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Good Practice Guide

Technical Guidance: Flood Estimation

May 2016

GPG 102

Hydrology and Water Resources Management

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This document will help and inform our Hydrology, Flood Risk Analysis and Development Planning staff when they deal with development proposals involving flood risk as well as flood hydrology calculation for flood risk mapping. It is also intended for use by external organisations.

These recommendations are based on information available to us at the date of the publication and may be superseded as further research and guidance are published. Natural Resources Wales (NRW) and its Officers accept no liability whatsoever for any loss or damage arising from the interpretation or use of this guidance by persons other than NRW and its Officers.

Background

The Flood Estimation Handbook (FEH) is the industry standard methodology for flood frequency estimation in the UK. The two principle techniques detailed in the FEH (and supplementary reports) are the Statistical method and the Revitalised Flood Hydrograph method (ReFH). Wallingford HydroSolutions recently released an updated version of the ReFH method, called ReFH2.1, which incorporates improved science and supports use of the new FEH2013 rainfall model, developed by the Centre for Ecology and Hydrology (CEH). ReFH2.1 replaces the previous ReFH2.0 and ReFH1 versions which use the FEH1999 rainfall dataset.

Natural Resources Wales have reviewed ReFH2.1 and have a number of recommendations regarding its use in Wales. This provides a timely opportunity to clarify our general position on flood peak estimation methodologies and how the ReFH2.1¹ software fits in. These recommendations should be used in conjunction with the most recent version of the Environment Agency (EA) Flood Estimation guidelines².

Recommendations

Preferred Approach

Our preferred approach for estimating peak flows up to and including the 100 year return period is the FEH Statistical method.

Peak flows for longer return periods should be estimated using the “ratio” method, whereby the flood growth curve from ReFH2.1 is applied to the 100 year estimate from the FEH Statistical method. For example, to derive the 1000 year estimate, the ratio of the 1000 year to 100 year ReFH2.1 estimates, is multiplied by the 100 year estimate from the FEH Statistical method. The resulting flow estimates should be compared to absolute values calculated by Statistical and ReFH2.1. ReFH2.1 should be used with the FEH2013 rainfall model, not the FEH1999 rainfall model.

There may be occasions when it is appropriate to use either the FEH Statistical method or ReFH2.1 method for all return periods. In such cases, the onus will be on the analyst to justify which is the more appropriate method. Choosing one methodology over another simply because it provides higher or lower estimates is not appropriate. Local data should be used where available to improve estimates. Further information can be found in other documents such as the FEH and the EA Flood Estimation guidelines.

¹ Wherever ReFH2.1 is referred to in this document, it should be read as ‘ReFH2.1 and later software versions which use the same methodology’.

² Available from enquiries@environment-agency.gov.uk

Urban Catchments

ReFH2.1 methodology improves on ReFH1 methodology for flood estimation in urban catchments, with the urban and rural components of the hydrograph being calculated separately. There is currently insufficient evidence to determine whether ReFH2.1 or the Statistical method is the most robust method of flood estimation in urban catchments. For the time being, it is recommended that peak flows in urban catchments are estimated using both the Statistical and ReFH2.1 methods (using local data where available) and the results compared. If the results are not in broad comparison then the analyst should apply professional judgement to determine which method is considered to be most appropriate.

Plot-scale runoff calculations

The Statistical, ReFH2 and the IH124 methods are identified in the SuDs Manual (CIRIA 2015)³ as appropriate to use for estimating plot-scale runoff:

- Greenfield runoff rates - Statistical method or ReFH2 (NRW prefer use of the Statistical method)
- Pre-developed runoff rates - ReFH2 or IH124.

Further information on surface water management can be found in the document “*Recommended non-statutory standards for sustainable drainage (SUDS) in Wales*” (Welsh Government, 2016)⁴.

Flood estimation calculation record

When submitting fluvial flood estimates to us for review, they must be presented in a clear and auditable format. We recommend use of our Flood estimation calculation record⁵.

Timescales for implementation

ReFH2.1 is available now and we recommend that new analyses utilise ReFH2.1 with the updated FEH2013 rainfall model. We acknowledge that not all analysts will have immediate access to ReFH2.1 and therefore a grace period will apply whereby outputs from ReFH1 will still be acceptable. It should be noted that from 1st August 2016 onwards, we may not approve any estimates that utilise ReFH1, or ReFH2 with the FEH1999 rainfall model.

Ongoing Research

The advice and recommendations presented in this document may be superseded by the results of ongoing research, which includes two projects by Joint Flood and Coastal Erosion Risk Management Research and Development Programme⁶;

- Estimating flood peaks and hydrographs for small catchments (Phase 2). SC090031
- Making better use of local and historic data, and estimating uncertainty in FEH design flood estimation (FEH Local). SC130009.

Further Information

If you have any questions regarding this document please contact us via email:

[South Wales](#) / [North Wales](#)

³ https://www.ciria.org/Resources/Free_publications/SuDS_manual_C753.aspx

⁴ <http://gov.wales/topics/environmentcountryside/epq/flooding/drainage/?lang=en>

⁵ GPG 102 FORM 1: Flood estimation calculation record

⁶ <http://evidence.environment-agency.gov.uk/fcerm>