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Welcome to *Preview* readers this month. In this column Tim Munday from the CSIRO tells us about the application of geophysics to food and water issues in Western Australia. Tim is a Research Group Leader in the Discovery Program of the Mineral Resources Flagship as well as a Project Leader in the Land and Water Flagship. He has an interest in the application of geophysical technologies in addressing Australia's shallow cover issues, which by their nature have relevance to minerals and groundwater exploration (and is firmly convinced that the two are inextricably linked).

Water, food and geophysics: the West Australian way

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In the first of several articles I'll briefly review how and why the West Australia Government has embarked upon an extensive programme of geophysical data acquisition to help secure the State's water future. There are two primary drivers for this – one being a huge surge in demand from its mineral and energy resource sector in the past 10 years; the second being a response to projected increases in the State's population (2.4 million in 2014 rising to 6.4 million by 2061 (ABS 2013)), coupled with a recognition that Australia's population is also forecast to increase to ~48 million over the same period. This projected growth and associated global population rises will increase world food demand by >70% by 2050.

Here, I focus on activities linked to WA's *Water for Food* programme. This programme, funded through the State's Royalties for Regions initiative, is a $40 m programme aimed at accelerating understanding of regional groundwater resources whilst optimising pastoral tenure across the State. In large measure this effort builds upon the recognition that water is a key enabler for almost all of the WA's economic activities (www.water.wa.gov.au/Future+water/Water+for+growth/default.aspx). The *Water for Food* programme, extending from the Kimberley region in WA's north, to the Great Southern region in its south, is fast-tracking water investigations, creating the potential for new irrigation precincts and the expansion of agricultural and pastoral opportunities in regional Western Australia. The intent is to enable West Australia's fresh food and animal protein production to increase by at least 50% by 2020 and twofold by 2050. The challenge, for all involved, has been to deploy technologies that assist in delivering information on groundwater and aquifer systems in a spatially consistent and timely manner, in regional parts of the State where existing hydrogeological data is relatively sparse and/or limited.

To assist, the relevant State Departments, including the Department for Water (DoW) and the Department for Agriculture and Food (DAFWA), have set out to use hydrogeophysical methods, and in particular airborne electromagnetics (AEM), as a basis for characterising groundwater systems present in the key areas identified for development. To date, *Water for Food* regional AEM surveys have been acquired over the La Grange catchment, which lies between Broome and Port Headland; the lower Gascoyne River east of Carnarvon; and over the West Midlands area west of New Norcia. These surveys have involved the use of a combination of fixed-wing and helicopter time domain EM systems, with the survey design and system flown defined by the targets of interest and the scales at which resulting information is required. The 'targets' have included the extent and geometry of salt water intrusion along the coast; aquifer geometry; and the nature and spatial variability of groundwater quality. In all cases the results from the AEM data have been used as a framework for follow-up hydrogeological investigations.

In the lower Gascoyne region, DAFWA in collaboration with CSIRO, used helicopter AEM data to map attributes of the unconfined alluvial aquifer beneath and adjacent to the ephemeral Gascoyne River, concentrating on spatial variations in groundwater quality. The primary purpose of the project was to improve groundwater resource management along the reach of the river, from the Carnarvon township inland by some 50 kms. In particular, the aim was to use the AEM to identify additional groundwater resources

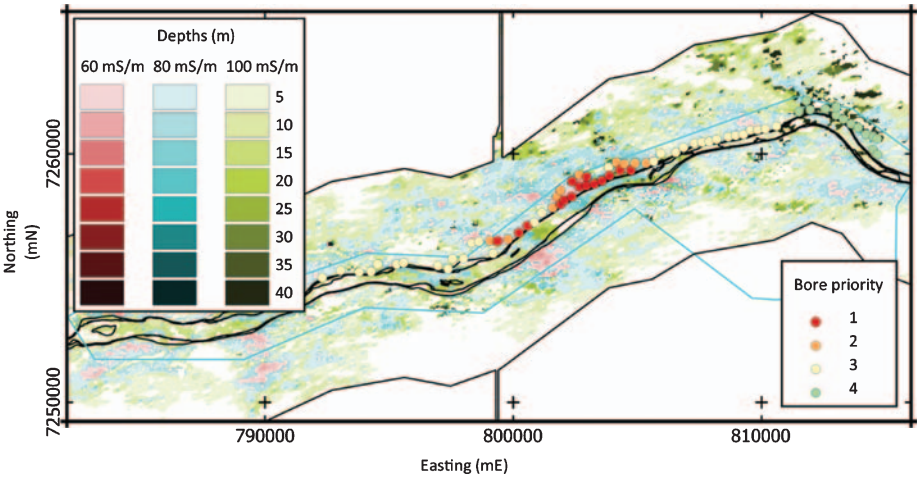

Figure 1. *Plan map of drilling sites and priorities determined from the interpretation of helicopter TDEM data. The priority sites are superimposed on a conductivity-contour depth grids derived from an inversion of the AEM data. In this study, sites only on the northern reach of the river (defined by the black lines in the centre of the image) were targeted. Other options for siting production bores remain on the southern bank (see Davis* et al. *2015).*

for securing and extending the current area of irrigated agriculture along the river. Information was required at a fine scale (vertical < 5 m, lateral < 150 m). The inverted AEM data provided drill targets (see Figure 1) close to the river, which were interpreted to represent zones of preferential recharge in flood events, and as sites where higher yielding sandy facies in the alluvium might also be present. As such, they are now targets for production bores intended to supplement irrigation development east of Carnarvon. This work is ongoing, and further information can be obtained from the DAFWA Project Leader: Dr Richard George (richard.george@agric.wa.gov.au).

References

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