

POLICY REGISTER

NAME:	CONDUIT BLOCKAGE POLICY
PROGRAM:	INFRASTRUCTURE
FUNCTION:	FLOODPLAIN MANAGEMENT
DIVISION:	DESIGN

File No: SU2002I

OBJECTIVE

To more accurately predict flood behaviour in real events as a result of blockage of bridges and culverts across waterways.

POLICY STATEMENT

In the preparation of catchment wide flood studies as well as those to be used in support of individual development applications appropriate blockage factors are to be applied to bridges and culverts in accordance with this policy.

STATEMENT OF PROCEDURES

The following procedures are to be taken into account when determining flood behaviour.

WATERCOURSES

Hydraulic Design - Estimation of Design Flood Level

Hydraulic design or analysis of watercourses shall proceed with the use of Flood Water Surface Profile (FWSP) calculations as appropriate. These calculations may be done manually or by the use of appropriate computer models. Any assumptions made in the hydraulic analysis/design are to be clearly stated and shown to be justified. The hydraulic design will need to integrate current riparian management and related environmental considerations and policies as appropriate.

The data required for the hydraulic design or analysis including channel cross sections, hydraulic properties (eg roughness), dimensions of controls, obstructions, etc, shall be obtained by the proponent. This data shall be documented clearly and reflect both the existing and proposed hydraulic characteristics of the creek channel and floodway. Unrealistic approximations are not to be made on this data and all assumptions should be documented.

A sufficient number of cross-sections selected at appropriate locations both within the site and extending sufficiently upstream and downstream of the site shall be analysed in order to reflect flood behaviour. This would normally require that the hydraulic calculations extend to a boundary condition at the hydraulic control downstream of the site.

In the hydraulic design of watercourses (which includes modified stream channels and floodway systems), a freeboard of 0.5 metres shall be provided above the 1 in 100 year ARI flood water surface level within the floodway for the profile that has been amended for blockage (see 7.3.2). If modifications are required to the creek channel or floodplain to convey larger than natural flows or if the proposal involves activities with 40 metres of the top of the creek bank, then liaison with DLWC regarding requirements for a permit under the River and Foreshores Improvement Act (1) is encouraged to be undertaken and integrated into the hydraulic design. This will ensure the hydraulic design appropriately integrates the final landform with geomorphic and riparian environment enhancement requirements. This will also reduce the number of iterations of hydraulic computations and reduce the overall timeframe and cost of the DA assessment process.

Conduit Blockage

(a) **General**

Historical evidence indicates a high probability of blocking of structures located along watercourses during major flooding. Evidence indicates that the debris source is catchment wide.

(b) **Blockage Criteria**

Based on a detailed evaluation of flood behaviour during the major floods of 17 August 1998 and 24 October 1999 the following blockage factors are to be applied to structures across all watercourses when calculating design flood levels:

- (i) 100% blockage for structures with a major diagonal opening width of <6m
- (ii) 25% bottom up blockage for structures with a major diagonal opening width of >6m

For bridge structures involving piers or bracing, the major diagonal length is defined as the clear diagonal opening between piers/bracing, not the width of the channel at the cross-section.

- (iii) 100% blockage for handrails over structures covered in (i) and for structures covered in (ii) when overtopping occurs.

(c) **Cross Catchment Flow Diversion Investigation.**

Flood Water Surface Profiles are to be developed upstream from each control structure to which blockage factors are applied. These profiles are to extend until the normal non-blocked profile is reached (ie afflux due to blockage is reduced to 0mm). Expected cross-catchment diversion flowpaths as a result of the afflux associated with blockage are to be identified. Where this is an issue, appropriate survey information at the structure and along the top of both banks will be required and is to be plotted against the computed Flood Water Surface Profiles until the afflux effect diminishes to zero.

Where flow diversions are identified, account shall be taken of the future potential for installing measures to prevent the flow diversion occurring. (That is, a flood mitigation device may be installed to manage the diversion). The impact of such a device on the proposed development shall be considered and appropriate measures included in the design of the development.

(d) **Provision of Debris Control Structures**

Historical evidence indicates debris loading in major flooding is catchment wide. Evidence also suggests the blockage occurs in a cascading fashion down the catchment. Therefore the appropriate blockage factor indicated above is to be applied unless a catchment wide program for debris control is part of an adopted Floodplain Management Plan and has been fully implemented. Provision of localised upstream control measures (trash racks, settling basins etc) will not remove the blockage requirement for individual structures.

(e) **Hydraulic Performance**

Hydraulic performance defined using the blockage factors outlined in 7.3.2(b) is to be used to evaluate flood behaviour at individual sites. Tailwater effects on the site due to blocked structures or other downstream constraints are to be considered in flood level derivation. This applies to both levels associated with the immediate watercourse as well as potential overland flow diversions from adjacent watercourses.

(f) **Design of New Structures**

Design of new structures across watercourses is to be carried out in an iterative manner as indicated below:

- Design is to consider the impacts of downstream structures and other downstream constraints and the associated tailwater effects.
- Structure is to be sized using conventional (non-blocked) design criteria
- Dependent upon the classification of the road, the structure is to be sized to convey the ARI event described in Section 1.3 of this Code.
- The appropriate blockage factor outlined in 7.3.2(b) is to be applied
- Adjusted surface profiles upstream and downstream of the new structure as a result of the blockages are to be calculated. Profiles are to extend until the afflux due to the blockage and the new structure is exhausted;
- Longitudinal plots should be provided for existing and proposed conditions for both the blocked and unblocked cases.
- Flows in the 100 year ARI event, in excess of the stated blockage percentage are to overflow the structure in a defined flowpath ensuring that this is consistent with the pre-structure flowpath. A check is to be made on an extreme event of 3 times the peak of the 100 year ARI event to ensure the flowpaths for rarer events remain the same.
- Flood Hazard considerations need to be identified, planned and managed on all overland flowpaths.
- Design is to make provision for the movement of both terrestrial and aquatic fauna under the road.
- Where the profile adjusted for blockage alters flow conditions such that:
 - flood levels to existing or potential development areas are raised;
 - additional overland flowpaths develop, and
 - cross catchment diversions are created compensating measures are to be considered to be incorporated into the new structure design to ensure pre-structure conditions are not made worse.

Compensatory measures which themselves will require a full assessment may include:

- hydraulic measures to facilitate streamlined overtopping of the structure; stream re-entry points shall be determined and checked for adequacy against erosion. Erosion protection measures may be required
- additional hydraulic capacity of the total floodway upstream and downstream of the site (this option will need to be checked against Council's stream management policy and DLWC's Part 3A permit requirements and state policy requirements)
- additional diagonal width of structure opening to minimise blockage potential
- upstream levees to contain elevated flows.

Because of the scale of the debris source, localised debris control structures will not be allowed to justify overriding of this clause.

The appropriate blockage factor may be negated where a catchment wide program for debris control is part of an adopted Floodplain Management Plan and has been fully implemented.

(g) **Applicability**

- (1) This policy will apply to all watercourses including creeks, floodway and other trunk drainage systems within the City of Wollongong with the exception of the minor system as defined in Section 1.1.
- (2) It will be applied to all flood study models being developed under Council's floodplain management program.
- (3) It is to be applied to all localised flood studies to support individual development proposals required under Section 8 of this Code.

Application of the Code

Responsibility for technical interpretation of this Code and investigations/designs produced in accordance with the Code rests with the Manager Design. If the Manager Design does not consider that the requirements have been satisfied, for investigations of a complex nature, the Manager Design will facilitate peer review of the studies submitted with a specialist technical panel comprising a representative of:

- Wollongong City Council
- DLWC
- Institution of Engineers, Australia Illawarra/Sutherland Regional Group
- Wollongong University Engineering Department