2.8 IMPACTS OF INSTREAM STUCTURES AND FLOW MANIPULATION ON FLOODING IN DUMARESQ CREEK

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INTRODUCTION

A flood occurs when a stream overflows its banks and water spreads over the adjacent land, which is called "the floodplain". The occurrence and magnitude of flood events are both highly variable and to a large degree unpredictable. This is particularly so in Australia, which has the most variable hydrology in the world.

It must be emphasised that floods are inevitable; they cannot be prevented, although we can take steps to mitigate their effects. People who occupy floodplains must expect to be flooded from time to time. This is why flood insurance is so difficult and expensive to obtain: insurance companies are not willing to take a gamble on a sure thing.

Because of the variability of their characteristics, floods are best described in terms of their statistical parameters. Specifically, we refer to the size of a flood in terms of the probability of its occurrence. For example, we may talk of the hundred year flood, or the one in a hundred flood, as a flood of such a size that it can be expected to occur, on the average, once in a hundred years. This terminology is rather misleading for lay people, who tend to assume that the hundred year flood is one which will only occur every hundred years or worse, that it will not occur for another hundred years. For a flood of this size it is better to refer to it as the one percent flood, which means a flood of such a size that there is a one in a hundred chance that it will occur in any given year. It may well occur this year, or next year; and it is theoretically possible for one percent floods to occur in two successive years.

FLOODING IN ARMIDALE

In Armidale we experience two kinds of flood: mainstream flooding and storm runoff flooding. Mainstream flooding occurs in Dumaresq Creek and across its floodplain, generally as a consequence of heavy rains across the whole catchment. Storm runoff flooding occurs as a result of heavy flooding in the urban area, and quite severe storm runoff flooding may occur when there has been no rain over the rest of the catchment at all. Such flooding can cause a rapid rise in Dumaresq Creek through the town, as well as localised flooding in other parts of the urban area. By way of example, the most recent example of this kind of flooding occurred in early 1999 as a consequence of a very heavy storm which dropped an inch of rain in 15 minutes. The creek rose rapidly, trapping a bus and a four-wheel drive vehicle in the Faulkner Street crossing. At the same time, there was flooding in other parts of the city, such as Tilbrooks Store in North Armidale, well above the floodplain. There was, however, no rain at all on the upper catchment. The worst flooding situations in Armidale tend to occur when there is widespread heavy rain across the catchment and in the city area, so that both forms of flooding occur at the same time.

Floods have several important characteristics which will determine their severity and the amount of damage which they can be expected to cause. The most important of these comprise the depth of flooding, the areal extent of flooding, the duration of flooding, the time of rise to the peak flood and the velocity of the floodwaters. Each of the possible changes to the existing creek configuration that have been discussed in the preceding discussion has the

potential to modify one or more of these characteristics adversely, leading to more severe flooding.

FLOODING AND THE FIVE SCENARIOS

There is little to be gained in speculating qualitatively about what these effects might be, since tools are available for predicting them quite specifically. The most useful of these tools involve simulation modelling, which can be undertaken using physical scale models, or mathematical computer models. A large scale model of the creek through the city was built at the University in the 1970's, and was used to examine the effects of development on the floodplain and to prepare the first floodplain maps for the creekland area. Unfortunately, this model has long since had to be destroyed. A computer model, specifically adapted to suit the Armidale floodplain, is however available, and has been used in the development of more precise flood mapping and a study of the likely effects of the Belgrave Theatre, which had to be raised on piers above the one percent flood level. This model, or further developments of it, could be used to analyse the effects of any future proposals for modifications to the creek and the creeklands. Indeed, it will be essential for the hydraulic and environmental effects of any seriously proposed modification to be examined in this way.

There is a variety of statutory tools available to State and Local Government for the control of floodplain development. The Water Act 1912 has provisions for the declaration of land as floodplain and the licensing of any works proposed for land so designated. To date, this mechanism has only been applied on a few very large areas of rural floodplain along the Namoi and Murray Rivers and is not likely to be applied to a small area of land such as the Armidale Creeklands. Much more useful in our case is the Environmental Planning & Assessment Act 1979, which gives Local Government bodies the right to make Local Environment Plans (LEP) and Development Control Plans (DCP) for the strict control of development on any area of land, which could include a floodplain or an entire catchment. One or more councils may make a Joint LEP, and there is no reason why the Armidale and Dumaresq Shire Councils, for example, could not make a special-purpose Catchment Management Plan for Dumaresq Creek in the form of a Joint LEP.

The Local Government Act 1993 further empowers Councils in regard to development control by giving them a general responsibility for environmental management and allowing them to issue "Orders" to control activities which may cause environmental damage or interfere with the flow of water. Most recently, new State policy has required all Councils to make Floodplain Management Plans and Stormwater Management Plans for their areas of responsibility. The Armidale City Council has recently developed and promulgated a Floodplain Management Plan and a draft Urban Stormwater Management Plan is currently under preparation. The provisions of the Floodplain Management Plan have now been incorporated into the Council's LEP, which states *inter alia* that "persons shall not erect a building or carry out work or carry out planting or removal of vegetation on flood liable land unless the council is satisfied that the flood hazard is not increased." The statement goes on to require consideration of many aspects of potential flooding including restrictions to flow, effects on flood levels, pollution effects, and the need to ensure that buildings are structurally capable of withstanding floods and are adequately floodproofed. These controls will ensure that any future proposals for development on or alterations to the creek and its floodplain will be very carefully examined before permission to proceed will be given.

In the light of all the foregoing, what can we say about the various possibilities for creek and creekland improvement or modification that have been canvassed at this meeting? As I have

already indicated, each of them has the potential to aggravate the existing flood behaviour of the creek system, to a greater or less extent.

WETLANDS, WEIRS AND PONDS

Weirs and ponds require the construction of some form of wall or embankment across the waterway and such structures clearly have the potential to cause an increase in flood levels upstream and increase flood duration. Weirs, ponds and wetlands all introduce increased water storage and, depending upon the nature of the wall or embankment used to form them, together with their depth and total capacity, may all affect flood heights and duration, perhaps in some cases beneficially since they can behave as small flood detention storages. The most serious effects of all these structures many be environmental rather than hydraulic - they will certainly act as traps for litter, rubbish and a variety of urban wastes including oil and animal faeces, as well as silt traps. They will therefore need to be carefully designed and maintained so that they can be cleaned out at frequent intervals. Because of the relatively low flows normally available in Dumaresq Creek, the water levels in such structures can be expected to decrease progressively after any flush flow events and to deteriorate progressively also in water quality, so that they may generally be unsuitable for recreational activities such as paddling, canoeing or fishing. To keep them relatively full would require the release of significant quantities of water from Dumaresq Dam, which in turn could be expected to affect very considerably the recreational values of that storage. Those values at the present time are substantial, and could not be duplicated in a series of small ponds along Dumaresq Creek.

PATHS AND BRIDGES

Bridges and other forms of constructed creek crossing might be expected to be obstructions to high flood flows, causing higher flood levels. Their hydraulic effects can be fairly easily investigated, however. More difficult to investigate would be major changes to existing vegetation, both riparian and across the Creeklands floodplain. At the present time there is considerable vegetation, particularly exotic species such as willows and large beds of macrophytes, which act as major obstructions to flood flows and could with advantage be removed or replaced with more appropriate species. The application of so-called "Green Engineering" techniques, which seek to improve streamflow and flood control by the imaginative use of vegetation, might very usefully be applied throughout the urban sections of the creek.

I would not necessarily wish to object to any specific proposals along the lines that have been suggested today. What I would insist upon is that any new developments or changes be in accordance with the LEP and the Floodplain Management Plan and be carefully tested by hydraulic computer modelling before they are allowed to be implemented.