

## PhD Case Study: Dr Richard Whitehouse

**Technical Director and Chartered Geographer at engineering and environmental hydraulics company HR Wallingford**

Richard's NERC-funded PhD laid the foundations for a successful career leading applied sediment transport research projects for the civil engineering industry. He is an award winning scientist and an internationally recognised expert in his field, tackling problems related to the way sediments move in marine environments, estuaries and rivers. This enables the safe and cost-effective design of offshore wind turbine foundations, marine renewable energy structures, breakwaters, oil and gas infrastructure and pipelines.

Richard became fascinated by geomorphology while conducting fieldwork and working on a model of water flow in ephemeral streams during the last year of his geography degree, and he decided that he wanted to pursue a career in research. His PhD involved a mixture of lab experiments, fieldwork and modelling. A highlight was a scientific expedition in the Sahara desert, studying the way sand moves on dunes, which led to a paper in *Nature*.



Richard (right) discussing a sediment transport experiment with colleagues at HR Wallingford

During his PhD, Richard developed problem-solving skills that he applies directly in his work today. "My supervisor was supportive, but he would say 'sort it out, then come and tell me when you've sorted it out', which was fantastic. Very early on he handed me a current meter for measuring water flows in a flume, and a computer, and told me to make the computer record the current. So I had to think about how you got electronic signals into the back of a computer, how you wrote a programme to count the revolutions on the current meter and how to calibrate it."

This experience was challenging, but has proved invaluable in teaching Richard to design research



One of the models Richard uses to study scour around wind turbine foundations

experiments from scratch. "During the PhD you go through the normal 15-month blues of total despair where you can't see the wood for the trees, and then you start to make intuitive leaps – that works, and that works – and you start to move forward. I had to work out how to correct for certain experimental effects and deal with experimental errors. It was down to me to work out how to design an experiment that would deliver the data

you need to test a certain hypothesis or to provide new insight into a process.”

After the PhD, he was responsible for designing and running sediment transport physical modelling experiments at HR Wallingford, directly applying and developing the understanding of sediment transport and technical skills he had learnt. “We’ve been very successful with our experimental work” he says. “You can do the thought experiments, but you need to actually see it in the laboratory with the solid structure, water flowing and moving sediment. We’ve also been very successful in developing computer models off the back of our experimental knowledge for the offshore wind area. We can now make long-term predictions of the scour that takes place around offshore wind turbine foundations, which is useful for predicting what sort of maintenance you might need to do.”

During his PhD, Richard developed an appreciation of the value of collaborative, multidisciplinary research which is put to good use in his current role, for example when on the steering committee for national and international research programmes. “Working here with physicists, mathematicians, engineers and scientists – I recognise the value of collaborating with those people. I think that’s what makes our business successful.”

Richard’s research is highly valued by the industry, and his achievements reflect this. He:

- Received the David Hislop Award from the Institution of Civil Engineers (ICE) in 2011 for a paper on scour around gravity-based offshore structures, published in *Maritime Engineering*;
- Was awarded the Halcrow Prize by the ICE in 2010 for the best paper published in the journal *Maritime Engineering*, for a paper on risk modelling of scour around offshore structures;
- Wrote two books which are widely used by industry, on sediment scour and estuarine muds;
- Sets the agenda for research in his own area of expertise (sediment scour and transport in offshore marine environments), thus helping to ensure safe and secure future energy sources for the UK by enabling more cost-effective construction of offshore wind, wave and tidal power structures;
- Has published over 30 papers with over 60 co-authors, receiving almost 500 citations, enabling his research to be made widely available to the civil engineering industry;
- Has sat on the steering committee for several big National and European research programmes, making sure that they deliver results that are useful for industry;
- Is currently contributing his expertise to the NERC iCOASST project, which is forecasting what the UK’s coastline will look like in 100 years’ time, to help inform strategies to deal with coastal erosion and flood management.

### **Career timeline**

1982-85	First degree in Geography, Bedford College, University of London.
1985-88	NERC-funded PhD ‘Effect of bedslope on sediment transport’, Royal Holloway and Bedford New College, University of London (awarded in 1989)
1988-present	HR Wallingford