

MEMORANDUM

Date 29 August 2013
Reference UA005763
From Claire French
To Anjumn Kanani
Copies
Subject Response to the Environment Agency's comments on the modelling technical note

The following sets out Hyder's responses (in blue) to Tim Hunt's comments (in black) on the modelling technical note (report no. 5001-UA005763-UU41R-01).

Apologies again for not getting to this sooner. I have now read it and your decision to crack on with the work is fine. I do have some comments on your report, which has been a very useful and readable analysis of the existing model, which may help or at least prove I have read it. I am not surprised by your findings but disappointed that some areas were so poorly schematised and modelled. Much has changed with ISIS units and modelling skills since this was done and I would hope we are just seeing this one bad example of this early attempt at modelling a complex system. LiDAR is another huge technological leap and would have improved things hugely just on its own. [For information, we are using the Environment Agency's LiDAR data to build the floodplain component of the model, and so are making the kind of improvements Tim is referring to.](#) As you know we always suspected issues and in recent years have used the JFLOW 2D output as our main data for Cullompton, we have steered people away from using the Culm model on the whole.

Structures are clearly a major area of potential error which will need to be addressed as you have said. I will be applying some scrutiny to this and I am hoping that calibration work will help dictate the best methods and we get the best representation of head losses. ISIS Bridge units do have their foibles and we have found in other locations that if you have some good calibration data then Bernoulli units are worthwhile. The important thing is that we think about the physics of the situation and observe the experience rather than using the units blindly. Bridges can be a huge area of uncertainty and we often underestimate the obstruction to conveyance they effectively create. [We are in the process of examining the choice of model unit used for culverts, bridges and orifices \(with reference to the available survey data\) and altering them if the head losses are unrealistic. We are currently using engineering judgement to assess the correctness of the headlosses, but will review the performance of the model at structures against any suitable calibration data.](#)

Are you entirely happy with the Ken catchment boundaries now? We have developed a very detailed (down to field level) rolling ball analysis of drainage paths in Devon and have a tool that we can calculate catchment boundaries more accurately than with the cruder DTMs. If you want we could check to see if it ties in with your thinking. This area is particularly flat. [We have sent Tim a copy of the Ken catchment boundary for checking using the tool he mentions. His team has found some potential errors in the boundary – we will verify these errors and revise the catchment boundary as appropriate.](#)

Be careful with existing LiDAR and the developments/changes that have happened on quite a big scale in Cullompton in recent years. I feel that, very cost effectively, the area could be flown again to ensure you have the very latest situation. Far cheaper than topo survey. [The LiDAR data provided to us by the Environment Agency for use in this project were flown in December 2005. From our discussions with the Agency, we are aware that, since this time, development has taken place around Millenium Way, and the M5 flood relief channel has been desilted. We have also compared OS mapping from 2007 with the latest version to identify any other recent development, but significant changes are restricted to the Millenium Way area. We have asked the Environment Agency's Geomatics Group for a quote to fly LiDAR. However, since LiDAR is normally only flown in winter to avoid measurements being obscured by vegetation, we have asked](#)

the Geomatics Group to comment on the inaccuracies associated with flying in late summer. We have also sent a survey brief to five survey companies to request quotes for traditional land-based survey. Quotes are due back by 4 September. However, there is still a chance of getting hold of data, for the M5 flood relief channel at least, from the Highways Agency – Andy Roberts, a colleague of Ian Parsons, is back from leave next week and we've been advised that he may have the relevant files.

DHS 2012 update is now available and should be used at least in the first instance. The trend formula we have developed for the small catchments is now updated and using local growth relationships we can give all return periods required. The Agency has supplied us with the 2012 updated peak flow data and we have revised our model inflows accordingly.

Durations may be insensitive in the 1D channel modelling but once coupled to 2D with likely areas of storage and volume issues this may become more sensitive. I would recommend looking at typical durations from Culmstock/Woodmill time series data and ultimately doing a bit of sensitivity around your best duration estimate which may well be around 14 hours (sounds reasonable), e.g. 0.5D and 2D. In our original proposal, we included sensitivity testing for storm duration so we can address Tim's recommendation.

You have said a number of items are essential and some are less so. I would say that for the calibration that is required that probably all of the items are required as you need to rule out all possible areas of inaccuracy in the build to make it work as well as you can. As you pointed out Anjumn, when we met in July, we must be clear on what is needed from the model to achieve the objectives of the commission, i.e. demonstrate the flood risk impacts of the road options, and not stray into improving the model solely for the benefit of other future purposes. We stand by our selection of recommended improvements (Table 3 of the technical note), leaving out some of the suggested and preferable improvements we listed in Appendix 4. We will obviously review the predictive performance of the model once we have generated some draft baseline results. This review, together with the Environment Agency's comments on the baseline model, may indicate further improvements are needed, but I think it is worth reviewing the baseline results first to avoid making unnecessary changes.

From previous work you may find simplifying smaller channels that flow down the floodplain maybe better modelled as gully lines within the 2D domain. Point noted.

I notice that the geology of the small tribs around Cullompton are very permeable. Our DHS estimates for the lesser return periods (say <10-25 yr) could therefore be too high although this may not be such a concern for the final design and higher returns it maybe worth consideration in your calibration work. We will bear this in mind, but please note that our original proposal did not allow for hydrological calibration, only hydraulic calibration (hydrological calibration is where you change the parameters defining inflow hydrograph shape so that the modelled shape matches the observed more closely; hydraulic calibration involves changing the parameters of the river model, such as channel roughness and structure coefficients, in order that modelled levels and flows match those observed more closely).

Please continue to supply outputs/drafts at any stage for review. The next item we will supply to the Environment Agency for review is the baseline model and draft outputs. Once the Environment Agency has approved the baseline model, we will then use the model to test the road options.