EVALUATING THE USE OF DATA PLATFORMS FOR WATER MANAGEMENT DECISIONS

Key Findings and Recommendations

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INTRODUCTION AND OVERVIEW

California has a long history of fragmented water management, which is mirrored by the fragmented state of water data and water-related ecological data, particularly outside of state and federal agencies. There is increasing recognition that this fragmentation hinders effective and timely water management decisions at all levels and that there is strong potential for open water data and decision support tools to improve water management outcomes. This recognition is exemplified by a number of recent open water data portals and initiatives, including the U.S. Department of the Interior’s Open Water Data Initiative;1 the Bureau of Reclamation’s Reclamation Water Information System;2 open data actions taken by the states of Texas;3 Utah4 and Arizona;5 the Water Data Exchange;6 the Internet of Water7 and numerous others.8 In 2017 the California legislature passed the Open and Transparent Water Data Act (A.B. 1755) to “create, operate, and maintain a statewide integrated water data platform; and to develop protocols for data sharing, documentation, quality control, public access, and promotion of open-source platforms and decision support tools related to water data.”9

At the same time, the burgeoning literature on the implementation and use of open data for improving governance, and on decision support systems for environmental and water management, demonstrates the difficulties encountered in efforts to apply these tools to influence management decisions. Indeed, literature suggests that arguments for open data and related

2 See https://water.usbr.gov/.
3 See https://waterdatafortexas.org/reservoirs/statewide.
4 See http://dware-utahdnr.opendata.arcgis.com/.
5 See https://gisdata2016-11-18t150447874z-azwater.opendata.arcgis.com/.
6 See https://www.wade.westernstateswater.org/.
9 See https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201520160AB1755.
projects are often based on ideas and social norms rather than on substantial research. There is little empirical evidence to shed light on whether, when and how open data can be used to improve water management decisions in measurable ways.

In an effort to address this research gap, Stanford University’s Water in the West Program observed the development and implementation of two data integration and visualization tools10 to support water management decisions: the Shasta Operations for Winter Run (SHOWR) and the Groundwater Recharge Assessment Tool (GRAT). Observation of these data platforms included extensive document review, meeting observation and 67 interviews with agency decision-makers, tool developers and stakeholders at two different times during tool development and implementation.

Recognizing the limitations associated with the evaluation of only two data platforms, we conducted an additional 31 interviews with tool developers, academics, state and federal agency representatives, consultants and nongovernmental organizations involved in the development and implementation of an additional ten data platforms to support water management decisions. Results from a portion of this analysis are described in a summary report and supplemental material available at: https://purl.stanford.edu/cb612zf3515. The authors have also developed a template Request for Proposals (RFP) that incorporates the findings and recommendations summarized here into more concrete requirements for tool development. While intended primarily for tool funders, tool developers, state and federal agency representatives and others involved in water management tool development may also benefit from the lessons and processes captured in the RFP, which can be accessed at: https://purl.stanford.edu/cb612zf3515.

The following section outlines the key findings from our analysis. These findings highlight the complexity of developing tools to support water management decisions.

**KEY FINDINGS**

**Finding 1:** The social, political and operational complexities surrounding water data should not be underestimated. In complex water management situations involving many different organizations it can be difficult to discern who the “key” decision-makers are, how (or if) they will use a decision support tool and what factors may hinder tool adoption.

**Finding 2:** Data platforms that have been adopted and continue to be used for water management decisions are generally supported by legislative processes, have a clear governance structure with engaged advisory boards and have long-term, stable funding sources.

**Finding 3:** Developing a clear tool development plan with milestones is crucial to long-term data platform success.

**Finding 4:** Successful tool scoping and development takes time, as well as ongoing financial and personnel commitments to manage and update tool functionality over time. Data platforms that have actively been used for more than ten years to support water management decisions, had scoping phases ranging between 1 to 5 years and development phases of 2.5 to 5+ years.

**Finding 5:** Finding one or more tool development “champions” is crucial for data platform success and adoption. However, finding a champion can be challenging.

**Finding 6:** Agencies may be reluctant to make data publicly available for a variety of reasons, including a lack of capacity to ensure adequate quality assurance and quality control of data in a timely manner; concerns that increased data transparency may lead to greater scrutiny or the risk of misinterpretation by parties external to the decision making processes; loss of power and protection of proprietary data.

**Finding 7:** Agencies are often more willing to release primary data than higher-value processed data or model outputs. Legal or regulatory steps may need to be taken to make certain types of data publicly available.

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10 We use the terms “tool” and “data platform” as generic shorthand for any of the different kinds of applications that we analyzed for this study. These included dashboard-style web applications, desktop or cloud-based data integration and visualization programs, and multi-purpose online portals with a variety of web-based tools and downloadable software, data, and models.
**RECOMMENDATIONS**

Findings from our analysis highlight the many potential legal, technical and governance challenges that may be encountered when developing tools to support water management decisions. *While identifying and mitigating these challenges is not easy or fast, it is possible.*

We believe the following recommendations will help mitigate the concerns outlined in our findings, however they do not guarantee the successful development, adoption and implementation of water management platforms. The recommendations outlined below are intended as guidance and will need to be tailored to individual tool development processes.

**Recommendation 1:** Prior to any technology development, the tool development team\(^{11}\) should establish clear objectives for the project, including the problem the technology is seeking to solve and the decision-making process being targeted. Whenever possible, the problem statement should be jointly developed with high-level decision-makers and key technical personnel at the entity or entities being targeted for tool development. Understanding and integrating the needs and workflows of key technical personnel into data platform design is likely to improve adoption long-term. (See Appendix A below for additional details).

**Recommendation 2:** Assuming there is a clear problem statement and sufficient support from decision-makers for data platform development (based on the analysis done in Recommendation 1), the development team should work with decision-makers to create a long-term tool development plan. This plan should include key project milestones that demonstrate clear progress toward objectives, as well as information on long-term funding, maintenance and housing; governance; and technical development of the tool. (See Appendix B below for additional details).

**Recommendation 3:** Whenever possible, discussions about who will house and support ongoing data platform maintenance should be resolved prior to initiating development. These discussions should determine who will fund the tool long-term. If the entity or entities being targeted for tool development are unwilling to commit to these obligations, platform development may need to be reconsidered.

**Recommendation 4:** The tool development team will need to work with the entity or entities being targeted for data platform development to (1) understand any potential concerns related to increasing data transparency and (2) consider the pros and cons of developing an open and transparent decision support tool (or components thereof). Where open and transparent decision support tools are deemed necessary, additional time should be incorporated into scoping and development to understand and mitigate concerns associated with open data and decision-making.

**Recommendation 5:** During data platform scoping, the capacity of agencies to support the data collection, quality control and assurance, maintenance and analysis necessary for tool development should be evaluated. Additional one-time or ongoing technical and financial resources may be required to ensure that data necessary for platform development are of sufficient quality and are readily available in a timely manner. The tool development team should also consider agencies’ capacity to support long-term data platform maintenance and upkeep. Additional funding may be necessary to support the use of external consultants.

**Recommendation 6:** Finding a data “champion” who can advocate for the data platform within an agency or across agencies is essential. Once data platform development is underway, developers should identify an individual within the decision-making body the tool is targeting to actively support development and adoption. This individual can often help ease political barriers associated with platform development, navigate tensions between project partners, and communicate value within partner agencies. Data champions are generally manager-level employees.

**Recommendation 7:** Where open and transparent data and decisions are critical for tool development, legal or regulatory steps may be needed to make all data or decisions publicly available. Tool developers may need to consider which portions of the data platform can be made publicly available. Where legal or regulatory measures are considered, legislators or regulators should be specific about the types of data to be disclosed to ensure that agencies provide all relevant data. Where multiple entities, consultants, individuals or others have been involved in data collection or model development, legal or regulatory requirements may need to consider intellectual property rights to ensure access, use and full disclosure of data or models.

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\(^{11}\) The term “development team” refers to both the tool developers and the larger group of participants in the development process who provided input and advice, and generally helped guide the development process. Development teams can and should include end users, agency representatives, facilitators and others. Whenever possible, the tool development team should also include stakeholder groups (e.g., cities and counties, environmental groups, disadvantaged communities or others) affected by the water management decision(s) being targeted for tool development.
Appendix A: Recommendation 1 Details

The answers to the following questions should be sufficiently understood before committing to development of a water management data tool:

(i) What is the management objective for the tool?
(ii) Who are the key decision-makers and how do they intend to use the tool?
(iii) Are the key decision-makers invested in, and supportive of, tool development (i.e., are they committed to providing financial, personnel and/or in-kind contributions during development and implementation)?
(iv) What are the legal, regulatory and policy requirements for data transparency and decision-making?
(v) What is the potential for litigation or other legal, political, economic or negative repercussions that may result from making data or decisions more accessible or transparent?
(vi) What is the plan to mitigate any negative repercussions resulting from making data or decisions more accessible and is the plan acceptable to the decision-maker?

Appendix B: Recommendation 2 Details

The tool development plan should, at a minimum include a:

(i) Problem statement.
(ii) Proposed long-term tool governance structure, including an advisory board.
(iii) Overview of the physical boundaries of the system.
(iv) Data collection and management plan.
(v) Technical tool description that clearly demonstrates how data platform development aligns with the project objectives.
(vi) Project budget.
(vii) Long-term plan for housing the tool and funding maintenance and ongoing development.
(viii) Tool development timeline with milestones that demonstrate clear progress toward tool objectives.
(ix) Plan for communicating project results and lesson learned to interested parties.
(x) Plan for developing legal or regulatory structures to support tool development and use, where necessary.

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Disclaimer

The authors would like to note that tool developers and reviewers were not asked to endorse the report’s conclusions or recommendations, nor did they see the final version of the report. As a result, responsibility for the final content of this report rests entirely with the report’s authors.

Recommended Citation