GROUND WATER RELIEF

MEET THE MEMBER - RICHARD CARTER

Area of Expertise: Groundwater and rural water supplies in Sub-Saharan Africa
Years' Experience: 50
Nationality: British
GWR Joining Date: May 2016

PROFESSIONAL BACKGROUND.

A brief overview of your day job outside of GWR...

My 'day job' has rarely stayed the same for long, and it is the variety of work that I've been privileged to be involved in that has meant there has never been a dull or unrewarding moment. I have been involved in a wide range of consultancy assignments; I have undertaken, led and supervised a variety of water-related research projects; and I have enjoyed teaching and supervising research, at Masters and PhD levels.
The most fulfilling aspect of my career to date is seeing so many of my former students and colleagues go on to senior and influential roles in development and humanitarian contexts around the world. If I have contributed in small ways to this, then that has made my working life worthwhile.
I have been employed by consulting firms (including my own); I worked for three years for the biggest water-focused international non-governmental organisation, WaterAid; but my longest period of employment was with Silsoe College (later Cranfield University) where I became Professor of International Water Development in 2002.

An introduction to your background in groundwater...

I graduated with a degree in Geology in 1975. The course was strong on the fundamentals of geology – mineralogy, sedimentology, palaeontology and so on – but it included very little in terms of practical applications. In three years we had a total of two lectures on 'economic geology', one on oil and gas, and one on minerals. The planned lecture on water never took place!

This left me very curious about the application of geology to groundwater research and development practice. I knew I needed to learn more about the subject of hydrogeology, especially as I was realising that I wanted to devote my career to the alleviation of poverty, especially in sub-Saharan Africa. Using my studies in the natural sciences to improve people's access to groundwater – for domestic water and for productive uses – seemed the natural next step.

Shallow groundwater abstraction for irrigation in Northern Nigeria.

Tomato harvest in Northern Nigeria.

Your inspiration in pursuing a career in groundwater...

It was this combination of a strong motivation to contribute to international (water) development, and my curiosity about groundwater and its role that has been an inspiration for me for the last many decades.

INSIGHTS AND EXPERIENCES.

Where do you find the most enjoyment working in groundwater -

There is something almost magical about seeing water emerging from a newly drilled borehole. That water may have fallen as rain many years, decades or centuries (or even longer) ago, and now it is seeing the light of day for the first time since. This is a source of endless wonder!

A particularly challenging groundwater issue you've encountered and how you addressed it...

I can describe a challenging groundwater issue that I encountered quite early in my career. It illustrates a wider issue that may apply more generally. This was the case of a borehole with quite a small submersible pump that we wanted to upgrade. We purchased a larger pump, installed it in the upper, cased, interval of the borehole (according to the driller's construction log that we had), and when we turned it on we immediately started pumping sand.

We tried adjusting its position vertically, with no change. According to the driller's log, the borehole was just over 30m deep, with plain casing from ground level to about 18m, about 12m of slotted well screen below that, and a short sump at the bottom.

The water table was at about 9m below ground level. At that time, down-hole CCTV was not commonly used, but we managed to find a local contractor with a CCTV camera that he mostly used for examining sewer pipes.

Monitoring well in Sierra Leone

On viewing the results of this survey it became clear that the drilling contractor had misreported the construction details. The lining consisted of plain casing from top to bottom, with large, punched slots (not proper well screen with a well-controlled slot size) commencing from just below ground to the bottom. Our sand pumping problem was fully explained by the mismatch between the documented design and the far inferior reality reported by the driller.

The lesson: always independently double-check the veracity of reports about what lies hidden below ground (both geology and construction details); don't just believe the driller.

A more challenging matter that I am struggling with at the moment is this: while it is relatively easy to explain groundwater concepts in simple terms, and ample basic documentation exists for this purpose, it is more difficult to find good, clear, rigorous ways of quantifying groundwater behaviour. A topical example is understanding the dynamics of intermittent pumping, as occurs in solar systems.

How do water levels vary with time through a succession of pumping and recovery periods - pumping for say 8 hours per day, recovery for 16 hours, repeated over many months, and including periods of recharge either annually or less frequently?

Of course there are computational models that can cope with these situations, but there seems to be a trade-off between the rigour of such models and the ease of the practical hydrogeologist to actually use them. In some areas of hydrogeology there are 'good enough' simple-to-use methods (for example the Logan formula for transmissivity, the use of specific capacity as a method of characterising the yield of boreholes in an aquifer), but there are many gaps too.

Drilling for water in Ethiopia.

What do you believe to be the most pressing challenges related to groundwater and water supply today...

I would highlight two main issues. First, the general (and unsurprising) lack of understanding by both the public and by policymakers about groundwater. Hydrogeology is of course a specialist subject, but it behoves those of us who do have some understanding of the matter to find ways to explain groundwater to these wider audiences. In particular, the sheer magnitude of groundwater's contribution to freshwater resources (in the order of 98%), the risks and uncertainties associated with accessing and developing groundwater (nothing is certain in geology and hydrogeology), and matters associated with the sustainable management of groundwater (especially in light of demographic changes and climate change) need to be far more widely and deeply appreciated.

The second critical matter in my view is figuring out, in each specific context, how the science of groundwater; the engineering of drilling and construction; the management and financing of long-term abstraction; and human behaviour; all come together to determine the sustainability of water supply services delivered by groundwater. These are not straightforward issues, but they directly affect the lives of millions of people, so we have to understand these connections in ever greater detail to ensure the long term resilience of groundwater-supplied water services.

The most rewarding project you have worked on with GWR...

The succession of training courses over many years in supervision of borehole construction.

Pump priming, Northern Nigeria

The best piece of advice you have ever received...

Two things: the first is 'question everything and make no (untested) assumptions'. The second, 'don't criticise something without proposing a better alternative'.

How being an active member of GWR has benefitted you professionally and personally...

All activities carried out with others or in teams offer immense opportunities for mutual learning. It's not always easy to put one's finger on specific things, but one always comes away richer for the experience.

GWR INVOLVEMENT AND ADVICE

What motivated you to join GWR's membership...

When discussions first began about the establishment of Groundwater Relief I was both an active participant in those discussions, but also a rather sceptical one. Although I could see much value in the services offered by GWR being made available to organisations that lacked groundwater expertise, I wondered whether and to what extent GWR's services would conflict with or undermine similar offerings made by consulting firms and freelance consultants. With the course of time however I have seen that GWR truly fills an important gap, enabling humanitarian and development organisations to access sorely needed expertise, without cost forming an insurmountable obstacle in the process. I joined GWR as I could see its growing impact and uptake – as my initial scepticism was replaced with increasing respect for its achievements.

A memorable experience from your work with GWR..

We used to run an ancient cable tool drilling rig, and on a previous one-day introduction to drilling with a group of students and other participants we were using this rig. It is important that a cable tool rig which is fitted with a hawser-laid steel cable uses one which is described as 'left-hand lay' rather than 'right-hand lay'. The difference is to do with how the strands of the cable are twisted together. With a left-hand lay cable, each time the tools are pulled back after striking the bottom of the hole, a sharp clockwise turn is imparted, tightening the threads on the tools below. A right-hand lay cable does the opposite, imparting an anticlockwise twist that tends to undo the tool threads.

Manual dilling, Northern Nigeria

On this particular occasion, for some reason the rig had been fitted with a new right-hand lay cable. The predictable outcome occurred. At some considerable depth in the hole, all the tool threads came undone and the cable returned to the surface without the tools.

We were suddenly left with a big problem – a group of enthusiastic students, a rig that was not going to drill safely, and the drilling tools at the bottom of the hole. It then became a matter of very rapid action – one team to replace the cable on the rig; another to design a set of fishing tools; all together then to try to recover the dropped tools.

I'm happy to say that all this was accomplished within an hour, tools recovered, drilling continuing, and a good lesson learned by all involved.

More broadly, it's been my experience that if the drilling all goes smoothly, no-one learns very much. If however a challenge is encountered – such as difficult ground conditions or rig problems – and everyone shares in the problem-solving, much learning can be achieved.

Advice you would give to someone aspiring to get involved at GWR...

If you have an interest in groundwater and its role in humanitarian and development contexts, join GWR!

Hopes for contributing to the GWR community in the future...

I'm getting a bit long in the tooth now, but if I can continue to contribute in small ways, I'm happy to do so.