CHAPTER 3.1 FLOODPLAIN MANAGEMENT/WATER CYCLE MANAGEMENT

PART A: GENERAL

3.1.1 INTRODUCTION

As the former Wyong and Gosford Councils had adopted different methodology for the mapping of hazard zones and the treatment of risk, this Chapter is structured in the following manner:

- Part A: General
- Part B: Northern Area (Former Wyong LGA); and
- Part C: Southern Area (Former Gosford LGA).

It is intended that a consolidated and consistent approach will be developed in a revision of this Chapter.

PART B: NORTHERN AREA FLOODPLAIN MANAGEMENT (FORMER WYONG LGA)

3.1.2 INTRODUCTION

3.1.2.1 Objectives of this Chapter

- To minimise the risk to human life and damage to property by controlling development on flood prone land
- To apply a performance and merit based approach to all development decisions taking into account ecological, social, engineering safety and environmental considerations to ensure development is appropriate and sustainable
- To ensure that the development or use of floodplains waterways and riparian corridors does not adversely impact upon aesthetic, recreational and ecological values
- To ensure that all land uses and essential services are appropriately sited and designed in recognition of all potential floods
- To promote flood compatible building design that considers requirements for the development of flood prone land and does not adversely impact on adjoining properties
- To establish guidelines for the development of flood prone land that are consistent with the *NSW Flood Policy* and *NSW Floodplain Development Manual (2005)* and as updated by the associated Floodplain Risk Management Guides

3.1.2.2 Application

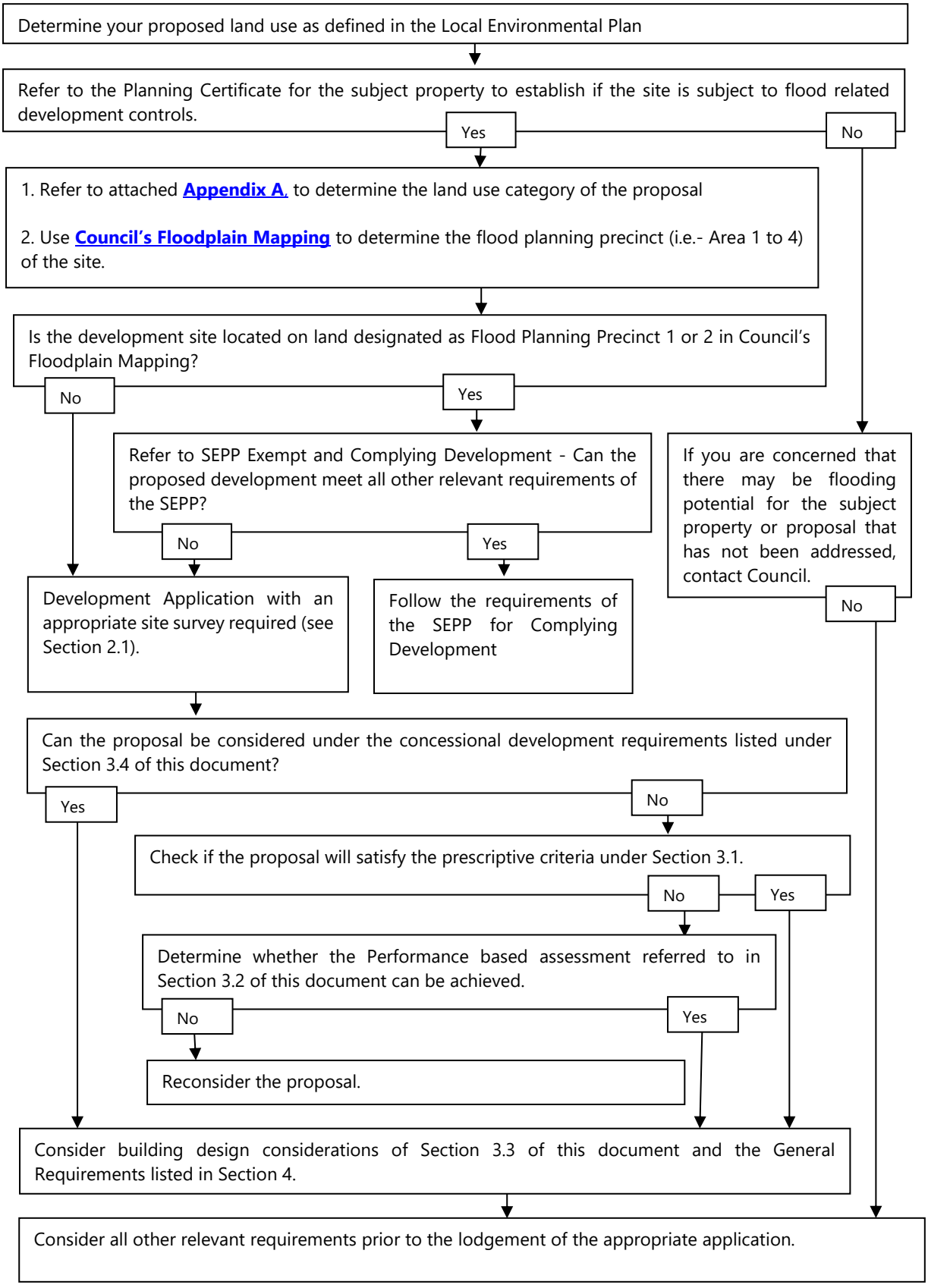
This plan has been prepared in accordance with the *Environmental Planning and Assessment Act, 1979* having regard to the provisions of the *NSW Flood Policy* and *NSW Floodplain Development Manual (2005)*. In circumstances where there may be any inconsistency between the requirements contained in this Chapter and any other Chapter within this Development Control Plan, with regard to floodplain management, the provisions of this Chapter apply.

3.1.2.3 Relationship to other Chapters and Policies

This chapter is to be read in conjunction with other relevant Sections of this Development Control Plan.

3.1.2.4 Using this Chapter

The flow chart that follows has been prepared to assist in the use of this document:



3.1.3 APPLICATION REQUIREMENTS

3.1.3.1 Required Information

Development Applications for land subject to flood related development controls are to include the following information

a A survey plan indicating:

i the position of the existing building/s or proposed building/s;

ii the existing ground levels and features to Australian Height Datum around the perimeter of the site and contours of the site; and

iii the existing or proposed floor levels to Australian Height Datum.

b Applications for earthworks, filling of land, infrastructure and subdivision are to be accompanied by a survey plan (with a minimum contour interval of 0.25m) showing relative levels to Australian Height Datum.

c For large scale developments, or developments that in the opinion of Council are in critical situations, where an existing catchment based flood study is not available, a flood study prepared by a suitably qualified engineer using hydrologic and hydraulic dynamic one or two dimensional computer model may be required.

3.1.4 DEVELOPMENT PROVISIONS

3.1.4.1 Prescriptive Criteria

The Prescriptive Provisions shown within the following table indicate where flood related development controls:

- can be met through the implementation of provisions as indicated (yellow and numbered);
- are not required (shown in green)
- in the view of Council, cannot be met through the use of reasonable development controls and will require further justification to be supported - see Section 3.1.4.2 (shown in orange).

▪

Proposed Land use	Precinct 1 FPL to PMF	Precinct 2 Below FPL	Precinct 3 Flood Storage and Flow Paths (up to 10% AEP)	Precinct 4 High Hazard (up to 50% AEP)
1 Single Dwelling Houses		1, 9	2, 5, 7	
2 Agriculture & Recreation		2	2, 5, 7	
3 Sheds / Garages / ancillary Residential		1	2, 5, 7	
4 Commercial and Industrial Uses		2, 6		
5 Medium to High Density Residential				
6 Critical or Sensitive Facilities	3			
7 Land Subdivision	4			
8 Tourist Development				
9 Caravan parks - short-term sites		6	5, 6	
10 Permissible Earthworks		8		

	Flood related development controls do not apply
	Flood related development controls apply (refer to numbered prescriptive criteria below)
	If the proposal is to be pursued further, a performance based assessment is to be provided demonstrating that the proposed development is compatible with the flooding characteristics of the site (refer to Section 3.2 and Appendix C).

1 = (a) Assessment indicating that the proposal can meet the relevant requirements of the BCA.
(b) Consideration of the impacts of climate change.

2 = Joint report by a professional engineer who specialises in floodplain management and a professional engineer who specialises in civil engineering to certify that the development provides:
(a) Minimum Habitable Floor Levels = 1% AEP flood level plus 500mm freeboard (*Flood Planning Level*)
(b) Minimum Non-Habitable Floor Levels = 5% AEP flood level
(c) Minimum level requirements for electrical fittings, internal sewer fixtures, and external overflow gully risers apply as per Building Code of Australia
(d) Minimum levels of open car parking spaces, carports and driveways = 5% AEP flood level
(e) Mine subsidence allowance to be added to levels (a), (b), (c) & (d) above, if applicable.
(f) Low flood hazard access and egress for pedestrians during a 1% AEP flood to an appropriate area of refuge located above the Flood Planning Level.
(g) Low flood hazard emergency vehicle road access (Ambulance, SES, RFS) during a 1% AEP flood event.
(h) All proposed structural components that can withstand the forces of floodwater including hydrostatic pressure, hydrodynamic pressure, impact of debris and buoyancy forces up to the flood planning level.
(i) Building materials and surface finishes at or below the flood planning level are all capable of withstanding prolonged immersion in water.

(j) Negligible flood affectation elsewhere in the floodplain for a full range of flood events up to the 1% AEP flood event, having regard to: a) loss of flood storage, b) changes in flood levels, flows and velocities upstream, downstream and adjacent to the site, c) cumulative impact of multiple development in the vicinity.
(k) Consideration of the impacts of climate change.

3 = Joint report by a professional engineer who specialises in floodplain management and a professional engineer who specialises in civil engineering to certify that the development provides:
(a) Minimum floor levels = PMF level plus mine subsidence allowance, if applicable.
(b) Low flood hazard access and egress for pedestrians during a PMF flood to an appropriate area of refuge located above the PMF.
(c) Low flood hazard emergency vehicle road access (Ambulance, SES, RFS) during a PMF flood event.
(d) Consideration of the impacts of climate change.

4 = Joint report by a professional engineer who specialises in floodplain management and a professional engineer who specialises in civil engineering to certify that the development provides:
(a) Minimum height of building footprints, open car parking areas, driveways and new public roads = 5% AEP flood level plus mine subsidence allowance, if applicable
(b) Low flood hazard access and egress for pedestrians during a 1% AEP flood to an appropriate area of refuge located above the Flood Planning Level.
(c) Low flood hazard emergency vehicle road access (Ambulance, SES, RFS) during a 1% AEP flood event.
(d) Risk assessment of flood hazard during a PMF flood event; including consideration of changes to flood behaviour, and location of floodways, to ensure that the consequences of the increased flood hazard are acceptable and manageable.
(e) Negligible flood affectation elsewhere in the floodplain for a full range of flood events up to the PMF, having regard to: a) loss of flood storage, b) changes in flood levels, flows and velocities upstream, downstream and adjacent to the site, c) cumulative impact of multiple development in the vicinity.
(f) Consideration of the impacts of climate change.

5 = No filling allowable apart from area of building footprint, open car parking areas and driveway

6 = Joint report by a professional engineer who specialises in floodplain management and a professional engineer who specialises in civil engineering to include:
(a) An Evacuation Plan demonstrating that permanent, failsafe, and maintenance free measures are incorporated in to the development to ensure the timely and safe evacuation of people from the development in a 1% AEP Flood event, without significant cost or risk added to emergency services personnel. Signage of the plan must be prominently displayed around the development.

7 = Maximum size of ancillary structure is $50m^2$. Appropriate signage on a minimum of one prominent internal or external wall indicating flood hazard of the area. Sign to be a minimum size 600mm x 600mm.

8 = Report by a professional engineer who specialises in floodplain management to certify that the development provides: Negligible flood affectation elsewhere in the floodplain for a full range of flood events up to the 1% AEP flood event, having regard to: a) loss of flood storage, b) changes in flood levels, flows and velocities upstream, downstream and adjacent to the site, c) cumulative impact of multiple development in the vicinity.

9 = Where a proposal involves the use of the dwelling is for short term rental accommodation, an Evacuation Plan demonstrating the timely and safe evacuation of people from the development in a

1% AEP Flood event, without significant cost or risk added to emergency services personnel is to be provided. Signage of the plan must be prominently displayed around the development.
Note: this provision also applies to any lawfully approved dwellings located on the floodplain where approval for use as short-term rental accommodation is considered appropriate.

3.1.4.2 Performance Based Assessment

Council will consider development proposals that do not meet the prescriptive requirements of this DCP only if a report prepared by a suitably qualified engineering professional accompanies the application and addresses the following:

a is compatible with the established flood hazard of the land. In areas where flood hazard has not been established through previous studies or reports, the flood hazard must be established in accordance with the Floodplain Development Manual.

b will not significantly adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other development or properties;

c incorporates appropriate measures to manage risk to life and property from flood;

d will not significantly adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses;

e is not likely to result in unsustainable social and economic costs to the community as a consequence of flooding.

f is consistent with the principles of Ecologically Sustainable Development.

g adequately considers the impact of climate change.

i It is to be noted that with regard to climate change, appropriate benchmarks based on the best available current information have been used in producing the flood risk management studies and plans that inform this document.

ii Some prescriptive requirements such as flood planning level requirements may be relaxed if Council can be satisfied that the projected life of the proposed development is for a relatively short-term and therefore does not warrant the imposition of controls that consider impacts beyond the cessation of the proposed development. This will only be considered for uses where the residual risk to the occupation of the development is considered to be low. This may include certain temporary or demountable structures but would not include residential developments.

Note 1: The information listed above can be used to justify minor variations to the prescriptive provisions. Appendix C provides further detail with regard to applying the Performance Criteria mentioned above and will need to be addresses in full for large scale proposals and/or significant variations.
Note 2: The prescriptive controls have been developed to ensure that proposals that meet the requirements of the relevant Prescriptive Control Schedule will meet the objectives of this Plan. A performance based assessment is likely to involve the submission of independent studies and reports. It is recommended that you should discuss the level of detail required and the likelihood of achieving a successful outcome using a performance based assessment with Council staff using the pre-application process prior to making any decision to purchase and/or develop flood prone land

3.1.4.3 Building Design Considerations

In any case, building design, whether relying on the Prescriptive Controls or Performance Criteria, should not result in significant impacts upon the amenity of an area by way of:

a overshadowing of adjoining properties that does not meet the requirements of the relevant development controls adopted by Council;

b privacy impacts (e.g. by unsympathetic house-raising);

c being incompatible with the streetscape or character of the locality. A request to raise the overall building height to beyond the prescribed building heights to achieve the appropriate minimum floor level will not be considered adequate. Building design is to be appropriate to the constraints of the site;

d filling of land to permit the construction of a building that has not been specifically designed in consideration with conditions that may be experienced on the floodplain. Slab on ground construction is generally not considered appropriate on a floodplain.

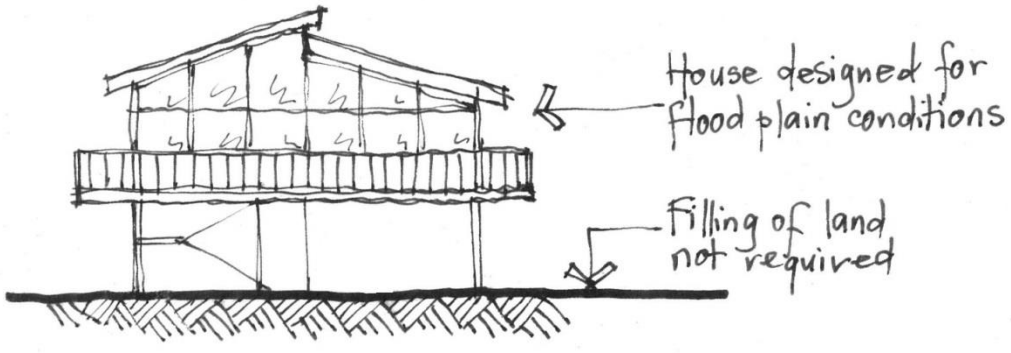


Figure 2 Floodplain development (where considered acceptable)

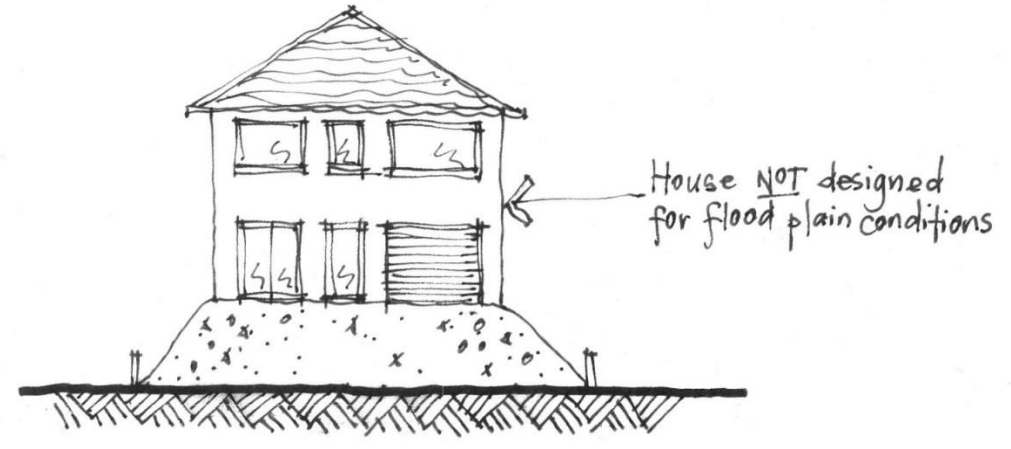


Figure 3 Inappropriate floodplain development

3.1.4.3 Concessional Development – Minor Additions

a Council acknowledges that in some instances, relatively minor building additions will have a minimal impact on the floodplain and will not present an unmanageable risk to life. Council will give consideration for the following forms of development on suitable sites:

i single dwelling house additions of up to 40m^2 of habitable floor area at or above the same level as the existing adjoining approved floor level for habitable floor area. The allowance for additions shall be made no more than once for any given development. Proposals for dwelling additions that exceed 40m^2 of habitable floor area are to refer to the provisions for single dwellings under Section 3.1;

ii additions to Commercial and Industrial Uses of up to an additional 100 m^2 or 20% (whichever the less) of the Gross Floor Area of the existing building at no less than the same level as the existing adjoining approved floor level. The allowance for additions shall be made no more than once for any given development. Proposals for additions that exceed 100 m^2 or 20% (whichever the less) of the Gross Floor Area are to refer to the provisions for commercial and industrial uses under Section 3.1;

b Any proposal to be considered as concessional development must:

i be supported with appropriate information at the development application stage that the proposed development can meet the requirements of the Building Code of Australia.

Note: The additional costs in achieving the requirements of the BCA for development below the flood planning level needs to be considered by the proponent prior to the submission of a Development Application.

ii comply with Section 3.3– Building Design Considerations, Section 4 – General Requirements, and any other relevant provisions of the DCP.

b As part of any consent issued pursuant to this Section Council may require:

i a restriction on use placed on the property title limiting the further development of the site ;

ii the existing development to be suitably upgraded to address the potential impacts of flooding.

Note: Due to concerns for safety and the consequences of prolonging poor land use practices, concessional development or other site redevelopment will not be supported within High Hazard areas

3.1.5 GENERAL REQUIREMENTS

The following ancillary development issues are to be considered in the assessment of proposed development of flood prone land.

3.1.5.1 Requirements for Fencing

OBJECTIVES

To ensure that fencing does not result in any significant obstruction to the free flow of floodwaters

To ensure that fencing will remain safe during floods and not become moving debris that potentially threatens the security of structures or the safety of people

REQUIREMENTS

a Fencing is to be constructed in such a manner that it will not modify the flow of floodwaters or cause damage to surrounding land.

b Fencing construction is to withstand flood waters including debris loads.

3.1.5.2 Requirements for Car Parking

OBJECTIVES

To minimise the damage to motor vehicles from flooding

To ensure that motor vehicles do not become moving debris during floods, which threaten the integrity or blockage of structures or the safety of people, or damage other property

To minimise risk to human life from the inundation of basement and other car park or driveway areas

REQUIREMENTS

a The proposed car park should not increase the risk of vehicle damage by flooding inundation. Any car park is to allow for a maximum of 300mm still water flood water depth unless otherwise provided through a flood study.

b The proposed garage/car park should not increase the likelihood of flooding on other developments, properties or infrastructure.

c Open car parking - The minimum surface level of open space car parking subject to inundation should be designed having regard to vehicle stability in terms of depths and velocity during inundation by flood waters.

3.1.5.3 Requirements for Filling of Flood Prone Land

OBJECTIVE

To ensure that any filling of land that is permitted as part of a development consent does not have a negative impact on the floodplain

REQUIREMENTS

a Filling for any purpose (including the raising of a building platform in flood-prone areas) is not permitted in areas identified as Flood Planning Precinct 3 or Flood Planning Precinct 4, unless a Floodplain Risk Management Plan for the catchment has been adopted which allows filling to occur. In Flood Planning Precinct 2, filling will not be permitted unless a report from a suitably qualified engineer has been submitted and approved by Council that certifies that the development will not increase flood affectation elsewhere.

b Filling of individual sites in isolation, without consideration of the cumulative effects is not permitted. Any proposal to fill a site must be accompanied by an analysis of the effect on flood levels of similar filling of developable sites in the area. This analysis would form part of a flood study prepared by a suitable qualified professional.

3.1.5.4 Requirements for On-Site Sewer Management

OBJECTIVES

To prevent the spread of pollution from on-site sewage management systems during periods of flood

To assist in the ongoing operation of on-site sewage management systems during periods of flood

REQUIREMENTS

a The treatment tank/holding device is to be located above the 1% AEP flood contour.

b The land application area is to be above that 5% AEP flood contour except in water catchment areas where systems are not to be located on land below the 1% AEP flood contour.

c Refer to Chapter 3.3 On-Site Sewer Management for guidance with regard to this form of application.

3.1.5.5 Requirements for the Storage of Hazardous Substances

OBJECTIVE

To prevent the potential spread of pollution from hazardous substances

REQUIREMENT

The storage of products which, in the opinion of Council, may be hazardous or pollute floodwaters, must be placed at a minimum of 500 mm above the height of the 1% AEP flood or placed within an area protected by bunds or levees such that no flood waters can enter the bunded area if the flood level rose to a level of 500 mm above the height of the 1% AEP flood.

APPENDIX A LAND USE CATEGORIES

Refer to Council's website to view Council's LEP and Land Use Matrix for further information.
Note: Contact Council if a land use is not listed below due to Standard Instrument or Council LEP changes.

1 **Single Dwellings Houses:** dwelling houses, exhibition homes *(Note: one dwelling per existing residential lot only)*

2 **Agriculture and Recreation:** agriculture, farm buildings, recreation area, stock and sales yard, environmental facility,

3 **Shed and Garages, ancillary residential development** *(Note: ancillary residential development includes swimming pools, cabanas, gazebos and similar structures)*

4 **Commercial and Industrial Uses:** amusement centre, animal boarding and training establishment, boat building and repair facilities, car parks, cemetery, charter and tourism boating facilities, commercial premises, community facilities, crematorium, depot, entertainment facility, freight transport facility, function centre, industries, health consulting rooms, health service facility (excluding patient transport facilities and hospitals), highway service centre, industrial retail outlet, industrial training facility, information and education facility, marinas, medical centre, mortuaries, passenger transport facilities, place of public worship, port facilities, public administration buildings (not occupied by emergency services organisations), recreation facilities(all), registered club, research station, restricted premises, rural industry (excluding stock and sales yards), service station, storage premises, sex services premises, toilet & amenities blocks, transport depot, truck depot, vehicle body repair workshop, vehicle repair station, veterinary hospital, warehouse or distribution centre, waste or resource management facility, wholesale supplies

5 **Medium to High Density Residential:** attached dwelling, boarding house, caravan parks (long term) sites), dual occupancy, exhibition village, manufactured home estates, multi dwelling housing, residential flat buildings, rural workers dwelling, secondary dwelling, semi-detached dwelling, shop-top housing.

6 **Critical Infrastructure and Facilities:** airstrip, air transport facilities, electricity generating works, emergency service facility, helipad, hospital, public administration buildings (occupied by emergency services organisations), public utility undertaking, sewerage system, water supply system

Sensitive Uses and Facilities: child care centre, correctional centre, educational establishment, group homes, home based child care, hostel, respite day care centre, seniors housing

7 **Land Subdivision – Torrens Title** *(Note: Does not include Community and Strata Subdivision or Subdivision of approved residential development)*

8 **Tourist Development:** camping grounds, eco-tourist facilities, tourist and visitor accommodation *(Note: Does not include short-term rental accommodation)*

9 **Caravan parks – short term accommodation**

10 **Permissible Earthworks:** environmental protection works, flood mitigation works

11 **Not Listed – Merit Assessment:** forestry, home business, home occupation, home occupation (sex services), wharf or boating facility, signage, boat launching ramp, boat sheds, charter or tourism boating facilities, environmental facilities, jetties, mooring, mooring pens, water recreation structure, extractive industries, , open cut mines

APPENDIX B FLOOD COMPATIBLE MATERIALS

Component	Flood Compatible Material
Flooring and Sub-floor	▪ Concrete slab-on-ground monolith construction ▪ Suspended reinforced concrete slab
Wall Structure	▪ Solid brickwork, blockwork, reinforced, concrete or mass concrete
Wall and Ceiling Linings	▪ Fibro-cement board ▪ Brick, face or glazed ▪ Clay tile glazed in waterproof mortar ▪ Concrete ▪ Concrete block ▪ Steel with waterproof applications ▪ Stone, natural solid or veneer, waterproof grout ▪ Glass blocks ▪ Glass ▪ Plastic sheeting or wall with waterproof adhesive
Roof Structure	▪ Reinforced concrete construction ▪ Galvanised metal construction
Doors	▪ Solid panel with water proof adhesives ▪ Flush door with marine ply filled with closed cell foam ▪ Painted metal construction ▪ Aluminium or galvanised steel frame
Insulation	▪ Closed cell solid insulation ▪ Plastic/polystyrene boards
Windows	▪ Aluminium frame with stainless steel rollers or similar corrosion and water resistant material.
Nails, Bolts, Hinges and Fittings	▪ Brass, nylon or stainless steel ▪ Removable pin hinges ▪ Hot dipped galvanised steel wire nails or similar
Main Power Supply	▪ Subject to the approval of the relevant authority the incoming main commercial power service equipment, including all metering equipment, shall be located above the designated flood level. Means shall be available to easily disconnect the dwelling from the main power supply.

Component	Flood Compatible Material
Wiring	▪ All wiring, power outlets, switches, etc., should be located above the designated flood level. All electrical wiring installed below this level should be suitable for continuous underwater immersion and should contain no fibrous components. ▪ Earth leakage circuit-breakers (core balance relays) or Residual Current Devices (RCD) must be installed. ▪ Only submersible type splices should be used below maximum flood level. ▪ All conduits located below the relevant designated flood level should be so installed that they will be self-draining if subjected to flooding.
Electrical Equipment	▪ All equipment installed below or partially below the designated flood level should be capable of disconnection by a single plug and socket assembly.
Heating and Air Conditioning Systems	▪ Heating and air conditioning systems should be installed in areas and spaces of the house above the designated flood level.
Fuel storage for heating purposes	▪ Heating systems using gas or oil as a fuel should have a manually operated valve located in the fuel supply line to enable fuel cut-off. ▪ The heating equipment and related fuel storage tanks should be mounted on and securely anchored to a foundation pad of sufficient mass to overcome buoyancy and prevent movement that could damage the fuel supply line. The tanks should be vented to an elevation of 600 millimetres above the designated flood level.
Ducting for heating/cooling purposes	▪ All ductwork located below the relevant flood level should be provided with openings for drainage and cleaning. Self-draining may be achieved by constructing the ductwork on a suitable grade. Where ductwork must pass through a water-tight wall or floor below the relevant flood level, a closure assembly operated from above relevant flood level should protect the ductwork.

Note: Materials not listed may be accepted by council subject to certification of the suitability of the material of the manufacturer to withstand immersion for up to 96 hours

APPENDIX C - DETAILED ASSESSMENT CRITERIA

a **Compatibility with established Flood Hazard / Flooding Impacts and Behaviour:**

i impact of flooding and flood liability is to be managed ensuring the development does not divert floodwaters or interfere with flood storage or natural function of the waterway;

ii flood behaviour (for example, flood depths reached, flood flow velocities, flood hazard, rate of rise of floodwater);

iii duration of flooding for a full range of events;

iv appropriate flood mitigation works;

v freeboard;

vi Council's duty of care – proposals to addressed or limit;

vii depth and velocity of flood waters for relative flood event;

Impact on other land / Cumulative Effects of the Development:

viii development should not detrimentally increase the potential flood affectation on other development or properties or infrastructure, either individually or in combination with the cumulative impact of development that is likely to occur in the same floodplain;

ix cumulative effects of the development and precedents created for further cumulative development.

Manage Risk to Life:

x the proposed development should not result in any increased risk to human life;

xi controls for risk to life for floods up to the Flood Planning Level;

xii controls for risk to life for floods greater than the Flood Planning Level;

xiii existing floor levels of development in relation to the Flood Planning Level and floods greater than the Flood Planning level;

xiv Council's duty of care – Proposals to address and limit;

xv what level of flooding should apply to the development e.g. 1 in 20 year, etc;

xvi effective flood access and evacuation issues;

xvii flood readiness – Methods to ensure relative flood information is available to current and future occupants and visitors;

xviii where appropriate existing information does not exist, a site specific Flood Risk Assessment in support of the application addressing the requirements of the NSW Flood Policy and NSW Floodplain Development Manual 2005. These documents are available from the NSW Department of Environment, Climate Change and Water website. http://www.environment.nsw.gov.au/floodplains/manual.html.

Warning and Evacuation:

xix available effective warning time and reliable access for the evacuation of an area potentially affected by floods;

xx evacuation should be consistent with any relevant or flood evacuation strategy where in existence;

xxi depth and velocity of flood waters for relative flood event;

xxii Council's duty of care – proposals to addressed or limit;

xxiii what level of flooding should apply to the development e.g. 1 in 20 year, etc;

xxiv effective flood access and evacuation issues;

xxv flood readiness – methods to ensure relative flood information is available to current and future occupants and visitors.

Environmental Impacts:

xxvi will not significantly adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.

The Cost:

xxvii the additional economic and social costs that may arise from damage to property from flooding should not be greater than that which can reasonably be managed by the property owner and general community;
xxviii land values and social equity – effect both negative and positive – e.g. development increasing land values, restrictions decreasing land values, etc;
xxix future development (specifically, the ability of the community and individuals to recover from flood events);
xxx economic factors both in regard to doing and not doing the development;
xxxi social issues;
xxxii servicing the development safely in flood e.g. potable water, sewer, etc.

Ecological Sustainable Development:

Proposed development must be consistent with ESD principles including but not limited to:

xxxiii intergenerational equity – namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations;
xxxiv the precautionary approach - namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;
xxxv biodiversity conservation - namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration;
xxxvi improved valuation, pricing and incentive mechanisms - namely, that environmental factors should be included in the valuation of assets and services.

Further information regarding ESD principals may be sourced from the Environmental Planning and Assessment Regulations 2021.

xxxvii must be addressed;
xxxviii land availability;
xxxix land values and social equity – both positive and negative;
xl social issues;
xli environmental issues;
xlii cultural issues.

Climate Change:

xliii the proposal adequately considers the impact of climate change. It is to be noted that with regard to climate change appropriate benchmarks based on the best available current information have been used in producing the flood risk management studies and plans that inform this document.

Emergency Services

xliv development will not unduly increase dependency on emergency services.

APPENDIX D - GLOSSARY

Note: Generally, the terms used in this Chapter have the same meaning as those terms are defined within the Floodplain Development Manual and Central Coast Local Environmental Plan 2022. Where a term is defined within the LEP, it is not repeated here. The following additional terms are relevant to this Chapter:

Annual Exceedance Probability (AEP) means the chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage.

Australian Height Datum (AHD) is a common national plan of level corresponding approximately to mean sea level.

Average Recurrence Interval (ARI) means the long-term average number of years between the occurrence of a flood as big as, or larger than, the selected event. For example, floods with a discharge as great as, or greater than, the 20 year ARI flood event may occur on average once every 20 years.

basement car parking means the car parking area generally below ground level or above natural ground level but enclosed by bunding, where inundation of the surrounding areas may raise water levels above the entry level to the basement, resulting in inundation. Basement car parks are areas where the means of drainage of accumulated water in the car park has an outflow discharge capacity significantly less than the potential inflow capacity.

caravan parks

long-term site means a dwelling site that is specified in the approval for a caravan park as being a long-term site.

short-term site means a dwelling site on which a moveable dwelling that is ordinarily used for holiday purposes may be installed and that is specified in the approval for a caravan park as being a short-term site.

carport is a structure used to house motor vehicles, which has a minimum of two sides "open" and not less than one third of its perimeter "open".

defined flood level - referred to in the Building Code of Australia, is taken to be equivalent to being equivalent to flood planning level for residential development.

development site – for the purposes of this document the area of land where works or structures will be located following the completion of the development.

effective warning time is the time available after receiving advice of an impending flood and before the floodwaters prevent appropriate flood response actions being undertaken. The effective warning time is typically used to raise furniture, evacuate people and transport their possessions.

evacuation is the transfer of people and or stock from areas where flooding is likely, either close to, or during a flood event. It is affected not only by warning time available, but also the suitability of the road network, available infrastructure, and the number of people that have to evacuate during floods.

extreme flood means an estimate of the probable maximum flood (PMF), which is the largest flood that could conceivably occur at a particular location, generally estimated from the probable maximum precipitation (PMP). Generally it is not physically or economically possible to provide complete protection against this event.

flood is a relatively high stream flow that overtops the natural or artificial banks in any part of a stream, channel, river, estuary, lake or dam, and/or local overland flooding associated with major drainage as defined by the NSW Floodplain Development Manual (FDM) before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences excluding tsunami.

flood compatible materials include those materials used in building which are resistant to damage when inundated. A list of flood compatible materials is attached.

flood evacuation strategy means the proposed strategy for the evacuation of areas with effective warning time during periods of flood as specified within any policy of Council, the floodplain risk management plan (FRMP), the relevant state government disaster plan, by advices received from the State Emergency Services (SES) or as determined in the assessment of individual proposals.

floodplain means the area of land which is subject to inundation by floods up to and including the probable maximum flood (PMF) event.

Floodplain Development Manual (FDM) refers to the document dated April 2005, published by the New South Wales Government and entitled 'Floodplain Development Manual: the management of flood liable land'.

flood planning area the area of land below the FPL and thus subject to flood related development controls.

Flood Planning Level (FPL) are the combinations of flood levels and freeboards selected for floodplain risk management purposes, as determined in management studies and incorporated in management plans.

Flood Planning Precinct (FPP) – mapped areas of flood prone land that have been established considering the overall impact of flooding. In assessing the flood environment, elements such as known flood behaviour, evacuation issues and site access are used.

Floodplain Risk Management Plan (FRMP) means a plan prepared for one or more floodplains in accordance with the requirements of the FDM or its predecessor.

Floodplain Risk Management Study (FRMS) means a study prepared for one or more floodplains in accordance with the requirements of the FDM or its predecessor.

flood storage means those parts of the floodplain that are important for the temporary storage of floodwaters during the passage of a flood.

floodway means those areas, often aligned with obvious naturally defined channels, where a significant discharge of water occurs during floods. They are also areas where, if only partially blocked, will cause a significant redistribution of flood flow or significant increase in flood levels, which many impact on other properties.

freeboard is a factor of safety expressed as the height above the design flood level. Freeboard provides a factor of safety to compensate for uncertainties in the estimation of flood levels across the floodplain, such as wave action; localised hydraulic behaviour and impacts that are specific event related, such as levee and embankment settlement; cumulative impacts of fill in floodplains and other effects such as changes in rainfall patterns as a result of climate change.

garage (private) – a building or part of a building used to park or keep a motor vehicle and that is not defined as a carport or car park.

habitable floor area means:

in a residential situation: a living or working area, such as a lounge room, dining room, rumpus room, kitchen, bedroom or workroom;

in an industrial or commercial situation: an area used for offices or to store valuable possessions susceptible to flood damage in the event of a flood.

hazardous materials are solids, liquids, or gases that can harm people, other living organisms, property, or the environment. These may include materials that are radioactive, flammable, explosive, corrosive, oxidizing, asphyxiating, bio-hazardous, toxic, pathogenic, or allergenic. Also included are physical conditions such as compressed gases and liquids or hot materials, including all goods containing such materials or chemicals, or may have other characteristics that render them hazardous in specific circumstances.

large scale development is (for the purposes of this document) a proposal that involves site disturbance 2500m^2 of land or greater.

local overland flooding means inundation by local runoff rather than overbank discharge from a stream, river, estuary, lake or dam.

Probable Maximum Flood (PMF) is the largest flood that could conceivably occur at a particular location, usually estimated from probable maximum precipitation.

Probable Maximum Precipitation (PMP) is the greatest depth of precipitation for a given duration meteorologically possible over a given size storm area at a particular location at a particular time of the year, with no allowance made for long-term climatic trends (World Meteorological Organisation, 1986). It is the primary input to the estimation of the probable maximum flood.

reliable access during a flood means the ability for people to safely evacuate an area subject to imminent flooding within effective warning time, having regard to the depth and velocity of flood waters, the suitability of the evacuation route, and without a need to travel through areas where flood hazard increases.

Section 10.7 Planning Certificate provides information, including the statutory planning controls that apply to a parcel of land on the date the certificate is issued.

shed – for the purpose of this chapter includes machinery sheds, garden and storage sheds but does not include a garage or car park.

suitably qualified engineer is an engineer who is included in the National Professional Engineers Register, administered by the Institution of Engineers Australia.

survey plan is a plan prepared by a registered surveyor which shows the information required for the assessment of an application in accordance with the provisions of this Policy

PART C: SOUTHERN AREA WATERCYCLE MANAGEMENT (FORMER GOSFORD LGA)

3.1.6 PURPOSE

The purpose of this plan is to minimise the impact of development on the natural predevelopment water cycle. This will lead to more sustainable outcomes that will protect the environment.

The water cycle (or hydrological cycle) refers to all the processes and forms that water undertakes as it is used within the built and natural environment. Important water aspects include:

- Stormwater (including groundwater)
- Water-borne pollutants
- Wastewater
- Flood waters
- Water supply
- Water dependant ecosystems

This chapter of the DCP has been prepared to facilitate the application of the following principles of Water Sensitive Urban Design (WSUD), Integrated Water Cycle Management (IWCM) and Flood Mitigation in the LGA:

1. Maintain and restore natural water balance whilst reducing the cost of providing and maintaining water infrastructure in a sustainable and efficient manner.

2. Reduce risk to life and damage to property by restricting and controlling building and other development so that it minimises risks to residents and those involved in rescue operations during floods.

3. Reduce nuisance and high level flooding and the cost of providing and maintaining flood mitigation infrastructure whilst improving water quality in streams and groundwater.

4. Reduce potable water demand by using stormwater as a resource.

5. Protect and enhance natural water systems (creeks, rivers, wetlands, estuaries, lagoons and groundwater systems).

6. Protect and enhance the water quality, by improving the quality of stormwater runoff from the urban catchments.

7. Integrate stormwater management systems into the landscape in a manner that provides multiple benefits, including water quality protection, stormwater retention and detention, public open space and recreational and visual amenity.

3.1.7 OBJECTIVES

The objectives of this chapter are to:

- Provide direction and advice to applicants in order to facilitate WSUD,IWCM and Flood Mitigation within the development application process
- Provide design principles that will assist development to meet the purpose of this chapter of the DCP
- Provide objectives and performance targets for specific water management elements including water conservation, retention / detention, stormwater quality, and flooding caused by Local Overland Flooding, Mainstream Flooding or Storm Surge

3.1.8 RELATIONSHIP TO OTHER PLANS

This chapter of the DCP is to be read in conjunction with:

- *Gosford City Council Water Cycle Management Guidelines.*
- *State Environmental Planning Policy - Building Sustainability Index: (BASIX) 2004*
- *NSW Government Floodplain Development Manual.*
- *Water Management Act 2000*.

3.1.9 BACKGROUND

Urbanisation has led to increased stormwater flows in urban creeks and the consequent impact on flooding, creek degradation and public safety.

Stormwater management has traditionally been focused on conveying stormwater runoff safely away from developed areas through pipes and drains. With progressive development, natural waterways in urbanising catchments have become increasingly taxed in their ability to convey the significant increases in quantity and rate of stormwater runoff generated, with bank erosion and increased frequency of flooding the obvious symptoms (ARQ 2006, p.1-1). Continued increase in the size of pipes and channels is not ecologically sustainable or financially sustainable, and it can lead to even greater levels of hazard.

In recognition of this issue Council has adopted Water Sensitive Urban Design (WSUD) as a new way of thinking for managing stormwater management (Argue 2004). It recognises:

- Flooding and stormwater runoff that can cause risk to life and damage to property, as the issue of first importance.
- Rainfall mobilises significant quantities of sediment, heavy metals, hydrocarbons and nutrients, which must be appropriately managed before it enters urban waterways and recreational receiving waters.
- Stormwater runoff is a valuable, readily available resource, which, when properly managed, can replace significant quantities of mains water.

Fundamental to the principles of WSUD is that of source control of stormwater. It is through controlling stormwater runoff at the source, whether that source is the massive roof area of a commercial development or the carriageway of a major road or the site of a typical residential development, that the objectives of WSUD are achieved.

This plan seeks to use source control to replicate, as practically as possible, the pre-development water cycle of the development site. The objective is to retain part of the runoff from rainfall events on site and redirect it to better mimic the natural water cycle. The retained water can be redirected for domestic use, industrial use, or the natural processes of infiltration, percolation, evaporation, or transpiration. The remaining surface

runoff leaving the development site will then better mimic the predevelopment runoff in terms of quantity, rate and water quality.

Water cycle management focus changes depending on the size or frequency of storm events, as shown below in Figure 1, which provides the scope for this plan.

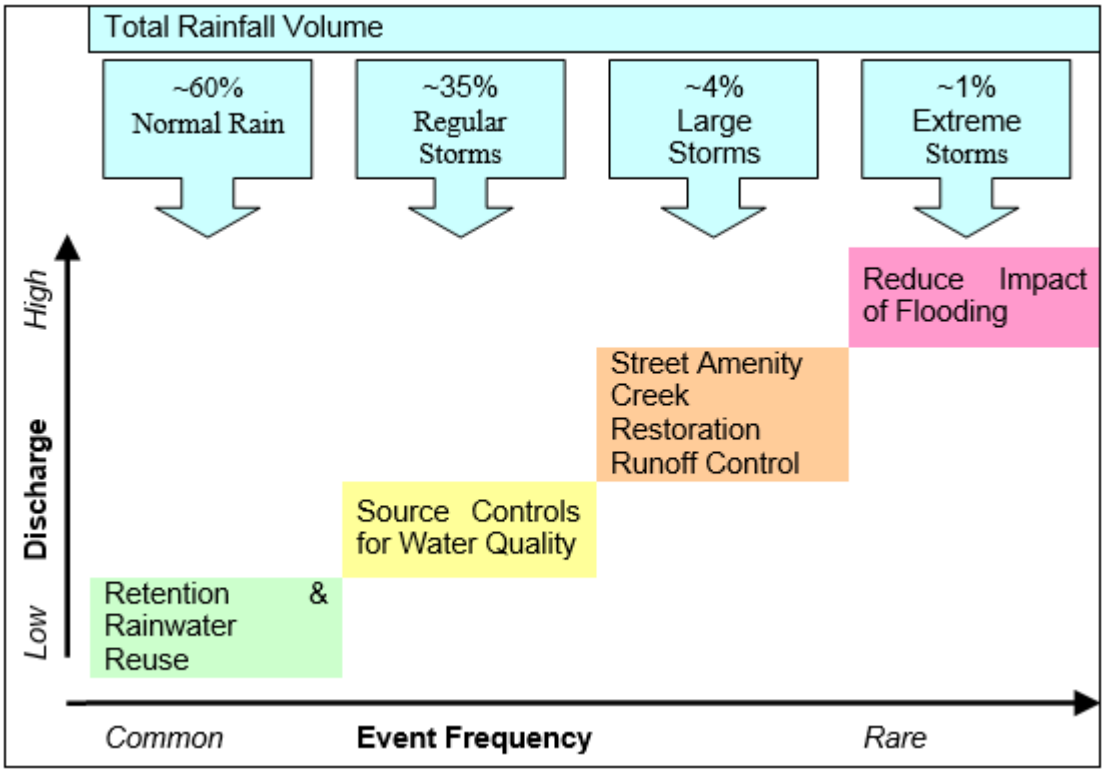


Figure 1 - Water Cycle Management Focus Areas

3.1.10 WATER CYCLE MANAGEMENT PLAN

3.1.10.1 Intent

All developments that require consent will be required to demonstrate compliance with the targets in Table 1.

Table 1 Development Control Targets Matrix

Development Control Targets	Development Types						
	Pools & Spas	Alterations & Additions in excess of 50m²	Single Dwellings & Dual Occupancy	Medium and High Density Residential Development	Group homes, seniors housing, emergency facilities	Commercial, Industrial	Subdivisions (Urban & Rural)
Water Conservation	Covered by BASIX					✓	x
Retention	✓	✓	✓	✓	✓	✓	✓
Stormwater Quality	x	x	✓	✓	✓	✓	✓
Onsite Detention	x	x	x	✓	✓	✓	✓
Local Overland Drainage	✓	✓	✓	✓	✓	✓	✓
Flooding	✓	✓	✓	✓	✓	✓	✓

3.1.10.2 Objective

The Water Cycle Management Plan (WCMP) is required for all developments with the exception of exempt developments and is to demonstrate compliance with the development control targets listed in Table 1 and described throughout this chapter.

3.1.10.3 Application Requirements

Applicants are encouraged to discuss development proposals with Council's Development Assessment staff at an early concept stage, prior to lodgement of a development application. This pre-lodgement discussion will assist in identifying and addressing any matters that may otherwise increase processing time. The following matters are to be taken into consideration during the preparation of WCMPs:

- safety – public safety and WH&S considerations; and
- maintenance – development of maintenance and monitoring regime for the management of WSUD elements.

Requirements for Water Cycle Management information required in support of a Development Application vary for different scales of proposed development, and the mechanism or approach adopted in the determination of management elements required to comply with applicable development control targets. The options available to proponents of different types / scales of development are described below.

Type 1 - Smaller Scale Developments

Type 1 - Smaller Scale Developments includes the following development:

- Alterations, additions, ancillary structures & second storey additions with regard to all works to any existing building or development where the net proposed development area is equal to or greater than 50m^2 for other than exempt development. After 01/03/2007 (date of operation of the superseded DCP 165 - Water Cycle Management), each site will be restricted to a one-off development approval of less than 50m^2 not requiring rainwater tanks. Once the combined total of all applications submitted after the date of operation of this plan reaches 50m^2 then the requirements of this chapter of the DCP shall be applied.
- Single residential dwellings & dual occupancy
- Medium density or high density developments that create less than 10 dwellings or involve the development of 2000m^2 of land or less.
- Rural subdivisions that create less than 10 lots.
- Urban subdivisions that create less than 10 residential lots or involve the development of 2000m^2 of land or less.
- Industrial / Commercial Development that involves the development of 2000m^2 of land or less.

Proponents of developments in the Type 1 category are required to demonstrate compliance against applicable stormwater targets through one of the following options:

- adoption of Council's Deemed to Comply criteria, as outlined in Section 3.1.10.4 or
- submission of a detailed WCMP Strategy, as described in Section 3.1.10.5.

Type 2 - Significant Developments

Type 2 - Significant Development includes the following development:

- Medium density or high density developments that create equal to or more than 10 dwellings and / or involve the development of 2000m^2 of land or more.
- Rural subdivisions that create equal to or more than 10 lots.
- Urban subdivisions that create equal to or more than 10 residential lots and / or involve the development of 2000m2 of land or more.
- Industrial / Commercial developments including alterations or additions that exceed 2000m^2.

Development applications for all Type 2 developments require the preparation and submission to Council of a detailed WCMP Strategy. Guidance on the scope and content of a WCMP Strategy is presented in Section 3.1.10.5.

3.1.10.4 Deemed to Comply

Proponents of small-scale developments may avoid the requirement for site stormwater modelling by adopting one of the following 'deemed to comply' solutions

Standard Design Parameters for Deemed to Comply solutions

Standard design parameters for Deemed to Comply solutions are provided in the following chapter.

Supporting Information

If a deemed to comply solution is adopted, the following information (if applicable) should be submitted as part of the development application:

- Site plan showing roofed, other impervious areas, topography and the location of easements & underground services,
- Drainage plan showing catchments, drainage systems, and discharge point including calculations of runoff (with and without blockage),
- Overland runoff flow paths (across the site and beyond the site boundaries clearly shown)
- Setback distances from buildings to infiltration devices and drainage easements,
- Demonstrate setback distances from buildings to top of bank of creeks,
- Water Saving Target: demonstrate compliance
- Retention target: Show rainwater tank/s, infiltration devices, and any stormwater capture, storage and slow release devices (including a table showing sizes, and details for each, along with calculations which demonstrate achievement of stormwater capture volumes and replenishment times for each device and for the overall site.
- On Site Detention Target: Detail the OSD device including size, outlet control and configuration, along with calculations which demonstrate the achievement of the predevelopment peak flowrates
- Stormwater quality target: Show location of each landscaping pollution retention measure (including a table showing calculations, sizes, and details for each; along with a table showing calculations of the overall Site Discharge Index).
- Local Overland Drainage Target: Show raised floor levels, cut & fill, overland flow paths, and discharge points.
- Flooding Targets: Show details of applicable targets, including: floor levels, flood impacts, access & parking (if applicable).
- BASIX certificate for residential developments,
- for commercial and industrial sites a summary of water conservation measures to be applied on site, including an estimate of total water demands and expected savings associated with water conservation measures / alterative water sources , as well as detail on how water demands will be managed and monitored,
- plans and cross-sectional drawings of stormwater treatment systems, showing inlets, outlets and overflow points (these may be prepared from standard drawings, with site-specific levels and dimensions included).

Further assistance in the preparation of a Deemed to Comply Solution is outlined in this chapter of the DCP and contained within the supporting documents:

HECREMS (2007) Practice Notes

3.1.10.5 WCMP Strategy

Discussions with Council are encouraged at an early stage in the development application process to discuss and agree on the overall design approach before a detailed WCMP Strategy is prepared. The intent is to have the locality analysis available so that parameters can be agreed rather than providing the analysis only at the development application stage, thus saving time and costs associated with revisions and major modifications.

The aim of the consultation process is to provide direction and guidelines to the applicant, and to provide advice on Council's requirements. The level of consultation required will largely depend on the size and the complexity of the development.

Water Sensitive Urban Design Strategy

A WCMP Strategy is a written report and associated plans detailing potable water saving and stormwater /flooding management measures that are to be implemented on the site. The strategy is to include, at a minimum, the following detail:

- Background information- Summarise any background information available, including previous studies, concurrent studies, mapping data.
- Site context– identify catchments, drainage lines and receiving environments (both within and downstream of the site). Characterise the ecological values of the site and its receiving environments.
- Proposed development- Describe the proposed development at the site, including site boundaries, proposed land uses, densities, population, infrastructure, development staging.
- Water Cycle Management objectives- Identify the Water Cycle Management (including flooding / overland flow) objectives and targets that apply to the proposed development.
- Constraints and opportunities- Identify the key constraints and opportunities for water management on the site, including flooding. This should include the identification of natural watercourses and other sensitive environments within the site that should be preserved and/or remediated by the development.
- Best planning practices– the capital and life-cycle costs of infrastructure required to meet Water Cycle Management targets can be minimised by considering site planning opportunities early in the planning process.
- Water conservation- This section should demonstrate how the potable water conservation targets will be met, and how potable water will be supplemented with roofwater, treated stormwater and/or wastewater.
- Stormwater management- This section should demonstrate how the WCMP stormwater quality targets will be met. It should include stormwater quality and flow modelling results and identify the location, size and configuration of stormwater treatment measures proposed for the development.
- Integration with the urban design- The WCMP Strategy should outline how management elements will integrate with the urban design.
- Costs- Prepare capital and operation and maintenance cost estimates of proposed water cycle management measures. Both typical annual maintenance costs and corrective maintenance or renewal/adaptation costs should be included.
- Operation and Maintenance Plan– should outline inspection and maintenance requirements to ensure proposed measures remain effective.

Assistance in the preparation of a WCMP Strategy is contained within the supporting documents:

- *HECREMS (2007) Practice Notes*

Modelling parameters for the determination of the size and configuration of WSUD elements must be in accordance with the guidance titled:

- *MUSIC Modelling Guidelines for New South Wales* (eWater, 2009)

Guidance on meeting the DCP objectives is contained in the supporting technical guidelines:

- *Managing Urban Stormwater: Treatment Techniques* (IPWEA, 2008)
- *Australian Runoff Quality* (Engineers Australia, 2005)

3.1.11 DEVELOPMENT CONTROL TARGETS

3.1.11.1 Water Conservation Target

3.1.11.1.1 Intent

Reduce potable water demand by 40%

3.11.1.1.2 Recommended Application

Specify water saving devices and potable water substitution option, where applicable, for new developments.

3.11.1.1.3 Deemed to Comply

Any *SEPP BASIX 2004* (BASIX) affected development is to demonstrate compliance with BASIX. Further information on details of types of development requiring a BASIX Certificate or to produce a certificate for your proposed development go to www.basix.nsw.gov.au.

Developments not affected by BASIX: a water saving target of 40% (consistent with the BASIX requirement), this must include the following:

- Ensure any water use fittings demonstrate minimum standards defined by the Water Efficiency Labelling and Standards (WELS) Scheme. Minimum WELS ratings are:
- 4 star dual-flush toilets
- 3 star showerheads
- 4 star taps (for all taps other than bath outlets and garden taps)
- 3 star urinals
- Water efficient washing machines and dishwashers are to be used wherever possible.
- Incorporate dual reticulation for toilet flushing, laundry, irrigation. Development within the Gosford CBD will be required to provide dual plumbing throughout.

Example applications: Runoff recycling in nursery, Erina

Recycled greywater - water from showers is treated and reused for toilet flushing at Terrigal Surf Life Saving Club

Harvested stormwater used in public open space, Kogarah, Sydney

3.1.11.2 Retention Target

3.1.11.2.1 Intent

To mimic the natural catchment hydrology from all development sites, in terms of:

- Quantity: the annual volume of stormwater reaching natural creeks and waterways.
- Rate: the peak flow rates leaving the site
- Response: the time it takes for rain to runoff the site.

In technical terms the intent is to mimic the pre-development runoff losses such that the post-development and pre-development runoff hydrographs are similar in terms of volume, peak and shape for the full range of design events.

3.1.11.2.2 Objective

Capture and retain runoff from impervious surfaces (whether roof, paving or road carriageway), retain it for a relatively long time, and slowly release it elsewhere in the water cycle within 7 days.

3.1.11.2.3 Recommended Application

The Stormwater Retention Volume may be adapted to individual site constraints, provided that the required volume from all impervious areas is captured before leaving the site. Management of captured stormwater will involve:

- Rainwater capture (from roof areas), storage (in rainwater tanks) and reuse (for domestic or industrial purposes)
- Stormwater capture (from external impervious areas), storage (in landscaping features, such as terraced gardens, bioretention - raingardens, or stormwater tanks) and slow release (through the natural processes of infiltration, percolation, evaporation, or transpiration)

3.1.11.2.4 Deemed to Comply

Show on the Water Cycle Management Plan the Stormwater Retention Volume, which can be calculated by the formula below, or interpolated from Table 2, with the exception of pools and outdoor spas.

$V = 0.01A(0.02F)^2$ V = Stormwater Retention Volume (m^3)

A = Total Site Area (m^2)

F = Fraction Impervious (%)

Show locations of each rainwater or stormwater capture device to treat each impervious area (whether rainwater tanks, stormwater tanks, raingardens, or soak away areas). Overflows from each device should preferably be via a suitably designed "natural" overland flow path.

Include a table summarizing sizes and details for each, along with calculations which demonstrate achievement of stormwater capture volumes and replenishment times for each device and for the overall site. Refer to example retention calculations below.

Installation of following require:

- a pool only - rainwater tank with a minimum volume of 2.0m^3 (2000L).
- an outdoor spa - rainwater tank with a minimum volume of 1.0m^3 (1000L)
- a pool and an outdoor spa - rainwater tank with a minimum 2.5m^3 (2500L)hav

Table 2 Stormwater Retention Volume Target (m^3)

Total Site Area (m^2)	Fraction Impervious (%)										
50000	0	20	80	180	320	500	720	980	1280	1620	2000
10000	0	4.0	16	36	64	100	144	196	256	324	400
5000	0	2.0	8.0	18	32	50	72	98	128	162	200
2000	0	0.8	3.2	7.2	13	20	29	39	51	65	80
1500	0	0.6	2.4	5.4	9.6	15	22	29	38	49	60
1000	0	0.4	1.6	3.6	6.4	10	14	20	26	32	40
900	0	0.4	1.4	3.2	5.8	9.0	13	18	23	29	36
800	0	0.3	1.3	2.9	5.1	8.0	12	16	20	26	32
700	0	0.3	1.1	2.5	4.5	7.0	10	14	18	23	28
600	0	0.2	1.0	2.2	3.8	6.0	8.6	12	15	19	24
500	0	0.2	0.8	1.8	3.2	5.0	7.2	9.8	13	16	20
400	0	0.2	0.6	1.4	2.6	4.0	5.8	7.8	10	13	16
	0	10	20	30	40	50	60	70	80	90	100

Table 3 Rainwater reuse plumbing options

Proportions of Household Water Usage		Rainwater reuse plumbing options			
		Outdoor Only	Toilet & Laundry	Hot Water	Entire House
Outdoor	20%	✓	✓	✓	✓
Toilets	20%	×	✓	✓	✓
Laundry (cold)	10%	×	✓	✓	✓
Hot Water	25%	×	×	✓	✓
Kitchen & Bath	25%	×	×	×	✓
Total	100%	20%	50%	75%	100%

Notes

- For the purposes of this DCP household water usage is assumed to be related to the size of the roof area (including covered pergolas and awnings). For a typical dwelling the water use is 1000 litres per day for a roof area of 200m^2. On this basis, the assumed water use per square metre of roof area is 5 L/day or 35 L/week.
- Higher levels of rainwater reuse help ensure that there will be adequate volume available in the rainwater tank to help retain the roof runoff without the tank overflowing.
- Retro-fitting an entire house to rainwater can be very cost-effective as it does not require dual-plumbing.
- The rainwater tank must be sized to have a rainwater storage volume not less than that required by any BASIX certificate issued for the development and configured in accordance with the requirements of that certificate.

- For the calculation of infiltration during the storm event, the design storm is assumed to be a 30mins duration event.

3.1.11.2.5 Examples Retention Volume Calculations

1. A house on an 800m^2 block with a roof area of 250m^2 and an external paved area of 150m^2. The rainwater tank is plumbed to outdoor taps, toilets and the washing machine. External retention is proposed by directing runoff from paved areas into a terraced garden (Size 12m^2; Soil: sandy loam; raised sides to temporarily contain runoff).

Retention volume required	= 50% impervious on 800m^2 block (Table 2)
	= 8000 L
Rainwater reuse over 1 week	= 35 L/m^2 x 250m^2 x 50% (Table 3)
	= 4375 L
Balance to be retained on site by infiltration or slow release	= 8000 - 4375
	= 3625 L

- This scenario shows that a volume of 3625 litres must be retained on site, assuming that a rainwater tank of at least 4375 litres useable capacity is available.
- The proposed landscaping of the site includes a terraced garden that will also act as an above ground retention storage, infiltration device and water quality treatment device.

Infiltration volume during the ½ hour storm	= 200mm/hr x ½ hr x 12m^2
	= 100 x 12 = 1200L
Balance of retention to be stored and slowly released after the storm	3625L - 1200L
	= 2425L
Ponding Depth required in garden	= Volume / Area
	= 2425L / 12m^3
	= 202mm

2. A house on a 600m^2 block with a roof area of 260m^2 and an external paved area of 100m^2. The rainwater tank is plumbed to the entire house (outdoor, toilets, laundry, hot water, bathroom and kitchen).

Retention volume required	= 60% impervious on 600m^2 block (Table 2)
	= 8600 L

Rainwater reuse over 1 week	= 35 L/m^2 x 260m^2 x 100% (Table 3)
	= 9100 L
Balance to retained on site by infiltration or slow release	= 8600 - 9100 < 0

- This scenario shows that household rainwater reuse provides an adequate retention volume, providing that the tank size is at least 8600 litres.

3. A factory on a 2000m^2 block with a roof area of 1200m^2 and an external paved area of 400m^2. The rainwater tank plumbed to toilets and bathroom facilities and the factory identified an opportunity for potable water replacement as part of an industrial process, whereby the water use has been estimated at 6000 L/day.

Retention volume required	= 80% impervious on 2000m^2 block (Table 3)
	= 51000 L
Rainwater reuse over 1 week	= 6000 L/day x 5 days (working week)
	= 30000 L
Balance to be retained on site by infiltration or slow release	= 51000 - 30000
	= 21000 L

- This scenario shows that a volume of 21000 litres must be retained on site by infiltration or slow release, assuming that a rainwater tank of at least 30000 litres usable capacity is available.

Example applications:

Initial planning of the building footprint should allow adequate space for rainwater tanks.

Planter box bio-retention system, Sydney

Example of how to safely increase the ponding

Planter boxes can treat stormwater from paved areas, USA

3.1.11.3 Stormwater Quality Target

3.1.11.3.1 Intent

Improve the quality of stormwater runoff, which will also improve the health of creeks and waterways and enhance urban amenity.

3.1.11.3.2 Objective

Achieve the following minimum reductions in total pollutant load, compared to untreated runoff from the developed impervious areas of the site:

- 80% reduction in Solids: suspended solids and gross pollutants (grit, sediment. leaves, grass clippings, litter)
- 45% reduction in Nutrients: total phosphorus and total nitrogen

3.1.11.3.3 Recommended Application

One Water Sensitive Urban Design concept involves landscaping practices that take advantage of natural site features to slow runoff and prevent the discharge of pollutants. The most effective way to treat stormwater runoff is through landscaping measures that are integrated into the site. These include:

- Rainwater water tanks to treat roof areas, for further information refer to HCCREMS (2007) Practice Note 4
- Infiltration and retention devices , for further information refer to HCCREMS (2007) Practice Note 5,
- Permeable paving , for further information refer to HCCREMS (2007) Practice Note 6
- Using crushed gravel or other treatments instead of paving
- Vegetated filter strips, vegetated swales, soak areas, rock basins or channels, raingardens, ponds, wetlands, and contour banks, for further information refer to HCCREMS (2007) Practice Note 4
- Sand/gravel filters for runoff from car parks and driveways
- Reducing the area of paving (for example, driveway strips)

The Site Discharge Index (SID) provides a very general indicator of the extent to which a development proposal will create unmanaged flows from impervious surfaces. If all runoff from impervious surfaces on a site will be managed by suitable stormwater source controls, the SID will be 0.0. The greater the area of impervious surface that is not managed by stormwater source controls, the higher the SID will be (up to a maximum of 1.0 on a site that is totally covered by impervious surfaces).

The SID is calculated by dividing the impervious area directly connected to the street drainage system (i.e. impervious area runoff which is not managed by an acceptable stormwater source control) by the total site. Refer to HECREMS (2007) Practice note 11 for further information regarding the SID. Figure 1 & 2 illustrate the SID calculation.

Landscaping measures must be placed and sized according to the amount of impervious area being treated. For each 100m^2 of impervious area then the following treatment options are considered to achieve the targets:

- 2m^2 of engineered bioretention device/rain garden/ or proprietary system,
- 4m^2 of depressed soak area/rock basin/pond/ or wetland,
- 7m^2 of garden/lawn/grass swale/vegetated filter strip (at <1% slope), or
- 15m^2 of garden/lawn/grass swale/vegetated filter strip (at <5% slope).
- 25m^2 of garden/lawn/grass swale/vegetated filter strip (at <20% slope).

Based on area ratios from pollutant removal efficiency graphs for various types of stormwater treatment measures in DECC (2007d)

Other types of stormwater treatment devices will be considered. However the pollutant removal efficiency of such devices will have to be adequately demonstrated by independent testing. Pollutant removal efficiencies claimed by manufacturers of proprietary devices are not considered sufficient without independent testing.

For Subdivisions landscaping measures must be provided to treat impervious areas within the road reserve, including road carriageways, footpaths, and driveway aprons. Consideration should be given to:

- Streetscape landscaping: planting of water efficient native vegetation and street trees for amenity and shade.
- Footpaths should be set back near the property boundary if a WSUD treatment is proposed along the edge of the road carriageway

3.1.11.3.4 Deemed to Comply

Compliance with the water quality target for all developments must be demonstrated on the Water Cycle Management Plan as follows:

- Site Discharge Index: To reduce the directly connected impervious area to 10% or less
- Details of appropriately placed and sized landscaping measures to treat the runoff from impervious areas.

Figure 1 - Typical detached dwelling with no stormwater source controls - HECREMS (2007)

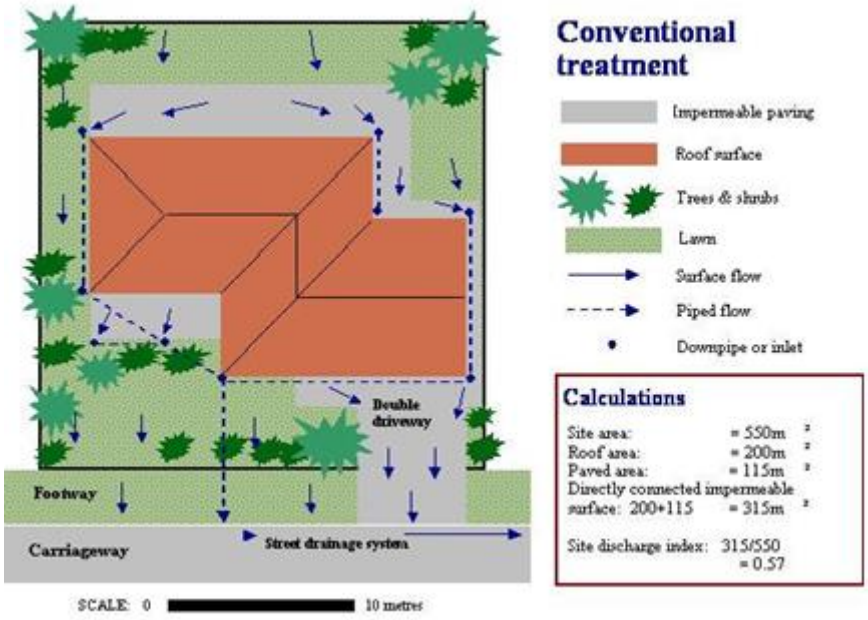
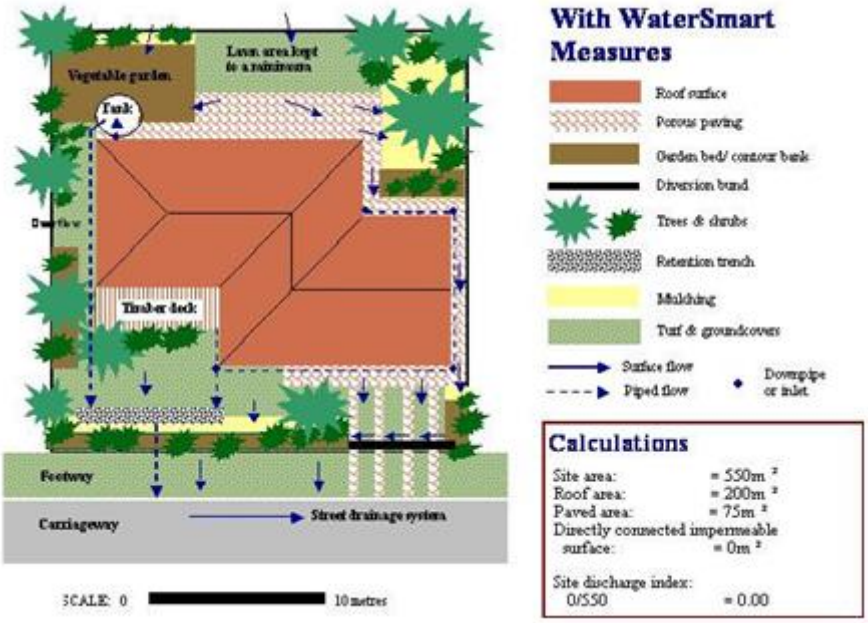


Figure 2 - Stormwater source controls applied to the same site - HECREMS (2007)



Example applications:

Large gaps between pavers can treat runoff at the source

Rock channel, Sutherland NSW

Grass swale, Bowral NSW (5 years old)

Raingardens in car-park, New Zealand

3.1.11.4 Onsite Detention Target

3.1.11.4.1 Intent

To protect downstream properties and infrastructure from increased stormwater flows from new development.

3.1.11.4.2 Objective

- Ensure future development does not increase the impact of rainfall events.
- Stormwater management design that demonstrates a consideration for the existing capacity of the public drainage system.

3.1.11.4.3 Recommended Application

On-site Stormwater Detention (OSD) shall be provided where required by Council in conjunction with a proposed development.

OSD will not be required on alterations, additions, ancillary structures, second storey additions, single dwelling & dual occupancies, except where:

- the volume of total retention storage provided does not correspond to the requirements in Section 3.1.11.2, in such instances the OSD system shall meet the short fall of retention volume and have a Permissible Site Discharge (PSD) of 8L/s, or
- it is required under a specific Council Plan of Management or other Council Plan.

OSD will be required for all other developments, except where:

- the development is located at a point within the catchment considered by Council not to warrant OSD, or
- an OSD system has been previously constructed to accommodate the proposed development, or
- the applicant undertakes a detailed total catchment analysis proving that the proposed development has no effect on properties and infrastructure downstream or upstream of the catchment. The study shall be undertaken by a Certified Practicing Engineer - The Institution of Engineers Australia, or
- the development is in a rural area and the following measures are implemented
    - all runoff from rural buildings, tracks and paved areas is to be discharged into absorption trenches or onto heavily vegetated areas so as to prevent an increase in the rate of runoff into streams / drainage systems.
    - all runoff is to be controlled so that it causes no nuisance or concentration of flow to watercourses or neighbouring properties.
    - inclusion of other WSUD solutions that can be reasonably demonstrated to address stormwater flow and water quality issues to the required level.
    - all runoff is to be controlled so as to prevent erosion.

Regardless of the points above, where Council considers development may adversely impact upon areas of environmental importance, drainage infrastructure or as deemed necessary, Council may determine that stormwater detention is required.

3.1.11.4.4 Demonstrated Compliance

A stormwater detention report and accompanying plans shall be prepared by a person accredited as below and submitted with the development application.

The following general parameters apply to the design of the OSD:

- Limit post development flow from the proposed development site to less than or equal to predevelopment flows for all storm events up to and including the 1% YEP storm event; Predevelopment coverage shall be taken as the natural vegetation that would normally occur on the entire site with no impervious areas. Appropriate infiltration rates for the natural vegetated state and underlying soils shall be applied and provided in the calculation report;
- A maximum of 50% of the Volume of Rainwater/Stormwater Retention Tanks can be claimed as part of the OSD Volume;
- A Runoff Routing method is to be used for developments;
- Where no road pipe drainage system exists, the maximum permissible site discharge (PSD) from a development to either the kerb and gutter or table drain shall be 30 litres/sec unless otherwise advised by Council's Engineer; Discharged water shall not be concentrated onto adjoining properties, unless through a formalised (legal) drainage system;
- Site controls will sometimes overflow. Council requires that overland flows must be adequately directed so as to not to cause intensification, concentration or inappropriate flow over neighbouring properties;
- Additional Subdivision parameters include:
- OSD shall be designed as either a single device serving all lots and other impervious areas (including roads, paths and other hard stand) or as single devices servicing each separate lot and road system;
- A maximum of 50% of the total volume of rainwater tanks can be claimed a part of the OSD volume subject to a Positive Covenant and Restriction-as-to-User being placed on the title of the lots requiring a minimum size rainwater tank be installed with building works or further development;
- Where OSD is proposed on a lot basis the requirement to construct the OSD system can be deferred subject to a Positive Covenant and Restriction-as-to User being placed on the title of the lots requiring OSD facilities complying with these provisions to be constructed at the time of each allotment's development;
- Wherever possible Council will prefer the construction of privately owned community detention systems;
- Site controls will sometimes overflow. Council requires that overland flows must be adequately directed so as not to cause intensification, concentration or inappropriate flow over neighbouring properties;
- To the extent possible, OSD and drainage design should be integrated with other WSUD measures, such as landscaping, road design, development layouts, provision of habitat, recreational open space, etc.

All design is to conform to best engineering practice, Australian Standards and OH&S requirements, and shall be undertaken by a person who retains one of the following standings:

- Practicing Civil Engineer with appropriate qualifications and experience to be eligible for Membership to the Institution of Engineers Australia; Surveyors Certificate of Accreditation in On-site Detention and Drainage Design (Institute of Surveyors, NSW and the Association of Consulting Surveyors, NSW.

3.1.11.5 Local Overland Drainage Target

3.1.11.5.1 Intent

To manage local overland drainage problems.

3.1.11.5.2 Objective

To effectively manage local overland drainage problems which may occur throughout urban areas and fall outside the definition of flooding.

Note that overland flows in the 100 Year Average Recurrence Interval Event in excess of $0.5m^3/s$ or greater than 0.3m deep are defined as flooding whereby flooding targets would also apply (section 3.1.11.6).

3.1.11.5.3 Recommended Application

- All finished floor levels above the finished surrounding ground levels are to comply with the minimum standard as set out in the Building Code of Australia to protect against any shallow water depths.
- Cut and/or fill is minimised on the site.
- Overland runoff generated by rain is to be directed into flow paths that follow the natural land slope to mimic the pre-development state as much as possible, which poses the least threat to residents2. The overland flow paths must not adversely affect adjoining properties. Overland flow paths must be shown on the Water Cycle Management Plan. They must not be obstructed by parked cars, retaining walls, landscaping, and where side passages are used they are to be kept clear of obstructions such as hot water heaters, air conditioners, solid fencing, rainwater tanks or garbage bins.
- Driveways: must not interfere with function of longitudinal drainage and must not provide spillway for stormwater runoff (either into the property if the road is higher, or on to the road if the road is lower).
- Minimum setbacks must be observed between buildings and watercourses (refer to Section 3.1.13)

3.1.11.5.4 Demonstrating Compliance

The following must be shown on the Water Cycle Management Plan:

- All floor levels complying with the minimum requirements of the Building Code of Australia.
- Adequately sized clear overland flow paths, including special attention where the driveway connects to the public road.
- Details of cut and/or fill.
- Show location of all stormwater discharge points including overland flowpaths.

Figure 3 - The difference between greenfield and local velocity - HNFMSC (2006a)

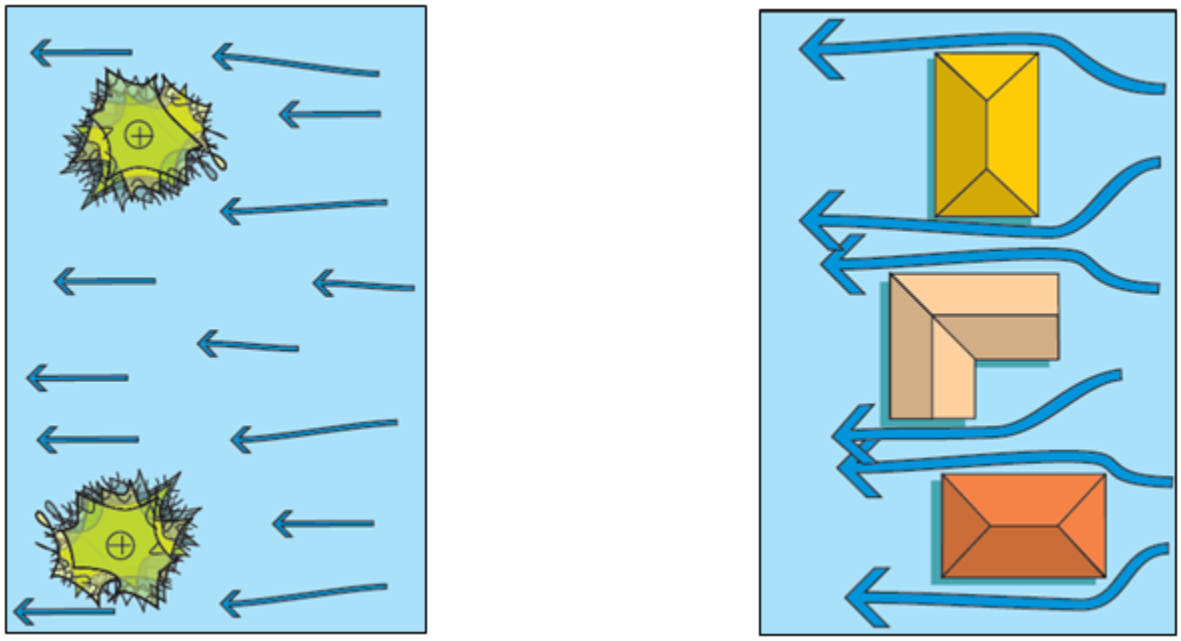


Figure 3 Illustrates, prior to development (left) there are few obstructions to concentrate flows. However following development (right) may concentrate flows and increase velocities, which may lead to local drainage problems.

Reference

[2] HNFMSC 2006b, p.61

3.1.11.6 Flooding Targets

3.1.11.6.1 Intent

To reduce the impact of flooding on flood prone property.

3.1.11.6.2 Objectives

- To reduce private and public losses resulting from floods.
- To enable safe access or evacuation of people to the existing public road network during flooding.
- To maintain the existing flood regime and flow conveyance capacity.
- To avoid significant adverse effects on the floodplain environment that would cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of any river bank or watercourse.
- To limit land uses to those compatible with flow conveyance function and flood hazard.

3.1.11.6.3 Recommended Application

Council has identified flood planning areas adjacent to significant creeks and waterways. These areas can be viewed on Council's Development Constraints web portal. Council is able to provide Flood Planning Levels (FPLs) in these areas on enquiry.

However many areas subject to flooding have not yet been assessed. In these areas, Council will request a flood study to determine the effects of a proposed development on flooding or conversely, the effect of flooding on a proposed development. Flood studies will be required for any type of development where the development occurs in a floodplain or in areas of where overland flow is suspected.

Flood studies must be prepared by suitably qualified civil engineers. Both the 100 year ARI and PMF flood events must be adopted to assess the effects of flooding on the proposed development site and adjacent properties. In certain circumstances, it may be necessary to assess the effects from lesser storm events.

The hydraulic component of the analysis shall be undertaken in accordance with the current version of the Australian Rainfall & Runoff. Unless it can be demonstrated that it is not applicable, flood studies shall be prepared using a fully dynamic 1 or 2 dimensional computer model to determine the flood extents and hazards. The model chosen shall be calibrated against a recorded storm event if available. All input parameters and assumptions made must be clearly described and justified. A hard copy of the report, including all results, results summary table, and all the relevant information must be submitted with the application. This information is to include the following information plan form for the pre-developed and post-developed scenarios:

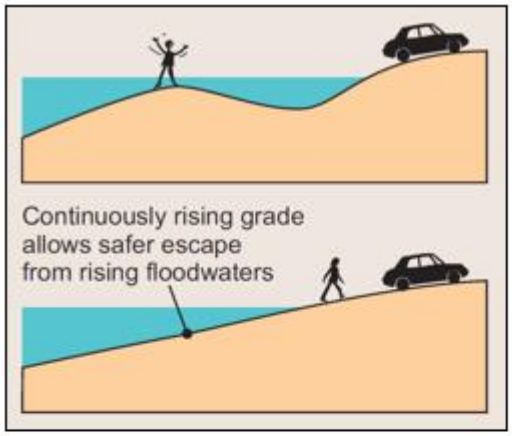
- Flood profiles/extents for the full range of events for total development including all structures and works (such as revegetation/culvert crossings).
- Water surface contours.
- Velocity and depth product contours.
- Delineation of flood hazard categories relevant to individual floodplains.

3.1.11.6.4 Demonstrating Compliance

If flood related development controls apply, then the Water Cycle Management Plan must demonstrate compliance with the relevant flood control targets as listed in tables 4 & 5 below.

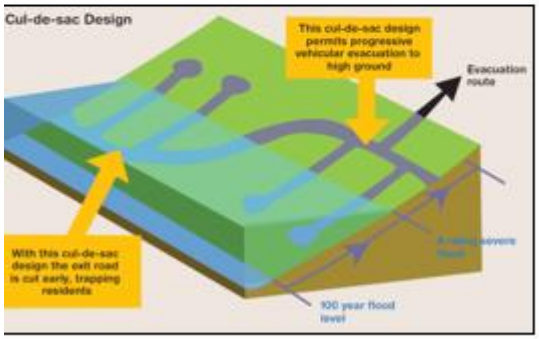
- Flood related development controls may apply for any development on flood prone land (up to the PMF) for the purposes of subdivision of land, earthworks, the erection of a building, the carrying out of a work or flood mitigation works.
- Flood related development controls will not apply for development for the purposes of residential accommodation (other than group homes and seniors housing) on land that is flood prone but is not in the flood planning area. (i.e. land that is above 1% AEP flood level + 0.5m freeboard but below the PMF).

Example applications:

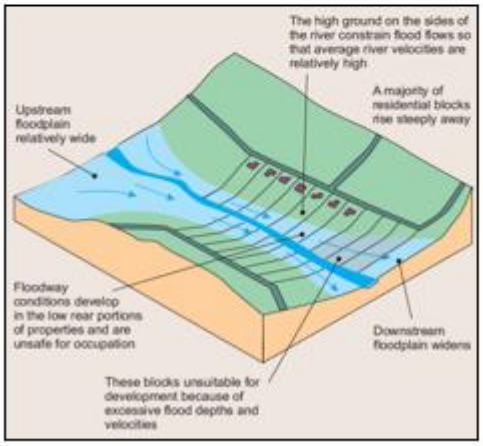


Safer escape from rising floodwaters[3]

Raising the slab on waffle pods is effective in reducing the possibility of the house being inundated by overland flooding[4]



Examples of both good and bad designs for evacuation[5]



Location of development in floodway areas[6]

Table 4 Flood Control Target Matrix

Development	Development Types					
Control Targets	Pools & Spas	Residential Buildings (Rural)	Residential Buildings (Urban)	Group homes, seniors housing, emergency facilities	Commercial, Industrial	Subdivisions (Urban & Rural)
Floor levels	-	B	B	A	B	-
Flood Impacts	C	C	C	C	C	C
Subdivisions	-	-	-	-	-	D
Access Parking	-	E	-	F	E	E
Fencing	-	G	G	G	G	G

A - Floor Levels

Floor levels whether habitable or non-habitable, are to be at or above the PMF flood level.

B - Floor Levels

Habitable floor levels are to be above the FPL for all new structures.

Rare floods will still occur, possibly well above the FPL, which may cause significant damage for some types of development. If the consequences of are likely to be high then consider raising floor levels well above the FPL.

Concession for building additions: where the existing habitable floor level is below the FPL then a one-off addition may be considered up to:

- 40m^2 if the existing residential floor level is less than 500mm below the FPL, or
- 20m^2 if the existing residential floor level is greater than 500mm below the FPL, or
- 10% increase in floor area for commercial or industrial additions

Non-habitable floor levels: Garage, laundry, or public toilets/sporting amenities to have floor levels at least 300mm (desirable 500mm) above surrounding finished ground level. Materials, equipment or contents are not to be stored below the FPL unless they are flood compatible, capable of withstanding the forces of floodwater, debris and buoyancy, and not prone to causing pollution or an environment hazard.

C - Flood Impacts

i Floodplain Risk Management Plan

If the subject land falls within the area of an existing Floodplain Risk Management Plan, then the development must comply with specific conditions of the plan.

ii Flood Impacts

The development must not:

- Affect the safe occupation of any flood prone land.
- Be sited on the land such that flood risk is increased.
- Adversely affect flood behaviour by raising predevelopment flood level by more than 10mm.
- Result in an increase in the potential of flooding detrimentally affecting other development or properties.
- Significantly alter flow distributions and velocities to the detriment of other properties or the environment of the floodplain.
- Significantly and detrimentally affect the floodplain environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of any riverbank or watercourse.
- Be likely to result in unsustainable social and economic costs to the flood affected community or general community as a consequence of flooding (including: damage to public property and infrastructure, such as roads, stormwater, water supply, sewerage, and utilities).
- Be incompatible with the flow of floodwaters on flood prone land (considering any structures, filling, excavation, landscaping, clearing, fences, or any other works).
- Cause or increase any potential flood hazard (considering the number of people, their frailty, as well as emergency service and welfare personnel).

iii Building components

- Limit use to that which is compatible with the level of flood hazard (considering likelihood and consequences of flooding).
- Building components located below FPL are to maintain strength and durability when wet, facilitate easy cleaning after inundation, and resist the forces of floodwater, debris and buoyancy[7].
- All electrical fixtures (including meter box) to be above the FPL
- The sewer gully trap is to be located at or above the 100 year ARI flood level (without freeboard). All other internal sewer fixtures (floor waste, WC pans, rim of shower, bath, laundry tub, and basins) are to be located at least 150mm above this level.
- Free standing Rainwater tanks are to be elevated above 100 year ARI flood level (without freeboard) or anchored to resist buoyancy and impact forces.

iv Local Overland Flooding

- If any part of the land is affected by Local Overland Flooding[8] then hydraulic calculations (by a skilled flood specialist) will be required as follows:
- Along all overland flowpaths that convey significant overland flows (≥ 0.5m3/s or deeper than 0.3m). Flow depths, velocities and flow rates and must be shown on the Water Cycle Management Plan.
- Overland flow paths shall be designed to limit 100y ARI flood velocities to a maximum of 2 metres per second. This may require the provision of regular drop structures (such as rough placed rock weirs) to reduce velocities.

- Flow conveyance along these overland flowpaths may be achieved through a combination of the following: naturally functioning streams, open channels incorporating natural features (i.e. pool & riffle sequences consisting of reeds, rocks and native vegetation), stream buffer zones, and swales. Details must be shown on the Water Cycle Management Plan.
- Pipes are typically prone to blockage. A minimum 50% blockage factor shall be applied to all pipe and culvert capacities as part of hydraulic calculations. As such pipes are considered appropriate for managing low flows, with the bulk of flood flows travelling safely overland.
- Overland flowpaths must not be obstructed by parked cars, retaining walls, landscaping, and where side passages are used they are to be kept clear of obstructions such as hot water heaters, air conditioners, fencing, rainwater tanks, and garbage bins.
- Where significant overland flow crosses a property boundary (≥ 0.5m^3/s or deeper than 0.3m), flow-through fencing (pool type fencing) is to be provided in the bottom part of the fencing to a height required to pass the flow. The width and height of flow-through fencing shall make allowance for 50% blockage. The overland flow paths shall be dispersed where possible to limit the concentrated impact on downstream or down slope properties.
- Significant overland flow paths may be classified as creeks, whereby minimum setbacks must be observed between buildings and watercourses (refer to Section 3.1.13)

v Filling

- Filling is not to be undertaken within the Flood Planning Area without Council's approval, including any cut and fill works on site.
- Filling of the land within the Flood Planning Area is not permitted unless:
    - It is allowable as part of an adopted Floodplain Risk Management Plan
    - Or it can be demonstrated (by a skilled flood specialist) that the cumulative effect of filling the area would not raise the flood level by more than 10mm and that the land can be considered 'flood fringe'
- Unless a Floodplain Risk Management Plan for the catchment has been adopted, which allows filling to occur, filling in flood prone areas is not permitted unless a report from a suitably qualified civil engineer is submitted to Council that certifies that the development will not increase flood affectation elsewhere.
- Filling of individual sites in isolation, without consideration of the cumulative effects is not permitted. The NSW Government's Floodplain Development Manual states that a case by case decision making approach cannot take into account the cumulative impact of flooding behaviour, and associated risks, caused by individual developments. Any proposal to fill a site must be accompanied by an analysis of the effect on flood levels of similar filling of developable sites in the area.
- Any filling proposal must include adequate provision for drainage of surface water erosion and siltation control and be so placed and graded as to prevent the shedding of surface water direct to adjoining properties.

vi Sea Level Rise

Note: The following applies unless otherwise specified under an adopted Flood Risk Management Study/Plan or revised Policy of Council

- For low-lying land below RL 4.0m AHD the development applications must assess the ongoing viability of the land, including the viability of road access to the land, associated with the adopted sea level rise figure for planning purposes of +0.9m by the year 2100, assuming a design life for the development. This will be particularly relevant for low-lying coastal or estuarine development.

D - Subdivisions

- Consideration of the increased potential flood damage consequences should the lots be developed in future associated with large floods, up to and including the Probable Maximum Flood.[9]
- The development is not to exacerbate flood levels, velocities or flow distributions at any other location, including a consideration of the cumulative impact of incremental development, should all the lots be fully developed in future.
- Significant flows on road carriageways should be avoided to prevent compromising traffic ability, access and evacuation. Special consideration should be given in the following cases.[10]
- *Roads in drainage depressions*: are likely to be liable to flooding. Care should be taken not to compromise traffic ability, access and evacuation.
- *Roads that are on grade*: can develop high velocity flows, which need to be checked to see that they will not wash cars and people away and will not cause flotation.
- *Roads running across the contours*: are likely to be cut at points where they cross a creek or drainage lines, therefore need to be designed to ensure people and cars will not be at risk of being caught in floodwaters.
- *Roads that follow ridges*: run-off will need to be shed off at regular intervals and directed through or between lots via drainage swales or engineered overland flow paths.
- Stormwater should be shed from road carriageways as quickly and diffusely as possible, to reduce flood hazard. Where kerbs are not required then vegetated edge strips and associated swales can be an effective solution, as well as greatly assisting in the achievement of water quality targets and providing an attractive streetscape.[11]
- Subdivision of land will not be permitted for the purpose of creating additional lots within the flood planning area.

E - Access and Parking in 100 year ARI Flood Event

All access roads and driveways, and external parking areas to be above the 100 year ARI Flood Level (FPL less 0.5m) to provide the ability to safely receive and evacuate occupants or contents without having to cross floodwaters in most flood events (assuming 50% blockage of any pipes, culverts or bridges). For rural subdivision refer to section 3.1.15.

F - Access and Parking in PMF Event

All access roads and driveways, and external parking areas to be above the PMF to provide the ability to safely receive and evacuate occupants or contents without having to cross floodwaters of any depth in all flood events, assuming 50% blockage of any pipes, culverts or bridges of any size.

G - Fencing

- Fencing within a floodway will not be permissible except for security/ permeable/ open type/ safety fences of a type approved by Council. Fencing in certain areas may also be restricted by current Floodplain Risk Management Plans.

- Council will require a Development Application for all new solid (nonporous) and continuous fences above 0.6m high, within the 100 year ARI storm event extents unless otherwise stated by exempt and complying development provisions which may be incorporated into in State Environmental Planning Policies or Councils Environmental Planning Instruments from time to time. An applicant will need to demonstrate that the fence would create no impediment to the flow of floodwaters. Appropriate fences must satisfy the following:-
- An open collapsible hinged fence structure, or flow through fencing (pool type fencing) is to be provided in the bottom part of the fencing to a height required to pass the flow. The width and height of flow-through fencing shall make allowance for 50% blockage;
- Other than a brick or other masonry type fence (which will generally not be permitted); or
- A fence type and siting criteria as prescribed by Council.
- Other forms of fencing will be considered by Council on merit.

References

3 Taken from HNFMSC (2006b, P.44)

4 Taken from HNFMSC (2006a, P.78

5 Taken from HNFMSC (2006b, P.86)

6 Taken from HNFMSC (2006b, p.71) 7 Helpful guidance on building materials can be found in reference HNFMSC 2006a.

8 Refer to definition in Definition section of DCP.

9 HNFMSC 2006b, p.92.

10 HNFMSC 2006b, p.106.

11 HNFMSC 2006b, p.104.

3.1.12 DEVELOPMENT IDENTIFIED AS DRAINAGE BLACK SPOTS ON THE PENINSULA

3.1.12.1 Objectives

- To indicate areas having drainage problems which cannot be readily overcome.
- To ensure that more intensive development does not exacerbate the drainage problem in identified "black spot" areas.

3.1.12.2 Recommended Application

Drainage "black spot" areas, which are identified under this Chapter are shown on the maps held by Council:

- Land in the vicinity of Cogra Road, Rothwell Street, Moana Street and Angler Street Woy Woy as shown on Map 1, held by Council.

- Land in vicinity of Shephard Street, Glenn Street and Carpenter Street Umina as shown on Map 5, held by Council.

3.1.12.3 Deemed to Comply

The Council has determined by engineering investigation that the nature of the situation and the problem is such that:

- It is unlikely that public funds will be available in the foreseeable future to carry out the works necessary to overcome the problem.
- It would not be appropriate to allow development to occur and seek contributions to future works, as these could not relate to the existing problem which would be exacerbated.

The Council has determined that the appropriate strategy to address the problem is for it to exercise its discretion to refuse any development application which would have the effect of increasing rainfall run-off from the site, until such time as the necessary work can be funded and carried out, unless the developer undertakes to provide the necessary infrastructure to deal with the existing problem as well as the compounding effect of the development.

In areas where no underground drainage exists the use of on-site detention will not be considered a satisfactory solution, unless the outflows can be conveyed directly to a drainage system shown to be capable of carrying the flow without detriment to adjacent property.

In areas where no underground drainage exists absorption trenches will not be considered a satisfactory solution if they are unable to absorb the extra full storm flow from the development up to and including the 1% AEP flood event.

On receipt of any application, which would be subject to the Chapter, the Council, will give the applicant the opportunity to:

- Withdraw the application; or
- Provide the drainage works required to overcome the problem of any increased flow or problems caused by the increased flow as a result of the development proposal, to Council's satisfaction, and prior to the determination of the application.

If either of these actions is not taken, the application will be formally determined under the provisions of the *Environmental Planning and Assessment Act 1979*.

This chapter will not apply in respect to an area identified under above where drainage works have been carried out to the satisfaction of the Council to overcome the existing drainage problem.

3.1.13 SETBACK TO CREEKS, RIVERS AND LAGOONS

3.1.13.1 Objective

To provide appropriate setbacks from creeks, rivers and lagoons in order to maintain ecological corridors, public access and drainage easements.

3.1.13.2 Deemed to Comply

Where a building is to be located adjacent to a creek, waterway or lagoon, the building shall be set back from the creek, waterway or lagoon such that:

- For further development of greenfield sites, setbacks are to be determined during the planning process to ensure that land inundated by the 1% AEP flood including freeboard will not be developed. As well as this criterion, access shall be provided along the creekbanks to enable further maintenance and ongoing public accessibility along the reserve areas. At least six metres width between the top of the bank of the creek and the property boundary shall be provided. (See Figures No. 4 & 5)
- For development proposals in existing subdivided areas, the following provisions shall apply:
    - For minor creeks defined as creeks with a catchment area of less than 7.5 hectares:
        - If no easement exists over the minor creek the setback shall be 4 metres.
        - If an easement exists over the creek, the normal building restrictions alongside an easement would apply.
        - Where appropriate, the applicant may create and pipe the easement in order to remove the setback requirement. All pipework shall be to a Council approved design and construction specifications. Such works will also require the consent of other relevant Government authorities.
    - For major creeks having a catchment area larger than 7.5 hectares a setback is to be provided to allow for:
        - Future adequate waterway construction
        - A 4m wide vehicular and machinery access along the waterway for maintenance where a suitable easement does not exist.
        - An overbank floodway to pass a minimum of the 1% AEP design flood.
        - Adequate landscaping to the bank area.
        - See Setback Figure 6.

Where the future waterway does not have an approved design, the setback shall be a minimum of 6 metres on each side of the creek from the top of the natural bank of the creek. Where banks of the creek have been filled without authorisation, the Council may determine a larger setback as considered appropriate. (See Figure 7)

The setback to be provided shall enable a hydraulically satisfactory waterway alignment to be retained or created. Setbacks, which when examined in relation to adjoining or nearby properties, cause sharp changes in direction or constrictions to flow will not be permitted.

In addition to the above requirements, if the land is subject of a Floodplain Management Plan, the setback of the buildings will also need to adhere to any controls specified in the Management Plan.

It is desirable that a "Drainage Reserve" be created over all major creeks, including the area required for access and landscaping. Access to creeks may also require easements for access to ensure access is retained.

Setbacks from the top of the bank of the creek shall apply to properties adjoining public reserves where the land is flood liable up to the 1% design flood event

A developer may, subject to approval by Council, prepare engineering plans for a reach of a major creek and incorporate the provisions described above into the proposal. The setback shall then be provided to a varied distance as suitable providing the engineering works are carried out during development.

Subdivision of land adjacent to major and minor creeks shall take into account the need to provide setbacks as described in this Chapter.

Setbacks from creeks and lagoons shall also be affected by other regulatory authorities i.e. Department of Environment, Climate Change & Water with regard to the Controlled Activity provisions of the Water Management Act 2000, and the Department of Primary Industries with regard to the NSW Fisheries Management Act. Details of the affections should be sought by the applicants from these authorities or authorities that supersede these authorities.

Figure 4 - Setback from watercourse

Figure 5 - Setback from watercourse

Figure 6 - Setback from watercourse

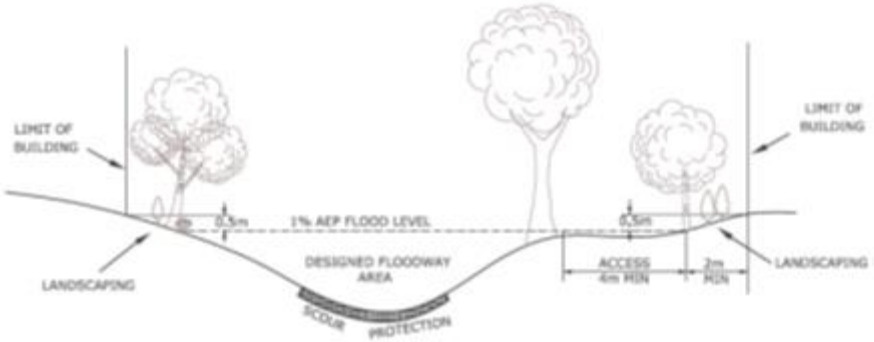
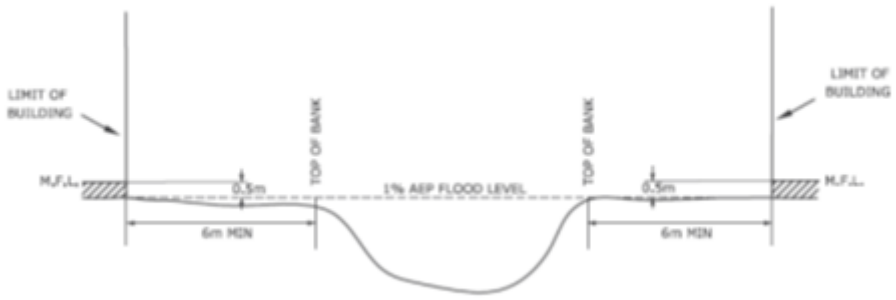


Figure 7 - Setback from watercourse



3.1.14 BUILDING ADJACENT TO DRAINAGE EASEMENT / STORMWATER PIPES

3.1.14.1 Objective

Ensure the integrity of the stormwater drainage systems, natural watercourses and any structures built in the near vicinity is maintained.

3.1.14.2 Recommended Application

In general no buildings/structures or overhanging structures will be permitted over a drainage easement of Council stormwater pipe/culvert.

3.1.14.3 Deemed to Comply

Council requires the construction of piers when building near to a drainage easement/Council stormwater pipe. Before building approval will be granted, full engineering details of the proposed piers and beams for all footings within the influence region of the drainage easement are to be submitted to Council by a suitably qualified practising Structural Engineer.

No excavation is permitted within 2 metres of any drainage easement unless approval has been granted by the Director City Services.

Depth of Piers

All piers along the drainage easement boundary/Council stormwater pipe shall have a minimum depth equal to the level of the invert of the stormwater pipe or culvert. The pier depth may be decreased by 500mm for each increment in distance of 1 metre from the boundary of the easement, or at an angle equal to the natural repose of the soil (saturated) as determined by a qualified practising Structural/Geotechnical Engineer.

Where an easement contains an existing watercourse or open drain to a depth greater than 1.5 metres the pier depth shall be determined as 0.5 metres below the actual invert of the open drain or watercourse.

Where a drainage easement is at present unpiped or proposed to be piped but there is not a detailed design for the proposal to pipe an easement a depth to the invert of a future pipeline of 1.5 metres shall be assumed unless otherwise specified by Council.

Engineering Details Required

The Consulting Engineer is to certify on the submitted plans that the piers are adequate to support the structure in the event of the easement/Council stormwater pipe being excavated along or within the easement boundary.

At the completion of construction of the piers and beams, a Certificate of Compliance will be required from the Consulting Engineer stating that all work has been carried out in accordance with the approved engineering plans. The following information is to be shown on the plans:

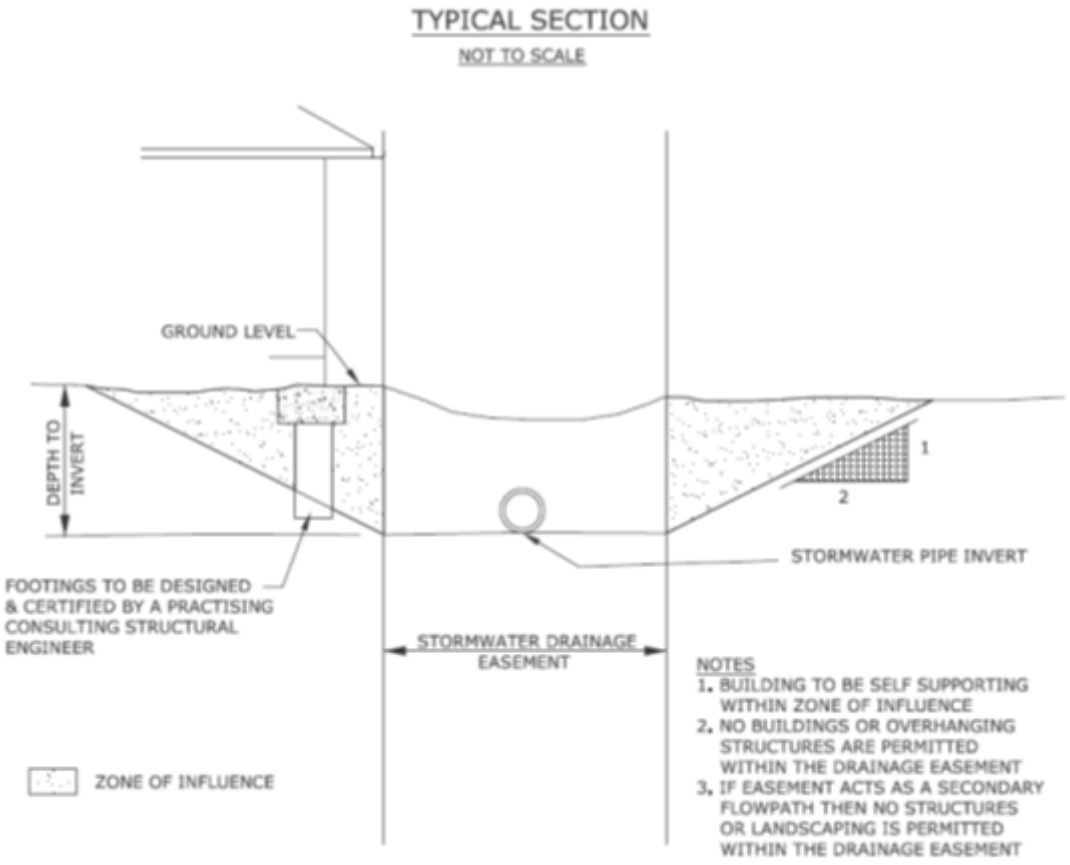
- Plan view of proposed building(s) in the region of the drainage easement and the
- extent of any excavation also showing pier locations and depths.
- Boundary of drainage easement of plan view.
- Limits of the Zone of Influence on plan view.
- Typical sections across Zone of Influence from the drainage easement.
- Section across Zone of Influence at the closest point between the drainage easement and foundation if it is different to the typical cross section.
- Engineering details of structural elements suitably dimensioned.

If the applicant proposes to modify the Zone of Influence from the standard, the following signed certification by the applicant's engineer is required:

- "I certify that the footings of this building as designed are adequate to support and protect the building from damage in the event that disturbance or settlement occurs within the Zone of Influence."

A typical section showing the zone of influence is shown in Figure 8, attached below.

Figure 8 - Building adjacent to a drainage easement



3.1.15 PROVIDING ACCESS TO RURAL PROPERTIES AFFECTED BY FLOODING

3.1.15.1 Objective

To provide safe access and/or evacuation routes to and from rural properties to a public road during a 1% AEP flooding event

3.1.15.2 Deemed to Comply

A qualified and experienced Consultant shall identify the following for the 1% AEP flood event affecting the property(s):

- the extent of the floodplain;
- the flood levels;
- mainstream and overbank velocities and depths over the floodplain along the proposed access route.

The Consultant report is to provide details of proposed pedestrian and vehicular access above the 1% AEP flood, it is desirable that at least 0.5 metre freeboard be provided. The site plans shall show the proposed location and floor level for dwelling(s), which shall be outside the 1% AEP floodplain.

The creek crossing shall be designed so that the construction of the creek crossing and its approaches must not raise flood levels for the 1% AEP event by more than 10mm (Council's standard) at the adjoining property boundaries and this must be certified by a competent practising hydraulics engineer. The designed crossing shall not have a significant detriment to the creek environment and should incorporate environmental protection measures as appropriate.

Alternative Option 1 Requirements

If the standard requirements are considered to be unreasonable by the Council, then the Council may use its discretion to resolve that the following requirements could replace the standard requirements.

- A qualified and experienced Consultant shall identify the following for the 1% AEP flood event affecting the property(s):
    - the extent of the floodplain;
    - the flood levels;
    - mainstream and overbank velocities arid depths over the floodplain along the proposed access route.
- The Consultant shall design the access which shall be covered by up to a maximum depth of 200mm in the predicted 1% AEP flood level.
- The creek crossing shall be designed so that the construction of the creek crossing and its approaches must not raise flood levels for the 1% AEP event by more than 10mm (Council's standard) at the adjoining property boundaries and this must be certified by a competent practising hydraulics engineer. The designed crossing shall not have a significant detriment to the creek environment and should incorporate environmental protection measures as appropriate.
- Velocities shall not exceed the safe levels for car access through floodwaters.
- Flood depth indicators and delineation guide posts including flood warning signs shall be installed over the extent of the 1% AEP floodplain to identify the alignment of the access and depth of floodwaters over the road access. The signage shall warn people not to cross the access when covered by floodwaters.
- The access driveway is to be sealed over the full extent of the 1% AEP floodplain to prevent erosion and siltation of the creek.
- An alternative all weather, informal, practicable access is required to higher ground above the PMF event. Therefore the Consultant shall determine the flood flow and level for the PMF event and show the level on the subdivision plan.
- A message will be placed on the Section 10.7 Certificate notice for the property advising that the access is constructed to a level below Council's flood standards.

Alternative Option 2 Requirements

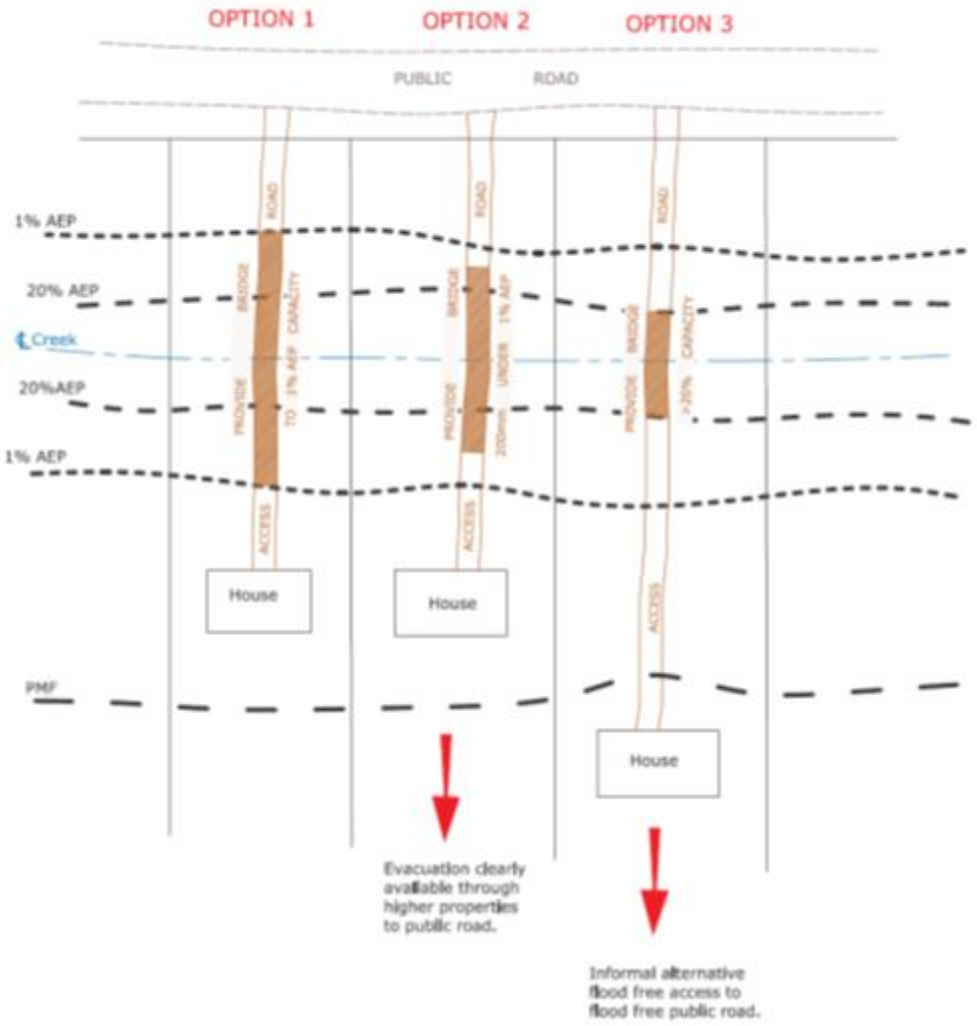
If the above access requirements are found in specific circumstances to be very unrealistic and/or environmentally insensitive by the Council and also if Council does not have any proposal to upgrade its adjoining public roads to higher flood free standards, then the Council may use its discretion to resolve that the following requirements could replace the standard requirements.

- A qualified and experienced Consultant shall identify the following for the 1% AEP flood event affecting the property(s):

- the extent of the floodplain;
- the flood levels;
- mainstream and overbank velocities and depths over the floodplain along the proposed access route.

- The Consultant shall determine the storm durations and flood levels for the PMF, 1%, 2%, 5% and 20% AEP events for Council's consideration.
- Dwelling(s) shall be located on land above the PMF and the extent is to be shown on the subdivision plan.
- Where the 1% AEP storm duration is less than 2 hours the proposed access is to be constructed to the highest of either the 20% AEP flood level or to the Councils adjoining road flood frequency.
- Where the access proposed is to be below the 20% AEP flood event or the 1% AEP storm duration exceeds 2 hours then an alternative practicable all weather informal access is required via adjoining property(s) to high ground and to a flood free public road. The access to be informally arranged.
- Flood depth indicators and delineation guide posts including flood warning signs shall be installed over the extent of the 1% AEP floodplain to identify the alignment of the access and depth of floodwaters over the access road. The signage should warn people not to cross the access when covered by floodwaters.
- The creek crossing shall be designed so that the construction of the creek crossing and its approaches must not raise flood levels for the 1% AEP event by more than 10mm (Council's standard) at the adjoining property boundaries and this must be certified by a competent practicing hydraulics engineer. The designed crossing shall not have a significant detriment to the creek environment and should incorporate environmental protection measures as appropriate.
- A message will be placed on the Section 10.7 Certificate notice for the property advising that the access is constructed to a level below Council's flood standards and that the property does not have safe flood free access up to Council's standard. Access may therefore be denied in severe flood events. Alternate access shall be arranged to higher ground through adjoining property.
- Alternative access methods for emergency services should also be considered close to the proposed dwelling(s), i.e. a helicopter landing area.
- The access driveway is to be sealed over the full extent of the 1% AEP floodplain to prevent erosion and siltation of the creek.

Figure 9 - Illustration of the three rural access strategies



3.1.16 HELPFUL RESOURCES

3.1.16.1 Water Smart Practice Notes

Water Smart Practice Notes provide the detail to apply the best-practice guiding principles and requirements of some of the targets within this plan. They are available on-line from the Hunter Central Coast Regional Environmental Management Strategy (HCCREMS) website:

1	The WaterSmart Home	706kb PDF
2	Site Planning	1Mb PDF
3	Drainage Design	508kb PDF
4	Rainwater Tanks	786kb PDF
5	Infiltration Devices	606kb PDF
6	Paving	574kb PDF

7	Landscape Stormwater Measures	863kb PDF
8	Water Efficient Landscape Practices	978kb PDF
9	Wastewater Reuse	464kb PDF
10	Groundwater	444kb PDF
11	Site Discharge Index	1Mb PDF

3.1.16.2 Estimation of soil infiltration Rates

Hydraulic conductivity can be roughly estimated by digging a test hole on site, filling with water, and measuring time it takes for the water level to fall a certain depth (in mm/hr). Note that this method will certainly over-estimate the actual hydraulic conductivity, given that water can infiltrate through both the bottom and the sides of the hole. However it will certainly give an indication of whether the soil type is unsuitable for infiltration. More accurate measurements of hydraulic conductivity can be made by laboratory testing, or by more advanced in-situ test methods [12].

Hydraulic conductivity ranges for common soils are as follows:

Table 6 Soil Properties

Soil Type	Hydraulic Conductivity	Distance to Footings
Sandy soils	> 180mm/hr	1 metre
Sandy clays	from 3.6mm/hr to 180mm/hr	2 metres
Medium clays	from 3.6mm/hr to 3.6mm/hr	4 metres
Heavy clays	< 3.6mm/hr	5 metres

Soils with a hydraulic conductivity in the range of 100-400mm/hr are often capable of managing runoff from small-moderate storms without overflow. The optimum soil type is loamy sand.

Soils with a hydraulic conductivity less than 50mm/hr are not able to effectively manage storm runoff; however ponded water will still eventually soak away.

Sandy soils may have a very high initial porosity (hydraulic conductivity) of up to 2000mm/hr. However they are prone to surface clogging - especially by clays and silts during construction.

3.1.16.3 Specification for rain-garden or bioretention filter media

The preferred filter media type is loamy sand. Filter media should (FAWB 2008, p.35):

- Be well graded and contain no gaps in the particle size range.
- Have a particle size distribution (% w/w) of:
    - Clay & silt <3%
    - Very fine Sand 5-30%

  - Fine sand 10-30%
  - Medium-course sand 40-60%
  - Coarse sand 7-10%
  - Fine Gravel <3%
- Contain less than 5% w/w of organic matter and less than 100 mg/kg of phosphorus (to avoid leaching of nutrients).
- Not be hydrophobic
- Not contain dispersive clays
- Be free of rubbish, toxicants, declared plants and local weeds

Biofilters will experience a drop in hydraulic conductivity immediately following construction, mainly due to compaction. However, infiltration capacity will recover due to plant activity, provided the system is not overloaded with silt. Plants with large diameter roots are better than those with fine roots at maintaining infiltration capacity.

3.1.16.4 Specification for selection of plants

Some plants are much better at removing nutrients than others. The filter media is important for the removal of solids (total Suspended Solids and Gross Pollutants) and for the health of the plants:

- Native plant species that are suitable for use in stormwater management measures can be found in Practice Note 7
- Water efficient landscaping practices and species can be found in Practice Note 8
- A mix of species is preferred to promote biodiversity
- The majority of plants should be made up of plants that are efficient at Nitrogen removal, such as Carex species, Juncus species, Melaleuca species, or Goodenia ovata. The remainder can be chosen for aesthetic or biodiversity outcomes.
- Plants are essential to maintain hydraulic conductivity
- Species with thick roots help, such as Melaleuca species
- The effect grows with time as the plants are established
- Higher density planting results is less weed invasion and lower maintenance.

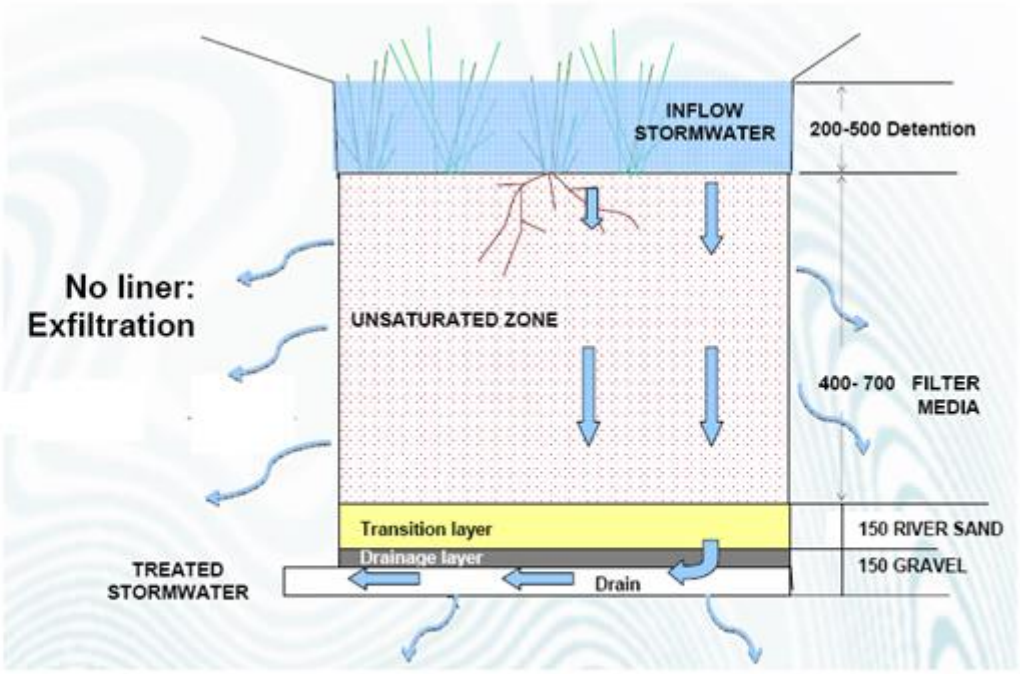


Figure 10 - An unlined system is much better for flow management. An sub-soil outlet at the base is required when the hydraulic conductivity of the surrounding soil is less than 50mm/hour (FAWB 2008, p.17).

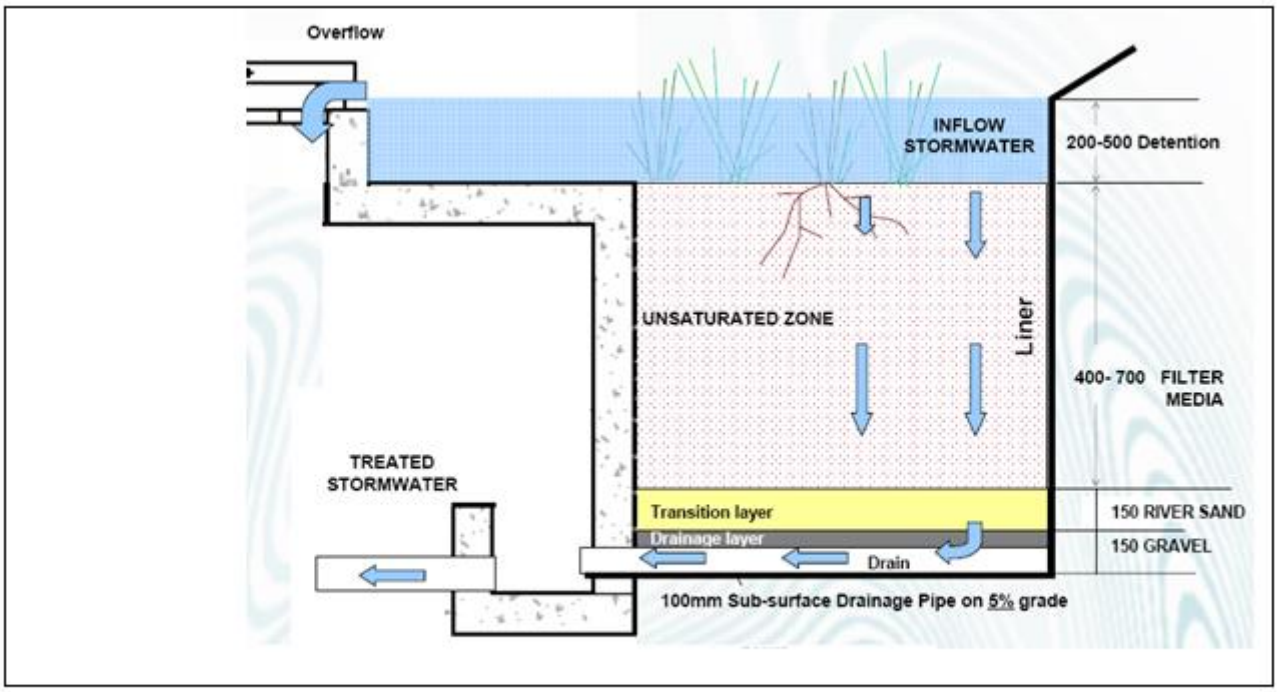


Figure 11 - A lined system is not as efficient as an unlined system, but is required if an infiltration device is to be located close to infrastructure or buildings (FAWB 2008, p.17).

Reference

[12] Appendix A in Argue (2004). A much more reliable in-site measurement of hydraulic conductivity can be found in Appendix B of FAWB (2008).

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