CFD models of real pond scenarios

First 3D Tests
- Ponds presented at 11th International Symposium on Ecohydraulics – The “Melbourne” Ponds
- Two vegetation layouts
- Artificial design

Melbourne pond results

Melbourne pond results
Modelling realistic ponds

- The Melbourne ponds are unrealistic
- Pond design guidance:
  - Natural vegetation around sides
  - Sides sloped 1:3, depth < 1.5 m
  - Length to width ratio of 3:1 and an outlet flow control device
- But first, validation...
- Longbridge pond

Longbridge pond model 1

- Validation case
- Based on survey point data
- Heavily simplified geometry around pond edge
- Potential for summer/winter vegetation layouts

Longbridge pond model 1 results

- A new smoothed geometry was created to reduce meshing issues
- Also mesh refinement in shallower areas

Longbridge pond model 2
Longbridge pond model 2 results

- Model still running, initial flow field results:

Other pond layouts to be investigated

- CIRIA Pond
- Highways agency ponds
- Wetlands?

Next steps

- Validate and enhance the CFD work based on field data
- Complete CFD modelling of selected pond configurations – Fred’s continuation
- Complete deep flume work to characterise vertical mixing
- Nathan Wilson (Warwick) – role of floating vegetation
- Mahshid Golzar (Sheffield) – lattice Boltzmann Method for CFD modelling mixing due to heterogeneous vegetation
- Dissemination
Forthcoming conference presentations

- IAHR Europe – 27-29 July, Liege
- HYTECH – 29-30 August, Aberdeen
- CWA 12th Annual Conference – 11-12 October, Manchester
- ISH, Poland – 23-26 May 2017
- CIWEM UDG Spring meeting

Journal papers

- “Transverse and longitudinal mixing in real emergent vegetation at low Reynolds numbers”, *Water Resources Research*
- “Solute mixing across low velocity emergent real vegetation shear layers”, *Water Resources Research*
- “Modified k-ε model to simulate mixing in real emergent vegetation”, *Water Resources Research*
- “Mixing due to vegetation in stormwater ponds”, *ICE Water Management themed issue on Green Infrastructure*
- Others ...

Legacy website: vpond.group.shef.ac.uk

- Presentations
- Publications
- Open-access Data

Follow-on projects

- (Potential) detailed exploration of pond design for Highways England
- Started to understand how the heterogeneous characteristics of real vegetation (different stem diameter and stem spacing) impact upon dispersion ... but there is clearly more to do ...
- Other suggestions for collaboration are welcomed
Thank you

Researchers:
James Hart
Fred Sonnenwald
Paddy West
Nathan Wilson
Mahshid Golzar
Ian Bayliss

Project Partners:

Speakers and participants at our two project workshops