ADELAIDE HILLS COUNCIL

ENGINEERING SERVICES

STORM WATER DRAINAGE DESIGN GUIDELINES

For

SUBMISSION OF ENGINEERING PLANS FOR NEW DEVELOPMENTS

April 2015

The guidelines contained in this document shall be considered mandatory for Submission of all drainage works within Adelaide Hills Council

TABLE OF CONTENTS

1 OBJECTIVES

The objectives of these drainage guidelines are to provide stormwater drainage systems designed to operate to maximise benefits to the community of the Adelaide Hills City area based upon adequacy of design, economy of construction and a high level of safety and amenity, including provision to:-

- Ensure hazardous situations do not arise on streets and footpaths.
- Ensure that all buildings in urban areas are protected against floodwaters to a similar standard to that applying in zones adjacent to rivers.
- Limit rubbish and pollutants entering the stormwater drainage system.
- Prevent erosion and sedimentation in estate development.
- Integrate drainage works into planning of estate development.

2 DRAINAGE DESIGN STANDARDS

2.1 Hydrological Computations

All hydrologic computations shall be in accordance with the parameters of Australian Rainfall and Runoff (ARR) 1997. Where local confirmable information, such as flood levels for known storm events and observed flow paths of major flood events are known these should be used in conjunction with ARR parameters.

The Rational Method hydrologic model shall be used for urban area developments within the Adelaide Hills City area.

2.2 Flood Predictions

Urban drainage system design within the Adelaide Hills City area shall satisfy the requirements of both the **Major** and **Minor** Flood predictions as defined in Australian Rainfall and Runoff (ARR1997).

The flood prediction model shall take into account the layout of the proposed drainage system including the measurement and influence of any outside catchments: upstream and downstream of the development that contribute\effect to the design flows, definition and measurement of sub-catchments, pipe networks and major flow routes.(Drainage Master Plan)

Major and minor storm event drainage design shall apply to residential and commercial urban subdivision development as well as infill, redevelopment sites and additions or extensions to existing developments.

The designer shall be required to:

- keep developments clear of overland flow paths,

- set floor levels above predicted major flood levels (reference Plumbing& drainage code AS/NZ 3500-2003 – section 3)
- Upgrade existing drains, where necessary,
- Provide drainage easements or reserves for major flow paths and minor drainage system or other methods as may be approved by the Engineering Services to ensure an acceptable passage of major flood events.

2.3 Minor drainage Standard

Materials used in drainage networks must be durable, maintainable and cost effective to the community.

2.3.1 Minor drainage designs

- Shall have the capacity to control storm water flows under normal operating conditions for an Average Recurrence interval of 1 in 5 years, except where overland flows exceed 0.4 square metres per second in this case piping to a 1 in 5 years ARI (1 in 10 years for commercial/Industrial zones)

- Shall be based on Australian Rainfall and Run–off (ARR) – A Guide to Flood estimation, Australian institute of Engineers, 1997 and cited references.

- Shall be based on a coefficient of run- off for impervious areas of 0.9 and for pervious areas, a coefficient derived form ARR- 1997 or locally based research.

The minor drainage system shall prevent ponding for a prolonged period (any period longer than 1 hour after cessation of rainfall) from a stormwater flow of an ARI of per 1 in 5 years.

Swale drains on access places or access streets shall be designed so that:

- Ponding for greater than 1 hour after cessation of rainfall is unlikely,
- Operating flow velocities are less than 1.5 metres per second, and
  The turf used is resistant (at operating flow velocities) to scour and erosion and tolerant of

The Minor system shall include the design of the gutter, pits and pipe network capable of carrying runoff from minor storms, without surface flooding of gutters or streets.

The minor drainage system must enable safe passage of vehicles at reduced speeds on streets that have been affected by run-off from a 1 in 5 –year ARI storm.

The drainage network shall be accessible and designed for easy maintenance.

Drainage networks shall minimise the potential for accumulation of silts and debris, and provide gross pollution traps for collection and removal of debris & silts at appropriate locations.

2.3.2 Detention Requirements

New Subdivisional Developments

In the event that the contribution of a Minor system flow from a development exceeds the point of discharge capacity available at the down stream trunk drain the designer shall provide on-site detention storage to ensure that the downstream flows are restricted to pre-development levels unless otherwise agreed to by the responsible drainage authority.

New Dwellings and Extensions to Existing Dwellings.

Drainage system shall be incorporated with an onsite detention system to ensure that the pre-development flows from the site are maintained for the given design standards.

Or otherwise

Designer to demonstrate that the capacity of the down stream drainage system is with an adequate capacity to accept the additional flows from the development.

2.3.3 Legal Point of Discharge - Dwellings and Extensions.

Drainage from dwellings should be directed to a legal discharge point nominated by the council: underground stormwater drainage system in the road reserve, to an easement drainage or to the street gutter.

In areas where no practicable drainage system exists as above or where soil permeability is adequate for on-site filtration, sub soil absorption (on site disposal) may be provided.

2.4 Major Drainage Flows

The Major system shall comprise both planned and unplanned drainage routes, in piped networks and overland, that will convey runoff from Major storms to trunk drains.

The designer shall avoid trapped low points in road sags or downhill court bowls that could cause flooding of private property. Specific escape routes along roadways and formed drains shall be provided to obviate such trapped low points

The designer shall plan for roads, public open spaces or drainage reserves along overland flow paths. The pattern of drainage system drainage flows shall be indicated on plans submitted with drainage design computations. The plans shall indicate specific routes designed to capture significant overflow quantities.

The designer shall ensure that proposed development within the drainage

reserves, such as fences or facilities, shall not obstruct the path of flows from major storm events.

The major drainage network shall have the capacity to control stormwater flows under normal and minor system blockage (50% blockage) conditions for an ARI 1 in 100 years.
The drainage system shall be designed to ensure that the landform of watercourses is stabilised and that erosion is minimised.

All dwellings must be protected from inundation during a flood of 1 in 100 years ARI. The drainage system shall be designed to ensure that flows downstream of the site are restricted to pre-development levels, unless council approves increased flows. (Reference – As/NZ 3500 –section 3)

The built environment down stream of the proposed residential development shall not be degraded by major drainage flows or flood waters.

Where a new subdivision is being developed, consideration shall be given to the installation of Gross Pollutant Traps as part of stormwater detention systems, and shall be located such that easy vehicle access is provided for maintenance.

Flood depths on streets shall not exceed 50 millimetres above the top of the kerb (or where there is no kerb, above the top of theoretical kerb). Flows shall be contained in the reserve.

Flood ways must be restricted to areas where no damage to property can occur and must discharge all gap flows. Roadways, car parks, reserves may be used as flood ways provided the flow depths and velocities do not create hazards.

3. HYDOLOGICAL DESIGN

3.1 Rainfall Data

Rainfall data to be derived from ARR 1997, Vol 2, Institute of Engineers, Australia as appropriate to the relevant site location in the Adelaide Hills district. It is the responsibility of the designer to ensure that current rainfall data is used.

3.2 Methodology

The Rational Method shall be used to estimate the peak flow rates for the determination of sizes of inlets, pipe and culvert sizes and overland flow calculations (ARR -1997)

In situations where large detention basins for flood storage are proposed, then methods such as runoff routing are preferred(AAR 1997). It is the designer's responsibility to use the most appropriate method for the particular situation under investigation.

3.3 Basis for Calculations

Catchment

Boundaries of the catchment may be determined by the following methods:

- Contour maps, or
- Aerial photographs, and/or
- Field inspection/survey levels

A Catchment Plan containing accurate contour information for the entire catchment shall be included with the drainage computations submitted to Council.

Where plans showing the location of existing drainage networks are available, these will be made available by Council at free of charge.

The designer shall take into account future road patterns where the contributing catchment includes areas subject to future development.

Where the contributing catchment includes existing subdivision areas, the location of existing drainage systems and the catchment associated with the drainage network being designed shall be include in the computations.

3.4 Runoff Coefficients

The runoff coefficient to be used shall be determined as suitable to the site and reference to ARR -1997

3.5 Time of Concentration

The maximum time to be adopted for flow travel from sub-catchment to its point of entry into the underground drainage system as per ARR 1997.

The Time of Concentration for any sub-catchment shall be determined by summation of times of travel for overland flow, flow in channels, flow in gutters and pipe flow and refer to ARR1997.

3.6 Partial Area Effect

The designer shall be responsible for ensuring that possible ‘Partial Area Effects’ are taken into account when calculating peak flows using the Rational Method.

4. HYDRAULIC DESIGN

It is the designer’s responsibility to ensure that all hydraulic design calculations are complete and correct as per councils requirements and relevant standards.

4.1 Pipelines

A full Hydraulic Grade Line (HGL) analysis is required for all designs. The analysis shall be carried out by starting at the outfall structure at the lower end of the pipe network and proceeding upwards through each consecutive pipe run to the most remote structure of the pipe network.

Wherever possible the designer shall endeavour to:

a) Avoid abrupt changes of pipe alignment
b) For pipes over 600mm diameter, where change in direction is unavoidable, splayed pipes are preferred
c) Minimise drop through pits.
d) Where drops through pits are unavoidable, the pit length should be increased to avoid flow impacting the opposite wall

4.2 Pits

Inlet structures shall be designed to capture flows (capture capacity) for the design storm event for which the pipe system is designed.

Inlets to the drainage system shall be in accordance with the Council Standard drawings (note - still to be prepared).

Side Entry Pits (SEP) shall be provided at low points in streets, at the upstream side of curves, at tangent points of kerb returns and spaced along streets to limit the width of gutter flow to acceptable widths for the design storm event.

Hydraulic criteria for entry design of SEP's varies for each of these cases and shall be investigated separately.

4.3 SEP's at Low Points

a) Inlets are to be designed as orifices at low points where water ponds.
b) An amount of head is required to achieve maximum flow capture and the designer shall investigate safety requirements and the level of flood waters in relation to footpath/property boundaries when considering this option.
c) The effects of blockage shall be evaluated.
d) Grates in gutter inverts, where approved, can be used to increase inlet capacity. Grates must be safe for cyclists.

4.4 SEP's on Grade

a) Spacing of pits shall be such that full capture of flow is achieved for the design storm event.
b) Where the standard pit is insufficient to capture the flow then the designer shall either:
    i) Reduce the pit spacing, or
    ii) Provide multiple pits (double or triple).

4.5 Overland Flows along Roads / Driveways

The Drainage Strategy permits overland flows along roads for Major Storm events (eg. 100 year ARI). The designer is responsible to ensure that such flows will not put at risk the safety of pedestrians, the disabled, cyclists or vehicles using the road.

In new sub-divisions or where redevelopment causes the re-direction of floodwaters the designer shall comply with current safety criteria and major flow design standards.

Council requires that the current safety limits specified in ARR not be exceeded (eg. product of Depth X Velocity of Flow to be less than 0.4 m^2/sec.).

In any development, or re-development, that requires a review of the safety of existing roads the designer shall address the following:

i) Current risk level associated with flooding.
ii) Consequences of increased risk to property and operational safety.
iii) Cost benefits associated with modifications.
iv) Level of protection/safety standard to be adopted.

All submissions shall include full details of the magnitude, velocities and predicted flood levels of overland flows that are likely to occur in a 100 year ARI storm. Provision shall be made to safely pass the flood waters within the catchment(s) under consideration and downstream properties.

4.6 Flood ways in Drainage Reserves

Flood ways in drainage reserves shall be designed for both Minor and Major Storm criteria. Pedestrian access, or stock grazing, in reserves shall be consistent with the predicted flood levels and flow velocities expected during a major flood event.

Flood ways shall be designed for channel flow and street flooding criteria in the event of either a Major or Minor Storm.

4.7 Floodway Design Criteria

i) Low Flow Pipeline Capacity

- Not less than 5 year ARI flow

ii) Channel Flow Capacity

- 100 year ARI flow

iii) Freeboard (reference AS/NZ 3500 section 3)

- 300mm minimum to abutting allotments for 100 year ARI, or
(if not possible)
- zero freeboard for 100 year ARI and habitable building floor level minimum 300mm above 100 year ARI water level.

5. Information to be provided on Drawings (But not limited to)

a) Catchment plan(s) of all sub-catchment areas (in Ha.) and inlet points (pits numbered), consistent with detail plans and readily identified, by inspection, with content of drainage computations.

b) External catchment boundaries shown to scale on a topographic plan.

c) All new drains and any existing outfall drain(s) as required, including hydraulic gradient determination.

d) Hydraulic grade lines plotted to scale on each pipe on longitudinal sections, including 1 in 100 scale drawing(s) where applicable.

e) Pit loss coefficients at each pit location on longitudinal sections(pit schedule)

f) Tail water level at outfall and flow velocity.

g) Pipe capacities (running full and design flow).

h) Pipe diameter, class and longitudinal grade, invert levels at both ends.

i) Other authority works plans and/or approvals (to be consistent with approved Functional Layout Plan).

j) Main Drain (Pipes) – Engineering plans and design verification, including the proposed network to Council standards.

k) Main Drain (Waterway) - Engineering plans, design verification, wetlands vegetation design and detailed requirements of Council maintenance program.

l) Finished surface levels and cover.

6. DESIGN CRITERIA

6.1 Pipeline Design Criteria and

1 All pipelines shall be designed for an underground capacity to pass the stormwater flows resulting from storms of ARI 1 in 5(commercial and industrial areas 1 in 10 years)

2 Pipelines located within private property and carrying runoff other than that contributed by residential properties shall be designed for an ARI of 20 years.

3 All, excavation, pipes; pipe laying and backfilling shall conform to the relevant Australian Standards and the Council 'Technical Specification for Road and Drainage Works '(still to be prepared).

4 Maximum Design Velocity shall not exceed 6 m/sec. (or the supplier's specification).

5 Minimum Design Velocity shall not be less than 0.9 m/sec. for any depth of flow.

6 Minimum diameter of pipelines shall be 225 mm

7 The following minimum grades must be used to obtain a minimum flushing velocity of 0.9m/sec

225mm diameter – 1 in 130
300mm diameter – 1 in 190

8 Pipelines less than or equal to 525mm diameter shall be Rubber Ring Jointed (RRJ), or approved equivalent reinforced Concrete (RCP) pipes, Reduction of pipeline diameter between the inlet and outlet is prohibited.

9 Design HGL shall be at least 150mm below the gutter invert for drains within the road reserve or 75mm below the underside of pit lids for drains within easements or reserves.

10 Exit velocity of pipes to open waterways shall be determined and the outfall structure designed to suit. The exit velocity shall not exceed that specified by the statutory authority responsible for the waterway.

11 Connections to open waterways must be angle downstream and drops shall not exceed 300mm from pipe invert to normal receiving tail water.

12 Spacing between pits shall not exceed 90 metres.

13 Drains within the road reserve are to be located on the high side of the road, unless otherwise approved by the Councils Engineering Services.

14 Minimum cover to pipes shall be:

- Easements 500mm
- Road reserve 900mm below top of kerb

16) Nature strips shall not grade toward property frontage, unless otherwise approved by the Councils Engineering Services. Where nature strip is grades toward property frontage the HGL of the drainage line shall be at least 150mm lower than the top of the pit grate of the footpath cut-off drain.

17) Stormwater connections from properties are to be connected directly into the underground drainage system.

6.2 Pit Design Criteria

1) Pits shall be used for all changes of direction for pipes and at start and end of curved pipes.

2) Side Entry Pits (SEP) shall be located at the tangent points of all kerb returns, at all low points of road alignments and spaced not more than 90 metres apart.

3) Pit inverts shall be profiled to shape with mass concrete to match the outfall pipe in accordance with Standard Drawings.

4) Gutter grates shall not be used for pits where gutters are running at supercritical flow velocity.

5) Pits located at low points of road alignments shall be designed to capture design flow assuming 50% blockage.

6.3 Water Sensitive Urban Design.

The drainage system shall, as far as practicable, follow the principles of Water sensitive urban Design (to achieve acceptable water quality criteria) such as

- Sediment basins
- Bioretention swales and basins
- Sand filters and infiltration measures
- Swale/buffer systems
- Wetlands and ponds
- other

6.4 Roads and Driveways - Overland Flow Design Criteria

1) Design storm event shall be ARI 100years.

2) Underground drainage systems inlets shall be considered 50% blocked for this event. (i.e. blockage on the inlet, not the receiving pipe).

3) Where sub-divisions or redevelopments intentionally re-direct Major flood flows along road reserves the designer shall adopt the current safety standards for suitability of design.

4) Minimum freeboard between the surface level at the boundaries of private properties and the maximum flood level, based upon ARI of 100 years, shall be 150mm.

6.5 Flood ways and Drainage Reserves - Overland Flow Design Criteria

1) Design storm event shall be ARI 100 years.

2) Exit velocity of pipes discharging to flood ways or drainage reserves shall be determined and the outlet structure designed to suit.

3) Centreline radius of bends shall not be less than 2.5 times the width of flow for the 100year ARI storm event.

4) Minimum freeboard between the surface level at the boundaries of private properties and the maximum flood level, based upon ARI 100 years, shall be 300mm.