Editorial

Some Curious Things about Water Management

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Water management is often very different from what we think intuitively or what we have been taught. The following are some examples:

Most Water Decisions are Local

Water policy and management discussions often seem to assume that state and federal government decisions and funding are the most important aspects of water management (Lund 2006). This is not nearly true. Historically, culturally, and practically, most water management in California and the United States is local (Lund 2006). There might be a dozen or more state and federal agencies, but there are thousands of local water, drainage, sanitation, and irrigation districts and millions of households and businesses. Local demand, supply, and operating decisions are the most important parts of water management and the areas from which most innovations in water management are coming. Because of the substantial build-out of large water projects, lack of water policy consensus, and debilitating state and federal budget deficits, local decisions, funding, innovations, and leadership are likely to become still more important in California and the United States. In California, in roughly 2011, local agencies spent a total of US$24 billion per year on water (US$12.1 billion), wastewater (US$6.5 billion), and flood control (US$1.3 billion). By comparison, state agencies spent approximately US$3.6 billion (mostly for flood control and the State Water Project), and federal agencies spent approximately US$0.5 billion (Delta Stewardship Council 2012).

Changes in Technology Change Optimal Management Institutions

In early times, it became clear that local institutions were needed to construct and maintain local water management systems (Pisani 1984; Kelley 1989). In the late 1800s, irrigation districts, reclamation districts, and local water utilities emerged to fill these functions more efficiently than individuals or private firms. When larger regional and statewide water systems involving major reservoirs and conveyance systems spanning the state became needed (or at least desired) in the early 1900s, state and federal agencies were developed to manage the planning, construction, and operation of such systems. Today, major storage and conveyance systems on a large scale are completed, and innovative water management is dominated by water conservation, water markets, conjunctive use, water recycling, and other techniques in which local agencies have comparative advantages, and state and federal agencies have different and largely diminished roles (Hanak et al. 2011). Institutions should change to make the best use of the most economical and appropriate mix of technologies for managing a system. In California, this indicates that local agency efforts need incentives to be better coordinated and better serve some regional and statewide objectives. Outside of this, state and federal agencies have diminishing roles following the age of large-scale infrastructure construction.

Continued Studies versus Action and Work

Studies forever are sometimes cheaper and more politically convenient than action or technically serious work. For example, there is a common and political perception that new reservoirs are needed. Most elected and business officials grew up in an era when if you needed more water, you went to the nearest watershed, built a dam, and diverted water to where you wanted it. Today, most of the technical community is lukewarm on the idea of expanding reservoirs, for economic, technical, and environmental reasons. Constructing new reservoirs also taps an immense reserve of controversy. So consider the following choices:

1. Building a reservoir, costing US$2 billion or US$100 million/year for a long time at a 5% interest rate; or
2. Study building a reservoir, costing $1 million/year, perhaps for a very long time.

The least controversial and most politic and economical choice is to study the problem for a long time and rarely release substantial reports on the subject. This neatly dampens most of the controversy, while keeping agencies and consultants well funded and out of trouble. However, studying the problem forever has a financial cost and arguably greater costs from dissipating analytical expertise, avoiding more serious discussions, and loss of technical integrity in government agencies.

Self-Optimizing Systems

Water users adapt to long-term management and tend to make optimal any given long-term infrastructure and operations (Lund 1995). Controlling floods with reservoirs and levees for some years leads people to settle more in floodplains (White 1945). Such encroachment sometimes can make it more difficult to use the official flood channel capacity and can further constrain water system operations. Outside of California, another example is the tendency of inland thermal power plants to build cooling water intakes at the lowest historical regulated water level. During a drought, this inflexible high-value demand for water elevation now requires awkward releases of scarce water from upstream. The power plants do not need the water, just the water elevation. A similar effect occurs with boat ramps on reservoirs during droughts. The recreational drought is often not so much a lack of water or lake surface area, but insufficiently long boat ramps for drought conditions. Smart water users adapt to any operations and force us to retain long-standing operations, which might not have been optimal initially. This implies costs for making transitions and responding to unusual drought or flood conditions. Water management is not just on the supply side, the reactions and long-term decisions of water users are just as important.

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Small Shortages Sometimes Create Disproportionately Large Costs, with Disturbing Implications

Usually, we assume, and it is often the case, that larger shortages lead to ever-increasing water shortage costs. Doubling a shortage more than doubles shortage costs. This is true for most water demands that are well managed and experienced with shortages because only a fool would short higher-valued crops or functions first.

However, for urban and small commercial water users, even small shortages impose a significant hassle cost, requiring the users to figure out how to deal with the shortage and distracting them from other valued activities. In terms of economic theory, this indicates that the first units of shortage are more expensive than the later ones (nonconvex shortage costs). You can see glimmers of this behavior in some less-than-satisfying contingent valuation studies of urban water shortages (e.g., Barakat & Chamberblin Inc. 1994) and some insightful modeling studies (e.g., Hashimoto et al. 1982).

If shortage costs begin small and gradually increase for everyone (convex shortage costs), as is commonly assumed, then it is optimal (and fair) to spread the shortage across all customers. However, if there is a high initial hassle cost for dealing with a shortage (making shortage costs nonconvex), then the economically optimal allocation of shortages is very different. Given a high initial cost for shortage and a slower increase in shortage costs afterward, the best way to minimize overall shortage costs to all customers overall is to concentrate shortages with as few customers as possible. This allocates as much shortage as possible to the fewest number of people, minimizing hassle overall, but concentrating it among a few. For small shortages, this saves the society a lot of cost. Those allocated shortage could be selected randomly, or the allocation could be to those with the least hassle. Sometimes, economically optimal is not fair. (Seen another way, fairness sometimes has a cost—which hardly seems fair.)

Ideally, those allocated the shortage would be compensated by others who are spared the shortage and hassle costs. (But when did you last see this happen?)

Chicken and Cooperation in Regional Water Management

We like to think that if everyone can be shown a win-win alternative, all stakeholders will jump onboard in support. But frequently, this does not happen. Why?

Often, one or more stakeholders will use stalling such an agreement to improve their share of win-win benefits. The strategy is to deny that they would be better off with the win-win solution and then ask for more. When enough stakeholders have incentive for this behavior, a chicken game results in which everyone is getting worse off while bargaining to do better for themselves (Madani and Lund 2012).

How Can Management and Planning Occur with Fading Federal and State Presence and Initiative?

We often assume that federal and state leadership can help solve problems, and this was quite true during the era of water infrastructure development. However, federal and state agencies are fading as most innovations (water conservation, water markets, conjunctive use, and reuse) are led and implemented locally; federal and state funding is in sharp decline; state and federal policy consensus is lacking; and many state and federal agencies suffer from bureaucratic sclerosis. How can regional collaboration be stimulated without state and federal funds or political support? How can regional collaborations make the best use of the remaining advantages of state and federal governments? Will regional chicken games worsen? This is perhaps our greatest challenge for water management and policy (Hanak et al. 2011).

Acknowledgments

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