

ARTICLE SUMMARY

CONCEPTUALIZING EQUITY FOR ONSITE NONPOTABLE WATER REUSE SYSTEMS IN THE U.S.

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San Francisco, CA | New York City, NY

Breaking equity into economic, environmental and social components

An existing definition of equity has been developed through the US Water Alliance, emphasizing 'fair and just inclusion' in the process and how equity is aligned with the three pillars of sustainability:

"Water equity occurs when all communities have access to safe, clean, affordable drinking water and wastewater services; are resilient in the face of floods, drought, and other climate risks; have a role in decision-making processes related to water management in their communities; and share in the economic, social, and environmental benefits of water systems." [6] (emphasis added)

This definition is for water equity for the sector as a whole. We build off of this definition to see what this could mean for onsite alternative water systems. To begin, we provide more detail for this baseline definition in alignment with economic, social, and environmental aspects of equity:

- **Economic equity.** The economic benefits and costs associated with systems [7], including affordability [8]. Research suggests that equitable water rates affect the economic accessibility to infrastructure services. In the context of urban ONWS, systems have primarily been installed in high-cost developments that are able to afford the initial capital and ongoing costs.
- **Environmental equity.** The quality and quantity of distribution and how this affects the resiliency of a system in the event of external impacts like climate change or natural hazards [9]. Impacts from climate change can be exasperated in communities with pre-existing vulnerabilities [10]. New water technology systems are an opportunity for environmental transformation. For example, during Superstorm Sandy, ONWS continued to meet discharge requirements while centralized wastewater treatment plants experienced system failures [11,12]. However, resiliency and new technologies often are not incorporated in vulnerable communities immediately [13].

On-site alternative water systems: an opportunity for equity?

The United States, among other parts of the world, are experiencing challenges adapting water and wastewater infrastructure to climate change [1,2]. Some common examples include drought on the west coast, and combined sewer systems that are beyond capacity due to extreme storm events and increased volume from rising urbanization. Recent efforts to address these stressors has moved several cities towards alternative configurations, like onsite non-potable water systems (ONWS). Much work has been done on the technical aspects of making these systems function successfully, and recent work has also highlighted the socio-technical barriers to adoption, like regulatory frameworks, public acceptance, and formation of stable market structures [3–5]. As decision-makers consider ways to assist the transition toward ONWS, there presents an opportunity to proactively integrate equity considerations in the development of a new urban water management regime. When thinking about new water technology systems, equity often goes overlooked, seen as a subjective ideal rather than a necessary step in the design and implementation processes. However, the reasons for adopting alternative water systems and their sustainability outcomes such as resilience to climate change and adaptation to urban densification have equity implications. Who is benefitting from these onsite water reuse systems and in what way are these benefits captured? For example, these systems supplement the centralized water supply by offsetting potable water demand, but the costs and benefits of increased climate resilience may be unequally distributed. The study associated with this summary paper looks at how equity is conceptualized with relationship to water and wastewater infrastructure and discussed by decision-makers in two US cities.

- **Social equity.** Finally, social equity encompasses the fairness of the system in its decision-making, representation of end-users, and access to services [14]. ONWS requires legitimation through policy, but also end-user acceptance [3] – increased community participation and engagement, coupled with enhanced workforce development [6] can help with this barrier to adoption.

"I think that's cool to weave in any kind of equity pieces to this puzzle... That is a lens that I'm looking through for climate-related issues."
- Regulator

Equity perceptions differ by sector roles

All three types of equity emerged, but we found that some stakeholder categories aligned with different subtypes of equity (Fig. 1 below). When asked about what equity looks like in the scope of ONWS, public agencies tended to relate back to their own roles, focusing on social equity. People from the private sector mostly focused on economic equity and what that looked like through roles outside their own (e.g. what financial incentives could increase access to new technology). People representing civil society externalized all three types of equity, talking about what could be done by others to improve accessibility, community engagement and protecting public health. Stakeholder engagement has already been noted as important to the ONWS adoption process, but these results also emphasize that engagement allows groups to better articulate their contributions to the development of a program, but also what they as well. For example, public agencies are responsible for overseeing the regulatory process; they can prioritize protecting human health through what standards are applied, but involving civil society actors while developing these protocol can also help encourage social equity through the permitting process.

Equity is desired, but difficult to conceptualize

We spoke with decision-makers in both San Francisco and New York City involved in various aspects of ONWS. In each conversation, people were asked how they viewed equity within the context of these urban alternative water systems. Most decision-makers expressed interest in incorporating equity but had a difficult time conceptualizing what that would look like with on-site water reuse. Definitions varied across each conversation, falling into one or more of the subtypes of equity (economic, environmental, social). Although it is difficult to conceptualize equity in respect to ONWS, since many ONWS programs are still in an early development stage, implicitly individuals are already thinking about these aspects in the process. For example, utilities emphasized the need to diversify water portfolios to ensure adequate supply for all communities, keeping in mind future climate events such as drought.

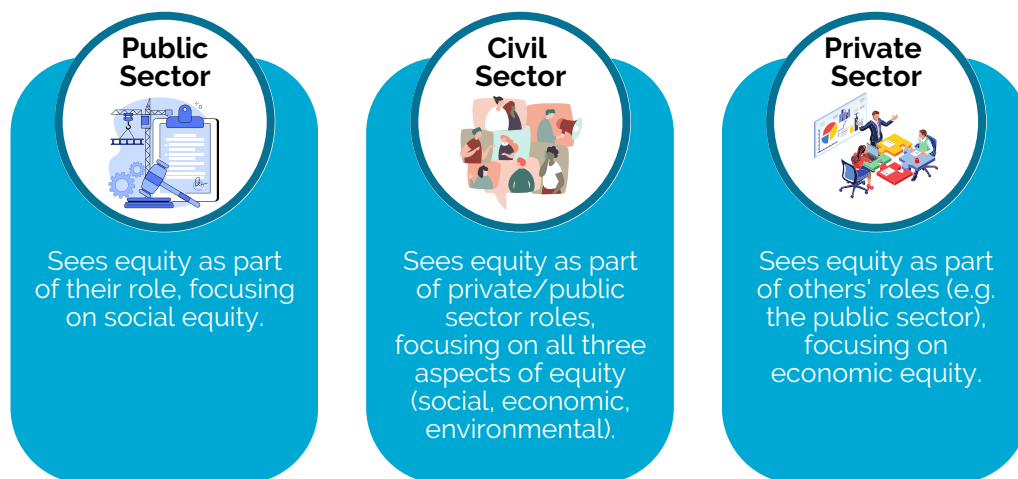


Fig. 1 - Summary of how study participants mentioned equity during their interviews, based on sector type.

Different cities, different approaches to equity

Affordable housing is one example of how equity with innovative technology can be pursued in different avenues. In **San Francisco**, onsite reuse is mandatory for development over 250,000 square feet, however, an exemption exists for affordable housing [15]. While a number of affordable housing still incorporate rainwater harvesting to meet stormwater regulations, the exemption was done as a way to improve economic equity of systems since significant financial investment is currently needed at this stage of adoption.

"Generally speaking, the affordable housing gets exempted from this kind of requirement because it costs more. But is that equitable for those housing units not to have it because they're affordable housing?"

- Public sector, San Francisco

In **New York City**, ONWS are not required but were initially considered for redevelopment projects that incorporated affordable housing as a way to improve environmental equity by reducing discharge to combined sewer systems [16, 17]. Despite the initial push for environmental equity, tradeoffs exist between what is economical, ultimately prioritizing affordability of the project.

"In an ideal world, we would love to see every new development project have some type of conservation tactic in place, whether it's a full-onsite water reuse system or something [else] so that you're not overburdening the sewer system capacity and causing the CSOs to occur. But what we really found out in the process of doing this advocacy is that it's really not cost-effective unless it's at a certain scale."

- Civil sector, New York City

Conversations with stakeholders in San Francisco and New York City show that decision-makers are considering equity implications, even though often in a rather implicit way. Both cities provide examples of how specific subtypes of equity can be incorporated into practice.

The National Wildlife Federation has also [developed a report on reuse in affordable housing](#), another great resource.

Some recommendations from this work include:

- **Using equity subtypes can help decision-makers practically incorporate equity in the adoption of ONWS.** People had difficulty articulating what equity broadly is, but were able to relate to equity within the constructs of economic, environmental, and social considerations. These subtypes were present throughout the discourse and using these subtypes in decision-making might help with incorporating more concrete steps towards a more equitable adoption.
- **Including stakeholders from different sectors provides a holistic approach to addressing equity.** Not only does stakeholder engagement encourage participation, but each of the stakeholder groups relates to equity differently. Participation in the process allows a more holistic discussion about the three subtypes of equity with the perspective about what is needed from others versus what people can contribute to the adoption of ONWS. For example, the private sector is looking at the economic viability of installing ONWS and can provide insight to public sectors that are looking to incentivize these systems. We saw civil actors work together with private actors in NYC to explore the viability of ONWS for a development with affordable housing.
- **Incorporating equity can potentially expand the market for ONWS.** Finding system configurations where economies of scale can be achieved opens an opportunity to expand ONWS beyond the current project type (e.g. luxury apartments and well-financed commercial projects).

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