

The Water Budget Navigator

A Comparison Tool for the Colorado River Basin

Tasha Griffiths • June 2022

The Colorado River Basin is experiencing a [historic drought](#). Many states in the basin are facing increasing variability in rain and snow patterns, and municipal water needs and infrastructure are more complex than ever. Given these challenges, state water budgeting is also becoming increasingly complex. To promote transparency and collaboration among CO River Basin States, the Nicholas Institute for Environmental Policy Solutions' Water Policy Program developed the [Water Budget Navigator](#) tool as part of the Internet of Water start-up project. This tool builds on the Internet of Water start-up project's [Coming to Terms](#) tool, which seeks to promote a shared vocabulary of water terminology and tracks definitions, synonyms, and homonyms of water-related terms used by public agencies and private entities.

The Water Budget Navigator is a web application that allows users to compare the water budgeting and water use estimation frameworks used by water resources agencies in the Colorado River Basin states (California, New Mexico, Colorado, Wyoming, and Utah).

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WHAT IS WATER BUDGETING?

Water agencies use water budgets to ensure that water is being used appropriately across their district. Water budgets track inflows (snowpack, rain levels, aquifers, reservoirs) and outflows (municipal use, agricultural use, ecosystem use) within

a district so that all water needs can be met. This inflow and outflow data is critical for water markets. However, many agencies struggle with imperfect information. It is difficult to know all water flows at all times, so water estimates are frequently used. Many water agencies are also dealing with limited technology and capacity, as well as outdated regulatory structures, all of which can lead to imperfect data.

Each US state has a different regulatory history and unique water use needs. This means that water budget forecasting is often estimated differently in different states. Some agencies rely on simple spreadsheet models using a mix of administrative and survey data (NM), while others rely on computer models that can incorporate in-the-field continuous reporting technology (CO). But, regardless of their water data infrastructure, all states need to estimate water budgets. Cross-state communication could make these budgets more effective. Prior communication has been limited since each state uses unique terminology and budget breakdowns. For example, when defining outflow use, some states combine both municipal and agriculture use into a larger 'human use' category (UT) - while other states keep these uses separate (CO).

This is where the Water Budget Navigator can provide clarity. This tool provides a clear visual of how each state (CA, NM, CO, WY, UT) consolidates its water flows and can show how water budgeting components used in different states are interrelated. It helps users to parse out the relationships between different states' estimation methods. The tool also aims to make the complicated work of water budgeting more understandable for non-hydrologists.



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HOW WAS THE TOOL BUILT?

The Water Budget Navigator tool was built by analyzing water budget guidelines, regulations, and in-practice conversations with water sector leaders in California, New Mexico, Colorado, Wyoming, and Utah. In 2020, The California Department of Water Resources published a [Handbook for Water Budget Development](#) that details the data sources used in water budgeting. The Water Policy Program team used this handbook as the foundation of the database and layered other states' policies and guidelines onto that foundation. Through this layering process, some similarities were found in vocabulary and estimation methods across different budgeting systems.

The team used an ontology framework of nesting relationships to identify how water budgeting terms and estimation methods used in different states were either:

- The same thing with a different name
- A subset of another state's component
- A Venn diagram with some interrelationships and some differences
- Or a not at all the same

By defining these relationships, the team was able to identify both commonalities and key differences in water budgeting methods across these western states. For example, Basin Outflow in Utah is an exact match to Steam Outflow in California however the term "Public Water Supply" in New Mexico has no match in the other Colorado River Basin states. One Duke graduate student intern who worked on the tool noted that "similar flow types were named differently, making collaboration difficult." As water flows through a watershed, it does not follow state boundaries, so one side of a watershed may use a name that does not correspond to that same terminology on the other side in a different state. It also became clear that "each of these states have really qualified people doing this work and have thought out reasons for their calculations."



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HOW HAS THE TOOL BEEN USED?

The water budget navigator enables users to compare the various components used by different water budget frameworks in various states, both in terms of their definitions as well as their estimation methods and data sources. The tool pulls together budgeting data in a standard format that allows different approaches to be compared.

Like any new technology rollout, gathering feedback and implementing updates is key to success. As the team shared the tool with each state, corrections and updates were made that not only improved the tool's clarity but allowed water agencies to better understand their own systems and identify guidelines that needed to be updated. For example, both Utah and New Mexico provided updates through the Western States Water Council's Water Data Exchange (WaDE) project, and Wyoming updated their online estimation method information to match new estimation procedures.

The tool's rollout and feedback sessions highlighted how building new tools or consolidating data can help identify key gaps and miscommunications. This is why many water agencies benefit from having shareable water data that allows for cross-agency collaboration and increased efficiency. When best practices for water data are used data are:

- discoverable, easy to find;
- accessible, machine-readable and easy to download; and
- usable, standardized with metadata and easy to share.

NEXT STEPS

The Water Budget Navigator provides transparency by showing how variable water budgeting can be both within and across state boundaries. The tool also provides water managers a baseline to start conversations about how agencies can learn from each other by understanding key commonalities and differences in budgeting methods. The last effort to provide this kind of transparency and collaboration was completed 15 years ago with the USGS and Bureau of Reclamation's ["Comparison of U.S. Geological Survey and Bureau of Reclamation Water-Use Reporting in the Colorado River Basin."](#)

However, challenges remain. As climate change increases uncertainty about water availability, collaboration on water budgeting across state boundaries will be more

important than ever. Increased transparency in water budgeting can help make collaboration possible. Strong relationships and clear communication between state agencies, water utilities, and local communities are the foundation needed to improve water budgeting. The technology to make more effective water budgeting decisions exists. However, data platforms don't exist in a vacuum – many water budgets are informed by unique cultural and political histories. Both technology and policy are needed to help water agencies manage water budgets in ways that protect municipal and agricultural needs while helping communities promote climate resilience.

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