

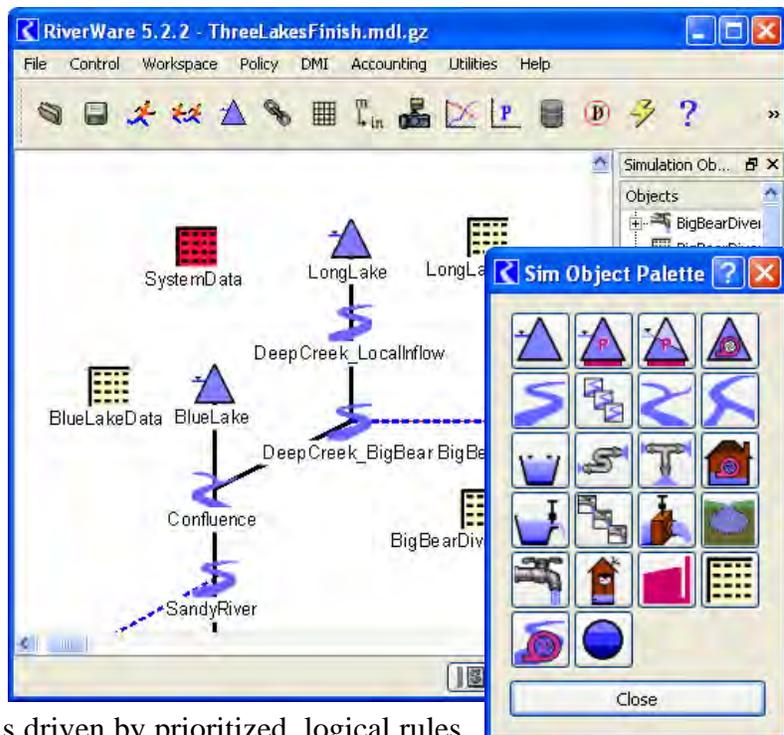
DEMONSTRATION OF RIVERWARE®

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Abstract RiverWare® is a river and reservoir modeling tool used by water managers, planners, consultants, utilities, researchers and stakeholders for forecasting and scheduling reservoir and hydropower operations, water rights and water accounting, developing and evaluating alternative operating policies and planning new projects. Developed by the University of Colorado Center for Advanced Decision Support for Water and Environmental Systems (CADSWES) with sponsorship of the Tennessee Valley Authority, the Bureau of Reclamation and the U.S. Army Corp of Engineers, RiverWare simulates the hydrologic response of a river/reservoir system given inflows and multi-objective operating policies. This demonstration will show how the object-oriented models are constructed from the palette of objects and linked together to form a river system network as shown in the following figure.

We'll show how data can be easily loaded into RiverWare from various sources (including directly from Microsoft Excel, HEC-DSS and HDB) and how outputs can be configured, viewed and exported.

Simulation demonstrations will include hydrologic processes in rivers and reservoir, consumptive uses and return flows, distribution canals, groundwater interaction and pumping, pipe flows, hydropower and pumped storage, inline pumping and hydropower plants, as well as water quality in rivers and reservoirs.



The rulebased simulation solution is driven by prioritized, logical rules that represent multi-objective operating policies such as flood control, water supply, environmental flows and hydropower production. We'll show how to create and execute these policies in the RiverWare Policy Language (RPL), using them to produce operating schedules, manage flood events or evaluate alternatives for EIS analysis. We'll show how to debug policy sets using the RPL debugger which steps through rule and function execution and presents the value of any variable in the policy.

RiverWare also models water ownership and can perform water accounting calculations – we'll demonstrate how agencies use RiverWare for prioritized water allocation, to operate with rules based on water ownership, and to perform after-the-fact legal accounting. We'll show how to configure accounts on simulation objects and link them together to form the accounting network. We'll show how to specify data and methods on these accounts and how rulebased simulation can be used to control the accounting calculations.

We'll demonstrate how utilities use RiverWare to optimize hydropower production while meeting water management constraints. RiverWare's optimization solution is a linear, pre-emptive goal programming algorithm that optimizes reservoir outflows for a prioritized set of user-specified objectives over multiple timesteps. We'll show how the policy is defined through the RiverWare Policy Language. Recently, a mixed integer programming solver was added to RiverWare. We'll show how this can be used to define more realistic operations in terms of unit level power modeling.

Multiple run management can be used to automate thousands of runs and produce probabilistic outputs. We'll show sample concurrent runs and output analysis tools that exhibit how the utility can be used to compare alternative hydrologic scenarios or operating policies. We'll also show an example of an iterative multiple run that executes user-defined logic to make iterative runs to compute a reservoir yield. The iteration sequence executes to converge on the reservoir withdrawal that exactly empties the reservoir during a specified hydrologic sequence while still constrained by full basin operating policy.

RiverWare's easy-to-use graphical user interface, statistical post-processing, spreadsheet-view of data, direct database connection configurations, scenario manager, output devices and powerful diagnostic and analysis utilities will complement as we show examples of the application of RiverWare to numerous river basins. Free evaluation versions of the software with demo models will be given to interested visitors.