SC6.9 Planning scheme policy for the flood hazard overlay code

SC6.9.1 Purpose

The purpose of this planning scheme policy is to:-

(a) provide advice about achieving outcomes in the **Flood hazard overlay code**;

(b) identify and provide guidance about information that may be required to support a development application where subject to the **Flood hazard overlay code**; and

(c) identify guidelines that may be relevant to achieving outcomes in the **Flood hazard overlay code**.

Note—the **Planning scheme policy for development works** also provides advice and sets out information that may be required to support a development application subject to the **Flood hazard overlay code** in relation to the stormwater management.

Note—nothing in this planning scheme policy limits Council's discretion to request other relevant information under the Development Assessment Rules made under section 638(1) of the Act.

SC6.9.2 Application

This planning scheme policy applies to development which requires assessment against the **Flood hazard overlay code**.

SC6.9.3 Advice for floodplain protection, flood and storm tide inundation immunity and safety, building design and built form, essential network infrastructure, essential community infrastructure, hazardous and other materials and flood impacts outcomes

(1) The following is advice for achieving outcomes in the **Flood hazard overlay code**:-

(a) compliance with Performance Outcome PO1 to PO9 of **Table 8.2.7.3.2 (Performance outcomes and acceptable outcomes for assessable development)** of the **Flood hazard overlay code** may be demonstrated in part or aided by the submission of a flood hazard assessment report and a flood hazard mitigation report prepared by a competent person in accordance with **Appendix SC6.9A (Reporting template for flood hazard assessment report and flood hazard mitigation report)**

Note—for the purposes of this planning scheme policy a competent person is a Registered Professional Engineer of Queensland (RPEQ) with appropriate and proven technical experience in the preparation of flood hazard assessment and mitigation reports.

(2) The following is advice for achieving Performance Outcome PO3 and PO5 of **Table 8.2.7.3.2 (Performance outcomes and acceptable outcomes for assessable development)** of the **Flood hazard overlay code**:-

(a) freeboard above the DFE/DSTE or Historical should not apply to ground floor commercial uses where activating the street frontage through direct pedestrian entry to the building from the road reserve;

(b) floor levels should be set above the minimum floor level to the greatest level feasible;

(c) building design should account for the potential need to relocate property prior to a flood event and recover quickly following a flood event;

(d) businesses should ensure that they have the necessary continuity plans in place that:

(i) understand the likely warning time for a flood event;
(ii) define a trigger for action to implement a disaster management plan (flood);
(iii) define necessary asset protection actions, such as relocating stock to a higher location (and the time required to implement);

(iv) define the necessary equipment required for clean-up and return to service and determine from where it will be sourced (based on an understanding that in a regional event demand may limit availability); and

(e) resilient building materials, including those required for wet and/or dry flood proofing, for use within a flooding and inundation area should be determined in consultation with Council, in accordance with the relevant building assessment provisions.

SC6.9.4 Guidance for the preparation of a flood hazard assessment report and flood hazard mitigation report

Flood hazard assessment report

(1) A flood hazard assessment report is to:-

(a) be prepared in accordance with the methodology prescribed in **Appendix SC6.9A (Reporting template for flood hazard assessment report and flood hazard mitigation report)**;

Note— the **Flood hazard overlay code** specifies alternative requirements for matching land use and flood hazard requirements.

(b) include accurate hydrological and hydraulic modelling of the waterway network and assessment of existing flooding and flood levels of major water systems;

(c) include modelling of the 39%, 10%, 5%, 1%, 0.5%, 0.2% and 0.05% AEP flood events and the PMF;

(d) include a qualitative assessment of the piped drainage and hydraulic analysis of the drainage network particularly in relation to the potential for a regional event to cause backflow flooding of the drainage network; and

(e) address the potential impacts of climate change.

Flood hazard mitigation report

(2) A flood hazard mitigation report is to:-

(a) assess the potential impacts of the development on flood hazard;

(b) assess the potential impacts of flood hazard on the development;

(c) recommend strategies to be incorporated into the proposed development to satisfy the outcomes of the **Flood hazard overlay code**;

(d) describe and evaluate the impact of the proposed mitigation strategies on the existing and likely future use of land and buildings in proximity to the proposed development; and

(e) address the following:-

(i) waterways, including bank stability;
(ii) impacts on adjacent properties both upstream and downstream;
(iii) preferred areas and non-preferred areas on site for various activities, based on the probability of inundation and the volume and velocity of flows;
(iv) the use of flood resistant materials and construction techniques able to withstand relevant hydraulic and debris loads where appropriate;
(v) the location and height of means of ingress and egress, including possible flood-free escape routes;
(vi) the location and height of buildings, particularly habitable floor areas;
(vii) structural design, including the design of footings and foundations to take account of static and dynamic loads (including debris loads and any reduced bearing capacity owing to submerged soils);
(viii) the location and design of plant and equipment, including electrical fittings;
(ix) the storage of materials which are likely to cause environmental harm if released as a result of inundation or stormwater flows;
(x) the appropriate treatment of water supply, sanitation systems and other relevant infrastructure;
(xi) relevant management practices, including flood warning and evacuation measures;
(xii) details of any easements or reserves required for stormwater design; and

(xiii) details of detention/retention storages.

(3) The level of detail required for a particular development application should be determined in consultation with Council's engineering and environment assessment officers.

SC6.9.5 Special design requirements

Climate change/variability

(1) Climate change/variability investigations must include tailwater increases that account for a projected sea level rise of 0.8m. A sensitivity analysis must be undertaken using a projected sea level rise of 1.1m to ensure the freeboard is not exceeded.

Levees

(2) Council will not permit the use of levees to satisfy flood immunity standards, for the following reasons:-

(a) there is no guarantee that the levees will remain with the land;

(b) levees are a band-aid solution rather than an intrinsic solution; and

(c) there is possibility that levees can be breached or overtopped in extreme storms, which can lead to an increase in damage and subsequently greater potential for damage.

Basements and carparks

(3) Minimum standards for flood and storm tide inundation immunity for all developments are detailed in **Table 8.2.7.3.3 (Flood levels and flood immunity requirements for development and infrastructure)** of the **Flood hazard overlay code**.

(4) As well as 10% AEP immunity, the 1% AEP flooding of carparking areas must not exceed a depth of inundation of 250mm, a depth x velocity ratio of 0.4m2/s and velocity of 2.0m/s.

(5) Basement carparks can be constructed below the specified levels provided that suitably waterproofed perimeter walls, air vents, and entry/exit ramps at the carpark entrance are above at least 500mm above the 1% AEP flood levels for all flooding sources.

Safety

(6) Flood and storm tide inundation safety can be addressed by either providing effective evacuation routes or incorporating safe refuges within the development.

(7) Developments which become isolated during a DFE and are inundated during a PMF shall be avoided.

(8) An effective access route is defined as follows:-

(a) at least one access route must be safely accessible and trafficable for evacuation purposes during the 1% AEP flood or storm tide event. This is achieved if the crown of the road which forms the evacuation route is at or above the 1% AEP flood or storm tide level;

(b) at least one evacuation route must be provided which enables people to progressively evacuate to areas above the PMF in the face of advancing flood or storm tide waters for events exceeding the DFE. This is achieved if the evacuation route continuously grades uphill from the development site to land not inundated during a PMF; and

(c) accounts for the time required for evacuation and ensures that this is achievable in the time between a DFE being exceeded and the peak of the PMF occurring.

SC6.9.6 Guidelines for achieving Flood hazard overlay code outcomes

For the purposes of the performance outcomes and acceptable outcomes in the **Flood hazard overlay code**, the following are relevant guidelines:-

(a) *Floodplain Management in Australia: Best Practice Principles and Guidelines SCARM Report 73* (CSIRO, 2000)

(b) the *State Planning Policy December 2013* (Department of State Development, Infrastructure and Planning) and *State Planning Policy Guidelines;*

(c) **Stormwater management code** and the **Planning scheme policy for development works**;

(d) *Planning for stronger more resilient floodplains, Part 2, Measures to support floodplain management in future planning scheme* (Queensland Reconstruction Authority, 2012);

(e) *QUDM, Australian Rainfall and Runoff* (IEAust, 1999);

(f) any subsequent revisions or project guidelines from ARR.org.au;

(g) *Guideline for improving flood resilience for new development: A selection of case studies* (Sunshine Coast Council, 2014); and

(h) *Guideline for improving flood resilience for existing development* (Sunshine Coast Council, 2014).

Appendix SC6.9A Reporting template for flood hazard assessment report and flood hazard mitigation report

This reporting template provides supplementary information relating to the **Planning scheme policy for the flood hazard overlay**. The template should be considered in conjunction with this planning scheme policy and the **Flood hazard overlay code**.

Document details and certification

Details of the authorship of the Flood hazard assessment report and flood hazard mitigation report should be provided. The report must be certified an RPEQ with experience in Flood Modelling and Management. An appropriate way to present this information may be in tabular form.

Example:

Report Title:	Flood Hazard Assessment and Mitigation Report for Proposed Maroochy Woods Development, Maroochy Road, Maroochydore
Affected Properties:	
Street Address	15-35 Maroochy Rd, Maroochydore
RP Description	Lots 1,2 & 7 on RP 123456
Prepared For:	Maroochy Development Company Pty Ltd
Date:	7 Sept 2013
Revision No.	3
Report Status:	Draft/Final
Prepared By:	
Name	Bob Jones
Qualifications	BE
Company	Water Consultants Pty Ltd
Phone No.	5555 1234
Certified By:	
Name	John Smith
Qualifications	BE, MSci
Company	Water Consultants Pty Ltd
Phone No.	5555 1234
Industry Accreditation	RPEQ No. 1234
Signature	

Executive summary

The summary provides a brief (1-2 page) overview of the development proposal, the findings and the associated recommendations and conclusions.

Introduction

The introduction should give an overview of the proposed development application and any relevant background information. The scope of studies presented in the report should also be outlined.

It may be appropriate to include a locality plan showing the location of the proposed development site.

Available data

Provide a summary of the sources of data used for the investigation. An appropriate way to present this information may be in tabular form, an example of which is shown below.

At the commencement of any hydrologic investigation, applicants are encouraged to contact Council's Customer Service Centre to determine whether Council holds existing information that may be of relevance. Applicants should be aware of Council's "Hydrologic Data Policy" which applies to any hydrologic information provided by Council. This includes extractions from regional flood models. Please note that fees apply.

The applicant should also contact Council's Customer Service Centre to determine whether historical flood levels are available in the area of interest. Council records such levels along waterways after major flood

events and has a regional network of maximum height gauges. This data may be useful in the calibration of hydraulic models. Example:

Table 1 Source data

Data	Source	Comments
Catchment boundaries	Determined from ALS	
Topographic Information	2008 ALS	
Hydraulic structure details	MSC hydraulic structure reference sheets: • Maroochy Rd Culvert crossing • Smith Rd culvert crossing	
Land use	SCRC Planning Scheme	
Historical flood levels	SCRC Advanced Flood Search Certificate No:12345	Peak flood levels for 1989 flood event
Existing SCRC Flood Studies	Smith Creek Flood Study, June 2003	
Historic Rainfall data	BoM	Daily rainfall, Station No. 040282 Pluviometer data, Station No. 040111
Streamflow data	DNRM Water Monitoring Portal	Daily volumes, Station No. 141003
Design Rainfall Data	BoM	2013 IFD at 4 locations within model extent
Site photographs	Taken by Water Consultants Pty Ltd, 7 July 2005	Site photographs for pre-development conditions

Catchment drainage characteristics

This section provides a general description of the catchment, including how existing catchment naturally drains. The proposal for the developed catchment should be described, clearly articulating how the drainage and overland flow paths within the catchment are intended to change.

It is expected that this section will conceptually describe how the proposed development is to occur in a manner that ensures:-

(a) natural hydrological systems are protected;

(b) natural landforms and drainage lines are maintained to protect the hydraulic performance of waterways;

(c) development integrates with the natural landform of the floodplain rather than modifying the landform to suit the development;

(d) achieving flood immunity for the development minimises physical alteration to the floodplain; and

(e) adequate overland flow paths are provided for all event severities, including those beyond the DFE.

This section of the report should include a plan showing flow paths and the boundaries of relevant catchment areas under existing and developed site conditions.

For ease of checking, plans should be prepared to an appropriate engineering scale (e.g. 1:1000 or 1:5000).

Previous studies

A number of flood investigations have been undertaken of waterways draining the Region. The applicant should contact Council's Customer Service Centre to determine if previous flood investigations have been undertaken in the vicinity of the proposed development. Applicants should be aware of Council's "Hydrologic Data Policy" which applies to any hydrologic information provided by Council. This policy requires applicants to make their own assessment of the applicability of existing studies.

Model setup

Hydrology

Model software

Applicants should undertake hydrologic modelling using industry-accepted software. Council is unable to recommend any particular software, however, checking of results will be expedited if applicants use software currently employed by Council. Details of Council's current hydrologic modelling software may be obtained through the Customer Service Centre.

Details of the adopted model software should be documented in this section, including software version number.

Model setup

Describes detail of the model setup undertaken for the two required catchment conditions:

- Existing conditions (normally before the proposed development); and
- Post-development conditions (Catchment conditions as would exist after the proposed development).

Subcatchment delineation

Provide a plan showing the configuration of the model, in particular the extent of sub-catchments and the location of the proposed development. Discharges at locations of interest should not be obtained from the output at a single sub-catchment.

Where distinct areas of different land use occur within a catchment, the catchment sub-division should reflect land use boundaries wherever possible.

Summary details of the model, such as sub-catchment areas and routing parameters, should be presented in tabular form, in sufficient detail that a model could be developed from the supplied data.

Fraction impervious

The Fraction Impervious should be determined from the land use category for the existing and developed catchments (Refer to **Table 2 (Fracture impervious)** below).

Table 2 Fraction Impervious

Land use category	Fraction impervious (FI)
Road Pavement Area	100%
Commercial and Industrial	90%
Low Density Urban	60%
Rural Residential	15%
Open Space	0%

Catchment lag parameters

The method of calculating parameters for flow routing along links between sub-catchments should be specified.

Hydraulics

Model software

Applicants should undertake hydraulic modelling using industry-accepted software. Council is unable to recommend any particular software, however, checking of results will be expedited if applicants use software currently employed by Council. Details of Council's current hydraulic modelling software may be obtained through the Customer Service Centre.

Model setup

Provide an overview of the method of analysis used to estimate design flood levels.

The two primary considerations in deciding on a modelling methodology are:

- whether a steady or unsteady flow model is required, and
- whether a one or two-dimensional model is required.

A steady flow hydraulic model may be appropriate where the proposed works do not involve earthworks within the DFE extent. Where the proposed works include excavation and/or filling within the DFE extent of flooding an unsteady hydraulic model should be used. The use of an unsteady model allows the impact of changes in floodplain storage on discharges to be assessed.

The need for two-dimensional, rather than one-dimensional, modelling sometimes arises where flow directions are not easily defined, such as across large, flat floodplain areas.

Note that Council has two-dimensional models of the Maroochy and Mooloolah Rivers. Extractions from these models may, at Council's discretion, be made available to consultants, where appropriate and noting that fee's will apply. Contact Councils Customer Service Centre for more details.

Details of the adopted model software should be documented in this section, including software version number.

Inflow points

Provides detail on how the inflows from the hydrological model are integrated into the hydraulic model.

Topography

Provide a plan showing the location and extent of cross-sections, or the arrangement and extent of the two-dimensional grid used in the model. Data used in deriving model cross-sections or the two-dimensional grid should be specified in the source data table (See **Table 1 (Source data)**).

Where two-dimensional grid data (ALS) is used, then a plan must be provided of the difference between pre and post development ground levels.

Structures

Provide a plan showing the location of structures that are included in the hydraulic model setup.

Hydraulic roughness

It must be assumed that waterways will not achieve optimal maintenance. Similarly it is reasonable to assume that flooding can occur towards the end of a maintenance cycle, or in periods of the years when regrowth is particularly aggressive. For these reasons, the design flood level for estimation of floor levels should be set using a conservative (high) Manning's n value, typically 0.15. All riparian areas corresponding to the buffer widths required for waterways and wetlands should be assumed to have a Manning's n value of 0.15. For inundated areas beyond the riparian buffer widths, lower Manning's n values of less than 0.15 must be supported by a landscape plan which confirms plant species, positions and densities and maintenance requirements.

The design of open channels within a development area must be consistent with the requirements of the **Planning scheme policy for development works**.

For assessment of the impact of a development on flood levels and velocities, a representative Manning's n value should be selected based on accepted industry standards, such as Brisbane City Council's Natural Channel Design Guidelines. A sensitivity analysis should be undertaken across the range of likely Manning's n values to assess the effect of channel roughness on flow velocity and flood level impacts.

Boundaries

Provides details on the Boundary Conditions that were adopted in preparation for model calibration.

Floodplain storage

The **Flood overlay code** has a strong intent to ensure that floodplain storage below the DFE is preserved. It is anticipated that in some instance compensatory earthworks will be an essential component of providing a flood solution for a development site. In such instances, earthworks that compensate for on-site fill must maintain their storage function in all circumstances. That is, they cannot fill with water, or any other material, and lose their flood storage capacity.

This section therefore is required to discuss how the proposed development will not directly, indirectly or cumulatively alter the flooding characteristics external to the development site for all flood events up to and including the DFE, based on current climate conditions and with climate change\variability allowances.

Calibration

Calibration events

Where suitable data exists, the hydrologic model should be calibrated to match recorded flow events, or discharges from an existing Council flood study. Flows should also be entered to the hydraulic model to ensure that levels are also matched.

Where a model is calibrated to recorded data at another location substantially downstream of the area of interest, a check should be made that the model produces reasonable discharge estimates at the location of interest.

Rational method calibration

In the absence of available data for event calibration, the predicted design peak discharges should be compared with the results of Rational Method calculations. The appropriateness of adopted model parameters for urban and non-urban areas should be confirmed by checking model results against the Rational Method at a location with homogenous land use upstream.

That is, non-urban model parameters should be checked at a location with no urban development upstream. Urban model parameters should be checked at a location where the whole upstream catchment is developed. This approach ensures that changes in the timing of runoff along different model branches do not distort the calculated impact of urbanisation

Results of Calibration

Commentary should be provided on the quality of the calibration and the confidence in the calibrated model for design flood estimation. The quality of the calibration should be informed by some form of goodness of fit qualification, between modelled and observed flood data.

The parameters derived from the calibration of the hydrologic and hydraulic models should be clearly tabulated in this section of the report.

Design flood events

Hydrology methodology

Temporal patterns

The rainfall hyetograph for design storm events should be obtained using Duration Independent Storm (DIS) Methodology.

The DIS temporal pattern is recommended for the consideration of design peak water levels. Where volume is an important consideration, temporal patterns extracted from significant historic events within the region should be considered. Contact Council's Customer Service Centre for further information.

Design loss rates

Design loss rates from a relevant regional flood may be available from Council. Contact Council's Customer Service Centre for assistance.

Where the available event calibration data support design loss calibration to flood frequency information, a proportional loss approach is preferred in conjunction with the DIS temporal pattern. This loss should be reduced log-linearly between the calibrated value at the 1% AEP to 0 at the AEP of the probable maximum precipitation (PMP).

Design rainfall estimates

Bureau IFD estimates

Design rainfall intensity frequency duration (IFD) data should be obtained for the catchment from the Bureau of Meteorology. For larger catchment, spatial variability in the design rainfall across the catchment should be considered. Bureau IFD estimates should be limited to the 1% AEP.

Probable Maximum Precipitation (PMP)

The Bureau of Meteorology provides two methods of PMP estimation relevant to the SEQ region. Generalised Short Duration Method (GSDM) and the revised Generalised Tropical Storm Method for longer durations. Both methods require determination for use with the DIS temporal pattern methodology.

Intermediate AEP design rainfall estimates (0.2%, 0.05% AEP)

Design rainfall depths at intermediate AEPs can be estimated using the methods of ARR87 Section 13.5.4 (Flood Frequency Curve Interpolation Based on Shape Factors). Alternatively FORGE estimates can be used but may require adjustment to ensure consistency where Australian Rainfall and Run off (ARR) 2013 Bureau IFD estimates have been used for design rainfalls up to the 1% AEP.

Climate change/variability allowances

A climate change/variability rainfall allowance is to be adopted as per the guidance of Schedule 3 of the Planning for stronger, more resilient floodplains, Part 2 (QRA, 2012). This recommends a 20% increase in rainfall intensity at year 2100.

A climate change/variability allowance of 0.8m at 2100 should be adopted for sea level rise. Additionally the sensitivity of a 1.1m increase should also be tested to ensure that freeboard is not exceeded.

Validation

Where calibration has occurred using historic events, it is appropriate to validate the peak design discharges from the hydrological model against Rational Method estimates. The calculations must be presented in sufficient detail to show how each term in the Rational Method has been derived.

Runoff coefficient

Values of the runoff coefficient for a 10% AEP event may be obtained from QUDM. Runoff coefficients for other AEP events may be calculated using the Frequency Factors from QUDM.

Time of concentration

Time of concentration should normally be calculated using at least two components of travel time. In a rural catchment these would usually be an overland flow component and a channel flow component. Overland flow time may be calculated using Friend's Equation. The Bransby-Williams Equation should NOT be used. In a rural catchment channel flow times may be estimated from QUDM and/or Manning's Equation.

In an urban catchment, Standard Inlet Times, from the version of QUDM current at the time of design, should be used to calculate the time for flow to reach the inlet of the pipe drainage system. For urban catchments channel flow time may be calculated using QUDM and/or Manning's Equation.

Detail the calculated discharges for event AEPs including: 39% AEP (Q2), 10% AEP, 1% AEP, 0.2% AEP, 0.05% AEP and the PMF.

Where another regional estimation tool is available, it may be used as an alternative validation method, with appropriate justification.

Hydraulics methodology

Design boundary conditions

Design boundary conditions should be sought from Council in the first instance to ensure integration with the wider regional model, where appropriate.

Where Council is unable to provide boundary conditions, it is the responsibility of the applicant to determine appropriate boundary conditions for the hydraulic model. These will depend upon the configuration and extent of the model. Typically, the downstream boundary condition is based on:

- normal flow depth;
- an analytically-derived rating curve for a downstream hydraulic structure, such as a culvert crossing, or
- a tailwater level from the receiving water, such as a tide level or design flood level in a downstream waterway.

In calculating normal flow depth, an appropriate bed slope should be determined from a longitudinal profile over a sufficient channel length to be representative of the reach of interest. The calculated bed slope should be checked against values obtained from topographic maps to ensure that the results are consistent.

It may be necessary to consider coincident flooding. This occurs when the location of interest is potentially affected by local and regional waterways with significantly different hydrologic response times (such as a small creek discharging into a major river) one rainfall pattern will produce floods of different recurrence interval in each system. These differences are automatically taken into account by simulating the hydrologic response of the entire catchment and estimating flood levels using an unsteady hydraulic model. However, where a steady-flow approach is appropriate, it may be necessary to consider combinations of local and regional events of different magnitudes.

In the absence of more detailed information, suitable event combinations, based on the ratio of the local to regional catchment area, may be obtained from **Table 3 (Event combinations for local and regional flooding)**. The 1% AEP flood level is the highest level resulting from:

- the smaller magnitude flood in the local system combined with the larger magnitude flood in the regional system; and
- the larger magnitude flood in the local system combined with the smaller magnitude flood in the regional system.

Hydraulic impacts of development should be considered for both cases.

Alternative event combinations may be acceptable with appropriate justification.

Table 3 Event Combinations for Local and Regional Flooding

Ratio of Local to Regional Catchment Area (A_L/A_R)	Event Combinations to Define 1% AEP Flood Level
< 0.001	39% AEP (Q2) + 1% AEP
0.001 – 0.01	18% AEP (Q5) + 1% AEP
0.01 – 0.1	5% AEP + 1% AEP
0.1 – 0.2	2% AEP + 1% AEP
> 0.2	1% AEP + 1% AEP

For determination of peak 1% AEP flood levels, the minimum downstream water level may be available from Councils Regional Flood Model, including for tidal reaches of estuaries. This data can be obtained by contacting Council's Customer Service Centre.

Where the development area is only a portion of the local catchment area (i.e. the local catchment area is the entire catchment area of the tributary to the point where it discharges to the regional water course), then the modelling for the development area must include the entire local catchment area and adopt the 1% AEP rainfall over the local catchment area.

Bridge and culvert blockages

Design blockage assumptions for bridges and culverts should be consistent with the guidance of QUDM 2013 (Section 7.5.2 and 10.4.10) or Australian Rainfall and Runoff, Project 11, Blockage of Hydraulic Structures (IEAust, 2013)

Design event results

Existing catchment

Provide mapping for the pre-development catchment condition of WSL, depth, velocity and hazard (using the methodology of the Floodplain Management Guidelines of Australia). This mapping should be provided for the following events: 39% AEP (Q2), 18% AEP (Q5), 10% AEP, 1% AEP, 0.5% AEP, 0.2% AEP, 0.05% AEP and the PMF

Comparison of design event results with historic observation

Where historic observations are available within the catchment of interest, the probability of the historic event should be notionally considered in relation to the design flood levels. Where the historic information indicates a degree of confidence in the design flood levels, this should be documented. Similarly where the historic information does not indicate agreement, documentation should be provided to explain why the difference is accepted.

Developed catchment

Provide mapping for the developed catchment condition of WSL, depth, velocity and hazard (using the methodology of the Floodplain Management Guidelines of Australia). This mapping should be provided for the following events: 39% AEP (Q2), 18% AEP (Q5), 10% AEP, 1% AEP, 0.5% AEP, 0.2% AEP, 0.05% AEP and the PMF.

Impacts of development (afflux)

Provide afflux mapping (water level difference between the pre-development and post-development) for the following events: 39% AEP (Q2), 18% AEP (Q5), 10% AEP, 1% AEP, 0.5% AEP, 0.2% AEP, 0.05% AEP and the PMF.

There should be no offsite impact. Water levels and velocities beyond the development site boundary should be unchanged between the pre and post development conditions. Numerical inaccuracies in the modelling process are accepted to 10mm (depth) and 0.5% (velocity).

Consideration of flood consequence

Discuss how flood consequences are managed by the design of the development. In particular consider whether:-

(a) essential network infrastructure within a site (e.g. electricity, water supply, sewerage and telecommunications) maintains effective function during and immediately after flood and storm tide inundation events;

(b) building materials used have high water resistance and will improve the resilience of a building during and after a flood or storm tide event. (Council can provide further guidance materials: Flood Resilience Implementation Guideline for New Development);

(c) community infrastructure is able to function effectively during and immediately after flood events;

(d) development does not compromise the safety of people resulting from flooding, including the residual flood or storm tide inundation risk associated with events exceeding the DFE or DSTE. Is a direct route to enable progressive evacuation to safe refuge above the level of the PMF available? Is there enough time required for evacuation been calculated and is there enough time between the DFE being exceeded and the peak of the PMF?;

(e) warning times are likely to be less than 24 hours;

(f) development ensures that public safety and the environment are not adversely affected by the detrimental impacts of floodwater on hazardous materials manufactured or stored in bulk during the DFE or DSTE;

(g) car parks achieve flood immunity for the 10% AEP and limit the extent of flooding at the 1% AEP to 250mm, velocity to 2.0m/s and depth x velocity ratio to 0.4m^2/s;

(h) basements are provided waterproofed perimeter walls, air vents and entry/exit ramps that are at least 500mm above the 1%AEP flood level;

(i) driveways that with a downhill slope have a raised entry ramp from the roadway, as per the requirements of QUDM to contain flood flows; and

(j) backflow flooding of the local stormwater network from a regional event will be problematic under current or future climatic conditions.

Flood mitigation infrastructure

Flood levees

Flood levees are not considered an acceptable flood mitigation solution for the design of new developments.

Design of detention basins

Detention basins, if required, should be designed in accordance with the QUDM. The DIS temporal pattern is not recommended for detention basin design. Where QUDM requires the consideration of alternative

temporal patterns derived from significant historic regional events, these can be obtained from Council. Contact Council's Customer Service Centre for further information.

Where the outflow from a detention basin is potentially affected by backwater, this should be taken into account in developing the rating curve for the detention basin outlet.

Since the long-term maintenance of any air gap for stormwater detention cannot be guaranteed, rainwater tanks should be regarded as having no impact on stormwater detention.

Sensitivity of flood mitigation infrastructure design assumptions

Where flood mitigation infrastructure has been included as part of the design, consider the sensitivity of the design assumptions adopted and how this may impact on future maintenance. For instance, where a detention basin is included, demonstrate the impact of a prior 5% AEP storm on the initial level. Where practical, design such basins to drain to normal operating level within 24hrs. Similarly provide some guidance on the impact of sedimentation on detention basins and assess the loss of flood storage after a period of 15 years. Demonstrate through mapping the impact this has on flood levels and flood immunity of properties.

Maintenance

Sensitivity of waterway vegetation conditions

Demonstrate, supported by mapping provided in Appendices, how the conveyance of waterways might be affected by hydraulic roughness assumptions that represent a "just maintained" condition.

Velocities of this condition should be checked to ensure that scour of the channel will not occur.

Sensitivity of blockage assumptions for bridges and culverts

Demonstrate, supported by mapping provided in Appendices, how the flood levels and velocities might be affected by 0%, 50% and 90% blockage scenarios. Comment on the impact downstream where lower blockages are assumed and impact upstream where higher blockages are assumed.

Conclusions and recommendations

This section should summarise the main findings of the report and make any recommendations arising from these findings.

Recommended lot levels and floor levels

The minimum lot and habitable floor level requirements of the Planning Scheme differ with the type of development. **Table 8.2.7.3.3 (Flood levels and flood immunity requirements for development and infrastructure)** of the **Flood hazard overlay code** provides the specific requirements for setting minimum floor level based on the type of development.

Qualifications and limitations

Detail any specific qualification and limitations that are relevant to the methodology, conclusions or recommendations of the report.

References

Provide a list of documents referred to in the study. Where a reference document is not widely available a copy of the document or the relevant section should be included as an Appendix.

Appendix A: Lot table information

As this information is also required in a tabulated electronic format for upload in to Council systems, an Excel template can be obtained from Council. Please contact Council's Customer Services Centre. This information will be provided on Council Flood Certificates until such time as Council is able to revise and re-run the regional flood model with ALS that represents the developed catchment.

The detail from this spreadsheet should also occur in this Appendix and follows the format.

General Notes and Assumptions

Column 1: Lot number
Column 2: Developed DFE level (Riverine)
Column 3: Developed DFE level (Drainage)
Column 4: Minimum floor level
Column 5: Minimum building pad level
Column 6: Stage number
Column 7: Survey plan number
Column 8: Comments specific to lot.