SEI Stockholm Environment Institute

Integrating sanitation and watershed management

Improving water governance and investments

SEI brief
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IMAGE (ABOVE): Stream of water pouring into children's hands ,Burkina Faso
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Key messages

- **Traditionally, watershed management and WASH have been governed in isolated silos.**
- **Efforts to connect these two areas require intentional technical work and interdisciplinary coordination.**
- **The development of new tools to analyse the benefits of WASH and watershed management allows us to identify sustainable water and sanitation project actions.**

WASH and water security

Achieving sustainable water, sanitation and hygiene (WASH) services requires an understanding that water comes from a hydrological system and, likewise, an inadequate sanitation system implies degradation of the system's water quality (Wetlands International, 2017). This simple connection highlights the importance of integrating the WASH framework with the Integrated Water Resource Management (IWRM) framework, which is practiced by most Latin American countries to achieve water security and support water governance (Rahaman & Varis, 2005). However, water quality and sanitation issues persist throughout the world, and in many cases, WASH actions are not integrated into watershed planning (Edmond et al., 2013; Hadwen et al., 2015; Vannucci, 2018; Wetlands International, 2017). This reality fails to support meeting the UN Sustainable Development Goal (SDG) 6 'Water and Sanitation' targets that require adequate frameworks that incorporate WASH approaches with IWRM frameworks.

An IWRM project typically includes water balance and hydrological modelling developed for a specific planning setting (Badham et al., 2019). A typical IWRM model integrates aggregated values of community-level demands; therefore, within this approach, it is difficult to determine the household-level water supply situation at any given moment. Additionally, most models do not consider sanitation, leaving behind the analysis related to environmental contamination due to pollution from inadequate sanitation systems (Carrard & Willetts, 2017).

Commonly, WASH analyses are based on data collected at the household level, and therefore, broader aspects that involve, for instance, water resources enclosed in the watershed are not reflected in such an analysis (Wetlands International, 2017). Considering an integrated understanding of the water cycle can reduce the risk of water scarcity within the WASH system (Hadwen et al., 2015). Furthermore, an integrated assessment of WASH solutions at the watershed level including aspects such as water

availability, water quality, climate change impacts and other water uses will lead to more sustainable and resilient WASH interventions.

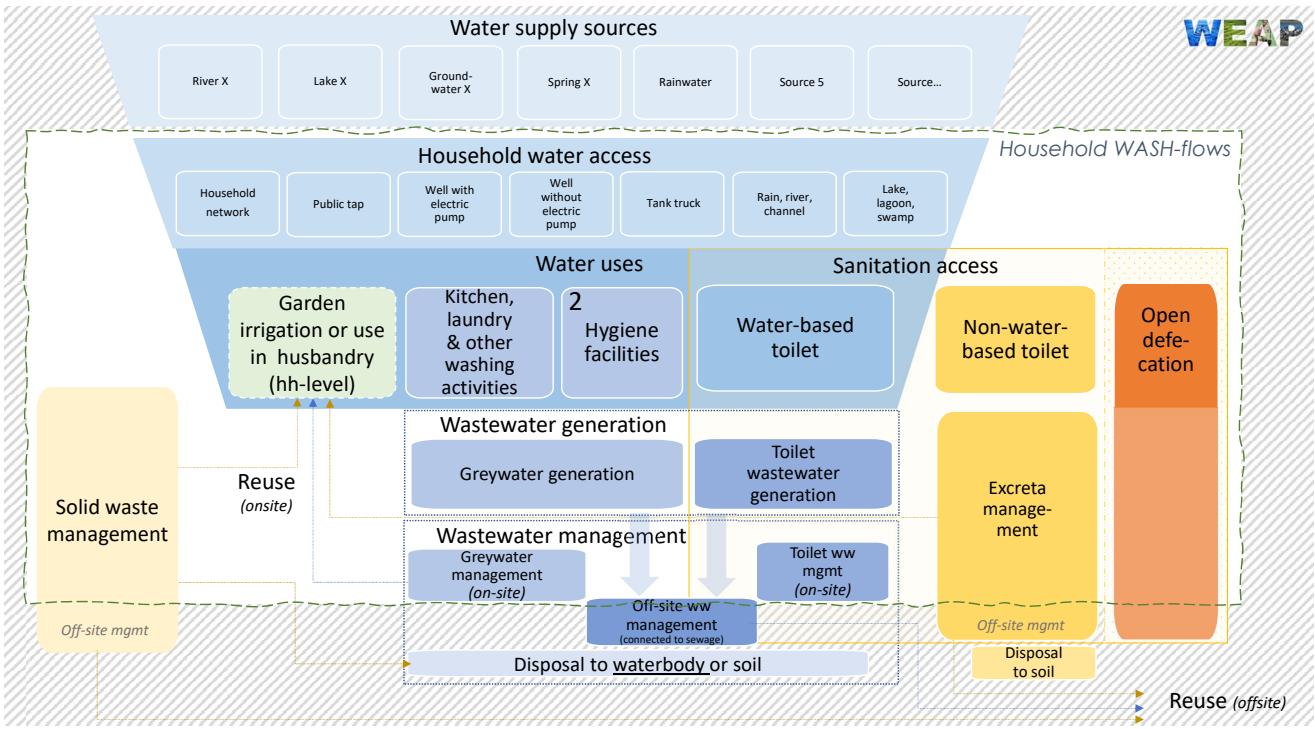
Modelling the interlinkage of WASH and IWRM: WASH Flows analytical tool

Integrating WASH and IWRM frameworks by linking quantitative models can help address existing gaps in these two critical water security components. For this, the Stockholm Environment Institute (SEI) conceptualized and implemented an innovative analytical tool named WASH Flows in the context of the Bolivia WATCH project, funded by the Swedish International Development Cooperation Agency (Sida). This tool operates in a Microsoft Excel interface and it comprehensively represents the simplified conditions of WASH services at the community level through quantitative analysis and graphical representations. The tool was designed following the framework built by the Joint Monitoring Program (JMP) for Water Supply, Sanitation and Hygiene, developed by UNICEF and WHO, which estimates WASH service levels (i.e. access) through a series of specific indicators and from information collected at the household level (Cotton & Bartram, 2008). WASH Flows includes functionalities that can either be used on its own or applied in connection to a watershed scale modelling tool, such Water Evaluation And Planning – WEAP (Yates et al., 2009).

On its own, WASH Flows estimates WASH service levels, water demand and wastewater generation based on current households' infrastructure. The tool can compare how different WASH interventions influence the service level and can help prioritize vulnerable communities where WASH interventions should be implemented. Additionally, it can estimate contamination loads resulting from inadequate or inexistent sanitation systems.

When coupled with a watershed modelling scale tool, WASH Flows solves the problem of connecting data at the household level and the basin level. As shown in Figure 1, the

Figure 1. Conceptualization of WASH Flows tool and its interaction within watershed modeling

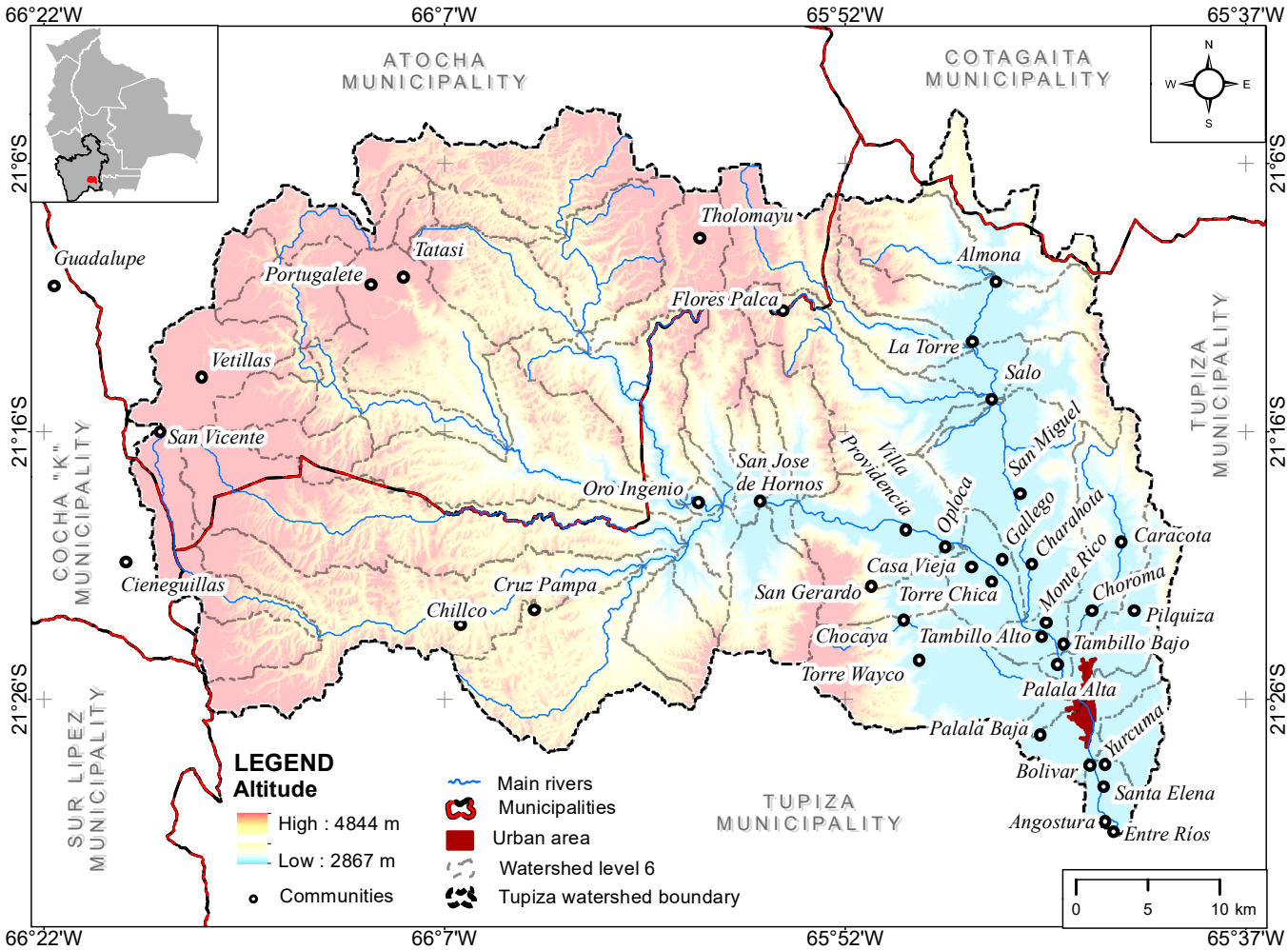


basin model encompasses all existing water supplies, including household drinking water access, within WASH Flows. This interaction allows users to analyse the reliability of the current or proposed water supply sources and their potential impacts on a basin's water availability. Furthermore, WASH Flows includes an analysis of sanitation and wastewater produced at the household (see Figure 1), estimating the quantity and quality of disposed water. When this quantification is integrated into the basin model, users can analyse these actions' potential effects on downstream water uses and propose alternative wastewater management strategies.

WASH Flows case study application: Tupiza watershed

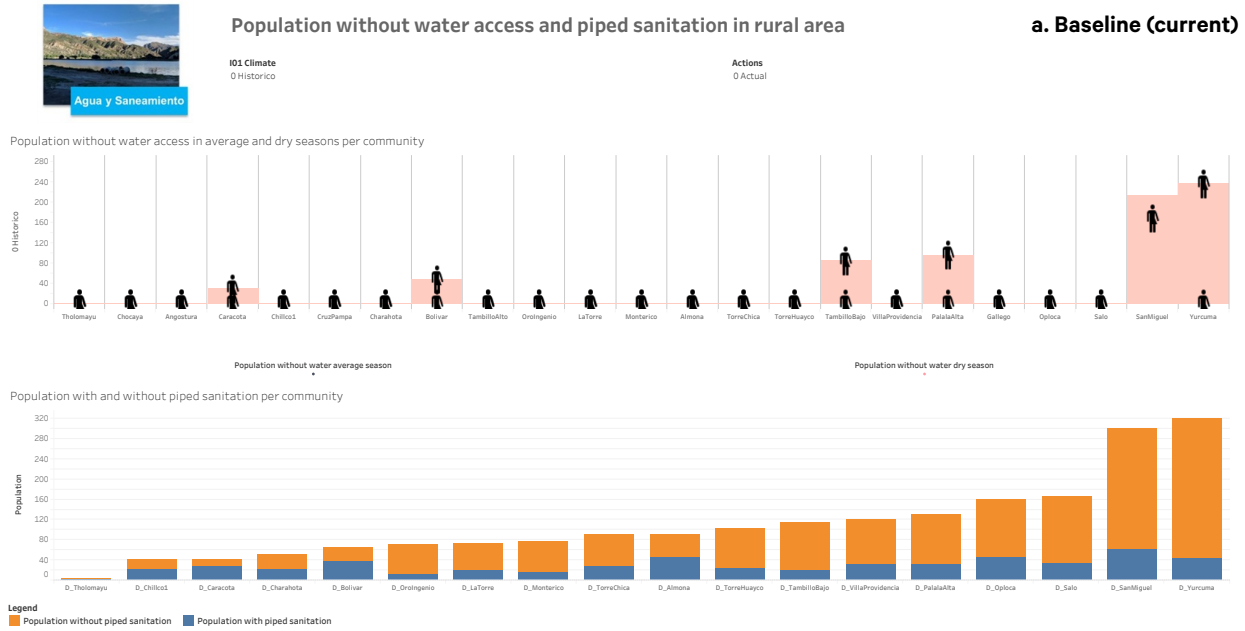
The Tupiza watershed is situated in Bolivia, the country with Latin America's highest rate of open defecation in rural areas and also suffers limited access to water and sanitation services. Located in the Potosi department, the watershed covers an area of 2,309 km^2 with a population of about 47 000, distributed among 38 communities settled near the rivers and creeks (see Figure 2). The WASH Flows model was implemented in the development of the Tupiza watershed plan using WASH data obtained from a survey of 312 households and supplemented with secondary sources to represent the conditions of WASH services.

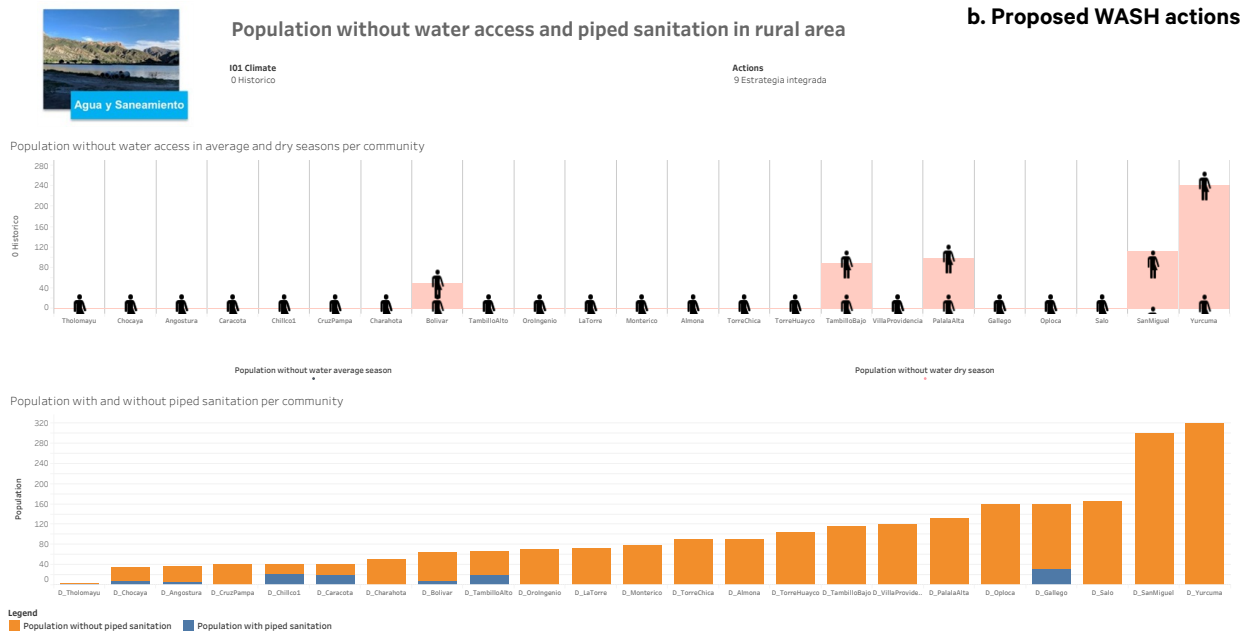
Figure 2. Location of the Tupiza watershed, including its administrative division and communities



The WASH Flows model in Tupiza generated outputs that identified the type of WASH service deficiencies present in the communities and allowed us to evaluate the impact of potential WASH solutions. As an example of the outputs, Figure 3a identifies six communities where people lack water access during drought periods, as the analysis was coupled with the climatic data in WEAP's Tupiza model. Furthermore, the WASH actions selected for projection in the watershed allow three communities to significantly reduce their water access vulnerability in drought circumstances, according to the analysed scenarios. Similarly, the selected sanitation actions considerably reduce the number of people with no piped sanitation connections. In that sense, the actions selected for the Tupiza watershed not only can increase WASH coverage, but also enhance communities' resilience.

Figure 3. Population without access to drinking water and piped sanitation per community in the Tupiza watershed (a. Current, and b. Proposed WASH actions)





Conclusion

Currently, WASH Flows is under a beta version and is being tested as part of the Bolivia WATCH project to finalize a generic version of the tool that can be adapted to other regions. WASH Flows is designed to be used by local water and sanitation utilities and government environmental organizations at different levels. The ultimate vision of WASH Flows is that it will be able to support water security analyses including:

- Assessing the current state of WASH services coverage in comparison with national goals for drinking water, sanitation and hygiene coverage.
- Estimating contamination loads in the environment resulting from inadequate sanitation at the household or community level.
- Prioritizing interventions in water, sanitation and hygiene by comparing the WASH service levels of different communities through a vulnerability analysis and identifying communities in which WASH interventions should be implemented.
- Anticipating the benefits and impacts of WASH development interventions and comparing the effectiveness of various WASH interventions.

WASH Flows is a critical tool that connects two water security disciplines that have been traditionally disconnected from the technical and governance perspectives. WASH information can illustrate the state of sanitation in rural communities and urban settlements; and watershed conditions show us critical water availability thresholds that need to be achieved to maintain safe WASH conditions in communities. Connecting these two key areas helps identify opportunities for resilience and adaptation in novel ways that were previously unseen.

Cleansing hands using metal water pump © VANWYCKEXPRESS / GETTY

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