

Rising groundwater levels in the United Kingdom

F. C. Brassington

T. Burke, *Mining Consultant*

Mr Brassington mentions the rise of the water-table in coalfield areas resulting from the reduction in dewatering pumping following mine closures. He points out that in some instances the water quality of newly flowing springs in such areas causes surface water pollution. Examples, he states, are most frequent in northern England, Scotland and South Wales.

39. This is in agreement with my own observations, but I am of the opinion that the extent of the problem created by rising groundwater levels in the British coalfields is not yet fully appreciated.

40. Coal production in Britain has declined fairly steadily from its peak in 1913: output in 1990 was only 33% of what it was then. It would be wrong, however, to assume that there has been a corresponding decrease in the amount of water pumped from mines over that period. The exhaustion of reserves at shallow depth has caused mining to go to greater and greater depths. Pumping from greater depth results in draw-down over a wider area. Where a new deep mine is developed, the closure of adjacent, shallower mines, while reducing output, often has no effect on the total water pumped from the area.

41. Generally, groundwater recharge does not begin with the closure of individual mines but with the complete abandonment of mining within a substantial area of coalfield. It is in these abandoned areas, when recharge has taken place and springs re-established, that surface water pollution is encountered.

42. In Britain, the trend over recent years has been to end production in the so-called peripheral coalfields and to concentrate it in the central coalfields of the English Midlands and Yorkshire. It is not surprising, therefore, that it is in the peripheral coalfields of Scotland, northern England and South Wales, as Mr Brassington records, that the pollution problem is currently being encountered. This is where the abandoned areas are, but even here some mining and dewatering pumping continues. Groundwater recharge is far from complete and the pollution problem not yet as great as it will become.

43. In the central coalfields, pollution problems such as those in the North, in Scotland and in Wales are generally absent and will remain so while coal production continues. Eventually, however, production will come to an end here also, the water-table will re-establish itself and the central coalfields will then experience the same problems that are current in the peripheral coalfields.

L. H. Swann, *Managing Principal, Saudi Arabian Dames & Moore*, and
Professor Dr Ahmed El Nimar, *Manager—Rising Groundwater Program, Arriyadh Development Authority, Saudi Arabia*

It was interesting to read of the extent of problems related to rising groundwater in

DISCUSSION

the United Kingdom. It was surprising not to see Saudi Arabia or Kuwait mentioned, as there have been a number of references to problems in the Middle East and, specifically, in Riyadh. Within Saudi Arabia there are known to be problems within several major cities, including Riyadh, Jeddah and Dammam, the three main conurbations. Major studies have been performed in Jeddah and Riyadh where schemes are being implemented to control rising groundwater. In Riyadh, the Arriyadh Development Authority has completed a series of major studies, aimed at understanding not only the causes of the problems, but also the mechanisms of groundwater movement and its impacts in terms of damage to structures and infrastructure.

45. In Riyadh, the cause of the rising groundwater is partially a change in use and also leakage from the water supply system, over irrigation and leakage from the sanitary system. Approximately 17% of water supply is lost through leakage from the water mains and a further 8% of the water supply is lost through leakage within individual properties.

46. The studies have indicated that between 1980 and 1990, rises in the groundwater table averaged about 1 m per year in many parts of the city. This rise had many detrimental impacts, not only on deep basements, but also on shallow foundations and infrastructure. In addition to the problems caused by over-stressing of walls and leakage into basements, the salinity of the water can result in chemical attack on reinforced concrete and steel utility pipes. Many of the soils in the city are sensitive to water-level changes and significant damage is being caused to low-rise residential buildings by foundation settlements.

47. As a result of the problems, the city of Riyadh is implementing a series of shallow horizontal drainage schemes and deeper vertical drainage schemes to control groundwater. In addition, a number of schemes have been implemented, or are in progress for a number of individual structures with deep basements. It is estimated that of the order of 250 000 m³/day is currently being pumped, and the total cost of implementation will exceed US\$ 100 million.

Mr Brassington

Mr Burke's comments are a useful reminder of the complexities in the hydrogeology of the coal measures, which result partly from the natural geological conditions and also from the extensive artificial inter-connections provided by mining activities. The restoration of a near-natural groundwater regime will depend generally on the cessation of dewatering, although there will be local deviations from this rule. It is worth bearing in mind that the eventual completion of the deep mining activities in the concealed coalfields, as described by Mr Burke, may well have the greatest impact on the exposed coal measures some distance away.

49. The comments of *Mr Swann* and *Professor El Namir* provide useful supplementary information, although they should not have been surprised that a review of UK conditions omits some Middle East examples.

50. The statistics they provide on water-mains leakage makes an interesting comparison with British experience. Published figures from the newly privatized water companies show leakage values around twice those found in Riyadh, lending powerful support to the opinions of Price and Reed⁴⁴ that this 'unaccounted for' water is a major factor in the problems of rising water-table in the United Kingdom.

Reference

44. PRICE M. and REED D. W. The influence of mains leakage and urban drainage on groundwater levels beneath conurbations in the UK. *Proc. Instn Civ. Engrs*, Part 1, 1989, **86**, Feb., 31-39.

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