Appendix E

Numerical Stability and Mass Balance Plot

E.1 Numerical Stability and Mass Balance Plot

Figure E.1-1 presents the convergence plot of the model for the Q100 fluvially dominant simulation.

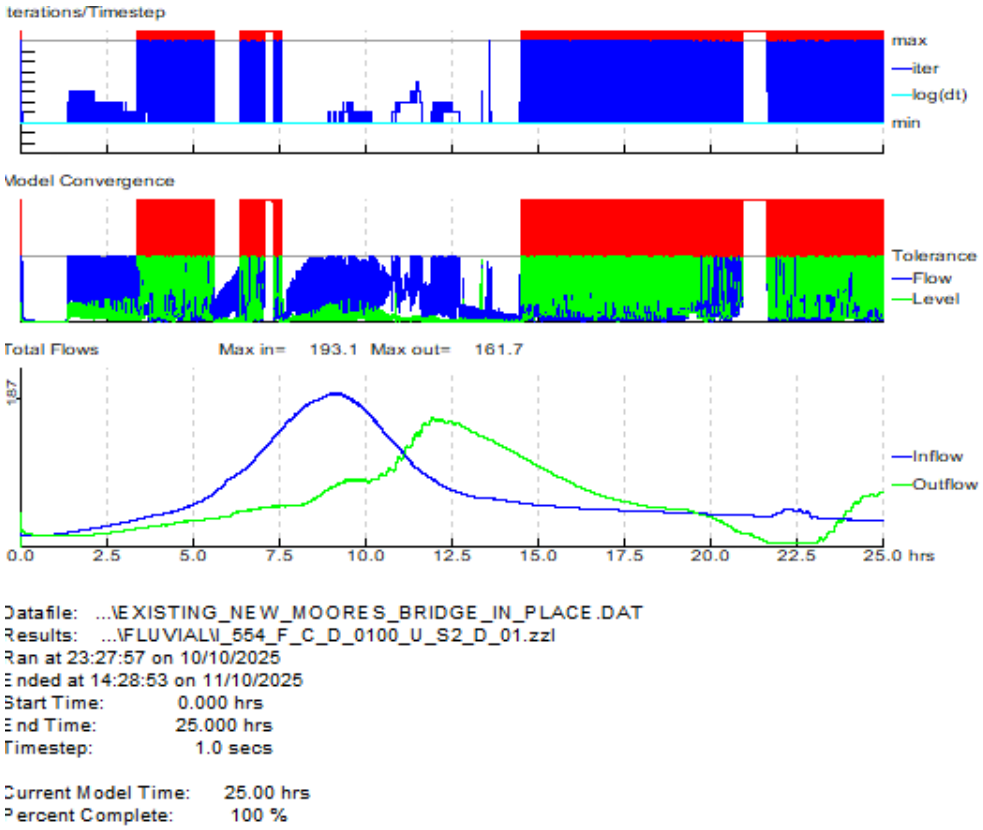


Figure E.1-1: Convergence plot for the Q100 fluvial even

It can be seen that the 1D model is convergent within the recommended tolerances for the majority of the time that the flood hydrograph is passing through the system. The model was run with a long post flood event baseflow to allow for the maximum flood extent to be reached within the 2D model. For this period, it can be seen that the model is not within the specified tolerance.

The times when the model is not within the specified tolerance are:

- A number of instances on the rising limb of the hydrograph at a small number of cross sections upstream of The Baby's Walk on the Dungourney (3DUN_654SX, 3DUN718SX). This poor convergence is due to the complex hydraulics associated with the 1D/2D interface along this reach – The local topography causes water to both exit and enter the channel at numerous points over a short reach.
- A number of instances on the rising limb of the hydrograph at Glen112SU (Tributary of the Owenacurra in the vicinity of Clohessy's Yard). The poor convergence at this section is due to complex hydraulics associated with the interaction of the backwatering from the Owenacurra up the tributary with the relatively high velocities of the water being conveyed down the tributary from the upstream catchment.
- As noted above, the model is not within the tolerance after the flood hydrograph has passed. This predominately occurs at Section 3DUN_478SX which is upstream of Baby's Walk which is subject to complex hydraulics.

The accuracy of the maximum modelled flood levels and extents across the model domain are not impacted by the lack of convergence as the convergence is within the tolerance when the peak flows pass through the key areas of interest in Midleton (circa 11.5 hours into the simulation).

Figure E.1-2 presents the mass balance percentage error plot for the Q100 fluvially dominant simulation run.

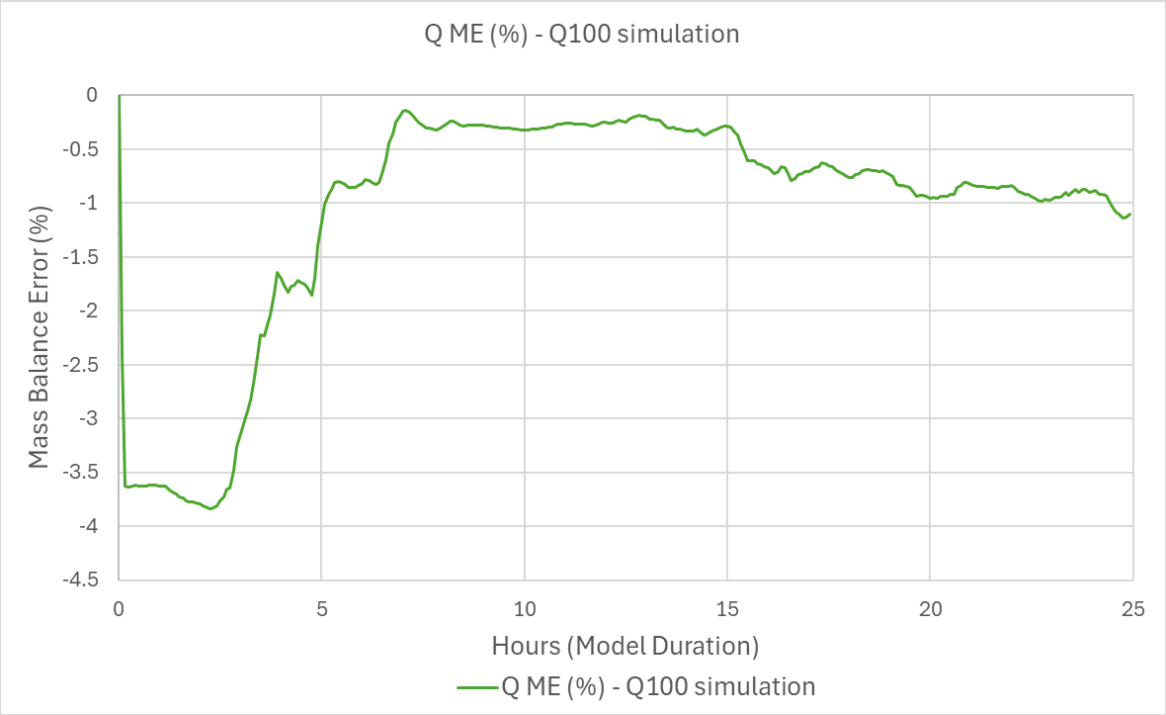


Figure E.1-2: Mass balance plot

This is calculated as the error in the volume divided by the total volume passing through the system at each timestep. The industry standard recommended tolerance for this key parameter is 1%.

It can be seen from the plot that the recommend tolerance is exceeded for the first four hours of the simulation. This is on account of the low flows passing through the model at the start of the simulation before the flood event begins. The low flows lead the volumetric error to be divided by a small total volume. At circa 4.5hrs however the flood hydrograph starts to rise and the mass balance percentage error decreases to within the accepted tolerance. For the duration of the flood hydrograph passing through the system the model is within the 1% tolerance and therefore demonstrates the accuracy of the mass balance within the model. After the hydrograph has passed the flows being simulated in the system are low and the mass balance percentage error increases above the tolerance.