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Editorial

W Alexander H Hamilton MA, CEng, FICE, MCIWEM
Chief Engineer, Black & Veatch, UK

This themed issue presents five papers on the subject of reservoir management. Reservoirs are some of the most spectacular human interventions in the hydrological cycle. Many are major features of the landscape, impacting on local and downstream environment and geomorphology. Their construction commonly requires great investment of human effort and treasure. Their impact on society, for better or for worse, has also been huge in the planning, construction and presence, and, more importantly, in the usual primary purposes; harnessing and balancing of water resources for cities, irrigation, hydroelectricity and more. Further purposes include flood mitigation, water quality management, nature and wildlife management, fisheries, navigation, leisure, sport, . . ., the list goes on. However, large dams/reservoirs have often been contentious, both in the construction and in the changes that they bring, particularly downstream. Nor have all reservoirs fully achieved the benefits promised. All this makes good reservoir management vital.

Reservoir safety is an overriding imperative. However, it is already well covered in the professional focus. It is taken as a given in this themed issue, which instead aims to explore how best to maximise reservoirs' primary outputs and life, and to harmonise their presence with society and the environment. The first paper by Chiamsathit *et al.* (2014) illustrates these aims. It covers a substantial study of operating policies at the Ubonrata reservoir in north eastern Thailand. This is a large reservoir used for multi-purpose water supply, including in-stream needs, hydropower and flood control. The aim is to optimise the performance, while balancing the conflicts. Four different operating policies are studied, and performance summarised for reliability, vulnerability, resilience and sustainability.

The next paper by Akbari-Alashti *et al.* (2014) covers hydroelectricity performance optimisation by analysis of real-time operation of a three-reservoir system in Iran. It also includes an interesting review of history of worldwide efforts to develop affective reservoir operating policies. Three optimisation methods are examined in detail. The authors find fixed-length gene genetic programming is the best. For developing rule curves the authors find little difference between an approach based on flow forecasts, and a simpler 'independent' approach instead using historical inflows. The latter is simpler, so it is preferred.

An important issue affecting the operation and life of many reservoirs fed from fast-eroding mountain ranges and uplands is that of sedimentation. This degrades storage capacity, blocks outlets, erodes turbines, and can even threaten dam safety. The next paper (Petkovsek and Roca (2014)) presents a very readable account of a numerical study of the influence of different reservoir operation strategies on fine and coarse sediment delta formation and movement, based on the Tarbela reservoir (a huge reservoir on the Indus in Pakistan). The aim is to help reservoir managers visualise what is happening with different operating strategies, and the effects on sometimes conflicting aims of maximising output and controlling sedimentation.

The next paper (Khan *et al.* (2014)) also covers interactions between reservoir operation strategy and sediment movement, but very differently. It gives a fascinating study of how the Kariba dam (Zimbabwe–Zambia) operating strategies have affected the morphology of the downstream Zambezi. The study includes numerical modelling, field- and historical-data analysis and satellite imagery. In the 50 years of operation there has been considerable channel widening and braiding. This has damaged the floodplain forest, affecting fauna and tourism, with regressive environmental and economic consequences. The main causation identified is abrupt closures of Kariba dam flood gates, causing rapid downstream flood recession, river bank slumping and vegetation collapse as groundwater flows out. The authors recommend more integration in dam projects, including the planning of operational rules, to provide adequate balance between human needs and environmental sustainability.

The last paper (Modiri-Gharehveran *et al.* (2014)) studies the potential effects of climate change, such as changes in air temperature and inflow patterns, on the thermal stratification regime in a large urban water supply reservoir in Iran. The stratification regime affects both raw water quality and aquatic ecosystem health. Such studies can assist planning of operational measures that may be needed to mitigate adverse effects.

This themed issue also includes one discussion submission (Easa *et al.* (2014)) on an earlier paper, on proposed improvements to the non-linear Muskingum hydrological flood routing method. This item is not a direct contribution to the themed issue, but it is welcome, as flood routing is relevant to operators of impounding reservoirs. I also hope its presence will encourage readers to comment on the subjects covered in the papers of this issue.

Reservoir management covers such a wide range of topics that it has not been possible to cover more than a fraction here. Nevertheless I hope that readers will find these papers interesting. I hope also that this themed issue will stimulate discussion of the issues, in particular the need to manage reservoirs sustainably, for

not only beneficiaries but for all other stakeholders, and that it may encourage others to write more on this important topic.

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