

# Urban floodplain land-use – acceptable risk?

*Allison Godber uses results from her research of potentially flood-affected areas of the Carrara-Merrimac Floodplain (Guragunbah) and the Nerang River catchment to assess “acceptable risk”*

## Abstract

There has been little research to examine how the flood standards adopted as ‘acceptable risks’ by decision makers such as local government (and communicated via a technical language) are interpreted by other stakeholders, and whether the formal standards can be accurately labelled ‘acceptable risks’. This paper presents a study, based on a Queensland local government area – the Gold Coast City Council (GCCC), examining the flood risks perceived ‘acceptable’ by the stakeholders. These stakeholders include local government, the residents and the development industry within a potentially flood-affected urban area of Guragunbah and the surrounding suburbs within the Nerang River catchment.

## Introduction

In Australia, the development of hazard-specific legislation, policy and guidelines aim to minimise community exposure to the adverse effects of natural hazards. This occurs under policies of ecologically sustainable development land-use planning processes, which must also now involve the assessment of hazard-risk. However the development occurring in potentially hazardous environments, for example urban floodplains susceptible to flooding, continues to occur as a result of contemporary land-use planning and risk management processes. Why is this an outcome of past and present risk management and land-use planning processes?

For land-use planning purposes local governments select levels of flood risk or exposure they consider to be ‘acceptable’ for the community and land-use, hereafter referred to as acceptable risk. One example is the 1-in-100-year design flood for residential land that represents a minimum level of flood-risk exposure for residents. However, local governments are not the only stakeholders to make decisions regarding acceptable flood risk. The development industry and residents of the floodplain also decide on a level of flood risk they consider acceptable. How well are the consequences of formal levels of acceptable risk understood by these stakeholders and are they really ‘acceptable’?

## Background

Unlike other Australian States, such as New South Wales, floodplain management in Queensland has traditionally been a local government responsibility. Under current management arrangements, local governments make significant decisions regarding the levels of flood risk other stakeholder groups, such as residents, are exposed to. A State Planning Policy (SPP) specifically related to land-use within hazardous areas such as on floodplains and flood affected land (*Mitigating the Adverse Effects of Flood, Bushfire and Landslide*) came into effect on 1 September 2003. The SPP proposes local government adopt the 1-in-100-year or 1 per cent flood as the defined flood event, representing the minimum level of flood risk and associated consequences residents of a site should be exposed to as shown by Queensland Department of Emergency Services (2003).

## Case study region: Guragunbah and the Nerang River catchment

The area surrounding the Guragunbah urban floodplain, located within the lower catchment of the Nerang River system on the Gold Coast, provides the case study of this research (map 1). The case study area has experienced minor flooding on many occasions during the last 20 years, with moderate to major flooding occurring on three occasions (1912, 1956 and 1974). Population growth during the 1960s and 70s saw the area converted into a variety of land-uses including residential, tourist and commercial development. With the last moderate to major flood occurring in the early 1970s, the majority of development and population growth within the case study area occurred during



*Looking northeast across the floodplain during flooding in 1974 (Photo courtesy of O. Harvey).*



Base map reproduced with the permission of the QLD Department of Natural Resources and Mines; adapted from GCCC (2003).

relatively minor and flood-free periods. The GCCC and former Albert Shire Council carried out a thorough examination of the Nerang River catchment in the early 1990s, resulting in the *Gurruginbah (Carrara-Merrimac Floodplain) Structure Plan* (GCCC, 1998) and the designation of the floodplain as a special development area.

The identification of the floodplain as a special development area, as represented in Gold Coast City Council (2003), has allowed land-use regulations to be applied to other flood-affected areas on the Gold Coast. The management and associated land-use planning regulations established for flood-affected areas suggest the local government has acknowledged the flood hazard situation faced by the city and adopted levels of acceptable flood risk for the community based on their own technical assessments and balancing of the flood hazard and urban land-use. The proactive approach to flood risk adopted by the GCCC provides an opportunity to study an area, acknowledged as hazardous, and examine what flood risks are considered acceptable by the stakeholders (local government, the development industry and residents). This then provides an opportunity to examine how accurately the standards and associated consequences adopted by local government reflect the stakeholders' perceptions of acceptable flood risk.

## The study

Based on Council planning documents (meeting minutes and technical reports) and interviews with stakeholders,

a descriptive model was established to illustrate how the case study Local Government is making decisions regarding acceptable flood risks within a potentially flood-affected area (Gurruginbah and the Nerang River catchment). From the resulting model, it was possible to identify four main stakeholder groups that make decisions regarding a level of acceptable flood risk:

- **Local government** – represented by hydraulic engineers, town planners, statutory planners and local area representatives;
- **Risk managers** – represented by members of the Disaster District Control Group, Local Government Counter Disaster Committee and Flood Strategies Section of the GCCC;
- **Development industry** – represented by major corporate landholders and developers; and
- **Floodplain residents** – represented by households within the residential and commercial developments on the floodplain.

Representatives from each stakeholder group were consulted regarding their perceptions of flood risk; acceptable flood risk; and the consequences associated with the formal standards adopted by local government.

## Methodology

The research findings outlined are based on data collected during 2002 from a sample of 130 randomly selected residential households within the floodplain and 16 representatives from local government and development industry stakeholder groups. The data were collected via structured interviews with representatives from local government and the development industry, and a structured written questionnaire to randomly selected residents in order to specifically measure acceptable flood risk. Three levels of flood risk (minor, moderate and major) were identified for the area, based on the Bureau of Meteorology risk categories (Bureau of Meteorology, 2000), information from the local government, and reports by the local media. The minor, moderate and major flood events were then matched to their corresponding probabilities of occurrence (example minor or 1-in-10-year flood, moderate or 1-in-50-year flood and major 1-in-100-year flood), which allowed the potential consequences associated with the formal standards to be identified.

To examine how the residents who are potentially exposed to flooding interpret formal standards and their associated impacts and consequences, flood risk was presented to each respondent within the floodplain resident stakeholder group in three ways:

1. by standard numerical terms such as 1-in-100-year flood and per cent Annual Exceedence Probability (AEP) – the likelihood that an event of particularly magnitude has of occurring each year) as presented in policy;
2. by scenarios using simple language to describe potential impacts of minor, moderate and major flooding. The severity of the flood was not disclosed

- to respondents to allow the evaluation of probabilities at a later stage; and
- 3. by photographs corresponding to minor, moderate and major flood events in the area. The locations of the photos were identified, but the dates and flood severity were not identified to allow the evaluation of probabilities at a later stage.

The survey questions and the interviews were based around four themes:

- the flood risks that stakeholders perceive to exist;
- the flooding that stakeholders consider to be acceptable;
- how the formal standards of acceptable risk are currently interpreted; and
- stakeholder perceptions of how other stakeholders perceive flood risk.

## Results

The majority of stakeholders acknowledged the potential for flooding on the Gold Coast and within the Nerang River catchment but there were variations in:

- the degree of personal risk or exposure perceived by the stakeholders;
- the flood risks considered acceptable by other stakeholders;
- the way in which land-use standards and flood risk information are interpreted; and
- how the stakeholders perceive each other's perceptions of acceptable risk and responsibilities for flood risk education and mitigation.

## The local government

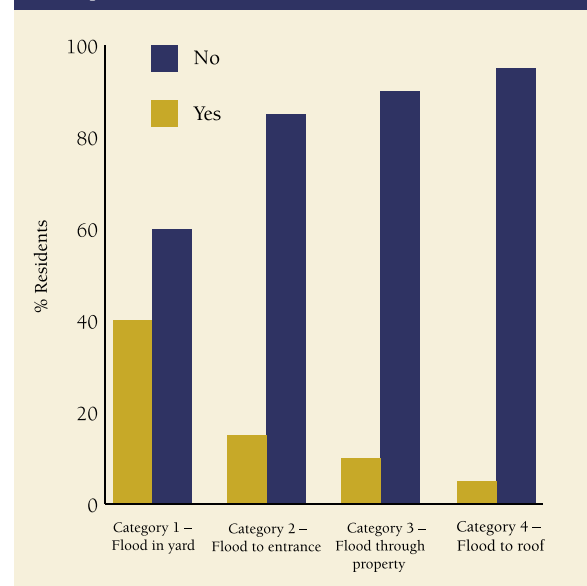
Local government representatives acknowledged the urban flood risk situation on the Gold Coast and recognised the potential for moderate to major flooding within the Nerang River catchment. The risks from flooding, approached from a quantitative perspective, were considered management issues or site-constraints that could be assessed and, to a degree, mitigated. While land-use regulations and development standards can ameliorate the level of immunity land has from specific levels of flooding, the local government acknowledged the risk can never be entirely removed. The 1-in-100-year flood was adopted as the 'design flood event' for the city and the formal standards of acceptable risk for specific land-use such as residential and commercial, were established through a quantitative process modelling local flood behaviour, examined land-use function and the ability of the land-user to evacuate. Local government planners and decision-makers communicate information regarding flood risk and land-use in technical or engineering terms generally accepted within the hydrological engineering and floodplain management sectors. A 'whole-of-community' approach to flooding is adopted by local government, where stakeholders are encouraged to assess their own levels of flood exposure, access available education

material and undertake mitigation. This approach becomes questionable if there are variations in the way flood risk is communicated by the stakeholders and residents do not believe they are at risk from flooding in the first place.

## The development industry

The majority of development industry representatives acknowledged the urban flood risk situation on the Gold Coast and recognised the potential for moderate to major flooding within the Nerang River catchment. Flood risk was approached from a quantitative perspective and as a site constraint that is assessable and can (to a degree) be mitigated. Despite this acknowledgment, some representatives did not consider their development sites to be potentially exposed to flooding, particularly if they considered their land to be elevated above levels specified by the land-use standards. When establishing levels of acceptable flood risk, the development industry representatives follow a process similar to local government and model the potential impacts that specific flood events may have on their sites. Acceptable flood risks were measured and communicated in quantitative terms (the 1-in-100-year flood for residential land). However there was some disagreement surrounding the interpretation of the 1-in-100-year event and whether developing above the flood level associated with this flood can eliminate risk. The development industry representatives considered flooding to be a 'whole-of-community' issue, although some of the interviewees suggested it was not their role to educate residents about flood risk. At the other end of the spectrum it was suggested that if developers had knowledge of the flood history and potential of their site, they had a duty to disclose such information to residents.

**Figure 1. Impact from flooding residents would be prepared to accept at their location**







Looking northeast across the floodplain in 2002 – development today (Photo courtesy of O. Harvey).

## Residents of the floodplain

The majority of residents did acknowledge the potential for flooding on the Gold Coast although they did not consider themselves to be personally 'at risk' and had minimal local flood experience. The residents were generally unaware the area they lived in was a floodplain and did not consider the land-use standards adopted by local government to be acceptable. The impacts from flooding associated with the minor, moderate and major events were presented to the residents graphically in the form of scenarios and photographs. The residents were asked if they would be prepared to accept the potential flood impacts to their properties (see figure 1).

It was possible to equate the residents' responses to the actual flood event probabilities depicted by the photos and scenarios. The residents had difficulty interpreting the technical land-use standards, and were unsure of the impacts and consequences statements such as '1-in-100-year flood' or '1 per cent AEP' represented. The residents were more likely to consider flooding as an acceptable risk when presented this way, as the majority believed a 1-in-100-year flood occurred only once during a one hundred year period. When pictures and scenarios were used to represent the flooding associated with the formal standards, the same risks (example the 1-in-100-year flood) became unacceptable. The majority of residents were unable to recall any land-use planning strategies developed to counter flood risk on the Gold Coast. Local government was perceived as answerable for flooding on the Gold Coast and few residents considered it their responsibility to assess their exposure to flooding, access information or undertake flood mitigation.

## Emerging questions for local government

The results of this study suggest stakeholders external to local government (such as residents and a proportion of development industry representatives) do not necessarily understand the consequences of flooding represented by the formal standards and may misinterpret their level of exposure. The results also signify variations in the flood risks perceived acceptable by the stakeholders, particularly when the potential consequences associated with events such as the 1-in-100-year flood are described. The residents and a section of the development industry misinterpreted the formal standards, particularly when the information is presented via technical expressions (1-in-100-year flood). When presented with flood risks expressed as statements such as '1-in-100-year flood' the stakeholders were willing to accept flood risk. On the other hand, when the potential consequences and impacts of flooding were graphically presented to the stakeholders, the formal standards (1-in-100) were not acceptable. The formal levels adopted by local government, on behalf of the community, may not actually represent acceptable flood risk. In fact, the extent to which the formal standards are misinterpreted suggests stakeholders may potentially be exposed to risks greater than they perceive acceptable.

The results identified a number of significant issues in the development and management of land-use within the floodplain and potentially flood-affected areas. The next stage of the research involves taking the issues outlined back to local government representatives

(GCCC) for comments from a practical perspective. These include:

- **issues regarding the way flood risks are perceived** – many of the residents and some of the development industry representatives underestimated the flood risks they may be potentially exposed to on this floodplain. The residents and some of the development industry representatives believed locating above the flood heights associated with the formal standards (1-in-100) removes all flood risk;
- **issues regarding acceptable levels of flood risk** – the stakeholders underestimate each other's perceptions of acceptable risk. The 1-in-100-year flood did not represent acceptable risk from the perspective of the residents potentially exposed to flooding. A level that is greater than the 1-in-100-year flood should be adopted as the defined flood event for residential land (for example the 1-in-200-year flood);
- **issues regarding land-use planning and management** – the residents were not aware of land-use planning measures and formal standards of acceptable risk (1-in-100). The residents underestimated the consequences associated with the formal standards (1-in-100); and
- **issues regarding who is responsible for education and mitigation** – the residents believed local government is responsible for informing them about any flood risk and taking the necessary action to eliminate risk. The majority of development industry representatives did not consider it their role to educate residents about flooding and believed local government has responsibility for ensuring mitigation. Local government considered education and flood risk mitigation issues that the entire community is responsible for.

## Conclusion

It may be possible for local government to address the issues potentially preventing more effective floodplain management by presenting flood risks graphically (through photos or detailed scenarios that can be directly related to the stakeholder's location) and outlining the consequences associated with formal standards such as the 1-in-100-year event. They could consult with stakeholders regarding acceptable flood risk during the processes to establish formal standards and take flood risk education and mitigation out into the community rather than placing emphasis on the community to access information and mitigate flood risk.

## References

- Bureau of Meteorology. 2000. *Flood Warning System for the Nerang River*. Brisbane: Bureau of Meteorology.
- Gold Coast City Council (2003). *Our Living City – Gold Coast Planning Scheme*. Gold Coast City Council, Gold Coast.
- Gold Coast City Council (1998). *Guragunbah (Merrimac/ Carrara Floodplain) Structure Plan*. Adopted by the City of Gold Coast March 30, 1998.
- Queensland Department of Emergency Services, Department of Local Government and Planning. (2003). *State Planning Policy 1/03 – Mitigating the Adverse Impacts of Flood, Bushfire and Landslide*. Queensland Government Press, Brisbane.

## Author

Allison Godber is a PhD candidate in geography within the School of Humanities and Human Services and Centre for Social Change Research, Queensland University of Technology. She has a background in natural hazard risk perception and has focused on the way in which risk management and land-use planning policy can better reflect community perceptions of risk.

