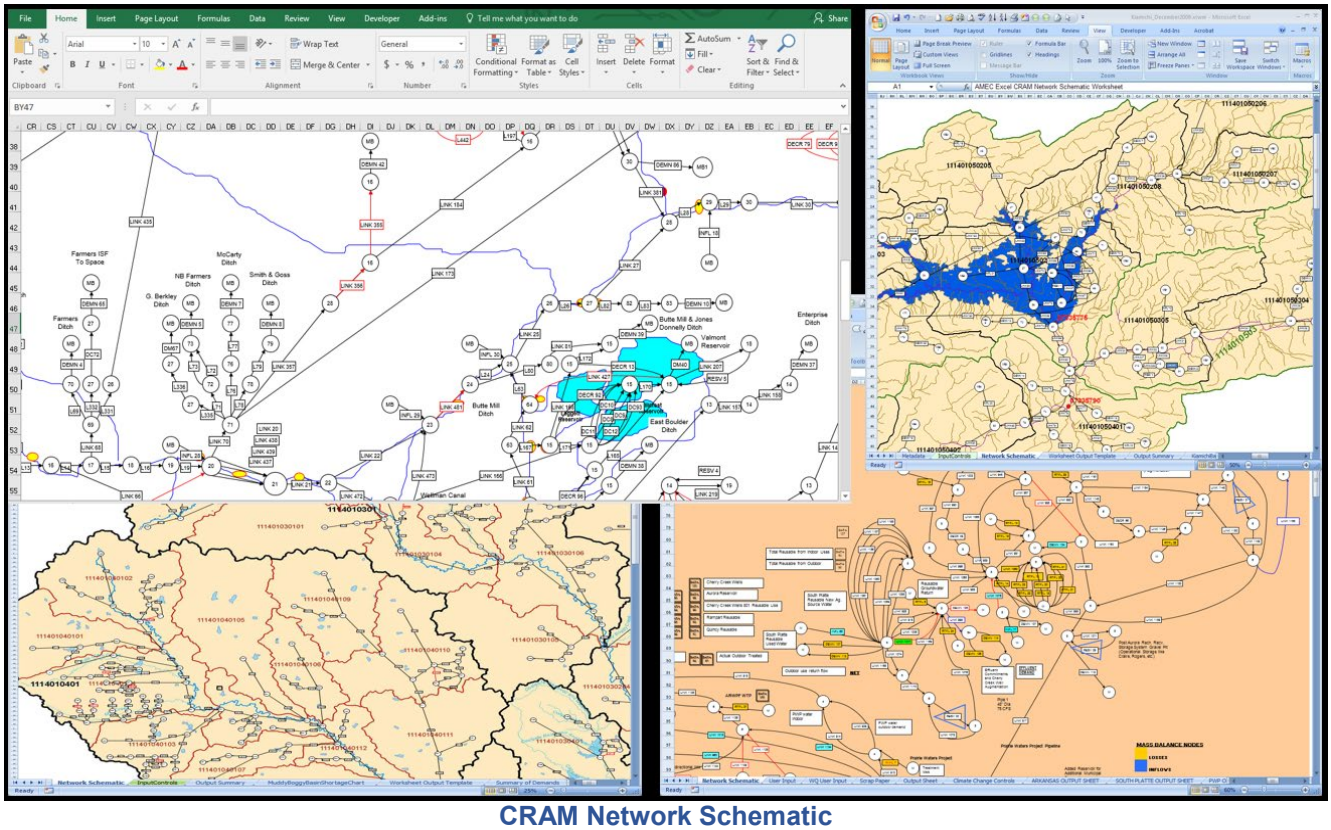
CRAM Water Resources Modeling Tool

CRAM is a water resources model used to support decisions for short, medium and long-range planning of a system's raw water supply. CRAM simulates all system components including reservoirs, water rights, wells, diversions, exchanges and more, through an intuitive drag and drop user interface. Whether your role is decision-maker, water resources manager, planner, engineer or accountant, CRAM will provide you with a more complete understanding of your water supply and demand, as well as how to optimize the use of this limited resource. CRAM is currently used by many cities, states and agencies throughout the United States for their water resources modeling and decision-making.



CRAM Network Schematic

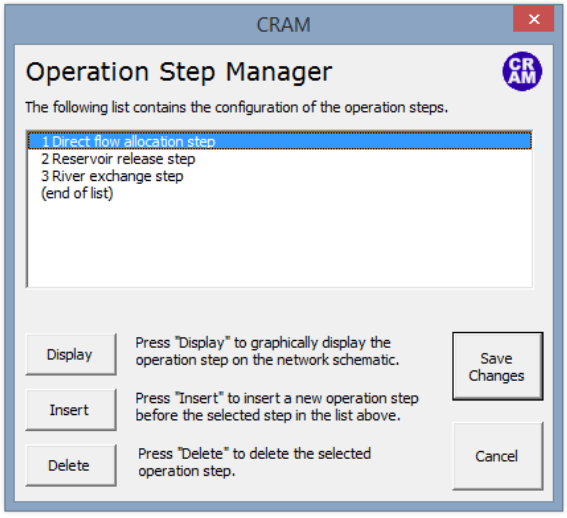
CRAM is embedded in Microsoft Excel ® as an Add-In, so you can develop and maintain water resources system models in a familiar and low-cost environment. This familiar and flexible framework, combined with CRAM's intuitive user interface means that minimal training is required before new users can develop, run and maintain a CRAM model. All model outputs are easily accessible from customized spreadsheets and analysis of model outputs is easy to automate with plots and tables using Excel's native capability.

Building a Model

The network schematic is the primary interface for building the model and interacting with model parameters. Users add nodes and links to represent their system's components, such as diversions, reservoirs, and treatment plants. Each object in the model opens a pop-up with its name, connection information, input data and output information. Because of its flexible and tolerant architecture, CRAM lends itself well to incremental model development – start simple and add complexity as needed. For example, if new groundwater wells are developed, it's as simple as a few clicks to add a new inflow to the model network.

Running the Model

CRAM is able to simulate operations with an input time series, demand time series, and priorities for flow links in the network. When CRAM solves the network, it supplies water first to those elements with the highest numerical priority, subject to any constraints, such as physical availability and capacity constraints. CRAM automatically enforces mass balance, so water is not created or lost within a system. This makes CRAM highly suitable for modeling systems where water rights must be administered in priority or modeling complex reservoir operations.



The Color of Water

With more complex systems it sometimes becomes necessary to track the source of the water or the type of water within the system (e.g., single use, full consumable water, etc.), often referred to as the color of water. CRAM makes this process easy with the use of *operation steps*, which are special model sub-time steps. If more control is desired, each time step can be broken down into two or more operation steps, wherein individual links can be manipulated, and the network resolved. If even more control is required, customizable VBA code can be configured within Excel to simulate complex operational or physical behavior.

Applications

CRAM has been applied to a wide range of water resources problems at scales ranging from a mine-site water balance to the entire Colorado River Basin. Lynker Technologies currently maintains and updates CRAM for the City of Boulder, which is used to simulate their raw water supply, water rights, and competing water demands. Boulder serves about 110,000 people using supplies from three different watersheds, including the water provided by regional programs such as the Colorado-Big Thompson project (C-BT). CRAM allows the City to quickly and easily run scenario analyses including the effects of climate change on supply and demand.

The development of a raw water supply model for Aurora Water demonstrates how CRAM provides the flexibility to proceed with model development incrementally without sacrificing simulation capability. Aurora serves a population of 310,000 people through a large and complex water collection and transmission system that obtains water from different source areas. Aurora's CRAM model currently simulates water rights yields from the South Platte, Arkansas and Colorado River basins with over 70 inflow time-series, some of which represent consolidated water rights yields. The model also simulates several complex water rights exchanges using CRAM's operation steps and custom VBA code. Aurora's staff utilize CRAM for routine planning scenarios as well as the evaluation of capital improvement projects.

CRAM is used for large and small water resources projects throughout the United States. Active users include the Oklahoma Water Resources Board (OWRB) and the U.S. Fish and Wildlife Service (among others). Call us today to see how CRAM can work for your organization at 855-LYNKER1.