Planning Scheme Policy
Flood Hazard, Coastal Hazard and Overland Flow

Planning scheme policy – Flood Hazard, Coastal Hazard and Overland Flow

Adoption
Moreton Bay Regional Council adopted this planning scheme policy on 24 November 2015.

Commencement
This planning scheme policy will take effect from 1 February 2016.

1. Introduction

1.1 Preliminary
This planning scheme policy supports the Moreton Bay Regional Council planning scheme and has been made by Council in accordance with Chapter 3, Part 4, Division 2 and Part 5, Division 1 of the *Sustainable Planning Act 2009*.

1.2 Purpose
The purpose of this planning scheme policy is to provide for the following:

a) guidance for the preparation of technical reports required to assist in the assessment of proposed development on land in the Flood hazard overlay, Coastal hazard overlay and Overland flow path overlay for natural hazards which include the following:
   - Structural Engineering Design Report;
   - Site Based (Localised) Coastal Engineering Report;
   - Site Based (Localised) Flood Report;
   - Site Based (Localised) Overland Flow Report;
   - Drainage Master Plan; and

b) advice on filling requirements when the premises is in both the Flood hazard overlay and the Coastal hazard overlay;

c) the Drainage Master Plan adopted by the Council for a Drainage investigation area identified on Figure 8.2.2.1 – 8.2.2.10 of the Flood hazard overlay code which state design standards for the development of premises included in the General residential zone – Next generation neighbourhood precinct or General residential zone – Urban neighbourhood provided in the Drainage investigation area.

1.3 Application
This planning scheme policy applies to assessable development where subject to the Flood hazard overlay code, Coastal hazard overlay code and Overland flow path overlay code assessment criteria.

1.4 Interpretation
Terms used in this planning scheme policy are defined in Schedule 1 – Definitions of the planning scheme. Where a term is not defined in Schedule 1, section 1.3 Interpretation of the planning scheme applies.

2. Risk Management Approach
Council has adopted a risk-based approach to managing flooding and coastal related risks that accords with the international standard AS/NZS ISO 31000:2009. This approach establishes a four (4) step process to risk assessment, as follows:

1. Risk identification;
2. Risk analysis;
3. Risk evaluation; and
4. Risk treatment.

Stage 1 involved the identification of the nature and extent of flood and coastal hazards by undertaking an extensive suite of technical investigations, covering both catchment flooding and storm tide inundation. The entire local government area is captured by these investigations.

Stage 2 involved the preparation of Risk Management Studies for both riverine/creek flooding and storm tide inundation which have analysed the risk associated with a range of events. In accordance with AS/NZS ISO

31000:2009, risk is defined as the combination of likelihood of occurrence of an event and the consequence if the event occurs. For these studies, likelihood is interpreted as the frequency of the flood or storm tide event, while hydraulic hazard categories were used to define the flood behaviour characteristics, which provide an indicative measure of the consequences of flooding and inundation.

Stage 3 involved the determination of acceptable, tolerable and intolerable risks, while Stage 4 involved the implementation of risk treatment measures that will reduce risks from a tolerable or intolerable level down to a level considered acceptable to Council and the community.

Council has adopted the following risk categorisation consistent with the State Planning Policy – State Interest Guideline: Natural Hazards Risk and Resilience (August 2014) –

- **Acceptable risk** – A risk that, following an understanding of the likelihood and consequences, is sufficiently low to require no new treatments or actions to reduce risk further. Individuals and society can live with this risk without feeling the necessity to reduce the risks any further.
- **Tolerable risk** – A risk that, following an understanding of the likelihood and consequences, is low enough to allow the exposure to continue, and at the same time high enough to require new treatments or actions to reduce risk. Society can live with this risk but believe that as much as is reasonably practical should be done to reduce the risks further.
- **Intolerable risk** – A risk that, following an understanding of the likelihood and consequences, is so high that it requires actions to avoid or reduce the risk. Individuals and society will not accept this risk and measures must be put in place to reduce risks to at least a tolerable level.

  For the purpose of this document and alignment with State Government terminology, unacceptable risk is considered to also be intolerable risk.

Figures 1 and 2 demonstrate the derivation of hydraulic hazard categories, which relate to the depth and velocity of flood waters for flood (river and creek) and storm tide events, respectively. The river and creek hydraulic hazard categories H1-H5 were derived from the Newcastle Concept Flood Planning Report (BMT WBM, 2009), which is modified from Floodplain Management in Australia (CSIRO, 2000) and the NSW Floodplain Development Manual (NSW Government, 2005). The storm tide hydraulic categories H1-H5 were derived by GHD (2012) based on the potential impacts of combined wave action and storm surge.

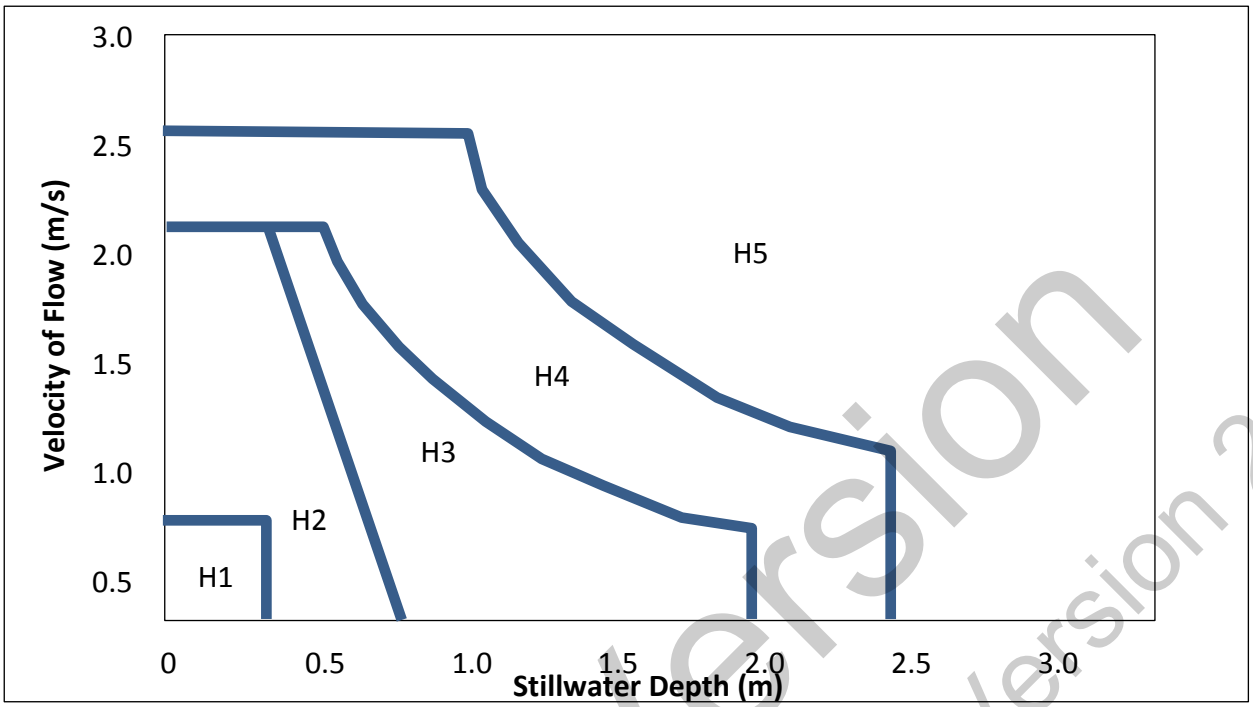


Figure 1 Hydraulic Hazard Categorisation (Flood)

Source: BMTWBM "Newcastle Concept Flood Planning Report 2009" and Molino Stewart, 2013

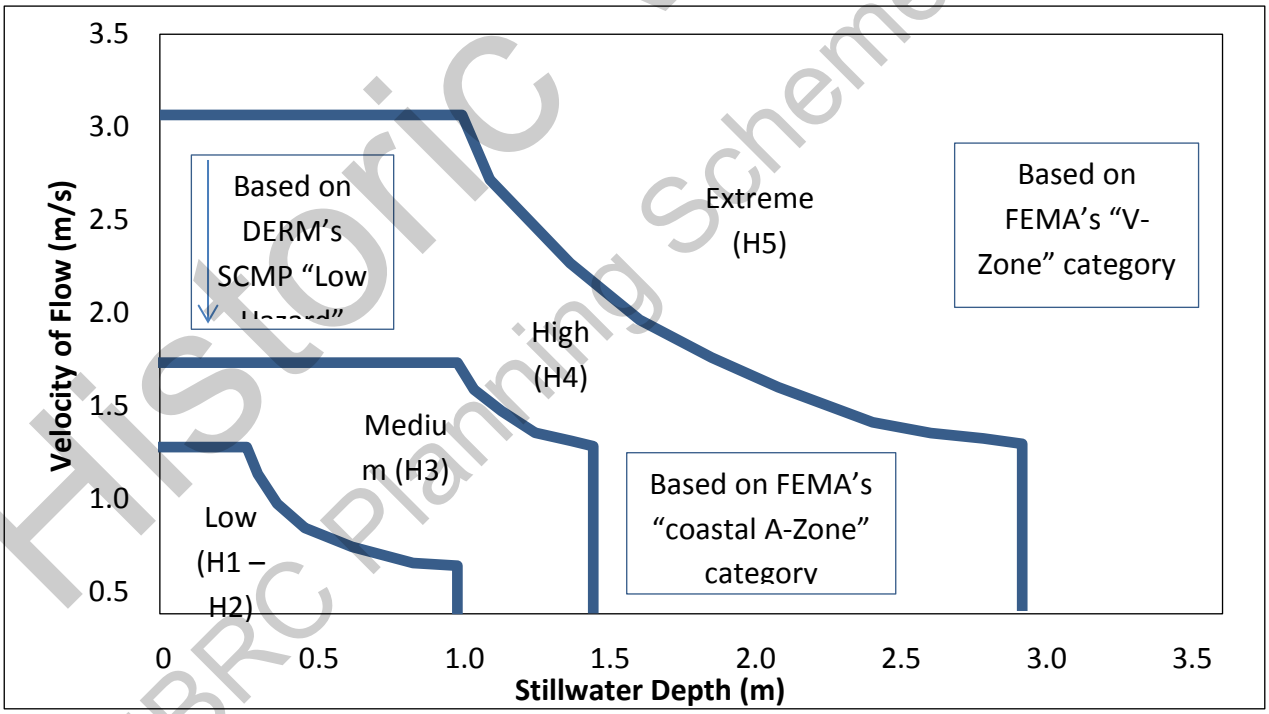


Figure 2 Hydraulic Hazard Categorisation (Coastal – Storm tide)

Source: GHD, 2012

The storm tide hazard approach presented in Figure 2 is considered by Council to be more detailed and locally focused than the standard State Government method for determining high and medium hazard zones for storm tide inundation.

The general consequences associated with each of these hydraulic behaviour categories are described in Table 1.

Table 1 Hydraulic behaviour categories and their respective consequences

Low Risk to life and property		***High Risk to life and property***		
H1	***H2***	***H3***	***H4***	***H5***
Insignificant [1]	***Minor*** [1]	***Moderate*** [1]	***Major*** [1]	***Catastrophic*** [1]
No significant life risk *Property risk only to items which come in direct contact with floodwaters such as building contents*	*Low life risk. Able bodied adults can walk safely.* *Cars can float and precautions must be followed to keep them out of floodwaters*	*Moderate life risk.* *Able bodied adults cannot safely walk* *Only large vehicles (trucks) can safely travel.*	*Major life risk* *Light frame buildings (e.g. houses) can fail structurally*	*Extreme life risk* *Majority of buildings could fail*

1. Equivalent from National Emergency Risk Assessment Guidelines October 2010 (NERAG 2010)

Using the data derived from the Stage 1 investigations, the flood frequencies were combined with the hydraulic hazard categorisation (H1-H5) in accordance with a risk matrix for river and creek flooding as well as storm tide inundation, as discussed further below.

The risk was defined based primarily on the hydraulic hazard category, but also gives some consideration to specific risk elements, such as the risk of isolation and risk to life elements.

A risk matrix (Figure 3) was developed by Council that describes the level of risk based on likelihood (i.e. the frequency of an event occurring) and consequence (i.e. the hydraulic hazard category). Development of the matrix involved specialist engineering and planning input, and has included feedback from community consultation regarding the tolerable and intolerable levels of risk.

Figure 3 Combined flood risk matrix

Likelihood level			**Consequence level**				
Current MBRC flood mapping (Flood Check)		*NERAG 2010*[1]	*Insign-ificant*	*Minor*	*Moderate*	*Major*	*Catastr-ophic*
Coastal hazard (storm tide inundation)	*Flood hazard*						
0.01% AEP 2014 (1:10,000 ARI)	River and Creek Floodplain Extent (PMF)	*Rare*	T-VL	T-VL	T-L	T-L	T-L
0.1% AEP 2014 (1:1,000 ARI)	0.1% AEP 2014 (1:1,000 ARI)	*Unlikely*	T-L	T-L	T-M	I-H	EI-H
1% AEP 2014 (1:100 ARI)	1% AEP 2014 (1:100 ARI)	*Possible*	T-M	T-M	T-M	EI-H	EI-H
5% AEP 2014 (1:20 ARI)	5% AEP 2014 (1:20 ARI)	*Likely*	T-M	T-M	T-M	EI-H	EI-H
Hydraulic Hazard category			*H1*	*H2*	*H3*	*H4*	*H5*
Risk to Life and Property			*Low*		*High*		
Approximate floodplain hydraulic category			*Flood fringe*	*Flood storage*		*Floodway / flood conveyance*	

EI-H	Extremely Intolerable High Risk
I-H	Intolerable High Risk
T-M	Tolerable Medium Risk
T-L	Tolerable Low Risk
T-VL	Tolerable Very Low Risk

1. National Emergency Risk Assessment Guidelines October 2010 (NERAG 2010)

Consistent with the categorisation of risk in the State Planning Policy – State Interest Guideline: Natural Hazards, Risks and Resilience (August 2014), there are no 'acceptable' risk areas within the Flood planning area or Coastal planning area (thus allowing some degree of risk treatment, such as planning controls) within the full extent of the Flood hazard overlay and Coastal hazard overlay. As such, Tolerable and Intolerable categories were sub-divided to provide additional levels of risk for interpretation and management response.

High risk areas defined on the Flood hazard overlay and Coastal hazard overlay approximately accords with areas that are categorised as Intolerable (I-H) risk and Extremely Intolerable (EI-H) risk, while Medium risk areas on the overlays mostly accords with areas of Tolerable-Medium (T-M) risk.

The Flood hazard overlay code and Coastal hazard overlay code outline provisions and development controls that relate to the level of risk for premises.

3. Technical reports

3.1 Summary of requirements

The technical reports which are required to be prepared by the assessment criteria of the Coastal hazard overlay code, Flood hazard overlay code and Overland Flow Path overlay code are summarised in Table 2.

Table 2 Technical reports

Development	Coastal hazard overlay	Flood hazard overlay	Overland flow path overlay
New development	Structural Engineering Design Report: • High risk storm tide inundation area • Medium risk storm tide inundation area • Erosion prone area Site Based (Localised) Coastal Engineering Report: • High risk storm tide inundation area • Erosion prone area	Structural Engineering Design Report: • High risk area • Medium risk area	Site Based (Localised) Overland Flow Report
Redevelopment (Erosion Prone Area only)	Structural Engineering Design Report Site Based (Localised) Coastal Engineering Report	Not applicable	Not applicable
Minor works (extensions)	Structural Engineering Design Report: • High risk storm tide inundation area • Medium risk storm tide inundation area • Erosion prone area	Structural Engineering Design Report: • High risk area • Medium risk area	Site Based (Localised) Overland Flow Report
Filling	Site Based (Localised) Flood Report: Within all parts of the Coastal planning area	Site Based (Localised) Flood Report: Within all parts of the Flood planning area	Site Based (Localised) Overland Flow Report
Development within a Drainage investigation area	Not applicable	Structural Engineering Design Report where in a High or Medium risk areas Drainage Master Plan	Not applicable

3.2 Structural Engineering Design Report (coastal and flooding hazards)

A Structural Engineering Design Report is a requirement for development which is at a High or Medium risk of impact from flood or coastal hazards. Specifically, a Structural Engineering Design Report is required to accompany a development application for the following activities:

a) development of a new building in a High or Medium risk area, as defined in the Flood hazard overlay or Coastal hazard overlay;
b) redevelopment of a building in the erosion prone area, as defined in the Coastal hazard overlay;
c) minor building works (extensions) in a High or Medium risk area, as defined in the Flood hazard overlay or Coastal hazard overlay.

The structural engineering design of the proposed new building, redevelopment or extension is to ensure the building or structure is capable of withstanding the nature of the hazards to which it will be subject. In this regard, the Structural Engineering Design Report is to identify and document the following:

a) the flood or coastal hazards that can potentially occur at the development site;
b) the structural design approach utilised to accommodate the flood or coastal hazards;
c) how the structural design satisfies the relevant overall outcomes and performance outcomes outlined in the Flood hazard overlay code and in the Coastal hazard overlay code.

The consideration of the impact of the flood or coastal hazards on the development is to include, but not be limited to the following:

a) hydrostatic loading due to water depth;
b) hydrodynamic loading associated with both depth and water velocity;
c) potential debris impact loading;
d) potential wave impact loading (wind waves, storm wave overtopping);
e) erosion and scour around the development;
f) any combination of the above.

The Structural Engineering Design Report is to demonstrate appropriate design of the following:

a) structural members to accommodate building loads;
b) floor levels relative to design flood conditions as specified in the relevant overlay code;
c) footings to maintain foundation requirements including allowance for scour;
d) flood resistant building materials;
e) integration of utilities; and
f) emergency egress from the building.

The design intent is for new development to remain structurally sound for all events up to and including the most extreme events (PMF; 0.01% storm tide). For locations where this is considered not possible, land has been included in the Limited Development (Constrained Land) Zone, and no new development or minor building work is intended to occur.

Reference is made to the following standards and guidelines:

- Australian Building Construction Board standard for *Construction of Buildings in Flood Hazard Areas*, (see http://www.abcb.gov.au/~/media/Files/Download%20Documents/Education%20and%20Training/Standards/130214%20Flood%20Standard_Final%20Combined.pdf);
- Mandatory Part 3.5 of the Queensland Development Code (QDC) *Construction of buildings in flood hazard areas* (see http://www.hpw.qld.gov.au/SiteCollectionDocuments/Mandatory3.5ConstructionOfBuildingsInFloodHazardAreas.pdf); and
- Fact Sheet: Water Resilient Products and Building Techniques for Rebuilding After a Flood (see http://www.hpw.qld.gov.au/SiteCollectionDocuments/WaterResilientProductsAndBuildingTechniquesForRebuildingAfterAFlood.pdf).

The Structural Engineering Design Report is to be prepared by a Registered Professional Engineer of Queensland (RPEQ) with appropriate expertise in structural engineering and design.

3.3 Site Based (Localised) Coastal Engineering Report

A Site Based (Localised) Coastal Engineering Report is a requirement for development which is at a High risk of impact from coastal hazards. Specifically, a Site Based (Localised) Coastal Engineering Report is required to accompany a development application for the following activities:

a) development of a new building in a High risk area, as defined in the Coastal hazard overlay;
b) redevelopment of a building in the Erosion Prone Area, as defined in the Coastal hazard overlay.

The Site Based (Localised) Coastal Engineering Report is to demonstrate that the proposed development:

a) is risk-appropriate for the full design life of the development, taking into consideration the expected future increase in coastal hazards due to sea level rise and changed storm conditions;
b) will not increase risk to life;
c) is supported by an effective evacuation plan;
d) will not significantly increase potential for damage to buildings or infrastructure;
e) will not lead to community hardship or loss of essential amenity, including after significant coastal storms and storm tide events;
f) will not cause detrimental impacts on adjacent properties or other areas within the coastal zone;
g) will protect biodiversity, environmental values, coastal resources and public amenity; and
h) satisfies the relevant overall outcomes and performance outcomes outlined in the Coastal hazard overlay code.

The Site Based (Localised) Coastal Engineering Report is to be prepared following a risk-based framework, as outlined in AS/NZS ISO 31000:2009. The Site Based (Localised) Coastal Engineering Report is also to be prepared giving consideration to the following:

- State Planning Policy – State Interest Guideline: Coastal Environment (July 2014);
- State Planning Policy – State Interest Guideline: Natural Hazards, Risk and Resilience (August 2014);
- State Planning Policy – State Interest Technical Manual: Natural Hazards, Risk and Resilience – Technical Manual, A 'fit for purpose' approach in undertaking natural hazard studies and risk assessments (August 2014);
- Moreton Bay Regional Council Storm Tide Hazard Study, Cardno (2009).

The Site Based (Localised) Coastal Engineering Report is to consider all relevant coastal hazards, including the following:

a) Storm tide inundation (including depth and velocities on inundation);
b) storm wave overtopping of coastal foreshores (for areas potentially affected);
c) sustained storm erosion of soft sediment foreshores (for areas potentially affected);
d) long-term recession of foreshores due to longshore sediment transport differentials, migration and geomorphologic changes to estuaries and tidal inlets, and impacts of other works and structures along the shoreline (for areas potentially affected);
e) gradual increase of area affected by permanent tidal inundation due to future climate change (for areas potentially affected).

As well as present day coastal hazards, the Site Based (Localised) Coastal Engineering Report is to establish and consider future coastal hazards. This will require the assessment of the expected response of the coastline and low-lying coastal floodplains to future climate change conditions, including sea level rise.

If necessary, the Site Based (Localised) Coastal Engineering Report is to detail mitigation measures required to manage coastal hazards in order to achieve the development outcomes listed above. The mitigation measures are to:

a) consider the full range of potential coastal storm events and storm tide events;
b) ensure that the structural integrity of the development is maintained, in accordance with the requirements of the Structural Engineering Design Report;
c) be wholly located on the site;
d) not cause any off-site impacts including exacerbating coastal risks on adjacent properties or elsewhere in the coastal zone;
e) ensure the relevant overall outcomes and performance outcomes of the Coastal hazard overlay code are achieved.

The Site Based (Localised) Coastal Engineering Report is to be prepared and certified by a Registered Professional Engineer of Queensland (RPEQ) with appropriate expertise in coastal engineering and management.

3.4 Site Based (Localised) Flood Report

A Site Based (Localised) Flood Report is a requirement for development involving filling and excavation on land affected by the Flood hazard overlay or Coastal hazard overlay. Specifically, a Site Based (Localised) Flood Report is required to accompany a development application for the following activities:

a) development involving filling in any part of the Coastal planning area, as defined in the Coastal hazard overlay;
b) development involving filling in the Medium or Balance flood planning area , as defined in the Flood hazard overlay.

Note that filling in a High risk area defined in the Flood hazard overlay is not intended, while filling in a Medium risk area in the Flood hazard overlay is only intended where the site is also located in the Coastal hazard overlay and the filling of the site is permissible under the Coastal hazard overlay code.

The level of filling is defined in the Flood hazard overlay code and in the Coastal hazard overlay code and depends on the location of the site within the subcategories within the overlay.

The Site Based (Localised) Flood Report is to document the outcomes of a localised flood investigation which has been carried out in support of the development. For consideration by the Council, the Site Based (Localised) Flood Report is to demonstrate that the proposed development, including filling (and excavation if included) of the site does not:

a) cause an increase in flooding or drainage risks to surrounding properties or elsewhere on the floodplain;
b) does not impede the flow of floodwaters across the site causing worsening of flood or coastal hazards (levels, velocities, hazard categories) on neighbouring properties; and
c) does not change the timing of the flood wave or impact on flood warning times.

The scope of the localised flood investigation is to generally accord with the following:

a) investigate the hydraulic characteristics of the waterway for the pre- and post-development scenarios;
b) determine whether the development is likely to cause any adverse impacts to upstream or downstream properties;
c) determine whether the cumulative impact of development is likely to cause an adverse impact on other properties elsewhere in the floodplain;
d) indicate how flood impacts of the development can be mitigated through on-site works.

The criteria for defining adverse off-site impacts is to be confirmed with Council prior to undertaking the flood investigation.

Existing flooding and storm tide information on a lot-by-lot basis is available from Council. Council has prepared detailed flood models of all minor basins across the local government area, as well as a storm tide study, which have been integrated into a consolidated Regional Flood Database. The localised flood investigation documented in the Site Based (Localised) Flood Report is to utilise appropriate information from Council's existing regional flood database as relevant inputs to the assessment. For larger sites, the use of Council flood models for assessment purposes is appropriate.

Where a Site Based (Localised) Flood Report is required, it is to be included as part of an application for a development permit under the Planning scheme. The report may be a standalone document or incorporated into a broader flood planning study conducted for the development.

The Site Based (Localised) Flood Report is to be prepared in accordance with the current industry practice for flood impact assessments, as outlined in the following:

- Australian Rainfall and Runoff – updates and revisions being released periodically;
- Moreton Bay Regional Council Floodplain Risk Management Framework Volume 1 and Volume 2 (Practice Notes) (GHD and Molino Stewart, 2013);
- State Planning Policy – state interest guideline: Natural hazards, risk and resilience;
- State Planning Policy – state interest guidance: Natural hazards, risk and resilience – Technical Manual, An example: Terms of reference for undertaking a flood hazard investigation;
- State Planning Policy – state interest technical manual: Natural hazards, risk and resilience – Technical Manual, A 'fit for purpose' approach in undertaking natural hazard studies and risk assessments;
- Queensland Urban Drainage Manual (DEWS, 2013).

The Site Based (Localised) Flood Report is to contain, as a minimum the following:

a) a site survey plan showing drainage easements, waterway corridors, cadastral boundaries, ground levels, existing structures, trees, fences, kerb and road levels, pipe invert levels, pit surface levels;
b) a catchment plan, with flowpaths and inundation extents;
c) the data used for modelling purposes;
d) a flood model layout, including ground elevations, adopted surface roughness and structures;
e) the proposed site layout, including an earthworks plan, mitigation measures etc;
f) a description of the modelling methodology (including software, modelling parameters, assumptions and limitations) adopted which should use the Council's existing models if assessing a large site;
g) the flood behaviour model files and results (levels, velocities, hazards) showing difference plots between existing and proposed conditions across the site and in surrounding properties, for a range of flood events up to the DFE, including scenarios incorporating projected climate change;
h) confirmation that flood behaviour in rare events up to 0.1% Annual Exceedance Probability (AEP) does not significantly change;
i) discussion and assessment of impacts of flooding on the proposed development;
j) discussion and assessment of the impacts of the proposed development on flooding elsewhere;
k) a statement of compliance with relevant requirements in the overall outcomes and performance outcomes outlined in the Flood hazard overlay code and in the Coastal hazard overlay code.

The Site Based (Localised) Flood Report is to be prepared and certified by a Registered Professional Engineer of Queensland (RPEQ) with appropriate expertise in flood assessment.

3.5 Site Based (Localised) Overland Flow Report

A Site Based (Localised) Overland Flow Report is a requirement for development that is located in a designated overland flow path as defined by the Overland flow path overlay.

The purpose of the Site Based (Localised) Overland Flow Report is to demonstrate that the development:

a) will not result in a material increase in flood level or flood hazard on upstream, downstream or surrounding properties; and
b) will provide acceptable management of flood risk with appropriate development levels to ensure the safety of people.

The Site Based (Localised) Overland Flow Report differs from a flood report in that overland flows are essentially shallow surface flows that discharge to the piped drainage system or a natural waterway. Overland flows are difficult to establish through computer models, given the fine resolution of the flow paths and controlling structures and topographic features. Rather, flowpaths are defined based on general landform characteristics, built structures (including fences, retaining walls and landscaping) and the existing stormwater network. In contrast, the site based flood report (Site Based (Localised) Flood Report) is more targeted at defined watercourses that can have significant increase in water levels in response to catchment rainfall and runoff.

In preparing the Site Based (Localised) Overland Flow Report, the following considerations are required:

a) proposed development is to take account of existing or created overland flow paths and make due provision in the design of the site stormwater system;
b) maximum overland flow velocity should not exceed 2m/s with a depth not exceeding 300mm;
c) overland flow paths should be located along roads and reserves rather than across private property;
d) development of the site should preserve existing overland flow paths as far as practical;
e) design is to be in accordance with QUDM (DEWS, 2013).

The Site Based (Localised) Overland Flow Report is to provide calculations and other necessary evidence to demonstrate the following:

a) impacts of the proposed development on localised flooding are mitigated and surrounding properties (upstream and downstream) are not adversely affected;
b) habitable floor levels for the development are higher than the 1% AEP overland flow level plus freeboard requirement;
c) relevant overall outcomes and performance outcomes of the Overland flow path overlay code have been achieved.

The Site Based (Localised) Overland Flow Report is to be included as part of an application for a development permit under the Planning scheme and may be a standalone document or incorporated into a broader flood planning study conducted for the development.

The Site Based (Localised) Overland Flow Report is to be prepared in accordance with the current industry practice for overland flow impact assessments.

The Site Based (Localised) Overland Flow Report is to be prepared and certified by a Registered Professional Engineer of Queensland (RPEQ) with appropriate expertise such as hydrology, hydraulic modelling and stormwater engineering.

3.6 Drainage Master Plan

Development for a material change of use not involving a dwelling house, reconfiguring a lot or operational work of premises in the General residential zone – Next generation precinct or the General residential zone – Urban residential precinct located in a Drainage investigation area identified on Figure 8.2.2.1-8.2.2.10 of the Flood hazard overlay code requires the preparation of a Drainage Master Plan.

The Drainage Master Plan will be prepared by the following:

a) the Council in which case it will be adopted by the Council and included in Appendix 1 of the planning scheme policy; or
b) the applicant for a development approval and approved by the Council as part of the development approval for the development.

The Drainage Master Plan prepared by the applicant is to identify all planning and design standards and outcomes, regulatory provisions, works and land transfers necessary to implement a stormwater management solution which will mitigate flood hazard on the site and within the Drainage investigation area sufficient to support the proposed development and meet the relevant provisions and outcomes of the Flood hazard overlay code.

The intent of the Drainage Master Plan is to provide an overarching plan which coordinates land use, built form and infrastructure in a manner that provides clear direction on the development capability of the Drainage investigation area, sets out infrastructure (including mitigation infrastructure) requirements and responsibilities, and addresses the risk to which the area is subject.

The Drainage Master Plan is to be prepared for the whole Drainage investigation area within which the development site is located, unless otherwise agreed with the Council.

The Drainage Master Plan is to be prepared in accordance with the requirements for a Master Drainage Plan, as outlined in Section 2.5 of QUDM (DEWS, 2013), as well as the following additional criteria:

a) completion of detailed master planning, preparation of appropriate development controls and identification of suitable works which:
    i) identify opportunities to support development of the area consistent with the underlying zone or local plan, including preparation of any area-specific development standards necessary to bring effect to any works or make further improvements to flood risk reduction;
    ii) provide for dedication of land or acquisition of strategically selected properties to provide surface flow paths; and
    iii) address the purpose and relevant provisions of the Flood hazard overlay code;
b) an assessment of possible interim impacts of the Drainage Master Plan where delivery is likely to span long term periods;
c) an assessment of the effectiveness of the overall scheme in reducing flood risk.

Where the area subject to a Drainage Master Plan is also located within the Coastal planning area, consideration is also to be given to:

a) storm tide inundation including depth and velocities on inundation;
b) storm wave overtopping of coastal foreshores;
c) sustained storm erosion of soft sediment foreshores;
d) long-term recession of foreshores due to longshore sediment transport differentials, migration and geomorphologic changes to estuaries and tidal inlets, and impacts of other works and structures along the shoreline (where appropriate); and
e) gradual increase of area affected by permanent tidal inundation due to future climate change (where appropriate).

A timeframe of 2100 is considered appropriate for identifying and managing future coastal hazards affecting the Drainage Investigation Area. Changes to sea level rise, storm frequency and wave climate will need to be considered and accommodated.

The Drainage Master Plan is to document a detailed hydraulic analysis of the proposed stormwater drainage system which is required to support the development and is to be prepared in conjunction with the requirements of the Stormwater Management Planning Scheme Policy and the Integrated Design Planning Scheme Policy.

The Drainage Master Plan is to be provided as part of a development application for development which is subject to a Drainage Master Plan. Where a Drainage Master Plan has not been adopted by the Council, the applicant for the development approval is to submit a Drainage Master Plan for approval by the Council as part of the development application.

The Drainage Master Plan is to be prepared and certified by a Registered Professional Engineer of Queensland (RPEQ) with appropriate expertise such as civil or stormwater engineering.

Where the Drainage Master Plan includes coastal hazard considerations, the Drainage Master Plan is to be prepared and certified by a Registered Professional Engineer of Queensland (RPEQ) with appropriate expertise such as coastal engineering.

4. Filling requirement

4.1 Concurrent Fill Requirements

Fill requirements for sites located within the Flood planning area or the Coastal planning area are detailed in the Flood hazard overlay code and in the Coastal hazard overlay code respectively. For sites that are within both overlays, the requirements of the higher risk area prevail. Filling requirements for sites within both overlays are summarised in Table 3.

Table 3 Concurrent fill level requirements

		Flood Overlay Code						
		High LDZ	High Non LDZ	Medium	Balance flood planning area	Drainage investigation area		
						High Risk	Med Risk	Balance flood planning area
COASTAL OVERLAY CODE	Erosion Prone Area (EPA)	No filling	No filling	No filling	No filling	As per DMP		
	High LDZ	No filling	No filling	No filling	No filling			
	High Non LDZ	No filling	No filling	No filling	No filling			
	Medium	No filling	No filling	No filling	HAT2100 (min)			
	Balance coastal planning area	No filling	No filling	No filling	DFE (min)			

Notes:
DFE Level of the Defined Flood Event relevant for the subject site.
HAT2100 Year 2100 Highest Astronomical Tide level
LDZ Limited Development (Constrained Land) Zone
DMP Drainage Master Plan

4.2 Compensatory Earthworks

4.2.1 Works within a Defined Flood Event area of inundation

Works within the area of inundation for the Defined Flood Event do not involve any of the following:

a) any physical alteration to a watercourse or floodway affecting its flow capacity;
b) any native vegetation clearing;
c) any increase in the rate of release of stormwater runoff from the premises to the area of inundation for the Defined Flood Event;
d) altering the existing surface levels to adversely impact flood immunity of surrounding properties;

e) filling or excavation below the Defined Flood Event inundation level inclusive of any previous occurrences of filling or excavation on the site that reduces the flood storage volume or increases flow velocities resulting in erosion, except for compensatory earthworks which are permitted to occur within a Defined Flood Event area of inundation but only under limited circumstances; or
f) any physical alteration of the watercourse or floodway within 30m landward of its top of bank.

4.2.2 Compensatory earthworks impact within a Defined Flood Event area of inundation

Compensatory earthworks seek to allow for limited cut and fill to occur, at the same incremental level, within the Defined Flood Event and achieving a nil impact on the hydraulic characteristics of the waterway or floodway. The purpose for allowing limited compensatory earthworks is to allow for the regularisation of development parcels subject to a Defined Flood Event constraint.

Where compensatory earthworks occur within the Defined Flood Event, such earthworks are only acceptable where they do not adversely impact upon the hydraulic characteristics of a waterway or floodway. Adverse impacts can be actual, potential or cumulative, and can result in adverse impacts downstream from where the earthworks occur. Earthworks which are not compensatory can result in:

a) a reduction in the flood-capacity of a waterway or floodway;
b) a reduction in flood storage;
c) altering of the hydraulic control (flow, velocity and direction) of a watercourse;
d) an increased or new scouring and sedimentation.

Compensatory earthworks are acceptable if:

a) the total area of cut or fill does not exceed 20% of the site below the Defined Flood Event;
b) the total volume of "cut to fill" plus any imported fill (in m^3) does not exceed the volume (in m^3) calculated by multiplying the site area below the Defined Flood Event (in hectares) by 250;
c) any physical alteration of the waterway or floodway occurs no closer than 30m from the top of the bank;
d) the fill area is free draining.

4.2.3 Typical compensatory earthworks

Figure 4 identifies an acceptable layout for compensatory earthworks where cut and fill within the Defined Flood Event are effectively undertaken at the same level and in excess of 30m from the top of the bank of the watercourse. Figures 5 and 6 identify unacceptable layout for compensatory earthworks as cut and fill within the Defined Flood Event are not undertaken at the same level and are within 30m from the top of the bank of the watercourse.

Figure 4 Acceptable compensatory earthworks

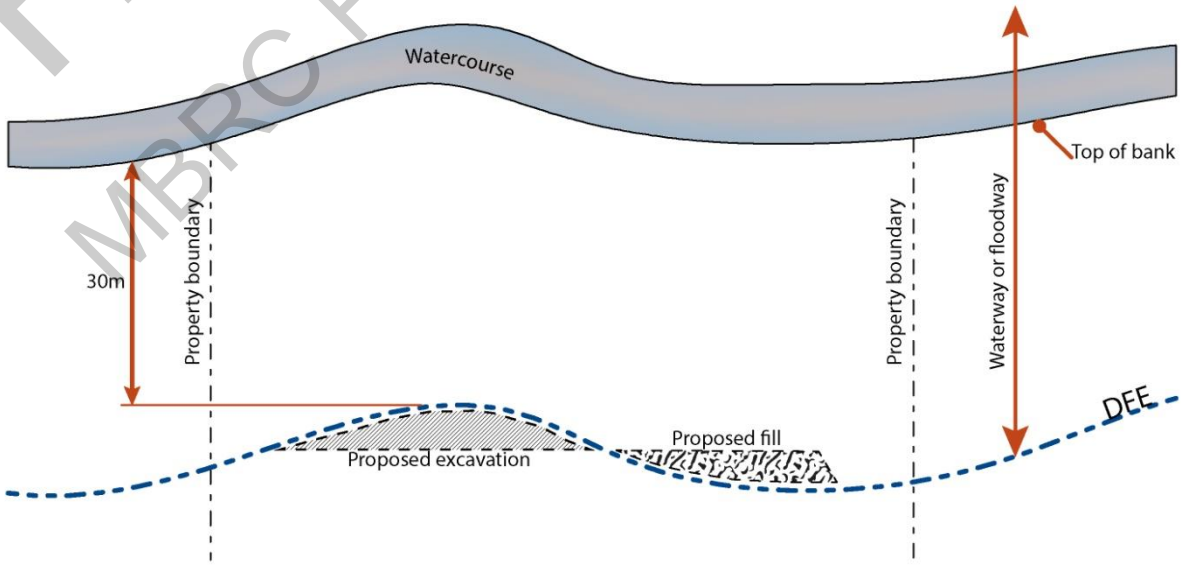


Figure 5 Unacceptable compensatory earthworks

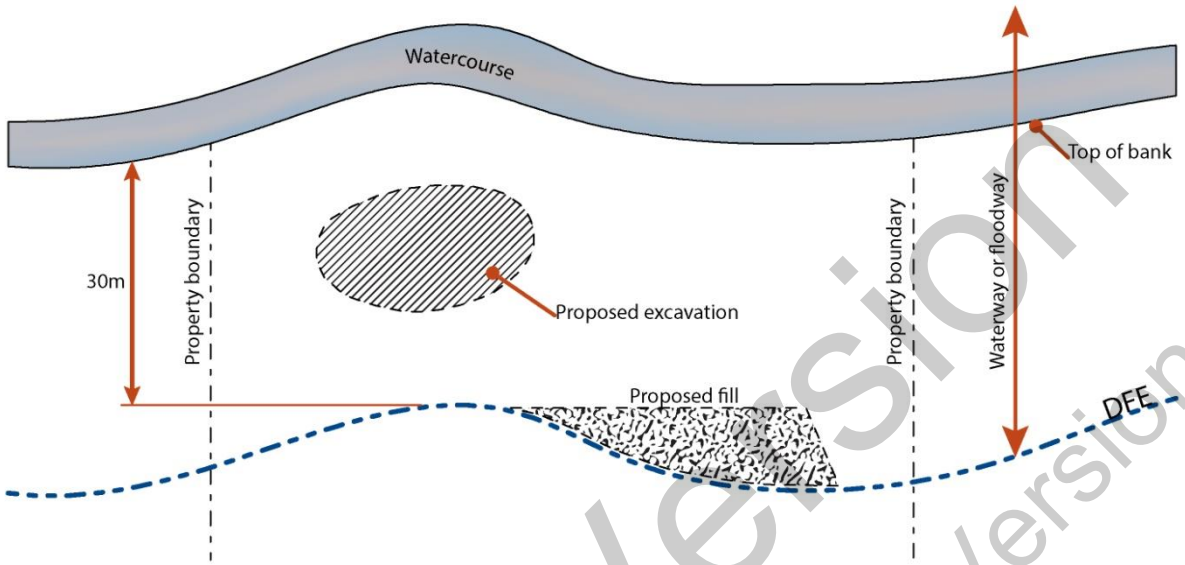
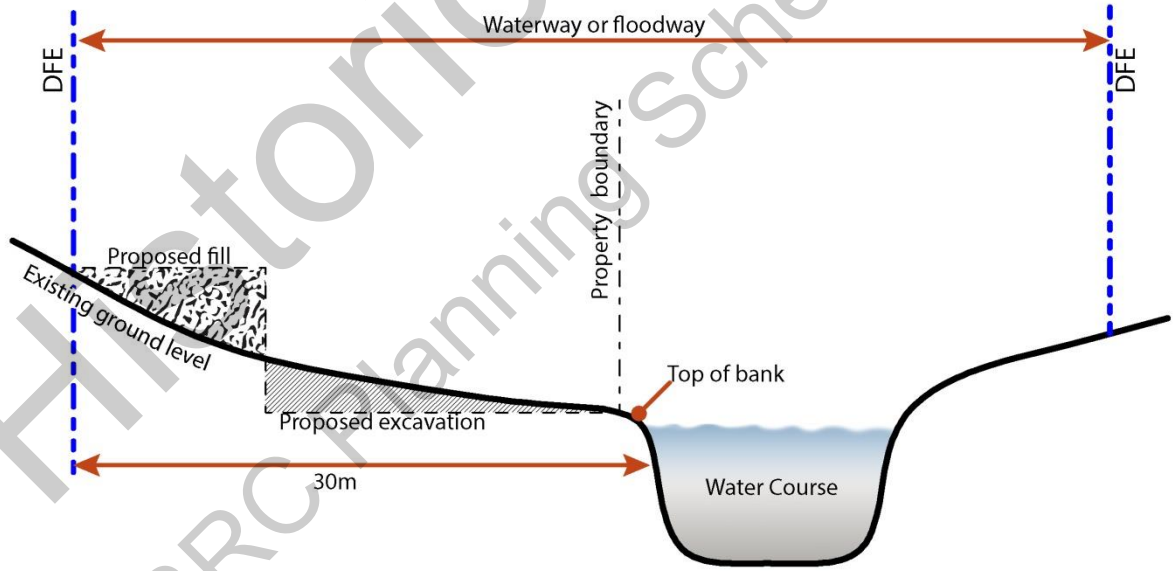


Figure 6 Unacceptable compensatory earthworks



Appendix 1

Drainage Master Plans

Column 1 **Item**	**Column 2** **Drainage investigation area in Figure 8.2.2.1-8.2.2.10 of the Flood hazard overlay code**	**Column 3** **Drainage Master Plan**
None applicable	None applicable	None applicable