

## Groundbreaking study examines climate change effects on dam yields

Consultants have concluded a first-of-its-kind study for the Metolong Authority in Lesotho to research the potential impacts of climate change on the long-term yield of the proposed Metolong Dam.

Arcus GIBB and Jeffares & Green were appointed to look at the possible effects of climate change on an infrastructure that will need to stand for at least the next 100 years.

"The issue of climate change and its impacts on water resources is not new, but planners are increasingly concerned about the possible negative impacts of climate change on the utilisable yields from dams and water resource systems," reports Gerald de Jager, Associate of Jeffares & Green and a key member of the study team. "Emphasis is now being placed on the need to implement special adaptation measures to mitigate such impacts and to consider how such efforts can fit within the mainstream of developmental strategies. We are now taking into account the fact that the useful life of larger water infrastructure is often measured in multiple decades, and investments that are made today will still be operating under new climates of the twenty-second century."

The proposed Metolong Dam will be located on the South Phuthiatsana River in the Lesotho Lowlands, some 35 km outside Maseru, and it forms part of a larger US\$370-million project that includes treatment and conveyance infrastructure to supply water to domestic users as well as for industrial use, particularly textile factories. International funding has been secured for the design and construction of the dam. The Metolong Authority is the project implementing agent.

"Estimates on dam yields are traditionally based primarily on historical climatic behaviour and the observed occurrence of precipitation and stream flows in upstream catchment areas. However, scientists and engineers are now developing new ways of assessing yield and, in particular, the possible impacts of precipitation and stream flow changes

caused by climate change," explains Darryn Knoesen of Jeffares & Green's Earth Sciences division.

To provide the Metolong Authority with information on the possible impacts of climate change on the yield of Metolong Dam, the study team modelled the behaviour of the dam for a range of different future situations. Each of these assumes an alternative set of inflows to the dam based on the climate change scenarios developed Climate Systems Analysis Group (CSAG) at the University of Cape Town. The result of the analyses is a range of possible changes in yield which can be used by planners as an indication of future trends.

Inflows used for the analyses were developed by the School of Bioresources Engineering and Environmental Hydrology at the University KwaZulu-Natal based on CSAG scenarios and using the daily time-step ACRU hydrological model. Inputs into the ACRU included, among others:

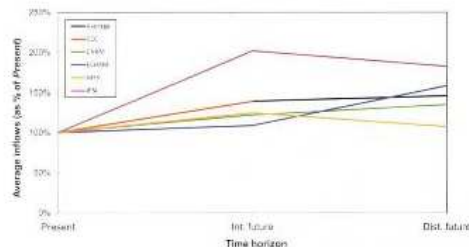
- Daily rainfall for each climate change scenario;

- Daily minimum and maximum temperatures for each scenario;
- Soils information; and
- Land cover information, which was assumed to be under natural conditions.

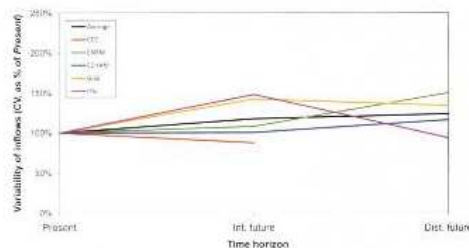
Resulting future inflow scenarios for Metolong Dam suggest that, in the intermediate future (i.e. 30 to 50 years from now) the average inflows to the dam are likely to increase moderately to significantly, together with some increase in variability.

This means that the available long-term yield of the Metolong Dam is highly unlikely to decrease in the intermediate future. In this case, therefore, no special adaptation measures will be required to account for the impacts of climate change on the yield of the dam over a 50-year planning horizon.

However, since projected inflows to the dam, as well as their variability are expected to increase, design engineers should account for the possibility of associated increases in the magnitude and the severity of extreme flood events in the future.



Averages of possible future inflows to Metolong Dam.



Variability of possible future inflows to Metolong Dam.

