Groundwater: Challenging times

Groundwater is regarded as a high quality, reliable and practical source of water for public supply and industry. It also plays an essential role in sustaining biodiversity in our environment through the normal functioning of river catchments. However, development now poses serious threats to both the quantity and quality of groundwater available for domestic, agricultural, industrial and environmental uses. Only careful sustainable management based on sound understanding can avoid potentially severe socio-economic and environmental costs.

Groundwater is an important source for public water supply and plays a vital role in maintaining supplies during dry summers and prolonged droughts. It provides 5% of public water supply in Scotland, 8% in Northern Ireland, and 33% overall in England and Wales, rising to over 70% in the south-east of England. The economic value of groundwater abstracted annually in the UK has been estimated at over £2 billion. The total capital cost of developing a groundwater supply to serve over 150,000 people (27 Ml per day) is of the order of £25M – low compared to developing a new surface water resource. Operational costs are also favourable, because groundwater needs little treatment and because boreholes can be developed close to where they are needed.

Groundwater is essential for much of the nation's natural environment. Rivers draining areas of permeable rocks, such as in the Chalk downlands of southern England, are fed almost entirely from groundwater. Wetlands formed in valley floors are often the result of groundwater discharging at the surface. Many ecologically important and naturally beautiful environments which are dependent on groundwater are also important to tourism. Groundwater-maintained river flows can also be vital for the dilution of discharged wastewater. Nevertheless the socio-economic value of groundwater is poorly understood by both decision makers and the general public.

The quality and quantity of groundwater and dependent surface water environments are vulnerable. They are influenced by man's activities in the past and will be influenced by the potential impacts of climate change. Groundwater is a finite resource dependent upon infiltrating rainfall for its renewal. There needs to be a balance between abstraction for human use and the requirement for environmental sustainability.

Water is one of the most heavily regulated areas of the environment, with a variety of legislative measures to protect both water supplies and the environment. Much of this legislation has been driven by European directives. In the UK, legislation requires the water suppliers to provide consumers with wholesome water, and the environmental regulators to prevent water pollution and (in England and Wales) to licence water abstractions in order to prevent over-exploitation. The EU Water Framework Directive (WFD), which came into force in December 2000, aims to help ensure that water is more effectively and sustainably managed for the benefit of both society and environment. It brings together management and protection of the whole of the water environment – surface and groundwater – and the activities and processes that impact it.

A groundwater-dependent Chalk stream in southern England (photograph courtesy of Paul Shand)

For groundwater, the WFD places a number of obligations on Member States (MS). The primary requirement is that groundwater is protected at least to the same level as that required by the existing Groundwater Directive (80/68/EC). Beyond this MS must strive to ensure that all groundwater bodies are of good status – in terms of water quality this is based on thresholds for the chemical constituents of groundwater and their impact on ecosystems. Clearly this is most relevant to surface water ecosystems and so highlights groundwater's important place in the hydrological cycle.

The route to achieving good status is mapped out in the WFD. It requires an initial characterisation, implementation of monitoring and a programme of measures to reach or maintain good status. It is perhaps worth mentioning that with the UK's high population density, intensive agriculture and a legacy of heavy industry, many of our groundwater bodies will undoubtedly be found to

be at risk of not being of good status by the compliance date of 2015. These "at risk" bodies must be further characterised and are likely to require more monitoring and potentially greater controls in order to achieve or retain good status.

Because of the high degree of complexity in addressing groundwater, the WFD provides for the production of a new groundwater directive. This will provide details of criteria for assessing good groundwater chemical status and the identification of starting points for trend reversal. The Directive will also detail controls on indirect discharges to groundwater that would otherwise be lost when the existing Groundwater Directive is repealed.

It is very significant that diffuse pollution, which is excluded from regulatory control in the current Groundwater Directive (80/68/EC), is included in the WFD. The implications of these controls to the UK, particularly in relation to nitrate and pesticide concentrations in groundwater, may be very serious. Nitrate pollution of the unsaturated zone in the Chalk and Permo-Triassic sandstone aquifers, due to application of agricultural fertilizers is widespread and a store of decades of high level nitrate loadings is held in this zone. Increasing trends in nitrate concentrations are widespread in groundwater sources. Some of these sources now pump groundwater which must be blended with low nitrate waters from other groundwater sources or be treated before public supply. The challenges of reversing these trends and achieving good groundwater status is likely to be an immense one and in some cases may not be achievable in the timeframe dictated by the WFD.

Clearly in order to make assessments of groundwater chemical status and trend reversal an adequate monitoring system, not currently in place, will be required. It seems likely that the monitoring will have to be carried out by both the environment regulators and the water utilities to avoid duplication and wasted effort. Costs will of course have to be borne by the tax payer or water users.

As is indicated here, the implications of meeting the requirements of the WFD are wide ranging for the UK. The capacity of those responsible will be severely challenged, both in terms of financial and human resources. Further, the scientific understanding may not presently exist to underpin the management decisions required. The potential impacts of the WFD have yet to be fully appreciated by the water industry and regulators, let alone the general public.

The introduction of the WFD and other regulations, such as the new Water Bill, means the demand for groundwater specialists is rising. The requirement for increased knowledge and research is high and the number of people adequately trained is falling year by year, as the number of students graduating with the appropriate skills declines. Factors contributing to this situation include the fall in the number of relevant postgraduate courses in recent years and poor salaries and career structures discouraging students, already burdened with substantial debt, to join the profession. There is a lack of appropriately qualified numerate science graduates, also felt by engineering professions and, in addition to all these disincentives, students may well be unaware of the potential for a career in groundwater.

This lack of a foundation for providing new blood in the groundwater community is causing great concern for many organisations employing, or using the skills of, groundwater specialists. The UK Groundwater Forum is keenly aware of this problem and is supporting efforts to address it.

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