Council Policy

Water Management for Development Policy

Policy Statement

This policy supports Councils commitment to protecting and enhancing the aquatic and terrestrial natural environment while ensuring protection of public and property across the Northern Beaches. The application of these principles, and corresponding planning controls, will deliver effective integrated management of stormwater, rainwater, groundwater and wastewater.

Principles

- Improve the quality of water discharged to our natural areas to protect the ecological and recreational condition of our, beaches, waterways, riparian areas and bushland.
- Minimise the risk to public health and safety.
- Reduce the risk to life and property from any flooding and groundwater damage.
- A sustainable and holistic catchment wide approach is taken to development, of both private land uses and public facilities, on flood prone land.
- Climate change will inform decisions for future water infrastructure.
- Water sensitive urban design measures will be integrated into the built form to maximise liveability and reduce the impacts of climate change e.g. urban heat island effect and intensified rainfall events.
- Wherever possible, water courses are to be conserved or restored to their natural state.
- Reduce the consumption of potable water by encouraging water efficiency, the reuse of water and use of alternative water sources.
- Protect Council stormwater drainage assets during development works and to ensure Council's drainage rights are not compromised by development activities.

Scope and application

This policy applies to all development in the Northern Beaches Local Government Area (LGA) subject to Part 4 and Part 5 of the Environmental Planning & Assessment Act 1979 including development applications, exempt and complying development; except development within the Warriewood Valley Release Area, which is required to comply with Pittwater 21 Development Control Plan Section C6.

This policy also applies to all employees, agents, officers, councillors and committee members of Northern Beaches Council.

Inability to comply with the requirements of this policy may result in Development Consent not being granted.

Responsible Officer

Executive Manager of Environment and Climate Change

Review Date

INSERT DATE

Revision History

Revision	Date	Status	TRIM Ref
1		First draft Water Management for Development Policy	2019/275257
2			

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1.0 Identifying Planning Controls Which Apply

To identify which planning controls apply to the development, applicants MUST refer to both Table 1 and Table 2.

All works are to be designed, constructed and installed in accordance with the following requirements.

Table 1 – Development Types

Development Types		Sections which Apply					
		Section 3.0 General Requirements	Section 4.1 Stormwater Quality and hydrology	Section 4.3 Erosion, Sediment and Pollution Controls	Section 5.0 Disposal of Stormwater	Section 7.0 Water Conservation	Section 9.0 Onsite Stormwater Management
Single Lot Residential Development		✓		✓	✓	✓	✓
Residential Flat Buildings or Multi-residential dwelling houses	Development with a site area less than 1000m^2	✓		✓	✓	✓	✓
	Development with a site area greater than 1000m^2	✓	✓	✓	✓	✓	✓
Commercial or Mixed Use or Industrial	Development with a site area less than 1000m^2	✓		✓	✓	✓	✓
	Development with a site area greater than 1000m^2	✓	✓	✓	✓	✓	✓
Subdivision	Subdivision resulting in the creation of: two (2) lots where the total post development impervious area of the new lots exceeds 40%.	✓	✓	✓	✓	✓	✓
	Subdivision resulting in the creation of: • three (3) lots or more.	✓	✓	✓	✓	✓	✓

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Table 2 – Site/Development Characteristics (more than one requirement may apply)

Site/Development Characteristics		Sections which Apply							
		Section 4.0 Protecting the Environment	Section 4.2 Groundwater Management	Section 6.0 Stormwater Drainage Systems	Section 8.0 Sewage Management	Section 9.0 Onsite Stormwater Management	Section 10.0 Flood Risk Management	11.0 Overland Flow Flooding	Section 12.3 Removal of Private Trees Threating Council Stormwater Infrastructure
Increased hard surfaces	Development where the total existing and proposed impervious areas exceeds 40% of the site area					✓			
	Development proposing an increase in impervious area of more than 50m^2	✓							
Near a Council stormwater system	All development containing or adjacent to Council stormwater infrastructure Refer to Council's Stormwater Planning Maps			✓					✓
Groundwater	All development intercepting groundwater		✓						
No Sewer	Any property not connected to the Sydney Water sewerage network or which utilises an onsite wastewater management system				✓				
Flooding or Overland flow	All development located on Flood Prone Land Refer to Section 10.7 Planning Certificate or Council's Flood Maps:- • High Flood Risk Planning Precinct • Medium Flood Risk Planning Precinct • Low Flood Risk Planning Precinct						✓		
	All development on land affected by overland flows. Refer to Council's Stormwater Planning Maps							✓	

2.0 Definitions

Explanations for specific terminology used throughout the Policy.

AEP Storm Event - Annual Exceedance Probability, the change of a flood of a given or larger size occurring in any one year, usually expressed as a percentage. For example, if a peak flood discharge of 500m^3/s has an AEP of 5%, it means that there is a 5% chance (i.e. broadly 1 in 20 chance) of a 500m^3/s or larger event occurring in any one year.

Average Recurrence Interval (ARI) - means the average or expected value of the period between exceedances of a given rainfall event or discharge.

Australian Height Datum (AHD) - a common national surface level datum approximately corresponding to mean sea level.

Bio-retention – a process of treating stormwater**.** The intention is that pollutants are removed when diverted stormwater flows through dense vegetation overlaying a porous, sand-based filter medium with a drainage pipe at the bottom discharging to the downstream system.

Catchment - means an area of land, bound by hills, mountains and the like from which all runoff water flows to the same low point. A catchment may possess more than one sub-catchment.

Downstream catchment - means the direct sub-catchment a property would drain to via gravity.

Development - has the same meaning as defined in the Environmental Planning and Assessment Act 1979.

Development Application (DA) - has the same meaning as defined in the Environmental Planning and Assessment Act 1979.

Drainage - has the same meaning as defined in the Plumbing Code of Australia, which means any sanitary drainage, liquid trade waste drainage or stormwater drainage system.

Endangered Ecological Communities - has the same meaning as defined in the Threatened Species Conservation Act 1995.

Exempt and Complying Development - means any development undertaken under the State Environmental Planning Policy (Exempt and Complying Development Codes) 2008.

Existing development - means any development prior to authorisation of this policy.

Floodways - those areas of the floodplain where a significant discharge of water occurs during floods. They are often aligned with naturally defined channels. Floodways are areas that, even if only partially blocked, would cause a significant redistribution of flood flow, or a significant increase in flood levels.

Flood plain - Areas of land, which is subject to inundation by flood up to, and including the PMF, that is flood prone land.

Flood Planning Level (FPL) - is the combination of flood levels and freeboards selected for setting design floor levels and floodplain risk management purposes, generally defined by the 1% AEP flood level plus 500mm.

Greywater - waste water from showers, baths, hand basins, laundry and washing machines etc.

Impervious area - refers to land covered by impervious surfaces such as buildings, paving, asphalt, tiles, and the like, which limits or prevents infiltration of water.

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Infrastructure Development - means any development undertaken under the State Environmental Planning Policy (Infrastructure) 2007.

Integrated Development - has the same meaning as defined in the Environmental Planning and Assessment Act 1979.

Inter-allotment drainage easement - has the same meaning as an Easement to drain water as referred to in the Conveyancing Act 1919. An easement usually identified on the Certificate of Title issued by the NSW Land and Property Information.

Inundation - is the experience being flooded, covered or overspread with water by any source of water including but not limited to fluvial, tidal, oceanic, overland flows, and stormwater.

Low Level Properties - means a property that has the ground level, which is lower than the roadway fronting the property.

New development - means any development being designed or constructed after the authorisation of this Policy.

Onsite stormwater detention system (OSD) - means is a stormwater drainage device to control the amount of stormwater discharge to a specified rate. The device is to be constructed on the subject property.

Onsite Wastewater Management System - has the same meaning as Sewage Management Facility as defined in the Local Government (General) Regulation 2005.

Overland Flow - means inundation by excess rainfall runoff, flowing across land before it enters a principal watercourse. Includes sloping areas where overland flows develop along alternative paths once system capacity is exceeded.

Pollution - has the same meaning as defined in the Protection of the Environment Operations Act 1997.

Permissible Site Discharge (PSD) - the maximum permitted flow exiting the subject property

Potable Water - water that is safe to drink or use for food preparation.

Probable Maximum Flood (PMF) - is the largest flood that could conceivably occur at a particular location, it is usually estimated from probable maximum precipitation. The PMF defines the extent of flood prone land, that is, the floodplain.

Rainwater - water that has fallen as rain and has not collected soluble matter from contact with soil or other materials.

Receiving waters - means a waterway/s into which water discharges from a development.

Riparian land - has the same meaning as defined in Council's Protection of the Waterways and Riparian Land Policy.

Riparian zone - has the same meaning as defined in Council's Protection of the Waterways and Riparian Land Policy.

Sewage - has the same meaning as defined in the Local Government (General) Regulation 2005.

Site Storage Requirements (SSR) - the volume of on-site detention required for the subject property.

Stormwater - water draining off a site from the rain that falls on the roof and land, and everything it carries e.g. soil, organic matter, litter, and pollutants.

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Tanked Construction - Involves fully sealing the basement structure to prevent the entry of groundwater. Groundwater surrounding the structure is controlled through the provision of subsoil drainage that allows the water to move around and beyond the structure without significant variations to the pre-existing groundwater regime.
Treatment - any process that improves the quality of water for specific uses or disposal into natural areas. Standards of water quality are defined throughout these guidelines.

Undeveloped Land - means land; that has not been subject to prior development, or is in a state of nature, or with an impervious area of less than 10%

Watercourse - has the same meaning as defined in Council's Protection of the Waterways and Riparian Land Policy.

Water Sensitive Urban Design (WSUD) - is a holistic approach to the planning and design of urban development, which aims to minimise the impacts on the natural water cycle and protect the health of aquatic ecosystems. Water sensitive urban design provides a proven approach to ameliorate the impact of urbanisation on the water cycle, and is underpinned by the following principles:

- protecting and enhancing the natural aspects of the Northern Beaches' receiving environments
- treating urban stormwater to best practice standards for reuse and/or discharge to receiving waters
- reducing potable water demand through water efficiency, stormwater harvesting and wastewater reuse
- minimising wastewater generation and treating wastewater so it can be reused
- integrating vegetated stormwater treatment and harvesting systems into the landscape, so as to provide increased biodiversity, amenity and micro-climate benefits which can reduce the heat island effect
- providing green infrastructure and green links.

Waterway - has the same meaning as defined in Council's Protection of the Waterways and Riparian Land Policy.

Wastewater - any water that has been affected by human use.

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3.0 General Requirements

Works are to be designed, constructed and installed in accordance with the following:

- Auspec1 Design Manual
- Minor works specification
- Local Government Act 1993
- Roads Act 1993
- Plumbing Code of Australia
- Relevant Australian Standards
- Environment & Health Protection Guidelines for Onsite Sewage Management for Single Households
- Technical Specifications where specified
- Water Sensitive Warringah Strategic Plan
- Water Sensitive Warringah Technical Paper

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4.0 Protecting the Environment

This policy aims to protect and improve the health of the Northern Beaches waterways through the appropriate planning, design and operation of stormwater treatments measures for urban development. The outcomes Council seeks include:

a) The integration of water sensitive urban design measures in new developments to address stormwater and floodplain management issues

b) Improvement of the quality of stormwater discharged from urban development

c) Stormwater flows that mimic natural flows by minimising impervious areas, reusing rainwater and stormwater and providing treatment measures that replicate the natural water cycle

d) Preservation, restoration and enhancement of riparian corridors as natural systems.

4.1 Stormwater Quality and Hydrology

Stormwater treatment measures are required to ensure the development does not unreasonably impact the downstream environment.

4.1.1 Stormwater Quality Requirements

To determine which stormwater quality requirements apply to the site use Table 3 below to identify the land type.

Table 3 – Site/Development Characteristics (more than one requirement may apply)

Land Type	Controls which apply
Undeveloped land[i] within a high quality Catchment[ii].	Table 4 – Stormwater Quality Objectives
Land containing or adjoining wetlands, bushland and saltmarsh endangered ecological communities, and land adjacent to estuarine habitat and areas containing seagrass, and land within the riparian buffer of a Coastal Upland Swamp in the Sydney Basin Bioregion Endangered Ecological Community[iii]	
Land subject to Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005	Please refer to Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005 and the RMS' Stormwater disposal into Sydney Harbour
Land that is not identified above that is single lot residential development, residential flat buildings, multi-residential dwelling houses, commercial, mixed use and industrial lots with a site area less than 1000m^2 that propose to increase impervious area by more than 50m^2 that is not a subdivision	Must install a filtration device that removes organic matter and coarse sediments from stormwater prior to discharge from the land. All stormwater treatment measures must make provision for convenient and safe regular inspection, periodic cleaning, and maintenance.
All other land not identified above	Table 5 – General Stormwater Quality Requirements

Notes:

i. Refer to the Definitions Section 2.0 in this Policy for definitions for "Undeveloped Land".

ii. High quality catchments are identified using Map 1

iii. To determine if the development is within any of the above noted land areas refer to the following: Section 10.7 Planning Certificate, Protection of Waterways and Riparian Land Policy, and Waterways and Riparian Lands Map.

Table 4 – Stormwater Quality Objectives

Criteria	Objectives
Stormwater Quality	Stormwater quality (temperature, salinity, chemical makeup and sediment loads) discharging from the development shall not impact the receiving waters. Reference shall be made to local data if available, including the Warringah Creek Management Study and the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC), or other widely accepted guidelines. Stormwater and other drainage shall not be discharged into saltmarsh.
Sediment	Disturbance to stream and wetland sediments is to be minimised by regulated discharge of stormwater and dissipation of flows at discharge locations. Runoff from the development must be retained at natural discharge rates and sediments controlled at the source.
Hydrology	Stormwater and groundwater flow is to mimic natural conditions and ensure a dispersed pattern of flow, avoiding centralised or concentrated discharge points into the wetland or waterway. Natural flow regimes must be retained. The reduction or increase in flows, alteration in seasonality of flows, changes to the frequency, duration, magnitude, timing, predictability and variability of flow events, altering surface and subsurface water levels and changing the rate of rise or fall of water levels must be avoided.

Table 5 – General Stormwater Quality Requirements

Pollutant	Performance Requirements
Total Phosphorous	65% reduction in the post development mean annual load[1]
Total Nitrogen	45% reduction in the post development mean annual load[1]
Total Suspended Solids	85% reduction in the post development mean annual load[1]
Gross Pollutants	90% reduction in the post development mean annual load[1] (for pollutants greater than 5mm in diameter)
pH	6.5 - 8.5
Hydrology	The post-development peak discharge must not exceed the pre-development peak discharge for flows up to the 50% AEP

[1]The percentage reduction in the post development mean annual loads are relative to the loads from the proposed development without treatment applied.

4.1.2 Standards of Design

a) All stormwater treatment measures must be designed in accordance with the requirements of this Policy and Northern Beaches Council's WSUD and MUSIC Modelling Guidelines (Appendix 1) and modified for local conditions as appropriate.

b) Stormwater treatment measures must be part of a unified design for the project and contribute to a positive urban design outcome, visually and physically integrated with the adjacent built and natural environment.

c) Council does not support the use of proprietary devices for pollutant removal if they do not achieve infiltration or the removal of dissolved pollutants. Council may approve the use of proprietary devices where infiltration is not achievable (for instance in clay soils) when evidence is provided that demonstrates the performance of the device in the field.

d) The substitution of an "equivalent" device for the stormwater treatment measure approved in the development application process must first be approved by the Principal Certifying Authority.

e) Stormwater treatment measures must be sited on private land. Council will not accept the ownership or maintenance responsibilities of any stormwater treatment devices.

f) For alterations and additions, and similar developments, the stormwater quality requirements only apply to the new works.

g) Stormwater treatment measures must not be sited within riparian zones or within remnant vegetation.

h) Stormwater treatment measures must not be completed, including the installation of filter media and vegetation, prior to two years after the issue of the subdivision certificate or before landform is stabilised in 90 per cent of the area the measures will service, whichever milestone is reached first. A two-year bond will be placed on stormwater treatment measures and will be refunded once the measures have been completed to the satisfaction of the Principal Certifying Authority.

i) Where stormwater treatment measures are constructed by a developer for handover to a future owner, the stormwater management plan must include asset handover arrangements including:

    i) proposed maintenance program including activity description and frequency (first 12 months following commissioning of the stormwater treatment measure – please also see section 4.1.4 for ongoing maintenance requirements)

    ii) plan for education of private owner on legal restrictions, maintenance and management responsibilities OR a checklist for handover to Council. This should include impervious area restrictions for the site to maintain the water balance, the intent of the stormwater treatment measure/s, and modelled pollutant removal rates.

j) All stormwater treatment measures must be sited in an area which is easily and safely accessible (e.g. road side) and have wet weather access.

k) Stormwater treatment measures with a permanent water body must be completely fenced to the standard as required by the *Swimming Pools Act 1992* and associated Australian Standards.

l) A positive covenant and Restriction As to User must be registered on the title for the stormwater treatment measures to ensure regular maintenance and reliable operation. The positive covenant must include a list of all stormwater treatment assets, the operation and maintenance plan for each, and acknowledgement that in the event that the devices are not maintained appropriately, Northern Beaches Council reserves the right to enter the property and carry out appropriate maintenance of the device at the cost of the property owner.

4.1.2.1 Special requirements for Region 3 – Southern Catchments

Special requirements relating to stormwater disposal apply to each zone in Region 3 (Map 3 – Region 3 Zone Map). These requirements are in addition to similar controls listed in Sections 4.1 and 4.3.

4.1.2.1.1 Region 3 Zone 1

Discharge outlets are required to have silt/grease arrestors and trash screens.

4.1.2.1.2 Region 3 Zone 3 and 4

Erosion control shall be provided as follows:

a) Appropriate scour protection devices installed at the outlet to stormwater conduits

b) Installation of pollution control devices to control sediment laden overland stormwater flows prior to discharge from the land.

Scour protection devices shall include embankment stabilisation e.g. rock walls, concrete aprons, gabions, turf, jute mesh, energy dissipating units, or other more appropriate erosion control devices approved by Council. Preference is for 'soft engineering' solutions.

Silt traps must be installed in all stormwater pits to contain silt and debris. Silt traps shall be installed at the bottom of pits at a depth of 200mm to capture silts and fines. Weep holes shall be drilled into the base of the pit to ensure that it does not permanently hold water. Where the pit is located over impervious material, subsoil drains will also need to be laid.

4.1.3 Demonstrating Compliance

To demonstrate compliance with the relevant stormwater performance requirements, a model preferably through the Model for Urban Stormwater Improvement Conceptualisation (MUSIC), or an equivalent, widely accepted model or methodology must be provided.

Should MUSIC be used, modelling shall be undertaken in accordance with Northern Beaches Council's WSUD and MUSIC Modelling Guidelines (Appendix 1) unless alternative modelling parameters are justified on the basis of local studies. Details of the modelling of those elements, parameters and assumptions used, and all data files must be provided to the Certifying Authority as required by the conditions of consent for the development application.

The applicant is to engage the services of a qualified Civil Engineer, who has membership to the Institution of Engineers Australia, National Engineering Register (NER) to ensure the development complies with the relevant stormwater quality requirements outlined above.

4.1.4 Operation and Maintenance Plan

An Operation and Maintenance Plan is to be prepared to ensure that stormwater quality measures remain effective in perpetuity. For Community Title developments, the Plan is to be included in the Community Management Statement.

The Plan must contain the following:

a) Inspection and maintenance schedule of all stormwater treatment measures

b) Maintenance requirements for establishment period

c) Routine maintenance requirements

d) Funding arrangements for the maintenance of all stormwater treatment measures

e) Identification of maintenance and management responsibilities

f) Vegetation species list associated with each type of vegetated stormwater treatment measure

g) Waste management and disposal

h) Traffic control (if required)

i) Maintenance and emergency contact information

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j) Renewal, decommissioning and replacement timelines and activities of all stormwater treatment measures (please note that a DA may be required if an alternative stormwater treatment measure is proposed)

k) Work Health and Safety requirements

l) Requirements for inspection and maintenance records, noting that these records are required to be maintained and made available to Council upon request.

4.2 Groundwater Management

a) The groundwater regime is to be maintained as close as possible to pre-development conditions and shall not adversely impact receiving waters and groundwater dependant ecosystems.

b) Developments intercepting the water table are classified as Integrated Development and will require concurrence from the NSW Natural Resources Access Regulator under the Water Management Act 2000.

c) A Geotechnical and Hydrogeological Report prepared by an Engineer, who has membership to the Institution of Engineers Australia, National Engineering Register (NER) must be submitted to the Council with the development application.

d) Groundwater discharged to the stormwater system shall comply with the discharge requirements detailed in Section 4.3 – Erosion, Sediment and Pollution Controls and any relevant legislation.

e) Records of all water discharges and monitoring results are to be documented and kept on site. Copies of all records shall be provided to the appropriate regulatory authority upon request.

f) Any concentrated groundwater or seepage flows must be discharged to the nearest Council stormwater system in accordance with Council's Auspec1 Design Manual. Discharge to the kerb and gutter will not be accepted.

g) Construction techniques, where possible, shall eliminate the need for ongoing management and disposal of groundwater or seepage flows i.e. a tanked construction designed by a suitably qualified Civil Engineer. Un-tanked structures are unlikely to be supported.

h) Where belowground structures are in close proximity to each other (typically less than 3 metres) there shall be no allowance provided for natural flow of groundwater through these narrow corridors, unless adequate justification from a suitably qualified engineer is provided.

i) Provision must be made for groundwater flows in the design of perimeter or through drainage system.

4.3 Erosion, Sediment and Pollution Controls

a) Erosion and sediment controls are to be designed, constructed and installed in a accordance with Managing Urban Stormwater: Soils and construction - Volume 1 and maintained until the site is fully stabilised to prevent pollution of the receiving environment.

b) Environmental safeguards (silt curtains, booms etc.) are to be installed and maintained during construction of in-stream and aquatic works to ensure there is no escape of turbid plumes into the aquatic environment.

c) Council will require the submission of one of the following plans with the development application:

- An Erosion and Sediment Control Plan (ESCP) for all development, which involves the disturbance of up to 2500m^2 of land.

- A Soil and Water Management Plan (SWMP) for all development, which involves the disturbance of more than 2500m^2 of land. A SWMP must be prepared by a suitably qualified Civil Engineer, who has membership to the Institution of Engineers Australia, National Engineering Register (NER).

d) The design storm event for the stability of erosion, sediment and pollution control structures is to be taken as the 10% AEP time of concentration storm event, unless as specified by Council.

e) Water to be discharged must be tested and, if required, treated to ensure it meets the water quality criteria and that pollution of the receiving waters does not occur.

Before water can be discharged to the receiving environment, the following criteria must be met, unless subject to an Environmental Protection Licence or site-specific criteria. Temporary dewatering in an aquifer requires the approval of the Natural Resources Access Regulator.

Parameter	Criterion	Method	Time Prior to Discharge
Oil and grease	No visible	Visual inspection	<1 hour
pH	6.5- 8.5	Probe/meter	<1 hour
Total Suspended Solids	<50mg/L	Meter/grab sample	<1 hour

f) Records of all water discharges and monitoring results are to be documented and kept on site. Copies of all records shall be provided to the appropriate regulatory authority upon request.

g) Additional point: Vehicle wash bays must be designed and constructed in a manner that does not allow polluted waters to enter the stormwater drainage system.

h) All chemicals and hazardous substances must be stored and handled in accordance with relevant State and Federal requirements. This includes providing mandatory spillage containment areas (i.e. bunding) to prevent chemicals entering the stormwater system and storage above the Flood Planning Level if located on flood prone land.

4.4 Stormwater Discharge to Watercourse or Open Channel

a) Direct discharge to a waterway will only be permitted from land directly adjoining a waterway or coastal area when it can be demonstrated through the Water Management Plan that no other alternatives are available. Other alternatives should be considered as detailed in Section 5.5 of this Policy.

b) The creation of a discharge point within a watercourse is a Controlled Activity under the *Water Management Act 2000* and will require approval from the NSW Natural Resources Access Regulator unless exemptions apply (refer to Schedule 5 of the Regulations) and must comply with Council's Protection of Waterways and Riparian Land Policy.

c) Only a single discharge point to the watercourse or open channel from the development will be permitted.

d) The outlet structure must comply with Guidelines for Outlet Structures prepared by the NSW Office of Water and Council's Protection of Waterways and Riparian Land Policy for additional requirements.

5.0 Disposal of Stormwater

5.1 General

All works are to be designed, constructed and installed in accordance with the following:

a) Stormwater drainage for all properties must be by gravity means. Mechanical methods of stormwater disposal (e.g. pump-out systems) will only be permitted for draining sub-surface flows from underground areas and basement carparks where a direct connection to a Council drainage system can be achieved. No pump-out or seepage flows are to be discharged to the kerb.

b) Diverting flows from one catchment (or sub-catchment) to another catchment (or sub-catchment) will not be permitted. Properties must drain in the direction of their natural catchment.

c) Private drainage easements obtained through downstream properties for piping flows to a public drainage system, at the applicant's expense, are strongly encouraged. Refer to Section 6.6 for further requirements regarding drainage easements.

d) All drainage structures are to be designed to be visually unobtrusive and sympathetic with the proposed development and the surrounding environment i.e. water sensitive urban design.

e) Disposal of stormwater must not unreasonably impact on the downstream environment.

f) Piping the property drainage system across a public road is not permitted. Consideration will be given to extending Council's system across the public road to facilitate disposal of stormwater from the property at the applicant's expense.

g) Stormwater drainage works must be approved by Council under the provisions of the Roads Act 1993 and Local Government Act 1993.

5.2 Street & Trunk Drainage

a) Street and trunk drainage is to be designed and constructed so as to:

   i) provide convenience and safety for pedestrians and traffic during storm events

   ii) minimise damage to private and public buildings

   iii) minimise risks to life and property by overland flow during major storm events.

b) Street and trunk drainage must comply with the following specifications:

   i) Auspec1 Design Manual

   ii) Minor Work Specification

5.3 Discharge to Roads and Maritime Service Drainage Systems

Where stormwater is to be discharged to the street gutter or underground drainage system of a road that is under the control of the Roads & Maritime Services (RMS), Council will refer the development application to the RMS for review.

5.4 Properties Unable to Connect to a Council Stormwater Drainage System or Easement

a) Any property that is unable to connect to a Council stormwater drainage system, such as land falling naturally away from a Council stormwater drainage system, is required to comply with Section 5.5 of this Policy.

b) Developments proposing to discharge stormwater to a watercourse or open channel must comply with the requirements of Section 4.4 – Stormwater Discharge to Watercourse or Open Chanel.

c) Where an inter-allotment drainage easement is to be created, a letter of agreement to the creation of the easement from all the affected property owners shall accompany the development application. This is to demonstrate to Council that a suitable easement/s can be obtained. The letter/s shall be accompanied with a plan of the location of the proposed easement/s also signed by all the affected property owners. The letter/s is/are not to contain any conditions that may preclude the creation of the easement.

5.5 Stormwater Drainage from Low Level Properties

The purpose of this section is to:

a) Manage overland flow, nuisance flooding and groundwater related damage caused by low level properties to adjacent downstream properties during storm events

b) Manage the impact of stormwater runoff on Council's stormwater drainage infrastructure as a result of any development on a low level property and ensure low level properties drain to their natural downstream catchment

c) Provide guidance for applicants with a property that naturally falls away from the street, for an appropriate drainage system and lawful point of discharge acceptable to Council.

5.5.1 Alternate Discharge Approach

This applies to all types of developments and land uses where these properties fall naturally away from the street and cannot connect directly to a Council drainage system. The requirement for stormwater disposal is dependent on the type of proposed development or proposed land use for the property.

Council is to be satisfied that all avenues of Stage 1 (Section 5.5.1.1 and 5.5.1.2) have been exhaustively investigated and these avenues considered impractical or unviable, prior to Council consenting to the property owner or developer progressing to the next stage. The same process must be followed as applicants proceed sequentially through the stages before finding an appropriate discharge solution.

OSD is to be provided in accordance with Section 9 of this policy.

5.5.1.1 New Single Dwelling House

For a development where a new single dwelling house (and any ancillary structures such as granny flats) is proposed, stormwater disposal from the site shall be in accordance with the following sections.

5.5.1.1.1 Stage 1 – Inter-Allotment Drainage Easements

Proponents of the development must exhaustively investigate the below options for stormwater drainage:

a) Connection of stormwater to an existing Council stormwater drainage line located within the subject site, subject to the drainage line having sufficient capacity.

b) Connection of stormwater to an existing inter-allotment drainage easement and pipeline subject to the property owner demonstrating the inter-allotment pipeline has sufficient capacity and the property owner having a formal drainage easement created over the inter-allotment pipeline within the downstream property. If the existing inter-allotment pipeline does not have sufficient capacity, the capacity of the pipeline will need to be increased to cater for the additional flow.

c) Creation of a new easement to drain stormwater to Council's drainage infrastructure through the downstream property(s).

Noting there may be difficulties obtaining an easement through multiple properties, the property owner is to ascertain which adjoining downstream property(s) it may be feasible and practical to drain stormwater through, and then approach the owner(s) to request an easement be granted for the purpose of draining stormwater to Council's drainage system (Appendix 2- Sample Letter). If the property owner is unable to attain any written approval from the adjacent downstream property owner(s), the property owner is to then enclose a Statutory Declaration stating the above.

5.5.1.1.2 Stage 2 – Onsite Stormwater Absorption

Where the means of disposal in Stage 1 are not available, the use of an on-site absorption system will be permitted subject to the following:

a) The on-site absorption system is designed by a suitably experienced and qualified civil engineer

b) The on-site absorption system will not have an adverse impact upon adjoining and/or downstream properties by the direction or concentration of stormwater on those properties

c) Soil absorption characteristics and other physical constraints indicate the on-site absorption system is appropriate for the property (refer Appendix 3 – On-site Absorption Design Guidelines).

The on-site absorption system shall require the creation of a Positive Covenant and Restriction on Use of Land over the system.

5.5.1.1.3 Stage 3 – Level Spreader

Where the means of disposal in Stage 1 and Stage 2 are not available, the use of a level spreader will be permitted subject to the following circumstances:

a) The level spreader will have minimal impact on the upon adjoining property, including public reserves and parks, by the direction and flow of stormwater

b) Soil absorption characteristics and other physical constraints indicate the on-site absorption system is not appropriate for the property (refer Appendix 3 – On-site Absorption Design Guidelines)

c) Compliance with any requirements of the affected downstream property owners.

The level spreader shall require the creation of a Positive Covenant and Restriction on Use of Land over the system.

5.5.1.1.4 Stage 4 – Other Methods

Other methods of stormwater disposal may be considered, if all of the abovementioned methods have been exhaustively investigated and were considered not appropriate for this development.

5.5.1.2 Alterations and Additions to a Single Dwelling House and Granny Flats

5.5.1.2.1 Stage 1 – Discharge to an Existing Drainage System

Connection of stormwater to the existing stormwater disposal system will be permitted under the following circumstances:

a) Connection into an existing inter-allotment stormwater pipeline or Council's stormwater pipeline subject to the drainage pipeline having sufficient capacity and the property owner having formal drainage easement(s) created over the above pipeline within the downstream property(s) or the existing drainage system was previously approved by Council

b) There are no valid objections of overland flow and groundwater related damage and the associated inconvenience from downstream property owners.

5.5.1.2.2 Stage 2 – Inter-Allotment Drainage Easement

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Where the means of disposal in Stage 1 is not available, the creation of a new drainage easement will be required subject to creation of a new easement to drain stormwater to Council's drainage infrastructure through the downstream property(s).

Noting there may be difficulties obtaining an easement through multiple properties, the property owner is to ascertain which adjoining downstream property(s) it may be feasible and practical to drain stormwater through, and then approach the owner(s) to request an easement be granted for the purpose of draining stormwater to Council's drainage system (refer Appendix 2 - Sample Letter). If the property owner is unable to attain any written approval from the adjacent downstream property owner(s), the property owner is to then enclose a Statutory Declaration stating the above.

5.5.1.2.3 Stage 3 – On-Site Stormwater Absorption

Where the means of disposal in Stage 1 and Stage 2 are not available, the use of an on-site absorption system will be permitted subject to the following:

a) The on-site absorption system is designed by a suitably experienced and qualified civil engineer

b) The on-site absorption system will not have an adverse impact upon adjoining and/or downstream properties by the direction or concentration of stormwater on those properties

c) Soil absorption characteristics and other physical constraints indicate the on-site absorption system is appropriate for the property (refer Appendix 3 – On-site Absorption Design Guidelines).

The on-site absorption system shall require the creation of a Positive Covenant and Restriction on Use of Land over the system.

5.5.1.2.4 Stage 4 – Level Spreader

Where the means of disposal in Stages 1, 2 and 3 and are not available, the use of level spreader will be permitted subject to the following circumstances:

a) The level spreader will have minimal impact on the upon adjoining property, including public reserves and parks, by the direction and flow of stormwater

b) Soil absorption characteristics and other physical constraints indicate the on-site absorption system is not appropriate for the property (refer Appendix 3 – On-site Absorption Design Guidelines)

c) Compliance with any requirements of the affected downstream property owners

d) The level spreader shall require the creation of a Positive Covenant and Restriction on Use of Land over the system to be registered with the New South Wales Land Registry Service.

5.5.1.2.5 Stage 5 – Other Methods

Other methods of stormwater disposal may be considered, if all of the abovementioned methods have been exhaustively investigated and were considered not appropriate for this development.

5.5.1.3 All Other Developments

For all other developments, except dwelling houses and secondary dwellings, that is subdivision developments, commercial developments, industrial development, boarding houses and mixed commercial/industrial/residential, etc. stormwater disposal via a gravity fed pipeline is required where these properties fall naturally away from the street. An easement(s) to drain stormwater to Council's drainage infrastructure through the downstream property(s) is required.

An application under Section 88K of the Conveyancing Act 1919 can be made to allow the Court to consider making an order to impose an easement over land if the easement is reasonably necessary for the effective use or development of other land that will have the benefit of the easement.

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Where the above cannot be achieved, the development application will not be supported.

5.6 Stormwater Entering Properties from Upstream Lots

a) Runoff currently entering the site from upstream properties should not be obstructed from flowing onto the site nor redirected so as to increase the quantity or concentration of surface runoff entering adjoining properties.

b) When a retaining wall is to be constructed across an overland flow path, any intercepted flow must be contained within the property where the retaining wall is required and this flow connected to the site drainage system.

c) Where the overland flow rates could pose a risk to life and property, the requirements of Section 11.0 – Overland Flow Flooding will need to be satisfied.

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6.0 Stormwater Drainage System

When a development application or application for a Complying Development Certificate is lodged on land that is burdened by or is adjacent to a Council stormwater drainage system and/or easement, the requirements outlined below are to be implemented.

This is to ensure that Council's drainage infrastructure is not damaged and that costs and liabilities are minimised when constructing, replacing, maintaining or obtaining emergency access to constructed public drainage systems located within private property.

Where the drainage system is a natural (unconstructed) drainage system or watercourse, refer to the Protection of Waterways and Riparian Land Policy for further detail.

6.1 Public Drainage Systems

6.1.1 Permanent Structures over Council's Drainage Easements

The construction of buildings or other permanent structures over or under constructed public drainage systems is not permitted.

In certain cases consideration may be given to a development proposal that can satisfy the minimum requirements for construction and maintenance access and comprehensively demonstrate that the objectives of this policy will be met. In these cases, it will also be necessary to demonstrate that the site cannot be reasonably developed without building over, or by relocating Council's drainage system.

Filling over Council's drainage systems may be permitted, subject to the approval of Council's technical staff with supporting hydraulic studies prepared by a Civil Engineer registered on the National Engineering Register (NER).

The hydraulic study is to demonstrate that there are no adverse effects including diversion of overland flow paths and flooding of upstream and downstream properties. Overland flows are not permitted under any structures.

Fences and gates are not to be built over Councils drainage system or within an easement as they impede the overland flow path and restrict maintenance access. These may be permitted if it is demonstrated that there are sufficient openings to cater for the overland flow and prevent the potential for debris blockages. Fences and gates are to be designed to be able to be readily dismantled. All costs associated with the removal and reinstatement of the fences or gates will be borne by the property owner.

6.1.1.1 Minimum Requirements for Construction and Maintenance Access

Council may give a property owner approval to build a permanent structure over an existing Council drainage system where the structure provides adequate access for Council to reconstruct and maintain the drainage system. Council will not approve a structure over a public drainage system, which will result in Council incurring additional costs to maintain or upgrade the drainage system by having to use specialised equipment or construction techniques.

6.1.1.1.1 Dimensional Requirements

Council's dimensional requirements for access are governed by the minimum horizontal and vertical clearances necessary for standard machinery to gain access to, and undertake construction and maintenance of public drainage systems. These clearances include:

a) The vertical clearance is the distance between the surface level over the public drainage system to the underside of the overlying structure. This is generally governed by the vertical swept path of backhoes, excavators and cranes and must take into account clearances necessary to load and unload standard trucks. The minimum vertical height shall be 5.0 metres.

b) The horizontal clearance is the distance between permanent obstructions along the line of the public drainage system. This is generally governed by turning circles and horizontal swept paths of backhoes, excavators and cranes and must take into account the limited manoeuvrability capabilities of these standard machines. The horizontal clearance shall be a minimum of 3.0 metres and increase incrementally in accordance with Table 6 – Easement widths (Section 6.1.2.1).

The above dimensional values are minimums only. The required clearances will vary according to the size of the Council drainage system and are subject to the discretion of Council's technical staff.

6.1.1.1.2 Structural Provisions

The pavement over which Council will obtain access to the public drainage system shall be designed and constructed in accordance with relevant Australian standards to sustain the loadings imposed by Council's construction vehicles or equipment. Any pavement constructed on the surface over the Council drainage system shall include construction joints along each longitudinal edge of the easement over the drainage system, in order to facilitate Council's access to the drainage system. Minimum cover over Council's pipelines / culverts is to be 600mm. Where this cannot be achieved, a proposal to modify this will need to be submitted to Council's technical staff for approval.

Footings or any structural support elements of any building located adjacent to an easement or constructed public drainage system are to be a minimum of 300mm below the invert of the public drainage system and may rise at 1:1 from the edge of the easement or from 1.0m horizontal clearance if no easement is in place (refer to Figure 1 below).

Any structural supports such as foundations, piers and footings located adjacent to an easement or public drainage system, will only be permitted if they do not impose any load onto the underlying drainage structure, and that the built structure will not be undermined by any future Council maintenance, renewal or upgrade work or overland flows.

Structural support elements are not permitted within the cross sectional area of an open channel or natural watercourse.

Planting of trees or large shrubs, particularly those with extensive root systems, is not permitted over the public drainage system or within an easement, as they damage the system and obstruct overland flows.

Figure 1 - Footing Placement in Relation to Pipe

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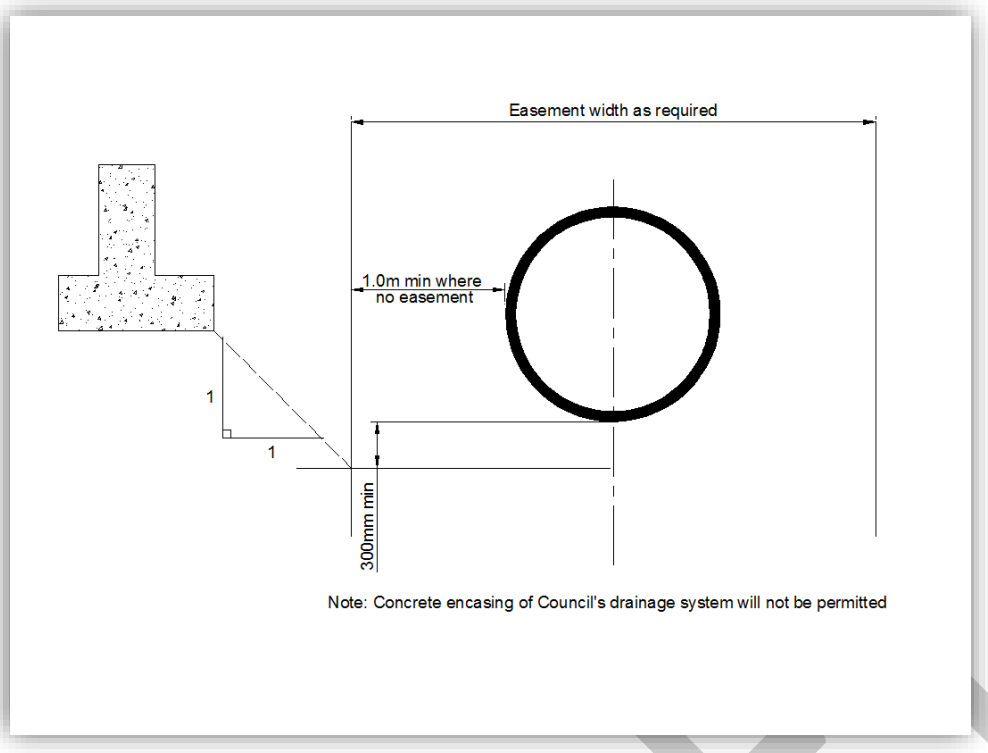


6.1.2 Easement Requirements for Council Drainage Systems

Where there is no current easement over the public stormwater drainage system within private property, a suitable easement to benefit Council is to be registered on the title of the land as part of the development process. This is required where any proposed development works are within 5.0m of a public drainage system or diversion works are proposed. All costs including legal and surveying associated with the creation of the easement are to be borne by the applicant.

6.1.2.1 Structural Provisions

The width of an easement is set to ensure:

a) the integrity of the stormwater drainage systems is maintained

b) stormwater flows including overland flow have continuity and are not impeded

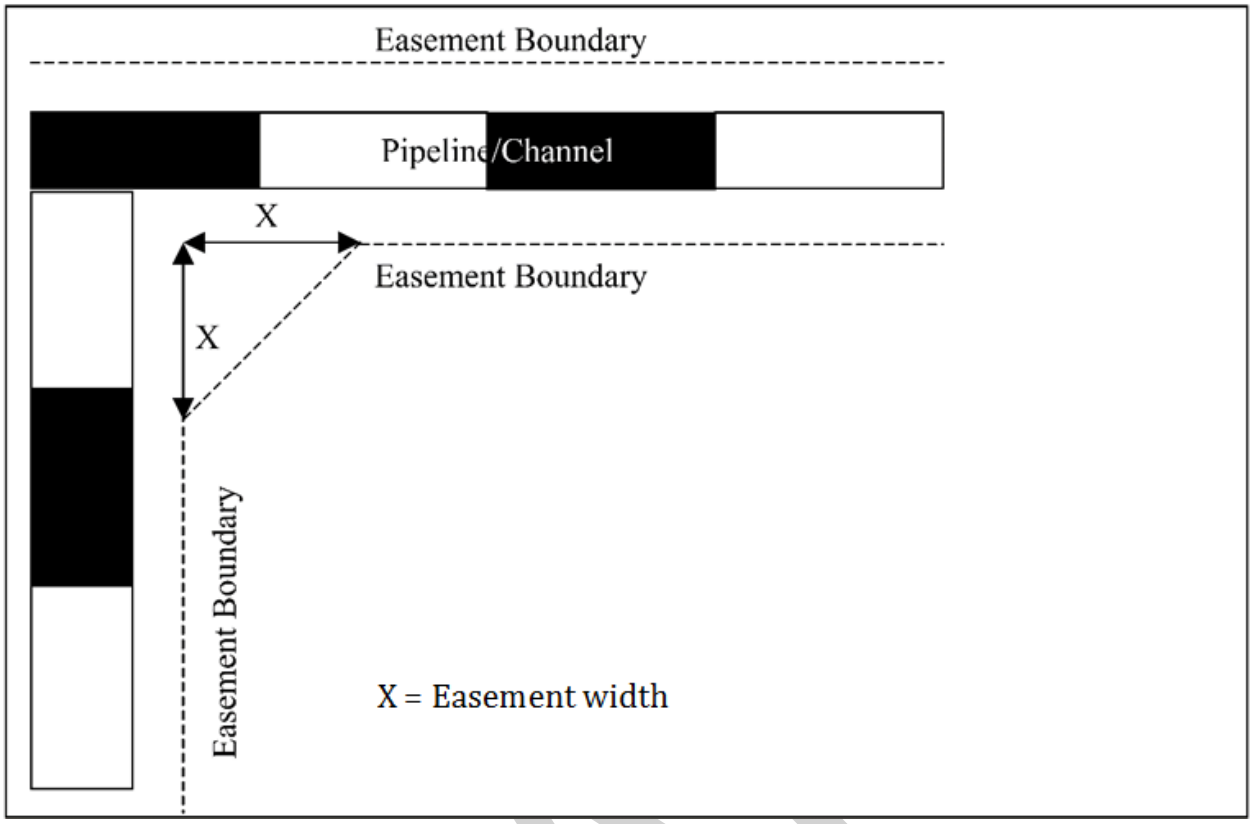
c) access is available for maintenance, operational and renewal activities of the constructed public drainage system.

All easements are to be located over the centreline of the stormwater drainage system. Where multiple pipes, deep pipes, pits or associated structures are proposed, a wider easement will be required and is to be determined in consultation with Council.

Where pits/headwalls are required, easements shall be 600mm wider than the structure but not less than the minimum width outlined in Table 6 below.

The width of any drainage easement is controlled by the minimum practical width necessary for standard machinery to carry out reconstruction of the public drainage system to current standards and Work Health and Safety requirements. For this reason, the minimum width of any drainage easement must be 3.0 metres. For all pipes, channels, culverts and open drainage systems, Table 6 below outlines the required easement widths. Figure 2 shows the dimensions required for easement splays at change of directions to facilitate turning movements.

Figure 2 - Drainage Easement Width (Bend)



For open stormwater systems, Council may at its discretion require the easement to be supported by a "Restriction on the use of land" to ensure structures are not constructed or the levels altered within the easement.

Table 6 - Easement Widths

Pipe Diameter / Box Culvert width / Open channel width (Diameter) (mm)	Minimum Width of Easement to Drain Water (m)
Diameter less than or equal to 675	3.0
675 < Diameter less than or equal to 900	3.0
900 < Diameter less than or equal to 1200	3.5
1200 < Diameter less than or equal to 1500	4.0
1500 < Diameter less than or equal to 1800	4.5
Diameter > 1800 and box culverts	As required by Council
Natural Watercourse or overland flowpath	As required by Council

6.2 Reconstruction/Relocation of Public Drainage System

Council may consider a proposal to reconstruct or relocate a public drainage system where it can be demonstrated that:

a) the diversion is wholly contained within the subject land or Council road reserve

b) that the flows are not diverted to an adjoining/alternative catchment

c) the hydraulic design requirements as outlined below can be achieved.

Any public stormwater drainage system piped through private land must remain on the land and cannot be diverted into adjoining land without the adjoining owner's consent and Council approval.

Any natural watercourses on the property shall be retained in their natural state wherever possible to carry stormwater flows through the property.

The diversion of natural watercourses is only permissible with a controlled activity approval for the work from the NSW Office of Water and in accordance with the Protection of Waterways and Riparian Land Policy.

Where a former creek system has been piped, Council encourages the replacement of such a system with a restored creek system where appropriate flow carrying capacity can be achieved and there is a sufficient riparian corridor.

Any piped drainage system shall be constructed using the appropriate class of rubber ring joint reinforced concrete pipes and the minimum size of a pipe is to be 375mm diameter.

Where a developer/property owner obtains Council approval to reconstruct and/or relocate any existing constructed public drainage system within the subject site, the developer/property owner shall create drainage easements in favour of Council in accordance with Section 6.1.1.2, to suit the relocated/reconstructed drainage system.

All costs associated with the reconstruction and/or relocation of Council's drainage system are to be borne by the applicant. Hydrological and hydraulic studies and design plans are to be prepared by a Civil Engineer registered on the National Engineering Register (NER) in accordance with Section 6.4.

6.3 Conveyance of Overland Flow

An overland flowpath through the property is to be provided for all storms in excess of the 5% AEP, up to and including the 1% AEP. The width of any easement for overland flow shall be governed by the extent of the predicted 1% AEP flowpath and also minimum easement width requirements listed above.

Where determined necessary, Council will impose conditions of consent on a proposed development to ensure the protection of any overland flow paths. This could include the construction of formalized flowpaths such as flow training walls, openings through fencing and the creation of positive covenants and / or restrictions as to use to be registered on the property title. This is to ensure that overland flowpaths are maintained, unobstructed and not modified without Council consent.

Any proposed development must:

a) not have an adverse impact on adjoining properties through diversion, concentration or damming of such flows

b) accommodate the passage of overland flow through the site and where applicable illustrates that the proposed development is designed to withstand damage due to scour, debris or buoyancy forces so that the risk of incidental damage is minimized in flood events up to and including the 1% AEP event

c) not be sited where flows will create a hazardous situation for future occupants in terms of depth and velocity of flows through the property.

Where overland flows from upstream catchments impact the site, this policy should also be read in conjunction with the requirements under the Flood Prone Land clause of the DCP that applies to the location of the proposed development.

6.4 Hydraulic Design Requirements – Public Drainage

Council's piped or underground drainage system is to cater for all storms up to and including the 5% AEP. If the existing drainage system is not designed for the 5% AEP then the drainage system will need to be upgraded by the applicant/developer to the 5% AEP capacity. The upgrading of Council's drainage system will be required prior to commencement of building works or during the

building construction. The required upgrading of Council drainage system may be within the site and or along the street frontage(s) located within the road reserve.

Hydraulic design plans and an accompanying report detailing the Council drainage system upgrade are to be prepared by a Civil Engineer registered on the NER. The Hydraulic design plans are to be submitted with the development application. Hydrological and Hydraulic technical guidelines as specified in Council's Engineering Design Specification - AUSPEC ONE are to be used in the preparation of the Hydraulic design plans and report.

Upstream and downstream impacts are to be addressed to prevent increases in hydraulic flows and water surface levels. All habitable floor areas are to be set at or above the Flood Planning Level as defined in the DCP that applies to the location of the proposed development. Basement car parking entry levels, ventilation openings and other potential water entry points are also to be set at or above the Flood Planning Level as defined in the DCP that applies to the location of the proposed development.

6.5 Right of Access by Council

Provision is to be made to ensure that Council has uninhibited legal right of access to the Council drainage system. To ensure that Council has uninhibited access through any overlying structure for emergency purposes, locked gates or doors cannot be installed along the path of access between the public road and the Council drainage system.

To ensure that Council has legal right of access, a Right of Carriageway may be required in favour of Council over the full length and width of the access, between the public road and the public drainage system. The Right of Carriageway shall be created to facilitate the minimum dimensions as set out in Sections 6.1.1 and 6.1.2.

6.6 Private Drainage Systems

6.6.1 Private Connection to a Public Drainage System via a private inter-allotment drainage system and easement

Where there is an option between private drainage systems and easements being placed across adjoining private land or adjoining public land, including land owned by Council, Council requires that a private inter-allotment drainage system and easement be placed across the adjoining private land, so as to not burden public land (regardless of whether the land is operational land or community land within the meaning of the Local Government Act 1993) and at the developers cost).

Written consent for the construction of a drainage system and acquisition of an easement is to be obtained from adjoining owners and provided to Council at the time of lodging the development application. Creation of easement(s) will be required to be completed prior to the issue of the Subdivision Certificate. For other uses other than subdivision, where the easement has not been created prior to the issue of consent, then a deferred commencement condition will be applied.

6.6.2 Private Connection to a Public Drainage System via a private inter-allotment drainage system and easement

Where the development has legal access to a public drainage system or a constructed public road (with kerb and gutter) adjacent to the development site, all concentrated stormwater must be discharged directly to that system (no basement pump out systems or seepage flows are to discharge directly to the kerb).

Where stormwater discharge is to be connected to the kerb and gutter of a public roadway, it is not to exceed a discharge rate of 30 litres per second (l/s) in a 1% AEP storm event per property. The number of outlets to the kerb and gutter should be limited to the minimum practically possible (typically one per property). Where discharge exceeds the above values, Council will require that

the site discharge be piped to the nearest Council piped system, channel or natural watercourse, with a minimum 375mm diameter pipe, to Council's standards.

Where an outlet pipe size exceeds 100mm diameter (or insufficient cover exists over the pipe) and flow is to be discharged to the kerb and gutter of a Council roadway, the following is required:

a) A minimum 600 mm x 600 mm grated converter pit is to be constructed inside the front boundary of the property. (Note: in the case of the main Commercial Centres where downpipes are located on the property boundary, the connection is required to be by direct connection at the base of the downpipe with an overflow system at the head of the downpipe.)

b) Flows between the converter pit and the kerb and gutter are to be discharged using galvanised steel box-section pipes as follows:

- 100 diameter outlet pipe - use 1 x 100 mm x 100 mm x 6 mm thick (w x h x t)
- 150 diameter outlet pipe - use 1 x 200 mm x 100 mm x 6 mm thick
- 225 diameter outlet pipe - use 2 x 200 mm x 100 mm x 6 mm thick.

Where a stormwater system discharges into a public road reserve that does not contain existing kerb and guttering or into a channel or natural watercourse, an outlet structure is required to be installed to defuse the concentrated stormwater discharge to reduce flow velocities to prevent scour, be safe and be easily maintained. The outlet structure must be designed by a Civil Engineer registered on the National Engineering Register (NER).

Council's preference for a private drainage connection into the public drainage system is at the stormwater pits. However, direct connection into a piped or culvert system for pipes 150mm in diameter or smaller using a factory connection fitting such as the 'Flowcon Connconect' or approved similar equivalent, may be permitted.

6.6.3 Private Connection to Public Drainage System via Public Reserve

Conveyance of stormwater that is required to traverse a public reserve (other than a public road reserve) in order to gain access to a piped drainage system, natural watercourse, estuary and lagoon may be permitted, but will require the prior approval in writing from the relevant sections of Council or the relevant statutory authority. A private easement will be required to be registered on the land. Should the applicant wish to apply for a private easement on Council land, an application form is to be submitted to Council.

6.6.4 Hydraulic Design Requirements – Private inter-allotment drainage

An 'inter-allotment drainage system' shall be designed to cater for a 5% AEP storm event for subdivisions creating separate lots. It shall be assumed that an appropriate percentage of the lot area is impervious to determine the design flow rate.

For an 'inter-allotment drainage system', the minimum sized pipeline is to be 150mm diameter. The piped drainage is to be constructed from an appropriate class of pipe with watertight and flexible joints.

The design requirements for inter-allotment drainage are defined in Auspec 1.

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6.7 Submission of Information

To demonstrate compliance with this Water Management for Development Policy, the following information may be required to be submitted at the following stages of the development application process.

6.7.1 Submission with Development Application

6.7.1.1 Location and Dimension Details

Accurately locate, confirm dimensions including depth, and plot to scale Council's stormwater pipelines and associated infrastructure on the development application site plans that outline the proposal. This should be carried out by a service locating contractor and registered surveyor (evidence of methodology used for locating stormwater system should be provided). It is recommended that a Closed Circuit Television Pre construction Dilapidation Survey be undertaken at the same time.

6.7.1.2 Hydraulic Design & Construction Plans

Where the reconstruction or relocation of a Public Drainage System is proposed, hydraulic design, construction plans and an accompanying report detailing the Council drainage system upgrade are to be prepared by a Civil Engineer registered on the NER. Hydrological and Hydraulic technical guidelines as specified in Council's Engineering Design Specification – Auspec 1 are to be used in the preparation of the Hydraulic design plans and report.

6.7.2 Submission as Required by Conditions of Consent

The following information may be required to be submitted as part of the conditions of the consent.

6.7.2.1 Closed Circuit Television (CCTV) Survey and Report

A CCTV Survey and Report for Council's Stormwater Asset prepared in accordance with Guidelines for CCTV Investigations of Council Stormwater Assets (refer Appendix 5) is required for:

a) Any development works located within the vicinity of a Council Stormwater Asset on public or private land and may be required as a condition of development consent

b) Any new stormwater infrastructure that has been constructed as part of a development and will be handed over to Council's care and control.

6.7.2.2 Dilapidation Survey

A Dilapidation Survey for Council Stormwater Assets prepared in accordance with Council's Guideline for Preparing a Dilapidation Survey of Council Stormwater Assets (Appendix 6) is required for:

a) Any development works located within the vicinity of a Council Stormwater Asset on public or private land and may be required as a condition of development consent.

b) Any development where a bond amount has been lodged for:

   i) security against any damage to Council's existing stormwater assets or

   ii) failure to complete the construction of stormwater drainage works to be handed over to Council's care and control.

This bond will be released based on a review and approval of the pre and post construction dilapidation surveys, engineering certification and Works-As-Executed data.

6.7.2.3 Works-As-Executed Data

Works-as-Executed Data for Council Stormwater Assets prepared in accordance with Council's Guideline for Preparing Works-as-Executed Data for Council Stormwater Assets (Appendix 7) is required for development works which modify Council's stormwater assets or create new

stormwater assets that will be handed over to Council's care and control. Generally, this is imposed as a condition of development consent.

6.7.2.4 Structural Details

All structures are to be located clear of any Council drainage system or easement. Footings of any structure adjacent to an easement or pipeline are to be designed in accordance with this policy. Structural details prepared by a suitably qualified Civil Engineer demonstrating compliance with this policy are to be submitted.

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7.0 Water Conservation

Water is a valuable limited resource and must be sustainably managed to protect the environment, maintain a healthy catchment and to meet current and future demand. Appropriate urban water conservation measures are vital due to the pressures of anticipated population growth and climate change impacts, which will reduce availability and increase demand for natural water resources.

7.1 Water Conservation and Reuse

Council is committed to reducing water consumption within the LGA. All developments must be designed to minimise potable water consumption through water efficiency and appropriate reuse. This includes promotion and adoption of water efficient fittings and appliances and the use of alternate (non-potable) water sources such as rainwater, stormwater and greywater, in accordance with the principles of Water Sensitive Urban Design.

7.1.1 Water Efficiency

a) The collection of rainwater for non-potable uses that exceeds the BASIX targets is encouraged.

b) All developments not affected by BASIX must demonstrate water efficiency compliance by installing water use fittings rated at, or above, the following minimum Water Efficiency Labelling and Standards (WELS):

   i) 4 star dual-flush toilets

   ii) 3 star showerheads

   iii) 5 star taps (for all taps other than bath outlets and garden taps)

   iv) 4 star urinals

   v) 4.5 star washing machines

   vi) 4.5 star dishwashers.

7.1.2 Alternate Water Sourcing

Potable water consumption can be significantly reduced through appropriate use of available alternate (non-potable) water sources to meet non-potable demand. Non-potable demand includes toilet and urinal flushing, washing machines, garden irrigation, vehicular washing, ornamental ponds and cooling tower top up.

Alternate water sources include rainwater, greywater and stormwater for non-potable demand is encouraged for all developments.

Where a scheme is proposed:

a) The Water Management Plan and accompanying assessment reports and documentation shall demonstrate the feasibility of the scheme, and shall include, but not be limited to:

   i) Description of proposed alternate water uses

   ii) Results of water balance modelling, including estimates of quantities to be collected and reused

   iii) A demonstration of compatibility of the proposed scheme with local and regional water management plans or stormwater strategies

   iv) An Environmental and Health Risk Management Plan with clear identification of public health and safety risks and environmental risk (e.g. the impacts of extraction on environmental flows), and how each risk is to be addressed

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v) The environmental and health risks and/or financial obligations that would be transferred to others (e.g. if the proponent intends to transfer part or all of the scheme to another stakeholder after construction), and legal agreements to formalise arrangements for risk apportionment and recourse in these circumstances of transfer of responsibility

b) An Operation and Maintenance plan, including a description of the ongoing management arrangements for the scheme and demonstration of adequate on-going funding for operation and maintenance.

c) The design for a stormwater harvesting and reuse scheme is to be certified by a suitably qualified and experienced Professional Engineer and is to be submitted with the Water Management Plan and any accompanying assessment reports and documentation.

7.1.3 Rainwater Tanks – Non-potable use

Rainwater tanks that are connected for internal use (toilet flushing & washing machine) and external reuse (garden irrigation) are encouraged for all developments.

a) Rainwater tanks shall comply with the following:

i) Be fitted with a first-flush device that causes initial rainwater run-off to bypass the tank and must drain to a landscaped area. The first flush device will not be permitted to connect to the stormwater system

ii) Have a sign affixed to the tank stating the contents is rainwater

iii) Be constructed or installed in a manner that prevents mosquitoes breeding, such as the use of mesh to protect inlets and overflows

iv) Have its overflow connected to an existing stormwater drainage system that does not discharge to an adjoining property, or cause a nuisance to adjoining owners

v) Pumping equipment must be housed in a soundproof enclosure.

b) Cooling towers must:

i) Connect a conductivity meter to ensure optimum circulation before discharge.

ii) Include a water meter connected to a building energy and water metering system to monitor water usage

iii) Employ alternative water sources for cooling towers where practical.

7.2 Rainwater Tanks - Water Supply

Where connection to a Sydney Water main is not able to be provided, rainwater tanks must be provided for potable (i.e. drinking, bathing, cooking, washing etc.) and non-potable (i.e. toilet flushing, watering garden, irrigation, firefighting etc.) uses.

The minimum capacity tank requirements for new dwellings and major additions to existing dwellings, where there is no connection to mains water, must be 45,000 litres of which up to 10,000 litres may be used for non-potable uses and stored in a separate system. The minimum capacity tank requirements for development (other than new dwellings and major additions to existing dwellings) where there is no connection to mains water must be in accordance with relevant Australian Standards.

Variations:

Council may consider a variation where a rainwater tank of this size already exists or a tank of this size is not appropriate and it can be demonstrated that the outcomes of this control are achieved.

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8.0 Sewage Management

8.1 Onsite Sewage Management

Council is committed to managing the local environment and protecting public health. Certain lands within the Northern Beaches LGA do not have access to the Sydney Water Sewerage System and are therefore reliant on providing on-site sewage management systems (OSMS) to treat and dispose of sewage.

Blackwater reuse and on-site treatment may not be approved on lands within 75 metres of a Sydney Water sewer.

8.2 Onsite Sewage Management Systems

Examples of common on-site sewage management systems include: septic tank and absorption trenches, septic tank to pump-out, aerated wastewater treatment systems, composting toilets and chemical toilets.

Northern Beaches Council is the regulatory authority for onsite sewage management systems under the Local Government Act 1993. All systems must be installed and operated in order to:

a) Prevent the spread of disease by micro-organisms

b) Prevent the spread of foul odours

c) Prevent contamination of water

d) Prevent degradation of soil and vegetation

e) Discourage insects and vermin

f) Encourage the re-use of resources (including nutrients, organic matter and water)

g) Minimise any adverse impacts on the amenity of the land on which it is installed or constructed and other land in the vicinity of that land.

The owners of the property are responsible for the correct operation and functioning of the onsite wastewater management system. Penalty Infringement Notice and Orders can be issued for systems that do not comply with the approval to operate or cause water pollution.

8.3 New Systems

a) An 'Approval to Install an Onsite Sewage Management System' must be obtained from Council prior to the installation or modification of any system as required by the Local Government Act 1993. The applicant must submit all information as detailed in the application form.

b) All systems must be designed, installed and operated in accordance with:

   i) Local Government Act 1993

   ii) Environment & Health Protection Guidelines for Onsite Sewage Management for Single Households

   iii) Interim NSW Guidelines for Management of Private Recycled Water Schemes

   iv) AS1547

   v) Plumbing Code of Australia

   vi) The manufacturer's specifications

   vii) Any conditions of approval from Council.

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c) Water use fittings must be rated at, or higher, the following Water Efficiency Labelling and Standards (WELS) to demonstrate compliance with water efficiency:

   i) 4 star dual-flush toilets

   ii) 3 star showerheads

   iii) 5 star taps (for all taps other than bath outlets and garden taps)

   iv) 4 star urinals

   v) 4.5 star washing machines

   vi) 4.5 star dishwashers.

d) A certificate from a licenced plumber may be required by the Principal Certifying Authority prior to the release of the Occupation Certificate.

e) Should 'Approval to Install' be granted, the applicant must then obtain from Council an 'Approval to Operate an Onsite Sewage Management System', prior to commissioning of the system. At this time, a risk category will be assigned to the approval which will determine the period of approval.

f) The use of pump-out style systems is not the preferred outcome for sewage management and should be proposed only after other onsite disposal systems have been determined as unsatisfactory.

8.4 Existing Systems

a) All onsite systems must hold a current 'Approval to Operate an Onsite Sewage Management System', obtained from Council as required by the Local Government Act 1993.

b) An Approval to Operate will be assigned a risk category which will determine the period of approval.

c) All Aerated Wastewater Treatment Systems (AWTS) must be inspected by an appropriately qualified servicing agent every three months or as specified by the systems NSW Health conditions of accreditation. All costs are at the householders expense. A report must be prepared for each inspection with a copy forwarded to Council. Any faults identified at this inspection must be repaired promptly.

d) For modifications of an existing system an 'Approval to Install an Onsite Sewage Management System' must be obtained in addition to the satisfying the requirements outlined in Section 8.3.

e) All systems will be subject to inspection by Council on a frequency determined by risk. The inspection will identify any Environmental or Public Health issues and where necessary take action to have these matters rectified.

f) The destruction, removal or reuse of an onsite sewage management system shall be undertaken in accordance with the NSW Health Advisory Note 3 dated May 2006 "Destruction, Removal or Reuse of Septic Tanks, Collection Wells, Aerated Wastewater Treatment Systems and other Sewage Management Facility Vessels".

8.5 Greywater

Council will only consider approval of on-site treatment, disposal and/or reuse of greywater subject to demonstration of scheme feasibility and compliance with all relevant State and Federal regulatory requirements and the referenced guidelines.

a) All greywater systems must be capable of effective disposal to a Sydney Water sewer main (for disposal in cases of emergency breakdown/malfunction).

b) Grey water systems must effectively manage wastewater and effluent to ensure environmental and public health protection.

c) Water conservation principles are to be applied to minimise potable water use in gardens and other areas of non-contact.

d) The greywater treatment and reuse system shall have a current NSW Health Accreditation.

e) All premises must maintain a connection to the Sydney Water centralised sewerage waste disposal system.

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9.0 Onsite Stormwater Management

Council requires the collection and safe disposal of onsite stormwater through a variety of methods outlined within this policy.

9.1 Stormwater Disposal Checklist

To assist Council in determining the disposal requirements for a property, an On-Site Stormwater Management Checklist (Appendix 16) is to be filled out and submitted with the development application.

9.2 Properties within Flood Prone Land

OSD will not be required where the site of the development is located within a Council established 1% AEP flood plain, and that it can be demonstrated that lesser storm events will also flood the site. Otherwise, it will be necessary to provide OSD to control the runoff for the minor storm events.

9.3 Regional Onsite Stormwater Disposal Requirements

Use Map 2 – Stormwater Regions to identify which stormwater disposal controls apply to your property.

9.3.1 Onsite Stormwater Disposal Requirements Region 1 – Northern Catchments

Properties within Region 1 require an OSD facility to be installed where the development results in additional hard (impervious) surface area of greater than 50m^2 (on a cumulative basis since February 1996).

Rainwater tanks and OSD facilities may also be combined in an integrated system and may be either above or below ground. Should an oversized rainwater tank be used, then 25% of the excess storage volume can be credited towards the OSD tank capacity.

A Region 1 OSD system is to be designed to the storage and discharge requirements detailed in the Table 7 to ensure that the development does not increase stormwater discharge downstream of the land over and above that of the existing stormwater discharge conditions up to the 1% AEP storm event. An experienced and competent designer would need to be engaged to ensure compliance with all of the requirements of this policy. The general requirement of this policy is to ensure that the site's stormwater runoff after any development does not exceed the runoff prior to the development.

Any property that is unable to discharge stormwater into a public drainage system, such as land falling naturally away from a Council stormwater drainage system, the site is required to comply with section 5.5 of this Policy.

Applicants may provide an independent assessment of the water management and OSD requirements through an OSD Assessment Report to be submitted with the Water Management Plan prepared by a suitably qualified and experienced civil Engineer.

To assist in the assessment of WMP's for Region 1, the following rainfall data is provided:

a) Design rainfall Intensity-Frequency-Duration (IFD) are provided in Appendix 12.

b) Design rainfall temporal patterns from Australian Rainfall and Runoff - A Guide to Flood Estimation are provided for AEP less than 30 years and greater than 30 years for the Region 1 in Appendix 12.

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Table 7 Requirements for Size and Allowable Discharge from On-Site Detention Systems

Additional Hard (Impervious) Surface Area (square metres)	Minimum Capacity of On-Site Detention Tank (Litres)	Discharge Rate Litres/Sec
0 -50	Nil	Nil
>50 - 75	4,500	2
>75 - 100	6,000	3
>100 - 150	9,000	4
>150 - 200	12,000	6
>200 - 250	15,000	7
>250 - 300	18,000	9
>300 - 400	24,000	12
>400 - 500	30,000	15
>500 - 600	36,000	18
>600 - 700	42,000	21
>700 - 800	48,000	24
>800 - 900	54,000	27
>900 - 1,000	60,000	30
>1,000*	A minimum storage capacity of 60 liters per m^2 of additional hard/impervious surface area, and a discharge rate which replicates the discharge from the site were it to be undeveloped.	

*Developments exceeding 1,000 square metres of additional hard (impervious) surface area must also provide with the Water Management Plan, an Integrated Water Management Strategy prepared by a suitably qualified and experienced Water Engineer. The plan must demonstrate that stormwater flows discharged from the site is to be no greater than what would have occurred predevelopment, and that Water Sensitive Urban Design principles have been practically maximised within the proposed development.

9.3.2 Onsite Stormwater Disposal Requirements Region 2 – Central Catchments

Generally, OSD is required for all developments in Region 2 where the total existing and proposed impervious areas exceed 40% of the total site area, irrespective if the site falls naturally to the public road or the site has the benefit of an inter-allotment drainage pipeline.

The above criterion does not apply to residential flat buildings (RFB's), commercial and industrial developments and subdivisions resulting in the creation of three (3) lots or more, as these will require OSD in all cases.

Where subdivisions result in the creation of two (2) or more lots, OSD will be required where the total post developed impervious area of the new lots exceed 40% of the total site area. This requirement also applies to newly created lots with existing dwellings to be retained.

All development applications for single residential dwellings where the total site area is 450m^2 or less will not require OSD for all sites that fall naturally to the public road. All development applications for alterations and additions for single residential dwellings will not require OSD that fall naturally to the public road.

Where possible, the OSD system must be designed to capture stormwater runoff from the entire existing and proposed roof and paved areas of the site and any other areas that can be physically directed to the system. Where this is not possible, then the majority of hardstand surfaces of the site must be directed to the OSD system. In this regard, only 20% of the hardstand area will be

allowed to bypass the OSD system, that is, a minimum of 80% of the total hardstand must be directed through the OSD system. If there are more than one OSD system(s), then a minimum of 80% of that proportion of the hardstand area must be directed through each OSD system.

9.3.2.1 Rainwater Re-use for Single Residential Development

Council may permit the volume of rainwater reuse to be credited against the calculated OSD storage volume as determined by this specification for single residential dwellings only.

Please note the rainwater reuse system shall be designed in accordance with the AS/NZS 3500 Plumbing and Drainage Part 3 Stormwater.

The maximum storage volume as determined by the BASIX tool will be credited against the calculated OSD volume. Additional storage beyond the determined BASIX volume will not be credited.

The following calculation may be used to determine the revised OSD volume:

- Revised OSD Volume = Determined OSD volume – BASIX certificate storage volume.

  Revised OSD Volume to be a minimum of 50% of determined OSD volume.

To achieve a full credit against the determined OSD volume rainwater reuse must be used for flushing of toilets as a minimum, however rainwater can be used for non-potable usage such as watering of gardens, washing cars, clothes washing etc. Combining OSD and rainwater reuse water in one tank is permitted.

The design must ensure at least 50% of the site is routed through the OSD system.

The calculated PSD is not to be adjusted as determined by this Policy.

9.3.2.2 Design Methods

Design of the OSD system shall be undertaken in accordance with one of the following methods:

- “Streamlined Method” for single residential dwellings as set out in Section 9.3.2.3
- "Simplified Method" for all development except single residential development as set out in Section 9.3.2.4
- "Full Computation Method" for all development except single residential development as set out in Section 9.3.2.5.

9.3.2.3 Streamlined Methods

The Streamlined Method involves the use of a Table 8 to size the OSD system and determine the PSD. This method is to be used for all single residential dwelling developments.

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Table 8 Minimum Site Storage Required and Maximum Permissible Site Discharge

Types of stormwater disposal	Minimum Site Storage Required	Maximum Permissible Site Discharge for all storms up to and including 1 % AEP design storm
All gravity fed drainage systems connected to Council's drainage system	200 m^3 per Ha	400 l/s per Ha
All drainage systems that require a level spreader	In accordance with Council's "Stormwater Drainage from Low Level Properties" policy	In accordance with Council's "Stormwater Drainage from Low Level Properties" policy

Note: All single residential dwellings will be assessed on the above SSR and PSD requirements.

9.3.2.4 Simplified Methods

The Simplified Method as given in Appendix 13 involves the use of tables to size the OSD system. The whole of the site area must be considered in the calculation of the SSR and the PSD, as predetermined by Council.

It is recommended that the Simplified Method be used only where the site conditions have similar parameters to those given in Appendix 13, in the derivation of the tables.

The Simplified Method can only be used for developments other than single residential developments when the whole of the site can be collected by the OSD system. That is, all runoff from the site is routed through the OSD system prior to discharging to the receiving external drainage system. A maximum of 30 m^2 of the site area, which cannot be physically drained to the OSD system, is permitted to bypass. However, where more than 30 m^2 of the site cannot be collected by the OSD system, then the Full Computation Method must be used.

Where there is more than one OSD system on the site, it is possible to calculate the required volume and discharge rate from each OSD system by determining the percentage of the site area draining to each OSD unit and then distributing the total calculated SSR and PSD (calculated from the total site area) to each OSD system.

The Simplified Method cannot be used for sites where its area exceeds 1200 m^2 in size. The derived tables were not intended for extrapolation.

9.3.2.5 Full Computation Methods

Where the site conditions vary from those given in the Simplified Method (see also Appendix 13) and/or more than 30m^2 of the site cannot physically drain to the OSD system then the Full Computation Method must be used.

The Full Computation Method can only be used for developments other than single residential developments as set out in Appendix 13. An experienced and competent designer would need to be engaged to ensure compliance with all of the requirements of this Specification. In many cases, this method of analysis may produce the most economical design. The Full Computation Method involves the use of computer models to simulate rainfall and runoff from the site. Refer to Section 9.8.1 for the types of models that can be used.

9.3.2.6 Pre and Post Development Runoff for Full Computation Method

The total site runoff for the 20% AEP and the 1% AEP storm event under existing site conditions (pre-development) must be determined. For the Simplified Method, these values are read from Tables A8-1 or A8-2 (Appendix 8). In the Full Computation Method, these values are calculated. A check of the 5% AEP storm event must also be made when using the Full Computation Method.

The direction of runoff from the site, which has to fall in the same direction of the catchment, must be maintained.

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The pre-development stormwater runoff or PSD, both piped and overland from the total site, must be calculated in the Full Computation Method. For all developments, the runoff from the site after development is not to exceed the runoff from the total site prior to the development for all storm durations for the 20% AEP, 5% AEP and a 1% AEP storm event.

For all developments except single residential dwelling developments the PSD is to be calculated on the maximum allowable impervious fraction of 0%. That is, discharge off the site is to be restricted to the “state of nature” condition.

Where alterations and additions are proposed, the PSD is to be calculated on the maximum allowable impervious fraction of 0% for the areas considered for the proposed alterations and additions only. Stormwater detention will be required for the extent of the proposed alterations and additions only.

For all subdivision developments that result in the creation of three (3) lots or more, the OSD system is to be designed for a minimum impervious fraction of 60% for each newly created lot.

The overland flow from the site is not to be concentrated at any single point, where necessary, flows are to be spread evenly across the entire site as uniform overland flow.

The post-development runoff is to be determined based on the post-development impervious area for all storm durations for the 20% AEP, 5% AEP and a 1% AEP storm event. The OSD system(s) must be designed to restrict these flows to the calculated pre-development discharge rates. Hence, the 20% AEP post-development runoff must not exceed the 20% AEP pre-development discharge, the 5% AEP post- development runoff must not exceed the 5% AEP pre-development discharge, and the 1% AEP post-development runoff must not exceed the 1% AEP pre- development discharge.

The total piped flow from the site to a Council drainage pipeline must not exceed the maximum 20% AEP pre- development runoff. The total piped and overland flows from the site must not exceed the 1% AEP pre-development discharge. Where surcharging out of the OSD system is not permitted or possible, for example where the overflows would pass through a downstream property via an easement and where there is no safe overland flowpath available, the OSD system must be designed not to overflow. In this circumstance, the outlet pipe is to be designed for the 1% AEP storm event even though the OSD outflow is to be restricted to the 20% AEP storm event. This is to account for any blockages in the pipe which may cause runoff to overflow out of the OSD system.

9.3.3 Onsite Stormwater Disposal for Region 3 – Southern Catchments

This section applies to all land within the Northern Beach Council LGA as shown in Region 3 – Stormwater Zone Maps (Refer to Map 3 for each of the stormwater zones).

The aim of this section is to provide more specific, detailed design guidelines for development within the Region 3 stormwater catchment. For zones where additional scour and erosion control is required, refer to Section 4.1.2.1.

To ensure that stormwater drainage pollution and degradation does not occur as a result of any development, the following controls are to be implemented:

a) The provision of OSD facilities to control the rate of stormwater runoff

b) The provision of on-site absorption systems to reduce stormwater loading on the receiving drainage system

c) The installation of appropriate scour and erosion control devices to attenuate flows.

Implementation of any of the above practices is complimentary to the operation of the natural water cycle.

The method of stormwater control to be applied shall depend on the location of the site. The stormwater control requirements for each zone are given in the Appendix 14. In general, the main types of controls available (source and discharge controls) are:

- Region 3 - Zone 1: on-site stormwater detention control
- Region 3 - Zone 2: on-site stormwater retention (absorption)
- Region 3 - Zone 3: scour and erosion control
- Region 3 - Zone 4: combination of on-site stormwater detention and scour/erosion control
- All zones: restricted application – mechanical pump-out and charged systems.

9.3.3.1 Disposal of site runoff

For all discharge points the maximum concentrated stormwater discharge shall be limited to 25l/s at any single point.

Discharge shall not be permitted to 'free-fall' over cliff faces. It must be piped to the lowest point with regard to aesthetics.

9.3.3.2 Requirements for Region 3 – Zone 1 – On-Site Detention

Sites within Zone 1 shall require the installation of OSD facilities to control the rate of runoff from the site due to the development, such that the runoff after development shall be less than the runoff prior to the development. Runoff from the developed site shall be reduced to a quantity with an impervious portion of 35% or less.

Within Zone 1, an OSD system shall be required for all proposed developments, re-developments or new land subdivisions ('greenfields' subdivisions where the condition of the site is currently 'state of nature'), except where:

a) The development is a one-off extension or an addition, involving an increase in impervious area of less than 50m^2 and the total existing impervious areas of the site does not exceed 35%

b) The developed site will have a total impervious percentage or area of no more than 35% or 250m^2, whichever is the lessor, unless it is a new allotment created from a 'greenfields' subdivision. An OSD system shall be required for any development on 'Greenfields' subdivisions, including those allotments in Boronia Lane North, Boronia Lane South, Boronia Lane West and Castle Circuit, Seaforth that were part of a land release by the State Government

c) The applicant can demonstrate to Council's satisfaction that the site is currently within a flood-affected zone, and that the application of an OSD system at the subject site would be of no benefit in reducing the adverse flooding impacts

d) An alternative method of stormwater disposal, such as an absorption system, is used – however the design of the on-site absorption system must be supported by soil data and appropriate calculations (refer to Appendix 3 for guidelines).

Council may require an alternative method of stormwater disposal such as source control (e.g. on-site absorption) or source control used in combination with another form of detention.

9.3.3.2.1 Design objective

The design objective is to ensure that the peak flowrate immediately downstream of the site in development is not increased due to the development. This is achieved by providing adequate storage to compensate. All storm events up to and including the 20% AEP post-development shall be limited to the PSD.

9.3.3.2.2 Critical storm events

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The critical storm events, which must be considered, shall be the 20% and 1% AEP.

9.3.3.2.3 Permissible site discharge

Runoff from the site shall be limited to the PSD.

The PSD shall be calculated as the peak 20% AEP storm event for the pre-development site based on the following impervious percentages:

- 0% – applies to all 'greenfields' developments, including allotments in Boronia Lane North, Boronia Lane South, Boronia Lane West and Castle Circuit, Seaforth, which were part of a land release by the State Government
- 35% or 250m^2 (whichever is the lessor) – if the total existing site impervious area exceeds either of these
- X% if the total existing site impervious area is less than 35% and where X is the percentage of the actual impervious area but less than 250m^2.

The maximum discharge into the kerb and gutter is 25l/s. This shall be the PSD if the total site's runoff is to be discharged at the kerb.

Note: No more than two outlets at a distance of 15m apart shall be permitted to discharge at any kerb along any one-property frontage.

The maximum discharge velocity to the kerb shall be restricted to 2.0m/s.

The PSD shall be calculated using one of the following methods:

- Design graphs for the relevant residential zone given in Appendix 14
- The Rational Method, in accordance with the Australian Rainfall and Runoff, Volume 1, 1987 or later editions
- The ILSAX program for urban stormwater drainage design and analysis, Version 2.13, April 1993 or later, or the DRAINS program for urban stormwater system design and analysis, Version 2001.1 by Geoffrey O'Loughlin and Bob Stack, April 2001 or later.

The rainfall intensities to be used in the Northern Beaches Council area are given in Appendix 12.

9.3.3.2.4 Site storage requirement

The minimum SSR or the basic volume shall be the volume needed to reduce the runoff from the peak 1% AEP storm event for the developed site back to the PSD or maximum discharge.

The SSR can be determined using one of the following methods:

- Design graphs for the relevant residential zone given in Appendix 14
- ILSAX program– hydrograph model
- DRAINS program – hydrograph model.

Computation methods based on approximate triangular method or the Rational Method is not acceptable.

9.3.3.3 Requirements for Region 3 – Zone 2 – Absorption

On-site stormwater retention (absorption) systems are to be implemented in zone 2.

Absorption systems shall be provided in soft landscape areas such as in garden areas and other vegetated on-ground areas. Wherever possible, on-site absorption is to be provided in hard landscaped areas, under driveways and other paved surfaces. The use of porous pavement (pervious paving) is preferred.

Stormwater collected on the roof and paved areas (all impervious surfaces) are to be directed into the absorption system. A fail safe overflow outlet must be installed to ensure that any overflows will be directed to the street.

In general, absorption systems will be required or permitted if the following applies:

a) The site is located within zone 2

b) A geotechnical report, showing at least one (1) bore log at the proposed location of the absorption facility, has been submitted which indicates that the soil has sufficient absorptive characteristics to consider it appropriate, or

   Irrespective of whether the site is located within zone 2, the site drains towards the rear, and downstream property owners have indicated that they are not prepared to grant easements to permit the drainage of the property to follow the natural fall of the land

c) Drainage against the natural grade of the land is not permitted because Council has assessed that the proposed receiving drainage system cannot adequately cope with the additional runoff

All sites within zone 2 must provide for on-site absorption unless the applicant can demonstrate that on-site absorption is not suitable by the submission of relevant evidence from a qualified geotechnical engineer indicating that the soil absorption characteristics and site constraints prevents its application.

Minimum design requirements for the use of absorption systems are given in Appendix 3.

9.3.3.4 Requirements for Region 3 – Zone 3 – Scour Protection

Refer to Section 4.1.2.1.2 for details.

9.3.3.5 Requirements for Region 3 – Zone 4 - On-Site Stormwater Detention Scour and Erosion Control

A combination of on-site stormwater detention and scour/ erosion control shall be required for all sites within zone 4 (See Section 4.1.2.1.2). Sites in this zone are within the Penguin Critical Habitat and Potential Habitat areas and encompasses Manly Point and Little Manly Cove.

OSD shall be required to control all runoff from the site, as a result of any development. Runoff from the developed site shall be reduced to a quantity with an impervious portion of 0%, that is, the ‘state of nature’ condition.

9.3.3.5.1 Design objective

The design objective is to ensure that the peak flowrate immediately downstream of the site in development is reduced to runoff for a pre-development ‘state of nature’ situation. This is achieved by providing adequate storage to compensate. All storm events up to and including the 1% AEP post-development shall be limited to the PSD.

The critical storm events, which must be considered, shall be the 20% AEP and 1% AEP.

9.3.3.5.2 Permissible site discharge

Runoff from the site shall be limited to the PSD. The PSD shall be calculated as the peak 20% AEP storm event for the pre-development site based on the following impervious percentages:

a) 0% – applies to all developments within Zone 4

b) The maximum discharge shall be 25l/s. This shall be the PSD if the calculated pre-development runoff is greater than 25l/s

c) The maximum discharge velocity to the kerb shall be limited to 2.0m/s.

The PSD shall be calculated using one of the following methods:

- Design graphs for the relevant residential zone given in the Appendix 14 based on 0% impervious area
- The Rational Method, in accordance with the Australian Rainfall and Runoff, Volume 1, 1987 or later editions, or
- The ILSAX program for urban stormwater drainage design and analysis, Version 2.13, April 1993 or later, or
- The DRAINS program for urban stormwater system design and analysis, Version 2001.1 by Geoffrey O'Loughlin and Bob Stack, April 2001 or later.

The rainfall intensities to be used in the Northern Beaches Council area are given in Appendix 12.

9.4 Drainage to Detention System

Wherever practicable, stormwater runoff from the whole development site shall be controlled through the OSD facility. If not possible, some of the pervious surfaces (grassed or vegetated areas) may be allowed to bypass the system. Stormwater runoff from all new and existing impervious areas must be directed through the OSD system. If this is not achievable, a maximum 30m^2 of impervious area may be permitted to bypass the system. The total area allowed to bypass the OSD system, which includes pervious and impervious areas, must not be greater than 20% of the total site area. Council may vary this requirement where site topography prohibits reasonable construction.

The total flows exiting the site must be taken into consideration. The total of the runoff bypassing the OSD system and the flows controlled through the OSD system must be no greater than the PSD or maximum discharge.

The discharge from the outlet of the OSD facility shall be controlled by an orifice plate set into the discharge line to control the rate of flow from the system. The required size of orifice plate is set out in Appendix 9. The orifice plate is to be located at the invert of all storage facilities to avoid stagnant water (silt traps will not be permitted).

A high-level outlet to the OSD facility is to be provided to cater for surcharge/overflow during major storm events and/or blockages. Surface flow paths, including the provision of an emergency overflow to cater for blockage of the system must be provided between the OSD facility and the point of stormwater discharge from the land.

All habitable floor levels are to be a minimum of 300mm above and garage floor levels are to be a minimum of 150mm above the maximum design storage water surface level and flow path levels.

The OSD facility may be an underground storage facility, a landscaped storage facility or driveway storage facility if it complies with the following controls:

a) Underground Storage facility

   i) Storage tank located underground provided with a maintenance access hatch

   ii) A stainless or galvanised mesh screen is to be installed a minimum of 300mm from the outlet to prevent blockage of the orifice by debris

   iii) Discharge orifice plate installed

   iv) High level outlet for discharge during a major storm event

   v) Venting of the storage tank to prevent the build-up of gases.

b) Landscaped OSD storage facility

i) Storage volumes in landscaping areas shall include an allowance for 20% additional storage for vegetation growth and construction inaccuracies

ii) Discharge orifice plate installed

iii) A stainless or galvanised mesh screen is to be installed a minimum of 300mm from the outlet to prevent blockage of the orifice by debris

iv) High level outlet for discharge during a major storm event

v) The desirable minimum surface slope to the discharge outlet is 1.5%, with the absolute minimum being 1.0%

vi) Subsoil drainage should be provided in landscaped areas to prevent the ground becoming saturated during prolonged wet weather.

c) Driveway and car park OSD storage facility

i) To avoid damage to vehicles, depths of ponding on driveways and car parks is not to exceed 200mm under design conditions

ii) Discharge orifice plate installed

iii) A stainless or galvanised mesh screen is to be installed a minimum of 300mm from the outlet to prevent blockage of the orifice by debris

iv) High level outlet for discharge during a major storm event

v) The minimum transverse paving slopes within storage areas to the discharge outlet is 0.7%.

9.5 Hydraulic Grade Line Analysis

If the rate of discharge from the outlet of the OSD system is affected by tailwater conditions from the receiving drainage system, for example, where the invert level of the orifice is lower than the surface level at the point of connection into the existing drainage system, then full hydraulic calculations, will be required. These hydraulic calculations shall include the determination of water surface profiles using hydraulic grade line analysis and/or backwater calculations. The preferred hydrologic model to be used in the analysis, to obtain flowrates, is the ILSAX or DRAINS program. Hydraulic analysis can be performed using hand calculations. However, for more complex analysis in the determination of water surface profiles in creeks or rivers, the use of the HEC-RAS computer program is preferred.

Full hydraulic calculations will be required for all public and major piped systems, or where Council believes that it is necessary to determine the feasibility of the proposal. Full hydraulic calculations shall be required in conjunction with a detailed engineering long-section.

Calculations must be in accordance with current design practices and principles outlined in Australian Rainfall and Runoff (1987 or later editions) and Guidelines, and must be prepared by a suitably qualified and experienced civil engineer.

9.6 Legal Requirements

All OSD systems shall require the creation of a Positive Covenant and Restriction on the Use of Land in favour of Northern Beaches Council on the Title, under Section 88E of the Conveyancing Act 1919 for newly created lots. For existing Titles, a Positive Covenant is to be created by an application to the NSW Land Registry Services using Form 13PC. The Restriction on the Use of Land is to be created using Form 13RPA.

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The purpose of the Covenant is to ensure that the registered proprietor takes care, control and maintenance obligations for the OSD system. The Restriction on the Use of Land is to ensure that the system is not altered in any manner, shape or form.

The terms of the instrument must be approved by Council. However, standard terms to be included in the Positive Covenant and the Restriction on the Use of Land are given in available on Council's website within the Permits and Certification - Engineering Specifications section.

Legal Documents Authorisation Application Form

Positive Covenants and Restriction on the Use of Land must be finalised prior to the issue of the Occupation Certificate.

9.7 Information to be lodged with the Development Application

9.7.1 Minimum Information required for all Single Residential Dwellings

a) An estimate of the volume of OSD SSR in accordance with Section 9.3.2.3 - Streamlined Method

b) An estimate of the PSD of OSD required in accordance with Table 8 in Section 9.3.2.3 - Streamlined Method

c) Details of Council's drainage infrastructure burdening the site together with any calculations of the maximum 1% AEP flow rate for flowpaths and floodways where applicable

d) Details of the OSD facility which must be located clear of any 1% AEP flow path where applicable

e) Copies of certificates of title showing the creation of easements to drain water, where applicable

f) Details of all paved and roof surface areas which must be collected and discharged into the OSD system

g) A Water Management Plan including the following:

   i) The development/site boundaries and area

   ii) Contours and spot levels (which reflect the site grading and extending into adjoining properties)

   iii) The extent and area of any upstream catchment for external flows entering the site

   iv) The location and extent of detention storages

   v) The location and levels of discharge points for the storages

   vi) The layout of the site, including location of all buildings, roadways and landscaped areas

   vii) The location and approximate extent of any floodways or flowpaths through the site

   viii) The location and area of any portion of landscaped area of the site unable to drain to the detention storages

   ix) Location and levels/invert levels of all surface drainage pits including the silt arrestor pit

   x) Location of stormwater drainage lines detailing sizes and grades.

9.7.2 Minimum additional information required when lodging a Construction Certificate for single residential dwellings

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a) Structural Details of the OSD tank or any proposed retaining wall for above ground systems as designed by a suitably qualified engineer

b) All other details are to be in accordance with the sample drawings in Appendix 15 of this policy.

9.7.3 Minimum Information required for all Developments Except Single Residential Dwelling Developments

At the lodgement of the development application, a Water Management Plan (WMP) showing the general layout of the proposed stormwater drainage system including the location(s) and dimensions of the OSD system(s) and water treatment measures must be submitted. The minimum information to be lodged with the development application is to include the following:

a) Engineering drawings showing all of the existing and proposed stormwater drainage system, including pipe diameters, existing or proposed pits, open drains and points of discharge(s), detention basin(s) (where applicable), control pit(s) and surface flow path(s)

b) Where a connection is to be made through an easement, a longitudinal section of the pipe through the easement and details at the connection are to be provided

c) Dimensions and areas of the site including all existing and proposed roof and paved areas are to be included on the stormwater drainage plan(s)

d) Copies of certificates of title showing the creation of easements to drain water, where applicable

e) Dimensions (mm) and volume(s) (m^3) of the proposed OSD system(s) or retention system(s) (where applicable)

f) Size (mm) and shape of the orifice and outlet device at the control pit

g) Finished floor levels of all existing and proposed structures and existing surface levels to Australian Height Datum (AHD) are to be shown on the drainage plan(s)

h) Plans, elevations and sections of the OSD system(s) in relation to all existing and proposed buildings and site conditions, finished surface levels and invert levels of all stormwater drainage pipes and structures, centre line level of the outlet pipe and orifice, the maximum design water level in the OSD system, and flood levels (where applicable) of the receiving water

i) Longitudinal section of all pipe(s) from the OSD basin to the discharge point showing calculated flows, velocities, pipe sizes, type and class, grades, and invert levels of all pipes, all utility services crossings and a hydraulic grade line (where required)

j) The depth of ponding for the 98.17%, 63.21%, 20%, 5% and 1% AEP storm events, for all above ground storage systems, are to be shown on the drawing(s)

k) Details of surcharge facilities and overland flow paths are to be shown on the drawing(s)

l) Details of Council's drainage infrastructure burdening the site together with any calculations of the maximum 1% AEP flow rate for flowpaths and floodways where applicable

m) Details of the OSD facility which must be located clear of any 1% AEP flow path where applicable

n) Details of access and maintenance facilities

o) Structural details of all tanks and pits, and manufacturers' specifications for proprietary items, and for above ground OSD systems, the type of surface finish to be used, are to be referenced or shown on the drawing(s)

p) All supporting hydrologic and hydraulic computations are to be submitted

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q) Calculations of the times of concentration (Tc minutes) of the existing and developed site are to be submitted

r) Calculations showing how the 20%, 5% and 1% AEP runoff (in litres per second) were determined for the existing and developed (with and without OSD) site, and the storm duration(s) that corresponds to these values

s) All designs and calculations submitted to Council for approval must include a copy of all input and output files on USB. Please note that DVD disc and CD-ROM will not be accepted

t) Summary information regarding the design of the OSD and associated stormwater drainage system in similar format as shown in Appendix 15.

It is the responsibility of the Applicant to provide full details of all relevant services that may conflict with the proposed OSD system(s) and stormwater lines. The exact locations of any crossings or connections are to be shown.

9.8 Drawings

Stormwater drainage drawings are to be submitted at the lodgement of the development application. These drawings are to show all relevant details of the OSD system and associated works as outlined above in Section 9.6 and are to be signed and certified by a suitably qualified and experienced Civil Engineer, who has membership to the Institution of Engineers Australia and National Engineering Register (NER).

Where an underground tank is to be used, the standard drawing detail as given in Appendix 15 of this Specification can be used.

Where an above ground OSD system is to be used, dimensions and levels of the basin must be provided. Sample drawings are given in Appendix 15 of this Specification.

Where partial or staged development of a large site is likely, consideration should be given in locating the OSD system in an area where the entire development can drain to it. The system could be modified as additional development occurs and may be more practical than having numerous smaller systems scattered throughout the site.

9.9 Computer Modelling

The preferred computer modelling programme to determine the volume for SSR and the PSD is ILSAX or DRAINS. Council has chosen the ILSAX model because it is public domain and requires minimal data entry, and is consistent with Council's drainage database. Computation methods based on the approximate triangular method or the rational method is not acceptable.

9.9.1 Design Parameters to be used in the Computer Modelling

Where computer modelling is to be applied, and the ILSAX or DRAINS model is used in the design, the following design parameters are to be adopted:

a) Soil type = 2.5

b) Antecedent moisture content, AMC = 3

c) Infiltration rates: Initial paved = 1 mm, grassed = 5 mm

d) Storms, as per Australian Rainfall and Runoff (AR&R 1987). All design storm duration for the 20%, 5% and 1% AEP, must be checked. Stacked rainfall patterns to be used in the ILSAX program are given in Appendix 12.

e) The time of concentration (Tc) can be calculated using the kinematic wave formula from AR&R (1987) p 300, (Appendix 12)

i) The flow path length, L is the distance from the furthest point of the site to the exit to Council's stormwater drainage system. This length may be modified by the development either by piping, paving or redirecting

ii) The surface roughness coefficient, n* is per AR&R (1987) p 300. For non- paved areas the minimum value of n* to be used is 0.33

iii) The area to be considered in the calculations is the total area of the catchment affected and not just the development site

f) Stored bypass or surcharge is not to be used. That is, type "0" inlets are not to be used

g) Supplementary areas are not to be used

h) Orifice size can be estimated using Appendix 9, or calculated from the formula:$Q = CA\sqrt{(2gh)}$ The tables are based on a 'C' value of 0.6 for a circular shaped, square edge cut in a flat plate

i) All areas likely to be paved after completion of the development (e.g. driveways, and courtyards), will be considered as part of the impervious area and included as such in the calculations

The determination of the SSR is to be undertaken by trial and error, using the above constraints.

9.9.2 Stormwater Runoff from Upstream Catchments

Stormwater from upstream catchment must not enter into the OSD system. The design of suitable channels, open drains, pits and pipes, mounding, landscaping or walls may be necessary to divert stormwater from adjacent properties away from the system. However, care must be exercised to ensure that the provision of such diversions within the site does not result in the concentration of stormwater onto adjoining properties. If this cannot be achieved, then the OSD system must be designed to cater for the additional stormwater inflow.

9.9.3 Floor and Ground Levels

All office, storage and habitable floor levels are to be set at a minimum of 300 mm above the maximum design storage water surface or surcharge flow path level, whichever is higher. All factory warehouse and garage floor levels are to be set at a minimum of 150 mm above the maximum design storage water surface and surcharge flow path levels.

Council will not approve detention systems directly under habitable floors. In special circumstances, where approval is granted for enclosed systems, the control/inspection pit must be able to be accessed externally to the building.

The definition of habitable floors includes all living areas, commercial office space, store rooms and show rooms where there is likely damage by water inundation (or condensation) to stored goods and materials.

Enclosed detention storage systems may be permitted under a basement or ground floor car parking area, garage or patio. Under these circumstances, unobstructed external access to the OSD system(s) must be provided at all times. A safe overflow route from the OSD system must also be provided. Access to the OSD system(s) via enclosed structures will not be acceptable.

9.10 Discharge Control Devices

The type of control device which is acceptable to Council is a flat plate with a square edge cut to form the orifice hole. This device is to be mounted in front of an oversized outlet pipe. Other forms of control devices may be acceptable to Council provided adequate supporting calculations can be submitted to demonstrate that it will perform as intended to the requirements of this Specification. All hydraulic control devices are to be non-removable. High early discharge or normal discharge control devices can be used.

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It is desirable that these control devices operate under inlet control, that is, a “free outlet” condition exists. However, in exceptional cases where inlet control cannot be achieved, Council, at its discretion, may allow the system to operate under outlet control. Systems which are to operate under outlet control or downstream control will require supporting calculations for determining flows and water levels in the external drainage system for which the OSD system will be connected to. A full range of storm recurrence intervals will need to be considered.

All discharge control devices and pits are to be located externally to all structures and buildings so that 24-hour access to the OSD system is possible and that overflows from the system can be safely directed away.

9.10.1 Orifice Plates

Orifice plates are to be made of a flat sheet of stainless steel plate with minimum dimensions of 200 mm x 200 mm x 3 mm thick. Galvanised steel plates will not be acceptable. The orifice hole is to be cut to the exact dimension as calculated and to be of a uniform circular shape with sharp (not rounded) edges. The centre of the plate is to be cast into the wall or epoxied and securely fixed over the centre of the outlet pipe by the use of at least 4 "Dyna" bolts or similar, one at each corner.

Generally, to minimise blockages, orifice diameters smaller than 50 mm will not be accepted. The invert of the orifice must be at least 50 mm lower than the base of the main tank. Ideally, the level at the base of the tank should match the level of the centre of the orifice. This is to ensure that the tank will not hold water during dry weather.

9.10.2 Trash Screens

A stainless steel or galvanised mesh screen (Maxi-mesh RH3030 or equivalent) with a minimum of 50 times the orifice area shall be provided between the orifice and all inlets. This screen is to protect the orifice from blockages.

For orifices greater than 150 mm in diameter, the area of the screen can be reduced to 20 times the orifice area, if a grid mesh is installed. The screen is to be located at a distance of 1.5 x the diameter of the orifice or 200 mm away from the orifice, whichever is the greater. Where possible, the incoming line is to flow across the face of the mesh.

The screen is to be placed diagonally against the face of the tank wall with a dividing wall on the inside of the tank to shield the end of the screen. Preferably, the screen should completely protect the orifice without the need for a dividing wall by having side panels on both ends of the screen. This could be achieved by welding triangular mesh side panels to the screen.

A lifting handle welded to the top of the mesh would also be required to allow for easy removal of the screen for cleaning purposes. The screen must not be bolted securely to the wall but should also not be easily removed.

9.10.3 Underground Storage Systems

Underground storage systems are accepted as OSD. However, they should not be used where surface storage can be provided. Underground systems should be located in areas where they can be readily accessed for inspections and maintenance. These systems can be constructed from reinforced concrete, prefabricated units or proprietary systems provided they can operate to the requirements of this Specification, can be readily cleaned, and must perform hydraulically as required. The structural adequacy of the system must be checked and certified by a suitably qualified Engineer.

These systems must be watertight if there is the potential for water seepage which may cause damage to adjacent properties or structures. For safety, all maintenance access to underground storage systems must conform to the current Work Health and Safety Bill 2011, Work Health and Safety Regulations 2011 and Australian Standard AS 2865-2009 “Confined spaces”. Venting must be provided where gas build up is likely. A hydrostatic valve must be provided where necessary. Step irons are to be installed where the depth of the tank is greater than 1200 mm.

A high level outlet or grate shall be provided at the discharge control pit to cater for surcharge during major storm events. Access to the discharge control pit must be provided for inspections and maintenance of the silt trap and trash screen.

Underground storage tanks should be located externally to all buildings and structures. The access opening to the pit must be a minimum of 600 mm x 600 mm in dimension and fitted with a removable galvanised steel grate. The grate is to be placed above the outlet and silt trap.

Additional access openings will be required for larger underground storage tanks and high early discharge structures. Underground tanks which exceed 1500mm in length must have a second access point (300 mm x 300 mm minimum dimension) at the extreme corner of the tank to allow regular inspections, flushing of the system and ventilation, where necessary.

Essentially, the system shall be designed to maximise ease of maintenance and ensure safety for the proprietor.

To avoid unpleasant odours and health risks, maintenance of the OSD structure must be carried out on a regular basis. For this reason Council will require a Positive Covenant to be placed on the title of the subject land to emphasise the proprietor's maintenance responsibilities, refer to Section 9.5.

9.10.4 Surface Storage Systems

Surface storage can be provided in either in landscaped and/or driveways and carpark areas. Surface storage areas must be located externally to all buildings and structures.

Where the depth of storage exceeds 300 mm, a Council approved fence must be provided around the perimeter of the storage area.

Surface storage in driveways must not exceed 200 mm. Reference is made to Section 9.10.6.

9.10.5 Storage in Landscaped areas

The ponding depths in landscaped areas for all residential developments must not exceed 300 mm under design conditions. The maximum depth of ponding in all other developments must not exceed 1200 mm. Pool fences must be installed around the landscaped area where the depth of ponding exceeds 300mm. Pool fences must be designed and constructed in accordance with the requirements of the Swimming Pools Act 1992.

Storage which is to be provided in landscaped areas shall include an allowance of an additional 20% volume to compensate for loss of volume due to vegetation growth and construction inaccuracies. The 20% additional volume is to be gained by increasing the surface area of the ponded surface. Increasing the depth of the basin to gain the additional storage will not be approved, as this will alter the designed stage-storage- discharge relationship of the model.

The maximum slope of batters in grassed areas is to be 1 in 4. The minimum surface slope is 1.5%, with the absolute minimum being 1.0%.

Sub-soil drainage must be provided around the outlet to prevent the ground becoming saturated during prolonged wet weather.

Where the storage is to be located in an area where frequent ponding could create maintenance problems or personal inconvenience to property owners, the first 5% of the storage volume must be provided in a pit. The next 15% must be provided in an area able to tolerate frequent inundation, for example, a small underground tank in conjunction with a paved outdoor entertainment area. A check using the ILSAX model to confirm that the 3-month design storm will occupy the first 5% of storage volume and the 63.21% AEP design storm will occupy the first 20% of the storage, will be sufficient. Generally, all grassed/landscaped areas would require the first 5% of the storage to be contained within the pit and the next 15% storage to be in a tolerable, frequently wettable zone. This is to be assessed at the discretion of Council.

The structural adequacy of any retaining walls, including any hydrostatic loads caused by full storage must be checked. The retaining walls are to be constructed as waterproof masonry walls.

9.10.6 Storage in Driveways and Carparks

Carparks and driveways used as storage areas must be located externally to all buildings and structures. To avoid damage to vehicles, depths of ponding on driveways and carparks are not to exceed 200 mm under design conditions. Transverse paving slopes within storage areas must not be less than 0.7%.

If the storage is to be provided in a commonly used area where ponding will cause inconvenience (e.g. carparks), this area should not, on average, flood more than once every three months. This will require approximately the first 5% of the storage to be provided in a non-visual area, e.g. an underground pit.

9.10.7 Compliance

If Council issues the Construction Certificate for the OSD system then, on completion of the Works, the system must be certified by a suitably qualified and experienced Civil Engineer, who has membership to the Institution of Engineers Australia and National Engineering Register (NER), with Works-As-Executed drawings supplied to Council in respect of:

a) Compliance with the development application.

b) Intended purpose of the storage structure, that is, the structure has been designed to comply with all relevant Australian Standards and Codes.

c) The Works have been constructed in accordance with the approved drawings. Where 'approved drawings' are those that bear Council's approval stamp. The Certification shall read "I have carried out all inspections necessary to declare that the work nominated in drawing No.XXX, have been carried out in accordance with the approved plans and specifications, and the conditions of development consent". Such certification shall be signed and dated.

d) The Works-As-Executed drawings are to be prepared by a Registered Surveyor and submitted to Council, to include all relevant levels, reduced to Australian Height Datum and locations including:

    i) invert levels

    ii) surface or pavement levels

    iii) floor levels including adjacent property floor levels, if required

    iv) maximum water surface level for 1% AEP storm

    v) dimensions of basin(s), tank(s), pit(s), etc.

    vi) locations of basins and distances from building and boundaries

    vii) storage volume(s) provided

    viii) size of the Orifice.

If the Applicant chooses to have an Accredited Certifier prepare the Construction Certificate, then certification of the works must be provided by the Accredited Certifier including the submission of Works-As-Executed drawings in respect of the above points a) to d).

A copy of the Works-As-Executed drawings must be lodged for Council's records.

9.10.8 Plaque

At Council's discretion, identification of the OSD system(s) may be required. Identification in the form of a plaque attached near the system and clearly displayed will be required. This would generally be necessary for large basins.

If required, a plaque measuring no less than 400 mm x 200 mm shall be attached permanently and prominently displayed within the vicinity of the OSD system(s). This plaque shall advise the occupants of the property of the existence of the OSD system(s) and that the controlling device must not be tampered with, changed or modified in any manner without prior written consent from Council.

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10.0 Flood Risk Management

Council manages flood prone land in accordance with the Flood Risk Management Process as outlined in the NSW Government Floodplain Development Manual, 2005 with the aim of producing Floodplain Risk Management Plans for the Northern Beaches LGA.

Through strategic and operational outcomes, Council aims to reduce the impact of flooding and reduce private and public losses resulting from floods.

10.1 Flood risk Management Objectives

The specific flood risk management objectives of this Policy are:

a) To increase public awareness of the hazard and extent of land affected by all potential floods, including floods greater than the 1% AEP flood

b) To ensure the flood risk associated with development is minimised

c) To manage the risk to life, damage to property and impacts on the natural environment caused by flooding and inundation by controlling development on flood prone land

d) To ensure the development is compatible with the flood risk through the application of risk-based controls that take into account social, economic, ecological and design considerations

e) To ensure that proposed development does not expose existing development to increased risks associated with flooding

f) To ensure that effective development controls apply so that development is carried out in accordance with these objectives and the requirements of this policy

g) To ensure that the preparation of flood related information required to be lodged is carried out by suitably qualified professionals with appropriate expertise in the applicable areas of engineering.

10.2 Strategic Flood Risk Management Activities

Council undertakes both strategic and operational actions in the management of the floodplain. At the strategic level, Council undertakes the following actions.

10.2.1 Risk Assessment and Management

Council will identify, map and manage flood prone land in accordance with the Flood Risk Management Process. This involves undertaking Flood Studies, Floodplain Risk Management Studies and Floodplain Risk Management Plans with the aim of adopting and implementing plans for the entire LGA. Recommended floodplain management options will be investigated in detail and implemented in a priority order in accordance with available resources.

10.2.2 Land Use Planning

Council will maintain a framework of Local Environmental Plans and Development Control Plans to provide appropriate flood risk protection measures. The flood related development controls will contain provisions to manage the flood risk to both life and property. Planning proposals seeking to rezone land will be assessed in accordance with the NSW State Government's Ministerial Direction 9.1 – 4.3 Flood Prone Land and must demonstrate that the flood risk to future occupants and structures can be appropriately managed through the available legislative framework.

10.2.3 Combat Agencies

Communication and relationships with relevant combat agencies will be fostered and strengthened through the sharing of flood intelligence, establishment of partnership projects and informing the development of Local Flood Plans and other emergency incident management plans. Strategies for

improvement in incident response and shared incident response methodologies will be implemented where relevant.

10.2.4 Climate Change

The Northern Beaches is expected to be particularly affected by the impacts of climate change. Council recognises the importance of climate change adaptation and will investigate the impacts of climate change in flood risk projects in accordance with the best available data, science and policy. Changes to climate change policy or practice will be implemented on an iterative basis to reflect the current best advice/information.

10.2.5 Community Engagement

Council recognises the importance of community engagement in achieving good governance and well understood and accepted outcomes. Engagement on flood risk projects will be undertaken in accordance with the Northern Beaches Council Community Engagement Policy and Matrix. Public exhibitions of flood studies will be accompanied by opportunities to meet with staff on a personal level to discuss issues. Flood risk awareness through engagement is recognised as a strategic priority.

10.2.6 Flood Monitoring Program

Effective flood warning and response can reduce the impacts of flooding. Council operates a series of flood monitoring stations and a publicly accessible flood warning webpage known as the Northern Beaches Flood Information Network. Council proactively monitors weather and potential flooding conditions. Council will continue to investigate and implement improvements to the flood warning system to better prepare for and respond to flood events.

10.3 Operational Flood Risk Management Activities

At the strategic level, Council undertakes the following actions:

10.3.1 Risk Response

Council undertakes a number of risk response measures to reduce the impacts of flooding. This includes mechanically opening the entrances of Manly, Curl Curl, Dee Why and Narrabeen Lagoons at defined trigger levels. Council also maintains the water level of Manly Dam at 34.1m AHD to provide flood storage during severe storms.

10.3.2 Education

Council in conjunction with the NSW SES will prepare and implement education strategies to build community resilience to flood and coastal storms. Such strategies will improve the capacity of the Northern Beaches community to prepare, respond and recover from major flood and storm events and learn from their experiences to improve future preparedness.

10.3.3 Mitigation Works

Floodplain Risk Management Plans will investigate a range of floodplain management options to reduce the impacts of flooding in individual catchments. This may include property modification options such as development controls, voluntary purchase or voluntary house raising however often a Plan may recommend the delivery of flood mitigation works. Council will investigate and implement mitigation works in accordance with the Floodplain Risk Management Process and priority rankings. Council undertakes the Narrabeen Lagoon Entrance Clearance Works on a 3-5 year schedule to promote an increase in the duration in which Narrabeen Lagoon is open and to reduce the severity of flooding impacts.

10.3.4 Development Applications

Applications for development on flood prone land will be assessed according to the legislative framework of Local Environment Plans, Development Control Plans and any supporting

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documentation including policies. Appropriate controls will be applied to ensure that future occupants of the floodplain are not subject to an unacceptable level of flood risk.

10.3.5 Planning Certificates

Question 7A of a Planning Certificate identifies whether flood related development controls apply to individual properties. Following the release of publicly available flood information, the answer to Question 7A will be amended to reflect whether flood related development controls now apply to subject properties. Part (5) Planning Certificates will be amended to reflect when flood studies are in progress but not yet adopted by Council.

10.3.6 Provision of Data to the Public

a) A Flood Information Report is available from Council (refer Council's fees and charges).

b) Council will provide the 1% AEP, FPL and PMF levels for a specific property where available.

c) Flood level information may be subject to change in the future.

d) For large-scale developments or developments in key flood areas, applicants may be requested to use Council's hydraulic model to assess the impacts. This would be applicable only for a development that is likely to cause a change in the flood regime or requires confirmation that it will create no impact on flooding for neighbouring properties. Hydraulic models are available from Council (refer Council's fees and charges) and recipients will be required to complete the appropriate Data Use Agreement.

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11.0 Overland Flow Flooding

Overland flow differs from mainstream flooding from creeks or lagoons as they are usually generated from surface run off and overflows from kerbs and smaller pipes, to more serious overland flows involving exceedance in the capacity of major trunk drainage systems.

11.1 Identifying Overland Flows

To determine if the subject property is affected by overland flow, a Civil Engineer who is currently registered on the National Engineering Register (NER), should be engaged to investigate and verify whether the subject property is affected by overland flows during a 1% AEP even. Council's Stormwater Planning Maps may assist identifying Council drainage in the vicinity of the property.

11.2 Development on Land Subject to Overland Flows

a) For development on properties subject to overland flow that has not been identified as being flood affected must comply with flood related development controls in the relevant planning instruments.

b) Overland flow paths designed to contain a 1% AEP storm flow are to be provided over all pipelines that are not designed to cater for this flow. The design of the overland flow path must consider the velocity-depth hazard.

c) An overland flow path shall be defined, and not impeded, even where the 1% AEP storm flows can be maintained within the underground-piped drainage system.

d) Overland flow paths are to be kept free of obstruction and must not be landscaped with loose material that could be removed during a storm event, such as wood chip or pine bark.

11.3 Subdivisions on Lots Affected by Overland Flow

Proposed land subdivisions of lots affected by overland flow will not be approved unless the applicant can demonstrate that future development can comply with the requirements of the relevant planning instruments.

11.4 Piping Overland Flows

Developments proposing the collection and piping of overland flow through the subject property will generally not be permitted. Where an existing Council pipeline is to be diverted and/or upgraded, the design is to be in accordance with Section 6 of this Policy.

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12.0 Compliance

Council will apply the Compliance and Enforcement Policy for the investigation of alleged unlawful activity, and any enforcement action required in relation to unlawful activity, within the Northern Beaches LGA for which Council is the appropriate regulatory authority.

12.1 Audit of Water Management Requirements

Council may undertake audits of developments to ensure the requirements of this Policy and the development consent are met at all times. For any non-compliances identified, Council will apply the provisions of the Compliance and Enforcement Policy.

12.2 Complaints Relating to Private Property

Complaints relating to stormwater from private property are only investigated by Council:

a) after the parties have exhausted reasonable attempts to resolve the matter with each other

b) when there is sufficient evidence that the water has caused, or is likely to cause significant soil erosion or physical damage to a building or land.

Council will not take action, when:

a) water flow problems are caused by natural ground seepage

b) water flows naturally onto the property from a higher property (or properties)

c) water flows from a defective or blocked private inter-allotment drainage easement of which the complainant is a part. Private inter-allotment easements are the responsibility of all property owners who are burdened by and/or benefited by the easement

d) water overflows from a swimming pool due to rainfall.

12.3 Removal of Private Trees Threatening Council Stormwater Pipes

To protect Council's stormwater pipes from blockage or structural damage by trees on private land, landowners may be required by Council to remove any tree adjacent to the pipes when it is apparent that the tree's root system has, or is likely to, penetrate the pipeline joints. If the owner refuses to do this after reasonable notification from Council, the owner is to bear the cost of any future maintenance work on the pipeline due to tree root damage.

Removal of private trees threatening Council stormwater pipes are to be conducted according to the following principles:

a) Identification of tree roots within the pipe system, by means of CCTV or visual inspection

b) Removal of root obstruction will be conducted only by the following means:

   i) unobtrusive removal of tree root mass with no physical interference to the pipe

   ii) excavation of the tree root mass at pipe location with minimal site disturbance

   iii) full excavation and replacement of pipe section in accordance with Auspec1 Design Manual.

c) Where a tree is required to be removed on private property and it is not an exempt species, a Tree Removal and Tree Pruning application must be submitted to Council by the owner of the property.

d) Tree removal will be at owner's expense.

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e) In circumstances where Council may need to be the applicant for the Tree Removal and Tree Pruning Application, Council will need to obtain the owner's consent and sign off of the application.

References and related documents

- Conveyancing Act 1919
- Environmental Planning and Assessment Act 1979
- Environmental Planning and Assessment Amendment (Building Sustainability Index: BASIX) Regulation 2004
- Local Government Act 1993
- Environment Protection and Biodiversity Conservation Act 1999
- Protection of the Environment Operations Act 1997
- Water Management Act 2000
- Biodiversity Conservation Act 2016
- Northern Beaches Council Compliance and Enforcement Policy 2018
- Water by Design Technical Guidelines
- Warringah Local Environment Plan 2000
- Warringah Local Environment Plan 2011
- Warringah Development Control Plan 2011
- Manly Local Environment Plan 2013
- Manly Development Control Plan 2013
- Pittwater Local Environment Plan 2014
- Pittwater Development Control Plan 2003

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Appendixes

Appendix 1 Northern Beaches Council WSUD & MUSIC Modelling Guidelines

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Northern Beaches Council

WSUD & MUSIC Modelling Guidelines

Appendix 2 Sample Easement Letter

Dear .....

I/we .....
are proposing to redevelop our property at .....

Before we can proceed with this proposal Council has advised us that we have two options for the drainage of stormwater. Council's preferred method is to obtain a drainage easement to convey the stormwater runoff from our property to the nearest public stormwater drainage infrastructure or Council approved discharge point,

being .....

This will require you to grant me/us a drainage easement through your property with all legal and survey costs for the creation of the easement being borne by us, together with any consideration for the use of your property as determined by an independent valuation or agreement. (Attach independent valuation or agreement to this form)

The alternative is to install an underground absorption system or level spreader (if appropriate for this site) to spread and disperse the stormwater flow. As the runoff and seepage from this system may flow towards your property because of the slope of the land, the best solution would be to have a drainage system that will convey our stormwater via an inter-allotment drainage

pipe to .....

You are advised that if Council determines that the only way to drain stormwater is via an easement through your property, I/we may have to use Section 88K of the Conveyancing Act 1919 to request the Supreme Court to grant me/us the drainage easement. This will probably result in legal expenses and time spent for both you and I/us.

Could you please indicate your position regarding this matter so that we can advise Council to enable our application to progress.

YES ..... I/we are willing to grant you a drainage easement.

....
Name Address

NO ..... I/we are not willing to grant you a drainage easement.

....
Name Address

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Appendix 3 On-site Absorption Design Guideline

a) A consulting geotechnical engineer must submit a geotechnical report providing the following details (where applicable) for the proposed location of the absorption/dispersal trench:

   i) Depth to rock

   ii) Depth to the water table

   iii) Measured infiltration rate (in litres/square metres/second)

   iv) Infiltration rate that can be maintained in the long term

   v) Minimum distance any infiltration system should be located clear of property boundaries

   vi) Whether the use of infiltration is likely to cause seepage problems to the proposed structure or to any adjoining properties

   vii) The use of any waterproofing to protect underground areas

   viii) Any special requirements for the design of walls or footings on the site.

   The above information must be submitted to Council to determine whether any absorption system is permitted for the site.

b) The absorption pit is to be designed for a 2% AEP storm using DRAINS computer software based on the infiltration rate that can be maintained in the long term. An overflow mechanism in the form of a level spreader must be provided for all storms greater than the 2% AEP storm, up to and including the 1% AEP storm. The overflow mechanism is required to minimise overland flow disturbance to the lower property.

c) The roof guttering and downpipe system should be designed to collect the 2% AEP design rainfall and pipe it to the absorption system, or alternatively provide for surface collection of guttering overflows into the absorption system.

d) A site plan showing the location of absorption pit(s) relative to fences and to the buildings on-site and on neighbouring properties must be provided. The pipe layout with sizes and grades is also to be shown. Drainage calculations must be submitted with the plans.

e) Where a high water table is encountered and a gravel filled trench design is proposed, the base of the trench should be at least 500mm above the water table to accommodate fluctuations of the groundwater.

f) When considering available storage volumes for the storage design methods, a maximum of 20% voids in the base aggregate may be used. Volumes in the end pits and the Everglas Trench systems may also be used.

g) The absorption pit should not be located within three metres of the side or rear boundary, or three metres from any on-site building or neighbouring buildings.

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Appendix 4 Level Spreader Design Guideline

a) Level spreader is to be designed by a suitably qualified and experienced Civil Engineer, who has Membership to the Institution of Engineers Australia.

b) Stormwater flows from the whole site are to be restricted for all storm events up to and including the 1% AEP storm event. This system will require the provision of an on-site stormwater detention system.

c) Total discharge including bypass flows and controlled flows through the level spreader must not exceed the 20% AEP state of nature storm event.

d) The level spreader should not be located within three metres of the side or rear boundary, or three metres from any on-site building or neighbouring buildings.

e) The level spreader ideally is to be located as far as possible from the downstream boundary.

f) Level spreader must not directly or indirectly, result in the concentration and increase of surface flows downstream of the property.

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Appendix 5 - Guidelines for CCTV Investigations of Council Stormwater Assets

This guideline is intended to provide advice to applicants on Closed Circuit Television (CCTV) Investigation of Council Stormwater Assets.

What is a CCTV Report for a Council Stormwater Asset?

A Closed Circuit Television (CCTV) Report for a Council Stormwater Asset consists of internal video footage of the infrastructure (provided as a digital file on USB or through sharing) and a hard copy report which is prepared to enable Council to assess the impacts of development upon Council Stormwater Assets, such as stormwater drainage pipelines. Council uses a CCTV Report for Council's Stormwater Assets to adequately assess potential damage that may have occurred to Council owned and maintained stormwater infrastructure and to assess the construction / condition of any new stormwater infrastructure that will be handed over to Council's care and control as part of a development.

When is a CCTV Report for Council Stormwater Asset Required?

A CCTV Report for Council Stormwater Asset is required for:

a) Any development works located within the vicinity of a Council Stormwater Asset on public or private land and may be required as a condition of development consent. Generally, a CCTV report is required for stormwater lines longer that 10m in length

b) Any new stormwater infrastructure that has been constructed as part of a development and will be handed over to Council's care and control.

Technical Requirements of a CCTV Report for Council Stormwater Asset

CCTV reports are to be as follows:

a) The survey is to be undertaken using a suitably sized tractor mounted CCTV camera for the pipe size to ensure the camera is close to the centre of the pipe

b) 360 degree panning is required at every pipe joint with inspections also required at lifting holes

c) The video footage is to be in focus

d) Each pipe reach report is to have a cover page outlining the "from pit" and "to pit" numbers, pipe diameter, direction of survey, location, and date (Pit numbers to be obtained from Council's Natural Environment Unit or available on Council's webpage – Stormwater Maps)

e) A new survey is required for each pipe reach

f) File format to be **mpeg**

g) The Electronic file name for each pipe reach report should be labelled using the following naming convention:

- 'Pit number' to 'Pit number'_Date

  Example: A survey from Pit no. SPP00001 to SPP00002 carried out on 1 August 2009

  Should be named as follows: SPP00001_SPP00002_010809.mpg.

NOTE: Northern Beaches Council has its own pit numbering system. Pits labelled A or B etc. will not be accepted. Pit numbers to be obtain from Council prior to undertaking works.

Other General Requirements of Reporting

All reports are to be professionally prepared and provide details of the author.

For further information contact Council's Environment and Climate Change Unit on 1300 434 434 or via email council@northernbeaches.nsw.gov.au

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Appendix 6 - Guideline for Preparing a Dilapidation Survey of Council Stormwater Assets

This guideline is intended to provide advice to applicants on preparing a Dilapidation Survey for Council Stormwater Assets.

What is a Dilapidation Survey for Council Stormwater Assets?

A Dilapidation Survey for Council Stormwater Assets is a document, which is to be prepared to determine the condition of Council's Stormwater Asset both before and after construction. A Closed Circuit Television (CCTV) inspection may be required to determine this condition. This allows Council to determine if there is any damage to Council's stormwater infrastructure caused by development works.

When is a Dilapidation Survey for Council Stormwater Assets Required?

A Dilapidation Survey for Council Stormwater Assets is required for any development works located within the vicinity of a Council Stormwater Asset on public or private land and may be required as a condition of development consent.

The pre-construction Dilapidation Survey of Council's Stormwater Asset must be submitted to Council prior to Construction, or as required by conditions of consent for any stormwater infrastructure that may be impacted upon during construction. This is to clearly identify to Council any existing damage to Council stormwater infrastructure before commencement of the development.

Copies of pre-construction Dilapidation Surveys are to be available on site for inspection until practical completion is reached.

Final post-construction Dilapidation Surveys are to be submitted to Council prior to the release of any bonds. All costs incurred in achieving compliance with these requirements shall be borne by the person entitled to act on a development consent.

Requirements of a Dilapidation Survey for Council Stormwater Assets

Dilapidation Surveys for Council Stormwater Assets are to include the following:

a) Photographs and written records identifying any damage to Councils stormwater infrastructure prior to construction

b) Photographs and written records identifying any damage to Councils stormwater infrastructure post construction

c) Closed Circuit Television (CCTV) footage - provided as a digital file, on USB or through sharing, and hard copy report (pre and post construction) in accordance with Council's guidelines for CCTV requirements.

Other General Requirements of Reporting

All reports must be professionally prepared and provide details of the author.

For further information contact Council's Environment and Climate Change Unit on 1300 434 434 or via email council@northernbeaches.nsw.gov.au

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Appendix 7 - Guideline for Preparing Works-as-Executed Data for Council Stormwater Assets

This guideline is intended to provide advice to applicants on Preparing Works-As-Executed Data for Council Stormwater Assets.

What are Works-As-Executed Data for Council Stormwater Assets?

Works-As-Executed Data Requirements for Council Stormwater Assets consists of a Works-As-Executed plan (dwg file), a spreadsheet and a Closed Circuit Television (CCTV) Report (refer to Guideline for CCTV investigations of Council stormwater assets) which is to be prepared to enable Council to update records and note variations to Council Stormwater Assets.

When is Works-As-Executed Data for Council Stormwater Assets Required?

Works-As-Executed Data for Council Stormwater Assets is required following development works which modify Council's stormwater assets or create new stormwater assets that will be handed over to Council's care and control. Generally, this is imposed as a condition of development consent.

Technical Requirements for Works-As-Executed Data for Council Stormwater Assets

The Works-As-Executed Data is to be provided by a Registered Surveyor and should comply with the following:

a) Level of accuracy:

   i) X, Y coordinates (Easting; Northing) shall be +/- 0.05m

   ii) X, Y (Easting; Northing) to GDA 94 Map Grid of Australia Zone 56 (MGA94)

   iii) reduced level heights shall be +/- 0.01m

   iv) reduced levels shall be in terms of Australian Height Datum (AHD)

b) Appropriate formats:

   i) Spreadsheet (.XLS);

   ii) WAE electronic plan – Drawing (.DWG AutoCAD 2009 or earlier version)

   iii) CCTV Report / footage DVD – (.MPEG)

c) Deliverables:

   i) One (1) soft copy of both the spreadsheet and plan on CD, one (1) scaled A1 paper copy plan of the Drawing, one (1) soft copy of the CCTV footage on DVD and one (1) paper copy of the CCTV report is to be provided to Council.

   The detailed information required within these formats is detailed in Appendices 5-7.

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Appendix 8 - SSR and PSD Tables

Table A8-1: SSR and PSD for various site areas with equal to or less than 60% impervious

total area of site	min. size of basin (SSR)	max. Q5 from existing site (PSD from basin)	max. Q100 from existing site	Max. overflow from basin
m^2	m^3	l/s	l/s	l/s
200	5.0	7	13	6
250	6.1	9	16	7
300	7.4	11	19	8
350	8.5	12	22	10
400	9.8	14	25	11
450	11.6	15	28	13
500	13.5	16	30	14
550	15.2	17	33	15
600	17.0	18	36	18
650	18.9	20	39	19
700	20.9	21	41	20
750	22.8	22	43	21
800	24.7	23	45	22
850	26.1	24	47	23
900	28.6	25	49	24
950	29.1	26	51	25
1000	30.5	27	53	26
1050	32.0	29	56	27
1100	33.5	30	58	28
1150	35.1	32	61	29
1200	36.6	33	63	30

Note: Maximum concentrated discharge to kerb and gutter is 20 l/s

650	18.9	20	39	19
700	22.9	20	41	21
750	25.8	20	43	23
800	28.6	20	45	25
850	31.7	20	47	27
900	34.7	20	49	29
950	37.8	20	51	31
1000	40.8	20	53	33
1050	44.2	20	56	36
1100	47.6	20	58	38
1150	50.9	20	61	41
1200	54.3	20	63	43

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Table A8-2: SSR and PSD for various site areas with between 60 and 100% impervious

total area of site	min. size of basin (SSR)	max. Q5 from existing site (PSD from basin)	max. Q100 from existing site	Max. overflow from basin
m^2	m^3	l/s	l/s	l/s
200	5.5	7	13	6
250	6.8	9	16	7
300	8.2	11	19	8
350	9.5	12	22	10
400	10.9	14	25	11
450	12.9	15	28	13
500	15.0	16	30	14
550	17.0	17	33	15
600	19.0	18	36	18
650	21.1	20	39	19
700	23.3	21	41	20
750	25.4	22	43	21
800	27.5	23	45	22
850	29.1	24	47	23
900	30.8	25	49	24
950	32.4	26	51	25
1000	34.0	27	53	26
1050	35.7	29	56	27
1100	37.4	30	58	28
1150	39.1	32	61	29
1200	40.8	33	63	30

Note: Maximum concentrated discharge to kerb and gutter is 20 l/s

650	21.1	20	39	19
700	25.1	20	41	21
750	28.0	20	43	23
800	30.8	20	45	25
850	33.9	20	47	27
900	36.9	20	49	29
950	40.0	20	51	31
1000	43.0	20	53	33
1050	46.4	20	56	36
1100	49.8	20	58	38
1150	53.1	20	61	41
1200	56.5	20	63	43

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Appendix 9 – Orifice Plate Table (Table 3)

PSD	Depth of tank above centreline of orifice																				
l/s	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	
2	55	46	42	39	37	35	34	33	32	31	30	30	29	28	28	28	27	27	26	26	
3	67	57	51	48	45	43	41	40	39	38	37	36	36	35	34	34	33	33	32	32	Min.
4	78	65	59	55	52	50	48	46	45	44	43	42	41	40	40	39	38	38	37	37	100 mm
5	87	73	66	62	58	56	54	52	50	49	48	47	46	45	44	44	43	42	42	41	diameter
6	95	80	72	67	64	61	59	57	55	54	52	51	50	49	48	48	47	46	46	45	outlet
7	103	87	78	73	69	66	63	61	59	58	57	55	54	53	52	51	51	50	49	49	pipe
8	110	93	84	78	74	70	68	65	64	62	60	59	58	57	56	55	54	53	53	52	
9	117	98	89	83	78	75	72	69	67	66	64	63	61	60	59	58	58	57	56	55	
10	123	104	94	87	82	79	76	73	71	69	68	66	65	64	63	62	61	60	59	58	
11	129	109	98	91	86	82	79	77	75	73	71	69	68	67	66	65	64	63	62	61	
12	135	113	102	95	90	86	83	80	78	76	74	72	71	70	69	67	66	65	65	64	
13	140	118	107	99	94	90	86	83	81	79	77	75	74	73	71	70	69	68	67	66	
14	146	122	111	103	97	93	90	87	84	82	80	78	77	75	74	73	72	71	70	69	Min.
15	151	127	115	107	101	96	93	90	87	85	83	81	79	78	77	75	74	73	72	71	150 mm
16	156	131	118	110	104	99	96	93	90	88	85	84	82	80	79	78	77	76	75	74	diameter
17	160	135	122	113	107	103	99	95	93	90	88	86	85	83	82	80	79	78	77	76	outlet
18	165	139	125	117	110	106	102	98	95	93	91	89	87	85	84	83	81	80	79	78	pipe
19	170	143	129	120	113	108	104	101	98	95	93	91	89	88	86	85	84	82	81	80	
20	174	146	132	123	116	111	107	104	100	98	96	94	92	90	88	87	86	85	83	82	
21	178	150	136	126	119	114	110	106	103	100	98	96	94	92	91	89	88	87	85	84	
22	183	154	139	129	122	117	112	109	105	103	100	98	96	94	93	91	90	89	87	86	
23	187	157	142	132	125	119	115	111	108	105	102	100	98	97	95	93	92	91	89	88	
24	191	160	145	135	128	122	117	113	110	107	105	102	100	99	97	95	94	93	91	90	
25	195	164	148	138	130	124	120	116	112	109	107	105	102	101	99	97	96	94	93	92	
26	198	167	151	140	133	127	122	118	115	112	109	107	105	103	101	99	98	96	95	94	
27		170	154	143	135	129	124	120	117	114	111	109	107	105	103	101	100	98	97	96	
28		173	156	146	138	132	127	122	119	116	113	111	108	106	105	103	101	100	99	97	
29		176	159	148	140	134	129	125	121	118	115	113	110	108	107	105	103	102	100	99	
30		179	162	151	143	136	131	127	123	120	117	115	112	110	108	107	105	104	102	101	
31		182	165	153	145	138	133	129	125	122	119	116	114	112	110	108	107	105	104	102	
32		185	167	156	147	141	135	131	127	124	121	118	116	114	112	110	108	107	105	104	
33		188	170	158	150	143	137	133	129	126	123	120	118	116	114	112	110	109	107	106	
34		191	172	160	152	145	140	135	131	128	125	122	120	117	115	113	112	110	109	107	Min.
35		194	175	163	154	147	142	137	133	129	126	124	121	119	117	115	113	112	110	109	225 mm
36		196	177	165	156	149	144	139	135	131	128	125	123	121	119	117	115	113	112	110	diameter
37		199	180	167	158	151	146	141	137	133	130	127	125	122	120	118	117	115	113	112	outlet
38		202	182	170	160	153	148	143	139	135	132	129	126	124	122	120	118	116	115	113	pipe
39		204	185	172	163	155	149	145	140	137	133	131	128	126	124	122	120	118	116	115	
40		207	187	174	165	157	151	146	142	138	135	132	130	127	125	123	121	120	118	116	
41		210	189	176	167	159	153	148	144	140	137	134	131	129	127	125	123	121	119	118	
42		212	192	178	169	161	155	150	146	142	139	136	133	130	128	126	124	122	121	119	
43		215	194	180	171	163	157	152	147	144	140	137	134	132	130	128	126	124	122	121	
44		217	196	183	173	165	159	154	149	145	142	139	136	133	131	129	127	125	124	122	
45		220	198	185	175	167	161	155	151	147	143	140	138	135	133	131	129	127	125	123	
46		222	201	187	177	169	162	157	152	148	145	142	139	136	134	132	130	128	126	125	
47		224	203	189	178	170	164	159	154	150	147	143	141	138	136	133	131	130	128	126	
48		227	205	191	180	172	166	160	156	152	148	145	142	139	137	135	133	131	129	128	
49		229	207	193	182	174	168	162	157	153	150	146	143	141	138	136	134	132	131	129	
50		231	209	195	184	176	169	164	159	155	151	148	145	142	140	138	136	134	132	130	

Min. 375 mm diameter outlet pipe

Min. 300 mm diameter outlet pipe

For orifice diameters less than 50 mm, a 90 mm diameter plastic pipe may be used as the outlet pipe from the basin.
Discharge allowed to kerb is not to exceed 20 l/s

Flow through the orifice is based on the equation

$Q = C A \sqrt{(2 g H)} \times 10^3$

$d = \sqrt{(4 A / \pi)} \times 10^3$

Q = the flowrate in litres per second

Where

C = 0.6 for a circular, square cut edged orifice

H = the depth of ponding from the centreline of the orifice to the upper water surface level in metres

A = the area of the orifice in square metres

g = 9.81 metres per second per second (gravity)

π = 3.1416

d = the diameter of the orifice in millimetres

Appendix 10 – ILSAX Data

ILSAX rainfall files for 3 month year Annual Recurrence Interval (ARI) storms

```
3  2 10
3 MONTH, 10 MINUTE ARI
1 2 -1 0 -0.3 0 375 0.3
1 5 2.5 3.0 1 1 0
1
5 10 5 .2 1
1  1 30.5
0
3 MONTH, 15 MINUTE ARI
-1  0 3.0
1
5 15 5 .2 1
1  1 24.0
0
3 MONTH, 20 MINUTE ARI
-1  0 3.0
1
5 20 5 .2 1
1  1 20.0
0
3 MONTH, 25 MINUTE ARI
-1  0 3.0
1
5 25 5 .2 1
1  1 17.4
0
3 MONTH, 30 MINUTE ARI
-1  0 3.0
1
5 30 5 .2 1
1  1 15.3
0
3 MONTH, 45 MINUTE ARI
-1  0 3.0
1
5 45 5 .2 1
1  1 10.8
0
3 MONTH, 1 HOUR ARI
-1  0 3.0
1
5 60 5 .2 1
1  1 7.8
0
3 MONTH, 1.5 HOUR ARI
-1  0 3.0
1
5 90 5 .2 1
1  1 7.0
0
3 MONTH, 2 HOUR ARI
-1  0 3.0
1
5 120 5 .2 1
1  1 5.5
0
3 MONTH, 3 HOUR ARI
-1  0 3.0
1
5 180 15 .2 1
1  1 4.5
0
```

ILSAX rainfall files for 1 year ARI storms

```
3 2 10
1 YEAR, 10 MINUTE ARI
1 2 -1 0 -0.3 0 375 0.3
1 5 2.5 3.0 1 1 0
1
5 10 5 .2 1
1 1 80
0
1 YEAR, 15 MINUTE ARI
-1 0 3.0
1
5 15 5 .2 1
1 1 67
0
1 YEAR, 20 MINUTE ARI
-1 0 3.0
1
5 20 5 1 1
1 1 58
0
1 YEAR, 25 MINUTE ARI
-1 0 3.0
1
5 25 5 1 1
1 1 52
0
1 YEAR, 30 MINUTE ARI
-1 0 3.0
1
5 30 5 1 1
1 1 47.4
0
1 YEAR, 45 MINUTE ARI
-1 0 3.0
1
5 45 5 1 1
1 1 38.0
0
1 YEAR, 1 HOUR ARI
-1 0 3.0
```

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1
5 60 5 1 1
1 1 32.4
0
1 YEAR, 1.5 HOUR ARI
-1 0 3.0
1
5 90 5 2 1
1 1 25.7
0
1 YEAR, 2 HOUR ARI
-1 0 3.0
1
5 120 5 2 1
1 1 21.6
0
1 YEAR, 3 HOUR ARI
-1 0 3.0
1
5 180 15 2 1
1 1 17.0
0

ILSAX rainfall files for 5 year ARI storms

3 2 10
5 YEAR, 10 MINUTE ARI
1 2 -1 0 -0.3 0 -100 0.3
1 5 2.5 3.0 1 1 0
1
5 10 5 .2 1
1 5 130
0
5 YEAR, 15 MINUTE ARI
-1 0 3.0
1
5 15 5 .2 1
1 5 110
0
5 YEAR, 20 MINUTE ARI
-1 0 3.0
1
5 20 5 .2 1
1 5 97
0
5 YEAR, 25 MINUTE ARI
-1 0 3.0
1
5 25 5 .2 1
1 5 87
0
5 YEAR, 30 MINUTE ARI
-1 0 3.0
1
5 30 5 .2 1
1 5 80
0
5 YEAR, 45 MINUTE ARI
-1 0 3.0
1
5 45 5 .2 1
1 5 65
0
5 YEAR, 1 HOUR ARI
-1 0 3.0
1
5 60 5 .3 1
1 5 55
0
5 YEAR, 1.5 HOUR ARI
-1 0 3.0
1
5 90 5 .3 1
1 5 44.0
0
5 YEAR, 2 HOUR ARI
-1 0 3.0
1
5 120 5 .3 1
1 5 37.0
0
5 YEAR, 3 HOUR ARI
-1 0 3.0
1
5 180 15 .3 1
1 5 29.1
0

ILSAX rainfall files for 20 year ARI storms

3 2 10
20 YEAR, 10 MINUTE ARI
1 2 -1 0 -0.3 0 375 0.3
1 5 2.5 3.0 1 1 0
1
5 10 5 1 1
1 20 166
0
20 YEAR, 15 MINUTE ARI
-1 0 3.0
1
5 15 5 1 1
1 20 142
0
20 YEAR, 20 MINUTE ARI
-1 0 3.0
1
5 20 5 1 1
1 20 125
0
20 YEAR, 25 MINUTE ARI
-1 0 3.0
1
5 25 5 1 1

DRAFT

1 20 112
0
20 YEAR, 30 MINUTE ARI
-1 0 3.0
1
5 30 5 1 1
1 20 104
0
20 YEAR, 45 MINUTE ARI
-1 0 3.0
1
5 45 5 1 1
1 20 85
0
20 YEAR, 1 HOUR ARI
-1 0 3.0
1
5 60 5 1 1
1 20 73
0
20 YEAR, 1.5 HOUR ARI
-1 0 3.0
1
5 90 5 2 1
1 20 58
0
20 YEAR, 2 HOUR ARI
-1 0 3.0
1
5 120 5 2 1
1 20 49.2
0
20 YEAR, 3 HOUR ARI
-1 0 3.0
1
5 180 15 2 1
1 20 38.7
0

ILSAX rainfall files for 50 year ARI storms

3 2 10
50 YEAR, 10 MINUTE ARI
1 2 -1 0 -0.3 0 375 0.3
1 5 2.5 3.0 1 1 0
1
5 10 5 1 1
1 50 193
0
50 YEAR, 15 MINUTE ARI
-1 0 3.0
1
5 15 5 1 1
1 50 168
0
50 YEAR, 20 MINUTE ARI
-1 0 3.0
1
5 20 5 1 1
1 50 147
0
50 YEAR, 25 MINUTE ARI
-1 0 3.0
1
5 25 5 1 1
1 50 132
0
50 YEAR, 30 MINUTE ARI
-1 0 3.0
1
5 30 5 1 1
1 50 122
0
50 YEAR, 45 MINUTE ARI
-1 0 3.0
1
5 45 5 1 1
1 50 100
0
50 YEAR, 1 HOUR ARI
-1 0 3.0
1
5 60 5 1 1
1 50 86
0
50 YEAR, 1.5 HOUR ARI
-1 0 3.0
1
5 90 5 2 1
1 50 69
0
50 YEAR, 2 HOUR ARI
-1 0 3.0
1
5 120 5 2 1
1 50 58
0
50 YEAR, 3 HOUR ARI
-1 0 3.0
1
5 180 15 2 1
1 50 46.1
0

ILSAX rainfall files for 100 year ARI storms

3 2 10
100 YEAR, 10 MINUTE ARI
1 2 -1 0 -0.3 0 -100 0.3
1 5 2.5 3.0 1 1 0
1
5 10 5 .2* 1
1 100 213
0

DRAFT

100 YEAR, 15 MINUTE ARI
-1 0 3.0
1
5 15 5 .2* 1
1 100 184
0
100 YEAR, 20 MINUTE ARI
-1 0 3.0
1
5 20 5 .2* 1
1 100 163
0
100 YEAR, 25 MINUTE ARI
-1 0 3.0
1
5 25 5 .2* 1
1 100 149
0
100 YEAR, 30 MINUTE ARI
-1 0 3.0
1
5 30 5 .2* 1
1 100 135
0
100 YEAR, 45 MINUTE ARI
-1 0 3.0
1
5 45 5 .2* 1
1 100 112
0
100 YEAR, 1 HOUR ARI
-1 0 3.0
1
5 60 5 .3* 1
1 100 96
0
100 YEAR, 1.5 HOUR ARI
-1 0 3.0
1
5 90 5 .3* 1
1 100 77
0
100 YEAR, 2 HOUR ARI
-1 0 3.0
1
5 120 5 .5* 1
1 100 65
0
100 YEAR, 3 HOUR ARI
-1 0 3.0
1
5 180 15 .5* 1
1 100 52
0

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Appendix 11 – Time of Concentration

Table A11-1: Time of concentration for 20% AEP design storm grassed times of flow where n* = 0.33

slope % / length (m)	.5	1	2	3	4	5	6	8	10	12	14	16	18	20	25	30
5	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
10	10	8	6	5	5	5	5	5	5	5	5	5	5	5	5	5
15	13	10	8	7	6	6	6	5	5	5	5	5	5	5	5	5
20	16	13	10	9	8	7	7	6	6	5	5	5	5	5	5	5
25	19	15	12	10	9	8	8	7	7	6	6	6	6	5	5	5
30	22	17	13	11	10	10	9	8	7	7	6	6	6	6	5	5
35	25	19	15	13	12	11	10	9	8	8	7	7	7	7	6	6
40	27	21	16	14	13	12	11	10	9	9	8	8	8	7	7	6
45	30	23	18	15	14	13	12	11	10	9	9	8	8	8	7	7
50	32	25	19	17	15	14	13	12	11	10	9	9	9	8	8	7
55	35	27	21	18	16	15	14	12	12	11	10	10	9	9	8	8
60	37	28	22	19	17	16	15	13	12	12	11	10	10	10	9	9
65	39	30	23	20	18	17	16	14	13	12	12	11	11	10	10	9

Table A11-2: Time of concentration for 20% AEP design storm concentrated times of flow over driveways, pathways, through pipes, etc. for the remainder of the site where n* = 0.012

slope % / length (m)	.5	1	2	3	4	5	6	8	10	12	14	16	18	20	25	30
5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
15	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
20	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
25	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
30	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
35	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
40	3	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1
45	3	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1
50	3	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1
55	3	3	2	2	2	1	1	1	1	1	1	1	1	1	1	1
60	3	3	2	2	2	2	1	1	1	1	1	1	1	1	1	1
65	4	3	2	2	2	2	2	1	1	1	1	1	1	1	1	1

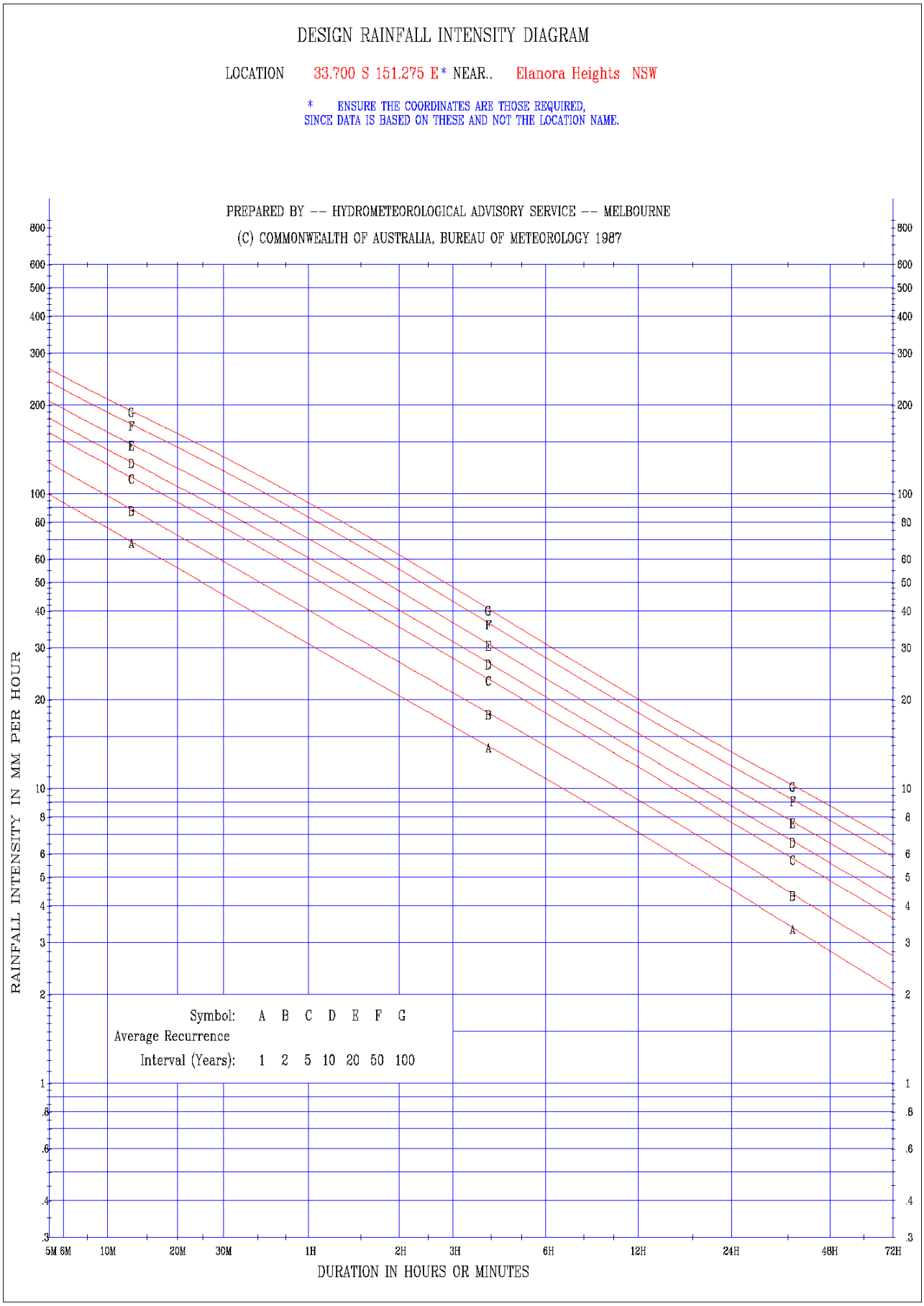
Table A11-3: Time of concentration for 1% AEP design storm grassed times of flow where n* = 0.33

slope % / length (m)	.5	1	2	3	4	5	6	8	10	12	14	16	18	20	25	30
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
10	7	6	6	5	5	5	5	5	5	5	5	5	5	5	5	5
15	10	8	7	6	5	5	5	5	5	5	5	5	5	5	5	5
20	13	10	8	7	6	6	5	5	5	5	5	5	5	5	5	5
25	15	12	9	8	8	7	6	6	5	5	5	5	5	5	5	5
30	17	13	10	9	8	8	7	6	6	5	5	5	5	5	5	5
35	19	15	12	10	9	9	8	7	7	6	6	6	5	5	5	5
40	21	16	13	11	10	9	9	8	7	7	6	6	6	6	5	5
45	23	18	14	12	11	10	9	9	8	7	7	7	6	6	6	5
50	25	19	15	13	12	11	10	9	9	8	8	7	7	7	6	6
55	26	21	16	14	13	11	11	10	9	8	8	7	7	7	6	6
60	28	22	17	15	13	12	12	11	10	9	9	8	8	8	7	7
65	30	23	18	16	14	13	12	11	10	9	9	8	8	8	7	7

Table A11-4: Time of concentration for 1% AEP design storm concentrated times of flow over driveways, pathways, through pipes, etc. for the remainder of the site where n* = 0.012

slope % / length (m)	.5	1	2	3	4	5	6	8	10	12	14	16	18	20	25	30
5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
15	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
20	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
25	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
30	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
35	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
40	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
45	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
50	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
55	3	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1
60	3	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1
65	3	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1

Appendix 12 - Design Rainfall Intensity Table Diagram



Design Rainfall Intensity Table Diagram should be used if the following site conditions apply:

a) The entire site drains to the front or to the rear of the property and the whole of the site was considered in all of the computations.

b) The average slope of the site does not exceed 5%.

c) The width of the site does not exceed 18m.

d) The existing site impervious area is to be 0% of the total site area.

e) The post-development impervious area is assumed to be equal to or less than 60% of the site area.

f) The estimation of the time of concentration for the pre-developed site is to be assumed as grassed for the entire site - refer to Tables A11-1 to A11-4 (Appendix 11).

g) Discharge from the OSD system must not be affected by any downstream tailwater levels from the receiving drainage system. That is, it must have a 'free outlet'.

h) The volume of the tank was designed so that:

    i) The maximum discharge through the orifice is equal to the 20% AEP (or 20 litres per second where concentrated discharge is to the kerb), and

    ii) The basin surcharged at a rate equal to the difference between the 1% AEP and the 20% AEP (or 20 litres per second where concentrated discharge is to the kerb).

i) Stormwater runoff for the total site prior to the development during the 1% AEP design stacked storm pattern is equal to the estimated flow after the development.

j) The two design stacked rainfall patterns were used to determine the 20% AEP and 1% AEP flows. These rainfall patterns are shown in Figure 1.

Note: Where the site constraints vary from the above parameters, it is recommended that the Full Computation Method be used.

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Appendix 13 – Simplified Method

The Simplified Method approach is set out below:

a) The minimum SSR and the maximum PSD values are read from Tables A8-1 or A8-2 (Appendix 8).

   Example: Site area = 600 m^2 and the total post-development impervious percentage is 80%, therefore from Table A8-2 gives PSD = 18 litres per second and SSR = 19.0 m^3.

b) The size of the outlet and orifice is read from Appendix 9.

   The top line of the table refers to the maximum depth that the water will pond above the centre of the orifice. Knowing the PSD and depth of ponding, the size of the orifice and the size of the minimum outlet pipe can be obtained.

   Example: PSD = 18 litres per second and the design maximum depth of ponding is 0.5 m, gives orifice size of 110 mm diameter with a 225 mm diameter outlet pipe. Outlet pipe size based on the greater of the minimum grade of 1% or 3 times the orifice outlet.

c) Detention storage volume will be achieved by the use of a properly designed and constructed above ground storage or below ground tank.

   The dimensions of an underground tank will be dependent upon the maximum depth of ponding that the site will allow.

   The dimensions of the tank, depth (D) x width (W) x length (L) should be equal to the minimum SSR determined.

   Example: SSR = 19.0 m^3 and depth = 0.5 m, Therefore W x L x 0.5 = 19.0 m^3 or W x L = 38.0 m^2

d) Values of W and L are independent. However, as the width approaches 3 m or more, the covering slab may become expensive to construct on site and pre-cast commercial tanks may be more economical. A suitably qualified professional Engineer will be required to design the covering slab.

e) The minimum information required, as set out in Section 3, is to be supplied with the Application to Council.

f) Design Rainfall Intensity Table Diagram (Appendix 12) applies only to the total area of the site. Dividing the original site area into smaller allotments and then using the tables in Appendix 8, is not acceptable. PSD and SSR values shall be determined on the original lot size, which can be proportioned down to the new allotment size.

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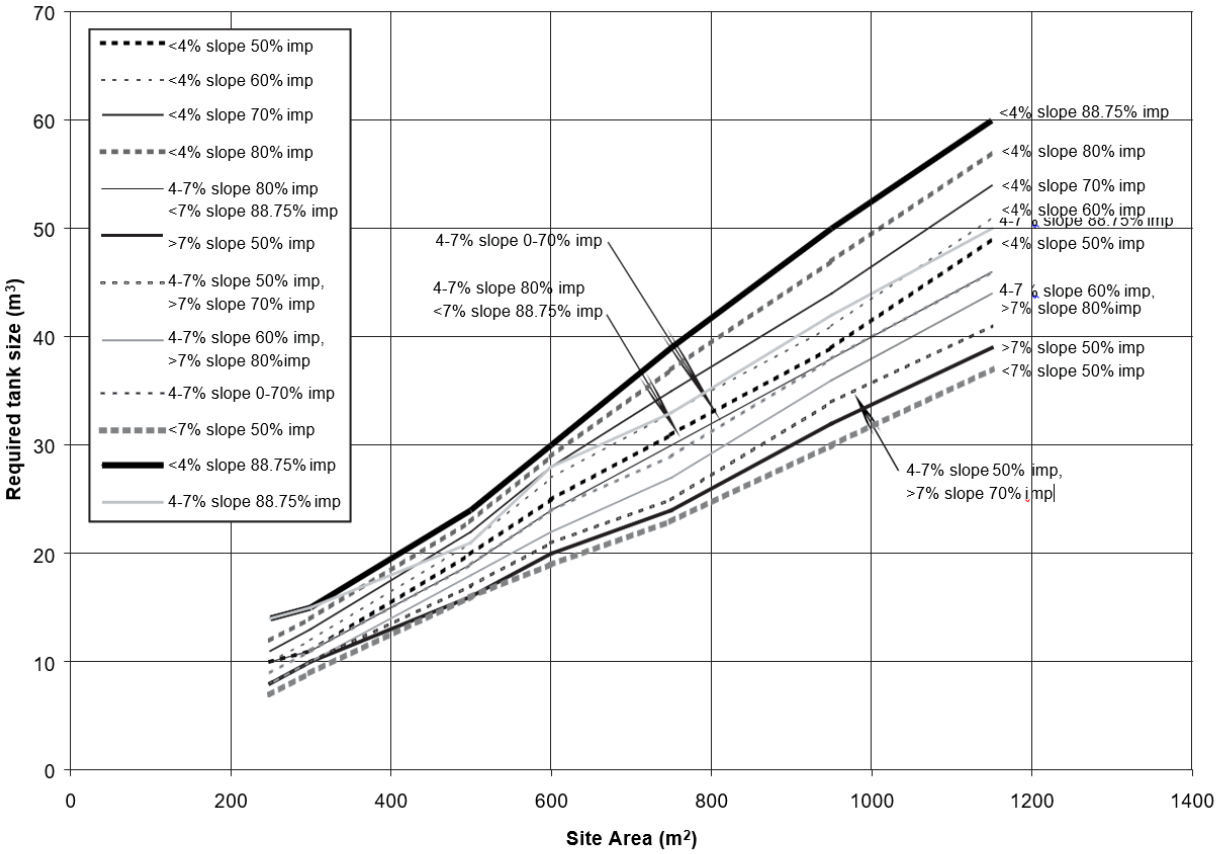
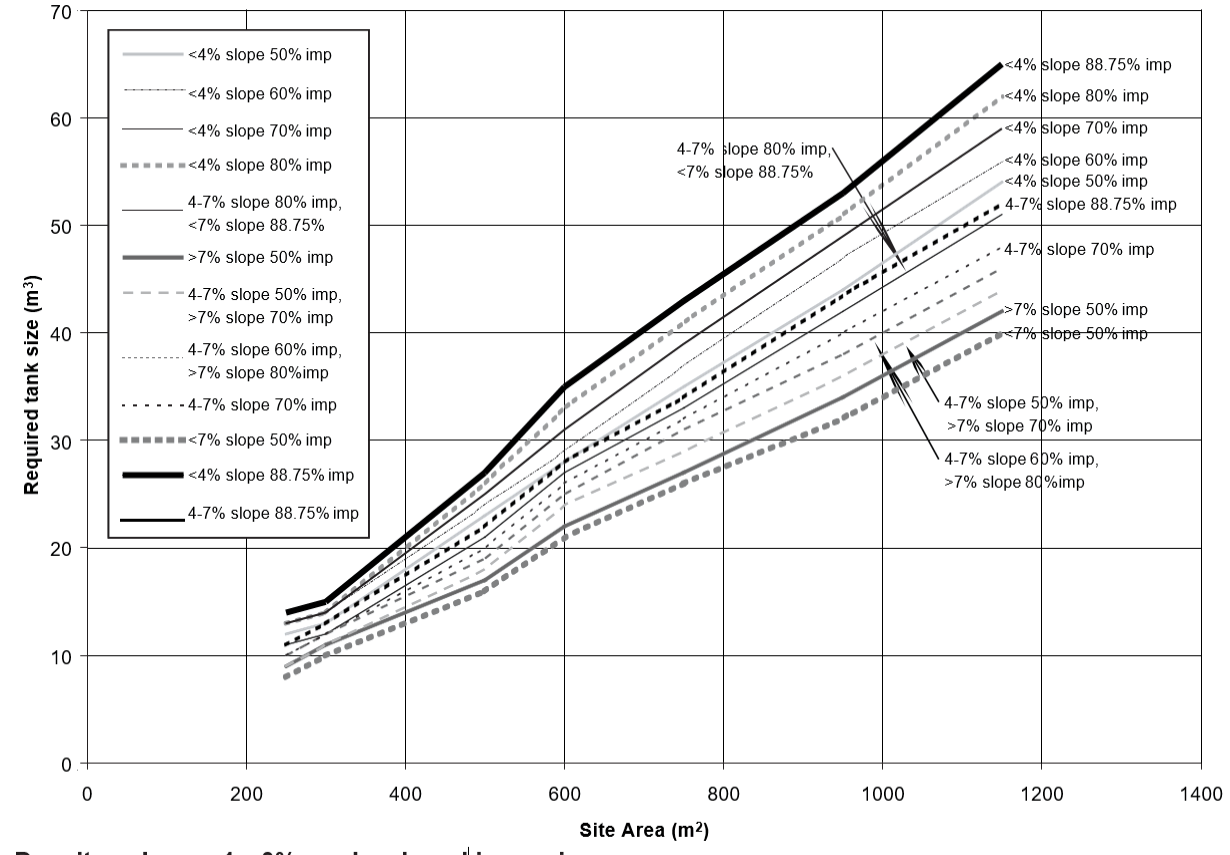
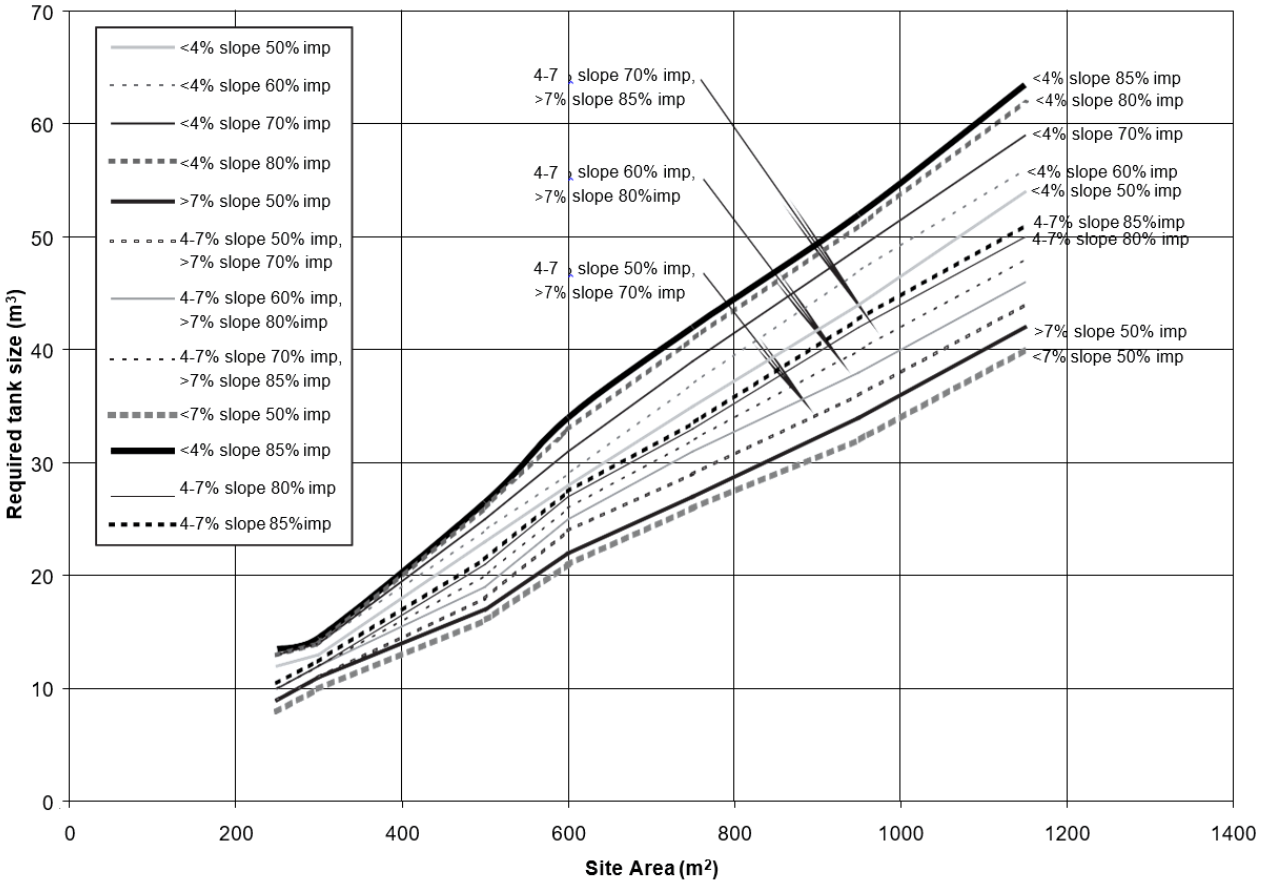
Appendix 14 – Region 3 Design Graphs



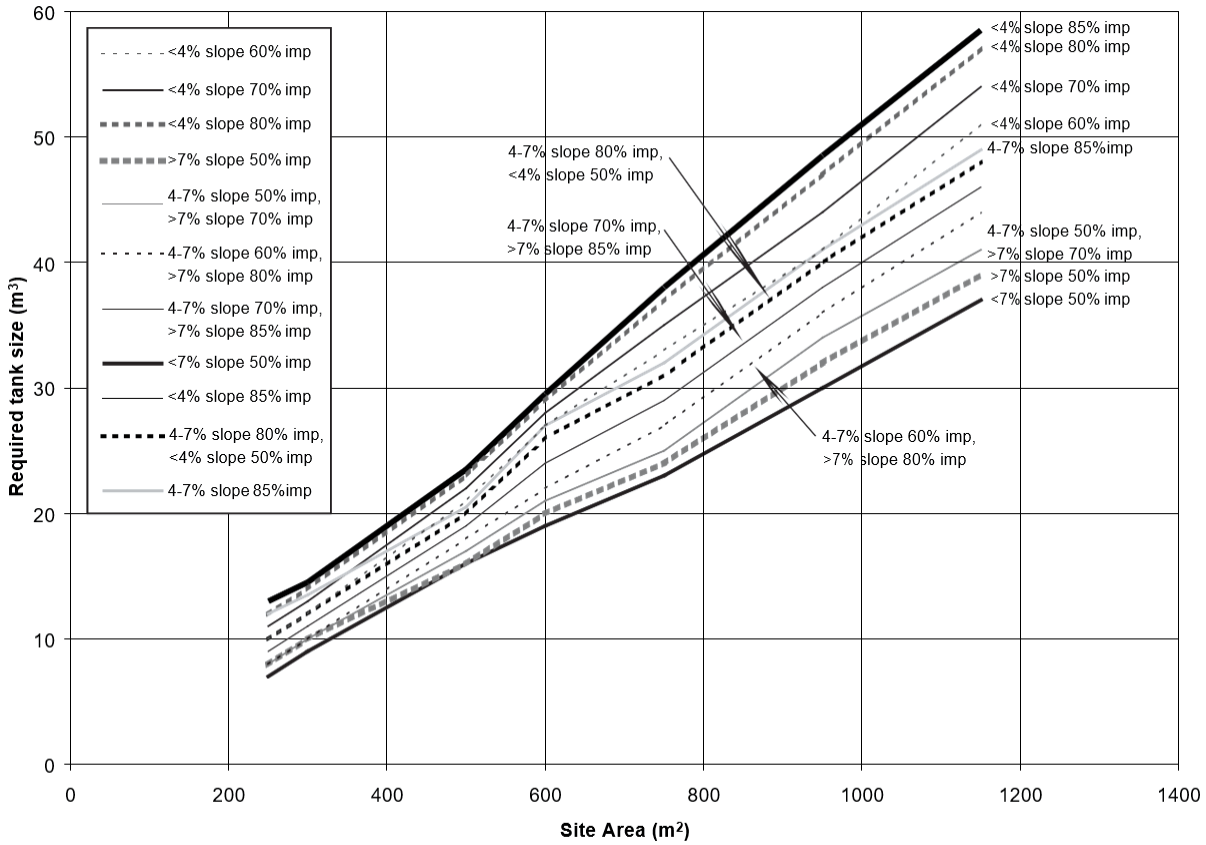
Density subzone 1—35% predeveloped impervious area



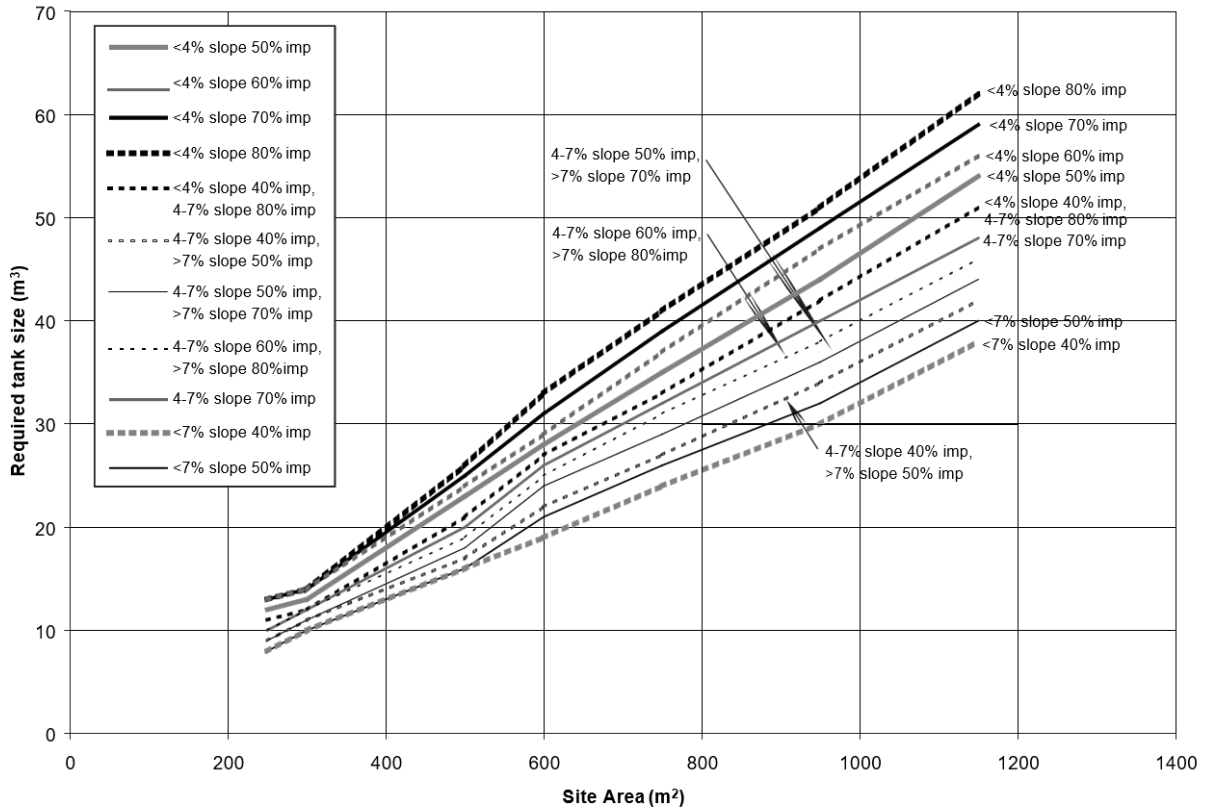
Density subzone 1—0% predeveloped impervious area



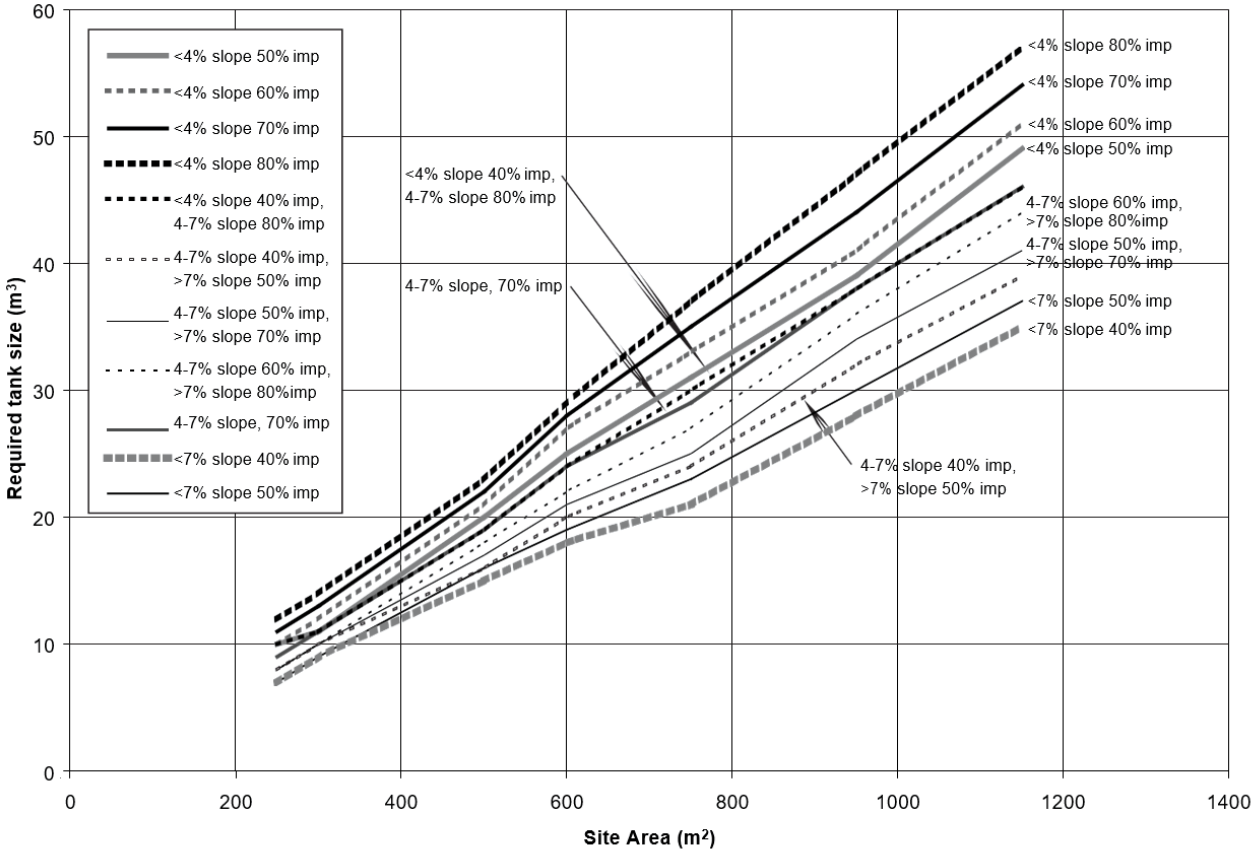
Density subzone 2—0% predeveloped impervious area



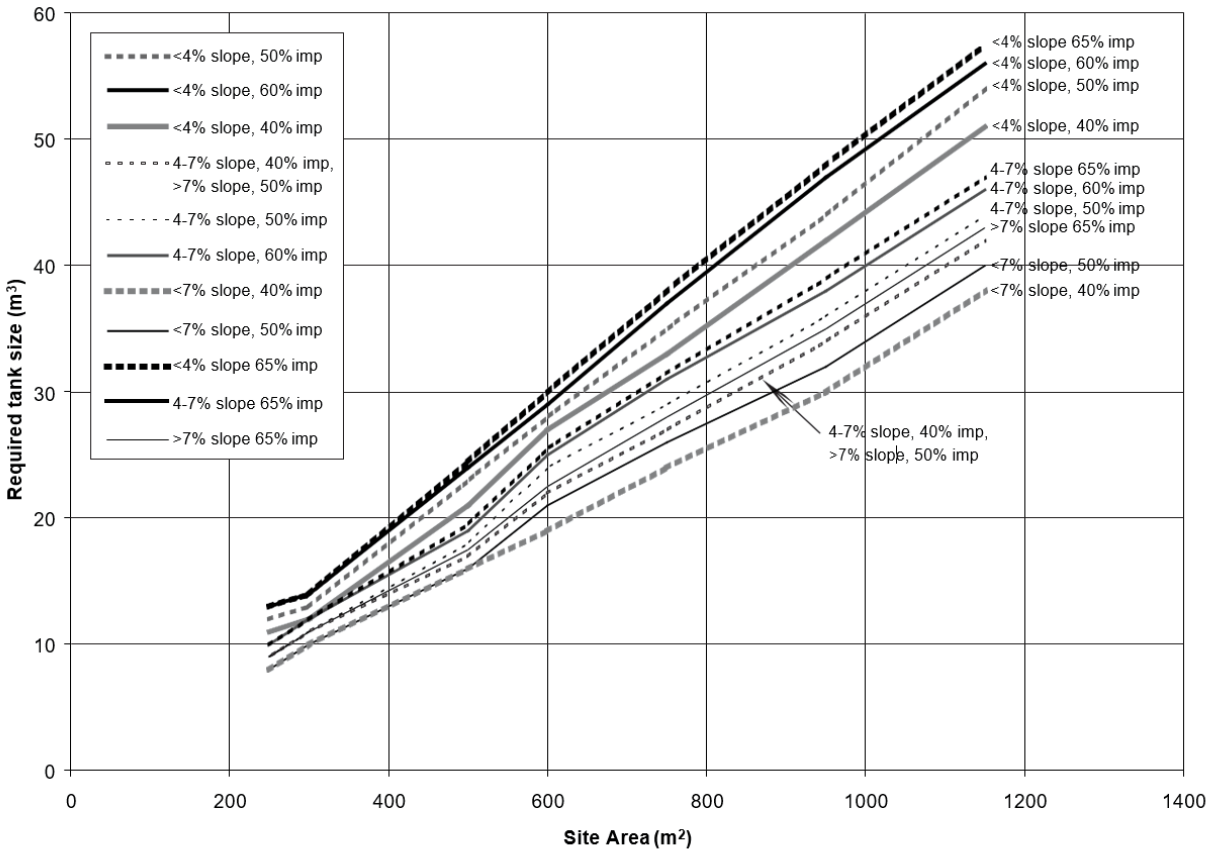
Density subzone 2—35% predeveloped impervious area



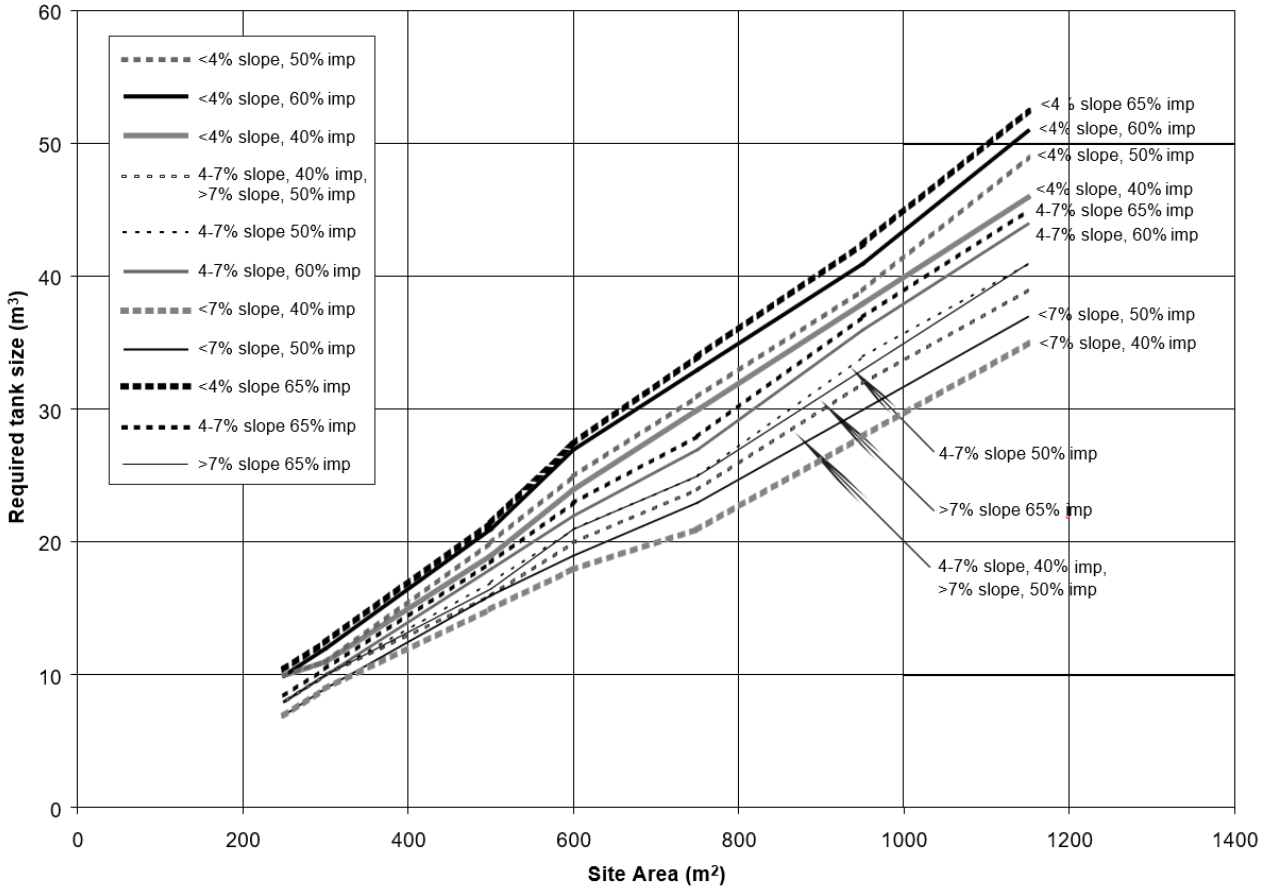
Density subzone 3-6—0% predeveloped impervious area



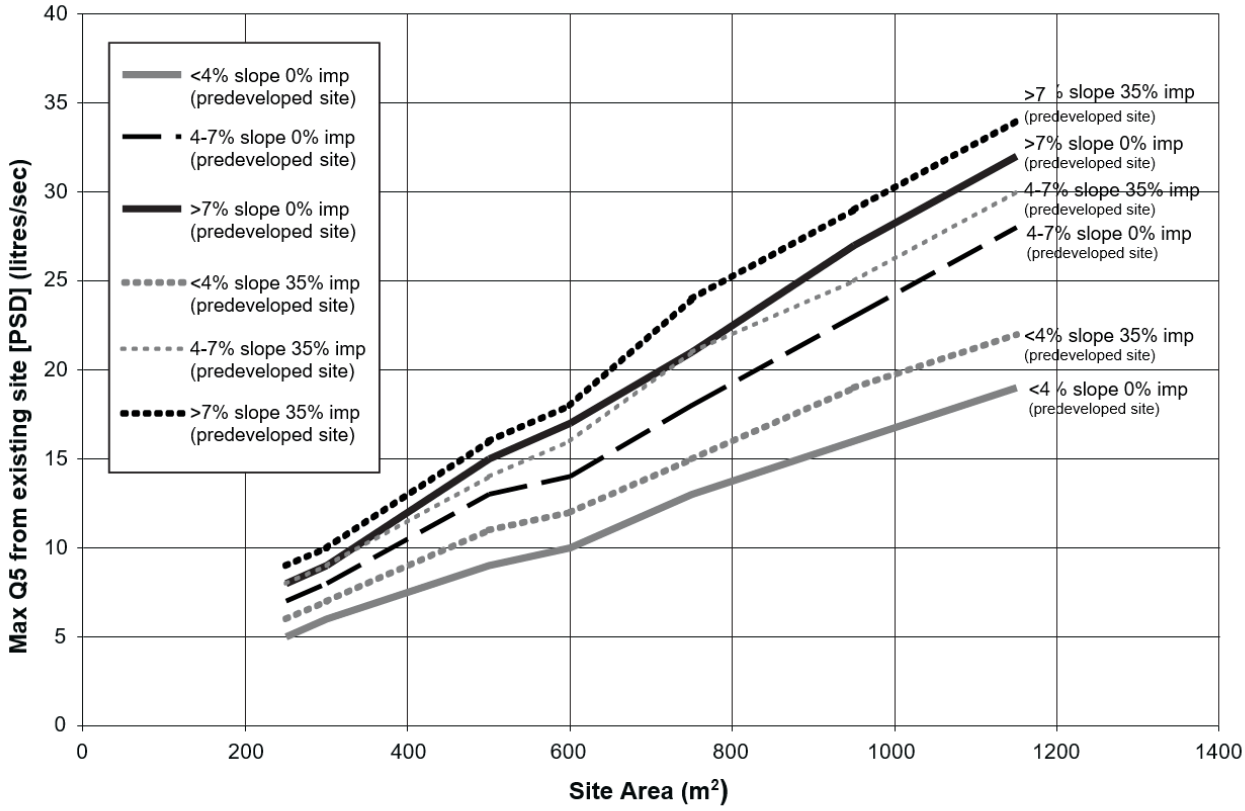
Density subzone 3-6—35% predeveloped impervious area



Density subzone 7—0% predeveloped impervious area



Density subzone 7—35% predeveloped impervious area



Permissible site discharge

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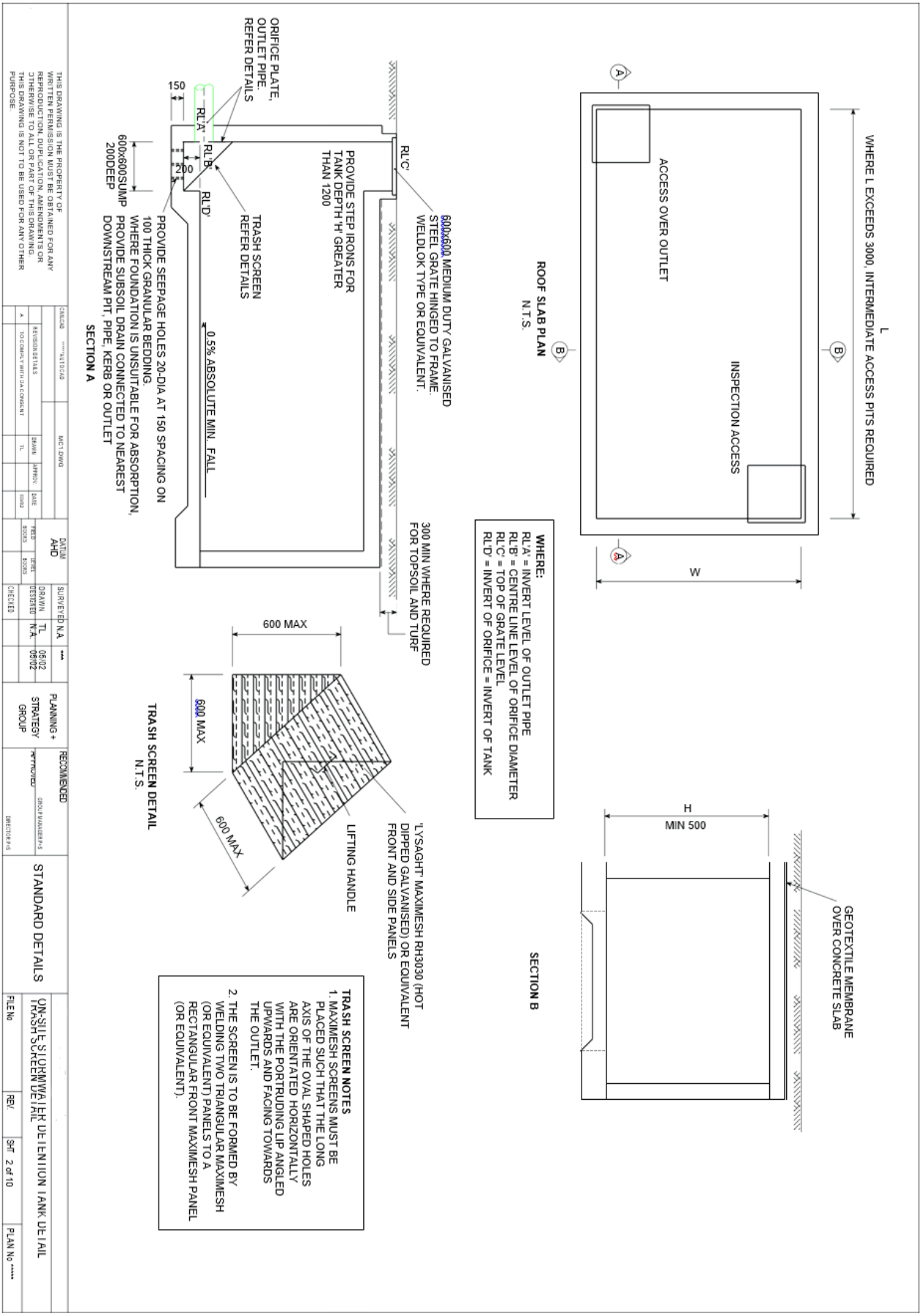
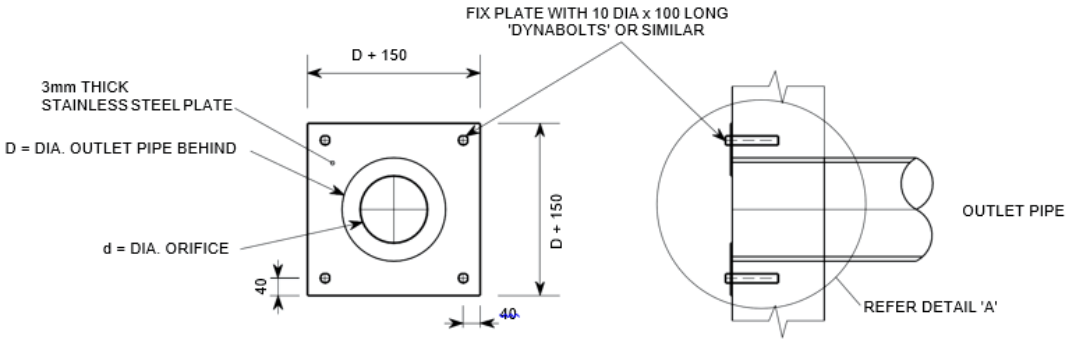
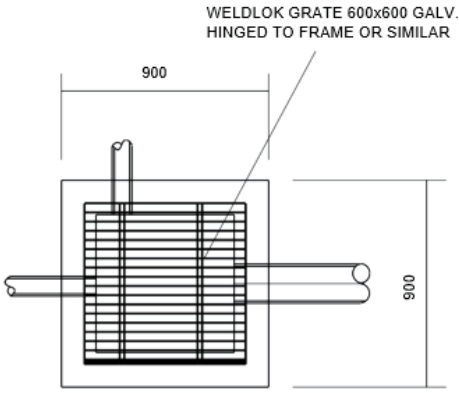
Appendix 15 – Sample Drawings

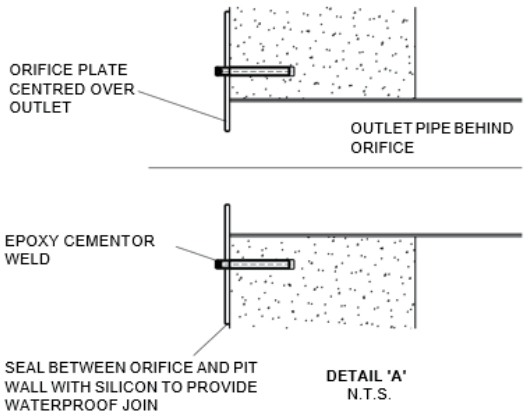




ORIFICE PLATE DETAIL
N.T.S



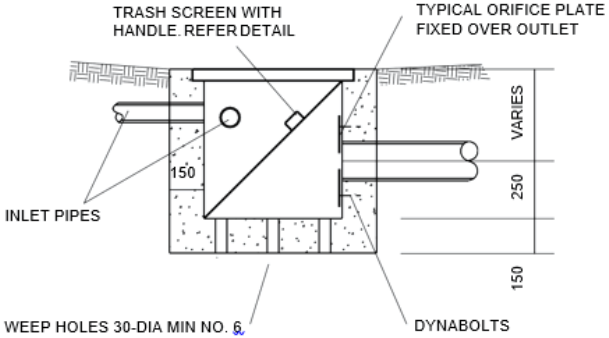
PLAN OF CONTROL PIT
N.T.S.



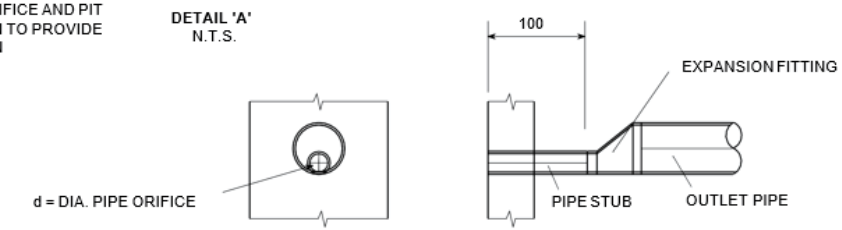
DETAIL 'A'
N.T.S.

ORIFICE PLATE NOTES

1. HOLE IN ORIFICE PLATE TO BE PRECISION CUT WITHSHARP EDGES TO THE SPECIFIED DIAMETER.
2. ORIFICE PLATE TO BE PLACED CENTRALLY OVER THE OUTLET PIPE.
3. PLATE TO BE MADE FROM STAINLESS STEEL. HOT DIPPED GALVANISED OR OTHERS NOT ACCEPTABLE.
4. OUTLET PIPE TO BE CAST INTO THE WALL OF THE PIT.
5. HOLE IN PLATE TO BE CENTRALLY PLACED.



SECTION THROUGH CONTROL PIT
N.T.S.



PIPE STUB ORIFICE DETAIL
N.T.S.

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CIVILCAD ******AUTO CAD	MC1.DWG
REVISION DETAILS	DRAWN / APPROV. / DATE
A TO COMPLY WITH DA CONSENT	TL / / 03/02

DATUM AHD — FIELD BOOKS — LEVEL BOOKS

SURVEYED	N.A.	***
DRAWN	TL	05/02
DESIGNED	N.A.	05/02
CHECKED		

PLANNING + STRATEGY GROUP

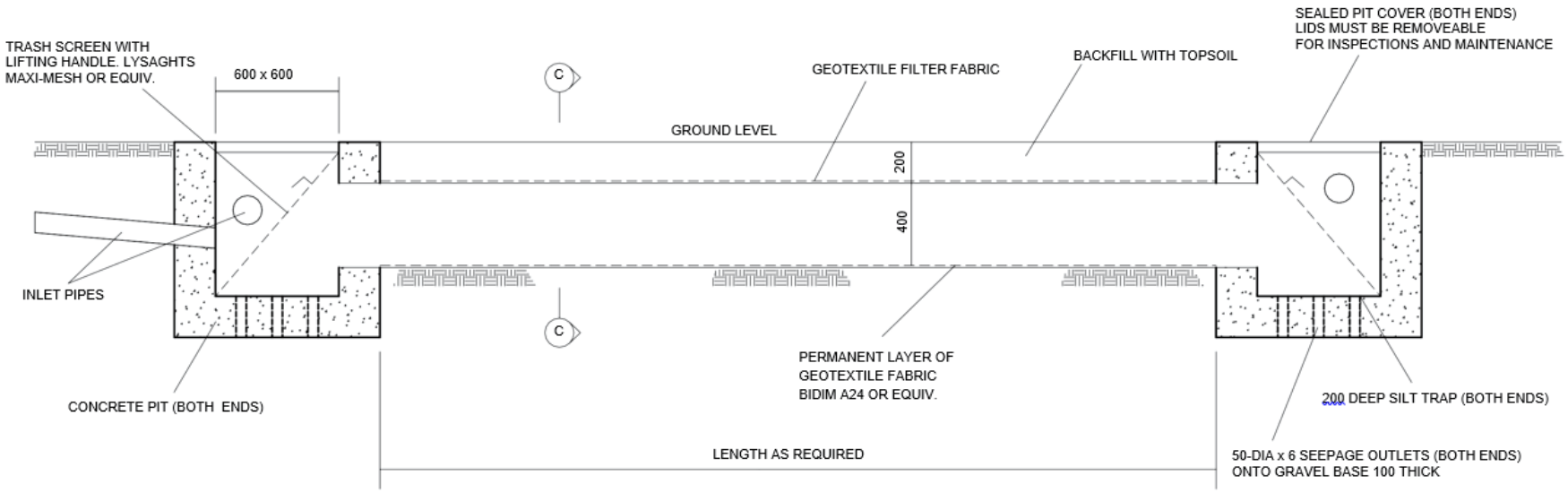
RECOMMENDED — GROUP MANAGER P+S

APPROVED — DIRECTOR P+S

STANDARD DETAILS

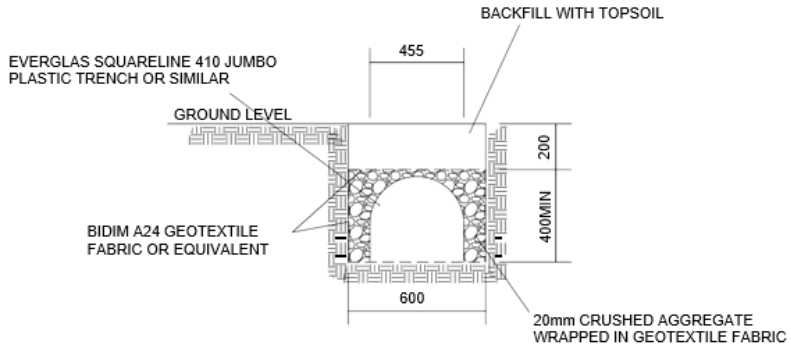
CONTROL PIT IN ABOVE GROUND OSD DETAIL
ORIFICE DETAIL

FILE No | REV. | SHT 3 of 10 | PLANNo *****



ABSORPTION TRENCH LONGITUDINAL DETAIL

N.T.S.



SECTION C

N.T.S.

ABSORPTION TRENCH NOTES

1. MINIMUM TRENCH LENGTH:
   1metre RUN OF TRENCH FOR EVERY 15sqm OF AREA DRAINING TO IT.
2. ABSORPTION SYSTEM MUST BE MINIMUM OF 5metres AWAY FROM DOWNSLOPE BOUNDARIES.
3. TRENCHES MUST RUN PARALLEL WITH CONTOUR LINE.
4. USE ONLY FOR SITES WITH 35% OR LESS IMP. AREAS

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DWG.CAD	******AUTOCAD	MC1.DWG

REVISION DETAILS	DRAWN	APPROV.	DATE
A TO COMPLY WITH DA CONSENT	TL		03/02

DATUM AHD

SURVEYED	N.A.	***	
DRAWN	TL	05/02	
DESIGNED	N.A.	05/02	
CHECKED			

FIELD BOOKS | LEVEL BOOKS

PLANNING + STRATEGY GROUP

RECOMMENDED
GROUP MANAGER P+S

APPROVED
DIRECTOR P+S

STANDARD DETAILS

UN-SITE ABSORPTION TRENCH DETAIL
FOR SITE AREAS WITH LESS THAN 35% IMPERVIOUS

FILE No	REV.	SHT 4 of 10	PLAN No *****

Appendix 16 – On-site Detention Checklist

This checklist is to be used to determine the on-site stormwater disposal requirement for developments and must be completed and included with the submission of any development application for these works. Please read this form carefully for its notes, guidelines, definition and relevant policies.

For assistance and support, please contact Council's Development Engineering and Certification team on 1300 434 434.

Part 1 Location of the Property			
House Humber		Legal Property Description	
Street		Lot	
Suburb		Section	
Postcode		DP	

Part 2 Site Details			
Northern Beaches Stormwater Regions (refer to Map 2 of Northern Beaches Council's Water Management for Development policy)		Total Site Area	
Pre-Development Impervious Area		Post-Development Impervious Area	
Is the site of the development located within an established Flood Prone Land as referred to Council's Local Environmental Plans? If yes, On-site stormwater Detention system (OSD) is not required and please proceed to part 5 of this checklist If no, please proceed to part 3 of this checklist.			Yes ☐ No ☐

Part 3: Northern Beaches Stormwater Regions (refer to Map 2 of Northern Beaches Council's Water Management for Development policy)
If the site of the development located within Region 1, please proceed to the part 4.1 of this checklist
If the site of the development located within Region 2, please proceed to the part 4.2 of this checklist
If the site of the development located within Region 3, please proceed to the part 4.3 of this checklist
If the site of the development located within Region 4, please refer to Council's Warriewood Valley Water Management Specification.

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Part 4 Determination of OSD Requirements

Part 4.1 Northern Beaches Stormwater Region 1	
Is the additional impervious area of the development more than 50 m^2 on a cumulative basis since February 1996?	Yes ☐ No ☐
If yes, OSD is required and please refer to section 9.3.1 of Council's Water Management for Development Policy If no, OSD is not required and please proceed to the part 5 of this checklist	

Part 4.2 Northern Beaches Stormwater Region 2	
Part 4.2.1 Description of Work	
Residential flat building, commercial, industrial, multiple occupancy development and subdivisions resulting in the creation of three lots or more, will require OSD in all case. Please provide a design in accordance with the section 9.3.2 of Council's Water Management for Development Policy. Any single residential building development, please proceed to part 4.2.2 of this checklist.	
Part 4.2.2 Exemption	
Is the site area less than 450m^2?	Yes ☐ No ☐
Does the site of the development drain directly to the ocean without the need to pass through a drainage control structure such as pipe, bridge, culvert, kerb and gutter or natural drainage system?	Yes ☐ No ☐
Is it an alternation and addition development to the existing dwellings?	Yes ☐ No ☐
If yes to any of the above questions, OSD is not required. If no to all the above questions, proceed to part 4.2.3	
Part 4.2.3 Determination of OSD Requirements	
Calculation	a) Site area m^2 x 0.40 (40%) = ... m^2 b) Post- development impervious area = ... m^2 **OSD will not be required when (a) is greater than (b)** Is OSD required for this development (tick one only) Yes ☐ No ☐ If yes, provide a design in accordance with the section 9.3.2 of Council's Water Management for Development Policy. If no, OSD is not required and please proceed to part 5 of this checklist.

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Part 4.3 Northern Beaches Stormwater Region 3	
Part 4.3.1 Stormwater Zone	
In the region, the method of stormwater control to be applied shall depend on the location of the site. Please refer to Map 3 of Northern Beaches Council's Water Management for Development policy.	
If the site of the development located within stormwater zone 1, please proceed to the part 4.3.2 of this checklist	
If the site of the development located within stormwater zone 2, please provide a design in accordance with the section 9.3.3.3 of Council's Water Management for Development Policy.	
If the site of the development located within stormwater zone 3, please provide a design in accordance with the section 9.3.3.4 of Council's Water Management for Development Policy.	
If the site of the development located within stormwater zone 4, please provide a design in accordance with the section 9.3.3.5 of Council's Water Management for Development Policy.	
Part 4.3.2 Determination of OSD requirements in Stormwater Zone 1	
Part 4.3.2.1 For A New Building	
1) Exemption	a) Is the site area less than 400? Yes ☐ No ☐ b) Is the post-development impervious area less than 190 m^2? Yes ☐ No ☐ If yes to both questions, OSD is not required. If no to any of the above questions, please process to calculation
2) Calculation	a) Site area _____m^2 x 0.35 = _____m^2 + 50 = _____m^2 b) Post- development impervious area _____m^2 OSD will not be required when (b) is less than 250 m^2 and (a) is greater than (b) Is OSD required for this development? Yes ☐ No ☐ If yes, provide a design in accordance with the section 9.3.3.2 of Council's Water Management for Development Policy. If no, OSD is not required and please proceed to part 5.
Part 4.3.2.2 For Alterations and Additions	
If the current impervious area of the site is more than 60% of the site area, OSD will be required. Alternatively, please proceed to the next calculation section.	
1) Calculation	Is the post development impervious area increased by less than 50 m^2? Yes ☐ No ☐ Is the post development impervious area less than 60% of the site area? Yes ☐ No ☐ If yes to both questions, OSD is not required. If no to any of the above questions, provide a design in accordance with section 9.3.3.2 of Council's Water Management for Development Policy

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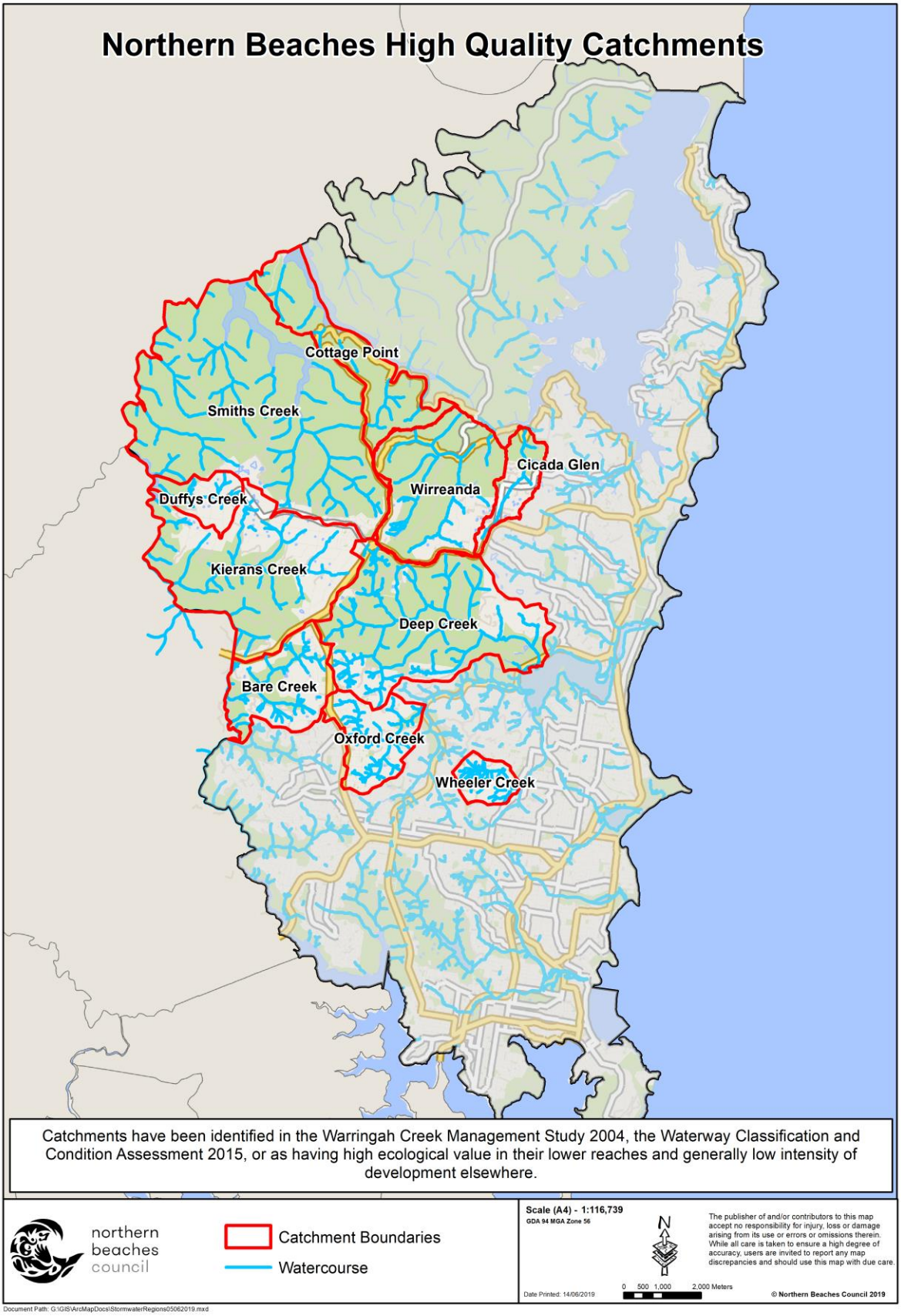
Part 5 Disposal of Stormwater
Does the site fall naturally towards the street? Yes ☐ No ☐ If yes, provide a design in accordance with section 5.1 of Council's Water Management for Development Policy. If no, provide a design in accordance with section 5.5 of Council's Water Management for Development Policy.

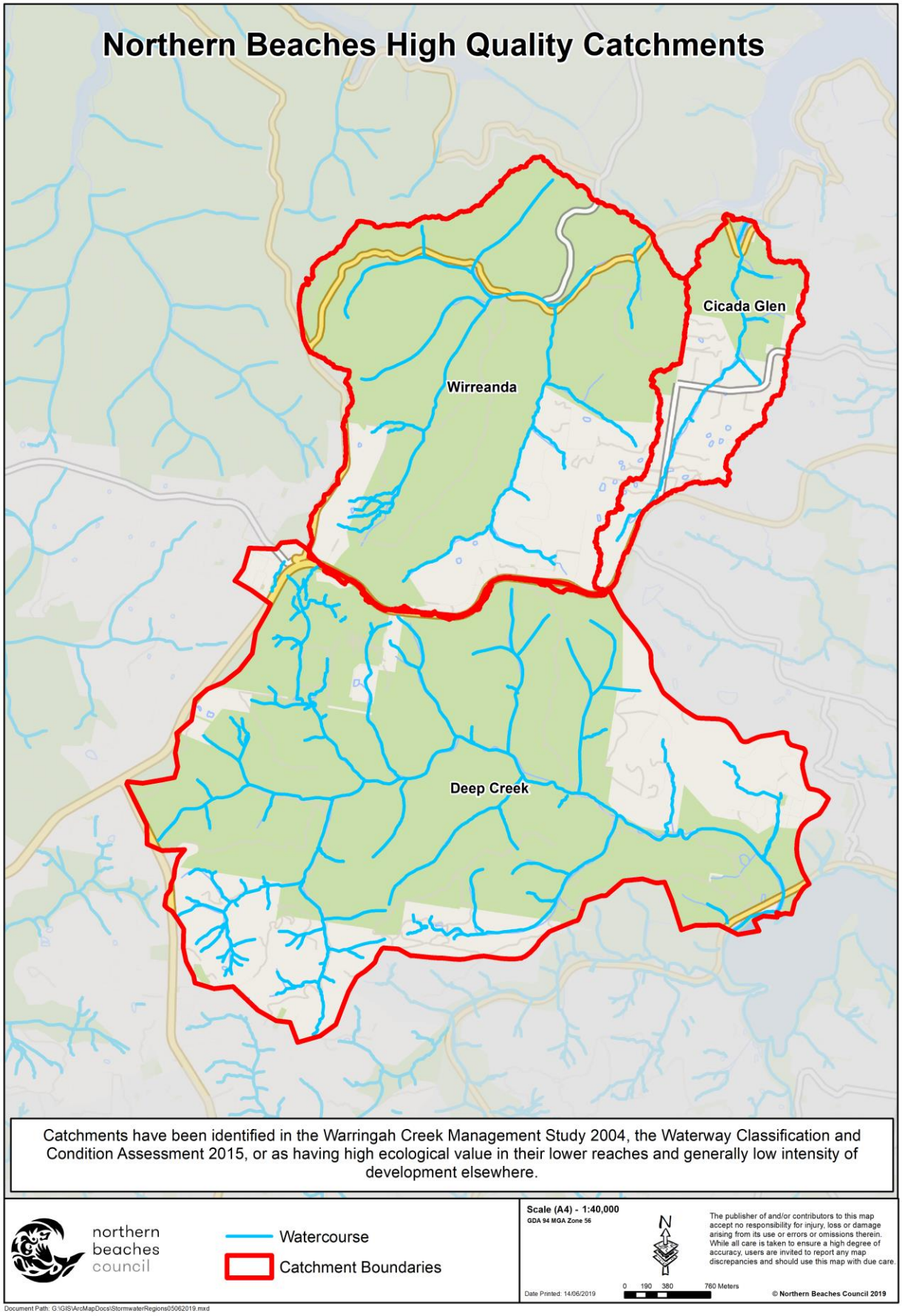
Definitions	
Designed to help you fill out this application	**Site area:** This refers to the area of the land bounded by its existing or proposed boundaries. **Impervious area:** This refers to driveways, parking spaces, pathways, paved areas, hardstand areas, roofed areas, garages and outbuildings. **Pre Development Impervious area**: This refers all impervious areas of the site before the development. **Post Development Impervious areas**: This refers all the impervious areas within the site after the development is completed.

DRAFT

Maps

Map (Set) 1 – Northern Beaches High Quality Catchments




Northern Beaches High Quality Catchments
Cicada Glen
Wirreanda
Deep Creek
Catchments have been identified in the Warringah Creek Management Study 2004, the Waterway Classification and Condition Assessment 2015, or as having high ecological value in their lower reaches and generally low intensity of development elsewhere.
northern beaches council
Watercourse
Catchment Boundaries
Scale (A4) - 1:40,000
GDA 94 MGA Zone 56
N
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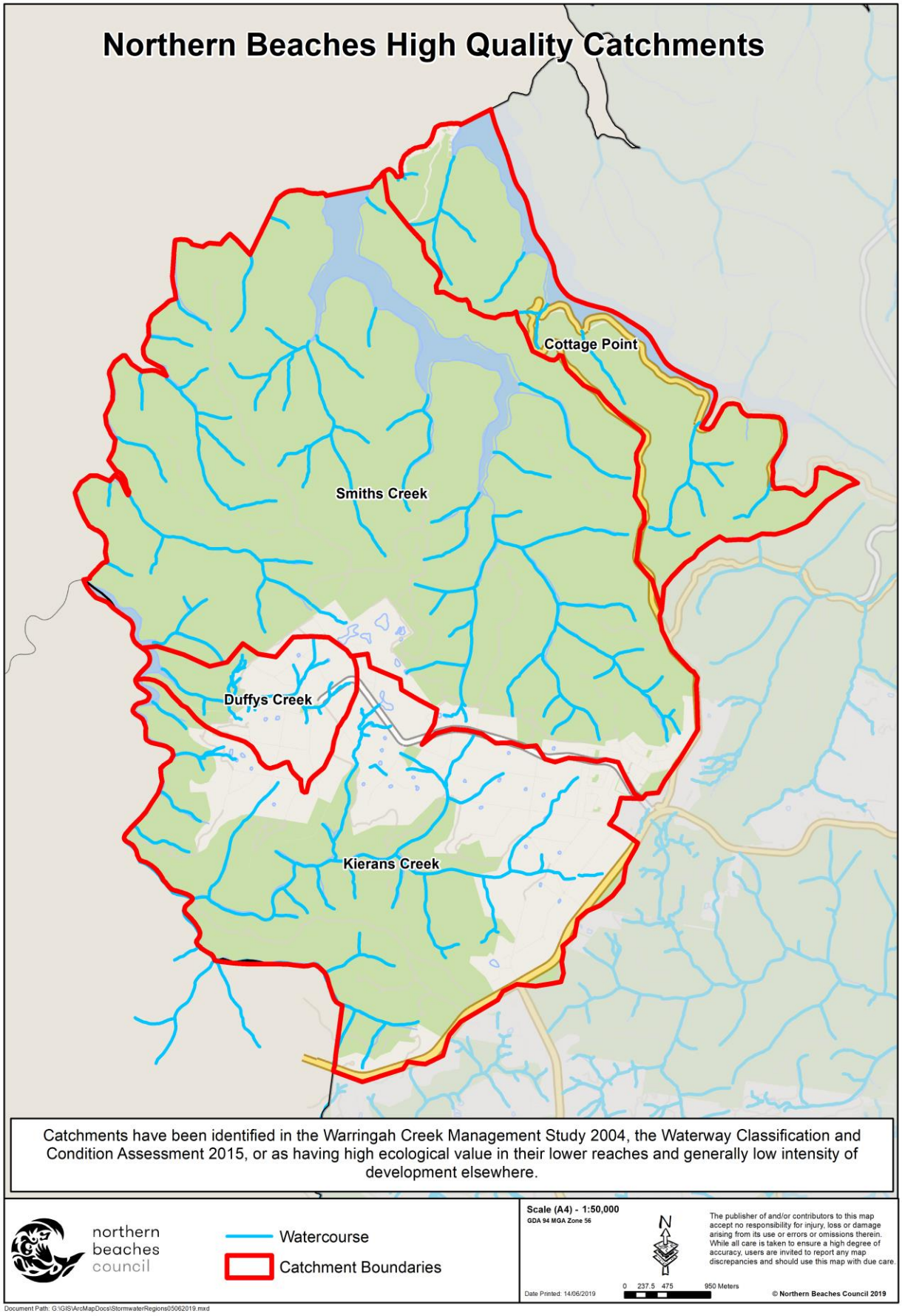
Northern Beaches High Quality Catchments
Cottage Point
Smiths Creek
Duffys Creek
Kierans Creek
Catchments have been identified in the Warringah Creek Management Study 2004, the Waterway Classification and Condition Assessment 2015, or as having high ecological value in their lower reaches and generally low intensity of development elsewhere.
northern beaches council
Watercourse
Catchment Boundaries
Scale (A4) - 1:50,000
GDA 94 MGA Zone 56
N
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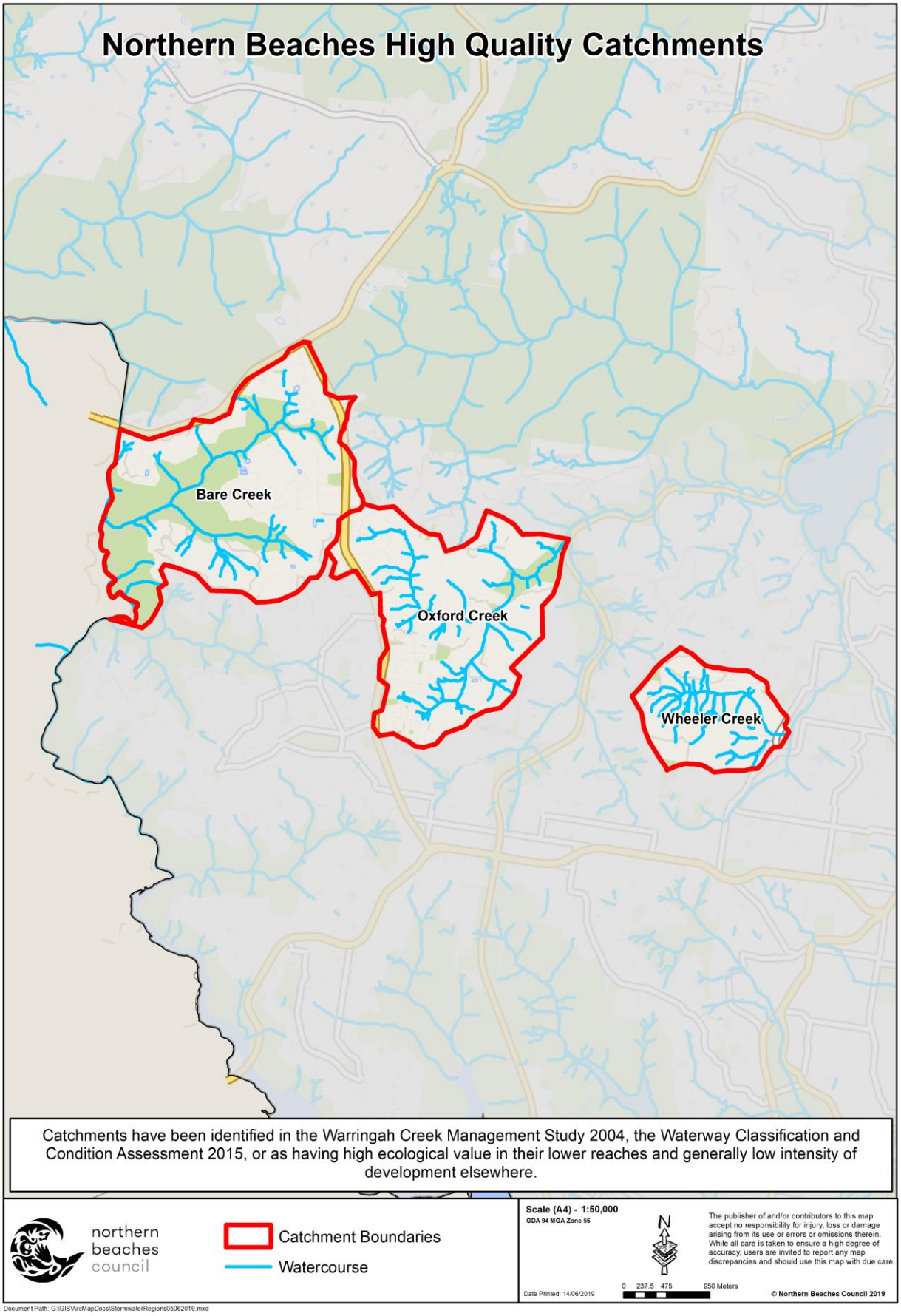
Northern Beaches High Quality Catchments
Bare Creek
Oxford Creek
Wheeler Creek
Catchments have been identified in the Warringah Creek Management Study 2004, the Waterway Classification and Condition Assessment 2015, or as having high ecological value in their lower reaches and generally low intensity of development elsewhere.
northern beaches council
Catchment Boundaries
Watercourse
Scale (A4) - 1:50,000
GDA 94 MGA Zone 56
N
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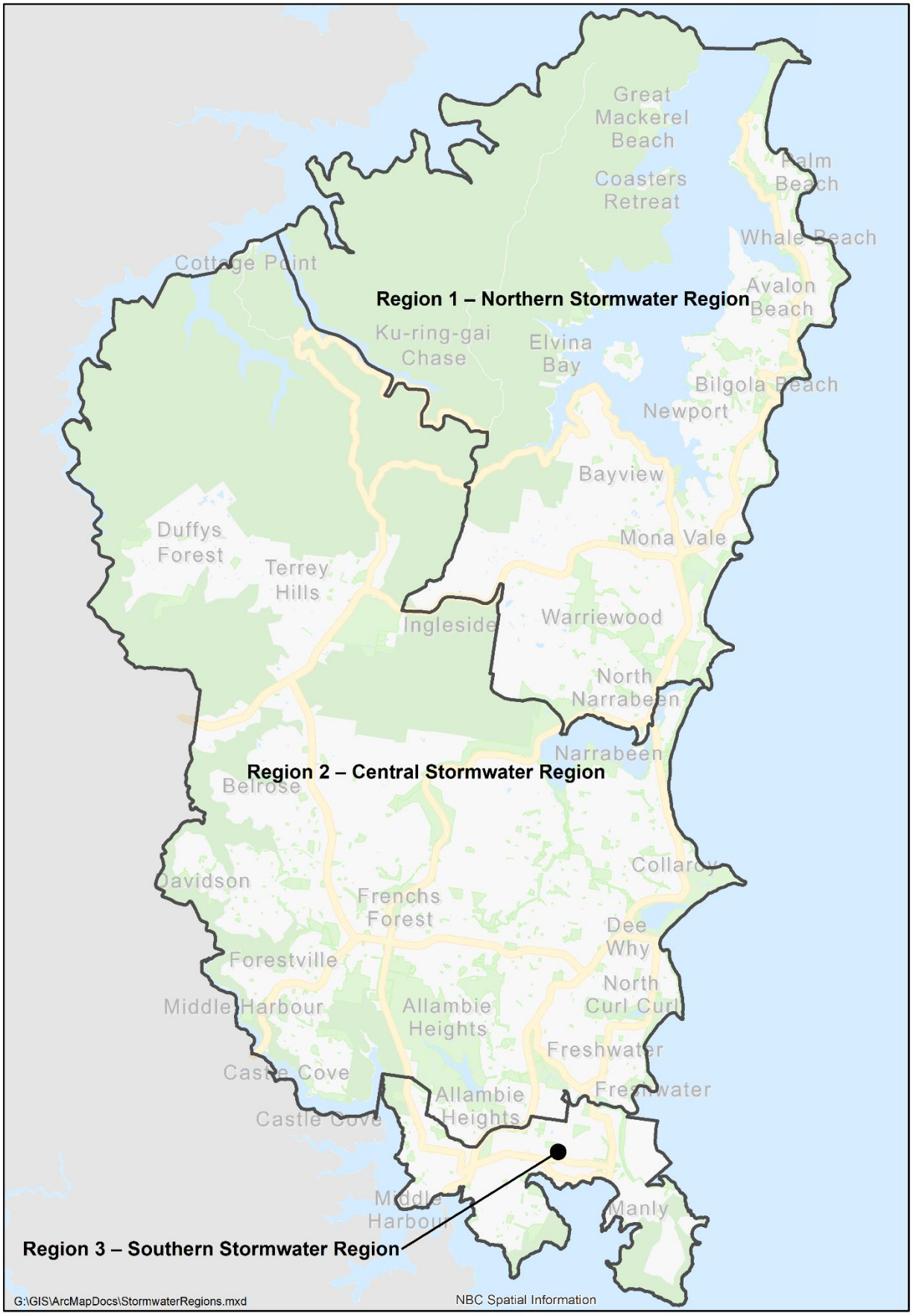
Map 2 – Northern Beaches Stormwater Regions



Map 3 – Region 3 Zone