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Hydrologic Systems Design and Operation: A Perspective on Where the Discipline has been and where it's going.

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Hydrology has been a component of the broader field of Civil Engineering since the days when engineers first began designing and constructing infrastructure that stores, transports, treats, and produces power from water. By the mid-1950s it was evident to some that the emergence of new mathematical methods used to analyze and evaluate alternatives and digital computer technology together could improve the ability of water resource engineers to plan, design and operate multiunit, multipurpose water resource systems. In 1955, a group of economic, government, and engineering professors together with government water planners began a program at Harvard University in the US to investigate ways to take into account far more alternatives than were usually considered with available procedures. The so-called Harvard Water Program responded to the lack of adequate guidance at the federal level for the design of water systems. Bureau of the Budget Circular A-47, issued in late 1952, requiring that net benefits be maximized, but offered little direction on how to do it. It's fair to say that that program, together with others at Resources for the Future in Washington, DC, and at UCLA, changed the water resources engineering discipline as we know it today. Today the use of various computer-based optimization, simulation and statistical methods for estimating various economic, environmental and social impacts of alternative plans, designs and operating policies of water resource systems is a central component of water resources engineering. My talk will offer some observations I've had being involved in this transition during the last half-century. The water resource systems field began with a focus mainly on economic impacts to now one that includes many more objectives and their links to a variety of environmental, ecological, and social issues. Our tools have gone from punching holes in IBM cards to working with interactive systems and GIS that allow the involvement of stakeholders in the political planning and decision-making process. My talk will conclude with some needed future developments in our discipline that will improve our ability to plan and develop as well as manage and maintain the water resources infrastructure needed to meet the range of sustainable development goals and challenges future water resources engineers will face.