

DESIGN SPECIFICATION

D5

**STORMWATER
DRAINAGE DESIGN**

SPECIFICATION D5 – STORMWATER DRAINAGE DESIGN

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CITATION

This document is named “Kempsey Shire Council, Design Specification D5 - Stormwater Drainage Design”.

ORIGIN OF DOCUMENT, COPYRIGHT

This document was originally based on PMHC AUS-SPEC. Parts of the AUS-SPEC document that remain are still subject to the original copyright.

VERSIONS, D5 STORMWATER DRAINAGE DESIGN

VERSION	AMENDMENT DETAILS	CLAUSES AMENDED	DATE ISSUED (The new version takes effect from this date)	Authorised by the Director of Infrastructure
1.0	Version 1 – First Draft Version		March 2025	

SPECIFICATION D5: STORMWATER DRAINAGE DESIGN**GENERAL****D5.01 SCOPE**

1. This specification is for the design of all stormwater drainage systems within the Kempsey Shire Council Local Government Area. It includes but is not limited to, design, construction, operation and maintenance of the following:
 - a. Subdivisions and private developments,
 - b. Council drainage works including road works,
 - c. Drainage structures and surrounds,
 - d. Earthworks, dams, lakes.
2. This specification details information relating to the management of stormwater quantity requirements needed to accompany development applications (DAs), Section 68 applications and construction certificates (CC). Or in the case of Council or Authority works, Part V assessments and detailed engineering plans.
3. Stormwater quality issues are addressed in AUSPEC D7 STORMWATER QUALITY.
4. **NOTE:** this document does not supersede the minimum standards and requirements of AS 3500.3.

D5.02 OBJECTIVES

1. The objectives of this document are as follows
 - a. To provide uniform guidelines and controls to the design of stormwater drainage infrastructure.
 - b. To protect property and infrastructure in urban areas against flooding as a result of the surcharge of stormwater systems, or uncontrolled overland stormwater flows.
 - c. To reduce risks to the public associated with stormwater and related infrastructure.
 - d. To manage stormwater assets so that they provide a satisfactory level of service for the life of the asset and within their design parameters.
 - e. To provide stormwater drainage infrastructure that minimises and where possible improves the impact of stormwater flows on the downstream environment.
 - f. To provide stormwater infrastructure that supports the implementation of the principals of Sustainable Development (ESD).

- g. To provide an effective lawful point of discharge for all development lots to a natural watercourse, Council drainage system or approved outfall*
- h. To achieve these objectives without detrimentally affecting the environment, surface and subsurface water quality, groundwater infiltration characteristics, the adjoining landowners and other landowners near the drainage outlet and watercourses either upstream or downstream of the subdivision.

* Lawful Point of Discharge – See Sections [D5-37](#) and [D5-54](#)

*Definition
Lawful Point of
Discharge*

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

*Design
Principles*

- a. Stormwater drainage design shall be undertaken in accordance with the current version of Australian Rainfall and Runoff unless varied by this specification.
- b. Water Sensitive Urban Design (WUSD) methods shall be incorporated in all developments in accordance with the requirements of AUSPEC D7 Stormwater Management.

D5.03 REFERENCE AND SOURCE DOCUMENTS

In cases of conflict or contradiction, unless otherwise specified, the provisions of this Specification will prevail over all reference documents and prevail over all Kempsey Shire Council Standard Drawings.

- 1. Council Specifications
 - D7 - Stormwater Quality
 - C220 - Stormwater Drainage - General
 - C221 - Pipe Drainage
 - C222 - Precast Box Culverts
 - C223 - Drainage Structures
 - C224 - Open Drains including Kerb & Gutter
- 2. (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 3500.3 - Plumbing and Drainage: Stormwater Drainage.
 - AS 3725 - Loads on buried concrete pipes.
 - AS 4058 - Precast concrete pipes.
 - AS 4139 - Fibre reinforced concrete pipes and fittings.
- 3. (c) State Authorities
 - TfNSW, NSW - Model Analysis to determine Hydraulic Capacities of Kerb Inlets and Gully Pit Gratings, 1979.
 - NSW, Dept of Housing

- Managing Urban Stormwater: Soils and Construction
3rd Edition, August 1998.

4. (d) Other

Australian Rainfall and Runoff - <http://arr.ga.gov.au/>

AUSTROADS - Bridge Design Code.

- Waterway Design, A Guide to the Hydraulic Design of Bridges, Culverts and Floodways, 1994
- Guide to Road Design, Part 5 - Drainage

Inst. of Eng. - Australian Rainfall and Runoff - A guide to flood estimation. Aug 1987.

Queensland Urban Drainage Manual, Fourth Edition -
<http://www.ipweaq.com/qudm>

Sangster, WM., Wood, HW., Smerdon, ET., and Bossy, HG.

- Pressure Changes at Storm Drain Junction, Engineering Series, Bulletin No. 41, Eng. Experiment Station, Univ. of Missouri 1958.

Hare CM. - Magnitude of Hydraulic Losses at Junctions in Piped Drainage Systems. Transactions, Inst. of Eng. Aust., Feb. 1983.

Concrete Pipe Association of Australia

- Concrete Pipe Guide, charts for the selection of concrete pipes to suit varying conditions.
- Hydraulics of precast concrete conduits.

Henderson, FM. Open Channel Flow, 1966.

Chow, Ven Te - Open Channel Hydraulics, 1959.

John Argue - Australian Road Research Board Special Report 34

- Stormwater drainage design in small urban catchments: a handbook for Australian practice.

Australian National Conference On Large Dams, Leederville WA.

- ANCOLD 1986, Guidelines on Design Floods for Dams.

Upper Parramatta River Catchment Trust

- On Site Stormwater Detention Handbook, Third Edition, December 1999.

Healthy Land and Water - <http://hlw.org.au/>

- Bioretention Technical Design Guidelines, October 2014
- Framework for the Integration of Flood and Stormwater Management into Open Space, August 2011
- WSUD Technical Design Guidelines, June 2016

5. Kempsey Shire Council Standard Drawings that apply to this section:
ASD 300 Series of Drawings

- 6. Policies
 - a. Flood policy

MAJOR AND MINOR DRAINAGE SYSTEMS

D5.04 MAJOR AND MINOR DRAINAGE SYSTEMS

1. The Principal Consultant of stormwater drainage works shall adopt the 'major/minor' approach to urban drainage systems as outlined in [Australian Rainfall and Runoff](#).

2. The 'Minor' system generally refers to the underground piped drainage system but also applies to surface structures, open drains, basins and the like. The design AEP storm events are defined in Section [D5-06](#) of this specification.

Minor storm event

3. The minor system generally refers to a pipeline network with sufficient capacity to contain nuisance and low flows from nominated storm events. These pipelines prevent stormwater damage to properties and also limit the frequency and quantity of surface water to a level that is acceptable to the community.

4. A 'major' drainage system caters for the runoff from rarer storms of higher intensity than for which the minor drainage system has been designed.

Major storm event

The major drainage system is designed to handle flows resulting from rare storm events up to and including a 1% AEP. These flows shall follow a designated overland flow path, which shall be:

- a. A road if the catchment area is small; and/or
 - b. A drainage reserve if it is impractical or unsafe for a road to carry the excess flows.
5. Freeboard shall be provided above the level of the Major event stormwater flows in accordance with Council's current Flood Policy and / Or Stormwater Overland Flow Policy as appropriate.

HYDROLOGY

D5.05 DESIGN RAINFALL DATA

1. Stormwater runoff estimation for all developments shall be undertaken in accordance with the hydrological methods and data contained within the current edition of [Australian Rainfall and Runoff](#).
2. Hydrology shall be determined using an appropriate storage routing model;
3. The use of methods such as the Rational, Advanced Rational or Probabilistic Rational methods is not permitted for the design of public drainage infrastructure, or stormwater detention/retention systems;
4. The use of the Rational Method, hand calculations or design charts for anything other than minor internal private works relating to single dwellings and dual occupancies, and where certified by a suitably qualified Civil Engineer or Surveyor, is not permitted.

Rational Method

Hand calculations

- | | | |
|-----|---|--|
| 5. | Design Rainfalls / Intensity-Frequency-Duration (IFD) Rainfall relationships shall be obtained from the current "Design Rainfall Data System (2016)" published by the Australian Government Bureau of Meteorology, available online here: http://www.bom.gov.au/water/designRainfalls/revised-ifd/?year=2016 | IFD Data |
| 6. | Storm Losses, Temporal Patterns, Preburst information and climate change factors shall be obtained from the ARR Data Hub website here: https://data.arr-software.org/ | ARR Datahub |
| 7. | When modelling urban areas/developments in DRAINS, the ILCL Hydrological Model is preferred, with inputs as obtained from the ARR Data Hub (with reference to the nominated procedure for NSW). If ISLAX Hydrology is selected, justification shall be provided by the designer. In such instances the following inputs should be utilised: | DRAINS
Model
Hydrology
Inputs |
| | <ul style="list-style-type: none"> a. Depression Storages: <ul style="list-style-type: none"> i. Paved (impervious) area depression storage – 1mm ii. Supplementary area depression storage – 1mm iii. Grassed (pervious) area depression storage – 5mm b. Soil Type - to be determined based on site characteristics c. Antecedent moisture condition (AMC) – 3.3 | |
| | Where alternate hydrology is utilised, (RORB, RAFTS, WBNM etc), any submission must be accompanied by details of and justification for the hydrological factors utilised. | |
| 8. | Due to spatial variances in IFD Data across the Kempsey Shire Local Government Area, a standard Council wide or area based dataset is not available. All designs shall be prepared based upon site specific data. | |
| 9. | Hydrology of large rural catchments (in excess of 0.5 sq km and containing no greater than 10% of the catchment affected by residential or urban development) may be calibrated against outputs from the Regional Flood Frequency Estimation Model (RFFE), available online here: http://rffe.arr-software.org/ . | RFFE Model |
| 10. | Climate modelling indicates that rainfall intensity on the Mid North Coast of NSW may increase by up to 10% on present day levels by the year 2100. | Climate
Change |
| | The design of Main (Trunk) Drainage Systems (as defined by section D5.26) must be based upon a 10% increase in rainfall intensity over those rates obtained from the Australian Government Bureau of Meteorology. | |

D5.06 ANNUAL EXCEEDANCE PROBABILITY (AEP)

- | | | |
|----|--|------------|
| 1. | AEP is defined as "The probability that a given rainfall total accumulated over a given duration will be exceeded in any one year (online: http://www.bom.gov.au/water/designRainfalls/ifd/glossary.shtml) | AEP |
| 2. | Recurrence intervals for "minor" events are dependent on the zoning of the land being serviced by the drainage system. | |

3. The “Major/Minor” system design storm events shall to be in accordance with Table D5.06.1 below:

TABLE D5.06.1. AEP'S FOR DRAINAGE DESIGN

Drainage System	Capacity
Parks and recreation area (Minor)	63.2% AEP
Urban Residential Areas (Minor)	20% AEP
Rural residential area (Minor)	20% AEP
Inter-allotment drainage	5% AEP
Commercial/industrial area (Minor)	5% AEP
Main (Trunk) drainage systems (Minor)	5% AEP
Major system for all developments	1% AEP

***AEPs for
Stormwater
Design***

4. Simulation of additional design storms may also be required in order to comply with Councils Flood Policy or to address site specific flood risks identified by Council.

D5.07 STORM DURATIONS

1. In determining the critical storm for a given AEP within an urban catchment, design storms shall be simulated for the following durations at a minimum:
- 5 minutes;
 - 10 minutes;
 - 15 minutes;
 - 20 minutes;
 - 25 minutes;
 - 30 Minutes;
 - 45 minutes;
 - 60 minutes;
 - 90 minutes; and
 - 120 minutes.
2. For each duration and AEP, the 10 rainfall temporal patterns obtained from on the “ARR Data Hub” website shall be tested, with a design solution prepared on the basis of the duration with the highest median of the 10 patterns, in accordance with the requirements of the current version of [*Australian Rainfall and Runoff*](#).

***Design Storm
Durations***

3. As a minimum, plan submissions shall present results for the median storm in the critical duration for the design AEP for each segment/link. Alternative is to submit an electronic model in DRAINS format for electronic review.

**Supporting
documentation**

D5.08 CATCHMENT AREA

1. The catchment area of any point is defined by the limits from where surface runoff will make its way, either by natural or manmade paths, to that point.
2. Catchment boundaries and characteristics shall be confirmed by field inspection.
3. Catchment area land use for models of existing systems must be based on current available land use and zoning information or proposed future zonings, where applicable. Details of the catchment composition and justification for the impervious fraction must be submitted in support of any design.
4. For new developments, and / or when designing a post-development scenario, the Principal Consultant shall determine the actual impervious areas for the development using design plans, zoning information and industry trends where applicable.

Catchments

Where this is not practical, the following minimum percentage impervious areas shall be adopted. These should only be used for large catchments or where the future nature of the development is unknown:

TABLE D5.08.1 IMPERVIOUS AREAS FOR THE DEVELOPMENT

Catchment Type	Percentage Impervious (%)
Forest	10
Woodland	15
Agricultural	20
Open Space & Parks	25
R5 Zoned and	40
R1 & R2 Zoned land	70
R3 Zoned land	75
R4 Zoned land	90
Industrial Zoned land (IN1-4)	98
Commercial zoned Land (B1-7)	95
Residential road reserves	60
Landscaped areas	25
Paved areas	95

Note: Where there is a likelihood of further subdivision occurring of allotments (eg. town houses, units etc) in new subdivisions the impervious

percentage used must reflect the ultimate proposed scenario. This avoids the need for on-site detention for these future developments.

5. Stormwater drainage designs should be prepared on the basis of stormwater runoff following the natural topography being discharged by a gravity system.

Diverting stormwater runoff from one catchment (or sub-catchment) to another catchment (or sub-catchment) should be avoided.

6. Council will only approve drainage against the natural grade of the land in the following circumstances:
 - a. Downstream property owners have indicated that they are not prepared to grant easements to permit the drainage of the property to follow the natural fall of the land; and
 - b. Council and / or the Principal Consultant has assessed the capacity of the proposed receiving stormwater drainage system and it is demonstrated that the proposed receiving drainage system can adequately cope with the additional runoff AND that the receiving drainage system complies with this Specification.
 - c. Where approval is granted, alternative methods of control/stormwater disposal such as 'charged systems', On-site stormwater absorption or a combination of these are to be designed in accordance with this Specification.

D5.09 DETERMINATION OF CATCHMENT RUNOFF

1. Catchment runoff shall be determined using a suitable hydrological method depending on the level of accuracy required and the extent and shape of the catchment.
2. The use of hydrological computer models is required.

D5.10 TIME OF CONCENTRATION (tc)

1. 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.
2. The time of Concentration shall be determined utilising a suitable Computer Modelling Method determined by the Principal Consultant OR using the Kinematic Wave Equation:

***Time of
Concentration***

$$tc = 6.94 (Ln)^{0.6} / I^{0.4} S^{0.3} \quad (minutes)$$

***Kinematic
Wave
Equation***

Where:

tc = overland flow time (minutes)

L = flow path length (m)

n* = retardance factor

I = rainfall intensity (mm/hr)

S = surface slope (m/m)

- The coefficient n^* is similar to, but not identical to, "Manning's n " used in open channel calculations. The Kinematic Wave equation is very sensitive to slope and surface roughness and these should be estimated carefully. The values for n^* to be used when determining times of concentration using the kinematic wave equation is given below:

TABLE D5-10.1 n^* COEFFICIENTS

Surface type	co-efficient " n^* "
Concrete or asphalt	0.010 – 0.013
Bare sand	0.010 – 0.016
Gravel	0.012 – 0.030
Bare clay-loam soil eroded	0.012 – 0.033
Sparse vegetation	0.053 – 0.130
Short grass	0.100 – 0.200
Lawn	0.170 – 0.480

n^* Values

HYDRAULICS

D5.11 HYDRAULIC DESIGN

- Stormwater hydraulic design shall be based upon hydrological methods and data contained within the latest edition of [Australian Rainfall and Runoff](#), unless otherwise specified.
- The modelling undertaken shall substantiate the hydraulic grade line adopted for design of the system and as shown on the design drawings. A copy of the stormwater model prepared must be provided in support of any plans and details of all calculations are to be submitted including listings of all programme inputs, outputs and assumptions.
- Plan submissions shall present results for the median storm in the critical duration for the design AEP for each segment/link. See Section [D5.07.2](#) for further detail.
- All drainage designs shall be prepared and certified by a suitably experienced person with experience and qualifications in accordance with Aus-Spec DQS-Quality Assurance of Engineering Design, Section DQS.06.

D5.12 HYDRAULIC GRADE LINE

HGL

- Designs shall be based on hydraulic grade line (HGL) analysis using appropriate pipe friction and drainage structure head loss coefficients.
- 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.
- Overland flow paths shall remain safe for vehicles, people, and in particular, children and the less mobile in all storms 1% AEP event. The velocity and depth of overland flow paths shall not exceed a velocity depth product of 0.4, unless in an area where pedestrians are excluded, where the velocity depth product shall not exceed 0.6.

4. The following hydraulic grade line design parameters shall apply:
- The hydraulic grade line shall be a minimum of 150 mm below the invert of the kerb for minor flows.
 - The hydraulic grade line shall be a minimum of 150 mm below the underside of all pit lids for minor flows.
 - The hydraulic grade line shall not exceed 200 mm above the invert of the kerb for major flows.
 - Where the downstream starting point is a pit and the hydraulic grade line is unknown, a level of 150mm below the invert of the downstream starting pit inlet shall be adopted.
 - Where the outlet is an open channel and the design storm is the minor event, the obvert of the outlet pipe shall be the downstream control.
 - Where the outlet is an open channel and the design storm is the major event, the downstream control shall be the 1% AEP flood event level. An alternate lower level may be permitted subject to an assessment of the likelihood of coincident downstream flooding has been undertaken by a suitably qualified engineer (in accordance with Aus-Spec DQS-Quality Assurance of Engineering Design, Section DQS.06) and determined that a lower tailwater level is appropriate.
 - All pipelines shall be designed to continue in the future unless the discharge point is directly to receiving water. Temporary outlets shall be designed to include future pit losses.
 - Recommended pipe friction coefficients to be used are shown below

TABLE D5.12.1 PIPE ROUGHNESS VALUES

Pipe Material	n	K
Spun precast concrete	0.0013	0.6
Fibre reinforced concrete	0.011	0.3
UPVC	0.009	0.06
PE	0.009	0.06

Pipe Friction Coefficients

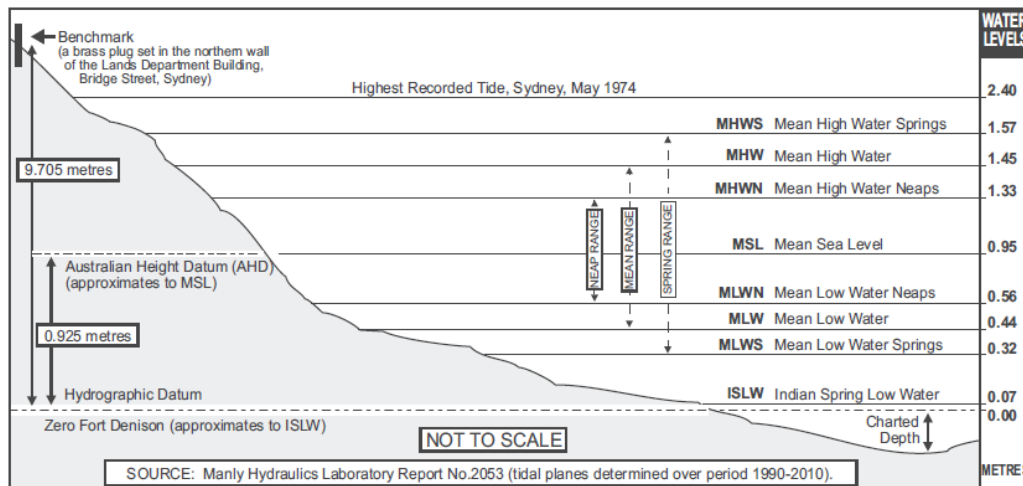
- Where the outlet is tidal, the following additional parameters shall be implemented:

TABLE D5.12.2 TAILWATER LEVELS FOR DISCHARGE TO TIDAL WATERWAYS

Design Condition	Design Tailwater Level
Minor storm	Mean High Water Springs (MHWS) 0.6m – OR to be determined by analysis of annual tide charts.
Major storm	Highest Astronomical Tide (HAT) 1.04m - as reported within MHL Report 2475 dated October 2016.
Climate change (sea level rise)	400mm additional allowance to be made.

Tailwater Levels

The following image is provided for tidal interpretation.



D5.13 PIPE VELOCITIES

- The velocity of stormwater in conduits shall be maintained within acceptable limits to ensure that pipes are self-cleaning and that scouring does not occur.
- The range of acceptable velocities are detailed below:

TABLE D5.13.1 ACCEPTABLE FLOW VELOCITIES FOR PIPES AND BOX SECTIONS (QUDM 7.12)

Flow Condition	Absolute Minimum * (m/s)	Desirable Minimum * (m/s)	Desirable Maximum ^ (m/s)	Absolute Maximum ^ (m/s)
Partially Full	0.7	1.2	4.7	7.0
Full	0.6	1.0	4.0	6.0
Notes:	*	Minimum flow velocities apply to 63% AEP (1 year ARI) design storm, and apply to all pipe materials		
	^	Maximum flow velocities apply to concrete pipes. For other pipe materials, refer to manufacturer's advice		

Acceptable Pipe Velocities

- Where outside of these limits, documentation shall be provided to demonstrate measures of preventing scour or pipe erosion, or in the case of low velocities, how self-cleaning will occur.

D5.14 PIPE GRADES

- In general, the absolute minimum grade of a stormwater pipe is to be 1:200 (0.5%). However for large diameter pipes, flatter grades may be approved where it is demonstrated that pipelines will be self-cleansing and that velocities are greater than 0.60 m/s.
- Maximum pipe grades shall be determined based upon achieving the velocity limits specified within section [D5.13](#) above.

Minimum pipe grade

Maximum Pipe Grade

NOTE: Where pipes laid at grades >10% are permitted, the design shall specify trench stops and / or concrete bulkheads in accordance with Construction Specification C221 – PIPE DRAINAGE.

D5.15 MINIMUM CONDUIT COVER

1. The minimum cover shall be as per:
 - a. Construction Specification C221 – PIPE DRAINAGE,
 - b. Determined from the Concrete Pipe Association - Concrete Pipe Guide,
 - c. AS 3725 – Loads on buried concrete pipes.
 - d. Manufacturer Specifications
 - e. AS3500.3 - Plumbing and drainage - Part 3: Stormwater Drainage
2. For uPVC pipes, the requirements shall be to AS 2032 – Code of practice for installation of uPVC pipe systems.
3. Pipe classes shall be determined in accordance with proposed cover.
4. Where possible, conduits shall have a minimum cover of 600mm.
5. Pipelines located within public and / or those to be dedicated to Council as assets shall be concrete encased where the cover is less than or equal to 300mm.
6. Pipes with cover less than 600mm and more than 300mm shall be assessed to ensure structural integrity of the pipe is not compromised under expected loads and the pipe shall be concrete encased if necessary.
7. Where required, concrete encasement shall be designed by a suitably qualified structural engineer to protect the conduit from expected loadings and to ensure that the conduit achieves a service life of at least 100 years.

**Minimum
Cover**

D5.16 PIPE ALIGNMENTS

1. The alignment of pipelines shall follow natural flowpaths where practical.
2. Pipeline systems are to be rationalised where possible to reduce head losses at pits.
3. Opposing flows entering at pits shall be discouraged.
4. Where practical, pipes at junctions should be aligned such that the projected area of the upstream pipe is wholly contained within the downstream pipe.
5. Curved stormwater pipelines may be utilised wherever there are significant advantages demonstrated in their use. Ad hoc curving of pipelines to avoid obstacles such as trees, power poles, water mains etc. is not permitted. Curved pipelines shall be positioned to follow easily identifiable surface features, eg. Parallel to a kerb line and shall have a constant radius.
6. Subject to the above, curved pipelines are permitted provided they are:
 - a. In the horizontal plane only (no vertical curves),

**Curved
Pipelines**

- b. In one direction only between successive structures.
- 7. The maximum deflection angle at a joint for a curved pipeline shall be as specified by the Pipe Manufacturer for a particular pipe.
- 8. Splayed pipes may be used to construct a curved pipeline provided that the curve is totally formed by the splays. Splayed pipes shall be factory formed.
- 9. For curved pipelines, design drawings shall show the following curve information:
 - a. Centreline radius
 - b. Pipe type (normal or splayed)
 - c. Effective length of individual pipes (if other than standard length)
 - d. Type of jointing.
- 10. Drainage lines in road reserves shall be located behind the kerb line and parallel to the kerb, unless otherwise approved by Principal Certifier.
- 11. Drainage lines in easements shall be generally centrally located within easements.

D5.17 PIPE SIZE AND TYPE

- 1. Minimum conduit sizes are given below:
 - a. The minimum pipe size within and/or servicing public land shall be 375mm diameter*
 - b. The minimum box culvert size shall be 600mm wide x 300mm high.
 - c. All pipes are to be rubber ring jointed
- 2. Minimum conduit sizes for interallotment drainage is defined within Section [D5.43](#)

**Minimum
Conduit Size**

NOTE: * A 225mm diameter (minimum) pipeline may be utilised in lieu of the 375mm pipe specified in part a) above subject to the following:

**Small
diameter
pipeline
exception**

- a. A sealed junction pit is provided at the upstream end of the small diameter pipeline (no grate or kerb inlet),
- b. It is demonstrated that a kerb inlet pit is not required to be installed within or upstream of the small diameter pipeline for road drainage purposes (i.e existing road drainage infrastructure meets the requirements of this Specification and the subject pipeline is located upstream of the last required street inlet pit).
- c. That it can be demonstrated that the small diameter pipeline has been sized to capture and drain inflows from the entire contributing catchment area having regard for the total future developed catchment.

D5.18 PITS

1. Inlet pits within roadways shall be spaced so that the gutter flow width is limited in accordance with this Specification and so that the inlet efficiency is not affected by adjacent inlet openings, kerb variations and upstream carriageway narrowing.
2. Other pits shall be provided:
 - a. To enable access for maintenance.
 - b. At changes in direction, grade, level or class of pipe.
 - c. At junctions*

NOTE: * Construction of pipe network junctions without a pit shall not be permitted, excluding private property drain connections as per Section [D5-37](#).

3. Pits are to be located clear of kerb returns, kerb crossings, driveways and in a manner to prevent flow across intersections during the minor storm event.

NOTE - in instances Council may approve the use of a kerb inlet pit within a kerb return/intersection, where it is demonstrated that other options are not feasible. In such instances, a custom curved lintel shall be utilised to match the kerb profile.

Pit Spacing

4. Minor event flows approaching an intersection shall be collected before the tangent point such that gutter flow around kerb returns does not exceed 20 l/s.
5. The maximum recommended spacing of pits where flow widths are not critical are given in table D5.18.1 below:

TABLE D5.18.1 MAXIMUM SPACING OF PITS

Pipe Material	Pipe Size (mm)	Spacing (m)
Generally	Less than 1200	60
	1200 or larger	100
In tidal influence	All	60

D5.19 PIT CAPACITY

1. Information on pit capacities is available in the following sources:
 - a. Book 9, Chapter 5 of [Australian Rainfall and Runoff](#)
 - b. Queensland Urban Drainage Manual
 - c. Roads and Traffic Authority's "Model analysis to determine Hydraulic Capacities of Kerb Inlets and Gully Pit Gratings", with due allowance to inlet bypass due to grade, for grade inlet pits, and recognised orifice or weir formulae for sag inlet pits.

2. The kerb inlet opening lengths for side entry pits (whether grated or not) shall be:
 - a. A desirable length of 2.4m,
 - b. A maximum length of 5.0m where the grade is 10% or more,
 - c. A maximum length of 4.0m where the grade is less than 10%.
 - d. Minimum length of lintel is 0.9 metres.

Smaller lintels and / or grated inlets only may be utilised subject to written approval from Council and the provision of justification/modelling.

3. Where not already allowed for, blockage factors are to be applied to the figures obtained from pit charts. The minimum percentage of theoretical capacity allowed in relation to type of pit is given below:

TABLE D5.19.1 PIT BLOCKAGE FACTORS

Condition	Inlet Type (See D5.22.1)	Blockage factor
Sag	Side entry (KIP / EKI)	50%
Sag	Grated (GP)	50%
Sag	Combination (GKIP / G-EKI)	Side inlet capacity only. Grate assumed completely blocked
Sag	Surface inlet pit - "Letterbox" (SIP)	50%
Continuous Grade	Side entry (KIP / EKI)	20%
Continuous Grade	Grated (GP)	50%
Continuous Grade	Combination (GKIP / G-EKI)	10%
Sag or on Grade	Headwall inlet	30% of pipe full capacity

Pit Blockage factors

4. Blockage factors may be reduced for Minor Storm Event design runs where it can be demonstrated that a substantial percentage of the approach flow is directly connected to the piped drainage network eg. Property connection drains from roof water. Designer shall nominate and justify adopted blockage factors within the design report accompanying the plan submission.

D5.20 HYDRAULIC LOSSES

Pit Losses

1. The pressure change co-efficient "Ku" shall be determined from the appropriate charts given in [Australian Rainfall and Runoff](#) and / or QUDM.
2. Computer program default pressure change co-efficient "Ku" shall not be accepted unless they are consistent with the above. The chart used and

relevant coefficients for determining "Ku" value from that chart shall be noted on the hydraulic summary sheet provided for plan checking and included on the final design drawings.

- | | | |
|----|---|--------------------------------------|
| 3. | The base of pits containing inlet /outlet pipes greater than or equal to 525mm in diameter shall be channelized to increase efficiency and improve ease of maintenance. In these instances, benching shall be provided to a minimum of half pipe height. | Channelized pits |
| 4. | Penetration of one service through another shall not occur. | Service Penetrations |
| 5. | All pipe inlets, including subsoil drainage but excluding a single roof water connection from single dwellings, shall enter the main pipe system at junction pits. These shall be finished off flush with the inside and be grouted into the pit wall. | Private pipes into system |
| 6. | Construction of a junction without a structure is to be avoided, excluding the provision of a single roof water connection from single dwellings. | Pipe Junction Losses |
| 7. | The design of larger upstream to smaller downstream conduits is to be done in accordance with the procedures outlined in QUDM. In going from smaller to larger pipes, detailed design of the benching in the pits to enable a smooth flow transition shall be provided. Losses in sudden expansions and contractions are given in QUDM. | Contraction/ Expansion Losses |

D5.21 GUTTER FLOW WIDTH

- | | | |
|----|---|----------------------------------|
| 1. | The maximum permissible gutter flow widths for the minor design storm is 2.5 metres. | Maximum gutter flow width |
| 2. | Gutter flow around kerb returns shall be limited to 20 l/s, but not exceed the gutter capacity. | |

D5.22 PIT SELECTION

- | | | |
|----|---|------------|
| 1. | Pit uses shall be in accordance with the following standards: | |
| | a. Kerb Inlet Pit (KIP or EKI) | KIP |
| | i. Kerb inlet pits have good entry conditions with little chance of blocking. | |
| | ii. To obtain maximum efficiency of kerb inlet pits the throat opening must be depressed below the line of the channel invert and the channel in front of and adjacent to the pit steepened so that water is drawn into the pit. | |
| | iii. The bypass flow must be added to the design flow for the next downstream pit. To design spacing for 100% capture is not economical, however when evaluating alternative pit spacing, the aim is to achieve economical design by minimising the total number of pits in the system. | |
| | iv. Entry to a kerb inlet pit is via a lidded chamber behind the kerb. | |

b. Grated Pits (GP)**GP**

- i. Grated pits are generally located clear of carriageways, such as medians, table drains, or catch drains.
- ii. The pit top is depressed below the drain invert by at least 75mm to increase inlet capacity.
- iii. Where subject to pedestrian and / or vehicular traffic, grates shall be 'bicycle safe'.
- iv. As grates are prone to blockage by debris, grated pits shall not be used in trapped low points on carriageways. KIPs are more suitable in this case.
- v. The use of grated pits is discouraged within arterial/regional roads and in locations within 20m of an intersection (a KIP whereby maintenance access is from the verge is preferred).

c. Grated Kerb Inlet Pit (GKIP or G-EKI)**GKIP**

- i. Grated kerb inlet pits may be used where the main pipe is located under and parallel to the road.
- ii. Where subject to pedestrian and / or vehicular traffic, grates shall be 'bicycle safe'.
- iii. On grades above 3 per cent, the GKIP with transverse bars may have less capacity than the side entry pit, due to diversion of water from the partially blocked grate, or water overshooting the transverse bars.
- iv. The use of grated kerb inlet pits is discouraged within arterial/regional roads and in locations within 20m of an intersection (a KIP whereby maintenance access is from the verge is preferred)

d. Side Inlet Pit (SIP)**SIP**

- i. Side inlet pits commonly known as letter-box or mail box pits are generally located clear of carriageways, such as medians, table drains, or catch drains where blockage is an issue.
- ii. The pit top is raised above the drain invert by at least 100mm to increase inlet capacity.
- iii. Lids can be solid, grated or domed as required.
- iv. These pits are not suitable where pedestrian traffic is involved due to the trip hazard.

e. Junction pits (JP)**JP**

- i. Junction pits are required at changes in both horizontal and vertical alignment of a pipeline where there is no need to admit surface water to the pipe system.

- ii. 'Blind' (buried and sealed) junction pits shall not be utilised.
2. Nonstandard pit types will be assessed and approved by The Principal Certifier in writing on a case-by-case basis.
3. Pit construction shall be in accordance with Council's Standard Drawings. The use of any pit that is irrelevant and/or beyond specifications of Councils Standard Drawings shall be structurally designed for Council review.
4. Covers/grates for all pit types shall have a clear opening of sufficient dimension and orientation to comply with WHS and confined space entry requirements.

Lock-down lids are required in high-risk areas such as public open spaces, recreation reserves, school areas etc. and to service pits with depths greater than 1.2m

Heavy-duty covers (including grates) are to be provided on all pits located in exposed kerb areas. Elsewhere, covers are to be installed with class rating in accordance with potential traffic loadings.

D5.23 PIT DIMENSIONS

1. The minimum internal dimensions of stormwater pits shall be consistent with Council's Standard drawings and shall not be less than the dimensions specified within Table 7.5.2.1 of AS3500.3: 2021 to facilitate safe and efficient access and as below:

Pit Depth

Depth to invert (mm)	Minimum Internal Dimensions (mm)		
	Rectangular		Circular
	Width	Length	Diameter
≤450	350	350	-
≤600	450	450	600
>600 ≤900	600	600	900
>900 ≤1200	600	900	1000
>1200	900	900	1000

2. Where the depth of the pit exceeds 1.2 metres, step-irons are to be provided where pit design permits safe and accessible use. The following criteria is to be applied to determine step iron installation for Council pits:
 - a) Step irons shall be installed on one pit wall only.
 - b) Step iron installation to kerb inlet pits (front access) on either the wall opposite to the grate hinge, or the wall facing the carriageway.
 - c) Step irons shall not be installed on pits where the pipe diameter on the appropriate pit wall for irons is equal to or greater than 600mm diameter.
 - d) Step irons will not be permitted where they protrude into the projection of the flow of water aligned between the inlet and outlet pipe/s of the pit.
 - e) Where step irons are installed above pipe cut-outs less than 600mm in diameter, the bottom step shall be installed no closer than 100mm above

Step Irons

the edge of the pipe cut-out and be certified by the structural designer of the pit that it will not compromise pit wall strength. Ensuring maximum vertical spacing meets AS1657.

- f) Step irons will not be permitted on walls that are recessed, which will impede access to steps i.e. overhanging inlet surrounds, lintels, or pit walls that are not vertically aligned with pit entry access openings.
- g) Step irons should be spaced at 0.3 m vertical intervals and provide access to the invert of the pit.
- h) Where the orientation of incoming/outgoing pipes precludes the provision of step irons, the pit must be re-sized or re-orientated (where practical) to ensure safe access is available.

D5.24 FALL ACROSS PITS

1. Minimum drops at pits are required to provide sufficient slope along the pit inverts to clear debris, and to provide tolerance in setting pipe invert levels.
2. The minimum drop through pits shall be 50mm.
3. Significant changes in level through pits may be necessary in order to avoid existing public utility services, or to convey water down a batter, or as a deliberate means of reducing the energy of flow.
4. Where drop pits are proposed with a level difference greater than 2 metres between any incoming pipe and the pit outlet, the pit floor should be protected by a wearing course of concrete or rock and the outlet should be placed a minimum of 300 mm above the floor to leave a permanent water cushion.
5. Where pipes of 1200 mm or larger are used, changes in elevation should be made by providing steeper lengths of pipes between close successive pits.
6. The length of a drop pit should be increased to prevent unnecessary thrust on the pit walls. The minimum length of pit is set out below:

**Minimum
Drop**

Drop Pits

TABLE D5.24.1 MINIMUM LENGTH OF DRAINAGE PITS

Drop	Inlet Type Du < 600mm L min.	Du > 600mm L min.
Less than 0.5 Du	Std size	1.5 Du
0.5 Du to 1.5 Du	1.5 Du	2.0 Du
1.5 Du to 2.5 Du	2.0 Du	2.0 Du
More than 2.5 Du	2.0 Du	2 - 3 Du

Du = diameter of upstream pipe

L = length of pit in the direction of flow

D5.25 MAJOR SYSTEM CRITERIA

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

Surcharging

- a. Surcharging of drainage system for storm frequencies greater than the 5% AEP event may be permitted across the road centreline where the road pavement is below the natural surface of the adjoining private property, and the road is not required for flood evacuation purposes.
- b. Flow across footpaths will only be permitted in situations specifically approved by Council, where this will not cause flooding of private property.

2. Flow depths within road reserves shall not exceed 200mm.

Flow Depths

3. Flow depths shall achieve freeboard of not less than 500 mm to the floor level of an adjacent building (or the likely floor level where adjacent buildings do not yet exist) where the building is located on ground that is above the road reserve.

Freeboard

Where necessary, a 'likely floor level' shall be determined based on the lot surface level at a location equal to the minimum building setback line for the zone (see Hastings LEP) plus 100mm.

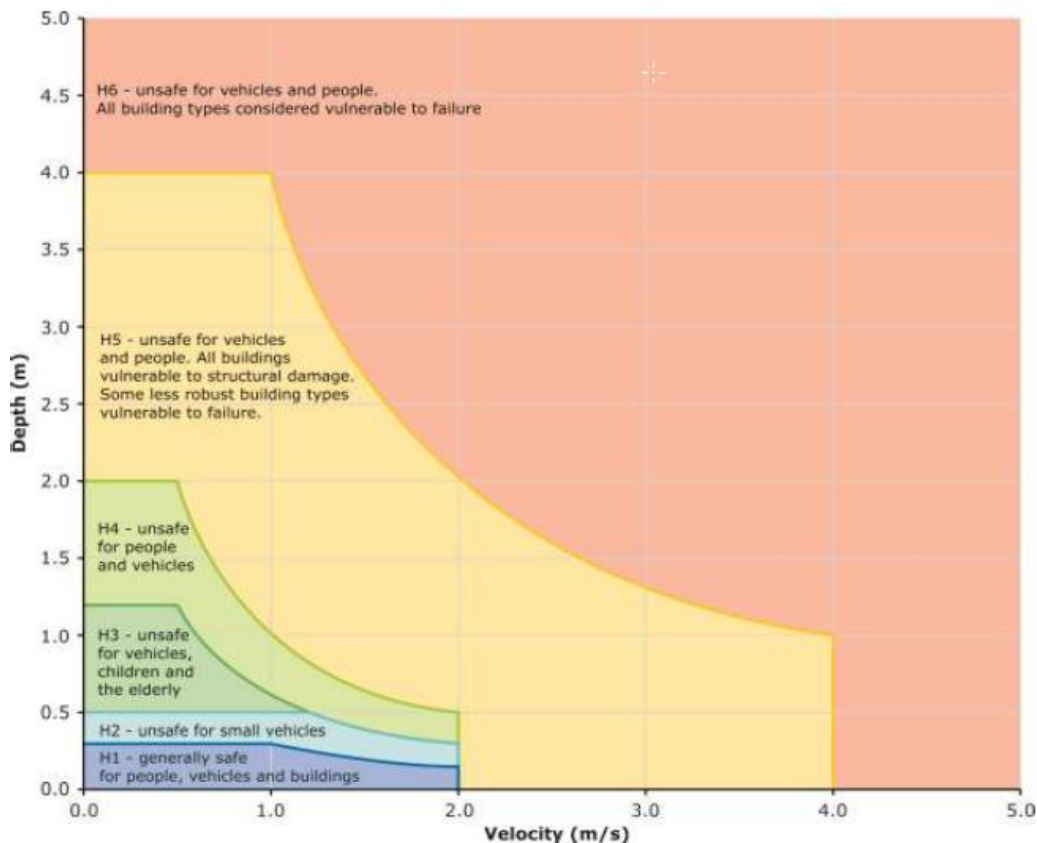
4. Water surface not greater than 50 mm above the top of kerb, where the floor level of an adjacent building is less than 550 mm above top of kerb. In these instances, where the road is in fill or overtopping of kerbs and flow through properties may occur, a 100mm freeboard shall be provided between the ponding level of water in the road and the overtopping level of the back of footpath. Driveway construction in these instances shall consider this requirement.

5. Surcharge and overland flow routes shall have 500 mm freeboard between the major storm event water surface levels and entrances to underground car parks.

6. The velocity x depth product of flow across the footpath and within the road reserve shall be less than 0.4, unless flows are withi an area where pedestrians can be reasonably excluded, where a maximum product of 0.6 is permissible.

***Velocity /
Depth
Relationship***

7. The safety of major event overflow paths shall be assessed having regard to the "General Flood Hazard Vulnerability Curves' defined within the *Technical Flood Risk Management Guidelines: Flood Hazard, Commonwealth of Australia, 2014* and as copied below:



8. The total overland flow for the major flood event shall be entirely contained within a road reserve, drainage reserve, park or open space.
9. Where flow is contained in an open channel, freeboard in accordance with Section [D5.27](#).

Roadway Capacities

D5.26 TRUNK DRAINS

1. Trunk Drainage is those drainage systems servicing catchment areas greater than 15 Hectares or conveying runoff in excess of 3m³/s during a 20% AEP event.
2. Trunk drainage shall be designed so that large changes (> 90 deg.) in the direction of flow does not occur at a single pit. Consideration shall be given to use of special pits and additional pits at all changes of direction.

Trunk drains

D5.27 OPEN CHANNELS

1. Generally, open channels will only be permitted where they function as part of the approved water quality improvement strategy for the location as determined in accordance with AUS-SPEC D07, or they form part of the trunk drainage system. Such open channels shall be designed to have smooth transitions with adequate access provisions for maintenance and cleaning.

Safety

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.

2. The design of all open channels shall be in accordance with the requirements of the current version of [Australian Rainfall and Runoff](#), the

NSW Government *Floodplain Development Manual* and *QUDM* as a primary criterion. Open channels shall be designed to contain the “major” system flow.

3. In open channel design, the term ‘channel freeboard’ generally refers to the vertical distance between the design water surface elevation and the top of the channel bank.

Where the consequences of a channel surcharging result in the flooding of adjacent private land or buildings, channel freeboard (relative to the top-of-bank) shall be the greater of:

**Channel
Freeboard**

- a. 300mm
 - b. 20% of channel depth, OR
 - c. Flow velocity head
4. Freeboard to the floor level adjoining buildings shall be provided above the level of the major event stormwater flows in accordance with the Council’s current Flood Policy.

5. Detailed modelling is required to accompany developments on properties affected by overland flow. For flows from small catchments, Manning’s equation will generally be sufficient to determine water surface levels of the flow path. For flows in excess of 0.5 m³/s, a more detailed analysis is required. HEC-RAS is the preferred computer package to be used for determining water surface profiles.
6. Where flows are in natural or man-made channels, Manning’s equation can provide a first estimate of hydraulic grade line levels. Where uniform flow occurs and no obstructions or inflows occur upstream or downstream of the area of interest for a significant distance the use of Manning’s equation may suffice.

**Analysis of
overland
flows**

7. Mannings "n" Roughness Co-efficients for open channels shall be derived from the latest edition of [Australian Rainfall and Runoff](#).

**Channel
Roughness**

8. Indicative values are shown below:

TABLE D5.27.1 MANNINGS ‘n’

Channel type	Mannings "n"
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

9. Where a grassed channel invert is permitted, the roughness coefficient must be representative of the channel condition prior to mowing and in the absence of regular maintenance (i.e. long grass and additional vegetation establishment).

10. Where a different response to flow may occur in high flows and low flows, each of these must be modelled.

11. 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.

**Channel
Batter Slopes**

12. Open channels shall be designed to avoid hydraulic jumps or generate supercritical flow conditions.

13. The velocity x depth product within the channel shall be assessed in accordance with the "General Flood hazard Vulnerability Curves referenced in Section [D5-25](#).

Safety

14. To allow for effective channel maintenance, the following low flow provisions must be made in man-made or altered channels:

**Low flow
provisions**

- Flows up to and including the 63.2% AEP event shall be contained within a Low Flow pipe system (preferred), OR
- The invert of the channel shall be concrete lined (or other suitable scour resistant and trafficable material), with the width / profile of the concrete lined section of channel being at least sufficiently wide enough to accommodate the full width of a typical maintenance vehicle (2.2m width, 6.93m length, 4.36m wheelbase, front overhang 1.17m), OR
- Subsurface drainage shall be provided below the invert of grass-lined channels to prevent waterlogging of the channel bed, OR
- The channel shall be designed and constructed as a natural drainage system, requiring no maintenance other than vegetation establishment.

15. The Principal Consultant shall ensure that the parameters adopted in the design of an open channel system accurately represent the range of anticipated conditions that could reasonably be expected to occur throughout the design life of the drainage system.

**Sensitivity
Analysis**

Specifically, it is important to assess the hydraulic capacity of vegetated channels for both the lowest and highest likely values of channel roughness likely to be encountered. In open channel design, a sensitivity analysis generally includes modelling the system for a range of assumed Manning's roughness coefficients, or modelling the system with a modified cross-sectional shape to account for the effects of sedimentation and/or scour.

D5.28 MAJOR STRUCTURES

- | | | |
|----|--|-------------------------------------|
| 1. | All major structures shall be designed for the 1% AEP storm event without afflux in urban areas. Some afflux and upstream inundation may be permitted in certain rural and urban areas provided the increased upstream flooding does not inundate private property. | Afflux |
| 2. | A minimum clearance of 500 mm between the 1% AEP flood level and the underside of all bridge structures is required to allow for passage of debris without blockage unless approved otherwise in writing by Council. | Freeboard |
| 3. | All bridges and culverts in urban areas shall be designed for flood intensity in accordance with Design Specification D3 – Civil Structures and Bridges. | Bridges and Culverts |
| 4. | Certified structural designs shall be required on bridges and other major culvert structures and may be required on some specialised structures. Structural design shall be carried out in accordance with AUSTROADS Bridge Design Code. | |
| 5. | All major culverts in urban areas shall be designed with a blockage factor of 50%. As an alternative, the designer may nominate an alternate blockage subject to justification in accordance with the established design techniques in the current edition of Australian Rainfall and Runoff . | Blockage of Major Structures |

D5.29 RETARDING BASINS

- | | | |
|----|---|-------------------------------|
| 1. | When Detention or Retention Basins are used to mitigate the impact of flows from a development site, a detailed hydrological and hydraulic analysis is required. | |
| 2. | Flood routing shall be modelled in accordance with the methods outlined in the current version of Australian Rainfall and Runoff . | Flood routing |
| 3. | The high level outlet from any retarding basin shall have capacity to contain a minimum of the 1% AEP 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 Australian National Conference on Large Dams ANCOLD (1986). | High level outlet |
| 4. | The spillway design shall generally be in accordance with the requirements for Open Channel Design in this Specification. | |
| 5. | Pipe systems shall contain the design low flow (minimum 20% AEP storm event) 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 seepage collars installed where appropriate. | Low flow provision |
| 6. | The low flow pipe intake shall be protected to prevent blockages. | |
| 7. | Freeboard - Minimum floor levels of dwellings shall be 500mm above the 1% AEP flood level in the basin. | Freeboard at Dwellings |
| 8. | The Principal Consultant shall assess all proposed basins against the requirements of the New South Wales Dam Safety Committee. Unless written | Dam Safety Committee |

approval from the General Manager of the Council is obtained, Council will not accept the dedication of any stormwater basins that are Prescribed (or likely to be Prescribed) by the Committee.

9. Public Safety Issues - Basin design is to consider the following aspects relating to public safety. **Public Safety issues**
- a. Side slopes within public stormwater basins shall 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.
 - b. Depth indicators should be provided indicating maximum depth in the basin.
 - c. Large basins or basins located within areas having recreational uses shall be designed and graded to fill in such a way that any person within the basin at the commencement of the design event is directed towards a safe escape route by the filling waters.
 - d. Protection of the low flow intake pipe shall be undertaken to reduce hazards for people trapped in the basin.
 - e. Signage of the spillway is necessary to indicate the additional hazard.
 - f. Basins shall be designed so that no ponding of water occurs on to private property or roads.
 - g. No planting of trees within the downstream basin wall(s) is allowed.
 - h. No basin spillway is to be located directly upstream of private land, buildings or structures. Basins and associated spillways shall be located such that any overflow or spill is directed directly to a watercourse, or reserve adjacent to a watercourse.
10. Where basins are proposed in areas with multiple uses, plans shall be prepared in reference to the *Framework for the Integration of Flood and Stormwater Management into Open Space*, August 2011, published by Healthy Land and Waters.

STORMWATER DETENTION

D5.30 STORMWATER DETENTION – GENERAL CRITERIA

1. Stormwater Detention systems are to be implemented to control the rate of runoff from development sites and subdivisions to limit or reduce the rate of runoff to existing conditions or better.
2. Stormwater detention will be required as part of all developments except in the following situations: **Exceptions**
 - a. The proposal is a new single residential dwelling or dual occupancy,

- b. Alterations and additions to an existing single dwelling or dual occupancy that does not result in the creation of new dwellings.
 - c. The proposal consists of improvements to an existing building, such as a second floor extension, which is wholly within the footprint of the existing building.
 - d. Subdivisions of existing dual occupancies where no works are undertaken and there is no increase in the impervious surface area is proposed,
 - e. Boundary adjustments and consolidations of allotments where no additional lots are created.
 - f. Change of use where no increase in the impervious surface area is proposed.
 - g. An alternative method of stormwater control is to be applied such as an on-site absorption facility, which satisfies this specification.
 - h. Public stormwater detention basins are in place downstream of the development that have been designed to cater for and manage stormwater runoff from the catchment containing the development lot. In such instances, the site impervious area/percentage shall be consistent with or less than the characteristics allowed for in the design of the downstream detention basin.
3. Detention facilities may not be required where development is located in the lower reaches of a catchment, where it is demonstrated that detention does not provide downstream benefits and where it can be demonstrated that runoff from the site can be conveyed to 'receiving waters' without adversely impacting flooding of downstream areas, drainage systems or properties.
4. Sufficient detention storage must be provided to ensure that peak flow rates and/or flood levels at any point within the downstream drainage system do not increase as a result of the development from the 63.2% AEP storm to the 1% AEP storm events (for all relevant storm durations).
5. Peak flows (pre and post) shall be calculated using the same methodology.
6. For minor alterations and additions involving the creation of less than 40m² additional site impervious area, the pre-development site conditions used to determine pre-development discharge shall be calculated on the existing footprint of the dwelling/structure before the improvements.
7. For new works, or alterations and additions resulting in the creation of greater than 40m² additional site impervious area, the pre-development site impervious area conditions shall be assumed to be greenfield. In all cases, the existing condition or better is to be maintained.
8. If the discharge from the development is to be concentrated at a single point to the kerb and gutter, the maximum concentrated discharge must be limited to no greater than 55L/s per outlet.
9. When a detention basin is required for a staged development, the basin and any overland flow paths shall be constructed as part of stage one works.
- Detention Criteria**
- Existing site conditions**
- Staged Development**

D5.31 STORMWATER DETENTION – PUBLIC BASINS

1. Public Basins are those stormwater detention basins that are to become part of Council's assets.
2. The following overarching principals shall apply:
 - a. The number of basins within any single catchment shall be limited, as much as possible, to reduce Council's future maintenance liability. Preference is given to a single end of line basin per catchment.
 - b. Public basins shall only be approved to treat runoff from residential developments, road reserve areas and existing developed areas. Stormwater discharge from new commercial / industrial developments/subdivisions, must be managed via Private Stormwater Basin(s). See Section [D5.36](#) in this regard.
 - c. To improve the quality of stormwater runoff being discharged from a particular development using Water Sensitive Urban Design principles. Refer to AUSPEC D7 STORMWATER QUALITY.
 - d. To protect the public from risk of injury or death.
 - e. Detention basins shall be designed and constructed so as to be aesthetically pleasing and having regard to the area that they will be located in. They will not have an adverse amenity impact on the surrounding areas.
 - f. All basins shall be designed to provide safe and unobstructed access for all maintenance operations and equipment.

D5.32 LOCATION AND SITING OF PUBLIC BASINS

1. Land that has been identified for stormwater detention basins to be maintained by Council, whether existing or proposed, must be shown on a Deposited Plan as a Council Drainage Reserve to be vested in the Council.
2. Detention basins shall be sited outside of areas zoned Environmental Conservation (E2), or land affected by Floodway. Detention basins siting may be considered within an area affected by Environmental Management Zone (E3).
3. Public detention basins shall be located clear of any Asset Protection Zone provided for bushfire protection purposes.
4. Siting of detention basins shall have regard to:
 - a. The physical dimensions required to accommodate the required storage volume including the provision of the flattest possible batters, maintenance access to the basin bed, and maintenance of batters and edges.
 - b. Maintenance of pre-development catchments and flowpaths.
 - c. Existing developed catchments.

- d. Existing drainage including piped, swale drains, or flow paths.
 - e. Existing and proposed drainage easements.
 - f. Ground water depth and seasonal fluctuations.
 - g. Subsoil characteristics.
 - h. Location and lawful point of discharge.
 - i. Soil type and seepage/infiltration rate.
 - j. Land uses and zoning.
 - k. Potential risk or effect on people, fauna and flora.
 - l. Amenity of the area.
 - m. Benefiting landholder issues.
 - n. Provision of all-weather maintenance access.
 - o. Water quality.
 - p. The location of overland flows into the basin and appropriate treatment(s) to minimise erosion.
 - q. Inlet velocity and the need to install energy dissipation structures.
 - r. 1% flood level or highest recorded flood level information.
5. An all-weather access is to be provided to the detention basin and any associated structures to enable maintenance to be carried out. The access must be provided so that maintenance of any portion of the basin can be safely carried out. Access into the basin shall be protected from scour.
6. A minimum 3.0 metre wide reserve shall be provided around the perimeter of any basin to provide for maintenance access. Within this reserve, an access track (or tracks) shall be provided to provide typical maintenance vehicles with direct access to all significant and structural components of the basin. Access tracks shall be provided in such a manner that there is no need to reverse at any time.

D5.33 INLET STRUCTURES WITHIN PUBLIC BASINS

- 1. Any inlet pipe to a basin must be fitted with a headwall and an approved structure that will minimise blockages and restrict the entry of children.
- 2. All inlet headwalls will be fitted with a post and rail barrier to prevent falls and to identify the location of headwalls and wing walls.
- 3. Energy dissipation shall be provided downstream of all inlets in accordance with ASD307 and 308.

Safety

D5.34 LANDSCAPING OF PUBLIC BASINS

- 1. A fully detailed landscape plan is required for all public basins.

2. Plants with major root systems shall not be permitted on downstream embankment walls. Shallow rooted shrubs and grasses are acceptable.
3. Basins and associated drainage reserve areas shall generally be landscaped with low maintenance native grass species, endemic to the local area and planted at densities sufficient to prevent weed and tree growth.
4. Turf is not permitted to be utilised within detention basins without the prior written consent of Council.
5. A minimum 12 month landscape maintenance and establishment plan must be prepared in conjunction with the design and construction of any stormwater basin. The plan shall be implemented by the contractor(s) constructing the basin.
6. Successful vegetation establishment at the end of the 12 month maintenance period for the basin undertaken by the developer and in accordance with the landscape maintenance plan shall consist of:
 - a. Survival of more than 90% of plants
 - b. Nominated plants covering greater than 80% of the batter slopes and basin invert surface area.
 - c. 5-10 plants per square meter within the basin invert, and 4-8 plants per square meter within the batters.
 - d. An increase in plant height of at least 50%, measured through markers or stakes.
 - e. No weeds

Landscape establishment

A basin that does not achieve the above will be deemed defective and will require rectification prior to acceptance by Council as a stormwater asset.

7. In recognition of the fact that basins constructed in conjunction with new subdivision construction works are often damaged as a result of high sediment loadings and debris resulting from subsequent home building works, Council recommends the delaying of basin landscaping and establishment until after land dedication and the completion of all building works within the subdivision. Where the developer proposes to delay the landscaping of a vegetated stormwater basin, the following applies:
 - a. A timeframe for landscaping / trigger must be agreed with Council. *Suggest 80% completion of home building development with a residential subdivision OR a defined timeframe of x years post dedication of basin as an example.*
 - b. The basin earthworks shall be completed along with all infrastructure within, including filter media, pits, pipes, overflow weirs and scour protection,
 - c. The basin earthworks, filter media and other associated infrastructure/components shall be protected via the provision of a sacrificial layer of geofabric, topsoil and turf (or equivalent) over the finished surface level of the basin.

Delayed establishment option

- d. At the completion of the delayed establishment period, the sacrificial layers shall be removed and the basin be landscaped/vegetated in accordance with the approved construction plans. Council shall be notified of such works a minimum of 1 week prior to commencement.

As an alternative to the basin being landscaped and established by the developer, a Voluntary Planning Agreement (VPA) may be entered into between Council and the developer for the payment of all costs associated with landscaping and establishment of a stormwater basin(s).

D5-35 FENCING AND SECURITY OF PUBLIC BASINS

Batter Slopes

1. Public safety is an important consideration near stormwater management devices. The following points need to be considered when designing a stormwater treatment &/or detention facility:
 - a. Above and below water batter slopes should be gentle (1V:6H to 1V:8H).
 - b. Dense planting of vegetation and/or fencing shall be provided where access is to be restricted. Wherever possible the extent of pedestrian barrier fence should be limited to control the risk at a particular location rather than the whole site.
 - c. Densely planted vegetation can be used in a number of situations to discourage public access to parts of a site.
 - d. Where dense vegetation is to be used as part of the risk minimisation strategy several factors need to be considered.
 - i. Advanced plants should be used adjacent to Accidental Entry Fencing and along the planting / public interface to provide a quick barrier whilst the remainder of the planting establishes.
 - ii. Accidental Entry Fencing provides a nominal level of protection and controls illegal vehicle access.
 - iii. Temporary fencing in the form of paraweb fencing (or similar) may be required until plantings are well established.
 - e. Slopes of 1V:6H (above water) are considered as a maximum where machinery is used for maintenance. Appropriate barriers such as fencing or dense vegetation may be required to discourage public access on steeper batters.

Signage

2. Appropriate signage shall be installed to indicate the purpose of the facility and other warnings that are applicable to the general safety of all persons directly or indirectly exposed to the area.
3. Standard signage should be used. Other information signage should promote positive public relations and convey the message of protecting the waterways within the LGA. For example:

“This is a Stormwater Detention Basin Maintained by Kempsey Shire Council to Protect Downstream Waterways from Flooding.”

OR

“This is a Stormwater Water Quality Control Basin Maintained by Kempsey Shire Council to Protect Downstream Waterways”

4. Safe, practical and efficient maintenance is a primary consideration in the selection and layout of fencing. Considerations include:
 - a. Access and manoeuvring areas for vehicles and equipment.
 - b. Material handling and the provision of de-watering areas.
 - c. Mowing operations. The layout should facilitate tractor mowing.
5. Use of standard products and module lengths. Limit the number of products used at any given site.

**Maintenance
Consideration
s**

6. The style / type of treatment to be provided to a stormwater basin shall be determined in accordance with the warrant within Table D5-36.2 below.

Warrant

The Principal Consultant must select the most appropriate condition / factor for items A-D. The total will determine the treatment needed for the sand filter, pond, wetland, basin etc.

As a general principle the Principal Consultant should aim to minimise the use of pedestrian barrier fence by selecting design elements with lower risk factors.

TABLE D5-35.1 FENCING AND SECURITY WARRANT

FACTOR	RISK FACTOR
17) Batter slopes – above permanent water level* Select the steepest batter slope in the section of the sand filter, pond, wetland, basin etc that is being considered.	
1:6 or shallower (1:8 ideal)	1
1:4 up to 1:6	2
Steeper than 1:4	6
Vertical Wall above permanent water level. 0.1m<wall height ≤0.5m	8
Vertical Wall above permanent water level. Wall height>0.5m	16

B) Vertical drop at water edge – below permanent water level*	
0.0<vert. drop ≤0.3m (vertical drop at the permanent water edge) or continuously graded slopes	0
0.3<vert. drop ≤0.5m (vertical drop at the permanent water edge)	8

STORMWATER DRAINAGE DESIGN

>0.5m (vertical drop at the permanent water edge)	16
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C) Max water depth between water edge and 4m from the water edge – below permanent water level*	
≤0.67m (max water depth up to 4.0m from the permanent water edge)	4
0.67<water depth ≤1.0m (max water depth up to 4.0m from the permanent water edge)	8
>1.0m (max water depth up to 4.0m from the permanent water edge)	16

D) Site context Select the site context that best fits the site being assessed.	
Reserve designed to incorporate a constructed wetland/pond or other feature that holds water as a landscape feature integral to the open space. Adjacent areas may already contain other water bodies or watercourses. Residences within 100m of site and there is good surveillance from overlooking houses. Infant/primary schools are >250m from the site.	4
Reserve, with potential high use including likely high pedestrian and cyclist numbers, playground, picnic/BBQ facilities and possible larger public events. Infant/primary school >250m from the site. Residential areas ≤150m of the site. Moderate/good public surveillance.	6
E) Site context (cont.) Select the site context that best fits the site being assessed.	
Reserve including parkland/natural areas, generally with low use. Infant/primary school ≤250m from site and/or on a direct route to/from the school. Residential areas >150m from the site. Limited public surveillance.	8

*: For stormwater detention basins, the 5%AEP water level shall be considered as the permanent water level. The permanent water level in a water quality control basin shall be considered to be the level within a 3EY event. For combination water quality/detention basins, utilise the greater of the above.

BATTER TREATMENT AND/OR FENCING REQUIREMENT (Add selected risk factors from items A-D)	TOTAL SCORE
Mown grass and/or planting for aesthetic and shade purposes.	≤11
Dense planting (2.5m width minimum, 4.0m width ideal. Plants to be preferably clumping, to approximately 0.75m high and at 0.5m spacing maximum).	12-16
Dense planting and Accidental Entry Fencing.	17-21
Pedestrian Barrier Fencing.	> 21

7. Where Accidental Entry Fencing is required / selected, fencing shall be provided in accordance with the Standard Drawings.
8. The preferred style for Pedestrian Barrier Fencing is Council's standard Pedestrian Barrier Fence (ASD 807) or an approved equivalent (to AS 1926.1-1993) in a powder coated colour (preferably black or dark green).
9. Fencing within industrial areas shall be 1.8m high chainmesh fence installed for the entire perimeter. Suitable access via lockable gates shall be provided for maintenance purposes.
10. For all fencing types, gateways shall be provided at location(s) around the basin to facilitate maintenance access. Gates should be lockable and 4.0m wide.
11. Gates shall be accessed via a suitably sealed hard wearing maintenance access track.

Gates
D5.36 STORMWATER DETENTION – PRIVATE BASINS

1. This section applies private basins within individual dwellings, multi-unit developments, commercial and industrial developments where works remain in the control of the property owner.
2. In addition to [D5-30](#), the following additional objectives also apply to the design of small scale private on-site detention systems:
 - a. That on-site stormwater detention (OSD) systems are able to be effectively maintained by landowners and provide a cost effective method of meeting the objectives of this section.
 - b. That OSD systems meet necessary WHS guidelines.

Objectives

3. Detention Storage shall be provided above ground wherever possible and permissible. Underground tanks will only be accepted where above ground storage systems are not possible or feasible due to site constraints.
4. Where below ground tanks are proposed, The Principal Certifier will only consider the tanks where the access provisions and internal depths comply with the following:

Approved types of basins
Below Ground detention

- a. All underground storages shall have suitable access for maintenance and comply with Occupational Health and Safety Act 2000 and Confined Space requirements. Access openings must be a minimum:
 - i. 600 mm by 600 mm for storages up to 600 mm deep
 - ii. 900 mm by 900 mm for storages greater than 600 mm deep.
- b. All underground storage tanks shall comply with the Public Health Act 1991.
- c. Access to underground storages shall be secured with a grate or cover and be fastened to prevent unauthorised access. Access points are not to be concreted, paved, built over or otherwise obstructed.
- d. An access grate shall be provided over the Discharge Control chamber.
- e. The floor of underground storages must be graded so that the storage empties and water does not pool with the tank.
- f. Underground tanks must not be installed over or within 1.0m of a water main, sewer main, on-site wastewater system or on-site wastewater disposal field.
- g. Where OSD facilities are located under driveways and parking areas, consideration must be given to the finished surface levels and vehicular access requirements.
- h. An access grate/vent shall be provided at the highest point of the tank.
- i. All underground tanks shall be designed in accordance with Section 7.10.2 of AS3500.3: 2021

Modular/multi-cell type underground storages are not permitted, unless a suitable gross pollutant trap s provided upstream to prevent all silt and debris from entering the system.

NOTE: In accordance with the Occupational Health and Safety requirements, only persons with Confined Space training shall be permitted to enter below ground storage tanks for any required maintenance. A Confined Space Danger sign shall be placed at all access points to the below ground storage tanks. Details of the required sign may be obtained within the Upper Parramatta River Catchment Trust OSD handbook.

5. Above ground stormwater detention facilities shall comply with the following:
- a. Storage within paved surfaces:

***Above ground
detention***

- i. Water ponding depth is to be limited to a depth of 150 mm in areas where vehicles are parked and 180 mm in areas where vehicles are not parked.
 - ii. The storage area shall be totally impermeable.

- iii. In trafficable or pedestrian areas, no less than 15% of the total storage volume shall be provided underground.
- b. Storage within landscaped areas:
 - i. Water depth shall be no deeper than 1200 mm.
 - ii. Water depth greater than 500 mm shall be fenced with child-proof fencing.
 - iii. The floor of the OSD area is to be permeable to allow infiltration and should not pond water.
 - iv. The bunded wall of the OSD area must be impervious.
 - v. Where vegetated with anything other than low horizontal growing turf species, the storage capacity shall be increased by 20% to allow for vegetation growth and organic matter buildup.
- 6. Each on-site detention system is to be marked by a plate in a prominent position, which identifies the on-site detention system and that it is an offence to reduce the volume of the tank or basin or interfere with the orifice plate that controls the outflow. **Signage requirements**
- 7. The volume of on-site stormwater detention (OSD) storage can be reduced where on-site retention (OSR) facilities for rainwater reuse and/or stormwater reuse are proposed to service all toilets, laundries and outdoor usage. **Rainwater storage offsets**

Where OSR is proposed in lieu of OSD, an offset may be calculated at a rate of 1m³ from the OSD storage volume, for every 2.5m³ of OSR storage provided (up to a maximum OSD offset of 10m³).

D5.37 DEEMED TO COMPLY OSD SOLUTION FOR SMALL SCALE PRIVATE DEVELOPMENTS

1. Council has undertaken modelling to define on-site stormwater detention volumes and discharge rates applicable to the following range of small scale and common development types situated on lots up to 1200m² in area:
 - a. Multi-unit/dwelling residential development resulting in the creation of up to 8 units/dwellings in total,
 - b. Commercial and industrial development where water quality controls are not required in accordance with AUS-SPEC D7,

For the above development types, the required stormwater detention volume and corresponding 1% AEP event discharge rate can be obtained by entering the **total site area (m²)** AND **percentage of impervious site area** (rounded up to nearest 5%) to the “*Small Scale Development OSD Calculator v1.xlxs*” sheet available to download on Council’s website:

NOTE: The calculated volume and associated 1% AEP discharge rate are provided as a ‘deemed to comply solution’ available for use by developers and persons who do not wish to undertake detailed hydraulic / hydrologic modelling for OSD facilities in accordance with the modelling requirements of Australian Rainfall and Runoff 2016 and the requirements of this specification.

When utilising the above deemed to comply solution, designers only need to design a discharge control / orifice for the proposed OSD facilities based on the dimensions of the proposed detention storage volume.

For reference, the equation calculating flow through an orifice can be represented as:

$$Q = C_d A \sqrt{2gh}$$

where Q = flow (cubic metres per second)
 Cd = coefficient of discharge
 A = area of orifice (square metres)
 g = acceleration from gravity (9.81 m/s²)
 h = head acting on the centreline (m)

For a circular orifice, the equation becomes:

$$Q = C_d (1/4\pi D^2) \sqrt{2gh}$$

Typical values for the coefficient of discharge are:
 Sharp edged plate: 0.61

Rounded orifice: 0.98
 Short Tube: 0.80

In lieu of the modelling information/summaries required to be submitted in support of custom OSD facilities, plans submitted based upon the deemed to comply OSD solutions must specify the following:

- a. total site area,
- b. percentage of impervious site area,
- c. the volume and discharge rate obtained from the spreadsheet,
- d. date the information was obtained
- e. and the version of the spreadsheet utilised

NOTE - a spreadsheet screenshot is suggested.

PROPERTY DRAINAGE

D5.38 LEGAL POINT OF DISCHARGE

1. The legal point of discharge for a development is generally defined by:
 - a. The development type and size
 - b. Proximity and type of existing adjacent public drainage infrastructure.
 - c. Topography of the land.
 - d. Any relevant development controls for the site(s).
2. Council will determine a legal point of discharge based upon development types as outlined in Table 1 of [Appendix A](#).
3. In addition, all development sites shall be drained generally in the direction that the site naturally drains. The Principal Certifier will only consider permitting the site to be drained contrary to the direction that the site naturally drains where it is demonstrated on Section 68 plans that there are no adverse impacts on the downstream receiving drainage system or properties.
4. All allotments in green-field developments shall provide a property drainage point connected to the council drainage system. For residential developments, the property drainage point shall consist of a 100 or 150mm diameter PVC pipeline, extended into the lowest point of the residential lot.
5. No property drainage shall discharge to kerb and gutter in a green-field development without the written acceptance of The Principal Certifier.

***Point of
discharge
matrix***

6. Pump-out systems to discharge surface or roof water runoff are not permitted.

***Pump-out
systems***

D5.39 DISCHARGE TO THE KERB AND GUTTER

1. Council's preferred method for stormwater discharge from development sites is by direct connection to the public piped network.
2. Where this is not feasible for developments involving single residential dwellings, some dual occupancies or commercial alterations / addition, the

provision of a single kerb outlet per dwelling/unit using an approved stormwater pipe & kerb adaptor will be considered.

3. See Table 1 of [Appendix A](#) for scenarios in which kerb outlets may be permitted.
4. In these instances, the outlet and associated pipeline crossing the street verge must meet the following minimum characteristics:
 - a. The kerb outlet shall be in the form of a single Council approved galvanised steel kerb adaptor.
 - b. The kerb adaptor shall match the profile of the kerb with no protrusions.
 - c. Kerb adaptors shall be installed by saw cutting of the kerb to the required depth and to the exact width of the kerb adaptor. The kerb adaptor shall be securely anchored to the kerb in accordance with manufacturer instructions and shall not be lower than any step in the kerb adjacent to the invert.
 - d. Where a high (greater than 200mm) barrier kerb (type SA) exists, coring through the kerb is preferred. The Principal Certifier approval shall be obtained prior to coring through kerbs.
 - e. Kerb adaptors shall not be located within 2 metres of the upstream extremity of any kerb inlet pit and within 1m of a driveway crossing.
 - f. The pipeline across the verge area shall have a minimum wall thickness of 6mm and be structural in nature to withstand vehicle loads (e.g class 18 pressure pipe or galvanised steel RHS) and be sized such that it can be sleeved into the galvanised steel kerb adaptor (i.e external diameter within 3mm of internal diameter of the kerb adaptor coupling).
 - g. The pipeline across the verge area shall be laid at a grade no flatter than 1 in 200 (0.5%).
 - h. No additional couplings / fittings shall be utilised in the verge area.
 - i. The upstream end of the pipeline shall terminate within the private property at a suitably sized grated boundary surcharge pit as per Figure 7.5.1.2 of AS3500.3. Surcharge pits shall be installed to avoid any adverse effects on neighbouring properties.
5. If a single kerb outlet has insufficient capacity to drain a proposed development site, a larger outlet pipeline may be considered subject to the following:
 - a. Pipeline across the verge area consisting of a suitably sized structural pipe with wall thickness suitable to withstand vehicle loadings.
 - b. Provision of a custom manufactured kerb adaptor. All kerb adaptors shall be approved by Council.
 - c. Stormwater discharge does not exceed 55l/s.

Kerb outlet specifications

Kerb adaptor

Coring of kerbs

Proximity to driveways and pits

Pipeline type/size

Outlet pipeline strength

Maximum discharge to kerb

NOTE: The provision and maintenance of private stormwater drains are the responsibility of the property owner. The property owner is also responsible for verge restoration to original conditions after construction or maintenance activities.

***Maintenance
of kerb
outlets***

D5-40 DIRECT CONNECTION TO THE PUBLIC DRAINAGE SYSTEM

1. All green-field developments shall provide a direct point of connection (either direct to pipe or pit) to each proposed allotment connected to the Council piped drainage system. Each junction/connection to the public piped drainage system shall have a minimum diameter of 150mm.
2. A direct connection may be made to either an existing stormwater pit (preferred), or to an existing public stormwater pipeline.
3. Where the private property outlet pipeline is greater than 150mm diameter, or the development includes more than 2 units / dwellings, a direct pipe-to-pipe connection shall not be permitted and an inlet pit is required.
4. Stormwater connections to existing pits shall be made by coring a suitably sized hole into the back of the pit (min 150mm diameter), into which the direct connection can be made. Jointing details shall provide for a watertight seal with a clean grouted finish on the inside and a concrete mass pour behind the joint.
5. The Principal Certifier approval shall be obtained prior to any coring into existing pits.
6. Modified pits shall not be backfilled unless the 'as constructed' pit has been inspected by The Principal Certifier or suitable photographic evidence is captured. Photos shall be easily related to the specific pit.
7. The outlet pipeline shall be located at a level so as to avoid service clashes and as such its level / orientation will be site specific. The upstream end of the outlet pipeline shall terminate within the private property at a suitably sized grated boundary surcharge pit as per Figure 7.5.1.2 of AS3500.3: 2021
8. Where a stormwater connection direct to a public stormwater pipeline is proposed, the connection shall be via either a proprietary saddle slope junction, a manufacturer approved connection tool / device specific to the pipe being connected to (i.e Vinidex PRO-Grommet for StormPRO pipeline), or a specific approved adaptor (such as the Flowcon Conconnect).
9. Pipe-to-pipe connections shall involve a single length of suitably sized pipeline at a continuous grade.
10. In instances where service clashes exist, proprietary fittings may be permitted to joint several pipes at differing grades. In these instances, a detailed plan of the proposed method of connection, prepared by a suitably qualified person, shall be submitted to the Principal Certifier for approval prior to construction.

**Connection to
Pit**

**Connection to
Pipe**

D5-41 EXTENSION OF PUBLIC PIPED DRAINAGE SYSTEM

1. Where a development is required to extend the public piped drainage system to the site frontage as per Table 1 of [Appendix A](#), there are two options available for the size / layout of the piped drainage system:

- a. Extend pipeline to the frontage of the development site using a minimum 375mm diameter pipeline, where a kerb inlet pit shall be installed to facilitate a direct piped connection from the development site. The pipeline and kerb inlet shall be sized to capture and drain inflows from the contributing road and lot catchments as per the requirements of this specification.
- b. A 225mm diameter (minimum) pipeline may be utilised in lieu of the 375mm pipe specified above, subject to the use of a sealed junction pit at the upstream end of the small diameter pipeline (no grate or kerb inlet), in instances where the following can be demonstrated:
 - i. That a kerb inlet pit is not required to be installed within or upstream of the site frontage for road drainage purposes (i.e existing road drainage infrastructure meets current standards and the pit is located upstream of the last required street inlet pit), AND
 - ii. That the provision of interallotment drainage within the frontage of the subject and adjoining sites is not possible / feasible,
- c. The pipeline shall be sized to capture and drain inflows from the contributing catchments area and must have regard for the total future developed catchment.

D5-42 DISCHARGE TO A NATURAL STREAM OR WATERBODY

1. Where connection is proposed to a natural stream or water body as per Table 1 of Appendix A, the stormwater outlet shall be located within the bank of the stream (or as prescribed in a separate approval), be provided with a headwall and scour protection designed / specified by a suitably qualified engineer (qualifications as per Aus-Spec DQS-Quality Assurance of Engineering Design, Section DQS.06).
2. The outlet must be located clear of any Asset Protection Zones (APZ) or access / pedestrian tracks. Design plans shall delineate all existing vegetation / services in proximity to the pipeline. As a general rule, outlets to reserve areas shall be located a minimum of 3m clear of the rear property boundary.
3. Where outlets are to be located on Council land, Principal Consultants shall obtain written approval from Council's Property Services section prior to the formal application to construct private infrastructure within Council reserves.
4. The Principal Certifier approval for connection to a Natural Stream or water body does not wavier the need to obtain other Government approvals that may be relevant. All relevant approvals shall be obtained prior to construction (e.g. Department of Primary Industries - Office of Water and Fisheries).

D5.43 ABSORPTION / DISPERSION TRENCHES

2. Where disposal by absorption is approved as per Table 1 of [Appendix A](#), the following requirements apply:
- a. The absorption facility must be accessible for future inspection and maintenance.
 - b. A trash rack and sump (or GPT) is to be provided upstream of the absorption facility to screen debris and remove fine silts to minimise the likelihood of future blockage.
 - c. The absorption facility is to be designed and certified by a suitably qualified person and be based upon site specific geotechnical analysis. A typical geotechnical analysis prepared to inform the design of an absorption trench should address the following at a minimum:
 - i. Depth to rock and/or water table,
 - ii. Measured infiltration rate,
 - iii. Infiltration rate that can be maintained in the long term over the life of the system,
 - iv. Minimum distance any infiltration system should be located clear of property boundaries,
 - v. Whether the use of infiltration is likely to cause seepage problems to the proposed structure or to any adjoining properties,
 - vi. Any special requirements for the design of walls or footings on the site.
 - d. Absorption pits shall be designed for a 2% AEP storm event using Mass Curve techniques. An overflow mechanism in the form of a level spreader or surcharge pit shall be provided. The overflow mechanism must minimise overland flow disturbance to lower property.
 - e. Where possible, absorption trenches should be utilised in conjunction with an upstream rainwater tank, plumbed for internal/external reuse.
 - f. Where a high water table is encountered, the base of the trench should be at least 500mm above the water table to accommodate fluctuations of the groundwater.

3. Absorption trenches should not be located within three (3) metres of the side or rear boundary, or three metres from any onsite building or neighbouring buildings.
4. Absorption trenches shall not be located above public water, sewer, and other underground utilities / services, with a minimum horizontal clearance of 1m from other services.
5. Absorption trenches and associated surcharge / overflow mechanisms shall be located clear of on-site sewer systems.

D5-44 INTERALLOTMENT DRAINAGE

- | | |
|--|---|
| <ol style="list-style-type: none"> 1. Inter-allotment drainage pipelines and easements shall be provided to all lots which cannot wholly drain to the street to which the lot fronts. 2. The interallotment drainage pipeline shall be sized and located to ensure that the whole lot area can be serviced. | <p>Warrant</p> |
| <ol style="list-style-type: none"> 3. A property junction, shall be provided at the lowest corner of each allotment at the time of subdivision works. | <p>Property junction</p> |
| <ol style="list-style-type: none"> 4. A maximum of six (6) allotments should be served by an inter-allotment drainage system. | <p>Maximum number of allotments serviced</p> |
| <ol style="list-style-type: none"> 5. Interallotment drainage shall be contained within an easement in favour of all upstream lots. The easement shall be cantered over the interallotment pipeline and wholly contain any designed overland flow path. The interallotment drainage easement shall be sized as per Table D5-44.2 below: | |

TABLE D5-44.1 INTERALLOTMENT DRAINAGE EASEMENTS

Minimum Pipe Diameter for single pipe cases (mm)	Minimum easement width where easement directly adjoins boundary to road reserve (m)	Minimum easement width where NOT located directly adjacent to road reserve
150*	1.0m	1.2m
225 - 450	1.0m	1.5m
>450	3.0m	3.0m
Where multiple pipes are contained within an interallotment easement for drainage, the easement width shall be measured as the overall outside width of the pipe group plus 1.5m. * 150mm pipelines are only permitted to service developments of less than or equal to two (2) Lots/Units and where the contributing area is less than 1000m².		

Interallotment drainage easements

Minimum Interallotment Drainage pipe sizes

6. The interallotment drain shall be designed to cater for runoff generated from a 5% AEP storm event for the whole area of the allotments serviced without surcharging.
7. Minimum pipe sizes shall be as per Table D5-44.1.

- | | | |
|-----|---|--|
| 8. | Inter-allotment drainage pits shall be located at all changes of direction and at distances no greater than 60m. | <i>Interallotment
Drainage pit
locations</i> |
| 9. | Interallotment pits shall be constructed of concrete, with internal dimensions as specified within Table 7.5.2.1 of AS3500.3: 2021 to facilitate safe and efficient access. | |
| 10. | Pits shall be fitted with a fixed concrete lid finished flush with the finished surface of works unless specified otherwise on Construction Certificate Plans. If required pit lids may be a grated inlet to catch surface flows. | |
| 11. | Where the subdivider only has ownership or control over the title to the lower land below the rear boundaries of the lots requiring interallotment drainage, then an interallotment drainage system satisfying the requirements of this Specification, as well as a grass swale profiled to convey stormwater up to the 1% AEP storm event (unless otherwise approved by The Principal Certifier), shall be provided within an easement located in the lower land property. | <i>Interallotment
drainage in
Downstream
Property</i> |
| 12. | Where the subdivider has no interest in the lower land (i.e. properties below the rear boundaries of the lots requiring interallotment drainage), then an interallotment drainage system satisfying the requirements of this Specification, as well as a grass swale profiled to convey stormwater up to the 1% AEP event (unless otherwise approved by The Principal Certifier), shall be provided within an easement, located in the subdivider's land. | <i>Interallotment
drainage in
Upstream
Property</i> |
| 13. | Where the subdivider's land is supported by a batter or retaining structure, then an interallotment drainage system satisfying the requirements of this Specification, as well as a grass swale profiled to convey stormwater up to the 1% AEP storm event (unless otherwise approved by The Principal Certifier), shall be provided within an easement, located in the subdivider's land. | <i>Interallotment
drainage Near
Retaining
Walls</i> |
| 14. | Easements shall be protected with a Section 88B Restriction as to User, preventing the alteration of the ground level within the interallotment easement for drainage nor the placement of landscaping on the surface of the easement other than low growing grasses. | <i>Section 88B
Restriction</i> |
| 15. | Interallotment drainage systems must be discharged to a legal point of discharge and may require easements through private property to achieve this. | <i>Interallotment
drainage
Discharge</i> |
| 16. | Inter-allotment drainage pipelines shall be constructed from the following pipe types and joints shall be of rubber rings: <ul style="list-style-type: none">a. Fibre reinforced concrete pipe (AS 4139).b. Reinforced concrete pipe (AS 4058).c. uPVC pipe (AS 1254). | <i>Interallotment
drainage pipe
types</i> |
| 17. | Where inter-allotment drainage and sewer mains are laid adjacent to each other they shall have a minimum clearance of 500 mm between pipes measured horizontally. | <i>Separation
from other
services /
structures</i> |

18. Inter-allotment drainage pipelines and easements shall be located clear of any on-site stormwater detention systems and retaining walls / structures. In some instances, eaves / gutters may be permitted to overhang an interallotment drainage easement. In such instances, supporting documentation shall be submitted to demonstrate that a minimum vertical clearance of 3000mm is available between the ground surface and underside of the eaves / gutter and that the interallotment pipeline is located at a depth not exceeding 1500mm.
19. No structures are permitted to encroach into or within an area 3m above the surface of interallotment drainage easements.
20. Pipes laid in close proximity to structures shall comply with AS3500.3 Section 6.2.7 and 6.2.8.

BASEMENT DRAINAGE

D5-45 BASEMENT DRAINAGE - OBJECTIVES

1. Basements must be of fully 'tanked' (sealed and watertight) construction such that pump-out systems are not required to drain subsurface water originating from outside the basement.

Wheresubsurface drainage is required to manage infiltration immediately surrounding the development structure it must be designed such that the existing subsurface flow regime in the vicinity of the development will not be altered as a result of the development and there will be no adverse impact on surrounding properties.
2. Where the basement is associated with car parking facilities, a pump out system is permitted for minor surface areas that drain to the basement, such as from the access driveway.

All other forms of access to the basement, including fire access stairs, must be protected from the weather, such that the entry of stormwater runoff to the basement is minimised.
3. Consideration may be given to the provision of a subsurface water pump-out system within a basement where it can be demonstrated that groundwater flows are minimal/ intermittent and subject to direct connection of the site discharge to Council's piped stormwater drainage system. This option may only be considered when supported by detailed geotechnical investigation.

For basements other than car parking facilities, the above consideration will only be contemplated where the sump and pump facilities can be housed and accessed for maintenance externally to the development.

***Subsurface
water
discharge***

D5.46 BASEMENT DRAINAGE DESIGN

1. The Stormwater Management Plan submitted with any Development Application incorporating a basement must include detail of how the proposed basement will be drained.

Where minor surface areas drain to the basement, such as from the access driveway, a pump out system is permitted with discharge directed to the OSD storage tank(s) (where installed as part of the development).

Where subsurface waters are permitted to be pumped from the basement, discharge must be connected directly to Councils piped drainage system.

2. An integrated Structural and Geotechnical Engineering report addressing the design of the basement must be submitted with any Development Application. The design must address the following issues at a minimum:

Structural and geotechnical engineering report

- a. The basement must be of fully 'tanked' construction and be entirely waterproofed.
- b. The existing subsurface flow regime in the vicinity of the development must not be significantly altered as a result of the development.
- c. No adverse impact on surrounding properties.
- d. Make recommendations regarding method of excavation and construction, vibration emissions and identifying risks to existing structures or those on adjoining or nearby property.

3. Where permitted, a pump-out system for stormwater disposal shall be designed in accordance with the following criteria:

Basement Pump system design

- a. The requirements of Section 8 of AS3500.3: 2021.
- b. Where OSD facilities are required, the pump system must discharge to the OSD storage tank.
- c. A maintenance regime for the pump system must be prepared, including provision for regular maintenance and servicing at least annually.

D5.47 MISCELLANEOUS

1. Cut off drains, inlets and junctions are to be installed on the upstream side of developments to capture the water from contributing catchments. These shall be designed to cater for any differences to the AEP capacity of existing upstream pipework. Surge devices are to be installed as required.

Cut off drains

2. No connection of private stormwater drainage to the public stormwater system (including any interallotment drainage) will be permitted without written approval by Council of an application made pursuant to section 68 of the Local Government Act 1993.

S68 Application

RETAINING WALL DRAINAGE

D5.48 OBJECTIVES OF RETAINING WALL DRAINAGE

1. Retaining walls must be designed having regard for any required subsoil drainage required. The subsurface drainage system must be designed such that the existing subsurface flow regime in the vicinity of the development will not be significantly altered as a result of the development and there will be no adverse impact on surrounding properties.
2. Where a retaining wall is proposed along / adjacent to a property boundary, the wall must be set back sufficiently such that all subsoil drainage required is located wholly within the boundaries of the subject allotment.

***Retaining wall
drainage***

D5.49 RETAINING WALL DRAINAGE DESIGN

1. The structural design of any retaining wall supporting a road reserve must address the following at a minimum:
 - a. Retaining walls must be entirely self-supporting in the event that excavation is undertaken within the road reserve adjacent to the property boundary to the depth of the proposed structure.
 - b. All components of the structure, including subsoil drainage, must be located entirely within the property boundary.
 - c. Any retaining walls must be adequate to withstand the loadings that could be reasonably expected from within the constructed road and footpath area, including normal traffic and heavy construction and earth moving equipment.
 - d. Relevant geotechnical/subsurface conditions of the site, as determined by full geotechnical investigation.

***Excavation
adjacent to
road reserves***

DETAILED DESIGN

D5.50 PIPES AND CONDUITS

1. Conduits and materials shall be in accordance with the standards detailed in Construction Specification C221 – Pipe Drainage.
2. Pipe Class, Bedding and Cover Requirements for reinforced and fibre reinforced concrete pipes shall be determined from the Concrete Pipe Association "Concrete Pipe Selection and Installation" or AS 3725. Compaction densities shall comply with Construction Specification C221 – Pipe Drainage. For UPVC pipes, the requirements shall be to AS 2032. Design pipe loadings shall allow for the heaviest construction equipment likely to be used on the site.
3. Conduit Jointing - Conduit Jointing shall be in accordance with Construction Specification C221 – Pipe Drainage.

***Pipe Class,
Bedding and
Cover***

4. Conduit Location - Drainage lines in road reserves shall generally be located in accordance with Design Specification D1 – GEOMETRIC ROAD DESIGN.
5. All pipelines and reinforced concrete structures located below RL1.9m AHD shall have salt water cover (marine grade).

D5.51 PIT DESIGN

1. Pits shall be designed for safe access with benching to improve hydraulic efficiency and reduce water ponding. Typical pit designs and relevant Standards or Codes are included in Council's series 300 standard drawings. Pits that do not meet the specifications set out in Councils Standard Drawings shall be structurally designed and certified for Council review.

D5.52 STORMWATER DISCHARGE

1. Scour protection at culvert or pipe system outlets shall be constructed in accordance with guidelines set down in QUDM unless outlet conditions dictate the use of more substantial energy dissipation arrangements.
2. From any outlet scour protection shall be provided for the length upon which turbulence is sufficiently dissipated. In the absence of hydraulic modelling the length shall not be less than $10 \times (V_o - V_i)$ in metres.

Scour

Where: V_o = the maximum design outlet velocity in metres per second at the end of the pipe or box culvert.

V_i = the average velocity in the open channel prior to any development.

3. Where the drainage is to discharge to an area under the control of another statutory authority the design requirements of that Statutory Authority are also to be met.
4. At points of discharge of gutters 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 subdivider to enter into a Deed of Agreement with the adjoining owner(s) granting permission to the discharge of stormwater drainage and the creation of any necessary easements with the cost of the easement being met by the developer.

***Downstream
Discharge
onto
Adjoining
Property***

5. Piped stormwater drainage discharging to recreation reserves is to be taken to a natural watercourse and discharged in an approved outlet structure or alternatively taken to the nearest trunk stormwater line.

***Discharge to
Recreation
Reserves***

D5.53 MISCELLANEOUS

1. Subsoil Drainage shall be provided in pipe trenches as outlined below.

- | | |
|---|--|
| <p>2. In cases where pipe trenches are backfilled with sand or other pervious material, a 3m length of subsoil drain shall be installed along the bottom of the trench immediately upstream from each pit or headwall. The subsoil drain shall consist of 100mm diameter agricultural pipes, butt jointed, with joints wrapped with hessian or slotted PVC pipe.</p> <p>3. Every pipe end surrounded by filter aggregate material or no fines concrete (buried inlet ends) must be fitted with a purpose built manufacture's cap to prevent backfill material entering the pipe. Tied filter sock or duck taped ends are not an acceptable form of capping. The designer shall include pipe end details on the design plans.</p> <p>4. Kerb and Gutter shall be extended to a drainage pit or natural point of discharge. Where outlet velocity is greater than 2.5m per second or where the kerb and gutter discharge causes scour, then protection shall be provided to prevent scour and dissipate the flow.</p> | <p><i>Subsoil Drain
at Pits</i></p>

<p><i>Kerb & Gutter
Termination</i></p> |
|---|--|

DOCUMENTATION

D5.54 PLANS

- | | |
|--|--|
| <p>1. See Kempsey Shire Council ASSET DELIVERY SPECIFICATION</p> <p>2. Open Channel Cross Sections shall be drawn at a scale of 1:100 natural and shall show the direction in which the cross sections should be viewed.</p> <p>3. Special Details including non-standard pits, pit benching, open channel designs and transitions shall be provided on the design drawings at scales appropriate to the type and complexity of the detail being shown.</p> <p>4. "Work-as-executed" drawings are required in accordance with Design Specification D14 –WORK AS EXECUTED PLANS</p> <p>5. Erosion and sediment control is to be in accordance with the requirements of Design Specification D7 – STORMWATER QUALITY.</p> <p>6. Drainage design is to comply with the Kempsey Shire Council DCP 2011 and Design Specification D7 - STORMWATER QUALITY.</p> | <p><i>Asset delivery
Specification</i></p>
<p><i>Open
Channels</i></p>

<p><i>Work-as-
Executed
Plans</i></p>
<p><i>Erosion and
sediment
control</i></p> |
|--|--|

D5.55 EASEMENTS AND AGREEMENTS

- | | |
|---|--|
| <p>1. Stormwater runoff and drainage may only be discharged from a development site at a "lawful point of discharge". This must be on or immediately adjacent to the development site and may be:</p> <p style="margin-left: 40px;">a. A natural watercourse or waterway to which the development site naturally drains.</p> <p style="margin-left: 40px;">b. A "lawful point of discharge as defined by Section D5-37.</p> | <p><i>Lawful point
of discharge</i></p> |
|---|--|

2. Such points of discharge will only be acceptable if there is legal continuity and capacity in the drainage path from the “lawful point of discharge” to the final discharge point in a natural watercourse or waterway. If there is uncertainty regarding the capacity and continuity of the drainage path, the developer will be required to carry out all necessary survey and hydraulic analysis to prove its adequacy to Council.
3. Where no acceptable point of discharge presently exists, Council may conditionally approve a “lawful point of discharge” with conditions that require the proponent to
 - a. Acquire and dedicate to Council, reserves or easements that provide legal continuity between the “legal point of discharge” and the final discharge point in a natural watercourse or waterway.
 - b. Design/construct/enlarge/improve drains to enable adequate transport of stormwater from the “lawful point of discharge” to the final discharge point (in such cases, Council will determine the appropriate width of easements and drainage standards).
4. Progressive subdivision of a site will need to create a lawful point of discharge at each stage of title creation, despite the discharge being into the applicant’s own (for the time being) land.

Easements

5. Easements shall be provided in private property over all public piped drainage systems and surcharge paths associated with the function of public stormwater infrastructure/land.

The combined pipe and surcharge path system shall meet the depth x velocity ratio of 0.4m²/s maximum. The surcharge path shall be maintained clear of obstructions (eg. Fence lines) and a restriction shall be placed on the title to secure the surcharge path shall be maintained clear of obstructions.

6. Such easements shall be registered benefitting Kempsey Shire Council as an Easement for Stormwater Drainage, with the terms of the easement as defined within [Appendix B](#).

***Standard
terms of
Easement for
Stormwater
Drainage***

7. The overall width of an 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 as indicated below.

TABLE D5.55.1 EASEMENT WIDTHS

System Type	Easement Width (Rounded up to nearest 0.5m)
Single pipe	3.0m (minimum)
Multiple pipes	Overall outside width of pipe group plus 2.0m, with a minimum of 3.0m
Box culverts	Overall outside width of box plus 2.0m
Open channels	Total width of channel and associated maintenance access track plus 2.0m (generally restricted to drainage reserves)
Surcharge paths	Total 1% AEP Major flow path width plus 2.0m
Inter-allotments drainage	See Section D5-43

8. Trees, shrubs and other vegetation if planted in close proximity to pipelines will cause damage to drainage pipes.

***Vegetation
within
easements***

In addition, vegetation including garden beds can cause considerable access problems if a pipe is to be repaired.

9. No vegetation of any type other than low or horizontal growing grasses shall be planted over any drainage pipes or in drainage easements where pipes exist.

10. Where drainage reserves are incorporated into developments the minimum reserve width shall be 3.0 metres.

***Drainage
Reserves***

11. Reserve widths shall accommodate a drain with sufficient capacity to cater for a 1% AEP storm event plus freeboard in accordance with this specification. All-weather access tracks will be required on one side of the drain.

12. Water-quality treatment infrastructure, open drains and basins shall be sited within Drainage Reserves with sufficient width/room for construction and maintenance access utilising standard Council vehicles.
13. Where an open drain or basin is provided within a reserve, a buffer of a minimum 3m width shall be provided within between the top of batter of the basin or other drainage structure to surrounding property. The buffer shall be trafficable for required maintenance activities and be free of trip hazards.
14. Where drainage infrastructure within the drainage reserve does not comply with standards for public access, the reserve shall be fenced to prohibit public access.

D5.56 BUILDING IN PROXIMITY TO STORMWATER PIPELINES

1. To ensure the adequate protection of both public and interallotment stormwater pipelines which may be affected by building works and to allow access to these services for maintenance and repairs, the following requirements apply:
 - a) All footings to structures within the zone of influence of a stormwater main shall be designed and/or certified by a Registered Structural Engineer who will include schedule on the drawings certifying that the design is in accordance with Council's AUSPEC Specifications with respect to building over or adjacent to stormwater.
 - b) Footings founded on rock may generally be considered to be outside of the zone of influence, however, the advice of a Registered Structural Engineer should be obtained.
 - c) Footings for residential like buildings shall be designed in accordance with AS2870-1996 Residential Slabs and Footings. Footings for other structures and buildings shall be designed in accordance with AS3600 Concrete Structures Code and AS2159 Piling Code.
 - d) No part of a footing is to be within an easement for drainage.
 - e) Buildings or structures shall not be constructed over public stormwater pipelines located within easements.
 - f) Buildings or structures may be permitted to be constructed over interallotment stormwater pipelines where it is demonstrated that the structure allows unimpeded maintenance access to be obtained and that it does not block or redirect the free flow of surface runoff within the easement.

In these instances, supporting documentation shall be submitted to demonstrate that a minimum vertical clearance of 3000mm is available between the ground surface and underside of the eaves / gutter /structure located over the easement and that the interallotment pipeline is located at a depth not exceeding 1500mm.

- g) Tanks or stands are not to be located over or adjacent to stormwater pipelines.
 - h) Any proposal to build over or adjacent to a stormwater pipeline is to include CCTV inspection of the stormwater pipeline at the proponent's cost and replacement of the pipeline if this is deemed to be required by Council's Group Manager Community Infrastructure Planning and Design.
2. When designing footings to support the building loads the following design parameters shall be taken into consideration:
- a) Footings shall be designed to take into account the probability that the disturbed and/ or uncontrolled fill in the sewer trench may not provide adequate support for the adjacent footing loads.
 - b) Footings shall be designed or located such that the additional forces within the soil, due to the footing load, that are transferred to the stormwater pipeline, along with the existing soil loads, do not exceed the permissible loads on the stormwater pipeline. Consideration should be given to the construction material and condition of the main. Reference should be made to manufactures information for allowable loads on stormwater pipelines.

APPENDIX A – POINT OF DISCHARGE MATRIX

Development Type	Existing Stormwater Pit / Pipe Connection	Inter-allotment drainage system	Pipe / Pit Network Extension to Site Boundary	Single outlet to Kerb and Gutter	Absorption / Dispersal Trench	Natural Creek / Gully
New Single Dwelling	Y Where existing junction available OR subject to provision of new junction via coring to existing pit	Y If site does not grade to street frontage	Y Subject to Council consent	Y Where existing direct connection to piped network not available	Y Where no alternative discharge is feasible AND subject to rainwater reuse and detailed design	Y Where traversing or adjoining site and subject to provision of erosion and pollutant controls
New Dual Occupancy	Y Where existing junction available OR subject to provision of new junction via coring to existing pit	Y If site does not grade to street frontage	Y If public piped system located within 20m of site	Y Where direct connection to piped network not feasible	N	Y Where traversing or adjoining site and subject to provision of erosion and pollutant controls
New Multi-dwelling (>2 dwellings)	Y Direct connection to pit only.	Y If site does not grade to street frontage OR where required to enable direct connection to public infrastructure	Y If public piped system within 60m of site	Y Where public drainage system >60m from site	N	Y Where traversing or adjoining site and subject to provision of erosion and pollutant controls
Residential alterations & Additions	Y Where existing pit, pipe, or junction available OR subject to provision of new junction via coring to existing pit	Y If site does not grade to street frontage	Y Subject to Council consent	Y Where existing direct connection to piped network not available	Y Where no alternative discharge is feasible AND subject to rainwater reuse and detailed design	Y Where traversing or adjoining site and subject to provision of erosion and pollutant controls
New Commercial / Industrial	Y Where available subject to provision of suitably sized junction. Provision of new junction pit may be required.	Y If site does not grade to street frontage OR where required to enable direct connection to public infrastructure	Y If public piped system within 80m of site	N	N	Y Where traversing or adjoining site and subject to provision of erosion and pollutant controls
Commercial / Industrial Alterations and Additions	Y Where available subject to provision of suitably sized junction. Provision of new junction pit may be required.	Y If site does not grade to street frontage OR where required to enable direct connection to public infrastructure	Y If public piped system within 80m of site	Y If existing junction, pit or pipe not available within frontage and development involves <40m ² increase in impervious area	N	Y Where traversing or adjoining site and subject to provision of erosion and pollutant controls
Subdivision - involving creation of roads and / or > 3 lots (Green field subdivision)	Y Junction to be provided to each allotment	Y To be provided for all sites that do not grade to street frontage	All allotments in green-field developments shall provide a property drainage point connected to the Council piped drainage system.	N	N	Y Where traversing or adjoining site and subject to provision of erosion and pollutant controls
Subdivision involving ≤4 Lots and construction of no roads (In-fill subdivision)	Y Where available subject to provision of suitably sized junction	Y If site does not grade to street frontage OR where required to enable direct connection to public infrastructure	Y If public piped system within 60m of site	Y Where public drainage system >60m from site	N	Y Where traversing or adjoining site and subject to provision of erosion and pollutant controls

STORMWATER DRAINAGE DESIGN

Notes: The above does not supersede the requirement to obtain any other approvals necessary to facilitate the connection proposed such as:

- NRAR and Water NSW approvals may be required to connect to a watercourse.
- Approvals from Council's Properties section (or other relevant landowner) will be required when draining into or across a reserve.
- RMS approval to connect to infrastructure within a State road corridor.

Where the above requirements cannot be satisfied, alternative solutions fully documented by a suitably qualified person may be considered on a case by case basis.

Table Key

Preferred
Satisfactory subject to Council requirements
Only where other options are not feasible
Not permitted

APPENDIX B - TERMS OF EASEMENT FOR STORMWATER DRAINAGE

1 In this instrument, the following definitions apply:

Burdened Lot means the lot burdened by the instrument referring to this memorandum.

Claim includes a claim, demand, remedy, suit, injury, damage, loss, Cost, liability, action, proceeding or right of action.

Cost means a cost, charge, expense, outgoing, payment, fee and other expenditure of any nature.

Drainage Work means any line of pipes, drains, conduits, channels, ditches, culverts and any other work for the purposes of drainage of water.

Prescribed Authority means Kempsey Shire Council and its successors, assigns, and every person authorised by it.

Easement Site means the part of the Burdened Lot identified as the site for stormwater drainage.

Registered Proprietor means the registered proprietor of the Burdened Lot from time to time and its successors and assigns (including those claiming under or through the registered proprietor).

2 The Prescribed Authority from time to time and at all times may drain water (including but not limited to rain, storm, spring, soakage, or seepage water) from any source in any quantities, together with any soil or other materials which may be dissolved or suspended therein, either continuously, intermittently or occasionally across and through each Burdened Lot, but only within the Easement Site.

3 For the purposes of the easement in clause 2, the Prescribed Authority may:

- 3.1 use any Drainage Work already laid or constructed within the Easement Site for the purpose of draining water or any Drainage Work in replacement or in substitution thereof,
- 3.2 lay, place, construct, maintain, repair, renew, replace and upgrade any Drainage Work of sufficient capacity determined by the Prescribed Authority beneath or upon the surface of the Easement Site and clean, inspect and remove them,
- 3.3 treat any part or parts of the Easement Site and carry out work on the Easement Site for the purpose of protecting the Easement Site and adjacent land,
- 3.4 construct pits for the purpose of gaining access to the Drainage Work within the Easement Site,
- 3.5 construct access ways and pits for the purpose of allowing the ingress of stormwater from the ground surface and from stormwater lines serving improvements located on the Burdened Lot,
- 3.6 do anything reasonably necessary for the above works, including but not limited to:
 - 3.6.1 entering and remaining, passing and repassing, on, over, across and under the Burdened Lot with or without vehicles, plant and equipment at any reasonable time (except in the case of emergency in which case the Prescribed Authority may enter, remain, pass and repass at any time), and
 - 3.6.2 taking anything reasonably necessary for the above works onto the Burdened Lot.

4 In exercising the powers under this instrument, the Prescribed Authority must:

- 4.1 ensure all work is done properly, and
- 4.2 cause as little inconvenience as is practicable to the Registered Proprietor and any occupier of the Burdened Lot, and
- 4.3 cause as little damage as is practicable to the lot burdened and any improvement on it, and
- 4.4 restore the Burdened Lot as nearly as is practicable to its former condition, and

- 4.5 make good any collateral damage.
- 5 The Registered Proprietor agrees that it will not:
 - 5.1 place or permit to be placed any services or structure within or over the Easement Site,
 - 5.2 place or permit to be placed any fencing over or within the Easement Site,
 - 5.3 place or permit to be placed any obstruction, material, plant or equipment within the Easement Site,
 - 5.4 alter or permit to be altered the surface of the Easement Site,
 - 5.5 do or permit to be done anything that restricts or interferes with access to the Easement Site by the Prescribed Authority, or
 - 5.6 plant or allow to grow vegetation other than low or horizontal growing grasses within the Easement Site,without the prior written consent of the Prescribed Authority and in accordance with such conditions as the Prescribed Authority may reasonably impose.
- 6 Without limiting clause 7, the Prescribed Authority may refuse to give consent to a matter under clause 7 if, in the Prescribed Authority's opinion, the matter may impede the flow of water or the use of the Easement Site for drainage purposes.
- 7 Notwithstanding any consent or anything elsewhere contained in this instrument, the Registered Proprietor releases the Prescribed Authority from any Claim it may have against the Prescribed Authority arising as a result of the exercise by the Prescribed Authority of the rights granted to it in this instrument, except if, and to the extent that, the Claim arises because of the Prescribed Authority's negligence.
- 8 The Prescribed Authority is not required to contribute to the cost of maintaining the surface level of the Burdened Lot.
- 9 This easement is intended to be an easement in gross under s88A of the *Conveyancing Act 1919* and may be released, varied or modified by the Prescribed Authority.