What's that about?

Why lake levels change **Water modelling**

Updated April 2013

Hydro Tasmania is the largest water manager in Australia. We manage water for multiple uses, but the main purpose is for hydro-electric power generation. There are a number of factors that affect the level of the lakes we manage in Tasmania.

We use water modelling to predict water levels in our lakes, and when best to use water to generate power.

Water modelling and how it is used for hydropower generation

Hydro Tasmania has 30 hydropower stations in Tasmania, ranging from stations smaller than 1 megawatt (MW) up to our largest at 432 MW. Our system also has varied water storages. It ranges from large and medium water storages, which store water for longer periods, and 'run of river' storages that use water as it comes into the storage.

Our hydropower system is a complex and integrated system. It is our generation controllers' responsibility to ensure that all our stations are working at the right time to ensure reliable energy supply and sustainable water management.

One of the major tools we use to predict the best hydropower station to use at any time is water modelling. Water modelling is very much as it sounds.

We use previous and future estimate data to model where water may be available and how it could be best used. We can then match our modelling with demand in the electricity market. Where opportunities are presented we take advantage of exporting opportunities via the undersea Basslink inter-connector. Basslink is one of the longest undersea cables in the world, connecting Tasmania to the Australian National Electricity Market (NEM).

Hydro Tasmania water models

The principal model Hydro Tasmania uses for water modelling is the computer simulation model "Temsim". It includes all Tasmanian hydropower stations and storages (lakes) together with the canals and rivers linking them. It also includes Tasmanian wind farms; thermal power stations (e.g. gas); and Basslink.

We use simulations in hourly steps to try and anticipate how the electricity market will play out. In each step, expected water inflow is added to each storage and then rules are applied that mimic the way the system would be operated.

In this way, each hourly step provides an estimate of what the storage levels will be; how each power station will operate (power generation and water flow); Basslink energy flow; and market prices that would have applied had that outcome occurred.

By the end of the hourly step the storages will be adjusted to reflect what already occurred and the process will start again.

Normally, the simulations are forward-looking which means that the water inflows are uncertain – because of this we are forecasting not calculating what actually happens. This means that there are a number of possible water inflows for each simulation. To model the uncertain inflows and electricity demand the simulation is repeated multiple times, each with randomised inflows and electricity demand, to produce a set of "replicates". Often 100 or more replicates are produced. Each replicate

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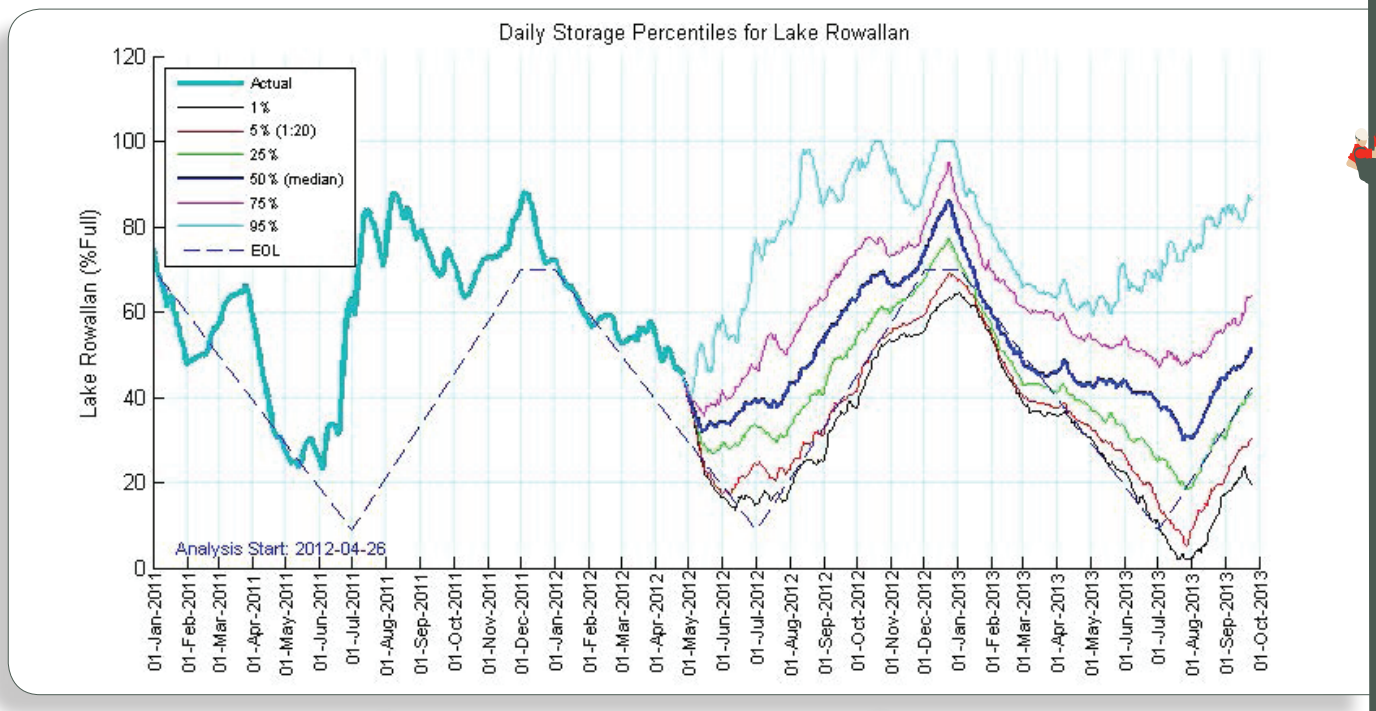
represents one possible outcome, based on the data used. Collectively the replicates can be used to show the range of outcomes possible, from dry conditions through to wet ones. This range of simulations also provides a mean (average) or median outcomes.

How Hydro Tasmania uses water modelling

Simulations can also be run to see the range of anticipated power generation, lake levels and river flows. We can do this using figures with expected values such as customer demand and water management rules. This really helps our generation planners when they are planning power generation and also ensures that the water storages are being managed sustainably. That is, the right water storage is being used to reliably meet electricity demand requirements. An example graph for one lake from such an electricity demand analysis is shown in the plot below.

We also use this water modelling to anticipate what will happen in situations outside of "business as usual". For example we often have upgrade and maintenance work on dams, power stations and canals – this means that our programmers must work out how the system will work without a certain power station for a period of time. You can find out more in our 'Power station outage' *What's that about* fact sheet.

With these simulations we can test, evaluate and refine what is the best time to complete maintenance using the modelled estimates of changes to generation, lake level and river flow. As part of this process we also consider the impacts of our outages on local water use. This can all be done before the proposed changes are committed to. As the costs involved can be large, the modelling can be of tremendous value in deciding what options work best and which justify the costs involved.



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