

Urban Floodplain Land-use – Acceptable Risk?

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Summary

Local Government, for the planning and management of potentially flood-affected areas, adopt formal levels of 'acceptable' flood risk (for example, the-1-in-100 year flood event for residential land). The results of this study suggest stakeholders external to the Local Government (such as residents and a proportion of development industry representatives) do not understand the risks flooding represented by the formal standards and may misinterpret their level of exposure. The results also indicate that variation exists 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 explained. The study raises doubts as to the true 'acceptability' of the formal standards being adopted in floodplain management policy at the Local, State and Federal levels of Government.

Introduction to the Research

The development of 'at-risk' urban flood plain and flood-affected environments continues to occur in Australia despite acknowledgement by hazard managers and land-use planners that there is a potential for flood impacts, as shown by Gillespie (1) and Granger et al (2,3). 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 occupants should be exposed to. However, Local Government are not the only stakeholders to make decisions regarding 'acceptable' flood risk. The development industry and the occupants 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'?

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 study aims to examine the flood risks perceived 'acceptable' by the stakeholders (Local Government, the residential occupants and the development industry) within a potentially flood-affected urban area (Guragunbah and the surrounding suburbs within the Nerang River Catchment).

The questions asked within this study are: Do those stakeholders potentially affected by flooding really understand what the quantified flood risk standards such as the 1-in-100 year flood represents in terms of possible occurrences and impacts? and how do these risk levels compare with what other floodplain stakeholders perceive to be 'acceptable flood risks'? The major outcome of the study will be a model that illustrates how the stakeholders within the case study area perceive 'acceptable' risk. This study will also provide the grounding for a follow-up study, examining the effectiveness of flood education campaigns recently enacted within the case study area.

Background

Floodplain management in Queensland has traditionally been a Local Government responsibility. Under current management arrangements, Local Government 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/ flood affected land – Mitigating the Adverse Effects of Flood, Bushfire and Landslide (1/03) - comes into effect on the 1st of September 2003. The SPP proposes Local Government adopt the 1-in-100-year or 1% flood as the defined flood event, which represents the minimum level of flood risk and associated consequences occupants of a site should be exposed to as shown by Queensland Department of Emergency Services (4).

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 study. The case study area has experienced minor flooding on many occasions during the last twenty 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 comprising 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 has occurred during relatively minor and flood-free periods. The Gold Coast City Council undertook a thorough examination of the Nerang River catchment in the early 1990s, resulting in the Guragunbah (Carrara-Merrimac Floodplain) Hydraulic Master Plan and the designation of the floodplain as a special development area.

The management of the floodplain as a special development area, as depicted in Gold Coast City Council (4), has allowed for the development of land-use regulations that have been applied to other flood-affected areas within 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. There are few guiding principles as to the degree and manner of stakeholder consultation during the process of developing standards of 'acceptable' flood risk, and a lack of research examining how other floodplain stakeholders (the development industry and the floodplain occupants) perceive the formal standards. The pro-active approach to flood risk adopted by the Gold Coast City Council provides an opportunity to study an area, acknowledged as hazardous, and examine what flood risks are considered 'acceptable' by the stakeholders (Local Government, hazard managers, the development industry and occupants). 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, 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 (Guragunbah 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:

- *The Local Government* represented by hydraulic engineers, town planners, statutory planners, pre-application advisors, building certifiers, social planners, and local area representatives;
- *Hazard Managers* represented by members of the Disaster District Control Group, Local Government Counter Disaster Committee and Flood Strategies Section of the Council);

- The *Development Industry* represented by major corporate landholders and developers; and
- *Floodplain Occupants* represented by households residing 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 below are based on data collected during 2002 from a sample of 130 randomly selected residential households within the floodplain and 16 representatives from the local government and development industry stakeholder groups. The data were collected via personal structured interviews with representatives from the local government and the development industry; a study examining flood risk perception within the Nerang River Catchment undertaken by ACNielsen Consulting (5); and a structured written questionnaire administered 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, 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 (e.g., 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.

In order to examine how the residents potentially exposed to flooding interpret the formal standards and their associated impacts and consequences, flood risk was presented in three ways: 1.) The standard numerical terms such as 1-in-100-year flood and % AEP as presented within policy; 2.) By way of scenarios using simple language to describe potential impacts of minor, moderate and major flooding. The severity of the flood was not disclosed to respondents in order to allow the evaluation of probabilities at a later stage; and 3.) 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 in order to allow the evaluation of probabilities at a later stage. The questions for the survey work (excluding the ACNielsen study) and the interviews were based around four themes: (1.) What level of flood risk the stakeholders believe to exist and be exposed to; (2.) What levels of flooding the stakeholders are prepared to accept at their current location and for a variety of land-uses; (3.) How the stakeholders interpret the way in which formal standards of 'acceptable' risk are currently presented; and (4.) How the stakeholders' perceive each other's perceptions of 'acceptable' risk, for example, what flood risks do the residents believe local government and the development industry would accept, what risks do local government believe the residents would be prepared to accept.

Results

The majority of stakeholders do acknowledge the potential for flooding on the Gold Coast and within the Nerang River catchment, however there were variations in: (1.) The degree of personal risk or exposure perceived by the stakeholders; (2.) The flood risks considered 'acceptable' and accepted by other stakeholders; (3.) The way in which land-use standards and flood risk information is interpreted; and (4.) How the stakeholders perceive each other's perceptions of acceptable risk and responsibilities for flood risk education and mitigation.

The Local Government

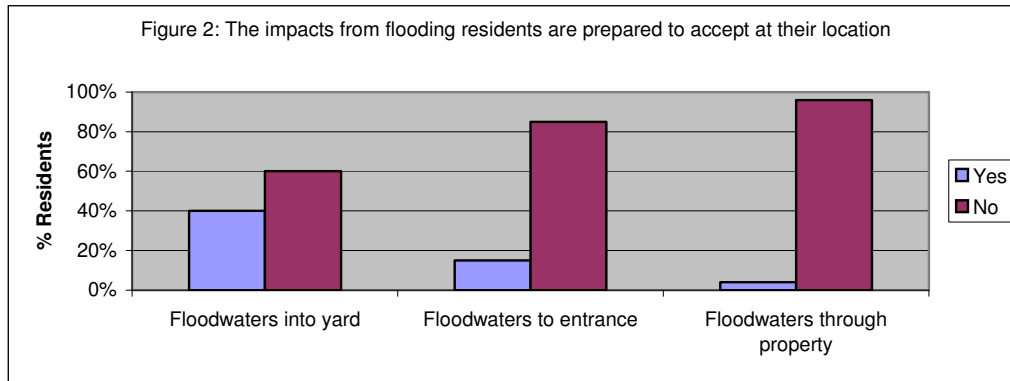
The Local Government representatives acknowledged the urban flood risk situation on the Gold Coast, and recognised the potential for moderate to major flooding within the Nerang River catchment. The risks from flooding, approached from a quantitative perspective, were considered management issues or 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 acknowledge 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 that modelled 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 that are generally accepted within the hydrological engineering and floodplain management sectors. A 'whole-of-community' approach to flooding is adopted by the 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 if the 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, recognising 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 be (to a degree) 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 the local government and model the potential impacts that specific flood events may have to their site. 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 is not their role to educate residents about flood risk. At the other end of the spectrum it was suggested that if the developers had knowledge of the flood history and potential of their site, they had a duty to disclose such information to the residents.

The Occupants of the Floodplain

The majority of residents did acknowledge the potential for flooding within 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 reside in was floodplain and did not consider the land-use standards adopted by the 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 then asked if they would be prepared to accept the potential flood impacts to their properties (see figure 2).



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% AEP' represented. The residents were more likely to be consider flooding to be an 'acceptable' risk when presented this way, as the majority believed a 1-in-100-year flood will occur 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 (i.e., 1-in-100-year flood) became unacceptable. The majority of residents were unable to recall any land-use planning strategies that have been developed to counter flood risk on the Gold Coast and with the local government perceived answerable for flooding on the Gold Coast, few residents considered it their responsibility to assess their exposure to flooding, access information and undertake flood mitigation.

Emerging Questions for Local Government

The results of this study suggest stakeholders external to the 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 was 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'.

From the results it was possible to identify a number of significant issues in the development and management of land-use within floodplain and potentially flood-affected areas. The next stage of the research will involve taking the issues outlined below to back to the local government representatives (Gold Coast City Council) for comments from a practical perspective:

1. **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 believe locating above the flood heights associated with the formal standards (1-in-100) will remove all flood risk.

2. **Issues regarding acceptable levels of flood risk** - the stakeholders underestimate each other's perceptions of 'acceptable' risk. The 1-in-100 year flood does 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.
3. **Issues regarding land-use planning and management** – the residents are not aware of land-use planning measures and formal standards of acceptable risk (1-in-100). The residents underestimate the consequences associated with the formal standards (1-in-100).
4. **Issues regarding who is responsible for education and mitigation** – the residents believe the Local Government is responsible for informing them about any flood risk and then taking the necessary action to remove risk. The majority of development industry representatives do not consider it their role to educate the residents about flooding and believe the local government need to take more responsibility for ensuring mitigation takes place. The local government consider education and flood risk mitigation issues the entire community are responsible for.

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

References

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