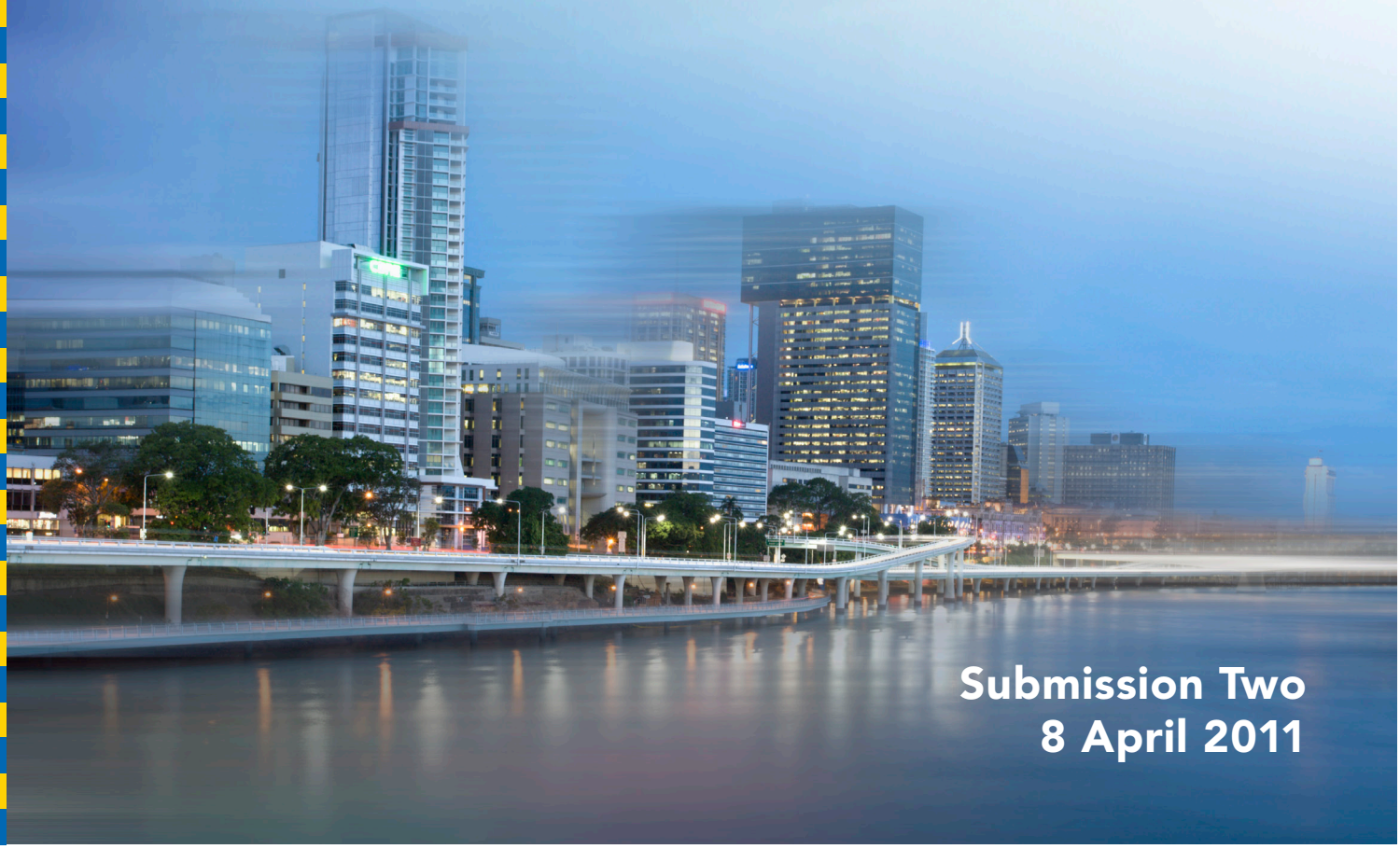
Brisbane City Council

QUEENSLAND FLOODS COMMISSION OF INQUIRY

Dedicated to a better Brisbane



Submission Two
8 April 2011

QUEENSLAND FLOODS COMMISSION OF INQUIRY

BRISBANE CITY COUNCIL SUBMISSION No. 2 - 8 APRIL 2011

Contents

1. INTRODUCTION

1.1 Brisbane City Council (**Council**) provided an initial submission (**Council's Initial Submission**) to the Queensland Floods Commission of Inquiry (**Commission**) on 11 March 2011 relating to Terms of Reference (a), (c), (d) and (e).

1.2 Council, by this further submission, provides information to assist the Commission in its consideration of Term of Reference (g) which relates to "***all aspects of land use planning through local and regional planning systems to minimise infrastructure and property impacts from floods***".

1.3 In addition to this further submission, Council:

(a) has provided the Commission with a copy of the report of Council's Joint Flood Taskforce dated 8 March 2011;

(b) intends to provide the Commission with the findings of Council's Flood Response Review Board which is due to report in May of 2011; and

(c) reserves the right to make further submissions to the Commission.

2. EXECUTIVE SUMMARY

2.1 Council adopts a balanced approach to flood planning decisions. When choosing an ARI for flood planning purposes, a balance must be struck between the costs associated with mitigating the risks of loss of life, injury, property damage and community disruption against the consequences of not mitigating these risks.

2.2 Since 1978, Council has consistently adopted 3.7 m AHD at the Brisbane City Gauge as the basis for planning decisions on flood-prone land.

2.3 The established Q100 and Defined Flood Level (**DFL**) was most recently confirmed in 2003, supported by flood modelling and data available at the time.

2.4 Council's DFL of 3.7 m AHD at the Brisbane City Gauge is a more conservative level than the Q100 as estimated by the Independent Review Panel: Review of Brisbane River Flood Study dated 3 September 2003. The 100 year ARI (Q100) is 3.3 m AHD at the Brisbane City Gauge.

2.5 Residential development receives the highest level of flood protection to reduce the risk of property damage to individual home owners. An additional 500mm of 'freeboard' is added to the DFL for habitable floors. The freeboard allows for a factor of safety, uncertainties and localised effects.

2.6 Council provides free access (through its website) to relevant flood level planning information through:

(a) Floodwise Property Reports for Brisbane River flooding, major creek flooding and storm surge; and

(b) Flood Flag Maps for every suburb in Brisbane City.

2.7 Council's balanced approach to flood risk management is promoted by the accepted best practice for floodplain management in Australia. This best practice recognises that it is not possible nor, indeed, desirable to provide absolute flood immunity by way of planning controls. The residual flood risk cannot be eliminated. Rather, the aim of planning controls is to mitigate or minimise the residual flood risk to an acceptable level.

2.8 After the January 2011 Flood Event, Council established a Joint Flood Taskforce (**JFTF**) which produced a Report on the Event on 8 March 2011.

2.9 The JFTF stated that:

(a) the January 2011 Flood Event was greater than the Defined Flood Event (**DFE**), being the 1974 flood event as mitigated by the Wivenhoe Dam;

(b) the DFE is a theoretical probability-based design flood event, whilst the flood event experienced in January 2011 is an actual observed flood event;

(c) the January 2011 Flood Event is one of many possible events from a large population of flood events that have occurred or could occur in the Brisbane River Catchment from a combination of meteorological, hydrological and hydraulic factors. Observations on these factors during actual flood events are the main source of data and information for the derivation of probabilistic design flood events such as the Q100; and

(d) any flood event will vary in some degree from the theoretical flood model. This is particularly an issue for a large catchment area such as the Brisbane River Catchment where there is a greater chance that the actual events will have variables that exceed the range used in developing the theoretical flood model.

2.10 The JFTF Report made 7 key recommendations (endorsed by Council on 15 March 2011) including:

(a) the use of the actual January 2011 Flood Event as the interim standard for Council's flood planning controls; and

(b) Commissioning of a comprehensive flood study, taking into account the new data from the January 2011 Flood Event, to review flood flows and levels within the Brisbane River.

2.11 Council will be following the recommendations of the JFTF Report.

2.12 A Temporary Local Planning Instrument (**TLPI**) has been prepared which implements the Interim Residential Flood Level (**IRFL**) standard as applying to residential development and commercial basements. This was presented to Full Council on 29 March 2011 where the resolution to propose the TLPI was adopted and is now awaiting State approval.

2.13 This interim position is intended to remain in place until the Commission and relevant comprehensive flood studies are completed. This will allow appropriate development to continue throughout the City in the interim period.

3. GLOSSARY OF TERMS USED

3.1 Definitions

Annual Exceedance Probability (AEP)

The chance of a flood of a given size being equalled or exceeded in any one year, usually expressed as a percentage. For example, if a specified peak flood discharge has an AEP of 1%, this means that there is a 1% chance (i.e. a 1 in 100 chance) of that peak discharge being equalled or exceeded in any one year.

Australian Height Datum (AHD)

The reference level used for defining ground levels in Australia. The level of 0.0 m AHD is approximately mean sea level.

Average Recurrence Interval (ARI)

The long-term (over several thousand years), average number of years between the occurrence of a flood as big as (or larger than) the selected event. For example, floods with a discharge as great as (or greater than) the 100 year ARI design flood will occur on average once every 100 years. ARI is another way of expressing the likelihood of occurrence of a flood event.

Brisbane City Plan 2000 (City Plan)

The Brisbane City Plan 2000 (**City Plan**) is a local planning instrument under SPA and is the planning scheme for the City of Brisbane. City Plan comprises 5 Chapters, 4 Appendices, and a series of maps. City Plan includes statements of general planning intention as well as 'use' specific and 'locality' specific criteria.

Brisbane City Gauge or Port Office Gauge

The Gauge located near the Port Office in Edward Street, Brisbane.

Cumec

A unit of volume flow rate equal to one cubic metre per second, expressed as m^3/s.

Defined Flood Event (DFE)

The flood event adopted for the management of development on the Brisbane River floodplain. State Planning Policy 1/03 states that the 1% Annual Exceedance Probability (**AEP**) flood equivalent to 100 year Average Recurrence Interval (**ARI**) is the Queensland Government's

position on what is an appropriate flood event for the DFE. For the Brisbane River, Council has adopted a DFE greater than the current estimate of the 100 year ARI flood. This was most recently confirmed by Council in 2003.

Defined Flood Level (DFL)

The flood level associated with the Defined Flood Event.

E&C Committee

Council's Establishment and Coordination Committee.

Floodwise Property Report

A free on-line Council report used to inform Brisbane residents and professionals about flood risks for a specified lot or property so that they may better prepare for flooding and plan and build in accordance with Council requirements.

Habitable Floor Level

The level above sea level at which habitable areas of development (generally including bedrooms, living rooms, kitchen, study, family, and rumpus rooms) must be considered.

Hydraulics

The term given to the study of water flow in waterways; in particular, the evaluation of flow parameters such as water level and velocity.

Hydrology

The term given to the study of the rainfall and runoff process; in particular, the evaluation of peak flows, flow volumes and the derivation of hydrographs for a range of floods.

iBIMAP

One of Council's geographic information systems which is used in various applications, including for use by Council's Development Assessment Branch to assist in identifying whether land related to a particular development application is subject to flooding. iBIMAP includes layers showing flood flags, contours and existing storm water drainage.

January 2011 Flood Event

Refers to the flood event experienced by Brisbane, with a peak on Thursday 13 January 2011 of 4.46 m AHD at the Brisbane City Gauge.

Mega-litre (ML)

1,000,000 litres (roughly equivalent to an Olympic size swimming pool).

Q100

This term is used interchangeably with 100 year ARI flood, 100 year flood, 1% AEP flood or 1 in 100 year flood.

SCARM Report

The paper on best practice and guidelines for floodplain management in Australia and New Zealand produced by the Standing Committee on Agriculture and Resource Management (**SCARM**) of the Agriculture and Resource Management Council of Australia and New Zealand.

SEQ Regional Plan

The South-East Queensland Regional Plan 2009-2031.

Subdivision and Development Guidelines (Guidelines)

The Subdivision and Development Guidelines is a Planning Scheme Policy under the City Plan.

3.2 Acronyms

AEP – Annual Exceedance Probability

AHD – Australian Height Datum

ARI – Average Recurrence Interval

BCA – Building Code of Australia

BoM - Bureau of Meteorology

DERM - Department of Environment and Resource Management

DFE – Defined Flood Event

DFL – Defined Flood Level

IDAS – Integrated Development Assessment System

FRL - Flood Regulation Lines

IRFL – Interim Residential Flood Level

JFTF – Joint Flood Taskforce

PMF – Probable Maximum Flood

RPEQ – Registered Professional Engineer of Queensland

SKM – Sinclair Knight Merz

SPP – State Planning Policy

SPP 1/03 – State Planning Policy 1/03: Mitigating the Adverse Impacts of Flood, Bushfire and Landslide

TLPI – Temporary Local Planning Instrument

ToR – Terms of Reference

4. BRISBANE FLOOD PLANNING CONTROLS

Historical Flood Planning Development

4.1 Land use and development within Council's local government area has been regulated since 1924.

4.2 Regulation of development within Council's local government area commenced with the *City of Brisbane Act 1924* (Qld) (now repealed), which continued to regulate development until 1965 when the first Town Plan was approved (**1965 Town Plan**).

4.3 The 1965 Town Plan was prepared in accordance with the provisions of the *City of Brisbane (Town Plan) Act 1959* (Qld) (now repealed) and was the first effective planning scheme for the local government area of Brisbane.

4.4 The 1965 Town Plan included '*Chapter 8, Part 8 - Drainage Problem Areas*', able to be declared by resolution of Council because the land:

(a) is so low-lying;

(b) is so affected, whether frequently or infrequently, by floods; or

(c) is, or forms part of an area which is so difficult or expensive to drain.

4.5 Drainage Problem Areas were areas where it was, in Council's opinion, "*undesirable that any or any further building construction for residential purposes should take place thereon without the permission of the Council*".[1] It was prohibited to do the following in a Drainage Problem Area without the written permission of Council:

(a) erect any building for residential purposes;

(b) change the use of a building from a non-residential purpose to a residential purpose; or

(c) rebuild or enlarge any existing building used for residential purposes.[2]

4.6 In the early 1970s, Council began a process of mapping Flood Regulation Lines (**FRLs**). These FRLs provided a basis for restricting development from occurring too close to floodable

[1] Chapter 8, Part 8, Clause 2, *City of Brisbane Ordinances*, published in the Queensland Government Gazette on 21 December 1965.

[2] Chapter 8, Part 8, Clause 4, *City of Brisbane Ordinances*, published in the Queensland Government Gazette on 21 December 1965.

waterways which would otherwise be subjected to unacceptable risks from flooding and may potentially exacerbate flood levels upstream or downstream of the site. The FRLs were developed as flood studies were undertaken in creeks and waterways across Brisbane. They were set on the requirement that development occurring in the relevant catchment would not increase flood levels by more than 150mm (up to the 1 in 100 year flood) upstream or downstream of the site. Development was generally not approved in areas below the FRL.

4.7 On 13 September 1976, Council's Establishment and Coordination Committee (**E&C Committee**) approved a memorandum of Council's Manager, Department of Health, Parks and Building recommending that the habitable floor levels for dwellings in areas prone to Brisbane River flooding be set at 3.7 m AHD at the Brisbane City Gauge. The E&C Committee adopted 3.7 m AHD for Brisbane River flooding in response to the anticipated mitigating effects of the proposed construction of Wivenhoe Dam. It was estimated that Wivenhoe Dam's then expected flood storage capacity of 1.04 million mega-litres (**ML**) would reduce the size of a flood equivalent to the 1974 flood from about 5.5m AHD to 3.7m AHD at the Brisbane City Gauge.

4.8 Administrative Policy No. AP065 - '*Erection of Dwellings in Flood Prone Areas'* (**Policy AP065**) was adopted by the E&C Committee on 30 October 1978. It adopted 3.7m AHD at the Brisbane City Gauge as the recommended habitable floor levels of dwellings erected in areas prone to Brisbane River flooding.

4.9 On 30 October 1978, the E&C Committee approved a memorandum dated 31 August 1978 from Council's Chief Engineer and Manager Department of Works which recommended that, although the flood storage capacity of Wivenhoe Dam had been increased to 1.4 million ML (and that the Wivenhoe Dam would mitigate a 1974 type flood to 3m at the Brisbane City Gauge), immunity from the 1 in 100 year flood is a 'minimum desirable standard' and the 3.7 m AHD flood at the Brisbane City Gauge be retained as a basis for recommending habitable floor levels of dwellings in areas prone to Brisbane River flooding.

(Attachment 1 – Approval - Erection of dwellings in flood prone areas).

4.10 On 2 December 1978, a new Town Plan prepared by Council in accordance with the provisions of the *City of Brisbane (Town Planning) Act 1964* (Qld) (now repealed) came into effect (**1978 Town Plan**). The 1978 Town Plan introduced two new maps entitled '*Areas Subject to Flooding*' in addition to the zoning maps.

4.11 The two maps show some areas affected by the 1974 floods and provide for a minimum habitable floor level for all development in those areas. In addition, Council had available a

series of 1:10,000 maps and two 1:15,840 maps showing the 1974 flood levels and providing for habitable floor levels for areas subject to flooding.

4.12 The 1978 Town Plan (Part V Areas Subject to Flooding) declared the minimum floor level applicable to an area to be the level in metres above the AHD depicted on Scheme Map ASF/76. Under the 1978 Town Plan, development that could not achieve the minimum floor level applicable to the area became a "prohibited purpose".[3]

4.13 On 5 December 1978, Council adopted the '*Brisbane River Floods – Restriction on Residential Use*' Policy. This policy confirmed the 3.7 m AHD Brisbane City Gauge level required by Council for the floor level of any habitable room and for site access and roads for applications in respect of a subdivision of land for residential allotment. No additional freeboard was applied at this time.

(Attachment 2 – Approval - *Brisbane River Floods – Restriction on Residential Use* Policy).

4.14 Under the 1987 Town Plan, most new detached houses in residential zones were permitted development and did not require town planning consent. In those cases where town planning consent was required for residential purposes, Local Planning Policy 20.07, adopted on 23 June 1987, required the application to show proposed flood levels, ground surface levels (both existing and proposed) and previously recorded highest flood levels in relation to the AHD. This Policy provided that the floor levels of proposed habitable rooms should be indicated as being above the level of flood waters which would achieve a height at the Brisbane City Gauge of 3.7 m above AHD. This Policy also required that where an application for the subdivision of land proposes the creation of residential allotments which would be affected by flood waters achieving a height at the Brisbane City Gauge of 3.7m above AHD, proposed residential allotments should contain sufficient land unaffected by flooding for the erection of anticipated residential buildings

(Attachment 3 – 1987 Brisbane Town Plan Planning Policy 20.07).

4.15 At this time, building applications were lodged with Council but assessed by a building surveyor in accordance with the *Building Act 1975* (Qld). Building applications over land identified as affected by flooding were subject to conditions on floor levels based on the 3.7 m AHD level at the City Gauge.

4.16 The *Local Government (Planning and Environment) Act 1990* (Qld) (now repealed), which applied to Council, specifically required Council to consider, in an application to subdivide

[3] Clause 29 The Town Plan for the City of Brisbane 1978.

land, whether any of the proposed allotments would be unsuitable for use because of existing or possible inundation, amongst other things.[4]

4.17 On 18th October 1994, Council adopted Planning Policy 19.22 – '*Brisbane Waterways*' which introduced wider criteria for assessing development applications in waterways. Planning Policy 19.22 stated that "*approval is unlikely to be granted to build a detached house between the regulation lines...as this would result in an unacceptable risk and would adversely affect the function of the waterway. Instead, every effort should be made to locate the detached house outside the regulation lines. It is best located well clear of any flood-plain or waterway*".

(Attachment 4 – 1987 Town Plan - Planning Policy 19.22 - Waterways).

4.18 In 2000, Council prepared a local planning instrument (City Plan) in accordance with the repealed IPA. City Plan was adopted in late 2000.

4.19 Waterway Corridors are now mapped in City Plan and development within Waterway Corridors is subject to specific development assessment criteria contained in the House Code, the Stormwater Management Code, the Subdivision Code and the Waterway Code.

4.20 The primary legislation currently governing development assessment in Queensland is the *Sustainable Planning Act 2009* (Qld) (**SPA**).

4.21 SPA provides for the making of State planning instruments (e.g. State Planning Policies (**SPP**)) and local planning instruments (e.g. planning schemes and temporary local planning instruments).[5] State Planning Policy 1/03: Mitigating the Adverse Impacts of Flood, Bushfire and Landslide (**SPP 1/03**) was made under the now repealed *Integrated Planning Act 1997* (Qld) (**repealed IPA**) and took effect on 1 September 2003. SPP 1/03 continued in effect under SPA and is taken to be a SPP made under SPA.[6]

4.22 A development application must be assessed against a SPP, amongst other things, to the extent the SPP is not identified in the planning scheme as being appropriately reflected in the planning scheme.[7]

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[4] Section 5.1(3)(b) *Local Government (Planning and Environment) Act 1990* (Qld).

[5] Schedule 3, definitions of State Planning Instrument and Local Planning Instrument *Sustainable Planning Act 2009* (Qld).

[6] Section 773 *Sustainable Planning Act 2009* (Qld).

[7] Sections 313 and 314 *Sustainable Planning Act 2009* (Qld).

4.23 SPP 1/03 requires the identification of natural hazard management areas within which minimising risks to the community should be a key consideration in development assessment and the preparation of planning schemes. Council achieves this outcome through the application of development standards in City Plan, the use of Council's Floodwise Property Reports and the iBIMAP system. Further information on Council's Floodwise Property Reports and the iBIMAP system is detailed at paragraphs 5.12 - 5.13.

4.24 SPP 1/03 sets out the Queensland Government's position that generally, the appropriate flood event for determining a natural hazard management area (flood) is the 1% Annual Exceedance Probability (**AEP**) flood.[8] However, SPP 1/03 also provides that it may be appropriate for a local government to adopt a different Defined Flood Event (**DFE**). SPP 1/03 defines DFE, relevantly, as "*the flood event adopted by a local government for the management of development in a particular locality. The DFE is generally not the full extent of flood-prone land*."

4.25 Planning decisions in relation to flooding are based on the likelihood of a particular flood event. The Average Recurrence Interval (**ARI**) is defined in City Plan as "*the average or expected value of the period between exceedances of a given discharge (or event magnitude)*". An ARI is generally expressed as a certain number of years (e.g. 100, 50, etc) and is a commonly used reference with regard to flooding. The term 'Q100' is used interchangeably with '100 year flood', '100 year ARI flood', '1% AEP flood' or '1 in 100 year flood' and represents a flood event having a 1% chance of being equalled or exceeded in any year.

4.26 From 1996, Council continued to model and review flood levels for the Brisbane River. In 2003, an expert Independent Review Panel (**Independent Panel**) was commissioned for the purpose of reviewing the findings of studies undertaken by Council and its consultants.

4.27 The work of the Independent Review Panel in 2003 is further discussed at paragraphs 7.6 - 7.12.

4.28 By Council resolution dated 2 December 2003, Council:

(a) endorsed the 3 September 2003 Report of the Independent Panel. This Report found that the best estimate of the Q100 flow at the Brisbane Port Office Gauge[9] is 6,000 cumecs;

(Attachment 5 – Independent expert Review Panel Report 3 September 2003).

[8] Annex 3, A3.2, *State Planning Policy 1/03: Mitigating the Adverse Impacts of Flood, Bushfire and Landslide*.

[9] The Port Office Gauge is also known as the Brisbane City Gauge.

(b) determined that the current adopted flood immunity level of 3.7 m AHD at the Brisbane Port Office Gauge[10] is still the most appropriate level, and adopted this level as Council's DFL; and

(c) resolved that there is no need to change current development levels for properties adjacent to the Brisbane River.

(Attachment 6 – 2003 Council Resolution which adopted 3.7 m AHD at the Brisbane City Gauge as the DFL for Brisbane River).

4.29 Levels for development affected by Brisbane River flooding are set in City Plan by reference to the DFL (or, in the House Code, the 100 year ARI). The levels vary with building classification and use (e.g. use of habitable rooms or non-habitable spaces) and reflect a risk management approach to development.

4.30 Residential development receives the highest level of flood protection to reduce the risk of property damage to individual home owners. City Plan therefore requires that an additional 500mm of 'freeboard' be added to the DFL or 100 year ARI for habitable floors. Accordingly, for a residential development at the Brisbane City Gauge the habitable floor level is 4.2 m AHD, being the DFL (3.7 m AHD) + 500mm. The freeboard allows for a factor of safety, uncertainties and localised effects.

4.31 The *Building Regulation 2006* (Qld) (**Building Regulation**) provides that a local government may, in a planning scheme or temporary local planning instrument or by resolution:

(a) designate part of its area as a natural hazard management area (flood); and

(b) declare the minimum level to which the floor levels of habitable rooms, as defined under the *Building Code of Australia*, of buildings on the land must be built.[11]

(Attachment 7 – List of floodable properties declared by resolution under the Building Regulations).

[10] Based on a flow of 6,800 cumecs.

[11] A habitable room is defined in the BCA to mean a room used for normal domestic activities and includes a bedroom, lounge room or kitchen, but excludes a bathroom, laundry, hallway or other space of a specialised nature.

Summary of Position as at January 2011 Flood Event

4.32 *Subdivision and Development Guidelines*

(a) City Plan incorporated the planning scheme policy '*Subdivision and Development Guidelines*' (**Guidelines**) in 2000, with the current version of this planning scheme policy published on 8 February 2008.

(b) The 2000 version of the Guidelines adopted the 100 year ARI for the Brisbane River as 6,800 cumecs and 3.7 m AHD at the Brisbane City Gauge. The current Guidelines continue the DFL at 3.7 m AHD at the Brisbane City Gauge.

(Attachment 8 – Subdivision and Development Guidelines)

4.33 *House Code*

(a) Acceptable Solution A6.1 of the House Code specifies: "*where a lot is subject to a resolution about minimum floor levels of habitable rooms under the Building Regulation, the floor level of all new rooms satisfied the level determined by the resolution*". In accordance with the Building Regulation (previously the *Standard Building Law*), six localities in Brisbane City have been declared and a minimum floor level has been prescribed for habitable rooms.

(b) For land that is not subject to the resolution, Table 1 in the House Code sets the habitable floor level at "*100 year ARI + 500mm*". Consistent with Council's resolution of 2 December 2003, the adopted flood protection level of 3.7 m AHD at the Brisbane City Gauge (as shown in the Floodwise Property Report for a particular property) is applied by Council and private certifiers as the "*100 year ARI*" for assessment against the House Code for Brisbane River flooding.

4.34 *Commercial Development* - City Plan requires that commercial floor levels be 300 mm above the DFL.

4.35 *Industrial Development* - Industrial developments have typically been located on flood plains as flood plains are flat and provide the large areas often needed for industrial uses. Council's approach to planning for industrial development is based on floor levels of the DFL + 300mm or a risk management approach as set out in the Guidelines.

4.36 The Queensland Government's South-East Queensland Regional Plan (**SEQ Regional Plan**), first introduced in 2005, provides a framework to manage growth, change, land use and development in South East Queensland (**SEQ**) to 2031. Brisbane is one of the local government areas subject to the SEQ Regional Plan.

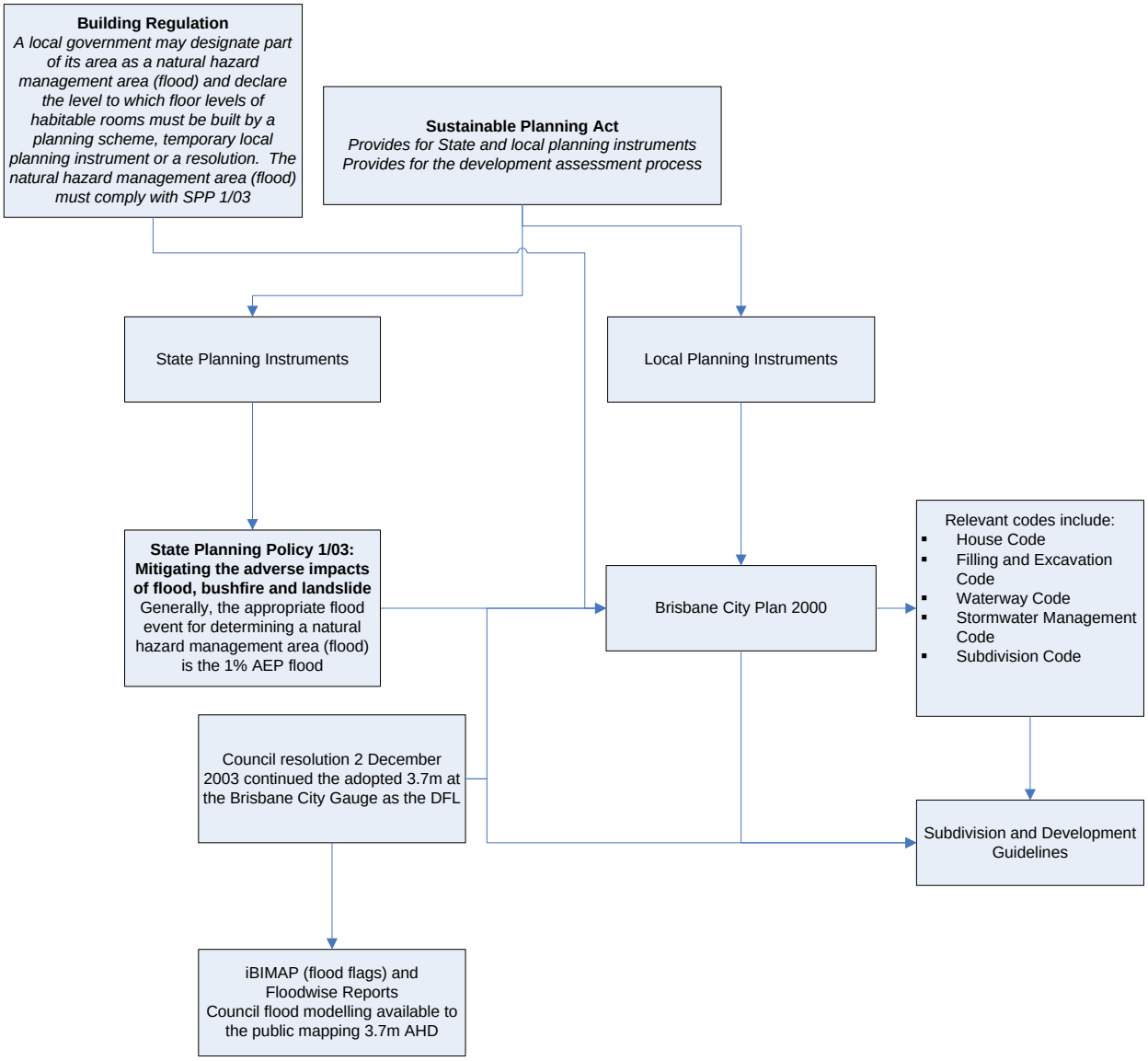
4.37 Under the SEQ Regional Plan, an additional 156,000 dwellings will be required to house Brisbane's expected population by 2031. Most of the dwellings are to be delivered in existing urban areas, with redevelopment and infill to deliver at least 138,000 of these additional dwellings. Broad hectare areas identified for growth (approximately 30,000 dwellings) are Rochedale, Upper Kedron and Lower Oxley Creek. Existing urban areas identified for potential redevelopment and infill development include the Brisbane CBD and surrounding frame areas of Milton, Albion, Newstead River Park, Woolloongabba, Bowen Hills, South Brisbane and West End.[12]

4.38 Council is required to amend its planning scheme to reflect the SEQ Regional Plan.[13]

4.39 *Figure 1* provides a diagrammatic summary of the planning instruments establishing the 100 year ARI and DFL for Council as at the date of the January 2011 Flood Event.

[12] South East Queensland Regional Plan 2009-2031, p17.

[13] s.29(2) *Sustainable Planning Act 2009* (Qld).



* The required floor level is a factor of the development type, DFL or 100 year ARI and the specified freeboard

Figure 1: Outline of instruments establishing the 100 year ARI and DFL for Brisbane City Council

5. DEVELOPMENT ASSESSMENT

Council Structure

5.1 The Water Resources Branch of the City Planning and Sustainability Division of Council is responsible for commissioning the City Design business unit of Council (**City Design**) to produce technical data and reports (such as flood studies) to inform the development of planning policies and guidelines by the City Planning Branch of the City Planning and Sustainability Division of Council (**City Planning**).

5.2 Council's planning policies and guidelines (for example in respect of City Plan) are developed through City Planning. City Planning is responsible for preparing and managing the content of Council's planning instruments and providing high level policy advice. City Planning's responsibilities include:

(a) implementation of the SEQ Regional Plan 2031 relevant to Brisbane;

(b) development and maintenance of City Plan;

(c) preparation and implementation of planning and development policy;

(d) Neighbourhood Planning and preparation of Local Area Plans; and

(e) coordination of infrastructure provision and the preparation of Infrastructure Charges Plans.

5.3 In the development of planning instruments, the impact of flooding is an important consideration.

5.4 Development applications that are lodged with Council are assessed against City Plan by Council's Development Assessment Branch of the City Planning and Sustainability Division of Council (**Development Assessment**). Applications are assessed in accordance with SPA and against the provisions of City Plan and its applicable codes, policies and guidelines.

5.5 Development Assessment personnel includes town planners, engineers, engineering technicians and other specialists such as architects, hydrologists and ecologists.

Process

5.6 Development assessment is carried out in accordance with the Integrated Development Assessment System (**IDAS**) as set out in SPA. IDAS was introduced in 1998 under the now repealed IPA.

5.7 Not all development will be subject to assessment by Council. Self-assessable development is required to comply with applicable codes under the City Plan, but is not assessed by Council.[14] This includes most detached houses (see paragraphs 5.26 to 5.31 for further discussion). Only code and impact assessable developments lodged with Council will proceed through Council's development assessment process. This development triggers relevant codes and is assessed against the flooding requirements of City Plan codes and Guidelines.

5.8 When a development application for assessable development is received, Council's planning and engineering officers in Development Assessment review the plans, drawings and reports submitted with the application to ensure that the development complies with the applicable codes and City Plan, where relevant.

5.9 Council assessment officers are required to prepare a report to Council's Delegate for the particular application (or in some cases to full Council) on whether the development application complies with the requirements of SPA and City Plan. This includes making a recommendation to approve the application subject to conditions or to refuse the application.

5.10 Through the use of City Plan codes and planning scheme policies, assessment officers achieve a consistent approach to the assessment of development applications. Council's nominated Delegate for a particular application signs off on the decision to either approve, approve with conditions or refuse the application. The role of Council's nominated Delegate is to provide an additional layer of consistency in the assessment of development applications.

5.11 Technical Specialists within Development Assessment (for example, specialist hydraulic engineers) are available in-house to assist in the assessment of applications.

5.12 Flood level planning information relating to a specific property is available to the Development Assessment team, and to the public, in the form of Council's Floodwise Property Reports for Brisbane River flooding, major creek flooding and storm surge.

(Attachment 9 – Example Floodwise Property Report).

5.13 In addition to the Floodwise Property Report, Development Assessment officers use Council's geographic information system (called **iBIMAP**), which has layers showing flood flags, contours and existing storm water drainage, to identify whether the land related to the application is subject to potential flooding from the Brisbane River, a waterway, local flooding and/or storm tide. iBIMAP and the Floodwise Property Report are used to assess whether the

[14] Section 574 *Sustainable Planning Act 2009* (Qld).

design levels for lots, roads, pavements and floors specified by the Guidelines or the House Code are achieved.

5.14 Flood Flag Maps show areas potentially affected by flooding from the Brisbane River (to the adopted DFL) and by flooding from storm tides, creeks, waterways (to the 100 year ARI), and overland flow (to the 50 year ARI) . These maps exist for every suburb in Brisbane City. The Flood Flag Maps, along with the Floodwise Property Reports, are freely available to the public on Council's website.

(Attachment 10 – Example Flood Flag Map)

5.15 Historically, flood reports have been available for purchase by residents since the early 1970's and could be obtained by a direct request for information or through a property search. Since 2005, the Floodwise Property Report (in hardcopy) has been free of charge, giving residents a way to find out the flood risk for the place where they live, or where they wish to build, renovate, buy or rent. Depending on the property, the report shows sources of flooding such as the Brisbane River, creek and defined overland flow, predicted flood levels, minimum habitable floor levels and whether a property is located within a waterway corridor.

5.16 In July 2008, in line with improvements in technology and community interest in accessing flood reports, Council launched free online Floodwise Property Reports which are publicly accessible via Council's website www.brisbane.qld.gov.au. Approximately 617,000 Floodwise Property Reports have been downloaded since July 2009.

5.17 A flood study is required as part of development applications to Council for sites potentially affected by flooding and where Council does not have complete flood information (e.g. as in the case of some minor waterways and local overland flow paths as shown in the Flood Flag Maps).

5.18 The flood study must also establish that the development will not increase flooding that affects surrounding properties. Council's '*Compensatory Earthworks Planning Scheme Policy*' applies to these flood studies.

5.19 Council requires flood studies submitted as part of a development application to be certified by a Registered Professional Engineer of Queensland (**RPEQ**).

Development Assessment – Subdivision

5.20 The Subdivision Code is triggered for applications for reconfiguration of a lot (subdivision) that is assessable under City Plan. This includes most subdivisions in residential and industrial areas.

5.21 The performance criteria and acceptable solutions in the Subdivision Code relevant to flooding are as follows:

Performance Criteria	Acceptable Solutions
5.4.1 Flooding	
P1 All lots must be provided with protection of property from flooding, in accordance with an acceptable level of risk as outlined in the **Subdivision and Development Guidelines** *Note: **The Stormwater Management Code** provides additional guidance on flooding issues*	**A1.1** All lots below 1000m² in size are located entirely above the minimum design levels for flood immunity in accordance with Council's **Subdivision and Development Guidelines** **A1.2** All lots equal to or above 1000m² in size have a building platform located above the minimum design levels for flood immunity in accordance with Council's **Subdivision and Development Guidelines** **A1.3** All created lots have unencumbered and unrestricted access from the building platform to road frontages with flood immunity in accordance with Council's **Subdivision and Development Guidelines**

5.22 The Guidelines are 'called up' by the Subdivision Code and/or Stormwater Management Code and are part of the assessment process for development applications for subdivision.

5.23 The Guidelines provide the following flood protection standards for lots for subdivision where there is dedication and opening of a road or where the subdivision creates more than 6 lots:

TABLE A1.1
FLOOD IMMUNITY LEVELS FOR SUBDIVISION

Flooding type (Note 1)	**Minimum lot levels (mAHD)** (Note 4)	
	Residential	**Other than residential**
Brisbane River (Note 2)	DFL + 0.3m	DFL
Waterway[A]	100y ARI + 0.3m	100y ARI
Local flooding[B]	50y ARI + 0.3m	50y ARI
Storm tide (Note 3)	100y ARI + 0.3m	100y ARI

NOTES:

1. Where the site is subject to more than one type of flooding (ie local flooding and/or waterway flooding and/or river flooding and/or storm tide), the minimum flood immunity level is the highest level determined from these sources. It should be noted that the flood immunity level in some older inner city areas is often controlled by local ponding.
2. The Defined Flood Level (DFL) for Brisbane River is based on the 3.7 mAHD level at the Brisbane Port Office Gauge. This standard was adopted by Council on 2 December 2003.
3. A storm tide is the effect on coastal water levels of a storm surge combining with the normally occurring astronomical tide. Storm surge (or more correctly meteorological tide) is a rise above normal water level due to the combined effects of surface wind stress and atmospheric pressure fluctuations caused by severe weather conditions such as tropical cyclone. The 100 year ARI storm tide is 2.5 mAHD. This value incorporates 0.3 m allowance to offset the potential effects of climate change.
4. If no hydraulic modelling data is available, the applicant should engage a suitably qualified Registered Professional Engineer in Queensland (RPEQ) to undertake appropriate hydrologic and hydraulic assessments.

5.24 For other subdivisions, it is required that 60% of the area of each new lot size or a 300m^2 rectangular shaped area (whichever is the greater) achieve the flood protection standards specified in Table A1.1 of the Guidelines.

5.25 The Guidelines also assign flood protection standards based on the building class under the Building Code of Australia (**BCA**) and the flooding type. The Guidelines recommend flood protection standards for particular community infrastructure, however it is noted that often community infrastructure, particularly where developed by the State, is not assessable under City Plan.

Development Assessment – Detached Houses

5.26 The House Code is applicable for development for the purpose of a detached house, whether the development is self-assessable, code assessable or impact assessable.

5.27 Development for a detached house in a residential zone under City Plan is generally self-assessable and does not require assessment by Council if the development complies with the acceptable solutions of the House Code. This development is also assessed under the Building Act and approval is given by a private certifier as assessment manager under the Building Act.

5.28 If development for a house does not comply with the acceptable solutions of the House Code or is otherwise assessable under City Plan, then the applicant must apply to Council for approval. For Council to approve the development, it must comply with the relevant performance criteria or the purpose of the House Code. Once assessment is triggered for any reason, the assessment of the application includes a check on flooding.

5.29 In relation to flooding, the House Code provides (as summarised in paragraph 4.33 above) as follows:

Performance Criteria		Acceptable Solutions	
P5	House must be protected from adverse flooding and must not significantly interfere with the passage, storage or quality of stormwater or the natural functions of a waterway	**A5.1**	House and ancillary structures are not within a waterway corridor (as shown on the Planning Scheme Maps)
		A5.2	Design and construction of the house complies with Council's **Erosion and Sediment Control Standard**
P6	Habitable rooms, non–habitable areas (e.g. utility areas, garage, laundry and storage room) have acceptable levels of flood immunity	**A6.1**	Where the lot is subject to a resolution about minimum floor levels of habitable rooms under the *Building Regulation*, the floor level of all new rooms satisfied the level determined in the resolution OR Where the house is on floodable land but the lot is not subject to a resolution about minimum floor levels of habitable rooms under the *Building Regulation*, the floor level of all habitable rooms is not less than those set out in *Table 1*
		A6.2	Where a lot is on floodable land, the minimum levels for non–habitable areas (including utility areas, garage, laundry and storage room) are not less than those set out in *Table 1*

Table 1 House flood immunity levels

Type of Flooding	Minimum Ground Level for House Pad after filling (where permitted)	Habitable Floor Level	Non–habitable Areas (i.e. utility areas, garage, laundry and storage room)
Brisbane River	100 year ARI + 300mm	100 year ARI + 500mm	50 year ARI + 300mm
Creek or waterway	100 year ARI + 300mm	100 year ARI + 500mm	100 year ARI + 300mm
Localised overland flowpath or designed open channel	50 year ARI + 300mm	50 year ARI + 500mm	50 year ARI + 300mm
Storm surge	100 year ARI + 300mm	100 year ARI + 500mm	100 year ARI + 300mm

ARI means Average Recurrence Interval and is defined in the definitions

Note: where subject to more than one type of flooding, the highest immunity level as determined for each case applies

5.30 As indicated at paragraph 4.33(b), the level of 3.7 m AHD at the Brisbane City Gauge is applied by Council and private certifiers as the "*100 year ARI*" for assessment against the House Code.

5.31 In addition to the House Code, Subdivision Code and the Guidelines there are other Codes relevant to the assessment of the impacts of flooding on development such as the Filling and Excavation Code, the Waterway Code and the Stormwater Management Code. These Codes are all part of City Plan and are available on Council's website at www.brisbane.qld.gov.au.

Draft Flood Code

5.32 In 2007, Council commissioned an investigation into the possibility of incorporating a 'Flood Code' into City Plan. This work was the result of a recommendation from the Lord Mayor's Taskforce on Suburban Flooding (this was discussed in further detail in Council's Initial Submission). Work on the draft Flood Code was initially undertaken by external consultants.

5.33 The prime purpose of the draft Flood Code was to consolidate the various assessment criteria that relate to flooding into a single Code. It was not for the purpose of redefining the DFL or ARI level requirements currently in the Codes or Guidelines.

New City Plan

5.34 Content from the draft Flood Code will be used to inform changes that may be made to the City Plan either as an interim amendment or as part of the new City Plan. Council intends to await any possible recommendations from the Commission prior to finalising the new City Plan.

6. FLOODPLAIN RISK MANAGEMENT

6.1 Floodplain risk management requires the adoption of a balanced approach. Council adopts a balanced approach to flood planning decisions. When choosing an ARI for flood planning purposes, a balance must be struck between the costs associated with mitigating the risks of loss of life, injury, property damage and community disruption against the consequences of not mitigating these risks.

6.2 A balanced approach to flood risk management is promoted by the principles and guidelines set out in the following Commonwealth Government publications:

(a) *Floodplain Management in Australia: Best Practice Principles and Guidelines;*[15]

(b) *Managing the Floodplain;* [16] and

(c) *Benefits of Flood Mitigation in Australia*.[17]

6.3 The following commentary (in paragraphs 6.4 to 6.12) has largely been extracted from the floodplain risk management principles and guidelines outlined in the above publications, which represent best practice in Australia.

6.4 Most of Australia's towns and cities (including Brisbane) are located on floodplains. This is an historical fact, principally for reasons associated with water supply, transportation, waste disposal, advantageous points at river crossings, access to productive soils or recreation purposes. These towns and cities are therefore subject to flooding.[18]

6.5 Floodplain management is inevitably a compromise - trading off the social, economic and ecological costs and benefits of conducting certain activities on the floodplain against the risk, hazard and adverse consequences to these activities caused by flooding.[19]

6.6 Flood risk management options are designed to reduce the flood risk for flood events up to a design flood (the DFE and the associated DFL). There is still a chance that the DFL adopted

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[15] *Floodplain Management in Australia: Best Practice Principles and Guidelines* (The Agriculture and Resource Management Council of Australia and New Zealand, Standing Committee on Agriculture and Resource Management) - SCARM Report 73: CSIRO Publishing, 2000.

[16] *Managing the Floodplain* (Commonwealth Attorney-General's Department, Emergency Management Australia Manual 19, 1999).

[17] *Benefits of Flood Mitigation in Australia* (Commonwealth Department of Transport and Regional Services Report 106, 2002).

[18] *Floodplain Management in Australia: Best Practice Principles and Guidelines*, page 1.

[19] *Floodplain Management in Australia: Best Practice Principles and Guidelines*, page xii.

by a local or state government will be exceeded by larger floods. This is referred to as '*residual flood risk*'. The larger the ARI selected for the DFE (and thus the higher the DFL), the lower the residual flood risk. As an example, if the Q100 is adopted as the DFL, then the residual flood risk will consist of the consequences associated with all the floods larger than the Q100 event, weighted by the probability of their occurrence.

6.7 In general, it is not economically or practically feasible to provide complete flood immunity up to the theoretical Probable Maximum Flood (**PMF**) event. As a result, lesser flood events - i.e. DFEs - are typically adopted for planning and development purposes. This represents a compromise between the level of protection we can afford and the risk we are prepared to take with the consequences of larger floods.[20]

6.8 Unless structural measures are designed to withstand the PMF (and this is generally not cost-effective or socially acceptable), structures will be overwhelmed by a sufficiently large flood at some time in the future.[21] Flood emergency plans are the only means of managing residual flood risk.[22] The community must therefore co-exist with an '*acceptable level of flood risk*', and the concept of affordable risk management must underlie considerations of acceptable levels of risk.[23]

6.9 Mitigating against all flood risk would mean foregoing valuable economic activity that might be compatible with a flood-prone location. Floods exceeding the design flood level are an inevitable source of continuing risk.[24]

6.10 Generally, the 1% AEP flood event has been adopted as the appropriate DFE for most Australian States and Territories.[25] The 1% AEP flood, or the 100 year ARI flood, or the Q100 flood (the terms are interchangeable), is sometimes called the '100 year flood'. This does not imply that 100 years elapses between such floods. While this is true in terms of long-term averages (over several thousand years), it is not true in terms of the immediate future. Thus, it is possible (but unlikely) for '100 year floods' to occur in consecutive years or within relatively short periods. Certainly, there is no guarantee that a 100 year period will elapse between such

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[20] *Floodplain Management in Australia: Best Practice Principles and Guidelines,* page 1.

[21] *Floodplain Management in Australia: Best Practice Principles and Guidelines,* page 8.

[22] *Managing the Floodplain*, page 3.

[23] *Floodplain Management in Australia: Best Practice Principles and Guidelines,* page 4.

[24] *Benefits of Flood Mitigation in Australia* , page 59.

[25] *Floodplain Management in Australia: Best Practice Principles and Guidelines,* page 19.

floods. Even if the 1% AEP floods occurred last year, there is a 1% chance that this flood will occur this year - and in each and every future year.[26]

6.11 The uncertainty of current risk assessments such as the level of a 100 year ARI event is an important source of continuing risk. Because of Australia's short period of records, ARI flood records are frequently revised after major flooding. Existing ARI levels for large floods have large degrees of uncertainty. Even if it is feasible and desirable to mitigate to a PMF design event, it is impossible to be sure that the risk assessment will not be revised.[27] Accordingly, residual risk cannot be completely eliminated.[28]

6.12 In summary, the above literature review demonstrates that it is not possible nor, indeed, desirable to provide absolute flood immunity by way of planning controls. The residual flood risk cannot be eliminated. Rather, the aim of planning controls is to mitigate or minimise the residual flood risk to an acceptable level.

6.13 It is for this reason that Council has invested heavily in community awareness campaigns including the Be Floodwise Campaign, Summer Storm Campaigns and the provision of Flood Flag Maps and Floodwise Property Reports (please refer to Council's Initial Submission for more information).

[26] *Floodplain Management in Australia: Best Practice Principles and Guidelines,* pages 37-38.

[27] *Benefits of Flood Mitigation in Australia*, page 59.

[28] *Benefits of Flood Mitigation in Australia*, page 60.

7. BRISBANE RIVER FLOOD STUDIES

7.1 River and creek flood studies are utilised by Council to determine design flood levels (including the DFL) for use in development planning. Flood studies generally involve the development of sophisticated computer models to estimate rainfall runoff rates and volumes, and anticipated flood levels in the relevant waterway. Data used in the preparation of flood models includes:

(a) detailed ground levels of the waterway's bed, banks and floodplain;

(b) estimates of hydraulic 'roughness' in the waterway (objects or plants that might slow the flow of water) in the waterway; and

(c) design rainfall distributions and various parameters relating to the catchment surface characteristics (e.g. how much development has occurred in the catchment).

7.2 The preparation of flood models commonly includes a calibration process whereby the results of the models are verified against actual/recorded flood levels (where available).

7.3 Flood studies constitute the principal technical foundation from which to determine the flooding characteristics of an area for a range of flood events. For a particular flood event, the maximum flood levels reached at different locations along the waterway are the characteristics of most direct interest to floodplain management. These are related to peak flows experienced at those locations.

7.4 Design flood estimation involves two steps. In the first step, *hydrologic* estimation methods are applied to estimate design flood flows, specifically peak flow rates for given ARIs expressed as cumecs. In the case of the Brisbane River Flood Study, the design flow of specific interest is Q100, the estimated peak flood flow with an ARI of 100 years. In the second step, *hydraulic* methods are then applied to convert the design flood flows into design flood levels.

7.5 It is important to note that the Q100 flood is a *design* flood only. It is used to determine an acceptable risk level for planning development and building purposes as reflected in SPP 1/03. As noted above, floods greater than Q100 will inevitably occur from time to time.

7.6 As noted earlier, the current Q100 for Brisbane River flooding was determined by an expert Independent Panel in a Report dated 3 September 2003.

7.7 The membership of the Independent Panel was:

(a) Professor Russel Mein (Chair) - Former CEO of the Cooperative Research Centre for Catchment Hydrology for Catchment Hydrology and former Chairman of the Australian Rainfall & Runoff Advisory Panel;

(b) Professor Colin Apelt - Former Head of the Department of Civil Engineering, University of Qld;

(c) Dr John Macintosh - Chairman of Engineers Australia National Committee on Water Engineering; and

(d) Erwin Weinmann - Deputy Director of the Cooperative Research Centre for Catchment Hydrology (Monash Node), Senior Lecturer in water subjects at Monash University, and co-author of Book VI of *Australian rainfall and runoff (estimation of large and extreme floods)*.

7.8 The Independent Panel was appointed by Council in July 2003 to provide advice on, and to make an expert assessment of, a study then being conducted by Sinclair Knight Mertz (**SKM**) on the design flood flows and levels in the Brisbane River.

7.9 The Independent Panel found that, based upon the evidence available, the best current estimate for the Brisbane City Gauge is that the Q100 flow is 6,000 cumecs with a corresponding Q100 level of 3.3 m AHD. The Independent Panel was of the opinion that a plausible range for the Q100 flow and level was 5,000 to 7,000 cumecs and 2.8 m to 3.8 m AHD, respectively. The Independent Panel found that this best estimate of Q100, and the corresponding flood levels at the Brisbane City Gauge, provided a sufficient basis for a decision by Council on whether the flood level of 3.7 m AHD adopted by Council (since 1978) was broadly acceptable.

7.10 A decision was subsequently made by Council on 2 December 2003, with the benefit of the Independent Panel's findings, to maintain the DFE at 6,800 cumecs (3.7 m AHD).

7.11 The flow rate of 6,800 cumecs corresponds to the DFE. The DFE for Brisbane River flooding is the actual 1974 flood event as mitigated by the construction of the Wivenhoe Dam. The DFE for Brisbane River flooding reflects a theoretical Brisbane River flood event having a flow of 6,800 cumecs with a resulting DFL measuring 3.7m AHD at the Brisbane City Gauge. The DFL reflects the slope of the flood profile and thus increases in level progressively upstream and decreases downstream from the Brisbane City Gauge. This level was first adopted in 1978 and was most recently reconfirmed in 2003.

7.12 Council's resolution to maintain the DFL at 3.7 m AHD at the Brisbane City Gauge was based on the best available expert evidence at that time. It must be borne in mind, however, that flood study estimates are not precise and are reviewed as new calibration data becomes available from subsequent flooding events. In this regard, the Independent Panel stated in their 2003 Report:

(a) The estimation of Q100 for a catchment the size of the Brisbane River (nearly 14,000 km^2) is a challenging task. The extreme variability of rainfall, the change in catchment response due to the construction of dams, and the variable conditions in the tidal section of the river were some of the factors which complicated the application of 'standard' flood study methodologies.

(b) There is an inevitable degree of uncertainty in any estimates of this kind; in this case heightened by the variable influence of the Somerset and Wivenhoe Dams on different storm events on the Brisbane River catchment.

(c) Design flood estimation is not a simple process of following clearly defined standards and guidelines. It involves a considerable degree of judgment by the investigator.

(d) The distribution of flood events over time is random. There is no clearly discernable or predictable pattern of how flood flow periods occur. Similarly, the magnitude of flood events also varies randomly. It is therefore not possible to predict the actual occurrence of the next flood but only to estimate the average flood frequency, expressed as the average number of years between occurrences of floods of a given magnitude and referred to as the ARI.

(e) The observations from historic flood events provide the main source of information for design flood estimation. Because of the great variability of climate and catchment conditions producing floods, each observed flood event differs from the next one with respect to one or several flood characteristics.

(f) In Australia, the adopted guidelines for design flood estimation are documented in '*Australian Rainfall and Runoff - A Guide to Design Flood Estimation*'. These guidelines are not prescriptive, and in more complex flood estimation situations such as the Brisbane River catchment, they allow for a substantial degree of subjective interpretation by the designer, based on experience and professional judgment.

(g) A substantial degree of uncertainty in flood frequency estimates is inherent from the high degree of variability of hydrological factors producing floods and the limited sample available from the total population of floods.

(h) Additional uncertainty may arise from the following sources of error in the basic data and in the methods of design flood estimation:

(i) systematic errors and inconsistencies in the basic rainfall and water level observations at gauging sites (e.g. for early historical data and very large events);

(ii) uncertainty in the rating curves used to convert water level observations to flow estimates (particularly for large floods and for sites affected by tidal influences);

(iii) errors introduced by the adjustment of flood data for the effects of changes in hydrological and hydraulic catchment conditions (e.g. dams and changes to lower Brisbane River cross-sections);

(iv) uncertainty in the choice of the correct model (distribution) for flood frequency analysis and in the estimation of its parameters; and

(v) uncertainty introduced by simplified representation of catchment characteristics in hydrological models and estimation of model parameters.

7.13 Subsequently, a study on the PMF of the Brisbane River was completed by Council's City Design in 2009. As indicated earlier, the PMF is one of a range of conceptual flood events for a particular catchment and may be considered as the largest flood that could possibly occur and never be exceeded. The reason for this study was to provide information to inform Council's flood emergency response capability up to and including the PMF. It is important to note that this report does not in any way impact or influence Council's land use planning policies and decisions. The flood emergency response tools or key deliverables from this project include:

(a) inundation mapping;

(b) critical infrastructure mapping and reporting;

(c) isolated area mapping; and

(d) evacuation zone mapping.

(Attachment 11 – 2009 PMF Study).

7.14 Council also prepares a range of studies to support flood planning and the management and mitigation of flooding for local areas and creeks.

8. JANUARY 2011 FLOOD EVENT AND JOINT FLOOD TASKFORCE FINDINGS

8.1 After the January 2011 flood event, Council made the decision to establish a Joint Flood Taskforce (**JFTF**) to report within 30 days on the following three questions:

(a) How does the January 2011 flood event compare to the Q100 as presently defined and Council's DFE?

(b) Does Q100, as it is currently described, remain the best estimate of a 1 in 100 year event?

(c) What standard should be used to enable new development and redevelopment to proceed with confidence and certainty?

8.2 Membership of the JFTF is comprised of three groups:

(a) Joint Flood Taskforce:

(i) Chair - Emeritus Professor Colin Apelt;

(ii) Shane Hackett - Acting Manager for Council's Water Resources Branch;

(iii) Quinton Underwood - Senior Engineer Hydraulics, Ipswich City Council. (Ipswich City Council chose to adopt an observer status, providing technical input and were not an approval entity);

(iv) Erwin Weinmann - Senior Lecturer in water subjects at Monash University, Former Deputy Director of the Cooperative Research Centre for Catchment Hydrology (Monash Node), and co-author of Book VI of *Australian rainfall and runoff (estimation of large and extreme floods)*;

(v) Professor James Ball - University of Technology Sydney.

(b) Technical Reference Group: Comprised of Council and external representatives with technical experience in flood management and modelling, and in land-use planning.

(c) Industry Reference Group: Comprised of external representatives who provided advice on the needs of industry to respond to the flood in terms of redevelopment and new development standards.

8.3 The JFTF report was completed on 8 March 2011.

(Attachment 12 – JFTF Report - March 2011).

8.4 The following findings were made in the report:

(a) The peak height at the Brisbane City Gauge of 4.46 m AHD during the January 2011 flood event was less than in 1974 (5.45 m AHD). However, the flood event in Brisbane in January 2011 was reduced by the mitigating effect of Wivenhoe Dam.

(b) On balance, the JFTF considers that the flood runoff resulting from the major rainfall event of January 2011 was greater than the 1974 event but not as great as the 1893 event.

(c) As can be seen by looking at the history of the Brisbane River annual flood peaks dating back to 1840, the January 2011 flood event of 4.46 m AHD at the Brisbane City Gauge is very significant. Prior to the January 2011 flood event, only 6 other events have exceeded 4 m AHD at the Brisbane City Gauge since the 1840s. All of these events occurred prior to the construction of Wivenhoe Dam.

(d) All of the peak flood levels recorded in the January 2011 flood event by the gauges along the Brisbane River were higher than the existing DFL (i.e. the level previously calculated for the 1974 flood event mitigated by Wivenhoe Dam). Therefore, taking into account this fact together with its assessment of the rainfall event, the JFTF considers that the January 2011 flood event was larger than Council's DFE.

(e) The Q100 as presently defined is, in general, a slightly lesser flood than the DFE. Therefore, the JFTF considers that the January flood event was larger than the Q100 as presently defined.

(f) Much more detailed work is required to accurately identify the probability (AEP) of the January 2011 flood event for Brisbane.

(g) The January 2011 flood event has brought a significant amount of new data and information on the nature of flooding in the Brisbane River and about the factors contributing to very large flood events in the catchment. This work is still being completed as the data is still being collected.

(h) In light of the available information about the January 2011 flood event, the JFTF considers it is essential that the current Q100 be reviewed. It is not possible to predict the outcome of such a review, but the JFTF considered it more than likely

the review would lead to an increase in the magnitude of the Q100 and increases in associated flood levels.

(i) The JFTF believes that, in the absence of results of a detailed flood study review, a precautionary approach should be adopted. Therefore, it considers that the actual January 2011 flood event, as observed during the event, should be used as the interim standard on which Council bases its decisions concerning habitable floor levels for new development and should be a consideration for habitable floor levels for redevelopment of existing properties. Wherever the existing DFL is higher than the January 2011 flood event, the JFTF considers the existing higher flood level should prevail.

8.5 The JFTF also commented on the differences between the DFE and the actual flood event experienced in January 2011. The current DFE is a theoretical event that has been in place for the Brisbane River since 1978. The January 2011 flood event was higher than the current DFE by 0.76 m at the Brisbane City Gauge, encompassing an estimated 9,767 additional properties (see page 31 of the JFTF Report). This height difference is amplified as the distance from the river mouth increases (with some local variations), demonstrated by a height difference of approximately 2.05m at Rocklea and Graceville.

8.6 The JFTF noted that before any comparative information is presented it is important to understand the difference between actual observed flood events such as the January 2011 flood event and probability-based designed flood events such as Q100.

8.7 The flood event experienced in January 2011 is an actual observed flood event. It is one of many possible events from a large population of flood events that have occurred or could occur in the Brisbane River catchment from a combination of meteorological, hydrological and hydraulic factors. Observations on these factors during actual flood events are the main source of data and information for the derivation of probabilistic design flood events such as the Q100.

8.8 Best estimates of Q100, or similar probability-based design floods, together with information on the bounds of uncertainty attached to these estimates, form the basis for the selection of the DFE for a specific location.

8.9 As such, any actual flood event will vary in some degree from the theoretical flood model. This is particularly an issue for a large catchment area such as the Brisbane-Bremer catchment. In such large catchments, there is a greater chance that the actual events will have variables that exceed the range used in developing the theoretical flood model.

8.10 In the time available and given the absence of key data which is still being collated, the JFTF was unable to define the probable Q100 for the Brisbane River taking into account the new data arising from the January 2011 flood event.

8.11 The JFTF report was taken to Full Council on 15 March 2011 where the recommendations of the report were endorsed. The report made seven key recommendations which have been summarised below:

(a) The use of the actual January 2011 flood event as the interim standard for Council's flood planning controls.

(b) Gathering of all data relating to the January 2011 flood event from all sources be undertaken and archived.

(c) Measurement of the bathymetry (the shape of river bed and banks) of the Brisbane River and its tributaries and the characteristics of the bed material from Wivenhoe Dam to the mouth is to be undertaken as soon as possible.

(d) Commissioning of a comprehensive flood study to review flood flows and levels within the Brisbane River.

(e) Investigation into the effects of morphological (river bed level and cross section) changes during flood events be studied to determine their effects on flood levels.

(f) Consideration of whether a Monte Carlo (a probability based analysis) approach to the flood risk for the Brisbane Catchment is feasible and, if yes, whether it should be carried out and which influencing factors should be included in the Monte Carlo approach.

(g) Carrying out of a complete Flood Risk Management analysis for the area of Brisbane affected by flooding by Brisbane River and its tributaries.

8.12 Council will be following the recommendations of the JFTF Report. The status of Council's action on the JFTF recommendations, in the order noted above, is:

(a) A Temporary Local Planning Instrument (**TLPI**) has been prepared which implements the Interim Residential Flood Level (**IRFL**) standard as applying to residential development. This was presented to Full Council on 29 March 2011 where the resolution to propose the TLPI was adopted and is now awaiting State approval. The purpose of this TLPI is to apply (where affected by waterway/creek and/or Brisbane River flooding) the IRFL and facilitate the following:

(i) Application of the IRFL.

(ii) Where on standard lots, allow self assessment of detached houses up to 9.5m above ground level (the highest point). This has increased from 8.5m above ground level.

(iii) Change the level of assessment for a house on a small lot to code notifiable where a new house or raising an existing house, and not meeting specified building envelope requirements of the Residential Design - Small Lot Code, and affected by waterway and/or Brisbane River flooding.

(iv) Allow existing houses to be raised or extended with habitable floor levels below the IRFL (plus 500mm) provided that it is built with resilient building design and materials.

(v) Introduce additional requirements for filling and excavation in the House Code.

(vi) Allow for waterway and Brisbane River flooding to be taken into account when assessing maximum building height for a house, Multi-Unit Dwelling or Single Unit Dwelling.

(vii) Identify additional technical standards and requirements to complement those in the Guidelines for properties affected by waterway and/or Brisbane River flooding, including building basements and essential services for residential and commercial development.

(b) With regard to development applications which were, or are currently, going through the development assessment process, Council has sought to negotiate with the applicants an outcome which takes into account the effects of the January 2011 flood event.

(c) Council is providing flood affected residents and business with free pre-lodgement advice to assist residents and business to explore options available for flood recovery. Council is also offering discounted development application fees for flood affected development applicants to ease the financial burden on flood victims.

(d) This interim position is intended to remain in place until the Commission and relevant comprehensive flood studies are completed. Council has accessed unverified rainfall, River Gauge heights and flows and Dam inflows and outflows

from the Department of Environment and Resource Management (**DERM**), BoM and Seqwater. This information has been compared to previous flood events to assess the severity of the event and make recommendations on changes to the standard for basing decisions around development in regard to flood planning levels. Further, Council will continue to collect relevant data as it becomes available and accessible from the DERM, the BoM and Seqwater as necessary to undertake the flood study under recommendations 4 and 6.

(e) To date, Council has contacted the Federal Government, State Government, other local government authorities and Seqwater requesting support and cooperation in the implementation of the JFTF recommendations and seeking funding support for Council's Voluntary Home Purchase Scheme.

(Attachment 13 – Letters from Council - March/April 2011).

(f) Council is beginning to scope out the brief of work required to undertake recommendations 2 to 7 of the JFTF Report and aspects of recommendation 2 of the JFTF Report have commenced.

Colin Jensen

CHIEF EXECUTIVE OFFICER

BRISBANE CITY COUNCIL

List of Attachments

1. Approval - Erection of dwellings in flood prone areas
2. Approval - *Brisbane River Floods – Restriction on Residential Use* Policy
3. 1987 Brisbane Town Plan Planning Policy 20.07
4. 1987 Town Plan - Planning Policy 19.22 - Waterways
5. Independent expert Review Panel Report 3 September 2003
6. 2003 Council Resolution which adopted 3.7 m AHD at the Brisbane City Gauge as the DFL for Brisbane River
7. List of floodable properties declared by resolution under the Building Regulations
8. Subdivision and Development Guidelines
9. Example Floodwise Property Report
10. Example Flood Flag Map
11. 2009 PMF Study
12. JFTF Report - March 2011
13. Attachment 13 – Letters from Council - March/April 2011