulate the filter material. The geotextile shall comply with the requirements included in the Construction Specification, SUBSURFACE DRAINAGE GENERAL – C221.

Encapsulation

2. All subsoil drainage systems, including but not limited to, both Type A and Type B Drainage Mats, shall be encapsulated in geotextile.

DOCUMENTATION

D4.14 DESIGN DRAWINGS AND CALCULATIONS

Submission Details

1. The proposed location of all subsurface drains shall be clearly indicated on the Design Drawings, including the nominal depth and width of the trench, and the location with respect to the line of the kerb/gutter or edge of pavement. Details shall be shown on a typical cross sectional drawing. The location of outlets and cleanouts shall also be indicated on the Drawings.

Geotechnical Reports

2. Geotechnical reports, assumptions and/or calculations used in the design of subsurface drainage shall be supplied to Council for approval with the Design Drawings.

SPECIAL REQUIREMENTS

D4.15 RESERVED

D4.16 RESERVED

D4.17 RESERVED

D4.18 RESERVED

COONAMBLE SHIRE COUNCIL

COONAMBLE DEVELOPMENT DESIGN SPECIFICATION

D5

STORMWATER DRAINAGE DESIGN

VERSION 3.1 – JANUARY 2022

Amendment Record for this Specification Part

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Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
A	**Initial issue**			**DJ**	**JAN 2022**

CONTENTS

CLAUSE **PAGE**

DESIGN MANUAL D5
STORMWATER DRAINAGE DESIGN

GENERAL

D5.01 SCOPE

1. The work to be executed under this Specification consists of the design of stormwater drainage systems for urban and rural areas.

D5.02 OBJECTIVES

1. The objectives of stormwater drainage design are as follows:

Design Objectives Major Works

(a) To prevent flood damage to the built and natural environment and prevent both short term and long term inundation of dwellings.

(b) To minimize the risks to the public of exposure to high velocity flows or dangerously deep water bodies during or as a consequence of rainfall events.

(c) To contain nuisance flows to a level that is acceptable to the community.

(d) To ensure the street system operates adequately during and after major storm events.

Design Objectives Minor Works

(e) To provide a stormwater system that minimises erosion and utilises open space in a manner that does not detract from its principal function.

(f) To protect the environmental values and physical characteristics of receiving watercourses.

The objectives of minor drainage design are as follows:

(a) To prevent stormwater damage to property.

(b) To provide a stormwater system that can be maintained economically.

(c) To minimise the occurrence of traffic accidents during minor storm events.

Design Principles

(d) To minimise increases in stormwater run-off and protect the environmental values and physical characteristics of receiving watercourses from degradation by urban run-off.

New Developments

2. In pursuit of these objectives, the following principles shall apply:

(a) New Developments are to provide a stormwater drainage system in accordance with the "major/minor" system concept set out in Chapter 14 of Australian Rainfall & Runoff, 2003 (AR&R); that is, the "major" system shall provide safe, well-defined overland flow paths for rare and extreme storm runoff events while the "minor" system shall be capable of carrying and controlling flows from frequent runoff events.

Re-Development

(b) Redevelopment - Where the proposed development replaces an existing development, the on-site drainage system is to be designed in such a way that the estimated peak flow rate from the redeveloped site for the design storm event does not exceed that which would be expected from the existing development subjected to the same design event.

Water Sensitive Design

3. All stormwater design shall be undertaken in accordance with the principles for Water Sensitive Design. The City of Greater Dandenong has adopted a best practice environmental management approach in regard to the operation and maintenance of the stormwater management systems and proposes to improve stormwater quality by:

- Assessing and planning operational activities which have potential to affect stormwater quality or quantity
- Development of stormwater management plans
- Planning for new developments and assessing development applications
- Planning and designing new drainage infrastructure
- By identifying opportunities to upgrade existing infrastructure to improve environmental performance

4. All stormwater systems donated to Council through the subdivisional and development process achieve their design lives due to the application of quality design and construction practices.

D5.03 REFERENCE AND SOURCE DOCUMENTS

(a) Council Specifications

C220 - Stormwater Drainage - General
C221 - Pipe Drainage
C222 - Precast Box Culverts
C223 - Drainage Structures
C224 - Open Drains including Kerb & Channel
City of Greater Dandenong Subdivision Checklist
Dandenong Planning Scheme Clause 56.09
City of Greater Dandenong Sustainable Stormwater Strategy City of Greater Dandenong Handbook of Drainage Design Guidelines
City of Greater Dandenong Water Sensitive Urban Design Guidelines and Specifications

(b) Australian Standards

AS 1254 - Unplasticised PVC (uPVC) pipes and fittings for stormwater or surface water applications.
AS 2032 - Code of practice for installation of uPVC pipe systems.
AS/NZS 2566.1 - Buried flexible pipelines, structural design
AS 3725 - Loads on buried concrete pipes.
AS 4058 - Precast concrete pipes.
AS 4139 - Fibre reinforced concrete pipes and fittings.

(c) VIC State Authorities

VicRoads - Road Design Guidelines.

(d) Other

CSIRO - Urban Stormwater – Best Practice Environmental Management and Guidelines 1999

AUSTROADS - Bridge Design Code.

Inst. of Eng. - Australian Rainfall and Runoff (AR&R) - A guide to flood estimation 2003.

Concrete Pipe Association of Australia
- Concrete Pipe Guide, charts for the selection of concrete pipes to suit varying conditions.

Henderson, FM.Open Channel Flow, 1966.

John Argue - Australian Road Research Board Special Report 34
- Stormwater drainage design in small urban catchments: a handbook for Australian practice.

Kingston City Council and Melbourne Water:2003 – Keeping our Stormwater Clean – A Guide for Building Sites

HYDROLOGY

D5.04 DESIGN RAINFALL DATA

I-F-D Relationships

1. Design Intensity-Frequency-Duration (IFD) Rainfall - IFD relationships shall be derived in accordance with Volume 1 Chapter 2, of AR&R, for the particular catchment under consideration.

2. The nine basic parameters read from Maps 1-9 in Volume 2 of AR&R shall be shown in the calculations submitted to Council, except where the Bureau of Meteorology provides a polynomial relationship for the catchment.

3. Where design IFD rainfalls are provided for specific locations these are provided in Council's current Handbook of Drainage Design Guidelines.

Average Recurrence Intervals

4. Design Average Recurrence Interval (ARI) Annual Exceedence Probability (AEP) - For design under the "major/minor" concept, the design ARIs or AEPs to be used are given below.

Storm Frequency and Coefficient of Run-off			
Development	**Coefficient of**	**Storm Frequency**	**AEP**
Residential lots			
Gross densities < 20 lots/ha	0.60	1 in 5 years	*.181*
Gross densities > 20 lots/ha	0.60	1 in 10 years	*.095*
Multi-Unit site	0.75	1 in 10 years	.095
Industrial	0.90	1 in 20 years	.049
Garden Industrial	0.75	1 in 20 years	.049
Commercial	0.90	1 in 100 years	.01
Roads	0.80	As per relevant area	
Pervious areas	0.20	As per relevant area	

Table D5.0

Easements in Private Property

5. In addition, where a development is designed in such a way that the major system flows involve surcharge, then the underground system (both pipes and inlets) shall be designed to permit flows into and contain flows having an ARI of 1 in 100 years or AEP of .01 from the upstream catchment which would otherwise flow across the property. A surcharge path shall be defined for systems even where1 in 100 year ARI or AEP of .01 flows can be maintained within the system. Surcharge paths shall only be provided across public land and will not be permitted over private property.

D5.05 CATCHMENT AREA

Catchment Definition

1. The catchment area of any point is defined by the limits from where surface runoff will make its way, either by natural or built paths, to this point. Consideration shall be given to likely changes to individual catchment areas due to the full development of the catchment.

2. Where no detailed survey of the catchment is available, 1:4000 orthophoto maps are to be used to determine the catchments and to measure areas.

3. Catchment area land use shall be based on current available zoning information or proposed future zonings, where applicable.

D5.06 RATIONAL METHOD

1. Rational Method calculations to determine peak flows shall be carried out in accordance with Volume 1, Chapter 14, of AR&R and the requirements of this Specification.

2. All calculations shall be carried out by a qualified person experienced in hydrologic and hydraulic design. ***Qualified Person***

3. Coefficients of Run-off shall be calculated based on Volume 1, Chapter 14.5 of AR&R and the Council's Handbook of Drainage Design Guidelines. Full details of coefficients utilised shall be provided ***Runoff Coefficients***

4. Details of percentage impervious and Coefficients of Run-off for specific locations and for individual zonings are given in Council's current Handbook of Drainage Design Guidelines. These can be used in lieu of more detailed calculations.

5. The time of concentration of a catchment is defined as the time required for storm runoff to flow from the most remote point on the catchment to the outlet of the catchment. ***Times of Concentration***

6. Where the flow path is through areas having different flow characteristics or includes property and roadway, then the flow time of each portion of the flow path shall be calculated separately. ***Different Flow Characteristics***

7. The time of concentration in an urban area shall be 7 minutes minimum and 20 minutes maximum unless sufficient evidence is provided to justify a greater time.

8. Flow paths to pits shall be representative of the fully developed catchment considering such things as fencing and the likely locations of buildings and shall be shown for each collection pit on the catchment area plan. Consideration shall be given to likely changes to individual flow paths due to the full development of the catchment. ***Flow Paths to Pits***

9. Surface roughness coefficients "n" shall generally be derived from information in Volume 1, Chapter 14 of AR&R and the City of Greater Dandenong Drainage Design Guidelines. ***Overland Flow Retardance***

D5.07 COMPUTER MODELS

1. Where computer analysis programs are used, copies of the final data files shall be provided on submission of the design to Council and with the final drawings after approval by Council. ***Files to Council***

2. Any computer analysis for stormwater design shall be compatible with the current City of Greater Dandenong requirements and produce a report in a format approved by Council. ***Compatibility***

HYDRAULICS

D5.08 HYDRAULIC GRADE LINE

1. Hydraulic calculations shall generally be carried out in accordance with AR&R and shall be

Qualified Person

undertaken by a qualified person experienced in hydrologic and hydraulic design. The calculations shall substantiate the hydraulic grade line adopted for design of the system and shown on the drawings. Summaries of calculations are added to the plan and details of all calculations are given including listings of all programme input and

output.

Calculations

2. The "major" system shall provide safe, well-defined overland flow paths for rare and extreme storm runoff events while the "minor" system shall be capable of carrying and controlling flows from frequent runoff events.

3. Downstream water surface level requirements are given below:- ***Downstream Control***

(a) Known hydraulic grade line level from downstream calculations including pit losses at the starting pit in the design event.

(b) Where the downstream starting point is a pit and the hydraulic grade line is unknown, the obvert level of the pipe at the downstream pit is to be adopted.

(c) Where the outlet is an open channel and the design storm is the minor event, the top of the outlet pipe shall be the downstream control.

(d) Where the outlet is an open channel, the design storm is the major event and downstream flood levels are not known, the top of the outlet pipe shall be the downstream control.

(e) Where the outlet is an open channel, the design storm is the major event and downstream flood levels are known, the downstream control shall be the 1% probability flood level.

D5.09 MINOR SYSTEM CRITERIA

1. The acceptable channel flow widths in the 20% probability event is 2.5 metres maximum. Wider flow widths may be approved on roads with flat grades. ***Channel Flow Widths***

2. Minimum conduit sizes shall be as follows: ***Conduit Sizes***

- Pipes 225mm diameter.
- Pipes under roads 300mm diameter
- Box Culverts 600mm wide x 300mm high. (To be used in special circumstances only)

3. Minimum and maximum velocity of flow in stormwater pipelines shall be 1.0m/sec and 3m/sec respectively. ***Velocity Limits***

4. The maximum rate of discharge at the entry point to a Melbourne Water drainage system shall be 0.3m/sec.

D5.10 PITS

1. Side Entry Pits shall be spaced so that the channel flow width is limited in accordance with this Specification and so that the inlet efficiency is not affected by adjacent inlet openings. Preference shall be given to the location of drainage pits at the upstream side of allotments. ***Spacing***

2. Other pits shall be provided:

- To enable access for maintenance.
- At changes in direction, grade, level or class of pipe.
- At junctions.

3. The maximum recommended spacing of pits, other than site entry pits, are given in Table D5.1 below:

	Pipe Size (mm)	Spacing (m)
Generally	less than 1200	45 to 90
	1200 or larger	150
In tidal influence	all	100

Table D5.1 Pit Spacing

4. Kerb inlet lengths to side entry pits are to be a preferred maximum of 3.0m, with an absolute maximum of 5.0m where the grade is 10% or more, and an absolute maximum of 4.0m where the grade is less than 10%. Throat width and slope of throat shall comply with Council's standard drawings. In adopting these standards the Designer shall take into account the risk to both Council and the public as well as public safety.

Inlet Capacity

Throat Width

5. Information on pit capacities is available in the following sources:-

- Council's current Handbook of Drainage Design Guidelines.
- VicRoads Road Design Guidelines, with due allowance to inlet bypass due to grade, for grade inlet pits, and recognised orifice or weir formulae for sag inlet pits.
- Pit relationships given in Volume 1, Chapter 14 of AR&R.

6. None of these pit charts include any blockage factors. The percentage of theoretical capacity allowed in relation to type of pit is given in Table D5.2 below:-

Allowance for Inlet Blockage

Condition	Inlet Type	Percentage of Theoretical Capacity Allowed
Sag	Side entry	80%
Sag	Grated	50%
Sag	Combination	Side inlet capacity only Grate assumed completely blocked
Continuous Grade	Side entry	80%
Continuous Grade	Grated	50%
Continuous Grade	Combination	90%

Table D5.2 Allowable Pit Capacities

7. A "Pit Schedule" shall be submitted detailing the pit number, pit size, inlet pipe (S) diameter, outlet pipe diameter, invert levels of all pipes and finished surface levels.

Pit Schedule

D5.11 HYDRAULIC LOSSES

1. The pressure change co-efficient "Ke" shall be determined from the appropriate charts given in council's current Handbook of Drainage Design Guidelines.

Pit Losses

2. Allowable reduction in "Ke" due to benching is given in Council's current Handbook of Drainage Design Guidelines.

3. Computer program default pressure change coefficient "Ke" shall not be acceptable unless they are consistent with those from the charts in Council's current Handbook of Drainage Design Guidelines. The chart used and relevant coefficients for determining "Ke" value from that chart shall be noted on the hydraulic summary sheet provided for plan checking and included on the final design drawings.

Bend Losses

4. Bends may be permissible in certain circumstances and discussions with Council regarding their use is required prior to detailed design. Appropriate values of pit pressure change coefficient at bends are given in Council's current Handbook of Drainage Design Guidelines.

Service Entry Losses

5. Where possible design should try to avoid clashes between services. However, where unavoidable clashes occur with existing sewer mains then the pressure change coefficient Kp shall be determined from the chart given in Council's current Handbook of Drainage Design Guidelines.

6. Requirements for private pipes entering Council's system are given below:-

Junction Pits

(a) All pipe inlets, including roof and subsoil pipes, shall where possible, enter the main pipe system at junction pits. These shall be finished off flush with and be grouted into the pit wall.

(b) If a junction has to be added which is larger than 225mm then a junction pit shall be built at this location in accordance with this Specification.

Breaking In

(c) For smaller inlets, the drainage pipes may be broken into to allow interconnection with the main line. In this case the sideline shall be finished flush with and be grouted into the main line.

(d) Collars shall be fitted in accordance with the requirements set out on the standard drawing.

Pipe Junction Losses

7. Construction of a junction without a structure should be avoided where possible. Permission to do this is required by Council prior to detailed design. Where this is unavoidable the pressure change coefficients Ku, for the upstream pipe and Kl, for the lateral pipe, shall be determined from the chart given in Council's current Handbook of Drainage Design Guidelines.

Contraction/ Expansion Losses

8. Going from larger upstream to smaller downstream conduits is not permitted without approval of Council prior to detailed design. In going from smaller to larger pipes benching shall be provided in pits to enable a smooth flow transition. Losses in sudden expansions and contractions are given in Council's current Handbook of Drainage Design Guidelines.

Pipe Friction Losses

9. Drainage pipe systems shall be designed as an overall system, with due regard to the upstream and downstream system and not as individual pipe lengths. Drainage pipeline systems shall generally be designed as gravity systems flowing full at design discharge. Pipe friction losses and pipe sizes in relation to discharge shall be determined using the appropriate references including the Council Drainage Design Handbook and acceptable roughness coefficients being 0.6mm for concrete pipes and 0.06mm for FRC pipes.

Property Drains

10. Property drains shall be 100mm PVC sewer class from residential properties and 225mm diameter minimum for industrial property drains. When residential drains are connected to kerb and channel they are to be located 5m from the side property boundary. The connection shall be via a rectangular kerb entry adaptor and shall be a welded solvent joint. The location of the drain shall be marked on the face of the kerb with an “H”. Industrial property drains shall only be connected to the underground drain and for large allotments the diameter shall be determined by calculation.

D5.12 MAJOR SYSTEM CRITERIA

Surcharging

1. Surcharging of drainage systems which would provide for water depth above the top of kerb will not be permitted except:

(a) Surcharging of drainage system for storm frequencies greater than 5% probability may be permitted across the road centreline where the road pavement is below the natural surface of the adjoining private property.

(b) Flow across footpaths will only be permitted in situations specifically approved by Council, where this will not cause flooding of private property.

(c) Surface water flow may be permitted where water depth and velocity even under the most severe rainfall event conditions can be kept within safe standards and the public not endangered. In this situation the maximum depth of flow is .35m and maximum flow velocity 1.5m/s

Velocity/ Depth Criteria

2. The velocity x depth product of flow across the footpath and within the road reserve shall be such that safety of children and vehicles is considered. The maximum allowable depth of water is 0.2 metres and the maximum velocity x depth product of $0.4m^2/s$ is permitted. Where the safety of only vehicles can be affected, a maximum velocity x depth product of $0.6m^2/s$ is permitted. In open channels the above velocity x depth product criteria will be followed where possible or the design shall address the requirements for safety in relation to children by providing safe egress points from the channel or other appropriate methods.

Freeboard

3. Freeboard requirements are set to ensure that valuable buildings and their contents and people in them are safely above the 100 year flood level. Lower freeboard requirements are established for outbuildings on the basis that their contents and uses are not as important

In determining the importance of assets and hence the appropriate freeboard, the following matters should be considered:
Whether essential or valuable assets or equipment is to be kept or installed on the lowest level of the building;
The nature of the use of any basements where provided;
The nature value and use of any outbuildings; and
The treatment of small extensions and garages where an existing building is less than the required freeboard height above the 1:100 year flood level.

Freeboard for floor levels and levee bank levels from flood levels in roadways stormwater surcharge paths and open channels are given below:

In Roadways:-

(a) A minimum freeboard of 0.3m shall be provided between the 100 year flood level and floor levels on structures and entrances to underground car parks. A higher freeboard may be required in certain circumstances.

(b) Where the road is in fill or overtopping of kerbs and flow through properties may occur a 100mm freeboard shall be provided between the ponding level of water in the road and the high point in the footpath. Driveway construction in these instances needs to consider this requirement.

In Stormwater Surcharge Paths:-

(c) A minimum freeboard of 0.3 shall be provided between the 100 year flood level and floor levels on structures and entrances to underground car parks.

In Open Channels:-

(d) A minimum freeboard of 0.3m shall be provided between the 100 year flood level and floor levels on structures and entrances to underground car parks. The design plans shall clearly show all flood levels, amount of freeboard and other relevant information.

In Flood Plains

(e) A minimum freeboard of 0.6m shall be provided between the 100 year flood level and floor levels on structures and entrances to underground car parks. These requirements are considered necessary to address the following floodplain characteristics, Flood surges, wave and wind effects or backwater curve problems due to tidal effects;
Larger than predicted flood flows and higher flood levels due to inaccurate rainfall intensity and flood flow estimations;
Requirement to address essential services provision or other sensitive activities which demand no diminution of site access and occupation safety.

The design plans shall clearly show all flood levels, amount of freeboard and other relevant information.

Outbuildings which are not to be occupied and will only be used for storage of low value items may have floor levels set at half the freeboard height requirements of the above cases.

Roadway Capacities

4. Road capacity charts are provided in the Council's current Handbook of Drainage Design Guidelines for some standard road designs. For other road designs, flow capacities of roads should be calculated using Technical Note 4 in Volume 1, Chapter 14 of AR&R with a flow adjustment factor as given in Council's current Handbook of Drainage Design Guidelines.

Downstream Flows

5. The drainage system shall be designed to ensure the flows downstream of the site are restricted to predevelopment levels unless increased flows are approved by Melbourne Water. The built environment downstream of the proposed development shall

not be degraded by major drainage flows or floodwaters.

6. The drainage system should be designed to ensure that the land form of water courses is stabilised and that erosion is minimised. ***No Erosion***

7. Floodways must be restricted to areas where no damage to property can occur and must discharge all gap flows. Roadways may be used as floodways provided the flow depth and velocities do not create hazards for motorists.

D5.13 a. OPEN CHANNELS

1. Generally, open channels will only be permitted where they form part of the trunk drainage system and shall be designed to have smooth transitions with adequate access provisions for maintenance and cleaning. Where Council permits the use of an open channel to convey flows from a development site to the receiving water body, such a channel shall comply with the requirements of this Specification. ***Safety***

2. Design of open channels shall be in accordance with Volume 1, Chapter 14, of AR&R. Open channels will be designed to contain the major system flow less any flow that is contained in the minor system, with an appropriate allowance for blockage of the minor system.

3. Friction losses in open channels shall be determined using Mannings "n" values given below:- ***Channel Roughness***

Mannings "n" Roughness Coefficients for open channels shall generally be derived from information in Chapter 14 of AR&R. Mannings "n" values applicable to specific channel types are given below:-

Concrete Pipes or Box Sections	0.011
Concrete (trowel finish)	0.014
Concrete (formed without finishing)	0.016
Sprayed Concrete (gunite)	0.018
Bitumen Seal	0.018
Bricks or pavers	0.015
Pitchers or dressed stone on mortar	0.016
Rubble Masonry or Random stone in mortar	0.028
Rock Lining or Rip-Rap	0.028
Corrugated Metal	0.027
Earth (clear)	0.022
Earth (with weeds and gravel)	0.028
Rock Cut	0.038
Short Grass	0.033
Long Grass	0.043

4. Where the product of average Velocity and average flow Depth for the design flow rate is greater than $0.4m^2/s$, the design will be required to specifically provide for the safety of persons who may enter the channel in accordance with Volume 1, Chapter 14, of AR&R.

5. Maximum side slopes on grassed lined open channels shall be 1 in 4, with a preference given to 1 in 6 side slopes, channel inverts shall generally have minimum cross slopes of 1 in 20. ***Side Slopes***

6. Low flow provisions in open channels (man-made or altered channels) will require low flows to be contained within a pipe system or concrete lined channel section at the invert of the main channel. Subsurface drainage shall be provided in grass lined channels to prevent waterlogging of the channel bed. The width of the concrete lined channel section shall be the width of the drain invert or at least sufficiently wide enough to accommodate the full width of a tractor. ***Low Fl***

7. Transition in channel slopes to be designed to avoid or accommodate any hydraulic jumps due to the nature of the transition. ***Hydraulic Jumps***

5.13 b. SWALE DRAINS

1. Swale drains will be permitted where they form part of a Water Sensitive Urban Design Treatment Train and shall be designed to be suitably connected to other drainage assets with adequate access provisions for maintenance and cleaning. Where Council permits the use of a swale to convey and treat flows from a development site, such a swale shall comply with the requirements of this Specification.

2. Design of swale shall be in accordance with Chapter 8 of *WSUD Engineering Procedures: Stormwater*. Swale will be designed to convey minor flood rates, with an overflow for greater flows.

3. The overflow system will be designed to allow major flows to be safely conveyed and not increase any flood risk compared to conventional stormwater systems with an appropriate allowance for blockage (i.e 50%).

4. Flow velocities within the swale should not:
    - Exceed $0.5 m.s^{-1}$ for minor storm flow rates;
    - Exceed $1.0 m.s^{-1}$ for major storm flow rates;

5. Friction losses in open channels shall be determined using Mannings "n" values given below:-

    Mannings "n" Roughness Co-efficients for swale shall generally be derived from information in Chapter 14 of AR&R. Mannings "n" values applicable to specific vegetation types are given below:
    - Short Grass 0.033
    - Long Grass 0.043

6. Where the average flow Depth for the design flow rate is greater than 0.35m or where the product of average Velocity and average flow Depth for the design flow rate is greater than $0.35 m^2.s^{-1}$, the design will be required to specifically provide for the safety of persons who may enter the swale.

7. Maximum side slopes of swale shall be 1 in 3, with a preference given to 1 in 6 side slopes, channel inverts shall generally have minimum longitudinal slopes of 1 in 100 and maximum longitudinal slope of 1 in 25.

8. Subsurface drainage shall be provided in swale to prevent waterlogging of the channel bed where the longitudinal slope is less than 1 in 80.

9. A minimum 100mm set down must be provided between the top of the ground surface (before turf/vegetation is placed) and the road surface (or any adjacent impervious surface) to allow for sedimentation accumulation.

10. A minimum 50mm set down below the road surface must be provided following construction.

D5.14 MAJOR STRUCTURES

1. All major structures in urban areas, including bridges and culverts shall be designed for the 100 year ARI storm event without afflux. Some afflux and upstream inundation may be permitted in certain rural and urban areas provided the increased upstream flooding is minimal and does not inundate private property. ***Afflux***

2. A minimum clearance of 0.3m between the 100 year ARI flood level and the underside of any major structure superstructure is required to allow for passage of debris without blockage. ***Freeboard***

3. Certified structural design shall be required on bridges and other major culvert structures and may be required on some specialised structures. ***Structural Design***

D5.15 a. RETARDING BASINS – COUNCIL CONTROLLED

1. For each ARI a range of storm events shall be run to determine the peak flood level and discharge from the retarding basin. Storm patterns shall be those given in Volume 1, Chapter 11 of AR&R. Sensitivity to storm pattern should be checked by reversing these storm patterns. ***Critical Storm Duration***

2. The critical storm duration with the retarding basin is likely to be longer than without the basin. A graph showing the range of peak flood levels in the basin and peak discharges from the basin shall be provided for the storms examined.

3. Flood Routing should be modelled by methods outlined in AR&R. ***Routing***

4. The high level outlet to any retarding basin shall have capacity to contain a minimum of the 100 year ARI flood event. Additional spillway capacity may be required due to the hazard category of the structure. The hazard category should be determined by reference to ANCOLD. ***High Level Outlet***

5. The spillway design shall generally be in accordance with the requirements for Open Channel Design in this Specification.

6. Wherever practical and certainly in areas known to be affected by high water tables and/or salinity of groundwater, retarding basins shall be designed to be water retentive so that surface drainage water does not leak to the subsurface, recharging groundwater. ***Salinity Prevention***

7. Pipe systems shall contain the minor flow through the Retarding Basin wall. Outlet pipes shall be rubber ring jointed with lifting holes securely sealed. Pipe and culvert bedding shall be specified to minimise its permeability, and cut off walls and anti seepage collars installed where appropriate. ***Low Flow Provision***

8. The low flow pipe intake shall be protected to prevent blockages.

9. Freeboard - Minimum floor levels of dwelling shall be 300mm above the 100 year ARI flood level in the basin. ***Freeboard at Dwellings***

10. Public Safety Issues - Basin design is to consider the following aspects relating to public safety. ***Safety Issues***

- Side slopes are to be a maximum of 1 in 6 to allow easy egress. Side slopes of greater than 1 in 4 may require handrails to assist in egress. Where handrails or grab rails are required then they must be designed in accordance with AS 1428.4

- Water depths shall be, where possible, less than 1.2m in the 20 year ARI storm event. Where neither practical or economic greater depths may be acceptable. In that case the provision of safety refuge mounds should be considered.

- The depth indicators should be provided indicating maximum depth in the basin.

- Protection of the low flow intake pipe shall be undertaken to reduce hazards for people trapped in the basin.

- Signage of the spillway is necessary to indicate the additional hazard.

- Basins shall be designed so that no ponding of water occurs on to private property or roads.

- Planting of trees in basin walls is allowed subject to Council approval.

5.15 b. SEDIMENTATION BASIN – COUNCIL CONTROLLED

1. Sedimentation basins will be permitted where they form part of a Water Sensitive Urban Design Treatment Train and shall be designed to be suitably connected to other drainage assets with adequate all-weather access provisions for maintenance and cleaning. Where Council permits the use of a sedimentation basin to treat flows from a development site, such a sedimentation basin shall comply with the requirements of this Specification.

2. Design of sedimentation basin shall be in accordance with Chapter 4 of *WSUD Engineering Procedures: Stormwater* and Melbourne Water's *Constructed Wetland Guidelines*. Sedimentation basin will be designed to contain design flows (generally 1 in 1 year), with an overflow system for greater flows.

3. The overflow system (generally a weir) will be designed to allow major flows to be safely conveyed and not increase any flood risk compared to conventional stormwater systems with an appropriate allowance for blockage (i.e 50%). Sedimentation basin shall not be designed to have a high flow bypass to ensure that some level of treatment is achieved even during high flow condition.

4. The restricted discharge outlet shall be placed at least 300mm below the invert level of the overflow system.

5. Flow velocities within the sedimentation basin should not:
    - Exceed $0.3 m.s^{-1}$ for design flow rates;
    - Exceed $0.5 m.s^{-1}$ for minor storm flow rates.

6. Maximum batter slopes of sedimentation basin shall be 1 in 3, with a preference given to 1 in 6 side slopes.

7. A buffer zone of 20m minimum shall surround a sedimentation basin from the nearest development.

8. Surrounding soil conditions (e.g. contamination, poor infiltration capacity) may pre-requisite the use of an impervious liner.

9. The depth of the sedimentation basin shall be a minimum of 1.5m and sufficient storage shall be provided for accumulated sediment not to exceed two-third of the sediment sump for a period of less than 5years.

10. Mechanisms to isolate and drain the sedimentation basin to allow maintenance operations shall be designed.

11. The outlet structure(s) of the sedimentation basin shall be designed and located so that they are easily identifiable and maintained. Outlets shall be accessible from the bank of the basin, with inlets to the orifices submerged to minimise clogging. Any submerged outlet pipes will be clearly marked.

12. The base of the sediment sump shall be designed as a hard structure (e.g. concrete slab) to facilitate maintenance operations.

13. Adequate area shall be allocated for dewatering and short term storage of removed sediments.

14. Sedimentation basins are regarded as impoundments and normal dam safety requirements should be met. Sedimentation basin shall be constructed in accordance with the requirements of Melbourne Water and the Department of Sustainability and Environment.

15. Depth indicators shall be provided indicating maximum depth in the sedimentation basin.

16. Appropriate safety measures shall be provided to minimise risk associated with the sedimentation basin.

D5.16 STORMWATER DETENTION

1. Installation of Stormwater Detention is required on redevelopment sites within the City where under capacity drainage systems exist. A redevelopment site is defined as a site which used to have or was originally zoned to have a lower density development than is proposed.

Re-development

2. Location of basins for stormwater detention, stormwater treatment or sedimentation purposes shall avoid areas that are known to be permanent or seasonal groundwater discharge areas. This action reduces the likelihood of recharge into the groundwater.

Salinity Prevention

3. The requirements for Stormwater Detention Design are outlined in the Council's current Handbook for Drainage Design Guidelines.

D5.17 BIO- RETENTION SYSTEMS

(Raingardens, Tree-pits etc.)

1. Bio-retention systems will be permitted where they form part of a Water Sensitive Urban Design Treatment Train and shall be designed to be suitably connected to other drainage assets with adequate access provisions for maintenance and cleaning. Where Council permits the use of a bio-retention system to treat flows from a development site, such a bio-retention system shall comply with the requirements of this Specification.

2. Design of bio-retention shall be in accordance with Chapter 6 of *WSUD Engineering Procedures: Stormwater*. Bio-retention will be designed to contain design flows (generally 1 in 3months), with an overflow system for greater flows.

3. The overflow system will be designed to allow minor flows to be safely conveyed and not increase any flood risk compared to conventional stormwater systems with an appropriate allowance for blockage (i.e 50%). The invert level of the overflow pits shall be placed at least 100mm below the invert level of the inlet (e.g. street gutter).

4. Flow velocities within the bio-retention system should not:
    - Exceed 0.5m.s^{-1} for minor storm flow rates;
    - Exceed 1.0m.s^{-1} for major storm flow rates;

5. The filter media of the bio-retention system shall have a minimum depth of 400mm and a maximum depth of 1000mm.

6. The filter media shall:
    - Provide a hydraulic conductivity between 100mm/hr and 200mm/hr;
    - Have a saturated hydraulic conductivity 10 times greater than that of the surrounding soils when in close proximity to structures (e.g. roads);
    - Have an organic content between 5% and 10%, measured in accordance with AS1289 4.1.1 - 1997
    - Preferably have a pH ranging between 6.0 to 7.5.

7. The drainage layer surrounding the perforated underdrainage pipes shall be a minimum of 150mm thick and preferably 200mm thick. It can be either coarse sand (1mm) or fine gravel (2-5mm). Should fine gravel be used, a transition layer of sand or a geotextile fabric will be required to prevent any filtration media being washed into the perforated pipes.

8. Native vegetation shall be used, in accordance with the guidelines.

9. The perforated underdrainage pipe(s) shall be sized so that the filtration media are freely drained.

10. Surrounding soil conditions (e.g. contamination, poor infiltration capacity) may pre-requisite the use of an impervious liner.

5.18 CONSTRUCTED WETLAND

1. Constructed wetlands will be permitted where they form part of a Water Sensitive Urban Design Treatment Train and shall be designed to be suitably connected to other drainage assets with adequate access provisions for maintenance and cleaning. Where Council permits the use of a constructed wetland to treat flows from a development site, such a constructed wetland shall comply with the requirements of this Specification.

2. Design of constructed wetland shall be in accordance with Chapter 9 of *WSUD Engineering Procedures: Stormwater* and Melbourne Water's *Constructed Wetland Guidelines*. Constructed wetland will be designed to contain design flows (generally 1 in 1 year), with a bypass system for greater flows.

3. The bypass system will be designed to allow minor flows to be safely conveyed and not increase any flood risk compared to conventional stormwater systems with an appropriate allowance for blockage (i.e 50%). If the constructed wetland forms part of the major drainage system, the bypass system will be designed to allow major flows to be safely conveyed and not increase any flood risk compared to conventional stormwater systems.

4. Batter slopes in the extended detention zone shall be a minimum of 1 in 6 side slopes.

5. Batter slopes in the macrophyte zone below normal water level shall be 1 in 8 side slopes.

6. Maximum batter slopes of inlet and outlet ponds below normal water level shall be 1 in 3, with a preference given to 1 in 6 side slopes.

7. The extended detention depth shall be a maximum of 500mm above normal water level.

8. Flow velocities within the macrophyte zone of the constructed wetland should not exceed $0.05 m.s^{-1}$ for design flow rates.

9. The detention time in the macrophyte zone of the constructed wetland shall be ideally 72hrs, with a minimum detention time of 48hrs.

10. A minimum of 150mm of topsoil with a minimum 5% organic content, measured in accordance with AS1289 4.1.1, will be provided throughout the macrophyte zone and adjacent fringing ephemeral areas to assist the establishment of the aquatic macrophyte vegetation.

11. A minimum of 80% coverage of emergent macrophyte vegetation will be provided within the macrophyte zone (below the normal water level).

12. Constructed wetland shall be designed so as to reduce mosquito breeding capacity and favour their predation.

13. A buffer zone of 20m minimum shall surround the constructed wetland from the nearest development.

14. Surrounding soil conditions (e.g. contamination, poor infiltration capacity) may pre-requisite the use of an impervious liner.

15. The outlet structure(s) of the constructed wetland shall be designed and located so that they are easily identifiable and maintained. Outlets shall be accessible from the bank of the wetland, with inlets to the orifices submerged to minimise clogging. Any submerged outlet pipes will be clearly marked.

16. Appropriate safety measures shall be provided to minimise risk associated with the constructed wetland.

17. Depth indicators shall be provided indicating maximum depth in the constructed wetland.

D5.19 INTERALLOTMENT DRAINAGE

1. Interallotment Drainage shall be provided for every allotment which does not drain directly to its frontage street, a constructed easement drain or a natural watercourse. All allotments shall be designed to drain either to the street frontage or a suitable easement drain.

DETAILED DESIGN

D5.20 CONDUITS

1. Conduits and materials shall be in accordance with the standards detailed in Council's current Handbook for Drainage Design Guidelines. ***Materials***

2. Pipe bedding and cover requirements for reinforced and fibre reinforced concrete pipes shall be determined from the Concrete Pipe Association "Concrete Pipe Guide" or AS 3725. For uPVC pipes, the requirements shall be to AS 2032. ***Bedding and Cover***

3. The design and selection of the pipe material and class must consider the ***Const***

appropriate construction loadings that will be applicable to the development site. ***Loading***

4. Conduit jointing shall be in accordance with Council's current Handbook for Drainage Design Guidelines. ***Jointing***

5. Drainage lines in road reserves shall generally be located behind the kerb line and parallel to the kerb. Drainage lines in easements shall generally be centrally located within easements. ***Location***

6. Bulkheads shall be designed on drainage lines where the pipe gradient exceeds 5 per cent. The design details shall address the size, and position in the trench as well as spacing along the line. ***Bulkheads***

ADVICE TO THE DEVELOPER'S DESIGNER
BURIED FLEXIBLE DRAINAGE PIPES

Particular situations may be identified during the design of a development for the use of buried flexible pipes instead of the pipes specified in Council's Handbook or the AUS-SPEC Specification C221 for PIPE DRAINAGE.

In such cases, the Developer's Designer will be required to select the flexible pipe type appropriate for the particular application and prepare the relevant technical specification clauses for supply and construction with reference to AS/NZS 2566.1, Buried flexible pipelines Part 1: Structural design. The proposed additional clauses would then be submitted by the Developer, as a variation to the development consent, for approval by Council. If use is approved, then the supply and construction specification clauses shall be inserted in the Special Requirements section of the AUS-SPEC Specification C221 for PIPE DRAINAGE.

D5.19 PIT DESIGN

1. Pits shall be designed with benching to improve hydraulic efficiency and reduce water ponding. Typical pit designs and other pit design requirements are included in Council's current Handbook for Drainage Design and Council's standard drawings. Safety and safe access are important considerations in pit design. Step irons shall be detailed where required and grates shall be of "bicycle safe" design.

D5.20 STORMWATER DISCHARGE

1. Stormwater discharge shall be located so as to avoid recharging groundwater and creating or worsening salinity degradation of adjacent land. Stormwater discharge shall be located to avoid areas with high groundwater tables, groundwater discharge areas or salt affected land. The Designer shall meet requirements of the appropriate land and water resources authority with regard to the salinity levels of discharge to natural watercourses. ***Salinity Prevention***

2. Scour protection at culvert or pipe system outlets shall be constructed in accordance with guidelines set down in Council's current Handbook of Drainage Design Guidelines unless outlet conditions dictate the use of more substantial energy dissipation arrangements. ***Scour Protection***

3. Kerb and channel shall be extended to drainage pit or natural point of outlet. Where outlet velocity is greater than 2.5m per second or where the kerb and channel discharge causes scour, then protection shall be provided to prevent scour and dissipate the flow. ***Kerb & Channel Termination***

4. At points of discharge of channels or stormwater drainage lines or at any concentration of stormwater from one or on to adjoining properties, either upstream or downstream, Council will

require the Developer to enter into a Deed of Agreement with the adjoining owner(s) granting permission to the discharge of stormwater drainage and

Outfall/ Easements Adjoining Owners

the creation of any necessary easements with the cost of the easement being met by the Developer.

5. Where the drainage is to discharge to an area under the control of another statutory authority eg, Melbourne Water, the design requirements of that Statutory Authority are also to be met by the Developer.

Other Authorities' Requirements

6. The minimum drainage easement width shall be 3.0m for drainage systems to be taken over by Council. The overall width of the easement in Council's favour will be such as to contain the full width of overland flow or open channel flow in the major system design event.

Council Easement

7. Subject to the consent of Council, piped stormwater drainage discharging to recreation reserves is to be taken to a natural water course and discharged in an approved outlet structure or alternatively taken to the nearest trunk stormwater line.

Recreation Reserves

DOCUMENTATION

D5.21 DRAWINGS

1. Catchment Area Plans shall be drawn to scales of 1:500, 1:4000 or 1:25000, unless alternative scales are specifically approved by Council and shall show contours, direction of grading of kerb and channel, general layout of the drainage system with pit locations, catchment limits and any other information necessary for the design of the drainage system.

Catchment Areas

2. The Drainage System Layout Plan shall be drawn to a scale of 1:500 and shall show drainage pipeline location, drainage pit location and number and road centreline chainage, size of opening and any other information necessary for the design and construction of the drainage system.

Drainage System Layout

3. The plan shall also show all drainage easements, reserves and natural water courses. The plan may be combined with the road layout plan.

4. The Drainage System Longitudinal Section shall be drawn to a scale of 1:500 horizontally and 1:50 vertically and shall show pipe size, class and type, pipe support type in accordance with AS 3725 or AS 2032 as appropriate, pipeline and road chainages, pipeline grade, hydraulic grade line and any other information necessary for the design and construction of the drainage system.

Longitudinal Section

5. Open Channel Cross Sections shall be drawn to a scale of 1:100 natural and shall show the direction in which the cross sections should be viewed. Reduced levels are to be to Australian Height Datum (AHD), unless otherwise approved by Council where AHD is not available. Cross sections may alternatively be provided on floppy disk in HEC2 format as a data input file for the design flow rates.

Open Channels

6. Details including standard and non-standard pits and structures, pit benching, open channel designs and transitions shall be provided on the Drawings to scales appropriate to the type and complexity of the detail being shown.

Details

7. Work-as-Constructed Drawings shall be submitted to the Council upon completion of the drainage construction. The detailed Drawings may form the basis of this information however, any changes must be noted on these Drawings.

Work-as-Constructed Drawings

8. All drawings submitted to the Council shall comply with the requirements of Appendix DQS-B.

D5.22 EASEMENTS AND AGREEMENTS

1. Evidence of any Deed of Agreement necessary to be entered into as part of the drainage system will need to be submitted prior to any approval of the Engineering Drawings. Easements will need to be created prior to the issue of the subdivision certificate.

2. Where an agreement is reached with adjacent landowners to increase flood levels on their property or otherwise adversely affect their property, a letter signed by all the landowners outlining what they have agreed to and witnessed by an independent person shall be submitted prior to any approval of the Engineering Drawings.

D5.23 SUMMARY SHEETS

1. A copy of a Hydrological Summary Sheet providing the minimum information set out in Council's current Handbook of Drainage Design Guidelines is required. ***Hydrology***

2. A copy of a Hydraulic Summary Sheet providing the minimum information set out in Council's current Handbook of Drainage Design Guidelines is required. ***Hydraulics***

D5.24 COMPUTER PROGRAM FILES AND PROGRAM OUTPUT

1. Computer program output may be provided as long as summary sheets for Hydrological and Hydraulic calculations in accordance with this Specification are provided with plans submitted for checking and with final Drawings.

2. Copies of final computer data files, for both hydrological and hydraulic models shall be provided for Council's data base of flooding and drainage information in formats previously agreed with Council. ***Hydraulic Models***

SPECIAL REQUIREMENTS

D5.25 GROSS POLLUTANT TRAPS

1. It is Council policy to reduce the volume of water borne pollutants such as industrial, commercial and domestic litter, vegetation and course sediments from entering water courses and streams, and eventually Port Phillip Bay via the underground drainage system by a program of installation of litter traps at strategic locations.

2. Where Council determines that an area is likely to have a “litter concentration” a gross pollutant trap shall be designed and installed by the Developer.

3. Any unit installed shall be capable of capturing all material larger than 20mm from all flows up to a storm with an average recurrence interval of three months (i.e. 0.9 cubic metres). The unit shall be capable of providing for the bypassing of stormwater flows in excess of the treatment capacity of the unit. The bypass shall protect the operational integrity of the drainage system during floods and be designed such that scour and/or re-suspension of pollutants previously collected does not occur during periods of high flow or bypass flow conditions. The unit shall be designed so that there is no capacity loss of existing drainage system. ***GPT Design Requirements***

4. The unit shall be designed so that all collector pollutants are able to be removed by mechanical means.

5. Refer also to Clause D7.21 for additional general information.

D5.26 CCTV INSPECTION and ACCEPTANCE CRITERIA

CCTV Inspection

1. At the end of the maintenance period, a CCTV inspection of all drainage pipes and ancillary works shall be carried out and reported to the satisfaction of Council's Delegated Officer. The CCTV inspection shall be carried out in accordance with Water Services Association of Australia – Conduit Inspection Reporting Code WSA 05-2006 or as updated..

2. All drainage pipes and other ancillary drainage installations with evidence of significant cracking, or other defects, shall be replaced and / or reinstated to Council's satisfaction, before the subdivision will be released (Statement of Compliance issued). Acceptance criteria for drainage pipes and other ancillary works shall be in accordance with Tables F1, F2 and F3 of the Conduit Inspection Reporting Code WSA 05-2006.

3. Pipe inspection software used to record the inspection data shall be compatible with WINCAN V8 or latest. The CCTV pipeline condition information shall be provided to Council in both electronic and hard copy format. The electronic copy shall include the WINCAN Project Files or compatible equivalent and a PDF file of printed report.

D5.27 STORMWATER PUMPS

Pump Approval

1. Where connection to the Responsible Authority's drainage infrastructure cannot be achieved by gravity alone, Council may consider alternative drainage systems. Written approval for the design and installation of internal drainage systems up to the Council designated legal point of discharge must be obtained from the relevant building surveyor.

2. The following sample calculation is for the City of Greater Dandenong area –

CONTRIBUTING AREA (A) = *1,000 SQ.M.*

ANNUAL RETURN INTENSITY(A.R.I.) = *10 YEARS*

AEP .095

STORM PERIOD (T) = *120 MIN.*

RAINFALL INTENSITY (I) = *18 MM / HR.*

RUNOFF CO-EFFICIENT (C) = *0.9*

*PEAK DISCHARGE AS PER RATIONAL METHOD = Q = C * I = 0.9 * 18 ~ 16 LITRES / HOUR / SQ.M. THEREFOR VOLUME FOR 1 HOUR STORM = V = Q * T * A = (16 / 1,000) * 2 * 1,000*

***= 40 CU.M**.*

ALTERNATIVE PUMP CAPACITY – WET WELL VOLUME COMBINATION EXAMPLE

SITE AREA 1,000 SQ.M.

COMBINED EFFECTIVE STORAGE VOLUME 25 CU.M.

PUMP CAPACITY (L/S)	***VOLUME PUMPED IN 30 MIN.***	***REQUIRED WET WELL VOLUME (CU.M.)***
(L/S)	*(CU.M.)*	*(CU.M.)*
8	*14.4*	*25.6*

COONAMBLE SHIRE COUNCIL

COONAMBLE SHIRE COUNCIL

COONAMBLE DEVELOPMENT DESIGN SPECIFICATION

D6

SITE REGRADING

VERSION 3.1– **JANUARY 2022**

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
VERSION 1					
1	Standards updated	D6.03	M	MC	04/02/13
2	EPA guidelines referenced	D6.09.1	M	MC	04/02/13

DEVELOPMENT DESIGN SPECIFICATION D6 -

SITE REGRADING - COONAMBLE

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DEVELOPMENT DESIGN SPECIFICATION D6 - SITE REGRADING - COONAMBLE

GENERAL

D6.01 SCOPE

1. This Design Specification sets out requirements for the site regrading involved in land development and subdivision. Conceptual requirements are presented as necessary considerations when preparing designs for site regrading.

2. The scope of this Specification assumes that the Designer is familiar with requirements cited in the various construction specifications, specifically those related to earthworks, clearing and grubbing, erosion and sedimentation. Additionally the Designer needs to make reference to the associated design specifications related to stormwater drainage design, geometric road design and erosion control and stormwater management.

Familiarity with other Specifications Required

D6.02 OBJECTIVES

1. This Specification aims to assist the Designer in achieving:

- efficient and economical design
- enhancement of the environmental character of the site whilst maintaining the natural features of the site

Environmentally Sound

- provision of safe conditions for construction commensurate with the proposed purpose of the development

Safe for Construction

- equality of building conditions for residential development
- a minimal impact on adjoining properties and developments.

Impact on Adjoining Properties

D6.03 REFERENCE AND SOURCE DOCUMENTS

(a) Council Specifications

Construction Specifications

C211 - Control of Erosion and Sedimentation – Version 3.2
C212 - Clearing and Grubbing – Version 3.2
C213 - Earthworks – Version 3.2
C273 - Landscaping – Version 3.2

Design Specifications

D1 - Geometric Road Design – COONAMBLE – Version 1
D5 - Stormwater Drainage Design – COONAMBLE – Version 1
D7 - Erosion Control and Stormwater Management – COONAMBLE – Version 1

(b) Australian Standards

AS 3798:2007 - Guidelines on earthworks for commercial and residential developments
AS 2870.1 - Residential slabs and footings - Construction.

D6.04 SITE REGRADING CONCEPT

1. Areas of a site proposed for building or recreational purposes may not be suitable in their natural state for their intended function without improvement works to:

(a) Alleviate flooding of low-lying ground

(b) Fill gullies or create emergency flowpaths after underground stormwater piping has been installed

(c) Allow improved runoff from flat ground

(d) Regrade excessively steep slopes that would preclude economical construction of dwelling foundations

(e) Allow effective recreational use or give reasonable access

The Designer shall review the natural surface contours and where necessary shall design finished surface levels that ensure the land is suitably prepared

Drainage

2. Where practical, areas should be regraded to minimise the necessity for underground drainage systems with surface inlet pits, and allow surface water to flow naturally to roads or drainage reserves without excessive concentration.

Natural Environment

3. The Designer shall consider the implications of site regrading in relation to the existing natural environment. Generally site regrading shall be minimised in heavily treed areas.

Overland Flow

4. Care shall be taken to provide depressions for overland flow from low points and over major drainage lines, to direct stormwater for storms up to a 100 year average recurrence interval (ARI).

Minimal Road Haulage

5. The design of site regrading areas in conjunction with the design of roadworks shall be considered with the objective of balancing cut to fill and achieving both an economical development and minimising haulage of imported fill or spoil to and from the development site. Bulk haulage should always be considered an adverse effect on adjacent development, and infrastructure.

D6.05 SPECIAL TREATMENT OF PARTICULAR AREAS

Flooding

1. Areas abutting the 100 year ARI flood levels shall be site regraded to a minimum level of 0.5 metres above the 100 year ARI flood levels. In doing so, the Designer shall ensure that other areas are then not affected by flooding. The site shall be identified on the Drawings with appropriate notation of site specific requirements.

Inundation Areas

2. In the event that an area is known to be affected by or inundated by local stormwater flows, the Designer shall investigate the existing conditions as they relate to the proposed development and advise the Developer in the preliminary design report on all data obtained in the investigation and recommend appropriate contour adjustments. The report should normally be accompanied by sketch plans to clarify recommendations.

3. Site constraints either natural or otherwise may be required to be identified as a burden on developed property. It is recommended that the Designer take this into account when preparing the design. The property may ultimately be affected by a "restriction as to user", which may be controlled by a legal 88B Instrument placed on title to the land and/or by a Section 149 message advising prospective purchasers of any restrictions affecting the land. ***Restrictions on Land Use***

4. The finished surface of filled areas shall be designed to levels allowing an adequate cover depth over the pipeline (if piped) and permitting surface stormwater flow to be guided to inlet pits if depressions are retained in the finished surface contouring. ***Piped Gullies or Depressions***

5. The location of such features shall be clearly defined on the site regrading plans and defined by distance to corner boundaries, monuments, etc for purposes of relocation at the geotechnical testing stage for work as executed Drawings. A geotechnical report specifying the site specific preparation and compaction requirements will be required to be incorporated with the site regrading plan. A description of the minimum acceptable quality of the fill shall also be specified on the plans, supported by geotechnical recommendations. All documentation necessary from various authorities to support the filling of dams and watercourses shall be supplied with the Drawings. ***Dams and Water Courses***

6. The finished level of any building area shall be designed to ensure a desirable surface grading of 1.5% (1% minimum) oriented in the direction of the drainage system designed to cater for its catchment. ***Flat Ground***

7. Building areas containing natural ground slopes of an excessively steep nature, ie greater than 15% shall be brought to the attention of a Geotechnical Engineer for investigation of compatibility with dwelling types proposed. Specific requirements shall be noted on the Drawings. ***Steep Slopes***

8. In known salt affected areas, or areas found to be salt affected by the geotechnical investigations, the Designer shall evaluate the existing conditions as they relate to the proposed development. The Designer shall also take advice from the relevant land and water resource authority and advise the Developer, in the preliminary design report, of areas requiring action to prevent salinity development. Appropriate regrading strategies aimed at lowering the groundwater table should also be included in the preliminary design report together with primary measures to prevent extension of salinity problems. ***Salinity Prevention***

D6.06 GENERAL STANDARD OF LOT PREPARATION

1. Special requirements will apply where necessary but generally lots are to be cleared of low scrub, fallen timber, debris, stumps, large rocks and any trees which in the opinion of Council are approaching the end of their functional life or are dangerous or will be hazardous to normal use of the development. Prior consultation with Council's Tree Preservation Officer is necessary. Such requirements shall be shown on the Drawings. ***Clearing***

2. All timber and other materials cleared from lots shall be removed from the site. All roots, loose timber, etc which may contribute to drain blockage shall be removed. Such requirements shall be shown on the Drawings. ***Disposal***

3. In areas to be filled over butts of trees, allowance is to be made for clearing of all trees and replanting with a minimum of six (6) advanced suitable species to each lot, planting to be clear of probable future building location, and not to be commenced until filling has been completed and graded, with provision for watering and maintenance for duration of the contract. These specific requirements shall be shown on the Drawings. ***Overfilling Area of Trees***

4. Selected trees shall be preserved by approved means to prevent destruction normally caused by placement of conventional filling or other action within the tree drip zone. The Tree Preservation Officer shall be consulted for advice and all specific requirements noted on the Drawings. ***Preservation of Trees***

D6.07 STANDARD OF FILL FOR LOTS

1. The following notations are to be incorporated in the Drawings. "Filling is to be of sound clean material, reasonable standard and free from large rock, stumps, organic matter and other debris." "Placing of filling on the prepared areas shall not commence until the authority to do so has been obtained from the Council". ***Drawing Notations***

2. All work shall be in accordance with AS 3798. Fill is to be placed in layers not exceeding 150mm compacted thickness. All fill is to be compacted to 95% standard maximum dry density. Maximum particle size shall be 2/3 of the layer thickness. ***Fill Quality***

3. Fill comprising natural sands or industrial wastes or by-products may only be used after the material type and location for its use is approved by Council and will be subject to specific requirements determined by prevailing conditions. ***Restricted Fill***

4. It is essential that prior advice be given of intended use of such materials. It should be noted that failure to obtain Council's approval may lead to an order for removal of any material considered by Council or other relevant authorities as unsuitable or in any way unfit for filling. ***Prior Approval***

5. All areas where filling has been placed are to be dressed with clean arable topsoil, fertilised and sown with suitable grasses. This work shall be carried out in accordance with the Construction Specification for LANDSCAPING – Version 3.2. ***Top Dressing***

D6.08 TEMPORARY DIVERSION DRAINS

1. Where temporary drains are required to divert surface flows away from the site regrading area, the location and silt/erosion control treatment shall be clearly identified on the Drawings. The scale of such works shall reflect the volume of water to be diverted. ***Silt/Erosion Control***

The objective will be to ensure minimal soil disturbances and material loss off the site.

Control measures will include, but not be limited to:

(a) Provision of trench stops every 30m along a trench, with provision for overtopping to be directed to the kerb.

(b) Placement of "blue metal" bags along kerb and gutter at maximum 30m spacings.

(c) Placement of "blue metal" bags around downstream drainage pits.

The requirements identified in the Design Specification for EROSION CONTROL AND STORMWATER MANAGEMENT – COONAMBLE – VERSION 3.1should be addressed for any additional requirements.

D6.09 CONCURRENCE WITH THE ENVIRONMENTAL PROTECTION AUTHORITY (EPA)

1. The Designer is recommended to refer to relevant guidelines issued by EPA with regard to any items requiring specific consideration when preparing a site regrading plan. Such plans may need to incorporate sediment/siltation/erosion/salinity control devices with specific reference to the stage at which these are to be provided. The responsibility shall rest with the Designer/ Developer to make enquiries with EPA and subsequently obtain Council approval to proposed measures. ***Specific Considerations***

D6.10 WORK AS EXECUTED DRAWINGS

1. The Designer shall annotate on the site regrading plan, the site specific detail to be shown on the Work-as-Executed Drawings. Such detail shall include geotechnical report certifying the works to be suitable for the intended purpose and any other certifications, testing and survey data, as required in this Specification. ***Site Specific Details***

D6.11 CARTAGE OF SOIL

1. The Designer shall refer to Council for acceptable haul roads with applicable load limits. This detail shall be required to be shown on the site regrading plan. The payment of a Bond may be required by the Developer/Contractor where Council has some concern about the ability of a haul road to sustain the loads without undue damage or maintenance requirements. ***Possible Bond Requirement***

2. Unless specific application is made to Council and approval obtained, the plans will be annotated as follows: ***Topsoil***

"All topsoil shall be retained on the development site and utilised effectively to encourage appropriate revegetation."

D6.12 EFFECT ON ADJOINING PROPERTIES

1. Where it is proposed to divert or direct piped stormwater into adjoining properties, drainage easement rights are to be created over the adjoining lots in accordance with the Specification for STORMWATER DRAINAGE DESIGN – COONAMBLE – VERSION 1. ***Stormwater Easement***

2. A written agreement shall also be sought to carry out construction work on adjoining properties and all such agreements are to be submitted to Council. It should be noted that such works will require development consent and where such consent was not obtained as part of the subdivision approval a further development application for the works will be required to be submitted and approved prior to the commencement of these external works. ***Construction Agreement***

SPECIAL REQUIREMENTS

D6.13 DEEMED TO COMPLY

1. Section D6 shall be Deemed to Comply if carried out in accordance with the requirements of Section D6, as amended by COONAMBLE SHIRE Council.

D6.14 RESERVED

D6.15 RESERVED

COONAMBLE SHIRE COUNCIL

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COONAMBLE DEVELOPMENT DESIGN SPECIFICATION

- D7

EROSION CONTROL AND STORMWATER MANAGEMENT

VERSION 3.1 – JANUARY 2022

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.

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Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
1	Hold Point for GPT	D7.25 (2)	A	BP	1/06
2	3 year maintenance period for GPT	D7.25 (6)	A	BP	1/06
VERSION 3.1					
4	WSUD publication added	D7.03	A	MC	04/02/13
5	TP & TN retention increased to 65%	D7.21.10	A	MC	04/02/13
6	Maintenance period for GPT reduced to 1 year	D7.25.6	A	MC	04/02/13
7	Use of swales as bio-retention facilities clarified	D7.29.3	A	MC	04/02/13

DEVELOPMENT DESIGN SPECIFICATION D7 - EROSION CONTROL AND STORMWATER MANAGEMENT - COONAMBLE

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DEVELOPMENT DESIGN SPECIFICATION D7 –

EROSION CONTROL AND STORMWATER MANAGEMENT - COONAMBLE

GENERAL

D7.01 SCOPE

1. Virtually all construction activity which requires the disturbance of the soil surface and the existing vegetation naturally predisposes the construction site to erosion. This in turn leads to sediment loss in the resultant run-off water. ***Erosion***

2. Since such soil disturbance is a necessary part of development, it is essential therefore to develop measures which reduce the erosion hazard of any particular construction activity. Having done that, it is necessary to control run-off water, which carries the sediment, in such a way as to reduce the amount of that sediment leaving the site to an acceptable level. ***Reduce Sedimentation***

3. After construction is complete and the site fully rehabilitated, permanent water quality control structures and features commence their role. These include trash racks, gross pollutant traps, wet retention basins and the creation of, or increase in size of wetlands. ***Water Quality***

4. Works covered by this specification include any land development or use including Private, Council or other authority works which may impact on the quality of runoff discharging from the site to any watercourse. It includes, but is not limited to, the development of: ***Land Development and Authority Works***

- Subdivisions;
- Buildings, structures and surrounds;
- Road works, car parks, site works, landscaping, earthworks, dams and lakes;
- Extractive industry;
- Mining

D7.02 OBJECTIVES

1. The objectives of erosion control and stormwater management design are as follows:

- To provide detailed design provisions in line with the principles of Ecologically Sustainable Development (ESD), Water Sensitive Urban Design (WSUD) and Total Water Cycle Management (TCM); ***Principles***
- To retain and enhance natural watercourses, aquatic habitat and riparian vegetation; ***Retain natural watercourses***
- To provide stormwater runoff quality specifications for the construction and occupation phases of a development; ***Stormwater quality***
- To promote scenic, landscape and recreational values for stream corridors through the integration of stormwater treatment techniques into the landscape by incorporating multiple use corridors that maximise the visual and recreational amenity of developments; ***Integration***
- To provide an effective major and minor stormwater system, incorporating water quality controls that has effective life cycle costs in terms of capital, operational and maintenance costs. ***Effective Stormwater System***

2. In pursuit of these objectives, the following principles shall apply: ***Design Principles***

- Limit/minimise the amount of site disturbance. ***Site Disturbance***
- Isolate the site by diverting clean upstream "run-on" water around or through the development where possible. ***Diversion Works***
- Control runoff and sediment movement as its point source rather than at one final point. ***Point Source***
- Stage earthworks and **progressively revegetate** the site where possible to reduce the area contributing sediment. This in turn increases the efficiency and effectiveness of the entire sediment control system while decreasing the number and size of controls required. ***Progressive Revegetation***
- Retain topsoil for effective revegetation works. ***Topsoil***
- Locate sediment and quality control structures and measures where they are most effective and efficient. ***Quality Controls***

D7.03 REFERENCE AND SOURCE DOCUMENTS

(a) Council Specifications

DQS	-	Quality Assurance Requirements for Design
D5	-	Stormwater Drainage Design
C211	-	Control of Erosion and Sedimentation – Version 3.2
C273	-	Landscaping – Version 3.2

(b) NSW State Legislation

Environment Planning and Assessment Act 1979
Environment Planning and Assessment Regulations 2000
Protection of the Environment Operations Act, 1997
Dams Safety Act, 1978
Soil Conservation Act, 1938
Water Act, 1912
Water Management Act 2000

(c) ACT Government Publications

Design Manual for Urban Erosion and Sediment Control - July 1988
"Protecting the Murrumbidgee from the Effects of Land Development"
"Guidelines for Erosion and Sediment Control on Building Sites"
Implications for Building Construction
Pollution Control on Residential Building Sites (Brochures)
Field Guide - Erosion and Sediment Control
Australian Journal of Soil and Water Conservation - Vol 3, Number 1

(d) State Authorities

NSW Department of Housing (DOH)
- *Managing Urban Stormwater, Soils and Construction*, 4th Edition. 2004.

Roads and Traffic Authority (RTA)
- *Erosion and Sedimentation Design Considerations.*

Soil Conservation Service (SCS)
- *Erosion and Sediment Control - Model Policy and Code of Practice* (Discussion Paper).

NSW Department of Land and Water Conservation (DLWC)
- *Urban Erosion and Sediment Control.*
- *Constructed Wetlands*

State Environmental Planning Policy No.14 - Coastal Wetlands.

(e) Others

The Institution of Engineers, Australia
- *Australian Runoff Quality: A guide to Water Sensitive Urban Design 2006* (ARQ)

Joint Steering Committee for Water Sensitive Cities
- *Evaluating Options for Water Sensitive Urban Design – a national guide*, July 2009

D7.04 PLANNING AND CONCEPT DESIGN

1. Assess the physical characteristics and limitations of soils, landform and drainage of the site and plan the subdivision or development accordingly. ***Site Characteristics***

2. A concept design shall be submitted with the development application to Council for all developments. This will assist in assessing the impact of the development on the site. ***Concept Design Submission***

3. The Development Consent will nominate that either an Erosion and Sediment Control Plan (ESCP) or a Soil and Water Management Plan (SWMP) is required for the detailed design. In general, a ESCP is required for sites of less than 2500 square metres of disturbed area and a SWMP for areas greater than 2500 square metres. Reference should be made to the DOH publication Managing Urban Stormwater, Soils and Construction. ***Development Consent Nomination***

D7.05 DETAILED DESIGN

1. After development consent is given, if an ESCP/SWMP is required it shall be prepared as part of the detailed engineering design for approval and receipt of a Construction Certificate. This plan shall give all details for erosion, sediment and pollution controls and shall be site specific and not a generalisation of erosion control philosophy. It also forms part of the contract specifications for a contractor to comply with during construction. ***Site Specific***

2. The ESCP/SWMP shall include scaled drawings (no larger than 1:1000) and detailed specifications/diagrams which can be readily understood and applied on site by supervisory staff. All Drawings shall be in accordance with the minimum drafting requirements in the Specification for QUALITY ASSURANCE REQUIREMENTS FOR DESIGN – COONAMBLE – VERSION 3.1.

Items to be included, but not limited to, shall be:

- existing and final contours
- the location of all earthworks including roads, areas of cut and fill and re-grading
- location of access haulage tracks and borrow pits

- location and design criteria of erosion and sediment control structures
- location and description of existing vegetation
- proposed vegetated buffer strips and "no access" areas
- location of critical areas (vegetated buffer strips, drainage lines and structures, water bodies, unstable slopes, flood plains and seasonally wet areas)
- type and location of diversion works to direct uncontaminated run-on around areas to be disturbed
- revegetation program
- procedures for maintenance of erosion and sediment control
- details for staging of works

Approval

3. No site works shall commence prior to receipt of the Construction Certificate. All works are to be carried out in accordance with any approved ESCP/SWMP. Its implementation must be supervised by personnel with appropriate qualifications and/or experience in soil conservation on construction sites.

Additional Works

4. The ESCP/SWMP and its associated control measures shall be constantly monitored, reviewed and modified as required, by the Developer, to correct any deficiencies. Council has the right to request changes if, in its opinion, the measures that have been put in place are inadequate.

Example Design

5. If required, examples of proposed subdivisions or developments detailing locations of water quality structures, sediment and erosion control devices may be obtained from Council and used as a guide when preparing an ESCP/SWMP.

Design ARI

6. Unless advised elsewhere in this specification, works to capture pollutants from stormwater runoff shall be designed to accommodate a design storm equivalent to a 3 month ARI storm event.

References

7. Erosion and sediment control works and stormwater quality management works shall be designed in accordance with *Managing Urban Stormwater, Soils and Construction*, (DOH) and *Australian Runoff Quality* (ARQ).

D7.06 MODELLING METHODS

Modelling Methods

1. The following three methods or a combination thereof are recommended to determine the requirements to maintain or enhance stormwater quality.

a. Best Management Practices (BMP).

b. An estimation of the average annual pollution loads from stormwater in kilograms of pollutant exported per year, relating land use, annual rainfall, catchment runoff characteristics and average pollutant concentrations to estimate the annual pollutant load generated from the catchment under both pre and post development conditions (refer to D7.06.8). Once the increase in pollutant loads is determined appropriate Stormwater Quality Improvement Devices (SQID's) shall be selected to conform to the criteria specified in Table D7-7.

c. Comparison of water quality discharging from a proposed development catchment to predetermined water quality as set out in table 6.2 of ARQ. The design of Stormwater Quality Improvement Devices (SQID's) will enable conformance to the required water quality objectives.

2. Best Management Practices (BMP) for erosion and sediment control during construction are required for all works. Requirements are as set out in this specification and in DOH. ***BMP Construction***

3. For development or development proposals which require a SWMP. Modelling approaches as listed in Chapter 13 of ARQ if appropriate to the requirements of water quality objectives may be used. ***Water Quality Models***

4. Modelling parameters including rainfall IFD information will be in accordance with Specification D5 STORMWATER DRAINAGE DESIGN – COONAMBLE – VERSION 3.1. ***Modelling Parameters***

5. For preliminary calculations, checking purposes and determination of pollutant loads for the modelling technique using constant concentration levels may be used. The following formula shall apply. ***Preliminary Calculations***

$L = PC_vCA$

Where L = average annual load (kg)

P = average annual rainfall (mm)

C_v = annual average volumetric runoff coefficient (dimensionless)

A = catchment area (km^2)

C = average event mean pollutant concentration (EMC) (mg/L) (refer to Chapter 3 of ARQ for landuse & predicted pollutant loads).

D7.07 TOTAL WATERCYCLE MANAGEMENT PLAN

1. A Total Water Cycle Management Plan shall be required for developments consisting of either 100 lots or more and/or with an area greater than 8 hectares. ***Water Cycle Management Plan***

EROSION CONTROL

D7.08 BUFFER ZONES

1. Buffer zones are corridors of vegetation adjacent to waterways or disturbed areas. The vegetation filters suspended solids and reduces the nutrient levels in run-off. Wetlands, stream and rivers adjacent to construction sites shall be protected by buffer zones. ***Filters***

2. Buffer zone performance increases as catchment area and slope gradient decreases. Thirty-metre-wide buffer zones generally provide adequate protection. Minimum buffer zones shall be as set out in Table D7.1 ***Performance***

Slope %	Buffer Width in Metres
2	15
4	20
6	30
8	40
10	50
12	60
14	70

Table D7.1 Buffer Zone Widths

3. Buffer zones can reduce the need for other erosion and sediment control measures. However, contaminated water in a concentrated form will require treatment both at its sources point and final disposal. ***Contaminated Water***

4. A fence shall be used to exclude traffic from buffer zones to prevent damage to the vegetation, particularly during any construction phase. ***Fencing***

D7.09 "NO ACCESS" AREAS

1. It is Council's Policy to conserve as much existing vegetation in new developments as possible. ***Conserve Vegetation***

2. The landscape plan shall incorporate as much existing native vegetation as possible.

3. The "no access" fence locations shall be shown on the ESCP/SWMP. These locations will be approximate only as machinery type, topography etc will determine actual on site location. ***No Access***

4. Fenced areas shall be clearly signposted "No Access Area".

D7.10 DIVERSION WORKS

1. Diversion works may be in the form of earth drains and banks, haybales, sand bags or even pipelines and may be permanent or temporary. ***Diversion Types***

2. Such techniques are used to divert the upstream run-on water around the site. Such flows shall discharge to a formal drainage point or open areas where level spreader banks should ensure a broad water spread. ***Discharge Point***

3. Pipelines may also be used to convey such run-on through the development site, and discharge the flow to a formal drainage point/dissipater if necessary. Such pipelines may also form part of the overall final drainage system. ***Pipelines***

4. Design of the diversion system should suit the following:-

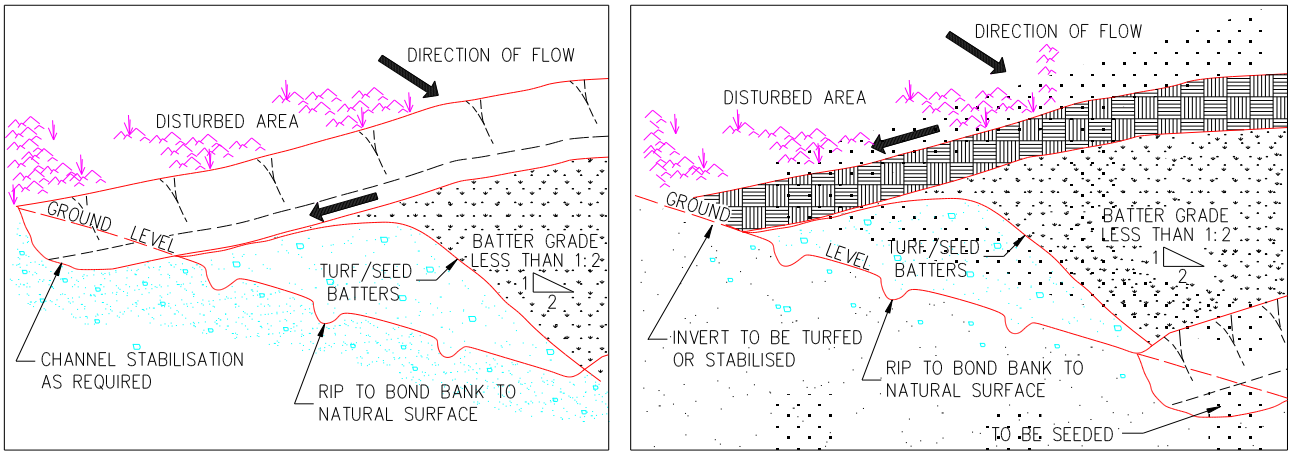
   (a) The drain should preferably be dish shaped with batter grades of less than 4:1 ***Drain Shape***

   (b) If a piped system is selected its design capaSHIRE shall be a minimum of the capaSHIRE nominated in the Specification for STORMWATER DRAINAGE DESIGN D5 – COONAMBLE – VERSION 3.1. ***Pipe CapaSHIRE***

5. Diversion works are designed to carry peak flows at non-erosive velocities in bare soil, vegetated or lined drains/banks. ***Peak Flows***

6. Generally, the channel should be lined with turf. However, where velocities are designed in excess of 2m per second, non erosive linings such as concrete, geotextiles, grouted rock etc or veloSHIRE reducers (check dams etc) are required. ***Non-Erosive Linings***

7. Typical arrangements of diversion drains and banks are shown in Figure D7-1.



DIVERSION DRAIN DIVERSION BANK

Figure D7-1 - Diversion Drains/Banks

D7.11 DROP DOWN DRAINS

Lined Drains

1. These are temporary or permanent drains which divert concentrated run-off down slopes such as road batters without causing erosion. They usually consist of a dished earth drain smoothly shaped, consolidated and lined with a variety of materials or they may be a flexible/rigid pipe or half pipe.

Piped Drains

2. Drop down drains consisting of rigid, or flexible, pipes are very effective as a temporary measure during road construction used in association with an earth windrow (or bund wall) along the top edge of the batter. Run-off flowing along the windrow is directed to the pipe by which water is conveyed down the batter. It is a simple matter to extend the pipe as the batter rises.

CapaSHIRE

3. Drop down drains shall have sufficient capaSHIRE for a minimum 1 in 5 year peak flow without eroding. Energy dissipators may be required to reduce the flow veloSHIRE at the outlet of the drop down drain.

D7.12 STOCKPILES

1. Location of stockpiles shall be indicated on the approved engineering Drawings.

Location

2. Stockpile sites shall be located:

   (a) Clear of existing or proposed drainage lines.

   (b) Clear of areas likely to be disturbed during construction.

   (c) Clear of the drip zone of trees.

   (d) Preferably on reasonably flat areas.

3. Stockpiles must be protected from erosion and sediment loss by: ***Erosion Protection***

   (a) The installation of diversion works.

   (b) The use of silt fences, haybales etc or other approved controls on the downstream side.

   (c) Compaction.

   (d) Revegetation if left exposed for longer than 30 days (refer to the Construction Specification for LANDSCAPING – VERSION 3.2 for seed mix).

4. Site topsoil shall be isolated from subsoil material in separate stockpiles. ***Separate Stockpiles***

D7.13 SEDIMENT BASINS/TRAPS/DAMS

1. Sediment traps are either permanent or temporary sediment control devices that intercept sediment and run-off usually at the final discharge point of the site or at a location to protect a downstream watercourse, wetland, riparian vegetated area or receiving water. Preferably they are to be located off line. ***Sediment Control***

2. They are formed by excavation and/or by constructing embankments. ***Construction***

3. There are two types, wet and dry basins. ***Types***

4. Preferably sediment traps shall not be located directly upstream of residential areas. ***Location***

5. Basin design must be in accordance with "Managing Urban Stormwater, Soils and Construction,(DOH)and meet the following: ***Design Criteria***

   (a) All disturbed areas including batters shall be topsoiled and seeded.

   (b) In areas known to be affected by high groundwater tables and/or salinity of groundwater, basins shall be designed to be water retentive so that surface drainage water does not leak to the subsurface, recharging groundwater.

   (c) Where eroding soils contain more than 10% of dispersible fines:

   - All waters captured in sediment basins must be treated with an approved flocculating agent to ensure that discharges contain no more than 50mg/l of total suspended solids;
   - Sediment retention basins must be maintained at a low water level in readiness for treatment and discharge of further runoff: All sediment captured in basins must be treated and discharged within 5 days of the cessation of a rainfall event;
   - A minimum stockpile of flocculating agents must be retained onsite to provide for at least three complete treatments.

6. A marker must be placed within each sediment retention basin to show the design capaSHIRE level.

7. Permanent wet basin designs slightly vary from the above. Refer to the Stormwater Management Section of this Specification. ***Permanent Wet Basins***

D7.14 SEDIMENT TRAPS/ BARRIERS FOR MINOR CATCHMENTS

1. These are silt retention/filtering structures of a temporary nature used in situations where the catchment does not exceed 0.5ha. ***Filtering Structures***

2. Such sediment traps/barriers generally consist of: ***Barrier Types***

   (a) silt fences

   (b) hay bales

   (c) “blue metal” groynes/sausages

   (d) filter fabric located beneath stormwater grates

   (e) gabions

   (f) or a combination of the above.

3. The choice of material and type of treatment will depend on the size of the catchment the location and the structure being treated such as: ***Location of Structure***

   (a) surface inlet pits

   (b) kerb inlet pits

   (c) catch drain disposal areas

   (d) culvert inlets and outlets

   (e) minor construction/earthwork sites

   (f) check dams/veloSHIRE reducers etc.

4. The design of sediment traps shall be in accordance with “Managing Urban Stormwater, Soils and Construction,(DOH

5. Sediment shall be removed and disposed/reused in accordance with Council and EPA guidelines after each rainfall event. Weirs shall be regularly maintained and cleaned to ensure effective operational condition. Hay bales and silt fence geotextiles shall be replaced when damaged or permanently blocked.

D7.15 LEVEL SPREADERS

1. Level spreaders are outlets or "sills" having a level cross section. They convert erosive channelised flows into non-erosive sheet flow. ***Convert Flows***

2. Level spreaders can only be used to dissipate flows from small catchments. The area below the outlet should be stable and of even cross section so that the water will not re-concentrate into channels. ***Location***

3. To reduce flow veloSHIRE before the spreader, the channel grade shall not exceed 1 per cent for a minimum of 8 metres. The outlet or "sill" width depends on contributing catchment, slope and ground conditions. The minimum width should be four metres, and the maximum width 25 metres. Final discharge should be over a level surface, which may require stabilising by turfing or seeding and fertilising or perhaps lining with a geotextile fabric or something similar. ***Design Criteria***

D7.16 THE LOCATION OF SHAKEDOWN AREAS AND ACCESS STABILISATION

1. Access to construction sites shall be limited to a maximum of two locations. ***Number of Accesses***

2. Such access locations shall require Council approval. ***Location Approval***

3. Shakedown areas or access stabilisation shall comprise a bed of aggregate on filter cloth or a metal bar cattle grid located at any point where traffic enters or leaves a construction site. Stabilised accesses reduce or eliminate tracking of sediments onto public rights of way or streets. Should such tracking occur the contaminants must be swept off the road way each day and before rain. Clean off draw bars etc after dumping and before starting journey. ***Types***

4. If a shaker grid is used, this should be so placed as to ensure the vehicles when crossing the grid have sufficient speed to "shake the mud" or other contaminants such as gravel from the vehicle. It must not be placed where the vehicle is slowing to enter a roadway. Cattle grids shall be a minimum length of 7 metres. ***Cattle Grid***

5. A stabilised access comprises a vehicular pathway suitably constructed to facilitate the collection of any site debris in order to prevent such material leaving the site. Stabilised accesses are generally used on small sites. The entrance shall be at least 15 metres long with a minimum width of 3 metres for a one way entrance and 6 metres for a two way entrance. ***Stabilised Access***

6. Surface water flowing to the street entrance/exit must be piped under the access, or a berm constructed to direct surface flow away from the exit. ***Flow Control***

D7.17 WIND EROSION/DUST CONTROL

1. Research has demonstrated average dust emission rates of over 2½ tonnes per hectare per month at urban construction sites. This erosion rate is unacceptable. ***Erosion Rate***

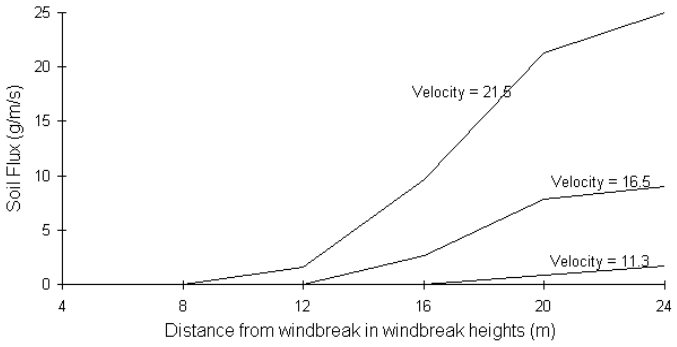
2. Various measures are available to minimise such emissions, including:- ***Treatments***

   (a) limiting the area of lands exposed to erosive forces through phasing works/progressive revegetation and/or provision of a protective ground cover and/or keeping the ground surface damp (not wet); and/or

   (b) on building sites, installing a barrier fence on the windward side - effective to a distance of 15 times its height, assuming an acceptable soil flux of 5 grams per metre per second. See Figure D7-2.

   (c) the use of water sprays, application of dust suppressants, surface stabilisation or covering of exposed surfaces.

3. Dust control measures must be used on site at all times including outside normal working hours.



Effect of distance from windbreak on soil loss, wind blowing at less than 90 to the windbreak.

Figure D7-2 - Pollution Control

D7.18 REQUIREMENTS FOR BUILDING SITES

1. The clearing of vegetation and preparation of building pads is to be undertaken in the last stages of the development when the majority of the site has been effectively revegetated. ***Site Clearing***

2. When the development calls for the construction of a number of buildings, the sediment trap/s and other appropriate sediment controls shall remain operational. ***Development Control***

3. Cross/catch drains shall be installed on long or steep unpaved driveways, disposing run-off to stable areas. ***Driveway Control***

4. Where a majority of the lot is disturbed the following minimum controls or measures shall be undertaken, but not limited to: ***Lot Control***

   (a) Silt fences, located around the downstream sides of the lot.

   (b) Sediment traps/barriers to be provided to all on-site and adjacent stormwater inlets.

   (c) Only one site access to be provided. This may require treatment to prevent soil being tracked from the site.

   (d) All subsurface drainage for roofing must be in place prior to the installation of the roof and gutter so downpipes can be immediately connected.

D7.19 EXTERNAL SITE REQUIREMENTS

1. Sediment control devices or stabilising works shall be provided outside construction sites where necessary or as directed by the Superintendent. ***Necessary Controls***

2. Where increased stormwater run-off is likely to accelerate erosion of any downstream watercourse, the necessary remedial work shall be provided concurrently with other sediment and erosion requirements. ***Accelerate Erosion***

3. Where sediment is likely to be transported from the site, all immediate downstream drainage inlets shall have appropriate controls installed. ***Downstream Controls***

4. If such works require entry onto private property, written permission shall be obtained prior to the entry and commencement of such works. ***Written Permission***

5. All disturbed areas on private property to be reinstated to original condition and to the satisfaction of the owner. ***Reinstated***

STORMWATER MANAGEMENT

D7.20 STORMWATER TREATMENT MEASURES

Main Components

1. Most developments mean a change in land use and it is usually accompanied by a decline in stormwater quality. This applies to the long term as well as during the short term construction phase. The main components required to enhance stormwater quality are as follows:-

a. Vegetated Buffer Zones (VBZ) and filter strips, porous pavements, grass swales in landscaped areas or similarly treated areas to facilitate the natural assimilation of water pollutants and reduce run-off. Swales are not preferred as a substitute for kerb and gutter where on street parking is required.

b. Where required, gross pollutant/sediment traps shall be designed to intercept litter, oil and debris to maintain visual quality in downstream waterways, and to reduce the coarse sediment load on downstream water management structures.

c. Wet retention ponds/permanent sediment ponds shall be designed to allow particulate matter to settle out operating under both sedimentation and macrophyte regimes.

d. Wetland (Nutrient) Filters shall be designed to enhance the removal of fine sediment and nutrients from stormwater run-off, (which are largely dependent on biochemical removal mechanisms).

e. Infiltration systems shall be designed to focus on the control of pollutants and the retention of stormwater.

f. Selection of stormwater quality enhancement devices and practises shall be based on current environmental guidelines and best practise management procedures.

Excess Nutrients

2. Excess nutrients (N,P) lead to eutrophication of waterways. This can cause uncontrolled growth of algae, water weeds etc, which can deplete oxygen levels, kill resident flora and fauna, and reduce recreational appeal. However waterways do have a natural capaSHIRE to assimilate nutrients in small to moderate amounts as initial flows have.

D7.21 WATER QUALITY

1. . Development or works that do not include water quality or quantity controls have the potential to increase pollutant loads of receiving waters, relative to those occurring under pre-development conditions

2. An assessment of water quality impacts and control measures to mitigate or improve the water quality shall be a carried out by the following process.

a. Identify the Water Quality Objectives (WQO).

b. Determine the Risk Category of the proposal.

c. Determine the type and condition of the receiving water ecosystem.

d. Determine the pollutant loads generated by the proposed works.

e. Determine the types of treatment measures to be used to mitigate or improve the water quality from the proposed works.

Water Quality Objectives

3. Water Quality Objectives (WQO) are used to describe the quality of water that is needed in a receiving water to protect or enhance Environmental Values (EV). Environmental Values are those values that a community believe a particular waterway should hold eg: ability to safely swim in a river or adjacent ocean beach, or the ability of a waterway to sustain healthy aquatic ecosystems.

Water quality objectives in this specification are based on the guidelines as specified in Chapter six (6) of the AQR. Aquatic ecosystem values are to be used as a base to determine the protection level required for a specified development, unless determined otherwise by Council.

4. Water quality objectives shall be evaluated over the full range of rainfall events to maintain the long-term protection of the pre determined Environmental Values (EV).

Low Risk Development

5. Water quality objectives shall be determined based on a developments "RISK" to the environment. Low Risk development (eg: single dwelling construction) will not be required to identify relevant water quality objectives for down stream receiving waters but will be required to follow Best Management Practices (BMP) in relation to the control of erosion, sediment and stormwater quality as outlined in this specification and in accordance with the DOH Chapter 9 – Building sites.

High Risk Developments

6. High Risk developments are classified according to the following criteria. Any development or development proposal:

a. Located in a waterway corridor.

b. Located within the catchment of a wetland area.

c. Consisting of multiple dwellings or commercial uses with an impermeable surface area (including roof area) in excess of 2500m² and / or

d. Subdivisions greater than 6 lots and / or

e. Industrial activities that are not impact assessable and at least 1000m² in uncovered storage/working space.

f. Uncovered car parks > 100 spaces.

Ecosystem Type

7. The long-term water quality sustainability of a high-risk development shall be based on viable protection levels of aquatic ecosystems. The classification of protection levels of aquatic ecosystems is defined as:

a. Pristine ecosystem or **unmodified ecosystem**, having high conservation values and 'protection' status.

b. **Slightly to moderately modified ecosystem**, where the ecosystem is largely intact (habitats, limited catchment clearing) such that some 'restoration' of the original values is viable.

c. **Highly modified ecosystem**, where the original ecosystem is so disturbed that it cannot be restored to a slightly, to moderately disturbed condition, but is capable of sustaining some ecological and conservation values with appropriate 'management'. (Ref: ARQ Chapter 6).

Council shall confirm determination of the classification of the receiving ecosystem.

Sustainable Average Annual Export Load

8. Estimation of Sustainable Average Annual Export Load (SAAEL) is to be a risk-based process where the export loads are compared to the trigger level for the receiving waterway (ref: ARQ 6.3.1 ARQ approach to estimating sustainable catchment loads). The median insitu water quality indicator must be below the trigger level of a receiving waterway to comply with this specification.

9. The assessment of potential water quality impacts shall be based on.

a. Changes in water quality discharging from a catchment and proposed management techniques to ensure no increase of or an improvement in water quality.

b. Increase in the average annual load of key pollutants, above that occurring under existing conditions or to levels compliant with predetermined water quality objectives.

Pollutant Retention

10 Stormwater treatments shall be designed to meet the minimum level of pollutant load objective in accordance with table D7.2

Pollutant	Objective
Suspended Solids SS	80% retention of average annual load
Sediment	100% retention of sediment greater than 0.125mm for flows up to the 3 month ARI peak flow
Oil & Grease	No visible oils for flows up to the 3 month ARI peak flow
Litter	100% retention of litter greater than 5 mm for flows up to the 3 month ARI peak flow
Total Phosphorus (TP)	65% retention of average annual load
Total Nitrogen (TN)	65% retention of average annual load

Table D7.2 Stormwater Treatment Pollutant Load (ARQ)

STORMWATER QUALITY IMPROVEMENT DEVICES

D7.22 SELECTION OF STORMWATER QUALITY IMPROVEMENT DEVICES

SQID's

1. The appropriate selection of Stormwater Quality Improvement Devices. (SQID's) will assist Developments meet Councils Water Quality Objectives (WQO). In selecting an appropriate SQID or combination of SQID's the following process shall be followed:

a. Risk Category – identify whether the proposed development is 'low risk' eg: Single dwellings & Dual Occupancy <6 Lots or < 2500m² or 'high risk' eg: Development >6 Lots and/or 2500m².

b. Pollutant Type – identify the target stormwater pollutants for the proposed land use for the construction and occupational phases of the development.

c. Construction Phase – during this phase the primary contaminant of concern is usually sediment. To identify the appropriate Best Management Practices (BMP) the guidelines contained within DOH shall be used.

d. Occupational Phase ('low risk') – if the development is 'low risk' Water Quality Objectives (WQO) need not be identified. Table D7.3 shall be used to select which type of quality control device is appropriate.

e. Occupational Phase ('high risk') – if the development is 'high risk' WQO's shall be identified as outlined in section 7.06 of this specification. Table D7.3 may be used to determine the appropriate types of devices, but detailed analysis shall be required to determine pollutant export loads and demonstrate that the device selection meets relevant WQO's for receiving waters.

f. Maintenance Plan – where SQID's are selected as an appropriate treatment device a maintenance plan shall be required as specified in table ***D7A-4 (Appendix A).***

g. Documentation – the Stormwater Management Plan is to include details of the SQID's selected their location, the timing for installation, and the maintenance regime. An evaluation of costs shall be submitted stating the initial establishment costs and the annual maintenance costs

Management Device	**Litter**	**Coarse Sediment**	**Suspended Solids**	**Nutrients (N& P)**	**Oxygen Demanding. Substances**	**Hydro carbons**	**Pathogens**	**Heavy Metals**
Source Controls								
Street Sweeping	H – M	M	–	-	L	-	-	L
Rubbish Bins	H – M	-	-	-	L	-	-	-
Education	L	L	L	L	L	L	L	L
Primary Treatments Small Scale								
Litter Baskets	L – M	L	-	-	L	-	-	-
Grates & Entrance Screens	L	-	-	-	-	-	-	
Side Entry Pit Traps	L – M	L	-	-	L	-	-	-
Baffle Pits	L	L – M	L	L	L	-	-	L
Catch Pits	L	L – M	L	L	L	-	-	L

Management Device	Litter	Coarse Sediment	Suspended Solids	Nutrients (N& P)	Oxygen Demanding Substances	Hydro carbons	Pathogens	Heavy Metals
Oil & Grit Separators	L	L – M	L	L	L	L – M	L	L
Nets	H	-	-	-	-			-
Medium Scale Devices								
Litter & Trash Racks	M	L	-	-	L	-	-	-
Downwardly inclined screens	H	-	-	-	-	-	-	-
Floating Litter Booms	L – M	-	-	-	-	-	-	-
In Ground GPT	H – VH	H	L	L	L – M	L	-	L
In Line Separators	M	L – M	-	-	-	-	-	-
Large Scale Devices								
Open Gross Pollutant Traps	M – H	H	L	L	L	L	L	L
Sediment Traps	L	H	L	L	L	L	L	L
Secondary Treatments								
Filter Strips	M	H	M	L – M	L	L	M	L
Grass Swales	L – M	M – H	M	L – M	L	L	M	M
Sand Filters	-	M – H	M – H	M	M	M	M	M
Infiltration Trench / Basin	-	M – H	M	M	M	M	M	M – H
Porous Pavement	-	H	M – H	M	M	M	H	M – H
Extended Detention Basins	-	M – H	L – M	L	L	L	M	L
Tertiary Treatments								
Water Quality Ponds	M – VH	H	L – M	L – M	L	L	L	L – M
Constructed Wetlands	M – VH	H	M	M	L	M	M	H

Legend:
- = Neglible benefit
L = 10 – 30 % Pollutant reduction efficiency
M = 30 - 50% Pollutant reduction efficiency
H = 50 – 75 % Pollution reduction efficiency
VH = 75 - 100% Pollution reduction efficiency

Table 7.3 Pollutant Reduction Efficiencies
From Brisbane SHIRE Council Design Guidelines for Stormwater Quality Improvement Devices Final Draft, 1999

D7.23 WET RETENTION BASINS/PONDS

1. Basins designed for water quality control should maximise the extent of settling. In general quiescent conditions and infiltration should be maximised. ***Maximise Infiltration***

2. A wet retention basin can be located either on-line or off-line as shown in Figure D7-3. Its capaSHIRE however needs to be considerably greater if it is located on-line. The wet retention basin usually has some form of energy dissipation at the inlet or a sufficient length-to-width ratio (greater than 2:1) to prevent short circuiting of flow across the pond, although its shape may vary considerably. It should be located such that the basin does not locally raise the subsurface water table under circumstances that might lead to a salinity problem. . Refer to Chapter 11 of ARQ for details of appropriate design procedures to be adopted.. Basins may be installed as smaller multiple units (in series) or as large single units. ***Location and Size***

3. Other design guides that will make the basin efficient in removing particles and provide for public safety include the following. ***Basin Efficiency***

(a) The minimum depth should be not less than 1.5 metres with an average depth of 2.5 metres. This discourages macrophyte growth in the deeper portions of the pond and also the breeding of mosquitos.

(b) The basins should have side slopes of approximately 1 in 8. This provides for safety and encourages microphyte growth around edges facilitating nutrient uptake. If side slopes are steeper than 1 in 6 the basin/pond shall be enclosed by a child proof security fence

(c) The maximum veloSHIRE through the pond based on a 1 in 1 year storm should not exceed 0.3 metres per second (at 2.5 metres depth, this is the maximum practical flow veloSHIRE at which optimum sediment removal can be achieved).

(d) A minimum freeboard of 0.3 metres should be provided between a restricted discharge outlet for the pond and a storm overflow weir. This discharge outlet should be designed so that the weir overtops on average three times per year.

(e) Inlet and outlet structures should be located at extreme ends of the basin, with short circuiting of flow further minimised by the use of baffles.

(f) Depth indicators shall be provided indicating maximum depth in the basin spillway.

(g) Appropriate hazard signage shall be provided for the basin and spillway.

(h) Protection of the low flow intake shall be provided to prevent blockage and to prevent the risk of people being trapped.

(i) Basins shall be designed so that no ponds of water occurs on private property or roads

4. Basins should be constructed prior to the commencement of any site clearing or construction works, and should be de-silted when the level of sediment reduces the average water depth to less than 1.5 metres. ***Construction and Maintenance***

5. (a) It may be desirable for the designer of an urban retention basin to incorporate an outlet device that enables dewatering of the basin. This simplifies de-silting, enabling earthmoving equipment to be used for de-silting operations. ***Outlet Design***

Access Track

(b) An all weather access track shall be provided to the basin for maintenance works.

(c) The basin spillway will not be located directly upstream of urban areas.

6. It is generally necessary to incorporate a gross solids trap and trash rack facility on major discharges into the retention basin. This prolongs the life of the basin and prevents the accumulation of litter. ***Trash Racks***

7. Basins should be surrounded by buffer zones, typically comprising grassed foreshores of not less than 20 metres between the nearest development and the basin. This allows for some infiltration of drainage from developments, permits the drainage authority scope to develop aesthetic surrounds and reduces the likelihood of over the fence dumping of rubbish. ***Buffer Zones***

8. The settling veloSHIRE of particles should service as the basis for design. This, of course, can only be found by conducting standard settling tests or from a knowledge of local soil characteristics. The surface area of the required basin can then be determined from design settling velocities (Randall et al 1982). ***Particle Settling***

9. Wet retention basins are regarded as impoundments and normal dam safety requirements should be met. A dam may be prescribed under the Dams Safety Act, 1978, depending on the recommendations of the NSW Dams Safety Committee. A dam is normally prescribed if it is: ***Basin Classification***

(a) 10 metres or more in height and has a storage capaSHIRE of more than 20 megalitres; or

(b) 5 metres or more in height and has a storage capaSHIRE of 50 megalitres or more.

10. If the wet retention basin is a prescribed dam, the Dams Safety Committee will maintain an interest in the dam, will seek information from its owner and will require that reports be prepared on the dam and submitted to the Committee. ***Dam Safety Committee***

D7.24 TRASH RACKS

1. Trash racks are usually permanent structures which intercept trash and other debris to protect the aesthetic and environmental quality of water. Where appropriate, construct them upstream of all permanent retarding basins and/or wetlands which have a capaSHIRE greater than 5,000 cubic metres, and elsewhere as required by Council. ***Environmental Quality***

2. Generally, their design criteria should ensure:- ***Design Criteria***

(a) vertical bar screens with bar spacing of 65mm clear;

(b) the length of the rack is consistent with the channel dimension and cause minimal damage when overtopped;

(c) they are as large as practicable while considering all other design criteria - a maximum height of 1.2 metres is suggested;

(d) a structure which remains stable in at least the 20 year ARI event, and is unlikely to cause flooding on adjacent lands as a result of the rack becoming completely blocked in the 100 year ARI event (analysis should include investigation of backwater effects and any consequent flooding);

(e) the structure drains by gravity to a dry condition;

(f) adequate access for maintenance and which permits the use of mechanical equipment;

(g) water can still flow past when the rack is fully blocked; and

(h) appropriate egress provision shall be included if steep side slopes exist adjacent to the trash rack.

3. Where associated with outlet structures for small sediment basins or constructed wetlands, they can be relatively simple in design. ***Associated Structures***

4. Trash racks may be incorporated in the design of gross pollutant traps. ***Gross Pollutant Trap***

5. A maintenance schedule for any trash racks shall be included in the SQID's Maintenance and Operations Procedures ***Maintenance***

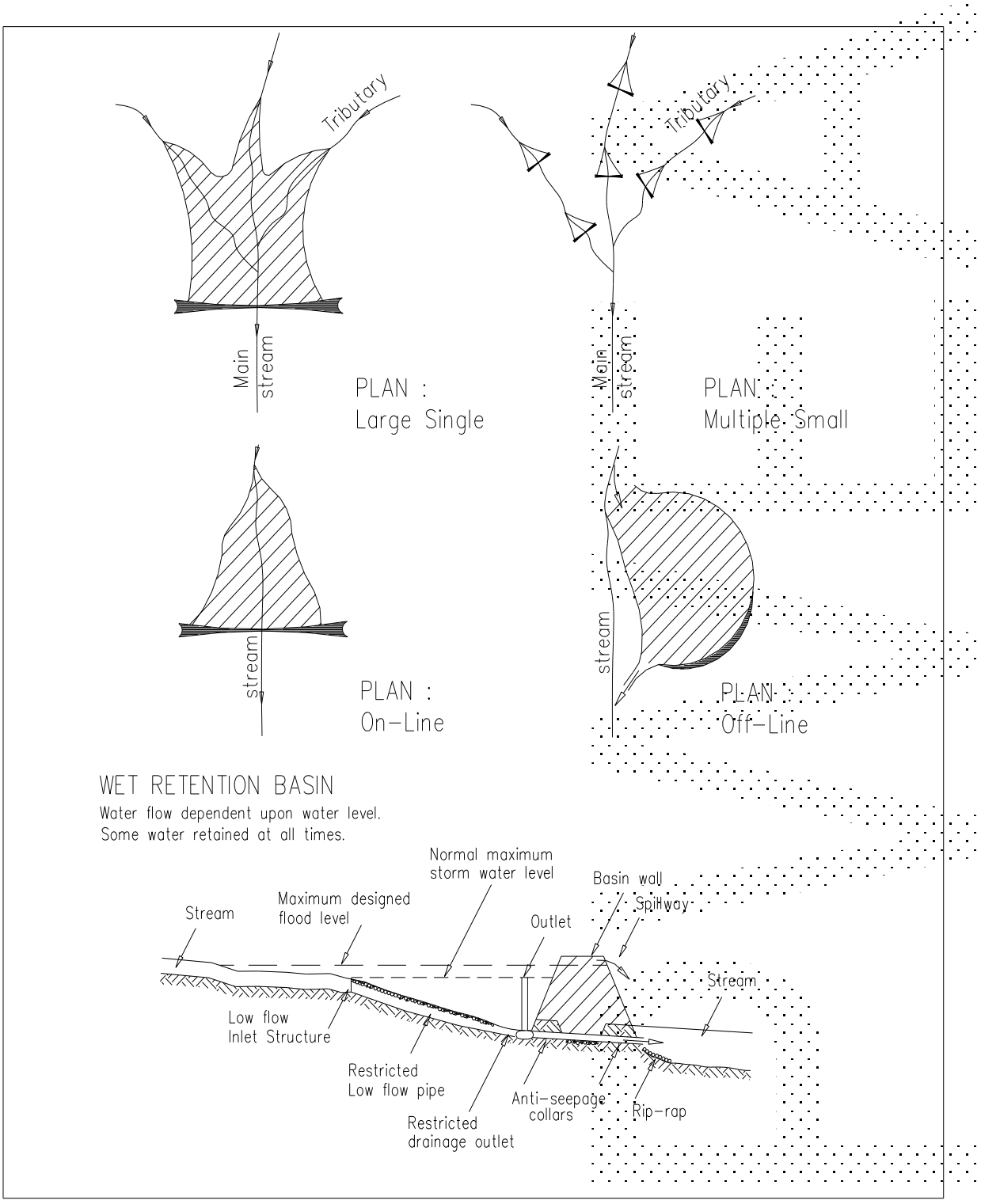


Figure D7-3 - Configuration and Design of Wet Retention Basins

D7.25 GROSS POLLUTANT TRAPS

1. Gross pollutant traps (GPTs) are permanent structures used to trap coarse sediments, trash, litter, and other floating materials. Usually, they are located upstream of constructed wetlands and receiving waters. They consist of an energy dissipater at the upper end, concrete sediment trap and trash rack at the lower end. Sometimes a "mini" wetland is incorporated at the downstream end. ***Description***

2. These traps have restricted application and each should be justified on individual merits. Selection of the size and type of GPT shall be based on information and guidelines contained in Chapter 7 of ARQ. Confirmation from Council shall be required when a GPT type is selected to ensure consistency and conformance with catchment management plans. This action constitutes a **HOLD POINT**. [see C223.11 (1)] ***Applications (HP)***

3. GPTs can be defined as major or minor: ***Definition***

   (a) major gross pollutant traps can be located on major floodways and waterways to intercept medium to high flows; and

   (b) minor, enclosed gross pollutant traps can be located at heads of major floodways and/or where stormwater discharges into floodways or water bodies.

4. Design traps to intercept at least 75 per cent of sediment with a grain size of 0.04mm or greater under average annual runoff conditions. Further, ensure peak flow velocities are less than 0.3 metres per second in the 1 year ARI storm event, and taking into account any likely backwater effect from a blocked trash rack. ***Sediment Interception***

5. The structure should have sufficient capaSHIRE and stability to discharge the inlet flow with the trash rack fully blocked without flooding adjacent properties. ***CapaSHIRE***

6. Ensure GPTs are capable of gravity drainage to a dry condition for periodic cleaning and maintenance if at all possible. The maintenance period for GPT's shall be one year from the date it is first brought into full service until handover. All GPT's shall be thoroughly cleaned prior to handover. A bond may be required for the maintenance period. ***Maintenance Requirement 1 year***

D7.26 LITTER BASKETS

1. Litter baskets are proprietary devices primarily designed to capture litter and gross pollutants. ***Description***

2. These traps have restricted application and should be justified on individual merits. Selection of the type and location of Litter Baskets shall be based on information and guidelines contained in Chapter 7 of ARQ. An intention to utilise Litter Baskets shall be approved by Council at the concept stage of a development. ***Application***

3. Litter Baskets are typically located within stormwater side entry drainage pits and are designed to collect and retain a range of pollutants including 95% of all solids greater than 2 mm.

4. Design loads and capture capaSHIRE shall be verified for each pit proposed. Provision for access and OHS issues shall comply with current Australian standards. ***Design***

5. All costs relating to design installation and maintenance shall be provided. ***Maintenance***

D7.27 CONSTRUCTED WETLANDS AND PONDS

1. . Constructed wetlands and ponds shall be designed in accordance with the requirements of: ***Design***

a) The primary reference documents shall be ARQ, Chapter 11, Austroads AP – 232, *Water Sensitive Road Design – Design options for improving stormwater quality of road runoff* - Technical report 00/1 2000 CRC.

b) Pollutant loads to target levels contained within this specification.

c) Care shall be taken to avoid situations that recharge the groundwater and elevate the water table so as to develop local salinity problems

2. Figure D7.4 shows a typical wetland arrangement. ***Typical Elements***

The major elements include pre-treatment, inlet zone, ephemeral zone and microphyte zone or wetland zone.

3. A Pre – Treatment zone is required to remove litter and organic matter from inflows to allow easy collection by maintenance crews. A litter trap shall be capable of retaining litter of a size greater than 5 mm for all flows up to a flow rate of 1 in 3 month ARI (the design rainfall event). A sediment trap may also be located within this zone. ***Pre Treatment Zone***

4. . An Inlet Zone has the primary functions of energy dissipation and sedimentation. Details of methods of sizing of sediment basins may be found in the specified reference documents. The inlet zone shall have the capaSHIRE to remove 95% of all suspended sediment down to 125um during the design rainfall event. If a natural stream is used to convey the waters to a downstream wetland a 1in 2 Year ARI event shall be the design rainfall event. When the Inlet Zone is to be a pond structure the following shall apply: ***Inlet Zone***

a. The length to width ratio shall be between 5:1 and 10:1 with sufficient energy dissipation to reduce velocities to below 1.0m/s. The maximum width shall be 14m to allow access for maintenance plant.

b. Maximum depth between 1.5 – 2.0 m

c. The preferred top water level shall be 0.5m above the downstream wetland zone.

d. Bypass facilities shall be included in the design to allow the water level to be lowered by at least 0.5m for maintenance of the pond.

e. Access ramps and tracks must be capable of supporting maintenance plant.

f. Batter slopes shall be a maximum of 1 in 6.

Ephemeral Zone

5. . The Ephemeral zone or marsh shall be used to trap leaf and other organic material prior to entering the wetland zone reducing the likelihood of anaerobic decomposition within the wetland zone. The design requirements are:

a. The total area shall be 250m² / m³/sec of the design flow

b. A shallow rock lined channel shall meander to maximise length of travel and allow event flows to inundate adjacent areas planted with ephemeral marsh plants.

c. Raised mounds consisting of topsoil positioned at 45° to the flow of water shall be included in the design. It is preferable to form the mounds by removing material from the location of the mounds rather than stripping the entire area and building the mounds.

d. Marsh plantings shall be arranged in offline cells to form a herringbone pattern.

e. A porous rock wall or similar shall be provided across the downstream end of the ephemeral zone to allow flow attenuation during the design flow event.

Wetland Zone

6. . The wetland Zone shall be designed to remove sediment less than 125 um and dissolved pollutants. Design criteria shall be as outlined in the reference documents, and shall include the following specific requirements.

a. Treatment shall be obtained by retaining runoff in a macrophyte-dominated wetland.

b. A residence time in the wetland shall be at least 72 hours for the design stored event volume.

c. The maximum stored water level shall be 450mm above the normal top water level unless Council gives specific approval.

d. Provision shall be made to minimise the veloSHIRE through wetland to less than 0.2m/s during the initial stages of a storm event.

e. An accessible outlet control shall be designed to be blockage free and able to change flow rates to allow initial plant establishment and for maintenance purposes.

f. A minimum of 80% vegetated marsh is to be arranged in bands across the flow path. The remaining area shall be allowed for submerged marsh or open water areas.

Vegetation

7. Emphasis in planting design should be given to species growing naturally in local wetland remnants. A vegetation and weed maintenance program of at least 24 months after the initial planting of the wetland shall be incorporated in the maintenance and operation procedures.

A variety of plant species should be planted in artificial wetlands to achieve efficient colonisation and maximise pollutant removal. Establishment of plants should be through transplantation of seedlings during spring and early summer

8. Safety considerations shall be included in the design of all structures. The following requirements shall be used as a minimum in the design. ***Safety***

a. Operational depths of sediment ponds to be from 1.5 to 2.0m. Shallow marsh areas, depths to 200mm, deep marsh areas 200mm to 350mm with a periodic maximum up to 600mm.

b. Minimum offset to any allotment boundary to be 15m and up to 30m where access is available.

c. Batter slopes shall not exceed 1 in 6

d. No formal access points to water shall be included in the design unless there is appropriate safety benching.

e. All edges to waterbodies and wetlands shall have safety benches of at least 1.5m to 3.0m wide from the normal top water level except where transitions to culverts or waterways occur. Safety benches shall have maximum slopes of 1 in 8 for the first 1.5m to 3.0m, a transition to 1 in 5 over 0.5m (min.) prior to steeper grades up to 1 in 3. The safety bench shall be densely planted with emergent macrophytes to preclude access

.

9. Interim fencing is recommended between the construction and vegetation establishment where water depths exceed 350mm. ***Fencing***

Permanent fencing combined with dense impenetrable plantings shall be used adjacent to water depths exceeding 350mm (normal top water level) areas where safety benches do not conform to the width criteria, adjacent to unsafe structures, areas of high velocities or where batters are steeper than 1 in 6.

Maintenance access areas shall be signed, fenced and gated where the safety measures above are not met.

10. Natural wetlands shall not be used for improvement of urban run-off quality. ***Natural Wetlands***

Where wetlands are natural, the provisions of State Environmental Planning Policy No 14 – Coastal Wetlands, should be consulted. This policy protects wetlands from clearing, construction of levees, draining and filing, but does not prevent wetlands being used for run-off control, provided safeguards and operation control ensures their continued viability.

11. Wetlands are primarily to be designed to capture the ARI 3 month storm (deemed to be 40% of the ARI one year event), however overflow structures and flow paths are to be provided to allow passage of the ARI 100 year storm event ensuring no damage to the wetland or associated drainage or other ancillary works and no re-mobilisation of captured sediments. ***Efficiency***

12. Where possible, small islands or shoals should be constructed in the upstream areas of the wetland to reduce water velocities, prevent short-circuiting and promote aquatic plant growth. ***Short Circuiting***

These areas are best planted with vegetation native to the area, but they can be used as grassed areas and as an aesthetic feature.

13. Wetlands will serve other purposes than just improving a quality of urban run-off. They will serve to attract a large range of biota and bird habitat. In areas where they have been installed, they have become an aesthetic feature. Indeed, this may present problems as surrounding communities may resist efforts by the controlling authority to de-silt the wetland. ***Aesthetic Feature***

14. To minimise mosquito problems, limit expanses of water with more than 50 per cent shading and ensure no sections of water become isolated from the main body. ***Insect Problems***

15. Islands are highly beneficial as wildlife refuges, especially for birds. Their design should consider the effects on changes in water tables. ***Wildlife Refuge***

16. Ponds May be stocked with selected native fish to improve the water quality (not for sport), especially species which will control mosquito larvae and select zooplankton in preference to phytoplankton. Avoid use of fish which are bottom feeders. Any fish stocking programme must be approved by Council. ***Native Fish***

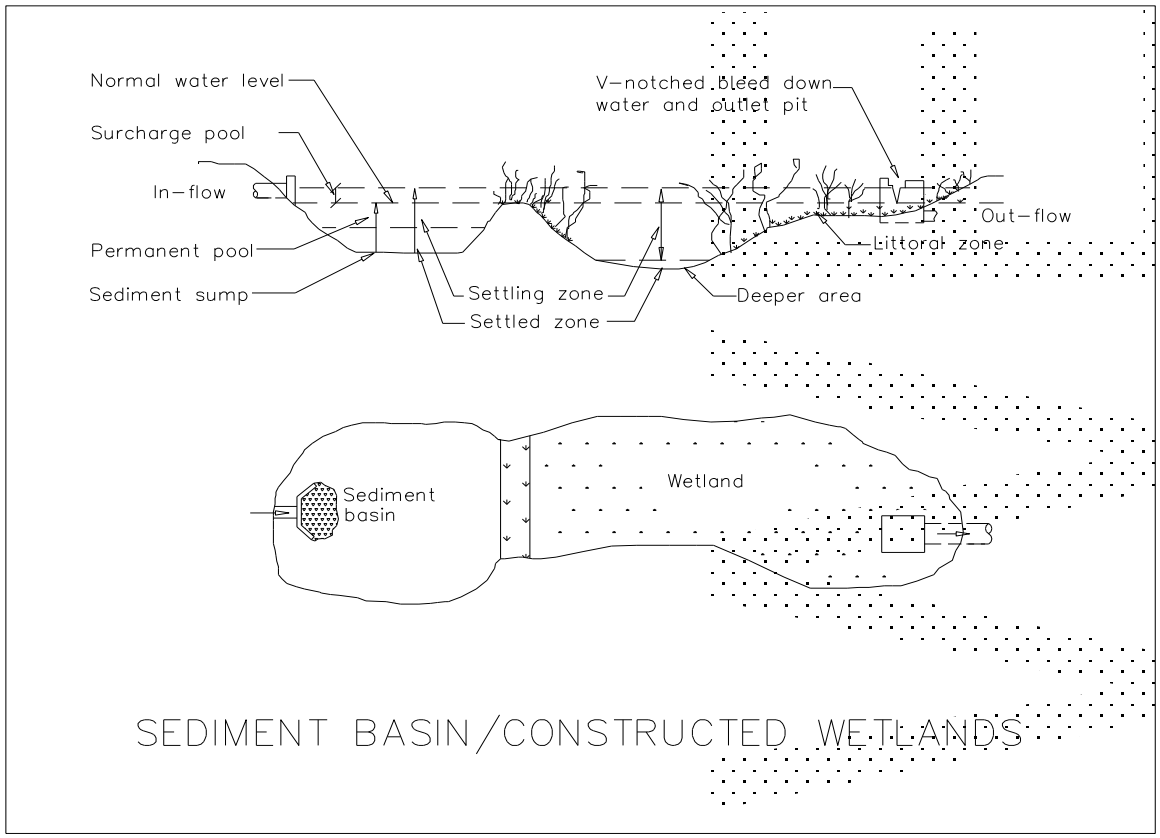


Figure D7-4 - Sediment Trap/Constructed Wetland

D7.28 INFILTRATION SYSTEMS

1. Infiltration systems are best utilised as part of a treatment train consisting of elements such as grassed surfaces, vegetated strips, swales, sand filters, gravel based reed beds, treatment train' tanks and geotextile filters. Infiltration systems are to follow the guidelines in Chapter 10 of ARQ. Infiltration systems are to be designed to achieve the following:

   a. Reduce the peak flow and volume of storm runoff

   b. Minimise pollution conveyance from urban catchments to downstream waterways and receiving waters.

   c. To harvest and use storm runoff as a "second quality" water resource.

2. The design capaSHIRE of infiltration systems can range from designs catering for the minor system flows to the major system flows.

3 Infiltration components can be constructed from the following:

   a. Single sized gravel.

   b. Slotted pipes – circular or semi-circular.

   c. Proprietary recycled drainage cell.

4. Types of suitable infiltration systems include:

   a. "Leaky" wells: typically concrete or PVC or similar pipe with perforated walls covered with non-woven geotextile fabric. The well is to be surrounded with gravel, enclosed in non-woven geotextile.

   b. Trenches may be gravel or gravel with a slotted pipe, drainage cell or a combination of all. All trenches embedded in host soil must be encased in non-woven geotextile fabric. Maximum floor level below ground is to be 1.5m, top of gravel should covered with 0.3m of backfill.

   c. "Soakaways" similar to trenches having a large plan area with depths ranging from 0.3m to 0.5m constructed of similar materials as trenches.

   d. Infiltration "dry" ponds are structures similar in design to small-scale retention wetlands. They are suited to sandy or sandy clay sites only with the screening of gross pollutants required upstream of the structure. Safe water depths during runoff events are critical in the design of this type of structure.

5. Appropriate types of runoff suitable to be directed to infiltration structures include:

   a. Storm runoff from roofs, cleared of leaves or other litter may be passed into a rainwater tank(s) and the overflow piped directly into an in ground device.

   b. Storm runoff from paved or hardstand areas (courtyards, walkways, carparks etc.) are not to pass directly to devices 4.a,b,c as described above. Such runoff must first pass across buffer zones or treatment devices such as 4.d above.

   c. Storm runoff from suburban scale areas are to be passed through a series of treatment devices (eg; litter screens, soakaways or similar) before entering into aquifers, urban waterways or receiving waters.

   d. During construction of infiltration systems appropriate measures are to be undertaken to ensure sediment is regularly removed prior to the infiltration system becoming operational.

6. The existing soil classification, permeability and water reactivity is to be determined by a geotechnical engineer or other suitably qualified person to determine how soil conditions at the project site will affect detailed design. Table D7.4 shows typical soil permeability and appropriate infiltration system types.

Soil Type	**Hydraulic Conductivity**		**Clearance to structures or boundaries**	**Recommended infiltration system**
	m/s	**mm/hr**	**m**	
Deep confined or unconfined Sands	5×10^{-5}	180	1 – 2	Leaky wells, trenches, soakaways
Sandy clays	$1x10^{-5}$ to $5x10^{-5}$	36 – 180	2	Trenches, soakaways
Medium clays	$1x10^{-6}$ to $1x10^{-5}$	3.6 – 36	4	Leaky wells
Heavy clays	$1x10^{-8}$ to $1x\ 10^{-6}$	0.036 – 3.6	5	Dry pond ,soakaways
Constructed clays	$1x10^{-10}$ to $1x10^{-8\ 0}$	.0004 – 0.036	5	Soakaways
Shallow soil over rock (sandstone)	$1x10^{-6}$ to $1x10^{-5}$	3.6 – 36	2	Leaky wells.

Table D7.4 Soil Permeability & System Selection Table

7. Conditions on selection of infiltration devices include the following:

   a. Leaky wells and gravel filled trenches are not to be used in areas of wind blown sands or Aeolian sands.

   b. Infiltration devices in areas of rock or shale of zero or near zero permeability are deemed to be unsuitable.

   c. Areas consisting of shallow soils over rock or lower permeable sands (eg. coffee rock) detailed investigations are to be carried out to determine the existence of stored water near the lower level layers (i.e. Perched water table) and the location of the emergence point of stored water. The impact on downstream areas is to be assessed in the selection of infiltration devices in these areas.

   d. A maximum slope of 5% and soil depth of at least 3m throughout a down slope area is required before infiltration devices are to be considered in areas of steep terrain.

   e. Infiltration devices are not to be used in areas of high or rising water table.

   f. Infiltration devices are not to be used in areas adjacent to underground carpark areas or lower basement areas unless seepage from such devices is adequately catered for by sump pumps or similar design to transfer flows to an appropriate drainage system or lower aquifer.

   g. The location of infiltration devices is to be assessed to determine the impact of upstream infiltration devices on valley floor water tables.

D7.29 VEGETATED SWALES

1. Swales are open vegetated channels that can be used as an alternative stormwater conveyance system to conventional kerb and gutter only with the approval of Council.

2. Vegetation of the swale can range from grass to native shrubs, depending on hydraulic requirements.

3. Criteria for the design of vegetated swales that form part of a bio-retention system is to include but not confined to the following:

a. The swale dimensions or catchment ratio should be designed so as to ensure 1 year ARI peak velocities do not exceed 0.5 m/s and 100 year ARI velocities do not exceed 1 m/s. In some situations, a high-flow bypass channel or underground pipe may be required.

b. Longitudinal gradients shall be in the range from 1% min. to 4% max.

c. The swale shall be integrated into the landscape character to enhance its aesthetic value.

d. The application of swales shall match the target pollutant characteristics. Where very fine particulates, or soluble material are of concern, other treatment measures such as infiltration systems or small wetlands shall be considered.

e. Established vegetation shall not be more than 75% inundated during the major design flow.

f. Swale profiles of triangular cross section are not acceptable, wide uniform flow shall be a design objective. Maximum width shall be 2.5m unless structural measures are used to ensure uniform spread of flow.

g. Manning's n value shall be between 0.15 and 0.3 for low flow conditions where the depth of flow is below the height of the vegetation. For the major storm event the Manning's 'n' value shall be a lower value (eg: 0.03) where flow is above the vegetation level.

D7.30 BIORETENTION SYSTEMS

1. Bioretention systems are designed to provide treatment of stormwater through fine filtration, extended detention and some biological uptake.

2. Runoff is filtered through a fine media layer as it percolates downward into a perforated pipe or similar and discharged either directly or via conventional stormwater conduit system. ***Treatment Processes***

An even flow distribution is required to allow water to infiltrate the filter media evenly and thus suited to flat terrain of less 2%.

3. Selection of filter media is a function of the infiltration rate required, refer to Table D7.9, and the type of vegetation utilised. ***Filtration Soil Media***

Soil type	Particle Size (mm)	Saturated Hydraulic Conductivity (mm/hr)	(m/s)
Gravel	2	36000	1×10^{-2}
Coarse Sand	1	3600	1×10^{-3}
Sand	0.7	360	1×10^{-4}
Sandy Loam	0.45	180	5×10^{-5}
Sandy Clay	0.01	36	1×10^{-5}

Table 7.5 Soil Hydraulic Conductivity

4. Vegetation shall be selected to complement the landscape of an area and to discourage movement and traffic over the bioretention area. ***Vegetation Requirements***

Plants selected shall be suitable to tolerate periods of inundation.

Plants having extensive fibrous root systems or a spreading, rhizomatous or suckering habit are required for efficient performance.

Plants with a clumped above ground habit shall not be used due to problems incurred by channelling, erosion and preferential flow paths.

SPECIAL REQUIREMENTS

D7.31 DEEMED TO COMPLY

1. Section D7 shall be deemed to comply if carried out in accordance with the requirements of Section D7, as amended by COONAMBLE SHIRE Council.

D7.32 RESERVED

D7.33 RESERVED

COONAMBLE SHIRE COUNCIL

COONAMBLE SHIRE COUNCIL

DEVELOPMENT DESIGN SPECIFICATION

D9

CYCLEWAY AND PATHWAY DESIGN

VERSION 3.1– JANUARY 2022

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
1	Lighting for Roads and Public Spaces	D9.03 (b)	A	BP	1/06
2	Crime Prevention through Environmental Design guidelines	D9.03 (c)	A	BP	1/06
3	COONAMBLE PAMP referenced	D9.03.(c)	A	KD	01/02/13
4	COONAMBLE PAMP referenced	D9.05.1	A	MC	01/02/13
5	Additional minimum design standards inserted in Table D9.1. Requirement for pram crossings at kerb lines added.	D9.10	A	MC	01/02/13

DESIGN SPECIFICATION D9
CYCLEWAY AND PATHWAY DESIGN - COONAMBLE

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DEVELOPMENT DESIGN SPECIFICATION D9
CYCLEWAY AND PATHWAY DESIGN - COONAMBLE

GENERAL

D9.01 SCOPE

1. This Specification sets out requirements to be used in the design of various types of cycleways and pathways.

2. All relevant design principles contained in the AUSTROADS Guide referenced below must be integrated in the design of cycleways and associated infrastructure. This Specification serves as a companion document to the AUSTROADS Guide extended to incorporate basic requirements for pathways. ***AUSTROADS***

3. The RTA NSW Bicycle Guidelines document is intended to provide technical assistance on a range of conditions particular to NSW and should be read in conjunction with AUSTROADS. Where there are differences between these guidelines the advice in the RTA Guidelines will prevail. ***RTA NSW Guidelines***

D9.02 OBJECTIVES

1. This Specification aims to set standards and document requirements related to the provision of cycleways and pathways which encourage pedestrian activities and cycling for transportation and recreational purposes. Cycleways and pathways are to be safe and convenient and shall maintain a satisfactory level of service for all pathway users including users with disabilities and limited mobility. ***Safety*** ***Level of Service***

D9.03 REFERENCE AND SOURCE DOCUMENTS

(a) Council Specifications

COONAMBLE Pedestrian and Mobility Plan (2010)
D1 - Geometric Road Design – COONAMBLE – Version 1
D13 - Vehicular Access Design – COONAMBLE – Version 1

(b) Australian Standards

AS 1742 - Manual of uniform traffic control devices.
AS 2156.1 - Walking tracks, Classification and signage
AS 2156.2 - Walking tracks, Infrastructure design
AS 2890.3 - Bicycle parking facilities
SAA HB69.14 - Guide to traffic engineering practice – Bicycles
AS Collection 005 Access and mobility – People with disabilities
AS/NZS 1158.3.1 1999 Lighting for Roads and Public Spaces

(c) Other

AUSTROADS - *Guide to Traffic Engineering Practice PART 13 Pedestrians, PART 14 Bicycles.*
- *Planning and Designing for Bicycles - NAASRA (now AUSTROADS) Technical Report June 1988.*

Roads and Traffic Authority of NSW (RTA)
- *NSW Bicycle Guidelines*.

Ministry of Transport, Victoria - State Bicycle Committee
- *Planning and Design of Bicycle Facilities*.

NSW Planning and NSW Police
- *Crime Prevention through Environmental Design guidelines*

COONAMBLE SHIRE Council – *COONAMBLE Bicycle Plan (2009)*
- *COONAMBLE Pedestrian and Mobility Plan (PAMP) 2010*

D9.04 CONSULTATION

1. The Designer must consult with Council, the Developer's Landscape Architects/Designers and relevant authorities prior to and during the preparation of cycleway and pathway design.

Landscape Designers Public Authorities

D9.05 PLANNING CONCEPTS

1. Council will provide specific requirements for cycleways and pathways in Council's Pedestrian and Mobility Plan (PAMP) and Bicycle Plan, as well as in a regional or local strategic bicycle plan. The Designer will need to enquire about such documents and comply with requirements defined.

Bicycle Plan

- The Designer should be familiar with cycleway geometric design requirements in terms of:

Geometric Design

  - width
  - grade
  - stopping sight distance
  - change in grade
  - horizontal curvature
  - crossfall and drainage
  - superelevation
  - sight distance on horizontal curves

AUSTROADS & RTA Guides

These requirements are discussed in the AUSTROADS Guide and RTA Guidelines.

3. The Designer shall incorporate all the requirements for disabled access as appropriate for pathway design in accordance with any Council Policy or Development Control Plan on Access and Mobility and AS Collection 005.

Disabled Access

D9.06 CYCLEWAY AND PATHWAY TYPES

1. Cycleways can be provided on road and off road. The AUSTROADS Guide and RTA Guidelines provide detailed descriptions, warrants, widths, pavement marking etc for the majority of these cycleways.

On Road Off Road

2. Common alternative cycleway types include:

On Road

Shared Parking/Bicycle Lanes
Wide Kerbside Lanes
Shared Traffic Lanes
Exclusive Bicycle Lane
Sealed Shoulder

Off Road

Shared Use Bicycle/Pedestrian Pathway
Separated Pathway
Exclusive Cycleway

The AUSTROADS Guide and RTA Guidelines provide advice on the suitability of pavement conditions, drainage pit grates etc for on road cycleways. ***AUSTROADS & RTA Guides***

3. Common pathway types include:

Exclusive Pedestrian Pathways
Shared Use Bicycle/Pedestrian Pathways

By definition pedestrian pathways are "off road" in that pedestrian facilities routinely designed adjacent to roadways are termed footpaths and are designed to meet criteria outlined in Council's Subdivision Code and typically related to road cross section detailing. ***Footpaths***

4. Pathways by comparison diverge from the road alignment either within the road reserve or across land reserves. Pathways can be provided in conjunction with overland floodways or retention basins. ***Land Reserves***

D9.07 PROVISIONS FOR CYCLEWAYS AND PATHWAYS AT STRUCTURES

1. Designers shall consider the best way to provide for the uninterrupted movement of cyclists and pedestrians at proposed and existing structures wherever possible. Structures include bridges and underpasses over rivers, roads or railways. The reference and source documents provide information on: ***Bridges Underpasses***

- acceptable widths and clearances
- types of cycleways and pathways
- handrails
- bicycle bridges
- approach ramps

  etc.

D9.08 SIGNAGE AND PAVEMENT MARKING

1. The Designer shall provide adequate signposting design for cycleways and pathways.

2. Signs and pavement marking will provide for the safe and convenient use of the facility. The signs and pavement marking will comply with AS 1742.9 Bicycle facilities. ***Compliance***

D9.09 END OF JOURNEY FACILITIES

1. Consideration must be given to the design of adequate facilities at common destinations of cyclists and pedestrians so as to encourage cycleway and pathway usage.

2. Such facilities could include: ***Facilities***

- seats
- standby areas
- secure bicycle parking
- picnic facilities

3. Bicycle parking installation design should meet appropriate criteria discussed in the AUSTROADS Guide and RTA Guidelines, and be fabricated to meet AS 2890.3. ***Parking***

D9.10 MINIMUM DESIGN STANDARDS

1. Notwithstanding the guidelines provided in this Specification and referenced documents the following minimum standards have been determined for Off-Road path types, as shown in Table D9.1.

Table D9.1 Off Road Path Types - Minimum Design Standards

	Cycleway	Pathway	Shared Use Pathway	
			Low Use	High Use
Path Width	2.0m	1.5m	2.0m	2.5-3.0m
Formation Width	3.0m	2.0m	3.0m	3.5-4.0m
Crossfall min.	1:40	1:40	1:40	1:40
max.	1:20	1:20	1:20	1:20
Grade max.	3% 5% for 120m 10% for 30m	NA	5% 10% for 30m	5% 10% for 30m
Granular sub-base (minimum compacted thickness at 97% standard compaction)	50 mm	50 mm	50 mm	50 mm
Path material	25mPa concrete with SL72 mesh	25mPa concrete with SL62 mesh	25mPa concrete with SL72 mesh	25mPa concrete with SL72 mesh
Path concrete thickness (compacted thickness)	100 mm	80 mm *	100 mm	100 mm

* Path thickness to be increased to the requirements for driveways at vehicular access locations – see D13 – Vehicular Access Design – COONAMBLE – VERSION 3.1for further detail of required driveway standards.

2. At kerb crossing points, a pram crossing must be provided for the path in accordance with ACT TAMS standard drawing DS3-02

Pram Crossings

D9.11 DOCUMENTATION

1. The following listing outlines Council's minimum requirements for presentation of cycleway and/or pathway designs.

- All plans for cycleways/pathways are to be presented at the reduction ratio 1:500. Plans will include signs and markings as well as fencing, railings and other furniture associated with the cycleway. ***Plans***
- The cycleway plan sheet may be incorporated into the road plan where clarity permits. Specific details are to be provided at reduction ratio 1:200.
- Longitudinal Sections will be required for all off-road cycleways where grades exceed 4%. ***Long Sections***
- Longitudinal Sections will have reduction ratios of 1:500 horizontal and 1:100

vertical.

- Cross Sections will be presented at 1:100 reduction ratio (natural) and transition tables will be required where cross falls vary or superelevation is provided. ***Cross Sections***
- A typical cross section will be detailed to indicate pavement materials and layer depths.

2. All Drawings shall be in accordance with the minimum drafting requirements in the Specification for QUALITY ASSURANCE REQUIREMENTS FOR DESIGN – COONAMBLE – VERSION 1.

SPECIAL REQUIREMENTS

D9.12 DEEMED TO COMPLY

Section D9 shall be Deemed to Comply if carried out in accordance with the requirements of Section D9, as amended by COONAMBLE SHIRE Council. ***Deemed to Comply***

D9.13 RESERVED

D9.14 RESERVED

COONAMBLE SHIRE COUNCIL

COONAMBLE SHIRE COUNCIL

COONAMBLE DEVELOPMENT DESIGN SPECIFICATION

D10

BUSHFIRE PROTECTION

VERSION 3.1 – JANUARY 2022

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.

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Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
1	Clause reserved	D10.08	M	HB	11/04
VERSION 3.1					
2	Standards Updated	D10.03	A	MC	04/02/13

DEVELOPMENT DESIGN SPECIFICATION D10
BUSHFIRE PROTECTION - COONAMBLE

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DEVELOPMENT DESIGN SPECIFICATION D10
BUSHFIRE PROTECTION - COONAMBLE

GENERAL

D10.01 SCOPE

1. The work to be executed under this Specification consists of the design of bushfire protection facilities to protect life and property and bring a fire to a halt.

2. The Specification contains procedures for the design of bush fire protection facilities. All relevant design principles contained in the NSW Rural Fire Service (RFS), *Planning for Bushfire Protection, A Guide for Councils, Planners, Fire Authorities, Developers and Home Owners*, 2006, (referenced below) must be integrated in the design of bush fire protection facilities. This Specification serves as a companion document to the RFS Guide extended to incorporate basic requirements for Perimeter Roads and Fire Trails. Designs shall be carried out to satisfy requirements of the Rural Fires Act 1997, the Council and the guidelines published by the NSW Rural Fire Service. Consultation with the local Fire Control Officer is recommended.

RFS Guide Compliance

D10.02 OBJECTIVES

1 This Specification aims to outline the requirements for bushfire hazard in developments, so that:

- All new allotments have measures sufficient to minimise the impact of bushfires.
- The impact of fire protection measures on vegetation, fauna, views, watercourses soil erosion, amenity and access is minimised.
- The potential bushfire threats to individual sites are identified.
- The risk to property and the community from bushfire is reduced.
- Bushfire protection is afforded to all new allotments and likely future improvements.

D10.03 REFERENCE AND SOURCE DOCUMENTS

(a) Council Specifications

D1 - Geometric Road Design
C501 - Bushfire Protection (Perimeter Tracks) – Version 3.1

(b) NSW Government Legislation

Environment Planning and Assessment Act 1979
Rural Fires Act, 1997
Rural Fires Regulations, 2002
Rural Fires and Environmental Assessment Legislation Amendment Act 2002

(c) NSW Government Department Publications

NSW Rural Fire Service,
- *Planning for Bushfire Protection*. 2006

Department of Land and Water Conservation (formerly Land Management)
- Soil Conservation Service 1994. *Guidelines for Planning, Construction and Maintenance of Tracks*.

(d) Other

Board of Fire Commissioners
- *Hazard Reduction for the Protection of Buildings in Bushland Areas*, 1984.

Insurance Council of Australia.
- *Bushfire Safety in Urban Fringe Areas*.

Luke, R.H. - *Before the Fires Start*.

DESIGN CRITERIA

D10.04 GENERAL

1. A bushfire threat assessment must form part of all development applications for subdivision. The threat assessment is an integral part of the subdivision design, and affects lot shape, size, orientation, and road layout. Bushfire protection measures have the potential to affect vegetation, fauna, views, watercourses, soil erosion, amenity and access.

Bushfire Threat Assessment

2. Assessment of threat from bushfire must examine impacts of the proposal both within and external to the site, including the capaSHIRE of the existing road network serving the site to accommodate traffic in emergency situations.

Internal and External Impacts

3. Preparation of an assessment of threat from bushfire should include reference to:

- NSW Rural Fire Service (RFS) – *Planning for Bushfire Protection – a guide for Land Use Planners, Fire Authorities, Developers and Home Owners*.
- Consultation with Council and RFS staff.

Consultation with Council and RFS

4. Fire protection measures must be capable of being maintained by owners and users.

Maintenance

5. Asset Protection Zones must be contained wholly within the subject site, and may incorporate fire trails, perimeter roads, cleared road verges and fixed building lines.

Asset Protection Zones

6. The subdivision design must provide adequate emergency vehicle access to those parts of the site fronting a potential bushfire source.

Emergency Vehicle Access

7. In instances where the balance between bushfire protection and environmental and social impact cannot be achieved, the proposal may not be supported.

Environmental and Social Impact

D10.05 ASSET PROTECTION ZONES

1. The provision of Asset Protection Zones (APZs) shall occur as part of the development of the subdivision pattern. Each individual allotment shall have adequate space for the main building (*usually a dwelling*), an area of open space (*front, back or side yard*) and the APZ. The APZ shall meet the requirements set out in the RFS Guide.

Part of Development

2. The Asset Protection Zones are to be placed wholly within the subdivision they are intended to protect.

3. The Asset Protection Zones are to be placed as restrictions on the burdened allotments. No habitable or storage structures are permitted within those zones.

Restrictions on Use

4. Asset Protection Zones, Fire Trails and Perimeter Roads are not acceptable on land which is considered environmentally sensitive.

Environmentally Sensitive

5. Hazard reduction within the Asset Protection Zone is to be carried out so as to minimise site disturbance. Where necessary, reduction is to be carried out by hand with trees being felled rather than pushed over.

Hazard Reduction

6. To ensure effectiveness of the fire protection measures, restrictions may be placed upon the titles of the affected lots. These restrictions may relate to:-

Restrictions on title

- Habitable and storage structures being excluded from within the APZ.
- Level at which the fuel loading is to be maintained within the APZ.
- Responsibility for and nature of maintenance of fire trail, hazard reduction and APZ.

D10.06 PERIMETER ROADS

Minimum Specifications

1. Perimeter roads in subdivisions are to have the following minimum specifications:
   - Width as set out in D01, Geometric Road Design – COONAMBLE – VERSION 3.1 for the appropriate road type, with a minimum of 6.0 m.
   - Vertical kerb and gutter on the fire source side of the road.
   - Kerb and gutter on the development side of the road as required for the appropriate road type.
   - Have adequate turning facilities for emergency vehicles.

2. Long “dead end” sections of road are not acceptable.

Dead Ends

3. For those subdivisions receiving reticulated water, fire hydrants shall be situated at appropriate intervals or near where potential fire hazard areas exist as determined by Council. The locations of hydrants are to be delineated by blue pavement markers in the centre of the road.

Hydrants

4. Battle-axe shaped allotments, where the access handles are in excess of 30m in length are not permitted.

Battle Axe Allotments

D10.07 FIRE TRAILS

1. Where a fire trail is located on private land, a 20m wide right of carriageway in favour of Council and the Rural Fire Service shall contain the fire trail.

20m Easement

2. Where a fire trail crosses common boundaries between allotments, a gate or barrier with a Council approved lock will be required.

Boundary Gate

3. In residential zones, fire trails are to be a minimum of 6 metres wide, free of overhanging barriers and be constructed in accordance with D01, Table D1.7 for a right of way. The maximum longitudinal grade of fire trails is 20%.

4. Mountable verges are to be stabilised and free of overhanging branches.

5. Passing bays should be provided at regular intervals of 200 metres (maximum spacing).

D10.08 NOT USED

D10.09 INTERNAL ACCESS FROM SUBDIVISION ROADS

1. The provision of adequate internal access is also controlled by subdivision design. Subdivision roads shall incorporate the following features:

Incorporated in Subdivision Design

(a) width, vertical clearances and any dips and crests which allow the two way movement of firefighting appliances;

(b) construction standards of roads and any bridges which allow for the carrying of fully loaded fire appliances (28 tonnes or 8 tones per axle);

(c) curves which have a minimum inner radius of 12m and are minimal in number;

(d) maximum grades which do not exceed 15% (1:7) and preferably not more than 10% (1:10);

(e) clearly signposted roads;

(f) dead end roads which do not exceed 200 metres in length;

(g) dead ends which incorporate a minimum turning circle of 12.5m diameter; and

(h) a road network which connects regularly to any access tracks.

D10.10 STAGING WORKS

1. When considering the rate of development, planners shall provide for initial development to occur on the hazard perimeter of the development. A line of dwellings will tend to minimise the threat to the entire subdivision by limiting the hazard interface.

Initial Development on Hazard Perimeter

2. Scattered developments on the other hand, will allow a continuous network of fuel to threaten individual buildings until development is substantially underway.

Scattered Developments

3. For similar reasons, new developments should be 'tacked' onto old developments to minimise the hazard perimeter.

Minimise Hazard Perimeter

4. It is important that much of the bush fire protection is incorporated into the design of the development, rather than into individual allotments.

Incorporated in Subdivision Design

SPECIAL REQUIREMENTS

D10.11 RESERVED

D10.12 RESERVED

D10.13 RESERVED

COONAMBLE SHIRE COUNCIL

COONAMBLE SHIRE COUNCIL

COONAMBLE DEVELOPMENT DESIGN SPECIFICATION

D11

WATER RETICULATION

AUS-SPEC appreciates the role of the NSW Water Directorate in comprehensively updating the design and construction specifications for water and sewer works.

VERSION 3.1 – JANUARY 2022

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
1	Provide for water supply to other areas	D11.04	A	HB	4/04
2	Pressure requirements to Council Standards	D11.05	M	HB	4/04
3	Requirement for Network Analysis	D11.05	A	HB	4/04
4	Requirements for individual services	D11.06	AM	HB	4/04
5	Valve closing clockwise	D11.06	M	HB	4/04
6	Details of Main location	D11.07	AM	HB	4/04
7	Delete use of some pipe materials	D11.09	O	HB	4/04
8	Delete use of uPVC, ABS, GRP pipes	D11.10 D11.11 D11.15	M	HB	4/04
9	Limit use of PE pipes	D11.14	A	HB	4/04
10	Information required at PS witness point	D11.17	A	HB	4/04
11	Ambient conditions changed to -10^0C	D11.19	M	HB	4/04
12	Telemetry to comply with existing	D11.21	O	HB	4/04
13	Lifting equipment to allow removal from Pump Station	D11.23	M	HB	4/04
14	Approval of design before start of construction	D11.24	AM	HB	4/04

15	Provide Longitudinal section only if required	D11.24	M	HB	4/04
16	Deemed to Comply	D11.27	A	HB	4/04
17	Generator connection for pump stations	D11.17.6	A	KD	9/05
18	A1 plan size	D11.25.3	A	KD	9/05
19	Hold Point for water reticulation design	D11.04.1	A	BP	1/06
VERSION 3.1					
20	Requirement for dual water supply	D11.02.1	M	MC	04/02/13
21	Water pressures amended to WSA 03	D11.05	A	MC	04/02/13
22	Fire fighting supply to AS2419.1	D11.05	A	MC	04/02/13
23	Requirements for distribution mains added	D11.06.1	A	MC	04/02/13
24	WSA 03 requirements for dead end mains stipulated	D11.06.4	M	MC	04/02/13
25	Requirements for distribution mains	D.11.06.5	M	MC	04/02/13
26	Requirements for recycled water services added	D11.06.6	A	MC	04/02/13
27	Valve structures to WAS 03	D11.06.7	A	MC	04/02/13
28	Alignment for dual water supply ,stop valve locations, permanent dead end hydrants, pressure zone valve arrangements, major commercial two directional	D11.07.1	M	MC	04/02/13
29	Requirement for easements	D11.07.2	M	MC	04/02/13
30	Pipe types for potable water and recycled water supply stipulated, pipe colour coding to WSA 03 (NDW), fire flow on recycled water main, thrust blocks to WSA 03.	D11.09	M	MC	04/02/13
31	PVC-M pipe for potable water mains and PVC-O pipe for recycled water mains	D11.10	M	MC	04/02/13
32	DICL PN35 flange class nominated	D11.12	M	MC	04/02/13
33	Use of steel pipe limited	D11.13	M	MC	04/02/13
34	PE pipe use limited	D11.14	M	MC	04/02/13
35	GRP pipe use limited	D11.15	M	MC	04/02/13

37	Hold Point added	D11.24.1	M	MC	04/02/13
38	Pipe colours for drawings	D11.24.6	A	MC	04/02/13
39	Hold Point added	D11.25.1	M	MC	04/02/13
40	References to WSA 03 updated to Version 3.1	Various	M	MC	04/02/13
41	Plastic identification covers required on valves	D11.06.11	A	MC	04/02/13
42	PE Water Services	D11.06.6	A	DJ	25/3/22

DEVELOPMENT DESIGN SPECIFICATION D11
WATER RETICULATION - COONAMBLE

CONTENTS

DEVELOPMENT DESIGN SPECIFICATION D11
WATER RETICULATION - COONAMBLE

GENERAL

D11.01 SCOPE

1. The work to be executed under this Specification consists of the design of a water reticulation system either as a stand-alone project or part of a development. ***System***

2. This Specification contains procedures for the design of the following elements of a water supply system. ***Elements***

   (a) Reticulation

   (b) Pump Stations

3. The design of reticulation and pump station components shall comply with the Water Services Association of Australia's publication WATER RETICULATION CODE OF AUSTRALIA unless specified otherwise herein and should be constructed in accordance with the DEVELOPMENT CONSTRUCTION SPECIFICATION - WATER RETICULATION – VERSION 3.2. ***Compliance***

4. Where the Specification forms part of a contract attracting Government Grant funds, the Principal shall identify: ***Subsidised Schemes***

   (a) Items which are not of the least cost option, that

      (i) Are intended to have a much longer design life than the normal asset service life detailed in the Asset Management Guidelines of the International Infrastructure Management Manual.

      (ii) Do not meet the project objectives and the requirements of the various Authorities for the least Net Present Value (NPV) but may become the preferred option for construction.

   (b) Particular equipment which is procured without relevant competition through tendering

   (c) Duplication of equipment or unit processes in a system configuration

D11.02 OBJECTIVE

1. The objective of a water supply system is to provide to the consumer a reticulated (either potable or dual potable/raw) water supply to meet the demands imposed upon it by both the consumers and fire fighting requirements. Consumer requirements shall be met by providing a water main and allowing an appropriate point of connection for each individual property. ***Water Supply***

D11.03 REFERENCE AND SOURCE DOCUMENTS

1. Documents referenced in this Specification are listed below whilst being cited in the text in the abbreviated form or code indicated. The Designer shall possess, or have access to, the documents required to comply with this Specification. ***Documents***

2. References to the WATER RETICULATION CODE OF AUSTRALIA are made where there are parallel sections or equivalent clauses to those in this Specification. ***Water Reticulation***

Where not called up as part of this Specification, these references are identified by part and section numbers and enclosed in brackets thus (WSA Part, Section). ***Code***

(a) Council Specifications

C401 - Development Construction Specification Water Reticulation – Version 3.2.

The Designer shall include the requirements of the DEVELOPMENT CONSTRUCTION SPECIFICATION - WATER RETICULATION – VERSION 3.2 .

(b) Australian Standards

References in this Specification or the Drawings to Australian Standards are noted by their prefix AS or AS/NZS. (WSA 03 Part 1, section 1.4, and Part 2) ***Australian Standards***

The Designer shall use the latest edition of the Australian Standards, including amendments and supplements, unless specified otherwise in this Specification.

AS 1102	-	Graphical symbols for electrotechnical documentation (various)
AS/NZS 1111	-	ISO metric hexagon commercial bolts and screws
AS/NZS 1112	-	ISO metric hexagon nuts including thin nuts slotted nuts and castle nuts
AS 1214	-	Hot dipped galvanised coatings on threaded fasteners (ISO metric coarse thread series)
AS/NZS 1260	-	PVC pipes and fittings for drain, waste and vent applications
AS 1281	-	Cement mortar lining of steel pipes and fittings
AS 1432	-	Copper tubes for plumbing, gasfitting and drainage applications
AS 1444	-	Wrought alloy steels – Standard, hardenability (H) series and hardened and tempered to designated mechanical properties
AS 1449	-	Wrought alloy steels – Stainless and heat resisting steel plate, sheet and strip
AS 1460	-	Fittings for use with polyethylene pipes
AS/NZS 1477	-	PVC pipes and fittings for pressure applications
AS 1579	-	Arc welded steel pipes and fittings for water and wastewater
AS/NZS 1594	-	Hot rolled steel flat products
AS 1646	-	Elastomeric seals for waterworks purposes.
AS 1657	-	Fixed Platforms, walkways, stairways and ladders – Design, construction and installation
AS 2129	-	Flanges for pipes, valves and fittings
AS 2200	-	Design charts for water supply and sewerage
AS/NZS 2280	-	Ductile iron pressure pipe and fittings
AS/NZS 2566.1	-	Buried flexible pipelines – Structural design
AS 2634	-	Chemical plant equipment made from glass fibre re-inforced plastics (GRP) based on thermosetting resins
AS 2638	-	Sluice Valves for waterworks purposes
AS 2837	-	Wrought alloy steels – Stainless steel bars and semi-finished products
AS 3500	-	National Plumbing and Drainage Code
AS 3518.1	-	Acrylonitrile Butadienne Styrene (ABS) pipes and fittings for pressure applications – Pipes
AS 3518.2	-	Acrylonitrile Butadienne Styrene (ABS) pipes and fittings for pressure applications – Solvent cement fittings
AS 3571	-	Glass filament reinforced thermosetting plastics (GRP) pipe - Polyester based - Water supply, sewerage and drainage applications
AS 3578	-	Cast iron non-return valves for general purposes

AS 3579	-	Cast iron wedge gate valves for general purposes
AS 3680	-	Polyethylene sleevings for ductile iron pipelines
AS 3688	-	Water supply – Copper and copper alloy body compression and capillary fittings and threaded-end connectors
AS 3691	-	Solvent cement and priming (cleaning) fluids for use with ABS pipes and fittings
AS 3735	-	Concrete structures for retaining liquid
AS 3855	-	Suitability of plumbing and water distribution systems products for contact with potable water
AS 3862	-	External fusion-bonded epoxy coating for steel pipes
AS 3952	-	Water supply- DN80 spring hydrant valve for general purposes.
AS 3996	-	Metal access covers, road grates and frames
AS 4020	-	Products for use in contact with drinking water
AS 4041	-	Pressure piping
AS 4058	-	Precast concrete pipes (pressure and non-pressure)
AS 4087	-	Metallic flanges for Waterworks purposes.
AS 4100	-	Steel structures
AS/NZS 4129(Int)		Fittings for polyethylene (PE) pipes for pressure applications.
AS/NZS 4130	-	Polyethylene (PE) pipes for pressure applications.
AS/NZS 4131	-	Polyethylene (PE) compounds for pressure pipes and fittings.
AS/NZS 4158	-	Thermal bonded polymeric coatings on valves and fittings for water industry purposes
AS/NZS 4321	-	Fusion-bonded medium-density polyethylene coating and lining for pipes and fittings
AS/NZS 4765(Int)		Modified PVC (PVC–M) pipes for pressure applications
HB 48	-	Steel structures design handbook

(c) Other

Institute of Public Works Engineering Australia (IPWEA)

- Streets Opening Conference Information Bulletin on Codes and Practices (Sections 3 and 4 detailing locations and depths of other services and preferred location for water reticulation pipes)

NSW Department of Public Works and Services (DPWS)

MEW E101	-	Electrical Services Minimum Requirements
PWD-WSIM	-	Water Supply Investigation Manual
PWD	-	Safety Guidelines for fixed ladders, stairways, platforms and walkways.
WS-SPEC	-	Technical Requirements (TRs) and Strategic products Specifications (WSAA)

Water Services Association of Australia (WSAA)

WSA 03	-	Water Reticulation Code of Australia

Building Codes Board of Australia

- Building Code of Australia - PART E1, Fire Fighting Equipment.

(d) Standard Drawings ***Drawings***

WATER RETICULATION CODE OF AUSTRALIA drawings shall be used in preference to DPWS standard drawings (WSA 03 Part 3).

DESIGN CRITERIA

D11.04 GENERAL

1. The layout and sizing of distribution and reticulation systems within a proposed development cannot be viewed in isolation, treating only the area under development. Provision shall be made for anticipated flows from and to other areas as required by the Water Authority. Except where specified otherwise, the division of responsibilities between the Water Authority and the Designer shall be in accordance with the DEVELOPMENT CONSTRUCTION SPECIFICATION-WATER RETICULATION. (WSA 03 Part 1, section 2). The approval of final design constitutes a **HOLD POINT**. ***Responsibility*** ***HP***

2. The Designer shall take into account the special requirements for dual water supplies where required by the Water Authority, including but not limited to, demand, size and location for each pipe system. Dual services shall not be installed unless part of a dual supply. ***Dual Supplies***

3. The Designer shall take into account the location and type of valve required considering maintenance and repair requirements, the need for double air valves with integral isolating valve on mains or single air valve with isolating valve on reticulation mains, and scour points. ***Valve Type and Location***

D11.05 RETICULATION PRESSURE

1. Reticulation systems shall be designed to supply peak instantaneous demand by gravity while maintaining a minimum static heads stipulated in Table 2.3 of WSA 03 Part 1, section 2.5. ***Minimum Static Head***

2. A peak instantaneous demand of 0.15 L/s/tenement shall be used.. Water demands for other developments shall be as detailed in the DEVELOPMENT CONSTRUCTION SPECIFICATION-WATER RETICULATION – Version 3.2 (WSA 03 Part 1, section 3) ***Water Demand***

3. Under no circumstances shall the pressure be able to equal or exceed the safe working pressure of the reticulation pipe material. The effect of water hammer is to be taken into account for the maximum pressure. ***Maximum Pressure***

4. The desirable maximum pressure is 580 kPa, normally acceptable maximum is 880 kPa. Zoning of the reticulation system by means of pressure reducing valves (PRV's) may be necessary to achieve these pressures across the development. ***Desirable Maximum Pressure***

5. Water mains required for fire-fighting purposes in the development shall be designed in accordance with AS 2419.1-2005. ***Fire Fighting***

6. The Designer shall provide a network analysis of the reticulation system detailing the pressure and distribution after consultation with the Water Authority. The data and model shall be supplied in an electronic format compatible with Council's water network analysis model. If compatible data is not available, then the network ***Network Analysis***

analysis provided will include computer software sufficient for Council to investigate the proposed reticulation system.

D11.06 PIPELINE

1. Trunk mains directly supplying reticulation systems shall be designed as part of the reticulation system to carry peak instantaneous demands. (WSA 03 Part 1, sections 3 and 5) ***Trunk Mains***

2. Mains feeding service reservoirs shall be designed to carry peak daily demands over 24 hours in the case of gravity mains and 22 hours in the case of rising mains. ***Peak Daily Demand***

3. Reticulation mains shall be looped to eliminate dead ends unless permitted otherwise by the Water Authority. ***Looped Mains***

4. Where a dead end is permitted to provide for future extension from staged development, the end shall be fitted with a gate valve, and hydrant. (WSA 03 Part 1, section 5.10.2) ***Staged Development***

5. Distribution mains shall comprise twin transfer mains and/or looped distribution mains in accordance with WSA 03 Part 1, Section 2.4, Figure 2.1(c). Distribution mains >225 mm dia shall not be utilised for service connections. Where required, rider mains shall be provided in accordance with WSA 03, Part 1, Section 5.8. Duplicate mains shall be provided when required as stipulated in WSA 03, Part 1, Section 5.7.

6. Each lot shall have an individual service tapped from each main and extending 500mm inside the lot boundary. As far as practicable services should be located adjacent one common property boundary, with other utility services located at the other common property boundary. The drinking water and non-drinking water services shall be located at least 1m off the boundary and 1m apart from each other. Road Crossings are to be in a conduit and PE services require tracing wire. All services shall be perpendicular to the main, unless approved by the Water Authority. The maximum length of individual services shall be 10m unless otherwise approved by the Water Authority. The following service sizes apply - ***Individual Service***

	Service Size (Copper or PE)
Residential Lot	20 mm
Dual Occupancy Subdivision	20 mm to each lot
Unit site - 3 – 6 units	25 mm
7 – 12 units	40 mm
13 – 50 units	65 mm
51 – 100 units	100 mm
Industrial Lot	40 mm minimum
Commercial Lot	40mm minimum

7. Valves on trunk mains are to be housed in valve chambers. The Designer shall show on the Drawings the type of cover and how the covers shall be seated. Valves on reticulation mains shall be provided with a valve surface box in accordance with WSA 03, Part 1, section 8.10. ***Valve Chambers***

8. Metal access covers shall be manufactured in accordance with AS 3996. The ***Access Covers***

Designer shall ensure that air valve covers have adequate openings for air exchange.

9. Stop valves shall be clockwise closing. ***Valve Closing***

10. The Designer shall provide for ease of valve maintenance within valve chambers, where provided, and select valve types such that servicing of the valve can be effected without removal from service, wherever possible. ***Valve Maintenance***

11. Plastic identification covers shall be installed on the valve spindle cap in accordance with WSA 03, Part 1, section 8.1.5.

D11.07 LOCATION

1. In designing the reticulation system, standard locations shall be followed, as detailed below: ***Standard Location***

(a) Reticulation mains shall be laid in compliance with the Water Authority's standard footpath allocation for public utilities, or in the absence thereof, in conformity with the Streets Opening Conferences' protocols and in accordance with WSA 03, Part 1, section 5.4.5. Location in a common trench in the footway allocation shall be the preferred treatment, with the non-potable water main located closest to the property boundary (WSA 03, Part 1, section 5.4.5). Where this arrangement cannot be achieved separate trenches in the footway allocation on opposite sides of the road reserve shall be used as an alternative. Location under the road carriageway, except for road crossings, shall not be used unless prior approval of the Water Authority and Road Authority is obtained.

(b) Valves shall be located to avoid conflict with driveways, telephone house service pits and underground electrical boxes. Stop valves shall be located to limit the number of dwellings isolated during a shutdown as specified in WSA 03, Table 8.2 and to ensure a maximum of 5 valves closures can affect a shut down. Mains in cul-de-sacs and dead-end mains shall be provided with a Stop valve adjacent the tee with the through main.

(c) Hydrants shall be located on all reticulation mains. The interval between hydrants on the non-drinking water supply mains to be used for fire fighting purposes shall not exceed 60 metres except at locations where fire fighting coverage is not required, where the spacing may be increased to 90 metres. The interval between hydrants on the drinking water supply mains shall not exceed 90 metres. Hydrants shall also be installed at all high and low points of the main, and at dead ends. Permanent dead ends of mains shall be provided with a hydrant bend, hydrant riser and spring hydrant.

(d) Water mains laid around the curves at the end of cul-de-sacs shall be minimum DN 100 and be located within the verge.

(e) Marker plates and Road Pavement markers shall be placed at all hydrant and valve locations.

(f) Pressure zone dividing valves and hydrants shall be installed in accordance with WSA 03, Part 1, Figure 8.10 (a) as an X-O-X arrangement.

(g) Major commercial lots shall be provided with two directional supply in accordance with WAS 03, Part 1, Figure 8.14. The Water Authority shall be consulted to determine whether a lot will be deemed to require this arrangement.

2. Water mains will not be located on private property. An easement for water ***Easements***

supply over the subject private properties must be created in favour of the Water Authority. A Registered Surveyor shall survey easements and pipelines.

D11.08 MINE SUBSIDENCE AREAS AND AREAS OF SLIPPAGE

1. The Designer shall accommodate the movement associated with the ground strain for the area, as advised by the Mine Subsidence Board for water reticulation jointing systems in proclaimed Mine Subsidence Areas, or in a known or expected area of subsidence or slippage. The design ground strain for the development shall be detailed on the Drawings. (WSA 03 Part 1, section 4.3.3.3) ***Ground Strain***

2. The pipe jointing system selected shall be capable of accepting ground movements, without impairing the water tightness of the joint, for the ground strain as advised by the Mine Subsidence Board. For areas with high ground strains a pipe jointing system using shorter effective length pipes and/or deep socket fittings shall be used. This action constitutes a **WITNESS POINT**. The Principal shall advise at the time of notification by the Designer whether the option to confer is required. ***Pipe Jointing System*** ***(WP)***

3. Where the Mines Subsidence Board does not cover an area of known, or suspected, subsidence or slippage, the above requirements shall still apply. ***Areas Applicable***

MATERIALS

D11.09 GENERAL (WSA 03 Part 2)

1. The working pressure of pipes, fittings, valves and hydrants shall be fit for the purpose in accordance with the relevant Australian Standard for the material and shall be at least 1200 kPa (120m). ***Working Pressure***

2. The Designer shall select pipe type, class and standard based on pumping design and in accordance with AS 2200 and site conditions. All pipes shall be a minimum Class 12 unless otherwise determined by the Water Authority. (WSA 03 Part 1, sections 3.3). ***Class and Standard***

3. Pipes and fittings for the potable water reticulation shall be of PVC-M, ductile iron, steel, or copper. Pipes and fittings for the recycled water reticulation shall be of PVC-O, ductile iron or copper. The material specifications for each pipe type are provided in clauses D11.10 to D11.16 inclusive. Other pipe materials shall only be used where the Water Authority agrees to their specific use where conditions warrant. ***Type***

4. The Designer shall provide for the water pipes to be colour coded and shown on the Drawings accordingly. (WSA 03, Part 1, sections 4.2.2 & 4.2.3) ***Colour Coding***

5. The Designer shall show on the Drawings the extent of external protection required to be undertaken by the Contractor. External protection shall be shown to comply with the DEVELOPMENT CONSTRUCTION SPECIFICATION-WATER RETICULATION – Version 3.2 (WSA 03 Part 1 section 4.8). ***External Protection***

6. Piers for any above ground water main shall be in accordance with the DEVELOPMENT CONSTRUCTION SPECIFICATION - WATER RETICULATION – version 3.1 (WSA 03 Part 1, section 7.8). ***Piers***

7. The Designer shall allow for adequate working area, waste removal and transport arrangements where scouring points or pipe inspection locations are nominated. (WSA 03 Part 1, section 8.6) ***Special Allowances***

8. The Designer shall indicate the location of connections for gauges required on mains. ***Gauge Locations***

9. The minimum diameter of all pipes shall be DN100 unless otherwise determined ***Diameter***

by the Water Authority. In commercial, industrial or high-rise building areas the minimum shall be DN150. In all cases pipe sizes and residual pressures shall be designed to cater for fire fighting flows. (WSA 03 Part 1, sections 2.3.1.1 and 3.7.3.1)

10. The Designer shall take regard of the limits of use for the pipeline system materials under consideration. (WSA 03 Part 2, sections 2.5, 3.6, 4.6, 5.6, 6.6, and 7.6) ***Limits of Use***

11. Where valves are specified and shown on the Drawings, they shall comply with the valve details in the DEVELOPMENT CONSTRUCTION SPECIFICATION - WATER RETICULATION – Version 3.1. (WSA 03 Part 1, section 4.7.1) ***Valves***

12. The Designer shall design thrust blocks in accordance with WSA 03, Section 5.9. ***Thrust Blocks***

13. The Designer shall provide for surge control by specifying an appropriate pipe material and class selection. ***Surge Control Method***

D11.10 UNPLASTICISED AND MODIFIED PVC (uPVC and PVC-M) PIPE

1. Series 2 PVC-M pipe (PN 16 minimum with rubber ring joints) and fittings shall be specified for all potable water reticulation mains and potable water trunk mains up to 375 mm diameter. ***Standards***

2. Series 2 PVC-O pipe (PN 16 minimum purple coloured with rubber ring joints) and fittings shall be specified for all recycled water reticulation mains and recycled water trunk mains up to 375 mm diameter.

3. Pipes and fittings and shall comply with AS/NZS 1477, AS/NZS 4441 or AS/NZS 4765 as appropriate, shall be suitable for use with elastomeric seals complying with AS 1646 and shall be of the class and size as shown on the Drawings. (WSA 03 Part 3, Section 12.1)

4. Pipes and fittings shall be handled and stored in accordance with WSA 03 or AS/NZS 2032. Where storage beyond the times specified in WSA 03 and AS/NZS 2032 are required, the Contractor shall provide protection for the pipes and fittings from ultra violet light and damage as recommended in the standards for the pipes and fittings. The Contractor shall take account of the time for storage and type of shelter. ***Protection***

5. Pipes and fittings shall be joined in accordance with the manufacturer's instructions using solvent cement to AS/NZS 3879. ***Jointing***

D11.11 ACRYLONITRILE BUTADIENE STYRENE (ABS) PIPE AND FITTINGS

Not to be used ***Reserved***

D11.12 DUCTILE IRON (DI) PIPE AND FITTINGS

1. Ductile iron pipes and fittings shall be specified for potable water and recycled water mains 450 mm diameter or greater and for all potable water and recycled water rising mains and are to be manufactured in accordance with AS/NZS 2280 minimum Class PN35 Flanged Class. (WSA 03 Part 2, section 3) ***Standard***

2. The Designer shall specify cement mortar lining in accordance with AS 1281, or fusion-bonded medium density polyethylene to AS/NZS 4321. External protection shall be epoxy coating to AS 3862 where not otherwise specified as sleeved or wrapped, taking into account the type of corrosion protection required. ***Corrosion Protection***

3. Generally, pipe and fitting joints shall be specified to be spigot and socket type using a rubber ring (elastomeric) push in seal made of natural rubber, ethylene propylene ***Joints***

rubber or nitrile rubber with compounds complying with AS 1646. The seal shall be a single jointing component shaped to provide both groove lock and seal mechanisms.

4. The Designer shall take account of congested service corridors, poor soil conditions and the need for additional security for strategic mains with regard to the provision of restrained joints. ***Restrained Joints***

5. Flanges shall be specified to be manufactured in accordance with AS 4087 and AS 2129 Table C. The Designer shall specify bolts and nuts for flanged joints in accordance with AS 2129, galvanised in accordance with AS 1214, or stainless steel in accordance with AS 1449 as for pumps specified in the DEVELOPMENT CONSTRUCTION SPECIFICATION - WATER RETICULATION – Version 3.2. ***Flanges***

D11.13 STEEL PIPE AND FITTINGS

1. Steel pipes and fittings shall only be specified where the Water Authority has granted concurrence to their use. Where allowed, the pipes and fittings shall be specified to be manufactured in accordance with AS 1579 and AS/NZS 1594 and designed to AS/NZS 2566.1. (WSA 03 Part 2, section 4). ***Standard***

2. The Designer shall specify the jointing system where long-term corrosion resistance, ease of construction or special circumstances dictate the need. The pipe jointing shall be either:

(a) Rubber ring (elastomeric) jointed to conform to AS 1646, or

(b) Welded with butt welding or by using a welding collar with the application of a polyethylene heat shrunk sleeve over the weld, or wrapped, or

(c) Flanged to comply with AS 4087 to the table specified on the Drawings. Bolts and nuts for flanged joints shall be in accordance with AS 2129 and galvanised in accordance with AS 1214, or stainless steel in accordance with AS 2837 as for pumps specified in the DEVELOPMENT CONSTRUCTION SPECIFICATION – WATER RETICULATION – Version 3.2.

3. The Designer shall avoid the positioning of continuously welded steel pipelines in parallel with high voltage power lines. (WSA 03 Part 1, section 5.4.12 and Part 2, Table 8.2) ***Power Lines***

D11.14 POLYETHYLENE PIPE AND FITTINGS

1. Polyethylene (PE) pipes and fittings shall not be used for water mains except where the Water Authority agrees to their specific use where conditions warrant. PE 100 pipe may be used for residential property services in accordance with WSA 03, Part 1, Section 5.11. ***PE Pipe***

2. Polyethylene pipe shall be manufactured in accordance with AS/NZS 4130 and designed to AS/NZS 2566.1. ***Standard***

3. Fittings shall comply with AS/NZS 4129. ***Fittings***

D11.15 GLASS REINFORCED PLASTIC (GRP) AND FITTINGS

1. Glass Reinforced Plastic (GRP) pipes and fittings shall not be used except where the Water Authority agrees to their specific use where conditions warrant. ***GRP Pipe***

2. Glass reinforced thermosetting plastics (GRP) pipes and collars shall be manufactured to AS 3571.2 and designed to AS/NZS 2566.1. ***Standard***

3. Ductile iron fittings conforming to AS/NZS 2280 with appropriate elastomeric seals conforming to AS 1646 may be used. ***Fittings***

D11.16 COPPER PIPE AND FITTINGS

1. Copper tube shall be specified to be manufactured in accordance with AS 1432 in the range of DN6 to DN200 for Type A. The Designer shall take into account the requirements of AS 3500. (WSA 03 Part 2, section 2) ***Standard***

2. Capillary and compression fittings shall be specified to comply with AS 3688 and de-zincification resistant. Capillary fittings shall have silver brazed joints or solder insert capillary joints. ***Fittings***

PUMP STATIONS

D11.17 GENERAL

1. The Designer shall take into account site access, site maintenance and restoration, easement, power supply and working area when locating pump stations in road reserves or on private property. A report on the options considered and reasons for selecting the location and the results of the matters considered constitutes a **WITNESS POINT**. The Principal shall advise at the time of notification by the Designer whether the option to confer on the locations is required. ***Location*** ***(WP)***

2. Pump units shall be secured under a purpose-designed building which shall be subject to the Development Approval (DA) of the Council. The building shall match the aesthetics of the surrounding land use and shall accommodate any need for climate and/or acoustic control. Occupational Health and Safety requirements shall be met especially with regard to clearance for maintenance, and avoidance of trip hazards. ***Pump Building***

3. Where pumps are to be installed below ground level, the Designer shall provide for the pumps to be mounted on plinths and housed in a single pump well. ***Substructure***

4. The Designer shall provide for the construction of the pump well after taking into consideration the ground and site conditions. ***Conditions***

5. Preformed components or systems, complying with the Drawings, if any, may be used in lieu of in-situ construction provided: ***Preformed Components***

   (a) Preformed concrete wall units are to be manufactured to AS 4058. The Designer shall take into account the cover requirements for the reinforcing steel.

   (b) Joints shall be internal flush

   (c) The Designer shall ensure components make a watertight system and have a satisfactory surface finish.

6. Where the pump station site is exposed to possible flooding, the Designer shall provide for the floor of the pump station or top of pump well, as appropriate, to be one (1) metre above the 1 in 100 year flood level or to such other level as provided by Council's planning instruments, whichever is the higher. ***Protection Against Flooding***

7. The Designer shall provide for the design of pump wells against flotation both during the construction/installation stage and whilst operating under flood conditions designed as above. ***Protection Against Flotation***

8. Capacities of the pump unit shall be calculated from the intersection of the pump performance curve and the pipeline characteristic curve calculated at mid water level of ***Pump Sets***

the service reservoir involved with this duty point. The pump station shall deliver the required transfer over a period of 22 hours. Standby pumping c\ shall be provided such that if one (1) pump is out of service, the pump station will remain able to supply the required transfer. The pump unit shall be capable of operating near optimal efficiency within the range of operating conditions.

9. All pipework and fittings shall be in accordance with this Specification. In addition, all steel bolts, nuts and washers shall comply with AS/NZS 1111 and AS/NZS 1112 and shall be galvanised in accordance with AS 1214 or stainless-steel complying with AS 1449 grade 316. ***Pump Pipework***

10. Where there is negative suction head at the pump inlet, provision shall be made to facilitate priming of each pump. ***Pump Prime***

11. The Designer shall provide for alarms and signals systems with the concurrence of the Water Authority. ***Alarms and Signals***

D11.18 PUMP

1. Pumps shall comply with the WS-SPEC. The Designer shall take account of dismantling joints and valves provided in the pipework to facilitate removal of the pumps for maintenance and the need for surge control devices. ***Pump Type***

2. Pump sets are to be interchangeable within each pump station where standby pumps are installed. ***Inter-Changeable***

3. The Designer shall design structural steelwork in accordance with HB 48. ***Structural Steelwork***

D11.19 ELECTRICAL

1. Notwithstanding other clauses mentioned herein, the Designer shall be responsible for the design of the equipment as suitable for the purpose. Equipment design shall comply with the requirements of the relevant standard specification. ***Design Responsibility***

2. The Designer shall provide for Switchgear Control Assembly (SCA), SCA housing and electrical requirements as detailed in the DEVELOPMENT CONSTRUCTION SPECIFICATION-WATER RETICULATION – Version 3.2. ***SCA and Electrical***

3. Where more than one (1) item of equipment is designed to form a particular function, all such items of equipment shall be identical and completely interchangeable (eg pilot lights, pushbuttons, relays, etc). ***Inter-changeability***

4. The switchboard shall be installed visibly and physically accessible above all areas at risk of flooding. ***Switchboard***

5. Ambient conditions shall be within the normally accepted limits of -10°C to 45°C. ***Ambient Conditions***

6. The switchboard shall be connected to the local electrical supply system. ***Connection to Local Supply***

Nominal system parameters:

(a) 415 volt, 3-phase, 4-wire, 50 Hz, solidly earthed neutral system.

(b) Prospective Fault Current: As specified by the Local Supply Authority.

The switchboard shall provide a generator connection point to allow the pump station to be run via generator in the event of failure of the local electrical supply system.

7. The works shall be designed in accordance with and subject to the provisions of MEW E101, except where modified by this Specification. ***Standards***

8. The pump station shall be designed for fully automatic operation in the unmanned condition. ***Automatic Operation***

D11.20 ELECTRICAL POWER SUPPLY

1. The consumer electrical mains shall be run underground where possible and commence at the point of attachment on a steel consumers pole (if applicable) installed near the property boundary and run-in conduit to the switchboard. ***Consumer Mains***

2. The minimum size of the consumers mains shall be sized to satisfy the following requirements: ***Minimum Size***

(a) Current carrying to suit the maximum demand with an excess current carrying of 30 per cent minimum.

(b) Be sized for a voltage drop less than 1.5 per cent of the maximum demand as calculated.

(c) Be single core PVC/PVC cables. XLPE insulated cable may also be used.

(d) Comply with the requirements of the Local Supply Authority.

(e) Pole termination method shall be determined in consultation with the Local Supply Authority.

D11.21 TELEMETRY

1. The Designer shall provide for telemetry requirements in accordance with the schedule supplied by the Water Authority. ***Schedule***

2. The telemetry system is to be compatible with the existing system in use by the Water Authority. ***Compatibility***

D11.22 LADDERS

1. Ladders shall comply with AS 1657 and applicable Occupational Health and Safety legislation. ***Standard***

2. If required, the Designer shall set intermediate landings in wells to achieve the minimum head room clearance. Wherever possible, the landing shall be located adjacent to fittings and machinery requiring maintenance. ***Ladder Landings***

3. Ladder cages shall not be used on ladders in pump station wells. ***Ladder Cages***

D11.23 OTHER APPURTENANCES

1. The Designer shall provide for machinery lifting equipment including pump chains and gantries as necessary to facilitate the removal of equipment from the pumping station. ***Lifting Equipment***

2. The Designer shall provide pressure tapping and gauges for all valves, including isolation and non-return valves as detailed in the DEVELOPMENT CONSTRUCTION SPECIFICATION-WATER RETICULATION – VERSION 3.2. ***Gauges***

3. The Designer shall take account of the possibility of site flooding ingress and overflow, and Occupational Health and Safety requirements in providing for access and ***Covers***

inspection covers.

DOCUMENTATION

D11.24 RETICULATION

1. The Principal shall submit, to the Water Authority an Application for Certification of Design Drawings under Part 3 Division 2 Section 307 of the Water Management Act 2000, together with four (4) copies of the proposed water main design, including calculations and network analysis, if required, and obtain approval for the design from the Water Authority prior to commencement of construction. (WSA 03 Part 1, section 2) This action constitutes a **HOLD POINT**. Approval of the design by the Water Authority will be made by the issue of a compliance certificate under Part 3 Division 2 Section 307 of the Water Management Act 2000. ***Review (HP)***

2. The Drawings shall show to scale:

(a) Plan showing: ***Plan***

(1) Lot boundaries and lot numbers

(2) Location and size of all mains, appurtenances and pump stations

(3) Existing mains

(4) Existing and proposed features and services

(5) North point and scale bar

(6) Easement locations

(7) Arrangement of other utilities.

(b) Longitudinal section, if required, showing: ***Longitudinal Section***

(1) Reduced levels for natural surface and design surfaces at all changes in grade

(2) Mains, appurtenances and pump stations

(3) Appurtenances numbered in accordance with Water Authority's Asset Register

(4) Invert levels where necessary

(5) Size, type, class and grade of pipe

(6) Location, invert level and size of all drainage lines, sewer mains, and other utility services crossing the main

(7) Notation regarding all joining lines

(8) Property ownership

(9) Note "In road" trench conditions

(c) General arrangement of pump stations with site plan; concrete outlines; number, make, model and details of pumps; inlet and outlet pipework details and levels; pump cut in; cut out and alarm levels; switchboard location; pump station access details; design starts per hour. ***Pump Stations***

(d) Details of corrosion protection required for pipes and fittings. ***Pipe Protection***

(e) Areas designated for trenchless pipe installation. ***Trenchless Installation***

3. Detail plans shall be drawn to a scale of 1:500 and longitudinal sections to a horizontal scale of 1:1000 and a vertical scale of 1:100. The Designer shall show locations of hydrants, stop valves, non-return valves, air valves and scour valves, tees, tapers, creek crossings, trench dimensions and backfill, thrust blocks, and other existing and proposed services and installations including chambers and covers and items of construction which are project specific. ***Drawing Scale***

4. Drawings shall be 'A1' size for approval with 'A3" size copies to be forwarded to the Water Authority once the plans have been approved ***Drawing Size***

5. Drawings shall also be provided in electronic form after consultation with the Water Authority. ***Electronic Form***

6. Potable water supply mains and fittings shall be indicated in blue colouring and recycled water supply mains and fittings shall be indicated in purple colouring (WSA 03, Part 1, section 4, Table 4.1). ***Drawing Colours***

D11.25 PUMP STATION

1. The Principal shall submit, to the Water Authority for approval, prior to commencement of the manufacture of any pumps and control equipment, four (4) copies of the following: ***Review***

(a) Switch and Control Gear Assemblies (SCA) - Proposed fully dimensioned manufacturing details, general arrangement (showing internal/external details) and foundation/gland plate details.

(b) Common Control - Complete circuit diagram and description of operation.

(c) Schedule of Equipment - Completed as to the equipment to be provided.

(d) Other Engineering drawings as required fully describing the proposed equipment.

The submission of the documents constitutes a **HOLD POINT**. ***(HP)***

2. The Designer shall take into consideration the technical requirements to minimise all risks associated with chlorination, and entry into confined space. ***Risk***

3. Drawings shall be on 'A1' size for approval with 'A3" size copies to be forwarded to the Water Authority once the plans have been approved. All symbols used shall conform to AS 1102 and all wires and terminals shall be numbered. ***Drawings***

4. Drawings shall also be provided in electronic form after consultation with the Water Authority. ***Electronic Form***

D11.26 ASSET REGISTER

1. The Designer shall provide asset schedules and Drawings in a form consistent with the existing or proposed Asset Register after consultation with the Water Authority. (WSA 03 Part 1, section 5.6) ***Consistency***

SPECIAL REQUIREMENTS

D11.27 DEEMED TO COMPLY

1. Section D11 shall be Deemed to Comply if carried out in accordance with the requirements of Section D11 as amended by COONAMBLE SHIRE Council.

D11.28 RESERVED

D11.29 RESERVED

COONAMBLE SHIRE COUNCIL

COONAMBLE SHIRE COUNCIL

DEVELOPMENT DESIGN SPECIFICATION

D12

SEWERAGE SYSTEM

VERSION 3.1 – JANUARY 2022

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
1	*Provide for Sewerage to other areas*	*D12.04*	*A*	*HB*	*11/04*
2	Gravity sewer only from lots, no private pumps	D12.05	AM	HB	11/04
3	Superimposed loads	D12.06	A	HB	11/04
4	Step iron, minimum height MH	D12.08	M	HB	11/04
5	Clauses added for Maintenance shafts	D12.09	M	HB	11/04
6	Delete use of some pipe materials	D12.10	O	HB	11/04
7	Relativity of Service	D12.10	A	HB	11/04
8	Clarify location of connection depth	D12.10	M	HB	11/04
9	Water hammer analysis required for Rising mains	D12.10	A	HB	11/04
10	Rising main minimum size specified	D12.10	A	HB	11/04
11	Delete reference to Polyethylene pipe joints	D12.11	O	HB	11/04

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
12	Delete use of uPVC gravity pipes, uPVC & PVC-M pressure pipes, Polyethylene and GRP pipes	D12.13 D12.14 D12.18 D12.19	MO	HB	11/04
13	Pump Stations to PWD standards	D12.20	A	HB	11/04
14	Pumps to Sewer Authorities requirements	D12.21	A	HB	11/04
15	Ambient conditions changed to -10^{o}C	D12.22	M	HB	11/04
16	Telemetry to comply with existing	D12.25	O	HB	11/04
17	Venting, Odour control to be provided	D12.26	A	HB	11/04
18	Approval of design before start of construction	D12.27	A	HB	11/04
19	Drawing scale change	D12.27	M	HB	11/04
20	Approval of pump station details required	D12.28	M	HB	11/04
21	Drawing size amendment	D12.28	A	HB	11/04
22	Deemed to Comply	D12.30	A	HB	11/04
23	Concrete encasement added	D.12.10.6	A	KD	9/05
24	Requirement for generator connection to pump station added	D12.22.6	A	KD	9/05
25	Sewer Authority approval of design added,	D12.27.1	A	KD	9/05
26	Additional requirement for longitudinal section to show other services	D.12.27.2	A	KD	9/05
27	Drawing size altered to A1	D.12.27.4	A	KD	9/05
28	Drawing size altered to A1	D.12.28.3	A	KD	9/05

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
29	Hold Point for preliminary sewer design	D.12.06.1	A	BP	1/06
30	Witness Point changed to Hold Point	D.12.27.1	A	BP	1/06
31	WAE plans - Hold Point	D.12.31.1	A	BP	1/06
32	Sewer to be concrete encased near storm water conduits	D.12.10.6	A	BP	1/06
VERSION 1					
33	RISS added	D12.01	A	MC	05/02/13
34	WSA code references updated	D.12.03	M	MC	05/02/13
35	Requirements for Maintenance Holes varied, sewer master plan required	D.12.08	A	MC	05/02/13
36	Maintenance Shafts permitted	D.12.09	A	MC	05/02/13
37	uPVC and PE & PP pipe allowed, Hold Point inserted, property connection specified, replacement in ductile iron pipe where clearance to stormwater is insufficient	D.12.10	A	MC	05/02/13
38	uPVC pipe standards inserted	D.12.13	A	MC	05/02/13
39	DICL PN35 flange class specified	D12.15	A	MC	05/02/13
40	PP pipe standards inserted	D.12.19	A	MC	05/02/13
41	WAE requirements amended	D12.31	A	MC	05/02/13
42	Standard Drawings added	D12-A	A	MC	05/02/13
43	Additional clauses added prohibiting curved sewers but allowing manufactured bends	D12.07	A	MC	05/02/13

DEVELOPMENT DESIGN SPECIFICATION D12 - SEWERAGE SYSTEM

DEVELOPMENT DESIGN SPECIFICATION D12

- SEWERAGE SYSTEM

GENERAL

D12.01 SCOPE

1. The work to be executed under this Specification consists of the design of a sewerage system either as a stand-alone project or part of a development. ***Design***

2. The Specification contains procedures for the design of the following elements of the sewerage system: ***Elements***

(a) Gravity sewers including junctions and property connection sewers;

(b) Common effluent sewers both gravity and pressurised;

(c) Reduced Infiltration Sewarge Systems (RISS);

(d) Vacuum sewer system;

(e) Maintenance holes and other structures;

(f) Rising mains; and

(g) Pump stations.

3. The design of gravity sewer systems and pump station components shall comply with the Water Services Association of Australia's publication SEWERAGE CODE OF AUSTRALIA unless specified otherwise herein and should be constructed in accordance with the DEVELOPMENT CONSTRUCTION SPECIFICATION - SEWERAGE SYSTEM. ***Compliance***

4. Where the Specification forms part of a contract attracting Government Grant funds, the Principal shall identify ***Subsidised Schemes***

(a) Items which are not of the least cost option, that

(i) Are intended to have a much longer design life than the normal asset service life detailed in the Asset Management Guidelines of the International Infrastructure Management Manual.

(ii) Do not meet the project objectives and the requirements of the various Authorities for the least Net Present Value (NPV) but may become the preferred option for construction.

(b) Particular equipment which is procured without relevant competition through tendering.

(c) Duplication of equipment or unit processes in a system configuration.

D12.02 OBJECTIVE

1. The objective of the sewerage system is to transport sewage or effluent from domestic properties to the treatment plant in accordance with all current relevant legislation. Consumer requirements shall be met by providing a sewer main and allowing an appropriate point of connection for each individual property. ***Sewerage System***

D12.03 REFERENCE AND SOURCE DOCUMENTS

Documents

1. Documents referenced in this Specification are listed below whilst being cited in the text in the abbreviated form or code indicated. The Designer shall possess, or have access to, the documents required to comply with this Specification.

Sewerage Code

2. References to the SEWERAGE CODE OF AUSTRALIA are made where there are parallel sections or equivalent clauses to those in this Specification. Where not called up as part of this Specification, these references are identified by part and section numbers and enclosed in brackets thus (WSAA Part, Section).

(a) Council Specifications

C402 - Development Construction Specification Sewerage System.

The Designer shall include the requirements of the DEVELOPMENT CONSTRUCTION SPECIFICATION - SEWERAGE SYSTEM.

(b) Australian Standards

Australian Standards

References in this Specification or the Drawings to Australian Standards are noted by their prefix AS or AS/NZS. (WSA 02 Part 0 section III).

The Designer shall use the latest edition of the Australian Standards including amendments and supplements, unless specified otherwise in this Specification.

AS 1102 - Graphical symbols for electrotechnical documentation (various)
AS 1210:1997 Pressure vessels
AS 1214:1983 - Hot dipped galvanised coatings on threaded fasteners (ISO metric coarse thread series)
AS/NZS 1260:2009 PVC pipes and fittings for drain, waste and vent applications
AS 1281 - Cement mortar lining of steel pipes and fittings.
AS 1444 - Wrought alloy steels – Standard, hardenability (H) series and hardened and tempered to designated mechanical properties
AS/NZS 1477:2006 PVC pipes and fittings for pressure applications
AS 1579:2001 - Arc welded steel pipes and fittings for water and wastewater.
AS/NZS 1594 - Hot rolled steel flat products
AS 1631 - Cast grey and ductile iron non-pressure pipe and fittings.
AS 1646:2007 - Elastomeric seals for waterworks purposes
AS 1657:1992 - Fixed Platforms, walkways, stairways and ladders – Design, construction and installation
AS 1741 - Vitrified clay pipes and fittings with flexible joints - Sewer quality.
AS 2129:2000 - Flanges for pipes, valves and fittings
AS 2200:2006 - Design charts for water supply and sewerage
AS/NZS 2280:2004 Ductile iron pressure pipes and fittings
AS/NZS 2566. Buried flexible pipelines
AS/NZS 2566.1:1998 - Structural design
AS 2634 - Chemical plant equipment made from glass-fibre reinforced plastics (GRP) based on thermosetting resins
AS 2832 Cathodic protection of metals
AS 2832.1-2004 Pipes and cables
AS 2832.2-2003 Compact buried structures
AS 2837 - Wrought alloy steels – Stainless steel bars and semi-finished products
AS 2865-2009 Confined spaces
AS/NZS 3000:2007 Electrical installations (known as the Australian/New Zealand Wiring Rules).

AS/NZS 3111:2009 Approval and test specification - Miniature overcurrent circuit-breakers.
AS/NZS 3190:2009 Approval and test specification - Residual current devices (current-operated earth-leakage devices)
AS 3439 Low voltage switchgear and controlgear assemblies
AS 3439.1-2002 Type-tested and partially type-tested assemblies
AS/NZS 3500 - National Plumbing and Drainage Code
AS/NZS 3500.2:2003 Sewerage
AS 3518 - Acrylonitrile Butadienne Styrene (ABS) pipes and fittings for pressure applications
AS 3518.1 – Pipes
AS 3518.2 - Solvent cement fittings
AS 3571 - Glass filament reinforced thermosetting plastics (GRP) pipes - Polyester based - Water supply, sewerage and drainage applications
AS 3600 :2009 Concrete structures
AS 3680: 2008 - Polyethylene sleevings for ductile iron pipelines.
AS 3735 - Concrete structures for retaining liquid
AS 3735 Supp1-2001 Concrete structures retaining liquids - Commentary (Supplement to AS 3735-2001)
AS/NZS 3862:2002 External fusion-bonded epoxy coating for steel pipes
AS 3996:2006 - Metal access covers, road grates and frames.
AS 4024.1-2006 Series: Safety of machinery (26 parts)
AS/NZS 4058:2007 Precast concrete pipes (pressure and non pressure)
AS 4060:1992 - Loads on buried vitrified clay pipes.
AS 4087:2004 - Metallic flanges for waterworks purposes
AS 4100:1998 - Steel structures
AS/NZS 4129:2008 Fittings for polyethylene (PE) pipes for pressure applications.
AS/NZS 4130:2009 Polyethylene (PE) pipes for pressure applications.
AS/NZS 4131 - Polyethylene (PE) compounds for pressure pipes and fittings.
AS/NZS 4158:2003 Thermal-bonded polymeric coatings on valves and fittings for water industry purposes
AS/NZS 4321 - Fusion-bonded medium-density polyethylene coating and lining for pipes and fittings
AS/NZS 4331 Metallic flanges
AS/NZS 4331.1:1995 Steel flanges
AS 4441-2008 Oriented PVC (PVC-O) pipes for pressure applications
AS/NZS 4765:2007 Modified PVC (PVC–M) pipes for pressure applications
AS 4883 – 2008 Air valves for sewerage
AS/NZS 5065:2005 Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications
AS/NZS 60269 Low voltage fuses
AS/NZS 60269.1: 2005 General requirements
AS 60947 Low voltage switchgear and controlgear
AS 60947.2- 2005 Circuit-breakers
AS 60947.5.1 Control circuit devices and switching elements - Electromechanical control circuit devices
AS/NZS 61000 Electromagnetic compatibility (EMC)
AS/NZS 61000.4.6: 2008 Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields
AS/NZS 61000.6.2: 2006 Generic standards - Immunity for industrial environments
SAA HB 48: 1999 Steel structures design handbook.

Where not otherwise specified in this document, the Contractor shall use the latest Australian Standard available within two weeks of close of tenders.

(c) Other

Institute of Public Works Engineering Australia (IPWEA)

- Streets Opening Conference Information Bulletin on Codes and Practices (Sections 3 and 4 detailing locations and depths of other services).

NSW Department of Commerce

MEW E101 - Electrical Services Minimum Requirements
PWD - Safety Guidelines for fixed ladders, stairways, platforms and walkways for use in sewage treatment Works, pumping stations and maintenance holes.
PWD-SD - Public Works Department Manual of Practice – Sewage Design.
PWD-PSD - Public Works Department Manual of Practice – Sewage Pumping Station Design (May 1986).
WS-SPEC - Technical Requirements (TRs) and Strategic products Specifications (WSAA)

Water Services Association of Australia (WSA)

WSA 01 – 2004 - Polyethylene Pipeline Code
WSA 02 - 2002 - Sewerage Code of Australia – Version 2.3
WSA 03 - 2011 Water Supply Code of Australia, Version 3.1
WSA 04 - 2005 - Sewage Pumping Station Code of Australia – Version 2.1
WSA 06 – 2008 - Vacuum Sewerage Systems.

Building Codes Board of Australia

- Building Code of Australia - PART E1, Fire Fighting Equipment.

(d) Standard Drawings ***Drawings***

SEWERAGE CODE OF AUSTRALIA drawings are to be used in preference to DPWS Standard Drawings (WSA 02, Part 4).

DESIGN CRITERIA

D12.04 GENERAL

1. The design shall be in accordance with the SEWERAGE CODE OF AUSTRALIA, or PWD-SD and PWD-PSD unless specified otherwise herein (WSA 02 Part 1). ***Standard***

2. Except where specified otherwise, the division of responsibilities between the Sewer Authority and the Designer shall be in accordance with the SEWERAGE CODE OF AUSTRALIA (WSA 02 Part 1, section 1.3). ***Responsibility***

3. The Designer shall confirm the design criteria with the Sewer Authority and shall design a gravity pipeline distribution system with pump stations and rising mains, where necessary to comply with the requirements of this Specification, to transport fresh sewage, or common effluent, for treatment. ***Gravity System***

4. Pressurised common effluent or vacuum systems shall only be considered after ***Pressurised or***

consultation with the Sewer Authority. ***Vacuum System***

5. The Designer shall not provide for common effluent or vacuum discharges to gravity sewers or conventional wastewater treatment plants without the concurrence of the Sewer Authority. ***Discharges to Gravity Sewers***

D12.05 DETERMINATION OF AREA TO BE SERVED

1. The area to be served shall be determined in accordance with PWD-SD except that the Sewer Authority may require provision for an upstream sewer. In the design brief the Sewer Authority will indicate the level and size of existing pipe as well as anticipated flows to be allowed for in the design (WSAA 02 Part 1, section 2.3.2). Alternatively, the Authority may require the designer to determine the future and ultimate upstream sewer loading and provide adequate allowance for such loadings to the satisfaction of the approving authority. ***Upstream Sewer***

2. The depth of sewer shall be sufficient to allow a minimum of 90 per cent of each lot to be serviced. ***Depth***

3. All lots shall be able to be served by gravity sewers. Private pump stations delivering to the Sewer Authority mains will not be permitted. **Provision of Sewerage**

D12.06 DESIGN LOADING

1. The Designer shall obtain the concurrence of the Sewer Authority for the flow to be used for the design of sewers serving industrial areas and developments not specifically listed in the SEWERAGE CODE OF AUSTRALIA or PWD-SD (WSAA 02 Part 1, section 3). ***Flows***

2. The design shall take account of AS 2200, AS/NZS 2566.1, AS 3500, AS 3735, the SEWERAGE CODE OF AUSTRALIA and, where design elements are not covered elsewhere in these codes, PWD-SD and PWD-PSD. The approval of preliminary design constitutes a **HOLD POINT** [see 12.27 (1)]. ***Design Codes*** ***(HP)***

3. The design shall take account of loads on the pipeline from all sources, including superimposed loads from stormwater pipes, water supply mains and other utility services. ***Superimposed Loads***

D12.07 SEWER ALIGNMENT (WSAA 02 Part 1, section 4.3)

1. Where it is necessary for sewers to be located outside the development, the Designer shall obtain written approval from the affected property owner. Preparation of any application for approval from an affected property owner shall constitute a **WITNESS POINT**. The Principal shall advise whether the option to review and direct on the application is taken at the time of notification by the Designer. ***Consent of Owner*** ***(WP)***

2. Where sewers are proposed to be located within existing road reserves, the Designer shall check that the sewers do not conflict with other utility services and locate the sewers in accordance with established protocols (WSA 02 Part 1, section 4.4). ***Road Reserve***

3. Sewers located on private property must be located in an easement of minimum width three (3) metres. Unless there are compelling reasons to the contrary the sewer shall be located in the centre of the easement. A Registered Surveyor shall survey easements and pipelines (WSA 02, Part 1, Section 4.2.5). ***Easement***

Trench Width

4. Where control of the trench width is practical or effective, the design may be based on wide trench condition. The Designer shall call up the need, in the Construction Specification, for the Contractor to supply special construction control with a method statement when there is economic justification to design to narrow trench condition.

Alignment

5. Sewers shall be laid in a straight horizontal and straight vertical alignment. Curved sewers are not permitted (WSA 02, Part 1, sections 4.3.7 & 4.6.7)

Manufactured Bends

6. Manufactured bends are permitted adjacent to a maintenance structure (WSA 02, Part 1, sections 4.3.7 & 4.6.7).

D12.08 MAINTENANCE HOLES (MHs) (WSAA 02 Part 1, section 6.6)

Spacing

1. Maintenance holes shall generally be placed on gravity sewers as specified in WSA 02, Part 1, section 6.3, except that

- the maximum spacing between any two consecutive maintenance holes shall be 180 m;
- maintenance holes shall be provided at all intersections of reticulation sewers;
- maintenance holes shall be provided at all changes in vertical grade; and
- maintenance holes shall be provided at all changes in sewer reticulation horizontal direction except where a maintenance shaft is permitted to be installed instead.

Terminal Maintenance Hole

2. All upstream ends of sewers shall terminate in a maintenance hole if the upstream end is more than 80m from the down stream maintenance hole.

Step Irons

3. Step irons shall be provided to all maintenance holes where the depth from top of cover to the invert of the outlet pipe exceeds 900mm. Step Irons shall be of 24mm diameter hot dip galvanised steel, cast aluminium or plastic encapsulated.

Venting

4. The Designer shall provide for the venting of maintenance holes which accept pumped discharges.

Connections to Existing Systems

5. Connections to existing maintenance holes or sewers of the existing sewerage system are to be based on a sewerage master plan. A master plan is to be developed for each subdivision stage and be approved by the Sewer Authority.

Access Covers

6. Metal access covers shall be manufactured in accordance with AS 3996.

D12.09 MAINTENANCE SHAFTS (MSs) AND TERMINAL MAINTENANCE SHAFTS (TMSs)

1. The maximum distance between consecutive maintenance shafts shall be 60 m;

3. A maintenance shaft may be located at a change of horizontal direction in the sewer main of 5^0 or below in lieu of a maintenance hole: and

4. A terminal maintenance shafts shall be used where the dead end of a main is greater than 30 m and less than 80 m from the downstream maintenance hole.

D12.10 PIPELINE (WSAA 02 Part 2)

1. Pipes and fittings for sewerage systems shall be of unplasticised PVC, ductile iron, polyethylene or polypropylene. The material specifications for each pipe type are provided in Clauses D12.13 to D12.19 inclusive. The choice of pipe type constitutes a **HOLD POINT**.

Type

(HP)

2. Asbestos cement pipe and fittings shall not be used.

Asbestos Cement

3. Concrete pipes, fibre reinforced concrete pipes, steel pipes and vitreous clay pipes shall not be used.

Other Pipes

4. Pipelines shall be buried. Above ground sewers may be designed in a gravity system only where other options are less practical (WSA 02, Part 1, section 8.7). The Designer shall obtain the concurrence of the Sewer Authority to any proposed above ground sewer. The action to provide for above ground sewers constitutes a **HOLD POINT**.

Buried Pipes

(HP)

5. The Designer shall show on the Drawings the extent of external protection required to be undertaken by the Contractor. External protection shall be shown to comply with the DEVELOPMENT CONSTRUCTION SPECIFICATION - SEWERAGE SYSTEM – Version 3.1.

External Protection

6. Where sewer pipes or rising mains are to be located in close proximity to other services pipes or where there is the likelihood of the pipes not being recognised as sewerage pipes, the Designer shall provide for the pipes to be colour coded and shown on the Drawings accordingly.

Colour Coding

Relativity of Services

Where sewer pipes or rising mains are to be located in close proximity to or cross other service mains clearances shall be maintained in accordance with WSA 02, Section 4.4.5.2. Sewer pipes shall not be located above water mains without the prior written approval of the Water Authority.

Where sewer pipes clearance to stormwater conduits is less than 0.6 metres the sewer shall be constructed in ductile iron cement lined pipe.

7. Piers for any above ground sewer pipeline shall be in accordance with the SEWERAGE CODE OF AUSTRALIA Drawing SEW-106.

Piers

8. Property connections shall utilise the buried interface method. Where the main is not a deep main and is located within private property or in the verge directly outside private property the property connection may be DN100. In all other cases the property connection shall be DN150. The pipeline alignment shall be such that no property connection sewer is to be more than 25 m in length. Where longer property connections are required, they shall be designed to the same standards as reticulation sewers and shall be provided with maintenance access. (WSA 02, Part 1, section 5).

Property Connection

9. The Designer shall ensure that the point of property connection to the pipeline shall be not more than 1500mm in depth below the finished surface of the property served.

Property Connection Depth

10. The Designer shall allow for adequate working area, waste removal and transport arrangements where scouring points or inspection pipe locations are nominated.

Special Allowances

11. The Designer shall design thrust blocks to the requirements of WSA standard

Thrust Blocks

drawing WAT-1205.

12. The Designer shall provide for surge control by specifying an appropriate rising main material and class selection. Water hammer analysis shall be carried out for all rising mains. The analysis shall be provided to the Sewer Authority. ***Surge Control Method***

13. Rising mains shall have a minimum diameter of 100DN. ***Rising Main Minimum size***

D12.11 JOINTS

1. Gravity sewers and rising mains shall generally be spigot and socket joints with rubber rings (elastomeric) complying with AS 1646. ***Rubber Ring***

2. Flanged joints connecting pipes, fittings, valves and pumps shall comply with AS 2129 (Flanges shall be Table C) or AS 4087, Class 16, as appropriate. ***Flanges***

3. The concurrence of the Sewer Authority shall be obtained for the type of joint to be used (WSA 02, Part 4, Section 10 and Tables 10.1 & 10.2).

D12.12 MINE SUBSIDENCE AREAS AND AREAS OF SLIPPAGE

1. The Designer shall accommodate the movement associated with the ground strain for the area, as advised by the Mine Subsidence Board for sewerage jointing systems in proclaimed Mine Subsidence Areas, or in a known or expected area of subsidence or slippage. The design ground strain for the development shall be detailed on the Drawings. ***Ground Strain***

2. The pipe jointing system selected shall be capable of accepting ground movements, without impairing the water tightness of the joint, for the ground strain as advised by the Mine Subsidence Board. For areas with high ground strains a pipe jointing system using shorter effective length pipes and/or deep socket fittings shall be used. This action constitutes a **WITNESS POINT**. The Principal shall advise at the time of notification by the Designer whether the option to confer is required. ***Pipe Jointing System*** ***(WP)***

3. Where the Mines Subsidence Board does not cover an area of known, or suspected, subsidence or slippage, the above requirements shall still apply. ***Areas Applicable***

MATERIALS

D12.13 UNPLASTICISED PVC (uPVC) GRAVITY PIPE

1. Unplasticized PVC (PVC-U) pipe shall be specified for sewer gravity mains of 150 mm and 225 mm diameter and shall be manufactured in accordance with AS/NZS 1260, designed in accordance with AS/NZS 2566.1 and with elastomeric seal spigot and socket joints (WSA 02, Part 2, Table 10.1). The pipe shall be not less than Class SN 8. ***Standard*** ***Ductile Iron Pipe Compatibility***

2. Where PVC pipe is used in conjunction with DI fittings, the Designer shall ensure the jointing system is appropriate. ***Fittings***

3. Fittings for use with PVC pipe shall be elastomeric seal jointed.

D12.14 UNPLASTICISED AND MODIFIED PVC (uPVC and PVC-M) PRESSURE PIPE

1. PVC-M pipe shall not be used. ***Not Permitted***

by Sewer Authority

D12.15 DUCTILE IRON (DI) PIPE AND FITTINGS

1. Ductile iron pipes and fittings shall be specified for all sewer rising mains and are to be manufactured and cement mortar lined in accordance with AS/NZS 2280 minimum and shall specify PN35 Flanged Class (WSA 02, Part 2, Table 10.2). ***Standard***

2. The Designer shall specify cement mortar lining in accordance with AS 1281, or fusion-bonded medium density polyethylene to AS/NZS 4321. External protection shall be epoxy coating to AS 3862 where not otherwise specified as sleeved or wrapped, taking into account the type of corrosion protection required. ***Corrosion Protection***

3. Generally, pipe and fitting joints shall be specified to be spigot and socket type using a rubber ring (elastomeric) push in seal made of natural rubber or ethylene propylene rubber with compounds complying with AS 1646. The seal shall be a single jointing component shaped to provide both groove lock and seal mechanisms. ***Joints***

4. Flanges shall be specified to be manufactured in accordance with AS 2129 Table C. Bolts and nuts for flanged joints shall be in accordance with AS 2129 and galvanised in accordance with AS 1214 or stainless steel in accordance with AS 2837 as for pumps specified in the specification DEVELOPMENT CONSTRUCTION SPECIFICATION – SEWERAGE SYSTEM – Version 3.1. ***Flanges***

D12.16 VITRIFIED CLAY (VC) PIPES AND FITTINGS

1. Vitrified Clay pipes and fittings shall be specified to be manufactured in accordance with AS 1741 and designed in accordance with AS 4060 (WSA 02 Part 2, Table 10.2). ***Standard***

2. Pipe and fitting shall be spigot and socket type using roll on rubber ring (elastomeric) joints. Natural rubber shall not be used. ***Joints***

D12.17 STEEL PIPE AND FITTINGS

1. Steel pipes and fittings shall be specified to be manufactured in accordance with AS 1579 and AS/NZS 1594 and designed to AS/NZS 2566.1. ***Standard***

2. The Designer shall specify the jointing system where long-term corrosion resistance, ease of construction or special circumstances dictate the need. The pipe jointing shall be either: ***Joints***

   (a) Rubber ring (elastomeric) jointed to conform to AS 1646, or

   (b) Welded with butt welding or by using a welding collar with the application of a polyethylene heat shrunk sleeve over the weld, or wrapped, or

   (c) Flanged to comply with AS 4087 Table C. Bolts and nuts for flanged joints shall be in accordance with AS 2129 and galvanised in accordance with AS 1214, or stainless steel in accordance with AS 1444 as for pumps specified in the DEVELOPMENT CONSTRUCTION SPECIFICATION - SEWERAGE SYSTEM – Version 3.1.

D12.18 POLYETHYLENE PIPE AND FITTINGS

1. (a) Twin walled, corrugated polypropylene pipes and fittings may be used for sewer gravity trunk mains 225 mm or greater in diameter and shall be manufactured to comply with AS/NZS 5065 and designed to AS/NZS 2566.1 . (WSA 02, Part 2, Table 10.2). ***PP Standard***

PE Standard

(b) Polyethylene pipes may be used for sewer gravity mains and shall be manufactured to comply with AS/NZS 4129 and designed to AS/NZS 2566.1. (WSA 02, Part 2, Table 10.2).

D12.19 GLASS REINFORCED PLASTIC (GRP) PIPE AND FITTINGS

1. Glass filament reinforced thermosetting plastics (GRP) pipes shall not be used. ***Not Permitted by Sewer Authority***

PUMP STATIONS

D12.20 GENERAL

1. The Designer shall take into account access, site maintenance and restoration, easement, power supply and working area when locating pump stations in road reserves or on private property. This action constitutes a **WITNESS POINT**. The Principal shall advise at the time of notification by the Designer whether the option to confer on the locations is required. ***Location*** ***(WP)***

2. Where not provided as a Vacuum Sewerage System, the Designer shall provide for all pump stations to be of the single wet well submersible pump style with self contained freestanding switchboards suitable for external use. Pump Stations shall be designed in accordance with PWD – PSD. ***Type***

3. The Designer shall provide for the construction of the pump well after taking into consideration the ground and site conditions. ***Conditions***

4. Preformed components or systems, complying with the Drawings, if any, may be used in lieu of in-situ construction provided: ***Preformed Components***

   (a) Preformed concrete wall units are to be manufactured to AS 4058. The Designer shall take into account the cover requirements for reinforcing steel and cement types.

   (b) Joints shall be internal flush

   (c) The Designer shall ensure selected components make a watertight system and have a satisfactory surface finish.

5. Where the pump station site is exposed to possible flooding, the Designer shall provide for the top of pump well to be one (1) metre above the 1 in 100 year flood level or to such other level as provided by Council's planning instruments, whichever is the higher. ***Protection Against Flooding***

6. The Designer shall provide for the design of pump wells against flotation both during the construction/installation stage and whilst operating under flood conditions designed as above. ***Protection Against Flotation***

7. Package pump station units may be designed, with the prior concurrence of the Sewer Authority, where the area being serviced is small and/or their inclusion contributes ***Package Units***

to an overall lesser depth of excavation in the system.

8. The Designer shall provide for internal surfaces of wet wells to be prepared and coated with an epoxy paint system approved by the Superintendent. All bolted connections within wet wells shall be stainless steel complying with AS 1449 grade 316. ***Surfaces***

9. The Designer shall size pipes and pump station capaSHIRE to avoid surcharges under design flow conditions. The Designer shall provide for overflows in strict accordance with the conditions of the licence, if any, permitting sewage overflow. ***Overflows***

10. The Designer shall provide for alarms and signals systems with the concurrence of the Sewer Authority. ***Alarms and Signals***

D12.21 PUMP

1. The Designer shall specify special requirements, if any, for materials to be used in the pump station, taking into consideration the nature and composition of the sewage to be pumped. Each pump shall be fitted with a flushing valve installed in accordance with the manufacturer's recommendations. ***Special Requirements***

2. The Designer shall provide for pump stations to be fitted with suitably sized pumps, consistent with other pumps in service, in conventional duty pump/standby pump arrangement. ***Size***

3. Each pump shall be capable of passing solids of not less than 75mm diameter unless grinding equipment is incorporated ***Impeller Clearance***

4. Each pump shall be capable of being removed with the aid of fixed guide rails. ***Removal***

5. Pump sets are to be interchangeable within each pump station. Pumps are to be consistent with other pumps in use by the Sewer Authority. The Sewer Authority will specify the brand and type of pumps to be used. ***Inter-changeable***

6. The Designer shall design structural steelwork in accordance with HB 48. ***Structural Steelwork***

D12.22 ELECTRICAL

1. Notwithstanding other clauses mentioned herein, the Designer shall be responsible for the design of the equipment as suitable for the purpose. Equipment design shall comply with the requirements of the relevant standard specification. ***Design Responsibility***

2. The Designer shall provide for Switchgear Control Assembly (SCA), SCA housing and electrical requirements as detailed in the DEVELOPMENT CONSTRUCTION SPECIFICATION-SEWERAGE SYSTEM. ***SCA and Electrical***

3. Where more than one (1) item of equipment is designed to form a particular function, all such items of equipment shall be identical and completely interchangeable (eg pilot lights, pushbuttons, relays, etc). ***Inter-changeability***

4. The switchboard shall be installed visibly and physically accessible above areas at risk of flooding. ***Switchboard***

5. Ambient conditions shall be within the normally accepted limits of -10°C to +45°C. ***Ambient Conditions***

6. The switchboard shall be connected to the local electriSHIRE supply system. ***Connection to Local Supply***

Nominal system parameters:

(a) 415 volt, 3-phase, 4-wire, 50 Hz, solidly earthed neutral system.

(b) Prospective Fault Current: As specified by the Local Supply Authority.

The switchboard shall provide a generator connection point to allow the pump station to be run via generator in the event of failure of the local electriSHIRE supply system.

7. The works shall be designed in accordance with and subject to the provisions of MEW E101, except where modified by this Specification. ***Standards***

8. The pump station shall be designed for fully automatic operation in the unmanned condition. ***Automatic Operation***

D12.23 WATER SUPPLY

1. The Designer shall provide for automatic well washers and flush valves to be installed at each pump station and controlled so that they operate when the duty pump is operating. ***Cleaning***

2. The Designer shall provide at all pump stations for an adequate water supply for cleaning purposes. This supply shall be protected from contamination due to backflow by the installation of a registered break tank or reduced pressure zone device in accordance with AS 3500. ***Contamination Protection***

D12.24 LADDERS

1. Ladders shall comply with AS 1657 and applicable Occupational Health and Safety legislation (WSAA 02 Part 1, section 6.6.8). ***Standard***

2. If required, the Designer shall set intermediate landings in wells to achieve the minimum head room clearance. Wherever possible, the landing shall be located adjacent to fittings and machinery requiring maintenance. ***Ladder Landings***

3. Ladder cages shall not be used on ladders in pump station wet wells. ***Ladder Cages***

D12.25 TELEMETRY

1. The Designer shall provide for telemetry requirements in accordance with the schedule supplied by the Sewer Authority. ***Schedule***

2. The telemetry system is to be compatible with the existing system in use. ***Compatibility***

D12.26 OTHER APPURTENANCES

1. The Designer shall provide for venting and odour control of each pump station, rising main, receiving maintenance holes, and gravity sewers, after consultation with the Sewer Authority. ***Venting and Odour Control***

2. The Designer shall provide for machinery lifting equipment including pump chains. ***Lifting Equipment***

3. The Designer shall provide pressure tapping and gauges for all valves, including isolation and non-return valves and as detailed in the DEVELOPMENT CONSTRUCTION SPECIFICATION-SEWERAGE SYSTEM. ***Gauges***

4. The Designer shall take account of the possibility of site flooding ingress and overflow, and Occupational Health and Safety requirements in providing for access and inspection covers. ***Covers***

DOCUMENTATION

D12.27 SEWERAGE SYSTEM

1. The Principal shall submit, to the Sewer Authority an Application for Certification of Design Drawings under Part 3 Division 2 Section 307 of the Water Supply Authorities Act 2000, together with four (4) copies of the proposed sewerage system design, including calculations, and obtain approval prior to commencement of construction (WSAA 02 Part 1, section 9). This action constitutes a **HOLD POINT**. The Principal shall advise at the time of notification by the Designer whether the option to direct the submission to the Sewer Authority is taken. ***Review*** ***(HP)***

Approval of the design by the Sewer Authority will be made by the issue of a compliance certificate under Part 3 Division 2 Section 307 of the Water Supply Authorities Act 2000.

2. The Drawings shall show to scale:

(a) Plan showing: ***Plan***

(1) Lot boundaries and lot numbers

(2) Location and chainage of all maintenance holes, junctions and dead ends

(3) Maintenance hole types

(4) Location and size of all gravity and rising mains and pump stations

(5) Location of vents

(6) Sewer main number and maintenance hole number

(7) Existing sewer mains, junctions and maintenance holes

(8) For level lots, spot levels at the lot extremities to show that at least 90 per cent of the area of the lot can be connected to the sewer by gravity.

(9) Hatching shall show the area of any lot not serviced.

(10) Site contours

(11) Existing and proposed features and services

(12) North point and scale bar

(13) Easement location

(14) Arrangement of other utilities.

(b) Longitudinal section showing: ***Longitudinal Section***

(1) Reduced levels for natural surface and design surfaces at all changes in grade

(2) Maintenance hole locations and type

(3) Maintenance holes numbered in accordance with the Sewer Authority's Asset Register

(4) Invert levels for maintenance holes inlet and outlet

(5) Size, type, class and grade of pipe

(6) Location, invert level and size of all drainage lines, water mains, and other utility services crossing the main

(7) Notation regarding all joining lines

(8) Property ownership

(9) Note upstream ET's at each maintenance hole

(10) Note "In road" trench conditions

(11) Locations and levels of other services (existing or proposed) relative to the sewer main

(c) General arrangement of pump stations with site plan; concrete outlines; number, make, model and details of pumps; inlet and outlet pipework details and levels; pump cut in; cut out and alarm levels; switchboard location; pump station access details; design starts per hour. ***Pump Stations***

(d) Details of corrosion protection required for pipes and fittings. ***Pipe Protection***

(e) Areas designated for trenchless pipe installation. ***Trenchless Installation***

3. Detail plans shall be drawn to a scale of 1:500 and longitudinal sections to a horizontal scale of 1:500 and a vertical scale of 1:100. ***Drawing Scale***

4. Drawings shall be "A1" size for approval with "A3" size copies to be forwarded to the Sewer Authority once the plans have been approved. ***Drawing Size***

5. Drawings shall be provided also in electronic form after consultation with the Sewer Authority. ***Electronic Form***

D12.28 PUMP STATION

1. The Principal shall submit, to the Sewer Authority and obtain approval, prior to commencement of the manufacture of any pumps and control equipment, four (4) copies of the following: ***Review***

a. Switch and Control Gear Assemblies - Proposed fully dimensioned manufacturing details, general arrangement (showing internal/external details) and foundation/gland plate details.

b. Common Control - Complete circuit diagram and description of operation.

c. Schedule of Equipment - Completed as to the equipment to be provided.

d. Other Engineering drawings as required to fully describe the proposed equipment.

The submission of the documents constitutes a **WITNESS POINT**. The Principal Shall advise at the time of notification by the Designer whether the option to direct the submission to the Sewer Authority is taken. ***(WP)***

2. The Designer shall take into consideration the technical requirements to minimise all risks associated with entry into confined space. ***Risk***

3. Drawings shall be on "A1" size with "A3" size copies to be forwarded to the ***Drawing Size***

Sewer Authority once the plans have been approved. All symbols used shall conform to AS 1102 and all wires and terminals shall be numbered.

4. Drawings shall also be provided in electronic form after consultation with the Sewer Authority. ***Electronic Form***

D12.29 ASSET REGISTER

1. The Designer shall provide asset schedules and Drawings in a form consistent with the existing or proposed Asset Register after consultation with the Sewer Authority. (WSAA 02 Part 1, section 9.3.2). ***Consistency***

SPECIAL REQUIREMENTS

D12.30 DEEMED TO COMPLY

Section D12 shall be Deemed to Comply if carried out in accordance with the requirements of Section D12, as amended by COONAMBLE SHIRE Council. The submission of the documents constitutes a **HOLD POINT** ***(HP)***

D12.31 WORK AS EXECUTED (WAE) PLANS ***WAE***

1. Full WAE plans for all constructed infrastructure shall be submitted to Council prior to the issue of a Subdivision Certification and/or and Occupation Certificate. The submission of these documents constitutes a **HOLD POINT.** ***(HP)***

D12.32 RESERVED

COONAMBLE
SHIRE COUNCIL

COONAMBLE SHIRE COUNCIL

COONAMBLE DEVELOPMENT DESIGN SPECIFICATION

D13

VEHICULAR ACCESS DESIGN

VERSION 3.1 – JANUARY 2022

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
VERSION 3.1					
1	COONAMBLE specifications and RTA standards referenced	D13.03	A	MC	05/02/13
2	Prohibited driveway locations amended	D13.04.3	A	MC	05/02/13
3	SHIRE Infrastructure Division referenced, "driveway" replaced by "vehicular footpath crossing"	D13.05	A	MC	05/02/13
4	"driveway" replaced by "vehicular footpath crossing"	D13.06	A	MC	05/02/13
5	Large lot residential subdivision referenced	D13.08	M	MC	05/02/13
6	F72 mesh in residential driveways	D13.09	M	MC	05/02/13
7	Driveway grades for long sections clarified	D13.11	M	MC	05/02/13
8	Standard Drawings added	D13-A	A	MC	05/02/13

DEVELOPMENT DESIGN SPECIFICATION D13
VEHICULAR ACCESS DESIGN - COONAMBLE

DEVELOPMENT DESIGN SPECIFICATION D13
VEHICULAR ACCESS DESIGN - COONAMBLE

GENERAL

D13.01 SCOPE

1. This specification sets out requirements to be used in the design of vehicular access for application in all types of development, including residential, commercial, industrial and subdivision development.

2. All relevant design principles referenced below must be integrated in the design of vehicular access. The design of vehicular access must be considered in conjunction with the geometric road design and subdivision layout.

Integrated design

D13.02 OBJECTIVES

1. This specification aims to set standards related to the provision of vehicular access to proposed allotments, which are to be safe and convenient, and shall maintain a satisfactory level of service for the user.

Safety

Level of Service

2. This specification also aims to set the minimum design standards required for the provision of vehicular footpath crossings and driveways, located within allotments and Council's Road Reserve.

Vehicular Footpath Crossings

D13.03 REFERENCE AND SOURCE DOCUMENTS

(a) Development Control Plans

COONAMBLE DCP 2012

(b) Council Specifications

DEVELOPENT DESIGN SPECIFICATION D1- Geometric Road Design – COONAMBLE – VERSION 3.1

(c) Australian Standards

AS 2890	- Parking facilities:
AS/NZS 2890.1:2004	- Parking facilities: Off-street car parking.
AS 2890.2:2002	- Off-street parking: Commercial vehicle facilities.
AS/NZS 2890.6:2009	- Off-street parking for people with disabilities

(d) State Authorities

Roads and Traffic Authority NSW
Road Design Guide.
Guide to Traffic Generating Developments – Version 2.2 (Oct 2002)

VEHICULAR ACCESS IN URBAN AREAS

D13.04 VEHICULAR ACCESS

Vehicle Kerb Crossings

1. Vehicular access from a roadway shall be provided by the developer to each allotment created within a subdivision by the developer. The provision of vehicular access may consist of either a vehicular kerb crossing in barrier type kerb, or modified layback kerb.

Geometric Design

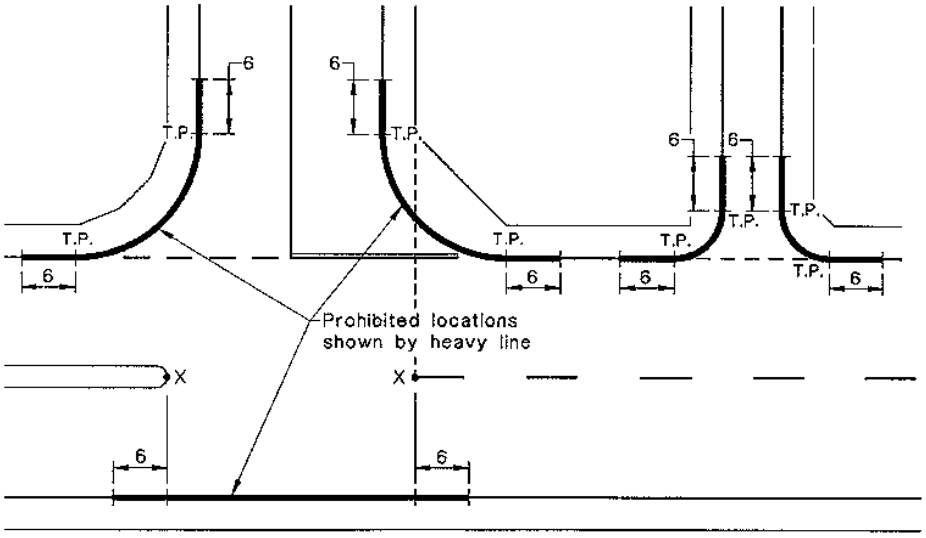
2. The number of vehicular kerb crossings required to be provided to each allotment in a subdivision is shown in Table D13.1. In urban areas the number of vehicular kerb crossings may be extended to two (2) provided that the combined width of the vehicular kerb crossings does not exceed 7 metres and there is adequate driveway and turning areas within the lot to justify the need for two vehicular crossings.

Table D13.1 Vehicular Access (Crossing) Requirements for Subdivisions

Type of Development	No. of Crossings	Minimum Crossing Width(1)	Maximum Crossing Width(1)	Crossing Type	Minimum Distance from Boundary(2)
Residential					
Barrier Type Kerb	1	3m	6m	VKC	2m(3)
Modified Layback Kerb	N/A	N/A	N/A	N/A(4)	N/A
Industrial	1	6m	As required	VKC	2m
Commercial	1	4m	As required	VKC	2m

NOTES:

1. Crossing width does not include the 0.5m wings on either side.
2. Distance is measured from the boundary to the edge of the crossing, but not including the wing.
3. Distance from a boundary to a crossing may be reduced to 1m at the driveway construction stage, but must be installed at 2m from boundary at the subdivision stage to allow for future widening.
4. A modified layback kerb crossing may be provided at locations where driveways will be constructed by the subdivision developer.
5. All crossings must be located at least 1m from any electrical, Telstra, post-box installation, stormwater inlet pit, other service or tree within the verge.



DIMENSIONS IN METRES

NOTE: The points marked 'x' are either at the median end on a divided road, or at the intersection of the main road centre-line and the prolongation of the side road property line on an undivided road.

Figure D13.1
Prohibited Locations for Vehicular Access

Prohibited Locations

3. Vehicular access is prohibited from being constructed in the locations shown in bold in Figure D13.1 adjacent the kerb returns of the intersection. Access to commercial properties is also prohibited along the kerb length marked in bold opposite the intersection in Figure D13.1. Access to residential properties is also prohibited along the kerb length marked in bold opposite the intersection in Figure D13.1 where the through street is an Arterial Road, Local Arterial Road or Local Sub-Arterial Road (as defined in Table D1.5).

Retaining Walls

4. Where vehicular access is provided through an opening in a retaining wall, the access opening shall be a minimum 4 metres wide, and the access shall be regraded to the finish levels of the future vehicular footpath crossing and driveway for a minimum distance of 8 metres. The cutting and filling associated shall not encroach on any adjoining allotment, public reserve or public pathway.

D13.05 VEHICULAR FOOTPATH CROSSINGS AND DRIVEWAYS

1. A vehicular footpath crossing and driveway is required to be constructed with each dwelling or development on an individual allotment. Where a development is situated on two or more allotments the number of vehicular footpath crossings shall be determined by Council at the Development Application stage.

Owner's Responsibility

2. The vehicular footpath crossing extends from the kerb and gutter to the property boundary. It is the responsibility of the property owner to construct and maintain the vehicular footpath crossing in a safe condition. Vehicular footpath crossing in urban areas shall be constructed of concrete only. Driveways in urban areas shall be constructed of concrete or segmental paving only.

	Number	Minimum Width	Maximum Width	Minimum Distance from Side Boundary
Residential (single street frontage)				
street frontage <15m	1 max	3m	6m	1m
street frontage >15m, <30m	2 max	3m each	Combined 7m	1m
street frontage >30m	2 max	3m each	Combined 8m	1m
Residential (dual street frontage - 1 per frontage)	2 max	3m each	Combined 10m	1m
Industrial	As required (1 min)	6m	As required	2m
Commercial (including unit developments)	As required (1 min)	4m	As required	2m

Table D13.2 Vehicular Footpath Crossing Requirements for Developments

Width

3. The minimum and maximum width of vehicular footpath crossings, and number of vehicular footpath crossings permitted to a development, shall be in accordance with Table D13.2. The width of all vehicular footpath crossings shall be equal at the boundary line and the kerb line, ie edges of the vehicular footpath crossings shall be parallel.

Property Line Levels

4. Prior to the construction of a vehicular footpath crossings, property line levels are required to be obtained from Council's SHIRE Infrastructure Group. Generally, the gradient of a driveway over the verge shall be 4%.

Driveway Gradients

5. The gradients of residential driveways within an allotment shall not exceed the following:

1(V):5(H), ie 20% for driveways which fall towards the property boundary.

1(V):6(H), ie 16% for driveways which fall away from the property boundary.

Grade changes greater than 12.5% algebraically require the introduction of transitions between the adjoining grades. The minimum length of the transition shall be 1.5m and the recommended transition grade is 10%. The design of transitions shall be in accordance with AS/NZS 2890.1- Off street car parking.

6. Gradients of driveways in industrial and commercial developments shall satisfy the requirements of AS2890.2 - *Commercial vehicle facilities*.

Maximum Splay

7. Driveways shall be constructed perpendicular to the kerb line and the boundary line. In areas such as Cul de Sac heads, the driveway shall be located to minimise the splay required, which shall not exceed 0.5 metres.

Subdivision Design

8. Consideration must be given to driveway gradients when designing subdivisions in steep areas. The subdivision design must enable driveways to be constructed to each allotment in accordance with the gradient requirements above.

D13.06 COMMON DRIVEWAYS

1. Where battle-axe allotments are incorporated into a subdivision, the common driveway located in the battle-axe handles shall be provided by the Developer. With the exception of the vehicular footpath crossings within the verge, common driveways shall be located wholly within private property.

Design

2. The number of allotments gaining access from a common driveway within properties shall not be greater than two (2). Common driveways serving two allotments shall be not less than 4.5 m wide, centrally located within a 7 m wide access corridor and must extend from the vehicular kerb crossing for the full length of the access handle. The access corridor shall be registered as two adjacent battleaxe handles each 3.5 m wide with reciprocal rights of way created.

Length

3. Driveways on single allotments with a battle axe handle shall not be less than 3 m wide located within a 4 m access handle and must extend for the full length of the access handle and must incorporate a vehicular footpath crossing.

VEHICULAR ACCESS IN RURAL AREAS

D13.07 VEHICULAR ACCESS

Pipe Culvert and Headwall

1. Rural road vehicular access shall be provided by a minimum 300mm diameter reinforced concrete pipe culvert with stone pitched headwalls, located in the table drain. The vehicular access must only be positioned where stopping sight distance is available, and must maintain a minimum of 1 metre clearance from the headwall to the prolongation of an adjoining property boundary.

Bituminous Seal

2. A driveway shall be constructed from the edge of the roadway to the property boundary of each allotment created by the subdivision developer. The crossing shall be a 3 metre wide bituminous sealed flexible pavement with a minimum thickness of 150mm.

D13.08 DRIVEWAYS

Materials

1. Driveways in rural and large lot residential areas shall be constructed using concrete, segmental paving or bituminous sealed flexible pavement with a minimum thickness of 150mm.

Gradients

2. The gradient of driveways in rural areas shall be in accordance with the requirements for driveway gradients for urban areas specified in this SPECIFICATION.

Common Driveways

3. Common driveways in rural and large lot residential areas are not permitted, but driveways should be grouped to reduce the number of access locations.

MATERIALS

D13.09 CONCRETE

1. Driveways constructed using concrete shall be constructed to the following nominal thicknesses and standards: ***Standards***

Residential	-100mm thickness. Concrete shall be reinforced where directed.
Large Lot Residential	-150mm thickness, reinforced with one layer of F72 mesh.
Common	-150mm thickness, reinforced with one layer of F72 mesh.
Commercial	-150mm thickness, reinforced with one layer of F72 mesh.
Industrial	-200mm thickness, reinforced with one layer of F72 mesh.

2. Minimum strength of Concrete used in the construction of vehicular footpath crossings shall be 20 MPa at 28 days. Concrete used shall be ready-mixed concrete in accordance with AS 1379.

3. The preparation and placement of the work shall be in accordance with Specification for MINOR CONCRETE WORKS where applicable. ***Specification***

D13.10 SEGMENTAL PAVING

1. Driveways constructed using segmental paving shall be constructed to the following standards: ***Standards***

Residential	-Pavers shall be placed on a bed consisting of compacted gravel or scalpings, covered with bedding sand.
Common	-Pavement shall be designed in accordance with Specification for PAVEMENT DESIGN – COONAMBLE – VERSION 3.1.
Commercial	-Pavement shall be designed in accordance with Specification for PAVEMENT DESIGN – COONAMBLE – VERSION 3.1.
Industrial	- Pavement shall be designed in accordance with Specification for PAVEMENT DESIGN – COONAMBLE – VERSION 3.1.

2. Segmental pavers, bedding sand and prepared base shall conform to the Specification for SEGMENTAL PAVING – COONAMBLE – VERSION 3.1 where applicable. ***Specification***

3. The preparation and placement of the pavers shall be in accordance with Specification for SEGMENTAL PAVING – COONAMBLE – VERSION 3.1 where applicable.

DOCUMENTATION

D13.11 DRIVEWAY LONGSECTIONS

1. A driveway longsection is required to be submitted to Council for assessment at the Development Application stage for all driveways which require the provision of transitions, ie:

- Residential driveways with grades in excess of 12%; and
- Commercial/Industrial Driveways with grades in excess of 8% when used by Heavy Rigid Vehicles, and 6% when used by Articulated Vehicles.

2. Driveway longsections for common driveways to be constructed by the subdivision developer shall be required at the construction certificate stage. ***Common Driveways***

3. For driveways connecting to a road with a longitudinal gradient in excess of 5%, the driveway longsection shall be taken along the worst case edge of the driveway. For driveways connecting to a road with a longitudinal gradient in excess of 12%, the driveway longsection shall be taken along both edges of the driveway. In all other cases the longsection shall be taken along the centreline of the driveway. ***Road Longsection***

4. Driveway longsections shall be drawn to a reduction ratio of 1:50 on the horizontal and vertical axis. In certain circumstances Council may require the submission of cross sections to ensure that an adequate standard of vehicle access is being provided. All Drawings shall be in accordance with the minimum drafting requirements in the Specification for QUALITY ASSURANCE REQUIREMENTS FOR DESIGN – COONAMBLE – VERSION 3.1 ***Reduction Ratio***

5. Driveway longsections shall be drawn from the road carriageway, ie kerb and gutter, to the nominated parking area/s within the property.

SPECIAL REQUIREMENTS

D13.12 RESERVED

ANNEXURE D13-A

STANDARD DRAWINGS

The following ACT Territory & Municipal Services (TAMS) standard drawings, as amended by COONAMBLE SHIRE Council (QCC), are deemed to comply for the purposes of this specification.

TAMS Design Standards for Urban Infrastructure: Standard Drawings

DRAWING NUMBER	DATE / REVISION	TITLE	QCC AMENDMENT / COMMENT
DS3 ROAD DESIGN			
DS3-01	Aug 02	Kerb & Gutter Standard Details – Sheet 1	Adopted by QCC.
DS3-02	Aug 02	Kerb & Gutter Standard Details – Sheet 2	Adopted by QCC.
DS5 DRIVEWAYS			
DS5-01	Oct 09	Domestic Driveways	Driveways shall be provided with both edges perpendicular to the property boundary from the lot frontage to the kerb unless otherwise approved by QCC. Grade across footway shall be 4% unless otherwise approved by QCC.
DS5-02	Oct 09	Heavy Duty Driveways	Driveway Type HD1 shall be provided with both edges perpendicular to the property boundary from the lot frontage to the kerb unless otherwise approved by QCC. Driveway Type HDR not used. Driveway Type HD2 used for commercial and industrial driveways only
DS7 BRIDGES AND ASSOCIATED STRUCTURES			
DS7-01	Aug 02	Gravity Retaining Walls – Stone & Clay Brick	Maximum retaining wall height 1200mm. Walls higher than 900mm to be provided with a handrail.
DS7-02	Aug 02	Reinforced Concrete Block Walls up to 2100	Maximum retaining wall height 1200mm. Walls higher than 900mm shall be provided with a handrail.
DS7-03	Aug 02	Stone Pitched Retaining Walls	Maximum retaining wall height 1200mm. Walls higher than 900mm shall be provided with a handrail.
DS7-04	Aug 02	Retaining Walls – General Notes	Adopted by QCC.

COONAMBLE SHIRE COUNCIL

HANDBOOK OF DRAINAGE DESIGN CRITERIA - COONAMBLE

VERSION 3.1 – JANUARY 2022

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
VERSION 1					
1	Large Lot Residential referenced	1.03	A	MC	05/02/13
2					
3					
4					
5					

Handbook of Drainage Design Criteria

Handbook of Drainage Design Criteria

PREFACE

General

1. This handbook has been produced to be read in conjunction with COONAMBLE City Council's *COONAMBLE Development Design Specification* series of documents.

2. The handbook contains technical design data including rainfall intensity charts, pressure change coefficients, pipeline design charts, pipeline material standards, summary sheets for calculations and requirements for computer analysis packages. ***Technical Data***

3. Where further technical design data are required that are not provided in this handbook, then the criteria shall be obtained from:

ACT Territory and Municipal Services (TAMS): *Design Standards for Urban Infrastructure*, Part 1 *Stormwater*, or ***ACT Stormwater Standards***

The Institution of Engineers, Australia: *Australian Rainfall and Runoff* 1987. ***AR&R 1987***

Technical data that is not included in this handbook or the references listed above shall be confirmed with COONAMBLE City Council prior to the commencement of detailed stormwater design.

4. Where further construction standards or specifications are required that are not provided in Council's *COONAMBLE Development Design Specification* series – Version 1, or this handbook, then the standards shall be obtained from the ACT TAMS *Design Standards for Urban Infrastructure*, Part 1 - *Stormwater*, and confirmed with COONAMBLE City Council prior to the commencement of detailed stormwater design. ***Urban Stormwater Standards***

SECTION 1 - HYDROLOGY

1.01 SCOPE

1. This section sets out technical data to be used in the estimation of rainfall intensities and runoff.

1.02 DESIGN INTENSITY-FREQUENCY-DURATION

1. The rainfall intensities given in Figure 1.1 shall be used for the estimation of design flows within the City of COONAMBLE. ***Design Flows***

1.03 PERCENTAGE OF IMPERVIOUS AREA

1. The percentage of impervious area used in hydrological calculations for each specific zoning type given in Table 1.1 shall be adopted.

Area/Zoning Type	% Impervious
Rural Residential	20 %
Large Lot Residential	20 %
Residential	
450 - 600 m^2	60 %
600 - 800 m^2	45 %
800 - 1000 m^2	35 %
> 1000 m^2	30 %
Multi-dwelling	70 %
Industrial	95 %
Commercial	85 %
Playing fields/Parks	10 %
Rural/Open country < 10 % slope	40 %
Steep rocky country > 10 % slope	70 %

Table 1.1
Percentage of Impervious Area

1.04 RUNOFF COEFFICIENTS

1. The following runoff coefficient shall be used for all impervious areas; ***Runoff Coefficient***

$$C_i = 0.90$$

The following relation shall be used for pervious areas in residential developments with densities in the range of 10 - 15 blocks per hectare:

$$C_p = 0.91 - 3.14 i^{-0.594}$$

where,
C_p = runoff coefficient for pervious grassed surfaces
i = rainfall intensity (mm/hr)

2. Time of Concentration - The procedures employed to calculate the overland flow travel time component (t_o) of the total surface flow time of concentration (t_c)for sub-catchment pervious runoff shall be as follows;

Time of Concentration

$$t_o = \frac{107nL^{0.333}}{S^{0.2}} \qquad \text{for L} \leq 200 \text{ m}$$

$$t_o = \frac{0.058L}{A^{0.1}S^{0.2}} \qquad \text{for L} > 200 \text{ m}$$

where,

A = catchment area (hectares)
t_o = overland flow travel time (minutes)
L = flow path length (m)
S = slope of surface (%)
n = Horton's roughness value for the surface (table 1.2)

The maximum travel time of concentration shall be set at 20 minutes and the minimum travel time set at 5 minutes.

Surface Type	'n' Value
Paved surface	0.015
Bare soil surface	0.028
Poorly grassed surface	0.035
Average grassed surface	0.045
Densely grassed surface	0.060

Table 1.2
Horton's Roughness Values

1.05 HYDROLOGICAL CALCULATIONS

1. Hydrological calculations shall be submitted in the format shown on the sample calculation summary sheet. A copy of the summary sheet is shown in Figure 1.2. Calculations which are not submitted in this format will not be accepted by COONAMBLE City Council.

Summary Sheet

1.06 RAINFALL/RUNOFF MODELLING REQUIREMENTS

1. The following clauses specify parameters and procedures that shall be used in lieu of values and procedures recommended in the program documentation and related reports. The parameters have been determined from calibration tests performed in the ACT.

Parameters and Procedures

1.07 RAFTS

1. Rainfall Loss Rates - the Rafts program offers a choice between two approaches to rainfall loss estimation. They are the initial/continuing loss model and the infiltration/water balance procedure which utilises the Australian Representative Basins Model (ARBM). The use of the ARBM shall be used in preference to the initial/continuing loss model due to the ability of ARBM to model a range of ARI events with a single set of parameters. The values for the ARBM loss model are given in Table 1.3.

Parameter	Adopted Values	Initial Values
Storage Capacities		
Impervious (IMP)	0.50	0.0
Interception (ISC)	1.00	0.00
Depression (DSC)	1.00	0.00
Upper Soil (USC)	25.00	20.00
Lower Soil (LSC)	50.00	40.00
Infiltration		
Dry soil sorptivity (SO)	3.00	
Hydraulic Conductivity (K_o)	0.33	
Lower soil drainage factor (LDF)	0.05	
Groundwater recession;		
constant rate (KG)	0.94	
variable rate (GN)	1.00	
Evapo-Transpiration		
Proportion of rainfall intercepted by vegetation (IAR)	0.70	
Max. Potential evapo-transpiration;		
upper soil (UH)	10.00	
lower soil (LH)	10.00	
Proportion of evapo-transpiration from upper soil zone (ER)	0.70	
Ratio of potential evaporation to A class pan (ECOR)	0.90	

Table 1.3
RAFTS ARBM Loss Rates

2. Surface Runoff Routing - The recommended surface runoff routing parameters given in Table 1.4 shall be adopted.

Parameter	Value
Impervious surface roughness	0.015
Pervious surface roughness	0.040
Non-linearity coefficient (default)	0.285

Table 1.4
RAFTS Surface Runoff Routing Parameters

1.08 ILSAX

1. Rainfall Loss Rates - the ILSAX program incorporates the Horton's infiltration equation to determine losses occurring on pervious surfaces. ILSAX also requires that a catchment soil type and antecedent moisture condition be specified. The parameter values given in Table 1.5 shall be adopted.

Parameter	Value
Impervious (paved) depression storage	1 mm
Pervious (grassed) depression storage	5 mm
Soil type	3.0
AMC	3.2

Table 1.5
ILSAX Rainfall Loss Parameters

2. Time of Concentration - The procedures employed to calculate the travel times of concentration for sub-catchment pervious runoff shall be as specified for overland flow in Section 1.04 above.

The travel time of concentration for all impervious areas should be adopted globally and set at 6 minutes.

1.09 RORB

Ungauged Catchment Caution

1. It is recommended that the following RORB parameters be used with caution for ungauged catchments. Gauged catchments should be calibrated against recorded storm events using the runoff coefficient as the calibration parameter.

Loss Rate

2. Rainfall Loss Rates - The RORB model utilises a constant loss rate for impervious areas and an initial loss followed by a runoff coefficient or constant (continuing) proportional loss rate for pervious areas. The rainfall loss parameters given in Table 1.6 shall be adopted.

Parameter	Value
Initial loss	10 mm
Runoff coefficient	45%

Table 1.6
RORB Pervious Area Rainfall Loss Parameters

3. Surface Runoff Routing - The RORB runoff routing method is based on the storage-discharge relationship

$$S = 3600kQ^m.$$

The dimensionless coefficient m is a measure of catchment non-linearity with a value of 1.0 implying a linear catchment. The dimensionless empirical coefficient k is the product of two factors, k_c and k_r. The factor k_r is a dimensionless ratio called the relative delay time applicable to an individual reach storage and k_c is an empirical coefficient applicable to the entire catchment and stream network. The runoff routing parameters given in Table 1.7 shall be adopted.

Parameter	Value
m (adopt default)	0.8
k_c (adopt default equation)	$2.2A^{0.5}$ (1)

(1) A = catchment area (km^2)

Table 1.7
RORB Runoff Routing Parameters

1.10 OTHER METHODS AND MODELS

1. The use of other hydrological methods or models will not be permitted without the prior approval of COONAMBLE City Council. To obtain approval, the designer must demonstrate that a particular method or model is appropriate for COONAMBLE conditions, by calibration of the method or model.

2. The designer shall submit a report to COONAMBLE City Council, prior to the assessment of the design, giving full details of the method or model to be used including all assumptions made, recommended parameters values, and tabulated flow comparisons for major and minor system ARI's.

Rainfall Intensity (mm/hr) For COONAMBLE							
Duration	**Average Recurrence Interval (Years)**						
	1	**2**	**5**	**10**	**20**	**50**	**100**
5 m	55.75	73.37	99.02	114.68	136.06	165.79	189.71
6	52.19	68.62	92.37	106.83	126.59	154.03	176.09
7	49.23	64.67	86.85	100.31	118.74	144.30	164.82
8	46.71	61.30	82.15	94.78	112.09	136.06	155.29
9	44.51	58.38	78.09	90.00	106.33	128.94	147.06
10	42.58	55.81	74.52	85.80	101.29	122.71	139.87
11	40.87	53.53	71.36	82.08	96.83	117.20	133.51
12	39.33	51.48	68.52	78.76	92.84	112.28	127.82
13	37.93	49.63	65.96	75.75	89.24	107.84	122.71
14	36.66	47.94	63.63	73.03	85.97	103.82	118.08
15	35.50	46.40	61.51	70.54	82.99	100.15	113.05
16	34.43	44.98	59.55	68.25	80.26	96.79	109.98
17	33.45	43.67	57.75	66.15	77.74	93.69	106.41
18	32.53	42.45	56.08	64.19	75.41	90.83	103.12
20	30.88	40.27	53.08	60.69	71.22	85.69	97.21
25	27.55	35.87	47.07	53.69	62.87	75.46	85.46
30	25.02	32.53	42.52	48.39	56.57	67.75	76.63
35	23.01	29.88	38.93	44.22	51.61	61.71	69.71
40	21.37	27.72	36.00	40.84	47.60	56.82	64.11
45	20.00	25.91	33.57	38.02	44.26	52.76	59.48
50	18.84	24.38	31.51	35.64	41.44	49.34	55.57
55	17.83	23.06	29.74	33.59	39.02	46.40	52.22
60	16.95	21.90	28.19	31.81	36.92	43.85	49.31
75	14.74	19.03	24.44	27.54	31.93	37.87	42.55
90	13.13	16.94	21.71	24.44	28.30	33.54	37.66
2.0 hr	10.91	14.06	17.96	20.19	23.35	27.62	30.97
3.0	8.39	10.78	13.71	15.38	17.74	20.94	23.45
4.0	6.95	8.93	11.32	12.66	14.59	17.19	19.23
5.0	6.01	7.71	9.75	10.89	12.54	14.75	16.48
6.0	5.33	6.84	8.63	9.63	11.08	13.02	14.54
8.0	4.42	5.66	7.13	7.94	9.12	10.70	11.93
10.0	3.83	4.90	6.14	6.84	7.84	9.19	10.24
12.0	3.40	4.35	5.44	6.05	6.93	8.11	9.03
14.0	3.09	3.94	4.92	5.46	6.24	7.30	8.11
16.0	2.84	3.62	4.50	4.99	5.60	6.65	7.39
18.0	2.63	3.35	4.17	4.61	5.26	6.13	6.81
20.0	2.46	3.13	3.88	4.29	4.90	5.70	6.32
22.0	2.32	2.95	3.65	4.02	4.59	5.33	5.91
24.0	2.19	2.79	3.44	3.79	4.32	5.01	5.55
36.0	1.68	2.13	2.60	2.86	3.24	3.74	4.13
48.0	1.38	1.74	2.12	2.32	2.62	3.01	3.32
60.0	1.17	1.48	1.79	1.95	2.20	2.53	2.78
72.0	1.02	1.29	1.55	1.69	1.90	2.17	2.38

Figure 1.1
Intensity-Frequency-Duration Chart for COONAMBLE

HANDBOOK OF DRAINAGE DESIGN CRITERIA

HYDROLOGY DATA AND RESULTS

NODE NAME	RETURN PERIOD	TIME OF CONCENRATION						AREA		FLOWS							CRITICAL AREA DATA		
		IMPERVIOUS			PERVIOUS							SURFACE FLOWS							
															PRIMARY PATH				
		LENGTH	SLOPE	Tc	LENGTH	SLOPE	Tc	TOTAL	IMPERVIOUS	TOTAL FLOW	PIPE FLOW	CATCHMENT CONTRIBUTION	TOTAL GUTTER FLOW	CAPTURED FLOW	DESTINATION	FLOW	CRITICAL AREA Tc	INTENSITY	EQ. IMPERVIOUS AREA
		m	%	min	m	%	min	ha	ha	cms	cms	cms	cms	cms		cms	min	mm/hr	ha

Figure 1.2
Sample Summary Sheet for Hydrological Calculations

SECTION 2 - HYDRAULICS

2.01 PIT INLET CAPACITIES

1. Pit inlet capacities for on-grade and lowpoint sumps on kerb and gutter (KG), modified layback kerb (MLBK), and modified kerb and gutter (MKG) shall be estimated as set out in part 1.5 Sumps of the ACT TAMS, *Design Standards for Urban Infrastructure*, Part 1 - *Stormwater*.

2.02 ROAD CAPACITIES

Flow Widths on Roads

1. Flow widths for surface flows on roads shall be estimated as set out in part 1.5 Sumps of the ACT TAMS, *Design Standards for Urban Infrastructure*, Part 1 *Stormwater*. Other road designs flow capacities shall be calculated using Technical Note 4 in Chapter 14 of AR & R 1987. The flow adjustment factor given in Technical Note 4 in Chapter 14 of AR & R 1987 shall be used.

2.03 CULVERT DESIGN

Urban Culverts

1. Culvert crossings in Urban areas shall be designed for a 100 year ARI flow with an upstream freeboard of at least 0.6m.

2. Culverts shall be sized in accordance with Section 3 Culverts, of the Concrete Pipe Association of Australia, *Hydraulics of Precast Concrete Conduits*.

3. Entrance loss coefficients shall be in accordance with Table 2.1

Design of Entrance	k_e
Pipe Culverts	
Pipe projecting from fill,	
square cut end	0.5
socket end	0.2
Headwall with or without wingwalls,	
square end	0.5
socket end	0.2
Pipe mitred to conform to fill slope,	
precast end	0.5
field cut end	0.7
Box Culverts	
No wing walls, headwall parallel to embankment,	
square edge on three edges	0.5
three edges rounded to 1/12 barrel dimensions	0.2
Wing walls at 30 to 75 to barrel,	
square edge at crown	0.4
crown rounded to 1/12 culvert height	0.2
Wing walls at 10 to 30 to barrel,	
square edge at crown	0.5
Wing walls parallel (extension of sides),	
square edge at crown	0.7

Table 2.1
Culvert Entrance Loss Coefficients

2.04 PRESSURE CHANGE COEFFICIENTS

1. Pressure head change coefficient data and water surface elevation coefficient data for sumps and manholes shall be obtained from the charts and figures given in Appendix A Sump and Manhole Head Loss Charts, of ACT TAMS, *Design Standards for Urban Infrastructure* Part 1 - *Stormwater*.

2.05 HYDRAULIC CALCULATIONS

1. Hydraulic calculations shall be submitted in the format shown on the sample calculation summary sheet. A copy of the summary sheet is shown in Figure 2.1. Calculations which are not submitted in this format will not be accepted by COONAMBLE City Council.

Summary Sheet

2.06 PIT DESIGN

1. Typical pit designs for sump inlets on kerb and gutter, plantation sumps, special structures, etc are shown on the standard drawings adopted by COONAMBLE City Council.

Standard Drawings

HYDRAULIC DATA AND RESULTS

UPSTREAM PIT NAME	DOWNSTREAM PIT NAME	NUMBER OF CONDUITS	RETURN PERIOD	CONDUIT DATA											DATA AT UPSTREAM MANHOLE							
															MANHOLE LOSSES							
				TOTAL LENGTH	DIAMETER OR HEIGHT	PIPE CLASS	UPSTREAM INVERT	DOWNSTREAM INVERT	CONDUIT GRADE	UPSTREAM HGL	DOWNSTREAM HGL	FRICTION GRADE	FLOW	VELOCITY	Ku	Kw	INLET CAPACITY	INLET INFLOW	PONDING LEVEL LIMIT	MANHOLE COVER LEVEL	WATER SURFACE LEVEL	FREEBOARD
				m	m		m	m	%	m	m		cms	m/s			cumec	cms	m	m	m	

Figure 2.1
Sample Summary Sheet for Hydraulic Calculations

SECTION 3 - STORMWATER DETENTION DESIGN

3.01 TECHNICAL DATA

1. Technical data required for the design of stormwater detention facilities shall be obtained from COONAMBLE City Council prior to the commencement of design.