GORE DISTRICT COUNCIL

SUBDIVISION AND LAND DEVELOPMENT BYLAW

CONTENTS

SECTION 9

STORMWATER

9.1 SCOPE

Management of stormwater requires consideration of rainfall and the manner in which water passes over land. Potential changes that could result from climate change also require consideration.

The design of stormwater systems provides an opportunity to utilise or replicate the natural drainage system, for example, by the use of grassed swales, natural or artificial waterways, ponds and wetlands. Low impact design is the preferred approach,

Nevertheless piped stormwater drainage networks will often be required either in support of low impact systems or as the primary system.

The following guidance manuals may provide a useful resource or basis for stormwater design and management.

(a) Auckland City Council. On-site stormwater management manual and stormwater soakage manual.

(b) Auckland Regional Council (ARC). Technical Publication No. 10, Design guideline manual – Stormwater treatment devices.

(c) Auckland Regional Council (ARC). Technical Publication No. 124, Low impact design manual for the Auckland region.

(d) EPA Victoria, Maintaining water sensitive urban design elements.

(e) Ministry for the Environment. Climate change effects and impacts assessment; A guidance manual for local government. 2nd edition.

(f) Ministry for the Environment. Coastal hazards and climate change; A guidance manual for local government.

(g) Ministry for the Environment. Preparing for climate change: A guide for local government..

(h) North Shore City. Bioretention guidelines.

(i) NZWERF. On-site stormwater management guidelines.

(j) Puddephatt and Heslop. Guidance on an integrated process designing, operating and maintaining low impact urban design and development devices, Landcare Research Low Impact Urban Design and Development publication.

(k) SNZ HB 44 Subdivision for people and the environment.

9.2 OBJECTIVE

The practices specified or advised in this section are intended to:

(a) manage storm surface water run-off to minimise flood damage and adverse effects on the environment, including:

- Moving stormwater in such a way as to prevent unintentional local flooding;
- Slowing stormwater where appropriate to reduce the surge of water into downstream areas; and
- Avoiding, as far as practical, the adverse environmental effects that can arise from contamination of stormwater from land use activities, in

particular, adverse effects on streams and marine life.

(b) The building of wastewater systems is “sustainable” as possible so as to limit any long term adverse effects and help “Future Proof” the subdivision or land development.

9.3 PERFORMANCE STANDARDS

Stormwater disposal networks shall be designed and constructed in conformity with this Bylaw and associated Standard Drawings, so that:

(a) The general performance standards of Section 1.4 are met.

(b) The primary network is capable of carrying water resulting from a 1 in 20 year storm event.

(c) Backup and secondary flow paths are provided to carry water arising from a 1 in 100 year storm event without surface water entering any buildings with floor levels above normal ground level.

(d) Adequate provision is made for the collection of surface water from roads, buildings and other impermeable surfaces.

(e) Piped networks are designed so that self cleansing velocities are maintained in them and blockages and root infiltration are minimised.

(f) Accessible inspection chambers are provided at each change of grade, direction and pipe size.

(g) Adequate provision is made for maintenance access to open water courses.

(h) The requirements of any Regional Plan or any resource consents regarding discharge to waterways and water bodies are met.

(i) Unless covered by specific design, pipe diameters shall not decrease in the direction of flow.

(j) The stormwater disposal system is compatible with systems in adjacent upstream and downstream catchments.

(k) Where appropriate retention zones may double as parks or reserves, car parking or other appropriate use are created to retain the stormwater surge and to feed the water to the downstream systems in a more controlled manner

Dispensation may only be permitted subject to approval of Council (see Section 15).

9.4 DESIGN CONSIDERATIONS

The stormwater system shall be designed within the terms of any catchment management plan for the relevant catchment, if available. There should be early consultation with Council. The drainage system shall be capable of serving the entire catchment upstream of the subdivision or land development and also have due regard to the effect it may have on downstream waterways and adjoining areas. Where, due to increased runoff, the existing downstream system is inadequate, the Developer may be required to:

- Limit outflow from the subdivision or land development;
- Upgrade the downstream system;

- Incorporate appropriate retention zones; or
- Incorporate appropriate swales.

Where further subdivision or land development is likely upstream of the development under consideration, the Developer may be required to extend the drainage system to the upper limits of the subdivision or land development.

Where the proposed subdivision or land development brings about the need for additional works to be undertaken downstream of the subdivision or land development, the Developer may be required to contribute to the costs of the additional works.

(a) Design life

All stormwater systems shall be designed and constructed for an asset life of at least 50 years.

(b) Water quality

Stormwater treatment devices may be required to avoid adverse water quality effects on receiving waters.

The need for treatment devices should be considered for every discharge from subdivision or land development even when it is not a direct discharge to a receiving water, for instance where the discharge is to an existing network.

(c) Climate change

The protection standards incorporating climate change factors need to be obtained from Environment Southland and appropriate government agencies at an early stage in the infrastructure design and planning process.

In considering protection standards, a precautionary design approach is recommended.

9.5 SYSTEM DESIGN

(a) Primary and secondary systems

Stormwater drainage shall be considered as the total system protecting people, land, infrastructure, and improvements against flooding. Such a stormwater system consists of:

(a) A primary system designed to accommodate a ten year rainfall event; and

(b) A secondary system to ensure that the effects of stormwater run-off from events that exceed the capacity of the primary system are managed, including occasions when there are blockages in the primary drainage system.

(b) Secondary systems

Secondary systems shall consist of ponding areas and overland flow paths to manage excess run-off.

Where possible, secondary systems shall be located on land that is, or is proposed to become public land. If located on private land, the secondary system shall be protected by legal easements in favour of the Gore District Council.

Secondary systems shall be designed so that erosion or land instability will not

occur. Where necessary the design shall incorporate special measures to protect the land against such events.

Ponding or secondary flow on local roads shall be limited to a 100 mm maximum height at the centre line and velocity such that the carriageway is passable in a 20-year return period event.

(c) Freeboard

The minimum freeboard height additional to the computed top water flood level of the 1% AEP (100 year) design storm, unless otherwise specified in any resource consent, shall be as follows:

- Habitable dwellings 0.6 m
- Commercial and industrial buildings 0.3 m
- Non-habitable residential buildings and garages 0.2 m

The minimum freeboard shall be measured from the top water level to the building platform level or the underside of the floor joists or floor slab, whichever is applicable.

9.6 CATCHMENT RUNOFF

The Developer shall provide design calculations for the proposed stormwater system.

Calculations shall be provided by a suitably qualified person and be based on reasonable judgement, taking account of the overall site conditions, details of the drainage system, and the probable impediments to free flow, (both upstream and downstream) and shall determine the expected runoff 'Q', and show that the design flood levels at the site satisfy the Performance Standards.

Estimation of the surface runoff shall be by a recognised engineering method with the following being acceptable:

(a) Catchments less than 500 ha - Rational Method.

(b) Catchments greater than 500 ha - Modified Rational Method.

Runoff coefficients used shall be as follows:

Natural surface types	**C**
Bare impermeable clay with no interception channels or run-off control	0.70
Bare uncultivated soil of medium soakage	0.60
Heavy clay soil types:	
- pasture and grass cover	0.40
- bush and scrub cover	0.35
- cultivated	0.30
Medium soakage soil types:	
- pasture and grass cover	0.30
- bush and scrub cover	0.25
- cultivated	0.20

High soakage gravel, sandy and volcanic soil types:	
- pasture and grass cover	0.20
- bush and scrub cover	0.15
- cultivated	0.10
Parks, playgrounds and reserves:	
- mainly grassed	0.30
- predominantly bush	0.25
Gardens, lawns, etc	0.25

Developed surface types	**C**
Fully roofed and/or sealed developments	0.90
Steel and non-absorbent roof surfaces	0.90
Asphalt and concrete paved surfaces	0.85
Near flat and slightly absorbent roof surfaces	0.80
Stone, brick and precast concrete paving panels	
- with sealed joints	0.80
- with open joints	0.60
Unsealed roads	0.50
Railway and unsealed yards and similar surfaces	0.35

Land use types	**C**
Industrial, commercial, shopping areas and town house developments	0.65
Residential areas in which the impervious area is less than 36% of gross area	0.45
Residential areas in which impervious area is 36% to 50% of gross area	0.55

Notes:

1. Where the impervious area exceeds 50% of gross area the chosen run-off coefficient shall be based on the conditions likely to exist after the full catchment development allowable by the District Plan.
2. The run-off coefficient C is the variable in the rational formula least able to be precisely determined, and represents the integrated effects of such things as infiltration, storage, evaporation, natural retention and interception, all of which affect the time distribution and peak rate of run-off.
3. The run-off coefficients given assume saturated ground conditions from previous rain, and shall be used in the calculation of surface water run-off.

9.7 PIPE DESIGN

Calculations of pipe capacity shall be by the use of Manning's formula and due allowance shall be made for energy losses through structures.

Pipes shall be sized so that, when flowing full, a minimum velocity of 0.7 m/sec is maintained.

Where a pipe gradient exceeds 10%, allowance shall be made for bulking of the flow due to air entrainment where the air to water ratio may be calculated from:

$$\frac{\text{Air}}{\text{Water}} = \frac{kv^2}{gR}$$

where k = coefficient of entrainment (dimensionless)

= 0.004 for smooth concrete

= 0.008 for cast in situ culverts

v = velocity, m/sec

R = hydraulic radius, m (A/P)

g = acceleration due to gravity, m/sec²

9.8 SUMPS

Sumps shall be spaced to provide for local rainfall intensities and the channel slope. Suggested typical spacing's are:

(a) In channels draining one lane, in such a position that the run of water in any channel is 90 to 125 metres, and for channels draining two lanes, 60 to 90 metres.

(b) Where required at intersections, at the uphill kerb line tangent points.

(c) At changes of gradient or direction in the channel where there may be a tendency for water to leave the channel.

(d) A double sump is required -

(i) At the lowest point in a sag vertical curve;

(ii) At ends of a cul-de-sac where water falls to the end;

(iii) On all channels where the gradient is steeper than 5%.

All sumps shall be fitted with a back entry grate.

9.9 SOAKAGE SYSTEMS

On-site disposal of stormwater may be approved by Council if it is demonstrated that:

(a) Sufficient field permeability testing has been undertaken before design approval to demonstrate the suitability of the ground across the site for soakage disposal.

(b) Soakage pits can be maintained and are viable as a long-term solution.

(c) The entry of silt into soakage systems is minimised.

(d) Due allowance has been made for long term pore clogging of the receiving ground.

(e) Lifetime costs do not exceed those of a fully piped network.

(f) The positioning of soak pits in road reserve does not unduly limit the options for placement and extensions of other utility services.

(g) Specific proving tests are carried out on each soak facility and certified by the Developer's Engineer.

(h) Secondary flow paths are identified and protected.

9.10 RETENTION PONDS

Stormwater retention ponds shall be designed taking the following considerations into account:

- Provision of a separate, easily maintained rubbish and sediment catchment fore bay with a hardstand base and easy maintenance vehicle access.
- A pond that is ideally wedge shaped, being narrow at the inlet and widest at the outlet, and a length at least 1.5 times the average width.
- A long flow path and adequate water volumes where water treatment is important.
- A permanent water depth not exceeding 2 metres.
- Side slopes not exceeding 1 vertical to 3 horizontal if fully planted, 1 vertical to 6 horizontal where grassed and 1 vertical to 12 where designed for recreational pedestrian access to the water's edge.
- Provision of a low level safety berm between steep side slopes and the pond water.
- Provision of measures to completely drain the pond in no more than 24 hours.
- Provision of an overflow spillway for extreme rainfall events.
- A freeboard of at least 600 mm.
- Easily cleaned outlets.
- Scour control, primarily through reduction in flow velocities, at inlets and outlets.
- Pond-scaping that takes into account the fluctuation and duration of water levels.
- Provision for easy maintenance of the pond itself and its surroundings.

9.11 OVERLAND FLOW PATHS

Overland flow paths to cater for extreme rainfall events shall be:

- Clearly identified during the design process.
- Protected by easements with restriction on any building, (including buildings on pole construction) walls or fences that would impede water in the flow paths.
- Shaped for easy maintenance.

9.12 CONSTRUCTION

Construction of piped stormwater systems shall be as set out in Sections 10 and 11 of this Bylaw.

9.13 STORMWATER PUMPING

Stormwater pumping should be avoided if possible. In certain circumstances for low lying areas, and where gravity drainage is difficult to achieve, stormwater pumping may be required to achieve the appropriate levels of service and protection.

The consequences and risk of pump malfunction and power outages require consideration and provision of appropriate "back-up" options.