

## What to Do about Wicked Water Problems

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It's a rare day when western water managers don't check the weather. A defining feature of this geographic region of the United States is a lack of precipitation. A second feature is great faith by its people in a technical solution to whatever problem a lack of rain creates.

Long before Europeans arrived, predecessors to the Hohokam people migrated from central Mexico to southern



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Photo: Lynn Ketchum, University of Arizona  
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Arizona, bringing domesticated crops and their knowledge of irrigation with them. Their descendants constructed networks of diversion dikes to capture runoff rainwater and cultivate fields. Mission

priests expanded and enhanced the historic systems, building new rock dams and small earthen reservoirs. In 1902, the U.S. Reclamation Service (later changed to Bureau of Reclamation) was

created to advance a federal effort of “irrigation works for the storage, diversion and development of waters”—to irrigate arid and semiarid lands in 16 Western states and territories.

It worked. The West bloomed. Planners and engineers crisply defined, understood, and fixed problems through technical solutions. It was not simple, yet problems were solvable. Either solutions worked or they didn't.

Lately, more and more water problems seemingly defy standard solutions. This typically occurs for four reasons: incomplete or contradictory knowledge, the number of people and opinions involved, the large economic burden, and the interconnected nature of these problems with other problems. These are wicked problems. Wicked problems are often hot potatoes tossed back and forth among policy makers, and decried as too substantial for grand solutions.

Wicked problems are not solved—they can only be mitigated through an approach that emphasizes empathy, abductive reasoning, and rapid prototyping. It is not possible to present an elegant solution and be done.

Horst Rittel, one of the first to formalize a theory of wicked problems, cites ten characteristics of these complicated social issues

1. Wicked problems have no definitive formulation. The problem of poverty in Texas is grossly similar but discretely different from poverty in Nairobi, so no practical characteristics describe “poverty.”

2. It is hard, maybe impossible, to measure or claim success with wicked problems because they bleed into one another, unlike the boundaries of traditional design problems that can be articulated or defined.
3. Solutions to wicked problems can be only good or bad, not true or false. There is no idealized end state to arrive at, and so approaches to wicked problems should be tractable ways to improve a situation rather than solve it.
4. There is no template to follow when tackling a wicked problem, although history may provide a guide. Teams that approach wicked problems must literally make things up as they go along.
5. There is always more than one explanation for a wicked problem, with the appropriateness of the explanation depending greatly on the individual perspective of the designer.
6. Every wicked problem is a symptom of another problem. The interconnected quality of socio-economic political systems illustrates how, for example, a change in education will cause new behavior in nutrition.
7. No mitigation strategy for a wicked problem has a definitive scientific test because humans invented wicked problems and science exists to understand natural phenomena.
8. Offering a “solution” to a wicked problem frequently is a “one shot” design effort because a significant intervention changes the design space enough to minimize the ability for trial and error.
9. Every wicked problem is unique.
10. Those addressing a wicked problem must have authority and responsibility for their actions.

Water planners and managers play a central role in mitigating the negative consequences of wicked problems. They will be required to position efforts in new and more desirable directions. This will not be easy, quick, or solitary. It requires methodical, rigorous iteration focused on the system qualities of the problem. Interdisciplinary collaboration that captures a broader knowledge of science, economics, statistics, technology, psychology, politics, and more is necessary for effective change.

Water managers and planners will also need to more actively utilize abductive reasoning in addition to deductive and inductive approaches.

Abductive reasoning begins with an incomplete set of observations and proceeds to the likeliest possible explanation for the set. This method yields the kind of daily decision-making that does its best with the information at hand, which often is incomplete. In court cases, judge and jury consider whether the prosecution or the defense has the best explanation to cover all the evidence. While reasonable, it is subjective.

Whereas deductive reasoning creates certainty and inductive reasoning quantifies uncertainty, abductive reasoning attempts to create meaning when uncertainty exists.

Managing wicked problems is a new kind of work. It requires changing the questions, managing uncertainty, and

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creating resilience. It does not solve existing problems but instead drives to a desired future state.

Reframing water issues as wicked problems will be essential for moving forward to a healthy water future. It begins with considering issues and solutions at the system scale. Water projects can no longer be solely the domain of the water community. Creating a change in one part of the water system will change the entire system, including the dependent social and environmental systems, sometimes in unexpected ways. This will require yet another solution to address that situation. It is an adaptive, iterative exercise. Solutions to wicked problems are never one and done.

Traditional approaches that focus on solution-proposing will need to transition to a process that defines a desired state. Solutions then balance and reconcile tradeoffs while considering self-interests of the parties.

Given that issues must be addressed at the system scale, collaboration and interdisciplinary approaches are key. The way the parts work together are as important as how they work

individually. While this degree of upfront engagement may seem time consuming, it takes far less time than the rework required when a lack of integration creates problems.

The largest hurdle may be reframing the public's perception of water management. The faith in the technological solution and the ability of the water professionals to create certain outcomes, while well deserved, does not match the emerging reality.

Introducing a wicked problems framework and the need for adaptive management is key. Also needed is an understanding that solutions for wicked problems are only good or bad, not true or false. This requires a change to previous approaches for defining success.

Moving forward, water managers will continue looking at the weather. The good news is, there are new ways of thinking about how to manage what it brings. 🏡

<https://wrrc.arizona.edu/wicked-water-problems>