4. ZONE 1: ON-SITE STORMWATER DETENTION CONTROL

4.1 General

Sites within Zone 1 shall require the installation of On-site Stormwater Detention (OSD) facilities to control the rate of runoff from the site, as a result of 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:

- the development is a one-off extension or an addition, involving an increase in impervious area, which is less than 50m^2 and the total existing impervious areas of the site does not exceed 35%
- 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 — in this case, an OSD system shall be required for any development on these allotments

'Greenfields' subdivisions shall include those allotments in Boronia Lane North, Boronia Lane South, Boronia Lane West and Castle Circuit, Seaforth recently released by The Department of Planning, Infrastructure and Natural Resources (DPINR)

- 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
- 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).

* **Note**: Council may require as an alternative method of stormwater disposal, such as source control (e.g. on-site absorption) or source control used in combination.

4.2 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 100-year ARI post-development shall be limited to the Permissible Site Discharge (PSD).

4.3 Critical storm events

The critical storm events, which must be considered, shall be the 5-year and 100-year Average Recurrence Intervals (ARI).

4.4 Permissible site discharge

Runoff from the site shall be limited to the Permissible Site Discharge (PSD).

The PSD shall be calculated as the peak 5-year ARI storm event for the pre-development site based on the following impervious percentages:

- 0%—applies to all 'greenfields' developments

  Greenfields developments shall include the newly created allotments in Boronia Lane North, Boronia Lane South, Boronia Lane West and Castle Circuit, Seaforth,

recently released by The Department of Planning, Infrastructure and Natural Resources (DPINR)

- 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 7
- 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 Manly Council area are given in appendix 5.

4.5 Site storage requirement

The minimum Site Storage Requirement (SSR) or the basic volume shall be the volume needed to reduce the runoff from the peak 100-year ARI 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 7
- ILSAX program—hydrograph model
- DRAINS program—hydrograph model.

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

4.6 What must drain to the detention system

Wherever possible, the total site runoff 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 routed 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.

4.7 Design parameters

The following design parameters are to be used, where applicable, in the model analysis:

- soil type = 2.5
- antecedent moisture content, AMC = 3
- infiltration rates: initial paved = 1mm grassed = 5mm
- storms, generated in accordance with the Australian Rainfall and Runoff, Volume 1, 1987 or later editions
- time of concentration, calculated using the kinematic wave equation given in the Australian

Rainfall and Runoff, Volume 1, 1987, page 300, or program generated.

For the purpose of determining the time of concentration:

- the length of flow, L, is the distance from the furthest point of the site to the exit point
- The surface roughness, n* is as given in the Australian Rainfall and Runoff, Volume 1, 1987, page 300
- the slope is the average gradient of the flowpath

- type '0' inlets are not to be used
- supplementary areas are not to be used
- orifice size and discharge from the OSD system are given in appendix 6 or can be estimated using the following equation:

$Q = C.A.\sqrt{(2.g.h}$

Where:

A = area of orifice outlet in m^2

h = depth of water above centreline of orifice outlet in metres

C = discharge coefficient = 0.6**

g = acceleration due to gravity = $9.81 m/s^2$

Q = discharge rate in m^3/s or $10^3 l/s$

* **Note 1**: The soil type in the Manly local government area is diverse. Where the designer considers that the site's soil landscape is significantly different to the values as given above, they may be varied upon submission of appropriate supporting information. For more detailed soil landscape information, reference is made to Manly Council's ***State of the Environment Report 1999 –2000, Section 1.3.1.3 Soil Landscapes***.

** **Note 2**: This value is for a flat plate with a circular shaped square edge orifice hole. 'C' varies between 0.5 to 1.0 depending on the type of outlet control to be used. A pipe stub of approximately 100mm long, may be permitted for diameters greater than 90mm. Smaller diameter pipe stubs are not acceptable due to the possibility of frequent choking and blockages. Please note that the accuracy of the controlled outflow may not be achieved when a pipe stub is to be used instead of an orifice plate.

4.8 Hydraulic grade line

When the OSD system is to be connected directly into the receiving drainage system, the discharge rate may be affected by the downstream water level.

Friction and head losses in pipes and pits may affect the discharge control, especially when the invert level of the OSD outlet is considerably lower than the ground level at the connection point. In this circumstance hydraulic grade line calculations must be performed to check that the tailwater level will not affect the rate of discharge from the OSD system.

Outlet control or a 'drowned orifice' is generally unacceptable due to inaccuracies (too many variables introduced) into the model, which may inadvertently cause discharge into the receiving drainage system which is greater than the PSD.

The peak flowrate in the receiving drainage system can be calculated using the ILSAX or DRAINS program. Hydraulic calculations can be performed manually, or for more complex models such as for determining water surface profiles in creeks or rivers, the HEC-RAS program can be used.

Manual calculations are to be carried out in accordance with current design practices and principals as outlined in the ***Australian Rainfall and Runoff, volume 1,1987*** or later editions and this specification and submitted by a suitably qualified person with experience in hydrology and hydraulics.

4.9 Outlet control devices

Various outlet control devices may be used to control the rate of discharge from the OSD system. These are specified below.

4.9.1 Square-edged orifice plate

A flat stainless steel plate, 3mm in thickness and approximately 200mm x 200mm minimum dimension (dependent on the outlet size) is fixed onto an oversized pipe outlet. The circular shaped orifice of specified diameter is pre-drilled centrally into the plate. This hole is tooled to the exact calculated dimension to obtain the required outflow rate. The plate is to be permanently fixed into the wall of the control pit with four (4) 'dyna' bolts to prevent its unauthorised removal.

The advantage of using an orifice plate is it provides the designer greater flexibility and accuracy in controlling the rate of outflow.

The orifice equation to be used is:

$Q = C.A.\sqrt{(2.g.h)}$

For a square-edged orifice,

$C = 0.6$

The above equation can be re-arranged to obtain the required diameter for the maximum discharge.

For a circular shaped orifice, the diameter:

$D = \sqrt{(4.A/\pi)}$

Where

$A =$ area of orifice hole in m^2

$\pi = 3.1416$

4.9.2 Pit and pipe losses

The outlet control is determined by calculating the friction and entry losses in the outlet pipe and pit leading from the OSD facility to the point of connection, to control the discharge rate. This method would require hydraulic grade line calculations for various storm events and duration.

Manual calculations are to be carried out in accordance with current design practices and principals as outlined in the ***Australian Rainfall and Runoff, volume 1, 1987*** or later editions.

4.9.3 Pipe stub

This type of control is not recommended because the diameter of the nominal pipe stub is not as accurate as an orifice plate, which can be machined to the exacting dimension. A short stub of nominal length approximately 100mm long can be used to control the rate of discharge from the OSD facility. The orifice equation can be used to determine the outflow rate.

For a pipe stub orifice, C = 0.8

The advantage of a pipe stub is that it is a permanent fixture that is not easily tampered with. However it is not acceptable for diameters less than 90mm, as they tend to create a choke which is difficult to clean.

4.10 Trash screens

A rustproof screen or cage is to be used to protect the outlet from potential blockages.

This screen or cage must be removable for maintenance and inspections.

The screen or cage should completely protect the outlet and be made of Lysaghts maxi-mesh RH3030 or similar material. The minimum surface area of the screen is to be 50 times the area of the orifice outlet.

The screen or cage is to be located at a distance 1.5 times the orifice diameter or 200mm away, whichever is the greater.

Where possible, the main incoming line is to flow across the face of the mesh.

The screen or cage should also include a lifting handle for ease of removal for inspection and maintenance.

4.11 Detention storage facilities

Detention storage facilities can be provided in three main areas. These being:

- underground storage—in tanks or oversized pipes, or
- above ground storage—as a shallow pond or on driveways and carparks, or
- a combination of the two (2) above.

Above ground storage is preferable where it can be provided with minimal adjustment to existing levels and where they do not create hazards to pedestrians and vehicular traffic. For this reason, ponding depths must be kept to a minimum. Allowable ponding depths are given below.

Storage facilities shall be designed and located to safely convey all stormwater flows to the Council road gutter or drainage system. Otherwise, the storage facility is to be moved to a more suitable location.

However, where likely overflow from these facilities is across private property and a suitable overflow path cannot be provided, the overflow shall be contained within an underground piped drainage system with a design capacity equivalent to the peak 100-year ARI storm event.

This underground system (both pits and pipes) shall be designed to receive and fully contain controlled flows and overflows from the detention facility.

A surcharge path shall also be defined even where the 100-year ARI flows can be maintained within the system in case of blockages. Easements are to be provided in private property over pipe systems and surcharge paths.

OSD systems must be located external to all building footprints. This includes basements, ground floor parking areas, garages, or patios unless all access points and emergency overflow provisions are external to the structure.

4.11.1 Underground storage systems

- are not to be used where suitable above ground storage facility is available
- are to be designed to be structurally sound to adequately withstand all service loads
- must be adequately soundproofed to minimise noise when stormwater is collected or discharged
- must be graded to drain completely—permanent water pondage encourages insect infestation and is not acceptable
- are to be located where they can be readily accessible for inspections and routine cleaning—for SEPP5 developments, the OSD facility shall be located in common areas and not in private courtyards—for strata subdivisions, the location is subject to Council assessment but the intent is to ensure that the facility is located where it is easily accessible for routine inspections and maintenance requirements
- must be constructed from reinforced concrete, pre-fabricated material or proprietary systems approved by Council
- must have at least one (1) inspection access grate over the outlet — this inspection access must be a minimum 600mm x 600mm in dimension
- must be in accordance with AS2865 – Safe Working in a Confined Space — to eliminate gas build-up and for ease of maintenance at least one (1) additional access at the extreme corner of the tank must be provided
- must have additional access points at distances of no less than 3000mm
- clearance height in the tank must not be less than 500mm
- must have step irons where the tank depth exceeds 1200mm
- must be located outside the root zones of trees that are to be retained
- must be located in areas, which will not impede the flow of water or undermine existing structures or services.

4.11.2 Above ground storage systems in areas other than driveways and carparks

- must not be located across the boundary of an allotment
- must not be located such as to restrict pedestrian access from the public road to the building
- must be adequately soundproofed to minimise noise when stormwater is collected or discharged
- are to be located where they can be readily accessible for inspections and routine cleaning—for SEPP5 developments, the OSD facility shall be located in common areas and not in private courtyards—for strata subdivisions, the location is subject to Council assessment but the intent is to ensure that the facility is located in an area, which is easily accessible for

routine inspections and maintenance requirements

- if a built structure is to be used to retain water, it shall be of masonry type construction
- control structures must be located where they can be easily accessed for inspections and routine cleaning.
- must be graded to drain completely—gradients shall not be less than 1.0%
- to avoid ground saturation in landscaped areas, subsoil drains shall be installed
- shall be designed in a manner, which minimises inconvenience, unsightliness and hazard
- must not allow water to pond more than 300mm in tennis courts or other surfaced areas
- must not allow water to pond more than 300mm in landscaped areas unless access by persons can be restricted
- must not have batter slopes greater than 1 in 4
- where the depth of ponding exceed 300mm in landscaped areas, it must be fully fenced off with approved pool fencing and childproof, self-closing gates with batter slopes into the basin, around its perimeter, not to exceed 1 in 6
- the maximum depth of ponding in landscaped areas must not exceed 1200mm.

4.11.3 Above ground storage systems on paved driveways and carparks

- must not be located such as to restrict pedestrian access from the public road to the building
- control structures must be located where they can be easily accessed for inspections and routine cleaning
- must be graded to drain completely—gradients shall not be less than 0.5%
- designed in a manner, which minimises inconvenience, unsightliness and hazard
- must be totally impermeable
- must not allow water to pond more than 200mm in depth.

4.12 Surface runoff

Stormwater runoff from the site or from upstream properties passing through the site is not permitted to be concentrated, increased, re-directed or otherwise onto any property. This may require diverting existing surface flows safely to the street or into the OSD facility.

Where this runoff is to be controlled through the OSD facility, the OSD system must be designed to cater for the additional inflow.

Provision must also be made for emergency overflows out of the OSD facility. Overflow weirs or spillways must be provided for unexpected blockages or flows in excess of the design storm. Likely overflow from these facilities must be fully contained within designated flow paths. These flow paths shall be designed for the peak 100-year ARI storm event.

The use of open channels, kerbs, pits and pipes may be used to contain runoff within the flow path. The width of overflow weirs shall not exceed more than 2000mm across any property frontage.

4.13 Finished levels

It is most important to ensure that adequate freeboard or clearance between the maximum depth of ponding in the OSD system and the levels of all habitable floor areas, garages, storage facilities, etc., are provided so that damage to goods and materials, nuisance flooding, or hazard is avoided.

Developments will not be permitted within known floodways unless it can be proven that the development will not be affected by floodwater nor will the development cause flooding both upstream or downstream of the development. Council's Policy is the removal of such flood affected developments from known floodways and the prohibition of future developments in such floodways, where necessary.

For OSD facilities and overflow paths, the following freeboard requirements will be required:

- 150mm—warehouse, factory and carport floor areas
- 300mm—office, living rooms, retail space, store rooms, and show rooms.

Flood waters (100-year flood level):

- 300mm—to enclosed garages and carparks
- 500mm—to all internal building floor levels which includes residential, commercial and retail.

4.14 Disposal of site runoff

4.14.1 Discharge points

The maximum concentrated stormwater discharge to a formed kerb and gutter shall be limited to 25l/s at any single point. A maximum of two (2) outlet points from the site shall be permitted, provided the outlets are spaced no less than 15m apart.

Outlets to the kerb must be sized adequately with at least 50mm cover. Where cover is inadequate, the following pipe equivalencies shall be used:

- 100mm-dia equivalent to one (1) 100mm x 100mm x 6mm thick RHS
- 150mm-dia equivalent to one (1) 200mm x 100mm x 6mm thick RHS
- 225mm-dia equivalent to two (2) 200mm x 100mm x 6mm thick RHS
- outlets through existing sandstone kerbing—drilling through sandstone kerbing may be permitted but should seek advice from Council's Heritage Officer.

The pipe class must also be adequate to withstand traffic loads.

All RHS are to be hot-dipped galvanised or stainless steel material.

Discharging into a watercourse or channel may be permitted subject to joint approval from Council and other relevant authority. Where approval is granted, adequate protection against scouring and erosion at the point of discharge shall be provided. Council should be consulted in regards to appropriate stabilisation treatment to be used.

The maximum discharge velocity into an unlined (other than concrete) channel shall be in accordance with the Department of Sustainable Natural Resources document 'Managing Urban Stormwater, Soils and Construction', table 5.1 maximum discharge flow velocities in waterways.

Discharge from the site is to be taken to the nearest Council drainage system, where the quantity exceeds 25l/s or into an approved piped drainage system or stormwater channel if this cannot be achieved.

Where an existing Council drainage line is available, connection into the system may be permitted subject to Council approval. The connection may require the construction of new inlet pits and the laying of a new pipeline, to Council standards.

Council encourages minimising the number of pits, junctions and pipe lengths in the road reserve. However pits are preferable over bend joins to eliminate blind junctions such that ease of maintenance can be achieved. Reference should be made to Council's ***Specification for Stormwater Drainage*** for details of pipe and pit design.

4.14.2 Gravity drainage

Stormwater drainage should follow the natural fall of the land and be discharged by a gravity system. Diverting stormwater runoff from one catchment (or sub-catchment) to another catchment (or sub-catchment) is generally not permitted. Council will only approve drainage against the natural grade of the land in the following circumstances:

- downstream property owners have indicated that they are not prepared to grant easements to permit the drainage of the property to follow the natural fall of the land, and
- Council has assessed that the proposed receiving drainage system can adequately cope with the additional runoff.