CREDIT VALLEY CONSERVATION

TECHNICAL GUIDELINES FOR PEDESTRIAN BRIDGE CROSSINGS

BACKGROUND

Pedestrian bridges, on either public or private lands, are structures in the floodplain within close proximity to a watercourse. They can be subject to the depth and velocity effects of flooding, and they may also be affected by watercourse erosion and ice damage. A variety of types and sizes of pedestrian bridges exist. The lack of standardization is a response to the desired level of use and economy of construction. Many existing bridge structures have been constructed with no regard to the risk of damage and adverse impacts on habitat. The need for design sensitivity towards natural watercourse morphology and aquatic – terrestrial habitat is required for any bridge. These guidelines integrate watercourse habitat protection with hazard protection by detailing appropriate height and span requirements.

ASSUMPTIONS AND CONSIDERATIONS

It is assumed that the reader is familiar with the general nature of the technical material presented. A detailed description of terms will be avoided. Reference can be made to the related Technical Guidelines for Floodproofing to clarify some terms. Reference made to "bankfull" depth and width of a watercourse should, however, be explained upfront. Bankfull is a descriptive term for the point on the channel bank that shows the regular erosive effect of frequent flows. Above this point there is either a sharp noticeable change in the slope as it flattens into the floodplain or valley floor or there is a strong presence of woody shrub or tree vegetation unaffected by the watercourse. The bankfull stage may only be immediately observable on one side of the channel because of the water erosion meanders from bank to bank. The bankfull stage may not be easily seen in step pool channels, braided channel, gullies, against bedrock channel banks, and in swamp/marsh channels. These specific situations will be discussed later. From a technical standpoint the bankfull stage is approximately equal to the 1 ½ - 2 year storm water level in rural areas, or the average annual flood (2-3 times per year) water level in urban areas.

DESIGN CRITERIA

The following design criteria are based on measurements of the width and depth of the bankfull channel. The width measurement is simply the horizontal level distance from bank to bank and the depth is the vertical distance in the centre of the channel, at the bankfull stage. These measurements are made in the riffle or straight reach between oppositely swinging meanders. The riffle should appear shallower and faster than the meanders upstream and downstream. If there is a deeper section across

the riffle, closer to one bank than the other, this is where the depth measurement should be made. If these conditions are not immediately obvious then a best approximation should be made. Generally, pedestrian bridges should not be located across the curving section of a meander because of the susceptibility of the outside bank to erosion.

	Minimum Height = X (times) bankfull depth	Minimum Span = X (times) bankfull width
Credit River above the "Forks" and all other watercourses	1 ½ + 30 cm when depth is greater than 60 cm	1 ½ (or 1 for existing man-made channelization)
Credit River below the "Forks"	2	1 ½

The minimum design height is measured from the deepest point of the bed of the channel and the minimum design span is centred over the bankfull width of the channel. Note that the minimum design span defines a limit that must be respected for bridges built either perpendicular or on an angle over the watercourse. See Figure 1 for an application example of the criteria.

In addition to the specific criteria there are general conditions for construction that must be met. Firstly, the use of standard pipe or box culverts is not appropriate conveyance techniques under a pedestrian crossing. These structures disrupt habitat and the natural stability of a channel. Likewise, the construction of hard erosion protection on one or both banks is not acceptable to permit a pedestrian bridge. Any disruption, grading, or realignment of the existing natural channel is also not permitted unless it is designed to restore or enhance habitat. Due to the arching configuration of prefabricated bridges, it is acceptable if only the centre ½ - 2/3 of the span is above the height requirements. Finally, bridge construction should generally be avoided wherever the bridge deck is more flood susceptible than the approach walkways.

In the case of step pool channels, gully channels, channels with closely encroaching valley walls, or where one or both banks are bedrock it may be required that a geotechnical assessment be performed to determine appropriate stability setbacks for the supporting abutments. Braided channels are highly dynamic appropriate stability setbacks for the supporting abutments. Braided channels are highly dynamic as they erode and aggrade and bridges are generally discouraged over channels that flow through wetlands. These channels are usually just low flow channels without an observable bankfull stage. Storm flows usually spill over the banks or diverge at the head of the wetland into a wide floodplain. It is recognized that there are exceptions to the criteria and general requirements presented and these can only be handled on a case by case basis.

Constructing any pedestrian bridge must also follow general and specific rules of structural integrity. Bridges proposed for heavy public or private commercial/industrial use will be required to be designed by a Registered Professional Engineer and must have structural integrity under Regulatory Storm conditions. Bridges proposed for light private use should respect basic consideration of structural integrity. By following the height and span criteria quoted, bridges will be located above the effects of storms in the 10-50 year range, but will only have integrity above this if properly designed by a Professional Engineer. Reference can be made to the related document Technical Guidelines for

Floodproofing for design considerations regarding saturated soils, hydrostatic pressures, and bearing/settlement conditions.

Pedestrian bridges will not be acceptable where they create adverse backwater effects onto the upstream neighbouring property. Likewise, bridges will not be acceptable where they increase velocities and flood levels on downstream neighbouring properties, due to conveyance constriction. These effects must be considered for the full range of design flows and a HEC-2 backwater analysis must be performed for any bridge designed by a professional Engineer, unless there are overriding hydraulic considerations on the watercourse.

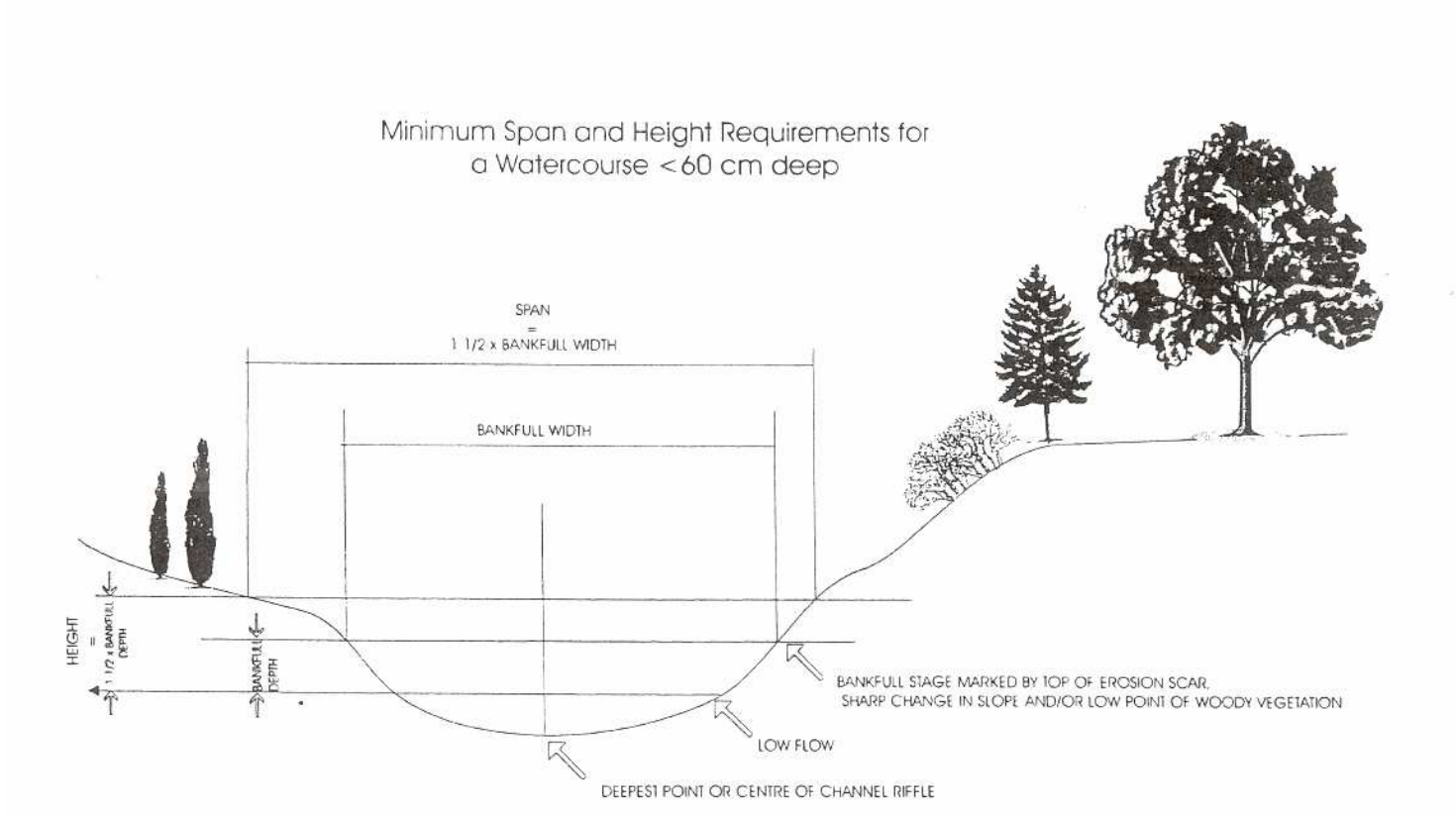

Figure 1