The Western States Water Data Access and Analysis Tool (WestDAAT) Pre-Design Engagement Workshop Report

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On December 15, 2021, the Western States Water Council (WSWC), in cooperation with the Colorado River Water Users Association (CRWUA), held a workshop as part of CRWUA's 2021 Annual Meeting in Las Vegas. The workshop was a pre-design engagement event for the Western States Water Data Access and Analysis Tool (WestDAAT). WestDAAT will provide user-friendly and standardized access to water rights and water use data for eighteen western states.

The workshop goals were twofold: (1) closely familiarize and engage participants with the prototyped dashboard that provides access to water rights and aggregate water use data for eighteen western states as part of the WSWC's Water Data Exchange (WaDE) Program; and (2) solicit feedback as to the usability and functions that would help participants address questions and challenges in the Colorado River Basin specifically and the West in general. This pre-design engagement event was an essential step towards WSWC completing the design for and building the WestDAAT dashboard by Fall 2022.

During the workshop, WSWC staff and collaborators from the Internet of Water (IoW) guided the workshop participants in using the prototype WestDAAT to answer water rights and water use questions related to the Colorado River Basin. The workshop was attended by 28 policy and technical level experts, including federal, state, and local water managers, irrigation and water districts, tribes, environmental organizations, and others.

Most of the workshop time and discussion was focused on the Water Rights tab of the WestDAAT prototype (https://tinyurl.com/WestDAAT-Prototype). Then we presented a demo application for site-specific water use data (https://tinyurl.com/RShiny-WaterUse), followed by a short presentation on the desired WestDAAT end-design. The workshop concluded with brief demonstrations from both the IoW and OpenET teams on the latest developments related to their corresponding tools on estimated evapotranspiration (ET) and consumptive water use in the West and indexing and cataloging water data to each.

We are very thankful to the participants' time and feedback and to our collaborators at the Internet of Water for facilitating the workshop. Below we summarize the key feedback and suggestions provided by event participants. The report draws on written notes by the IoW staff during the workshop and from note cards written by the workshop participants. We plan on addressing questions raised by participants and will try to incorporate each suggestion into our final design. The suggestions below will be very useful in prioritizing our design features. At the end of many of the suggestions, we share our comments and responses, explaining different directions we could take to address the issues raised. We would appreciate your feedback on this report, especially if you have questions about more details.

1. WATER RIGHTS DATA

Summary: The participants generally appreciated the value of the WestDAAT prototype in providing consistent access to water rights data, especially for states other than their own, thus providing a regional perspective. Below is a summary of the questions raised and suggestions by the participants regarding water rights data issues with the prototype and solutions we have identified to address them.

We note that water rights in the West are complex, and WaDE represents common metadata among the states. Generally, a water right establishes a priority date and defines a specific water amount (as flow and/or volume) that can be put to beneficial use from the point of diversion to a place of use. A water right may have multiple beneficial uses, multiple points of diversions, and some rare cases, multiple priority dates, and amounts. A few comments below have hit on such complexities. We have plans to resolve some of those issues, and we will specify how we handle or, if any, leave out the complex cases in our design documents.

1.1 Map Navigation: Navigating the app (e.g., map zoom level, filters, and pie charts) was not user-friendly. Some workshop participants used touch-sensitive tablets, which made it difficult to use the tool compared to the use of laptops with a mouse. In addition, there was a complaint that "points" disappeared as the user zoomed into the map.
Suggestions: (1) add a zoom in and out toolbar on the map; (2) separate the map scroll functionality from the filters scroll; (3) remove "sites" outside the river basins (e.g., points appearing outside the Colorado River Basin); and (4) for WestDAAT in the final design, it will fill the entire window with no need to scroll down. We note that WestDAAT is designed to work on a desktop-based computer with a mouse, not tablets and finger multi-touch devices. More funding is needed to support multi-touch devices

1.2 Priority Date Slider: The slider bar tool for selecting priority date parameters is not user-friendly, as the sensitivity makes it difficult to land on a specific date.
Suggestions: (1) add both static start and end date labels on the slider bar and dynamic ones that indicate the year as the user moves the slider bar; (2) allow the use of a "date entry" box for specific start and end dates; and (3) incorporate the option for multiple slider bar tools to allow users to have sliders side-by-side so they can compare different periods side by side rather than looking up one time period and memorizing it while you look up the second period. This third suggestion may be time-intensive to program, so we classify it as a lower priority. Instead, we suggest that a user may open the tool in two browsers to similar and compare different filter results.

1.3 Response Time: App response time to filters and queries is slow and unpredictable. Pie chart analytics are slow to respond to filter changes.
Suggestions: (1) provide a progress bar indicator to let the user know that data is being loaded; (2) provide a "go" or "submit" button to allow the user to pre-select multiple? filters before app processing begins; and (3) improve the app performance to be more responsive. There is a chance the slow response is due to the participant's computer not having enough processing resources to render the app fast. We will identify the minimum computer requirements for the app to respond reasonability fast.

1.4 Pie Chart Analytics: The pie charts did not work/load for half the workshop participants. Some suggested the pie charts might be too confusing for the public to understand and may need to be simplified.
Suggestions: (1) support an interactive pie chart experience that allows drilling down on specific analytics of interest; (2) provide a "go" or "submit" button to allow users to generate the analytics when they are ready to do so; (3) improve the app performance to load faster.

1.5 Beneficial Uses and Aggregations: Participants were confused by the pie chart's aggregating flows or volumes from either consumptive or non-consumptive water rights together in one chart.
Solution: (1) we need to fill the existing "category" column in the beneficial uses-controlled table with two values indicators (consumptive or non-consumptive). Then the analytics can be aggregated into two groups based on this category value; (2) for the purpose of regional analyses when multiple beneficial uses exist for a single water right, we decided to define rules that allow us to programmatically select one predominant beneficial use to be the primary beneficial use. Then this primary beneficial use will be used in aggregating water rights amounts in a region for each beneficial use. We will request feedback on these rules from each state agency sharing water rights data with WaDE.
One other issue is that at least as shared by Utah participants, water right amounts as flow or volume left blank or with zero values should be carefully considered in the aggregation. Zero or bank values probably indicate that the value is not estimated or quantified yet and is therefore unknown. Our planned dashboard has a toggle filter that allows users to include or exclude such "blank values" from the analysis.

1.6 Representing Sites and Water Rights with Numerous Assigned Parameters: Participants were unclear how a single water diversion could be shown to support multiple water rights, multiple beneficial uses, and similarly how to recognize and represent multiple water source types, and multiple priority dates.
Solution: (1) we need to revisit how WestDAAT supports the use cases of (a) a single diversion serving multiple water rights, and (b) how a single right can have multiple beneficial uses. Careful reconsideration of how this data is displayed and downloaded is needed. If the data is displayed in a flat table, the flow or volume values represented across beneficial uses may accidentally duplicate amounts; (2) we are planning for a design change that allows users to toggle the popup window for a point of diversion between multiple water rights.

1.7 User Interactions with Available Data: There was a consensus regarding the need to support data download for further analysis in a common format like Comma-Separated Values (CSV).
Solution: this is a planned feature for the final design. We will also support a suggestion to provide the "data citation" as part of the exported data option.

1.8 River Basin Filter: Many users wanted to query water rights data for custom basins or spatial areas that are not supported in the existing filters.
Suggestions: we have plans to (1) allow users to draw custom polygons; (2) add more basin options; (3) update existing basin labels (e.g., Rio Grande) to make it clear that these are either surface water or groundwater basins; and (4) consider an option to allow a user to upload a shapefile for custom boundary of interest such as a basin or ranch area.

1.9 Map Legend: The map legend is fixed and does not dynamically change regardless of which beneficial uses are selected in the filter. Colors on maps didn't match with the legend.
Suggestion: (1) arrange legend items alphabetically; (2) resolve the color matching issue; (3) make the legend update based on the selected beneficial uses in the filter. This third suggestion is doable, but we are giving it a lower priority at this point, given its development cost.

1.10 Labels and Metadata: Further information should be presented related to WaDE controlled terms (e.g., beneficial uses) and how they relate to each state's terms. Participants inquired about the data gathering process.
Suggestions: allow a hover-over feature where the user clicks on a question mark icon (e.g., pop up) to open an external webpage with more information on the meaning of the controlled term, etc. We may need to use the IoW ontology application that shows relationships between terms to visualize how WaDE terms relate to state-defined terms. For example, show how "steam" in Texas and "thermoelectric power" in California are mapped as heating/cooling in WaDE. We will add "about" pages that describe the data gathering process and reference GitHub pages that describe mapping each state's data to the WaDE database.

1.11 Additional Filters: Many participants asked about adding more filters.
Suggestions: (1) the following additional filters are being considered for the final design: site type (e.g., reservoir, point of diversion, spring), water right type (e.g., reserved right), and legal status (e.g., adjudicated, in review), tribal water rights either as specific to a diversion location or not; (2) users want a "state" filter for water rights to see the total consumptive or non-consumptive permitted water rights amounts (e.g., cubic feet per second or acre-feet per year). See point 1.5. This permitted amount could be overlaying tribal boundaries and would help understanding water management and use, especially in Arizona. We also need to support filtering by active management areas (AMAs) in Arizona.

1.12 Metadata Detail Page for Clarity: Many users pointed to the need for viewing disclaimers and metadata related to water rights. Some users faced issues in clicking at a site and viewing its detail page.
Suggestions: (1)provide links to pages that provide the latest organizational (i.e., state agency) contact information for data providers; (2) distinguish between organizational contact information and water right owner information; (3) post the date when the data was last published in WaDE or by member states along with the data in WestDAAT (as WaDE data might not be the latest version available on the states' websites). Our goal is to update water rights data twice a year, while states may update their data monthly or even daily; and (4) acronyms (e.g., POD and POU) should be on the detail page and need to be more clearly defined in the rest of the dashboard. We plan on automating the data update whenever it is revised and posted by the states. However, a few states, such as Wyoming, have shared a mass-downloaded data file with us, and such a service is not yet available online to automate its query. The data import automation is planned as future work.

1.13 Missing Data: A Wyoming user identified that their data in WestDAAT is incomplete.
Suggestions: (1) reimport Wyoming's more complete data to the WaDE Data System. (2) Nevada

permits didn't show up. It is unclear which Nevada water rights did not show up. We will follow up with Nevada's participants to identify the issue they faced and resolve it.

1.14 Transmountain Diversions Connections and Relationships: A couple of participants noted the value in connections between points of diversions and places of use. Others asked how to identify relationships between water rights that depend on the return flow of other water rights.
Solution: (1) more support is needed to display the Place of Use (POU) geospatial data layer along with the Points of Diversions (PODs) layers in WestDAAT. We need to revisit the feasibility of building connections between PODs and POUs for water rights data at the dashboard map level (verses just the landing page); (2) water rights that depend on return flow and reuse are not directly provided by all of our member states. We will keep this point in mind as we coordinate the water rights data review with our member states.

1.15 More Information on How Users Can Ask for Support, Cite Data, and use APIs.
Suggestion: add "contact us" page. A "contact us" page is currently being planned for the final WestDAAT; (2) documentation on how users can query the data using API endpoints will be provided through the WaDE webpage via the WestDAAT documentation link. This link will also be provided in the app itself.

1.16 AGGREGATE WATER USE DATA TAB

Summary: Users were expecting more out of the aggregated water use data tab that it offered. Below are issues raised and suggestions by the participants for improving aggregated water use data and our identified solutions to address them.

1.1 Compare Aggregate Water Use Data with Permitted Water Rights over the Same Watershed or County: Users wanted to connect and compare data across the two tabs: water rights and aggregate water use data.
Solution: this idea is related to the comparison of water rights permits with the OpenET estimated consumptive use. Implementing this idea is possible as part of the proposed OpenET integration, but it will require close coordination with our member states. We need each state's input on how we could aggregate water rights to the watershed or county level, given that volume or flow-based permits data may be incomplete or limited by privacy concerns.

1.2 Duplicate App Services: There was a suggestion that the Bureau of Reclamation is revising its consumptive uses report back to 1971 at a HUC8 level, and the product will provide info on historical uses.
Solution: we have imported a smaller subset of this data for the Upper Colorado River Basin into WaDE, and we can import more. We would like to coordinate with the Open Water Data Coordinator at the Bureau of Reclamation to determine whether they have plans to share this type of data as part of the Reclamation Information Sharing Environment (RISE).

1.3 Aggregate Map Response Time: aggregated data on the provided map was loading slowly and unresponsive for some users.
Suggestions: (1) add a submit button or progress bar that may help the user understand the lag in

response time; and (2) improve the app performance to be more responsive.

1.4 Confusing Aggregate Area Map: Many users were not clear on why some states have polygons while others are blank, especially across spatial representations for a county or custom basin. The term "basin" is vague and needs to be specific such as "surface water basin." Labels like "Data sources" need to be renamed to be clear such as "Polygon Type."
Suggestions: we are aware of the issue because many states' data are available in multiple overlaying geospatial units while others have not yet shared data for any spatial area. We have planned for a solution in the designs to provide more complete polygons for the states, even if we don't have data for them. We also will clarify how "basins" are defined.

1.5 There was a suggestion to allow comparing state-reported aggregate use with USGS estimates.
Suggestions: the WaDE data system is flexible and will support USGS National Water Use census data. We will explore how WestDAAT can support comparisons across data sources for the same basin. We will also provide a disclaimer to WestDAAT users that the methods of estimating water use are different and caution them from drawing conclusions that do not consider the differences in methods and assumptions.