GOULBURN BROKEN CATCHMENT MANAGEMENT AUTHORITY

Works on
Waterways Notes No. 2

Bridge Crossing

2.1 Bridge Type

Clear span bridges are the preferred structure for crossing streams as they cause the least disturbance to the waterway both hydraulically and environmentally. The assessment criteria for bridge crossings are described in **Section 2.3**.

2.2 Potential Waterway Impacts

The impacts of bridges can include:

- Alteration to the stream's natural flow pattern;
- Reduction in hydraulic capacity of the stream;
- Reduction in aquatic fauna and flora habitat;
- Reduction in hydraulic capacity of the stream;
- Increased extent of flooding upstream;
- Increased sediment and nutrient input from unsealed roads;
- Toxicant inputs from highly trafficked bitumen roads;
- Removal of riparian and in-stream vegetation;

2.3 Assessment Criteria

Purpose
Assessment of bridge crossing applications is for the purpose of ensuring that bridge construction does not have detrimental impacts on the stream environment. Bridges on a public road will have different requirements and / or impacts to those used for internal farm access.

Structural Design
Where the bridge is open to public usage or heavy vehicles, the applicant should submit design drawings that have been certified by a qualified engineer and satisfy all relevant Australian Standards or Bridge Design Codes.

Alternative bridge structures are acceptable for light duty farm access purposes.

Bridge Level
Bridge height relative to flood levels and the natural surface level is needed to assess potential impacts on flows.

Where bridges are to be used for public access, the underside of the bridge beams should preferably be above the maximum recorded flood level or the 100 year ARI flood level. A freeboard clearance of up to 600mm above design flood level is desirable to avoid damage from floating flood debris.

On minor bridges such as for internal farm access, submergence during floods would be acceptable provided the bridge is securely attached to the foundations.

Waterway
Where the underside of the deck is above or at the top of bank and in-stream piers/piles occupy less than 5% of the cross sectional area, there would be no significant change to the available waterway. In such cases, the proposed bridge would be acceptable subject to correct alignment of the piers/piles to mitigate debris problems.

Where the underside of the deck is below the top of bank, there is potential for a significant reduction in the available waterway area and a hydraulic assessment may be required. *It may be necessary for the applicant to engage a qualified person to carry out a hydraulic assessment.*

Provided that the available waterway under the bridge exceeds 75% of the natural waterway, the velocity increase will be less than 33%, and the afflux will generally be acceptable.

Road / Track Approaches
Potential increases in flood levels due to obstruction by road or track approaches need to be considered.

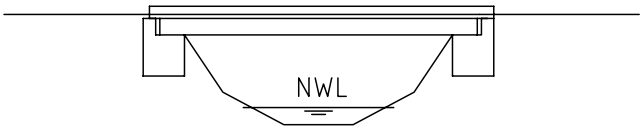
Where the road or track approaches are at natural surface level or floodplain level, the structure would not obstruct flood flows.

Where the road or track approaches are above natural surface or floodplain level, an assessment of flows across the floodplain is needed. Detailed hydraulic modelling would be a prerequisite for approval in such cases. In preparing the hydraulic report, consideration must be given to multiple waterway openings across the floodplain. This avoids excessive flow concentration and bed erosion in the main stream in the longer term and provides a balanced flow distribution over the floodplain. This will normally be associated with significant public works and the applicant should submit a report on the effects of the works.

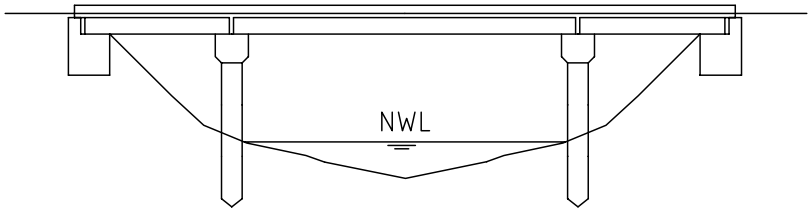
Number of Spans
Bridges can be either single or multi-span as shown in **Figure 2.1**

Figure 2.1

Single Span Bridge



Three Span Bridge



NWL = Normal water level

Single span bridges are preferred as they avoid disturbance to the stream bed and in-stream biota, and minimise flood debris being caught on the piers that may threaten the stability of the bridge or increase flooding upstream.

However, multiple span bridges are acceptable on wide streams. Acceptable arrangements include:

- Piers located outside the normal low flow stream width. In this regard, a three span bridge would be preferable to a two span bridge. The spans do not need to be of equal length.
- Piers aligned parallel to the direction of flow
- Riprap provided around the piers to mitigate local scouring.

Bridge Abutments
The abutments should be located so they do not significantly encroach into the waterway and thereby reduce the available waterway area. Abutments should also be located so as to avoid obstruction of movement of terrestrial fauna along the riparian zone.

Batter Protection
Rock beaching is generally used on the batters to protect against abutment scour, as this area will generally not revegetate due to inadequate light and lack of rainfall. Beaching should generally extend 3 metres upstream and downstream of the bridge abutments.

The batter is to be excavated to the depth of the beaching to maintain the waterway area. The slope of the batters should be in the range of 1(v):1(h) to 1(v):2(h). In general, the beaching should extend at least 600 mm below the toe of the bank to mitigate undermining.

Where the stream banks are stable, rock beaching may not be required. The CMA will determine this.

Fish Passage
To ensure adequate light for fish passage, it is suggested that the underside of the bridge beams should be at least 1.0 metre above the base flow water level of the stream.

Local Drainage
Local drainage from the site and access roads should be directed to sedimentation basins or grassed filter zones to trap sediments, rather than discharging directly to the stream. The bridge deck should be graded to sedimentation basins or grassed filter zones to trap sediments at each end of the bridge, with the return flow either overland or by pipe to the stream.

On dairy farms, the bridge deck and tracks are to be graded away from the waterway to a drainage recycling system to prevent animal wastes directly discharging to the waterway. There should be no direct connection of any dairy track to a stream or connected drain.

Fencing and Bridge Railing
Bridge railing or fencing is normally necessary on access crossings for the safety of users. The type of railing depends on the purpose of the crossing and risks associated with flooding. For bridges used for public access, the guardrailing must comply with VicRoads standards.

Where the crossing is set above the highest recorded flood level or the 100 year ARI flood level, it is not necessary to place restrictions on the type of guard railing. Where the crossing is below flood level the railing should have minimal potential to catch flood debris, as this can reduce the hydraulic capacity, cause upstream flooding and ultimately threaten the stability of the structure.

For stock crossings, a plain wire fence would be suitable. These fences are easily repaired or replaced after floods. Mesh type fencing (eg. ringlock) should <u>not</u> be used as they catch debris and restrict flood flows.

Similarly, fencing across the stream close to a crossing is to be avoided. Cross fencing should be located at least 20 metres upstream or downstream of the bridge. Again, a simple plain wire fence with as few wires as is practical is preferred to avoid catching debris and creating obstructions to the movement of aquatic fauna.

Figure 2.3 **Examples of well planned bridges**

Single Span Bridge for light vehicles

Three span bridge over wide stream