Cyfoeth Naturiol Cymru
Natural Resources Wales

Guidance note

Modelling for Flood Consequence Assessments

Reference number: GN 028

Document Owner: Flood Risk Analysis Sub Group

Beth sydd yn y ddogfen?

Mae'r canllaw hwn yn nodi cyngor ar arfer da ar gyfer paratoi modelau perygl llifogydd. Ei fwriad yw helpu datblygwyr ac ymgynghorwyr i ddeall yr hyn sydd ei angen arnom, a pham, er mwyn gwirio eu modelau perygl llifogydd, a gyflwynwyd fel rhan o asesiad o ganlyniadau llifogydd i gefnogi cynigion cynllunio datblygu a/neu Trwydded Gwethgarwch Pergyl Llifogydd.

What is this document about?

This guidance sets out good practice advice for preparing flood risk models. It is intended to help developers and consultants understand what we need, and why, in order to check their flood risk models as part of Flood Consequence Assessments (FCAs) submitted in support of development planning proposals and/or Flood Risk Activity Permits (FRAPs). It is not a mechanism to undertake a flood map challenge.

Who is this document for?

This guidance is for developers and their consultants and for NRW Flood Risk Teams. It may also be useful for our Development Planning teams.

Contact for queries and feedback

Flood Risk Analysis Wales

FRA.Wales@cyfoethnaturiolcymru.gov.uk

Croesewir gohebiaeth yn y Gymraeg a’r Saesneg / Correspondence welcomed in both Welsh and English.

Version History - Review Date: [Spring 2020]

Document Version	Date Published	Summary of Changes
1.0	Dec 2014	Document created
2.0	May 2015	Updates and signed-off
3.0	May 2018	Renamed from GPG to GN Reference to FDC changed to FRAP Fixed hyperlinks to maps Added model checklist section
4.0	July 2018	Contact for queries updated Reference to ordinary watercourse FDC changed to OWC Added surface water flood risk and drainage as a risk NRW do not advice on Hyperlink to Discretionary Planning Advice Service included
5.0	Nov 2018	Amended document to clarify the FCA requirements also apply to FRAP applications. Changes made to regulatory info section and FRAP reference under 'mitigation evidence'
6.0	Jan 2020	Amended document to include minimum requirements for Flood Consequence Assessments and references to related guidance notes.

To report issues or problems with this guidance contact Guidance Development

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Scope

The Welsh Government seeks to ensure new development is sustainable in the long term and does not create a legacy of problems for future generations. Its national planning policy aims to direct new development away from areas of flood risk and ensure any flood risk and associated impacts both on and off-site can be appropriately managed. The preparation of a Flood Consequences Assessment (FCA) is key in identifying the flood risk to and from a development. It can also be used to demonstrate what mitigation measures will be required to reduce the risks and consequences to ensure the development itself is as safe as possible and that there is minimal impact on flood risk generally.

Regulatory Information

Most development proposals require planning permission from the Local Planning Authority (LPA). In gaining that permission, any development shown to be at risk of flooding will need to comply with the Welsh Government's Planning Policy Wales and Technical Advice Note 15 (TAN15)[1]. In some circumstances, a formal Flood Risk Activity Permit (FRAP) may also be required from NRW for works in, under, over or within 8m of a main river /16m of a tidal main river and/or sea defence. If a site is located within an Internal Drainage District, a developer may also need to obtain the relevant consent from NRW. Development likely to impact an ordinary watercourse such as a stream (incl. culverting works), may require an Ordinary Watercourse Consent (OWC) from the relevant Lead Local Flood Authority.

Information on whether a development site is at river or coastal flood risk can be found by referring to the Welsh Government's Development Advice Map[2](DAM). Further detail on all sources of flood risk can be found on NRW's own flood maps[3].

A key requirement of TAN15 is that a FCA must be produced for any development at risk of river or coastal flooding. The results of the FCA should be used to inform the final design of a development and to demonstrate that all risks have been identified and appropriately mitigated for. This is vital to ensure that the development will be safe for people to live in or use for all of its proposed lifetime.

NRW is a statutory consultee in the Town & Country Planning process. Our role regarding flood risk is to provide technical advice to LPAs on the acceptability of flood risk assessment and the measures proposed to manage that risk to people and property from any new development proposal.

We assess FCAs and any other supporting flood risk documentation to decide whether you have met the requirements of Planning Policy Wales and TAN15. Within our advice to the LPA, we provide comment regarding the acceptability of flooding consequences and the

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[1] http://gov.wales/topics/planning/policy/tans/tan15/?lang=en

[2] https://maps.cyfoethnaturiolcymru.gov.uk/Html5Viewer/Index.html?configBase=https://maps.cyfoethnaturiolcymru.gov.uk/Geocortex/Essentials/REST/sites/Flood_Risk/viewers/Flood_Risk/virtualdirectory/Resources/Config/Default&layerTheme=2

[3] https://maps.cyfoethnaturiolcymru.gov.uk/Html5Viewer/Index.html?configBase=https://maps.cyfoethnaturiolcymru.gov.uk/Geocortex/Essentials/REST/sites/Flood_Risk/viewers/Flood_Risk/virtualdirectory/Resources/Config/Default&layerTheme=0

technical soundness of an FCA. It is important to note however that there are matters related to flood risk that we are unable to give advice on, such as surface water flood risk and drainage, emergency plans, procedures and measures to address structural damage that may result from flooding. For such matters, advice should be sought from other professional advisors.

Where a FRAP is required, we assess the FCA, to ensure the proposals/activity(ies) do not cause or exacerbate flood risk.

Although TAN15 primarily refers to build development such as housing, industrial or commercial premises, the principles of assessing flood consequences relate to any development at risk of flooding that requires planning permission and/or a FRAP or OWC and the production of an FCA.

Ideally, the FCA will be a standalone document and should be considered as early as possible in the development feasibility stage.

To comply with the requirements of TAN15, the FCA/ appraisal must include:

- an assessment of the risk and consequences of flooding to and from the development.
- consideration of an appropriate allowance for climate change in line with current government guidance at the time of application. Current national planning policy requires climate change to be considered on all fluvial flows up to and including the 1% (1 in 100) annual probability of occurrence and on all coastal flood levels up to and including the 0.1% (1 in 1000) annual probability of occurrence.
- an assessment of the flood consequences of the development to third parties for an appropriate range of fluvial flows and coastal flood levels (including climate change) up to and including the 0.1% annual probability of occurrence (1 in 1000 in any given year).

Table 1 Minimum Range of flows for FCAs

	Statistical chance of occurring in any given year						
Fluvial	50%	10%	3.33%	1.33%	1%	1% + Climate Change	0.1%
Tide	MHWS	-	3.33%	-	0.5%	0.5% + Climate Change	0.1% + Climate Change
Defended		✓	✓	✓	✓	✓	✓
Undefended		✓	✓	✓	✓	✓	✓

- Sensitivity testing should be undertaken; by adjusting the key parameters within it to assess the effects on calculated flood levels. This would include model inflows (usually ±20), downstream boundary, upstream boundary, channel roughness (usually ±20%) and key structure setup/ coefficients/parameters.

- Sensitivity to blockage of critical structures must be considered. See our guidance modelling for breach and blockage scenarios.

The results of the sensitivity testing must be included in the FCA, and the assessment of these changes that may cause flood levels to be significantly higher than the baseline modelled. Recommendations must be made on the design of the proposed development to to comply with TAN15.

If a development covers an area of combined fluvial (river) and coastal flood risk, then agreement with NRW's Operational Flood Risk Analysis team must be made about the combinations of joint probability to be assessed. Please note, where a development is located in an area at risk from any other source of flooding (incl. surface water / groundwater), the FCA should include an assessment of the risks from these sources. Information pertaining to surface water or groundwater flooding will be assessed by the Local Authority in their role as Lead Local Flood Authority (LLFA), as per the Floods and Water Management Act 2010.

Section A1.12 of TAN15 states (amongst other criteria) that any new development must show 'no flooding elsewhere'. Current national policy suggests this should include a flood event with a 0.1% (1 in 1000) annual probability of occurrence (including climate change for coastal flood levels).

TAN15 also advises that an FCA can be used to establish whether appropriate mitigation measures can be incorporated within the design of a development to ensure that it minimises risk to life, damage to property and disruption to people living and working on the site or elsewhere in the floodplain. NRW will review the FCA and hydraulic modelling and advise the LPA on the submission's technical competence and the merits of the proposed mitigation.

Our assessment of the FCA will have two key aims:

a) to identify whether the flood risks to the development itself and elsewhere have been fully identified and quantified.

b) to advise the LPA on whether every reasonable mitigation measure has been included in the final proposed design to ensure the development is as safe as possible and that the consequences of flooding meets the requirements of current planning policy.

NRW advice on flood risk matters is intended to assist the LPA in making a fully informed decision based on the merits of a proposed development.

How to access our Flood Data and ask for Technical Advice

The first point of contact for provision of NRW hydraulic model data is the Data Distribution team who can be can be contacted via email at - datadistribution@cyfoethnaturiolcymru.gov.uk . They will liaise with the Flood Risk Analysis (FRA) teams, who are the custodians of NRW's hydraulic models. Our Customer Care Centre will help you find your local FRA team.

If a NRW hydraulic model already exists in the area of interest, we can provide the baseline model (under licence if required) and provide advice on the scope of any work that may be required to achieve the objectives of the hydraulic modelling work. Please note that provision of this information may incur a cost (access-our-data).

If a hydraulic model does not exist at the area of interest, our Flood Risk Analysis teams can assist with defining the scope of the hydrological and hydraulic model required.

Pre-application discussions with the relevant Flood Risk Analysis team is strongly recommended as they can provide local knowledge, data and advice on the suitability of a hydraulic model's fitness for purpose.

A hydraulic model may also be used to provide design water levels. Site specific hydraulic model accuracy and safety margins (uncertainty/freeboard) should also be discussed and agreed with the relevant Flood Risk Analysis team.

If a development project has a long duration or a flood event occurs, it may be necessary to review the hydrology, hydraulic model calibration and blockage scenarios being considered in light of new data becoming available.

Please note that NRW will not accept a hydraulic model for review and consideration to be included within our library of hydraulic models, or as part of a FCA, unless it is accompanied by a hydraulic modelling technical/user report, all model files relating to final model runs which include: log files, record, results files, and survey data.

Mitigation Evidence

It is usually necessary to undertake mitigation work to address any increased flood risk elsewhere. The following evidence is required as part of the FCA/development appraisal, and where appropriate FRAP application, to ensure a full assessment of the risks and impacts to third parties of any development, and to pass the acceptability criteria in line with the requirements of current planning policy.

1. An appropriate **baseline hydraulic model** must be constructed to represent current conditions and include the latest hydraulic modelling software (if a hydraulic model is used), topography and flood flow estimates available at the time of the planning application.

2. A **proposed hydraulic model** must be developed where the proposed permanent and temporary works have been integrated with the baseline hydraulic model.

3. Both the baseline and proposed hydraulic models must produce, where possible for the model software and hydrological input, outputs that clearly calculate the flood risk in terms of depth, velocity, rate of rise, speed of inundation and extent for the appropriate range of flood flows chosen.

4. A comparison of Baseline and Proposal results.

5. An appropriate range of flood flows “up to and including” the maximum design event should be considered, see Table 1, particularly around the threshold of flooding, if considered to be critical to the results.

6. An appropriate allowance for climate change must be considered in line with current government guidance at the time of application.

Increased Flood Risk and its Measurable Limit

Calculations will be carried out to the appropriate numerical precision; however, for the purposes of determining any flooding impact, depth and level results will be produced in metres to two decimal places due to model resolution. For example; a baseline water level would be calculated to 100.000m Above Ordnance Datum (AOD), the proposed change in water level would be calculated as 100.004m AOD and therefore reported as 100.00mAOD. That is, no reported change.

Conversely in the same example, should the calculated proposed water level be 100.005mAOD, then this would be reported as a change in water level with a proposed water level of 100.01mAOD. This is a positive change in water level from the baseline.

Velocity, rate of rise of flood water and hazard values must also be measured in metres to one decimal place.

To demonstrate that a proposed development has not increased flood risk elsewhere the FCA and hydraulic modelling must show:

1. No increased depth, velocity, rate of rise or extent for flood water outside the river channel or agreed flood storage area.

2. No change to the onset of flooding.

3. No impact to infrastructure within or connected hydraulically to the river channel.

Where parts 1, 2 and 3 cannot be fully met, all appropriate evidence must be provided

within the FCA to enable NRW to advise the LPA on the merits and acceptability of the

development proposal in comparison to any demonstrated increased flood risk elsewhere.

The FCA must therefore clearly identify the increase in flood risk elsewhere and

provide comprehensive detail on depth, velocity, with corresponding flooding hazards rate of rise, speed of inundation and /or the increase in extents and the number and type of property(ies) and/or infrastructure affected.

NRW technical advice to the LPA will be based on the evidence presented in the FCA.

Modelling Checklist

We have developed a checklist to help us understand how you developed your model and to do our quality assurance checks. It is also a good starting point for most models, but it does not preclude further checks being carried out by either you or us on:

- Local features
- Local conditions
- Software limitations.

We recommend that you complete a checklist and submit it with your model and reports.