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Commissioner Holmes
Queensland Floods Commission of Inquiry

Date: 12 February 2012

Dear Justice Holmes,

Review of Hydraulic Modelling.

We write to you to provide the Commission with guidance in relation to a technical review of the flood modelling that has been provided to the Commission.

DHI are the developers of the MIKE11 river and flood modelling software that has been applied to the Brisbane River floods to assess the January 2011 flood event. As professional engineers we have extensive experience in flood modelling and engineering river hydraulics across Australia. We also have extensive experience in the river and flood modelling that has been carried out for Brisbane over the last 15 years

Review of the MIKE11 Hydraulic River Modelling

We have carried out a review of the MIKE11 hydraulic flood model of the Brisbane River provided to us by the Commission. We do not believe that the model as developed can be used in a reliable and transparent way to assess the impact of flooding in the Brisbane River.

The model has been developed in a way that is not physically realistic and does not correctly represent the river hydraulics of the Brisbane River. Our specific concerns are based on the following observations:

1) The representation of the boundary conditions to the model is incorrect. The catchment inflows between Wivenhoe Dam and Moggill have been combined as a single inflow source at Moggill. Consequently the only river flow being modelled between Wivenhoe Dam and Moggill is the Dam release. The water levels in the model are therefore distorted and the storage and propagation of dam release flows in this, approximately 80km, stretch of the river is incorrect. The model can therefore not be used to reliably represent the behaviour of the flood releases from Wivenhoe Dam.

2) The representation of the significant floodplain storage in Oxley Creek and many other creeks downstream of the Bremer River confluence have been oversimplified to a level that is not physically realistic. The model is therefore not able to represent floodplain behaviour correctly and we would suggest that the model is not useful for carrying out floodplain studies.

3) The "calibration" of the model has primarily been achieved by adjusting inflows to achieve a model "prediction" close to actual measured flows at the various gauges along the river. This is not a suitable or an appropriate way to calibrate a hydraulic flood model as it may disguise other shortcomings in the model, such as errors in the floodplain storage description. As such the model cannot be considered to be reliably calibrated to represent the river and floodplain behaviour.

There are a number of other issues in relation to how the model has been developed and applied that limit its predictive capabilities and add to the uncertainty associated with the model results. We would like to stress that these limitations are due to the manner in which the physical river system has been represented in the model, and are not due to limitations in the underlying MIKE 11 modelling software.

We would urge the commission to use with caution the results of the model for supporting findings in relation to the likely impact on water levels of alternative scenarios.

Review of the Alternate Scenarios

The report submitted to the Commission by WMA Water on 3rd February 2012 ***"Clarification of Scenario C and Additional Modelling"*** presents the results of alternative dam release scenarios C, D and G1 and G2 that were requested by the Commission. Within the report a Table 1 presents possible lower flood levels that may have been achieved if alternative dam release strategies were adopted.

We do not believe that any of these scenarios fully exploits the flood mitigation capabilities of Wivenhoe Dam that could be reasonably expected by the Community. Whilst these scenarios may represent the best possible result using the current operating rules in the Manual, we believe that a well-designed forecast system that considers all objectives simultaneously could achieve much greater levels of flood reductions than presented here. Such a system was described briefly in our previous submission (T. van Kalken, DHI, 11 March 2011).

The key reasons supporting this conclusion include:

1) There is inadequate consideration for timing dam releases to avoid coincident peaks with Lockyer Creek and Bremer River flows.
2) The current dam operation and forecasting systems do not consider the likely water levels at the Brisbane Port Office gauge which is fundamental to minimising damages in Urban areas. It is not sufficient to simply rely on an estimated flow at Moggill as a threshold for damage.
3) The flood storage in Wivenhoe Dam has not been fully utilized in the scenarios. Therefore by adopting alternative release strategies, lower releases could have been made while achieving further reduction in flood levels.

Experience in River and Engineering Hydraulics

We would like to draw your attention to a requirement in Section 2.5 of the Wivenhoe Dam Flood Operating Manual. The Manual requires that flood control engineers have experience in "Hydrology". In our opinion the Manual should also require that engineers must have suitable and extensive experience in hydraulics and applied river hydraulics.

Hydrology is the science of predicting how rainfall becomes runoff and focuses on converting precipitation events into flow estimates. It is therefore suitable in application for predicting inflows to the dam and to the river systems from catchments. However hydrology is an observational based science and is not a suitable approach for estimating water levels in river systems which are dominated by river and floodplain hydraulic processes.

A hydrological background is necessary but insufficient qualifications for a Flood Control Engineer. The engineers should have extensive experience in engineering hydraulics and numerical hydraulic modelling.

Yours sincerely
DHI

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