flow scenarios and determination of the potential impacts of material changes. Such confidence in a model's utility is derived through both calibrations against available data and sensitivity studies.

6 SUMMARY

The finite volume scheme utilised in the new TUFLOW 2D HPC solver was presented and benchmarked against test results for two distinctly different test cases.

The solver demonstrated mesh size convergence for both test cases in both 1st and 2nd order spatial interpolation schemes with a constant viscosity model. Convergence typically required 8 cells or more across feature widths, however meshes as coarse as three cells across feature widths still appear to perform well with regard to predicting head loss.

The solver demonstrated time step convergence. For the highly transient test case 'UK EA Test 06A', convergence was obtained using time steps of 0.8 of the limiting time step targets.

The solver reproduced the test results from UK EA Test 06A well including supercritical flow and hydraulic shocks/jumps.

Using only the proportional term in the Smagorinsky viscosity model, mesh size convergence is not demonstrated for either spatial scheme, possibly due to the model viscosity diminishing at smaller mesh sizes.

In the absence of viscosity, the 2nd order spatial scheme admitted eddy structures in the solution, while the 1st order solution demonstrated a dampening of eddy formation most likely due to numerical diffusion.

In terms of best practice modelling with the new HPC scheme it is recommended that

(1) as far as practical meshes utilise three or more cells across any feature of interest;
(2) the 2nd order spatial scheme can be selected, unless the 1st order scheme produces sufficiently similar results to the 2nd order scheme;
(3) the overall time step control to be set to 0.8 of default targets; and
(4) sufficient (and only sufficient) constant viscosity is used to prevent multitudes of small eddies forming in the solution.

REFERENCES

Malone, T.R. & Parr, A.D. (2008). *Bend Losses in Rectangular Culverts*, Kansas Department of Transportation, (http://ntl.bts.gov/lib/30000/30900/30935/KU-05-5_Final_Report.pdf).

Syme, W.J. (1991). Dynamically Linked Two-Dimensional / One-Dimensional Hydrodynamic Modelling Program for Rivers, Estuaries & Coastal Waters. *PhD Thesis*, Dept. of Civil Engineering, The University of Queensland, May 1991.

Syme, W.J. (2001). Modelling of Bends and Hydraulic Structures in a Two-Dimensional Scheme. *The Institution of Engineers Australia Conference on Hydraulics in Civil Engineering*, Hobart.

UK Environment Agency (2013). *Benchmarking the Latest Generation of 2D Hydraulic Modelling Packages*, Environment Agency, Horison House, Deanery Road, Bristol, BS1 9A United Kingdom, (http://evidence.environment-agency.gov.uk/FCERM/Libraries/FCERM_Project_Documents/SC120002_Benchmarking_2D_hydraulic_models_Report.sflb.ashx).

