

Drinking Water Equity

Analysis and Recommendations
for the Allocation of the
State Revolving Funds

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ENVIRONMENTAL POLICY
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SEAS SCHOOL FOR ENVIRONMENT
AND SUSTAINABILITY
UNIVERSITY OF MICHIGAN

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EXECUTIVE SUMMARY

Access to safe, reliable, and affordable drinking water in the United States is uneven. Disparities often stem from unequal investments in infrastructure, leading to lower quality service with serious public health consequences. Drinking water systems serving low-resource communities tend to have less revenue and less access to capital to finance projects.

Financial assistance from state and federal governments can reduce disparities in drinking water service and health outcomes. In this report, we evaluate the largest source of intergovernmental aid for drinking water systems, the Drinking Water State Revolving Fund (DWSRF). This program already helps address disparities and has the potential to do more.

Using national and state-level data from 2011 to 2020, we look specifically at three key mechanisms by which states can further equity through the allocation of DWSRFs: 1) by distributing assistance across more drinking water systems; 2) by providing grants (rather than loans) to low-resource communities; and 3) by distributing assistance across demographic contexts in a just manner.

We find that states address disparities by targeting assistance towards:

- *Health*: Communities with more health-based Safe Drinking Water Act violations are more likely to receive assistance.
- *Income*: Communities with lower median household incomes are slightly more likely to receive assistance.

We also find that states could do more to address disparities by expanding:

- *Reach*: 7.1 percent of eligible drinking water systems have received assistance.
- *Additional subsidies*: 26.6 percent of total assistance was distributed as principal forgiveness, grants, or negative interest loans, despite a federal ceiling of 35 percent for disadvantaged communities.
- *Diversity*: Small communities and more racially diverse ones are less likely to receive assistance.

Much of the national conversation about state revolving funds focuses on increasing the size of the program. Recent legislative proposals include larger appropriations for DWSRFs. In addition to increasing the size of the program, the funds must reach the communities who need them most. State and federal administrators can take several steps to ensure historically under-invested communities benefit from federal funding. Specifically, we recommend:

- improving technical assistance to drinking water systems with limited fiscal capacity,
- increasing the amount of additional subsidies distributed by states, and
- prioritizing projects in high poverty and historically under-invested communities.

Ensuring that intergovernmental aid reaches the communities with the greatest need is critical to enhancing equity in water access and public health.

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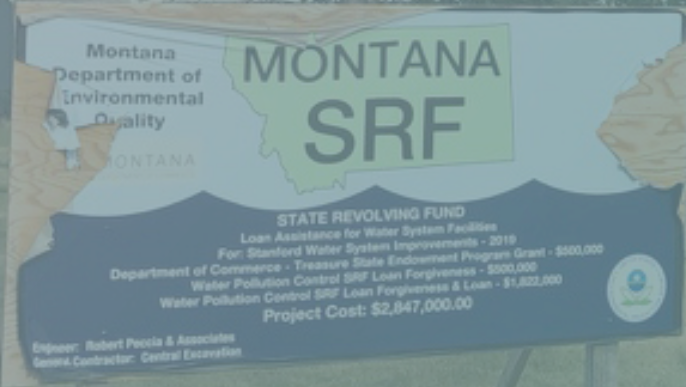
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ACRONYMS

CWSs: Community Water Systems
 DAC: Disadvantaged Community
 DWSRF: Drinking Water State Revolving Fund
 EPA: Environmental Protection Agency
 NIMS: National Information Management System
 MHI: Median Household Income
 PBR: Project Benefits Reporting system
 SDWA: Safe Drinking Water Act
 SDWIS: Safe Drinking Water Information System
 SRF: State Revolving Fund
 ULO: Unliquidated Obligation

1 INTRODUCTION



Montana
Department of
Environmental
Quality

**MONTANA
SRF**

STATE REVOLVING FUND
Loan Assistance for Water System Facilities
For Stanford Water System Improvements - 2019
Department of Commerce - Treasure State Endowment Program Grant - \$500,000
Water Pollution Control SRF Loan Forgiveness - \$500,000
Water Pollution Control SRF Loan Forgiveness & Loan - \$1,827,000
Project Cost: \$2,847,000.00

Engineer: Robert Poole & Associates
General Contractor: Central Excavation

Access to safe, reliable, affordable drinking water in the United States is often inequitable along economic and racial lines.

Research has consistently shown that low-income and Black, Indigenous, and People of Color (BIPOC) communities are more likely to have contaminated drinking water,¹ experience water shutoffs,² and struggle to afford their water bills.³ These disparities often stem from uneven investments in water infrastructure. Drinking water systems serving low-resource communities tend to have less revenue and less access to capital to finance projects. Infrastructure deteriorates without investment in maintenance, which reduces water quality and threatens public health. People who do not have access to safe drinking water risk contracting waterborne diseases and other adverse health outcomes.

Financial assistance from state and federal governments can reduce disparities in drinking water service and health outcomes. The largest source of intergovernmental aid for drinking water systems in the United States is the Drinking Water State Revolving Fund (DWSRF).⁴ Congress authorized the program in the 1996 amendments to the Safe Drinking Water Act (SDWA) to provide low-interest loans and other types of subsidized assistance to help drinking water systems finance capital projects. The program has played a key role in improving drinking water quality by providing more than \$45.7 billion to finance more than 16,000 projects nationwide since 1997.⁵ Notwithstanding these substantial investments, it is important to understand whether DWSRFs address disparities in service and how to further support equity as the gap between communities with and without safe and affordable drinking water widens in the United States.

The allocation of DWSRF resources largely depends on state-level policies and practices. States administer the program with significant discretion. There are three key mechanisms by which states can further equity through the allocation of DWSRFs: (1) distributing funds across drinking water systems; (2) providing additional subsidies to drinking water systems serving low-resource communities; and (3) distributing funds across demographic contexts in a just manner.

Financial assistance from state and federal governments can reduce disparities in drinking water service and health outcomes.

¹ Allaire, M., Wu, H., & Lall, U. (2018). National trends in drinking water quality violations. *Proceedings of the National Academy of Sciences*, 115(9), 2078–2083. <https://doi.org/10.1073/pnas.1719805115>.

Switzer, D., & Teodoro, M. P. (2017). The color of drinking water: Class, race, ethnicity, and safe drinking water act compliance. *Journal American Water Works Association*, 109(9), 40–45. <https://doi.org/10.5942/jawwa.2017109.0128>.

² Swain, M., McKinney, E., & Susskind, L. (2020). Water shutoffs in older American cities: Causes, extent, and remedies. *Journal of Planning Education and Research*. <https://doi.org/10.1177/0739456X20904431>.

³ Mack EA, Wrase S (2017) A Burgeoning Crisis? A Nationwide Assessment of the Geography of Water Affordability in the United States. *PLOS ONE* 12(4): e0176645. <https://doi.org/10.1371/journal.pone.0176645>.

Teodoro, M. P. (2019). Water and sewer affordability in the United States. *AWWA Water Science*, 1(2), e1129. <https://doi.org/10.1002/AWS2.1129>.

⁴ There are several other federal and state programs to assist drinking water systems beyond the DWSRF program. We focus exclusively on DWSRF resources.

⁵ US EPA. (2020). Drinking Water SRF Program Information National Summary. https://www.epa.gov/sites/production/files/2020-11/documents/national_summary_0.pdf.


In this report, we examine whether and how states' allocation of DWSRF assistance in the past decade reflects principles of equity and justice. We analyze national- and state-level data from 2011 to 2020. We find:

- A small percentage of drinking water systems have received DWSRF assistance: 7.1 percent of eligible drinking water systems received assistance through DWSRFs.
- States often have not reached the federal ceiling on additional subsidies: 26.6 percent of federal capitalization grants were used for principal forgiveness, grants, and negative interest, despite a federal ceiling of 35 percent for disadvantaged communities.
- Drinking water systems with more health-based SDWA violations were more likely to receive DWSRF assistance.
- Drinking water systems serving communities with lower median household incomes were slightly more likely to receive DWSRF assistance.
- Drinking water systems serving small communities and communities with larger proportions of people of color were less likely to receive DWSRF assistance.

State administrators can continue to help communities with the greatest need access funds by improving technical assistance, increasing the amount of fully subsidized assistance, and prioritizing projects in high-poverty and historically underinvested in communities. Ensuring that intergovernmental aid reaches the communities with less safe, reliable, or affordable drinking water is critical to improving equity and public health.

// **State administrators can continue to help communities with the greatest need.** //

Photo by Patrick Pahlke on Unsplash



2 THE ROLE OF SRFs IN FINANCING WATER INFRASTRUCTURE

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Drinking water systems in the United States rely on local service fees to fund infrastructure.⁶

The pumps, plants, and pipes that treat and deliver drinking water are expensive to build and maintain. The amount of revenue that water systems can collect at affordable water rates largely depends on the resources in the community they serve. Water systems serving low-income residents cannot increase water rates as readily as those serving high-income residents. Many water systems that serve low-income communities also struggle to access capital due to lower revenue and limited credit histories, which makes it difficult to secure low-interest loans.

Federal and state financial assistance can reduce disparities in revenue and access to capital.⁷ The Drinking Water State Revolving Fund is the largest, most universal source of intergovernmental aid for water systems in the United States.⁸ A revolving loan fund is designed to create a pool of capital to finance projects in perpetuity. The lender capitalizes the fund, issues initial loans, receives repayments, and then issues new loans with the repaid capital. The federal government provides grants to capitalize a DWSRF in each state. Congress typically appropriates \$820 million to \$1.4 billion to the program each year, except for the \$2.8 billion appropriation included in 2009, which included \$2.0 billion in stimulus funds from the American Recovery and Reinvestment Act (Figure 1).⁹ The EPA apportions grants to each state according to a formula based on estimated capital needs. States add at least a 20 percent match to the federal capitalization grant.

States have significant discretion in the administration of their DWSRF programs. The SDWA requires states to finance projects that improve water quality, address threats to human health, and assist “economically disadvantaged communities” (referred to as DACs).¹⁰ Within these statutory requirements, states determine how to allocate the funds. They establish eligibility, application, and ranking criteria; solicit applications from drinking water systems; rank project applications; and determine the type

⁶ Although the federal government made substantial investments in wastewater treatment systems through the Construction Grants program in the 1970s and 1980s, local government spending is typically at least two or three times more than federal government spending on drinking water infrastructure.

Congressional Budget Office. (2018). Public spending on Transportation and Water Infrastructure, 1956 to 2017. www.cbo.gov/publication/49910.

⁷ Knopman, D., Wachs, M., Miller, B. M., David, S. G., & Pfrommer, K. (2017). Not everything is broken: The future of U.S. transportation and water infrastructure funding and finance. <https://doi.org/10.7249/rr1739>.

⁸ Other intergovernmental aid programs for drinking water systems include the Water and Waste Disposal Loans and Grants Program, the Water Infrastructure Finance and Innovation Act (WIFIA) program, and the Water Infrastructure Improvements for the Nation Act (WIIN) grants.

⁹ Humphreys, E. H. (2019). *America's Water Infrastructure Act of 2018 (P.L. 115-270): Drinking water provisions*. [https://crsreports.congress.gov/product/pdf/R/R45656#:~:text=America's%20Water%20Infrastructure%20Act%20of%202018%20\(AWIA%3B%20P.L.%20115%2Dand%20other%20water%20infrastructure%20concerns.&text=Title%20IV%20extends%2C%20authorizes%2C%20and, and%20programs%20administered%20by%20EPA](https://crsreports.congress.gov/product/pdf/R/R45656#:~:text=America's%20Water%20Infrastructure%20Act%20of%202018%20(AWIA%3B%20P.L.%20115%2Dand%20other%20water%20infrastructure%20concerns.&text=Title%20IV%20extends%2C%20authorizes%2C%20and, and%20programs%20administered%20by%20EPA).

¹⁰ The SDWA does not explicitly define a disadvantaged community. Rather, each state determines the criteria for a community to qualify. See Table 4 for several examples.

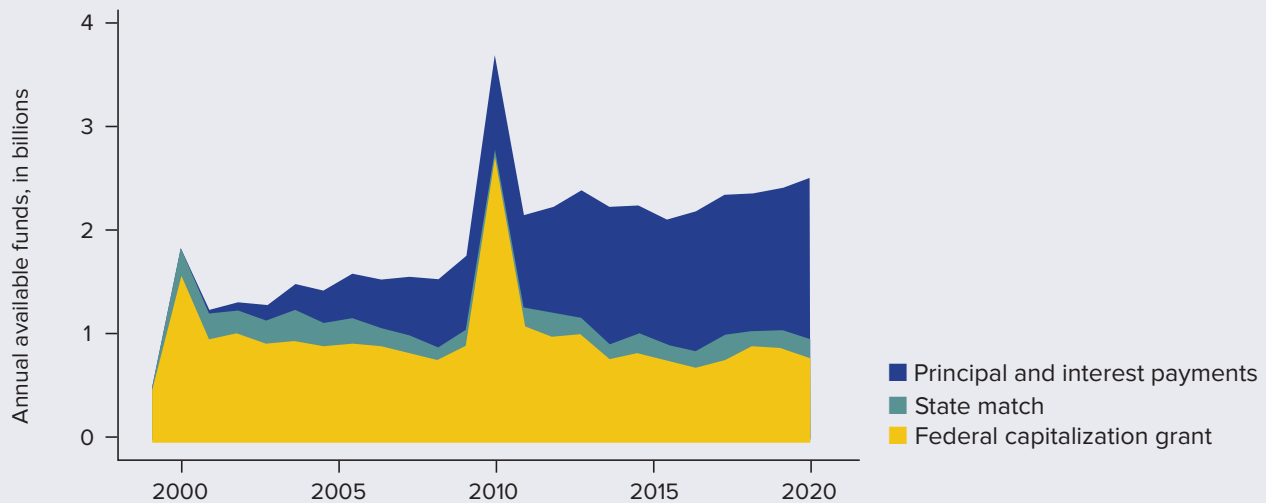


Figure 1. Annual available funds from federal capitalization grants, state match contributions, and principal and interest payments in DWSRF programs nationwide, in billions of 2020 US dollars

of assistance to provide. The flexibility allows states to address diverse environmental and public health concerns. Various agencies in each state—typically the environment, public health, or finance department—administer the program.¹¹

States provide a variety of subsidized assistance through their DWSRF programs. Low-interest loans are the main type of DWSRF assistance. States typically offer 20-year loans with very low (1.5–2 percent) interest rates.¹² States also offer some additional subsidies through other types of assistance such as loans with even lower or negative interest rates, principal forgiveness, and grants.¹³ Congress requires states allocate 14 percent of their federal capitalization grant as additional subsidy to any eligible borrower. The EPA encourages states to subsidize assistance for DACs. In addition to the 14 percent additional subsidy requirement, Congress sets a floor and a ceiling on the amount of additional subsidies states must and can provide to DACs annually. Most recently, the America’s Water Infrastructure Act of 2018 set the minimum amount of additional subsidies to disadvantaged communities at 6 percent and the maximum amount of additional subsidies at 35 percent of the federal capitalization grant.¹⁴ This allowance does not roll over if it is not used.

¹¹ Daley, D. M., Mullin, M., & Rubado, M. E. (2014). State Agency Discretion in a Delegated Federal Program: Evidence from Drinking Water Investment. *Publius: The Journal of Federalism*, 44(4), 564–586. <https://doi.org/10.1093/PUBLIUS/PJT033>.

Mullin, M., & Daley, D. M. (2018). Multilevel Instruments for Infrastructure Investment: Evaluating State Revolving Funds for Water. *Policy Studies Journal*, 46(3), 629–650. <https://doi.org/10.1111/psj.12228>.

Travis, R., Morris, J. C., & Morris, E. D. (2004). State implementation of federal environmental policy: Explaining leveraging in the clean water state revolving fund. *Policy Studies Journal*, 32(3), 461–480. <https://doi.org/10.1111/j.1541-0072.2004.00075.x>.

¹² For comparison, the average interest rate for municipal bonds was 3–4 percent over the past decade.

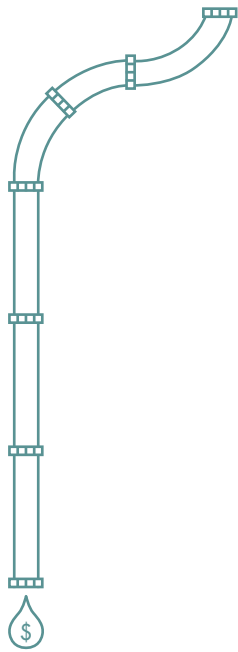
¹³ Humphreys, E. H. (2019).

¹⁴ 42 U.S. Code § 300j–12 – State revolving loan funds. <https://www.law.cornell.edu/uscode/text/42/300j-12>

States can design their DWSRF program in ways that give more or less priority and support to DACs. Specifically, states choose:

- How to allocate funds across systems. Providing support to many systems will increase access.
- Which types of assistance to provide. Offering more principal forgiveness and grants will benefit communities with limited resources.
- How to define and prioritize DACs. Prioritizing communities with limited resources to invest in water infrastructure will enhance equity.

Even with statutory criteria and state policies to assist economically disadvantaged communities, DWSRF funds do not always reach the communities that need them most. Access can depend on whether water systems have the capacity to apply as well as whether state agencies prioritize the project and offer advantageous terms. In both instances, low-income, small, high-minority, or unincorporated communities may be at a disadvantage, despite standing to benefit most from DWSRF funds. Drinking water systems serving low-income or small communities are more likely to struggle to provide reliable and affordable drinking water to all their residents, comply with health-based water quality standards,¹⁵ or respond to regulatory violations.¹⁶



//

Many water systems that serve low-income communities also struggle to access capital.

//

¹⁵ Switzer, D., & Teodoro, M. P. (2017).

¹⁶ Scott, T. A., Moldogaziev, T., & Greet, R. A. (2018). Drink what you can pay for: Financing infrastructure in a fragmented water system. *Urban Studies*, 55(13), 2821–2837.

An aerial photograph of a water treatment plant. On the left side, there are several large circular clarifiers with central mechanical structures. On the right side, there are multiple long, narrow rectangular aeration tanks filled with water, showing a complex, web-like pattern of bubbles or foam. The entire image is overlaid with a semi-transparent blue filter and a large, faint white number '3'.

THE ALLOCATION OF DRINKING WATER SRFs

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A small percentage of drinking water systems apply for and receive DWSRFs.

The number of drinking water systems that apply for and receive assistance is an important dimension of equity in the allocation of DWSRF resources. Expanding the number of recipients distributes access to aid across communities. Slightly less than half of the approximately 140,000 drinking water systems in the United States are eligible to apply for DWSRF assistance. Privately and publicly owned community water systems and nonprofit, non-community water systems are eligible to apply; privately owned non-community water systems such as gas stations, factories, and hospitals are not.¹⁷

To compare the number of drinking water systems that apply for and receive DWSRF assistance, we compiled eligibility data from the EPA's Safe Drinking Water Information System (SDWIS), applicant data from annual Intended Use Plans (IUPs), and award data EPA's Project Benefits Reporting (PBR) database.¹⁸ The applicant data are sparse because most states either do not track or publish which drinking water systems applied for DWSRF assistance. We compiled applicant data from IUPs in seven states between 2016 and 2020.¹⁹

Number of applicants

We find a fraction of eligible drinking water systems apply for DWSRF assistance. In a subset of states, the proportion of eligible systems that applied for DWSRF assistance between 2016 and 2020 ranged from 1.53 percent (49 of 3,198 systems) in Pennsylvania to 13.4 percent (104 of 775 systems) in Arkansas.

There are several reasons why eligible drinking water systems may not apply for DWSRF assistance, including:

- limited need capital improvements.
- sufficient revenue or savings to fund projects.
- financing from other sources with better terms or fewer requirements.
- lack of awareness of the DWSRF program.
- insufficient technical, managerial, or financial capacity to apply.

Outreach and technical assistance likely affect the number of applications. States encourage drinking water systems to apply and assist with the planning, design, and paperwork. These efforts can boost the number of applications. However, states have limited resources to provide assistance.

Number of awards

Nationwide, we find that 7.1 percent (4,721 of 66,552) of the eligible drinking water systems received DWSRF assistance between 2011 and 2020. The percent of the population served by drinking water systems that received DWSRF assistance is larger. Almost one-third of US residents rely on a drinking water system that received a DWSRF award between 2011 and 2020 (Figure 2).

¹⁷ The EPA defines a community water system as a system that supplies drinking water to at least 25 people at least six months per year. EPA. Drinking water requirements for states and public water systems. Retrieved July 5, 2021, from <https://www.epa.gov/dwreginfo/information-about-public-water-systems>.

¹⁸ The PBR was created to track ARRA funds and is accurate after 2009. We measure receipt from 2011 onward since number of projects in 2009 and 2010 were unusually high. The PBR database does not include Arizona.

¹⁹ We compiled applicant data for Arkansas, California, Connecticut, Kansas, Pennsylvania, Texas, and Washington.

The percent of drinking water systems that received DWSRF support varies considerably among states (Figure 3). While North Dakota, South Dakota, Alabama, and Ohio provided assistance to over 15 percent of their drinking water systems, nearly 15 states provided DWSRFs to fewer than 5 percent.

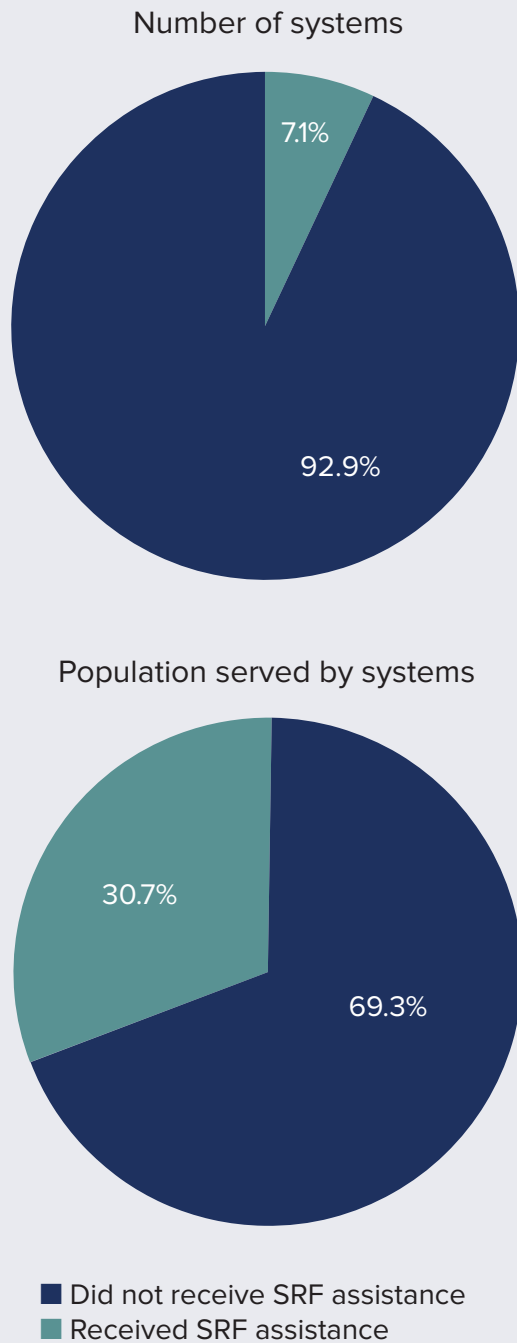


Figure 2. Proportion of the systems and population served by systems that received DWSRF assistance nationwide, 2011–2020

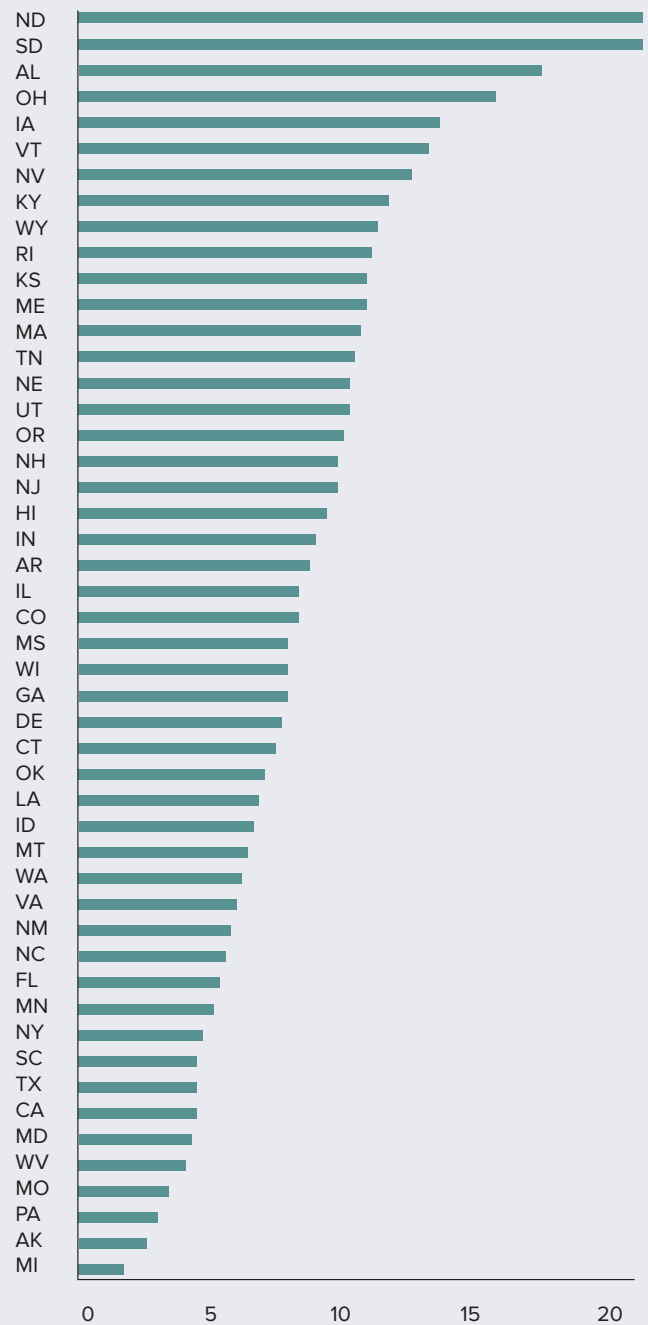


Figure 3. Proportion of drinking water systems that received a DWSRF award by state, 2010–2020

The proportion of drinking water systems that receive DWSRF assistance varies by the:

- Number of applicants: Based on a small sample of states, we find that fewer than 15 percent of drinking water systems apply in any year.
- Size of the projects: States can finance many small projects and few large projects.
- Size of the DWSRF fund: Some states leverage to secure additional capital to provide more awards.
- Availability of additional funding: Many states provide assistance to water systems through other state and federal programs.
- Administrative capacity: The size and expertise of the staff affects the administration of the program.
- Terms of assistance: Drinking water systems may not accept assistance if the terms are not advantageous enough.

States are not reaching the federal ceiling on technical assistance or additional subsidies

States can use part of their capitalization grant on technical assistance or additional subsidies, such as principal forgiveness, grants, or negative interest loans. Additional subsidies do not need to be repaid. Previous research shows that states tend to spend less than the federal ceiling allows.²⁰ We compare the amount of the capitalization grant distributed as technical assistance or additional subsidies between 2011 and 2020 using data from the EPA's National Information Management System (NIMS).

Amount of technical assistance

Federal statute allows states to use some of their capitalization grant on technical assistance through various set-asides. The authorized set-asides that include technical assistance are summarized in Table 1.

We find that states set aside 19.7 percent (\$1.89 billion of \$9.6 billion) of their capitalization grant from 2011 to 2020. States spent many of these funds on administrative expenses, technical assistance, and capacity development, which helps water systems build their technical, managerial, and financial capacity.²¹

²⁰ Copeland, C., & Tiemann, M. (2010). Water Infrastructure Needs and Investment: Review and Analysis of Key Issues. *Congressional Research Service*. <https://fas.org/sgp/crs/homesec/RL31116.pdf>

US EPA. (2015). *Analysis of the Use of Drinking Water State Revolving Fund Set-Asides: Building the Capacity of Drinking Water Systems*. https://www.epa.gov/sites/production/files/2017-10/documents/final_dwsrf_2017_report_508compliant.pdf

US EPA. (2020). *DWSRF 2020 State and National IMS Roll-up Reports*. https://www.epa.gov/sites/default/files/2019-12/documents/state_and_national_roll_up_2019.pdf

²¹ The set-asides also include funds states spend on source water protection and wellhead protection.

Table 1: Description, allowed percent, and average percent of capitalization grant allocated for authorized set-asides that include technical assistance

Authorized set-asides that include technical assistance	Allowed percent of capitalization grant ²²	Average percent of capitalization grant
Administration and technical assistance	4 %	3.7 %
Technical assistance to systems serving fewer than 10,000 people	2 %	1.6 %
State program management, including supervision, technical assistance through source water protection program, capacity development, and operator certification	10 %	7.9 %
Local assistance for land or conservation easements, source water protection, technical and financial assistance for capacity development, and wellhead protection	15 %	6.5 %

Amount of additional subsidies

While DWSRF low-interest loans provide a subsidy to water systems,²³ additional subsidies provide an opportunity to support those serving very low-income communities. Drinking water systems that are unable to take a loan benefit most from assistance does not need to be repaid.

Nationwide, slightly less than half (3,792 of 7,968) of DWSRF awards included an additional subsidy between 2011 and 2020 (Figure 4). Very few awards are full subsidies; a portion of nearly every award needs to be repaid. States committed 26.6 percent (\$2.59 billion of \$9.60 billion) of federal capitalization grants as additional subsidies in the past decade.

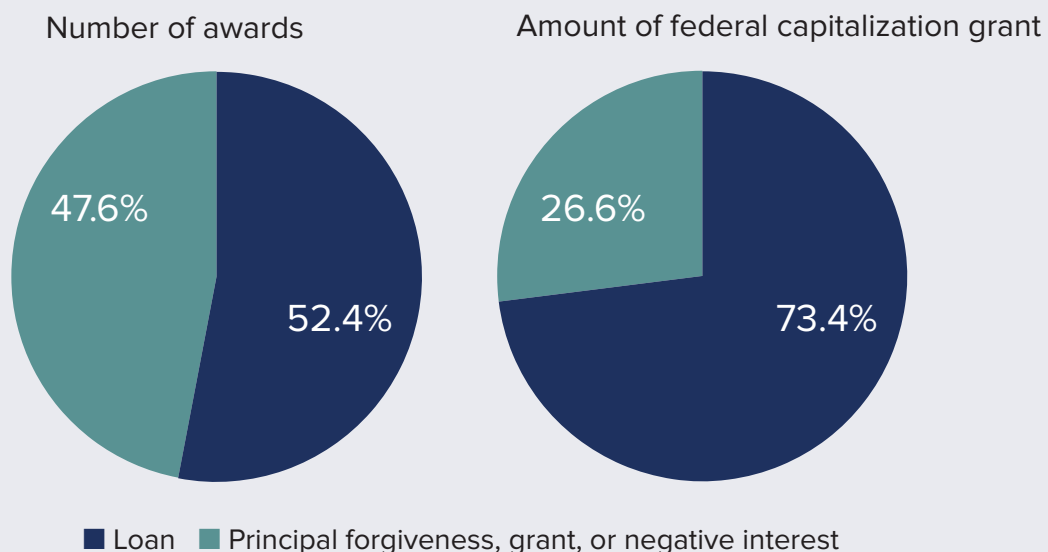


Figure 4. Cumulative federal capitalization grant allocated to DWSRF assistance by type, 2011–2020

The main reason why states provide less technical assistance and fewer additional subsidies than the federal ceiling allows is that state revolving funds are designed as loan programs. Technical assistance and additional subsidies reduce the pool of capital available to finance water infrastructure in the future. The Council of Infrastructure Financing Authorities (CIFA) explains that “every federal dollar provided in additional subsidization is permanently removed from circulation.”²⁴ States may also provide technical and financial assistance to low-income communities through other funding programs.

Policymakers must determine how to balance the need for technical assistance and additional subsidies today with future needs. Greater use of technical assistance and additional subsidies are available to states under the constructs of the Safe Drinking Water Act. Many drinking water systems serving low-income communities do not have the technical, financial, or managerial capacity to apply for assistance or repay loans.²⁵

Certain communities receive disproportionately more DWSRF assistance

Another way of assessing equity in the allocation of DWSRF resources is by tracking the characteristics of communities that benefit from DWSRF assistance. To examine the allocation of DWSRF assistance across contexts, we compiled data from the SDWIS, PBR database, US Census, and service area boundaries in 10 states.²⁶ More details on the case selection and data are reported in Appendix A. We use a probit model to estimate the relationship between the likelihood of receiving DWSRF assistance and four characteristics of the drinking water system or the community served: the number of water quality violations, median household income, population size, and the racial/ethnic composition of the service area.²⁷ The model results are reported in Appendix B. We compare the characteristics of systems that receive DWSRF to all systems in the state. When possible, we also collected and analyzed data to compare the demographics of systems that apply to all systems in the state and found similar results.

Communities with SDWA violations are more likely to receive DWSRF funding

Congress authorized the DWSRF program to improve water quality and protect human health.²⁸ When states allocate funds to achieve this objective, systems that violate SDWA water quality standards receive more assistance.

We find that states allocate DWSRF assistance to improve compliance with drinking water quality standards. Drinking water systems with more health-based water quality violations in the past decade have a higher likelihood of receiving DWSRF assistance (Figure 5). The average probability of receiving an award is 5.9 percent. Moving from zero to one violation increases the likelihood of receiving DWSRF 2.8 percentage points on average. Water systems with three or more water quality violations are the most likely to receive DWSRF assistance.

²⁴ CIFA. (2020).

²⁵ Ibid.

²⁶ The 10 states in our sample are Arkansas, California, Connecticut, Kansas, North Carolina, New Jersey, New Mexico, Pennsylvania, Texas, and Washington.

²⁷ We measure water quality violations as the sum of health-based SDWA violations between 2011 and 2020. We use the sum to create an ordinal variable with these four categories: zero violations, one violation, two violations, and more than two violations.

²⁸ 42 U.S. Code § 300j-12.

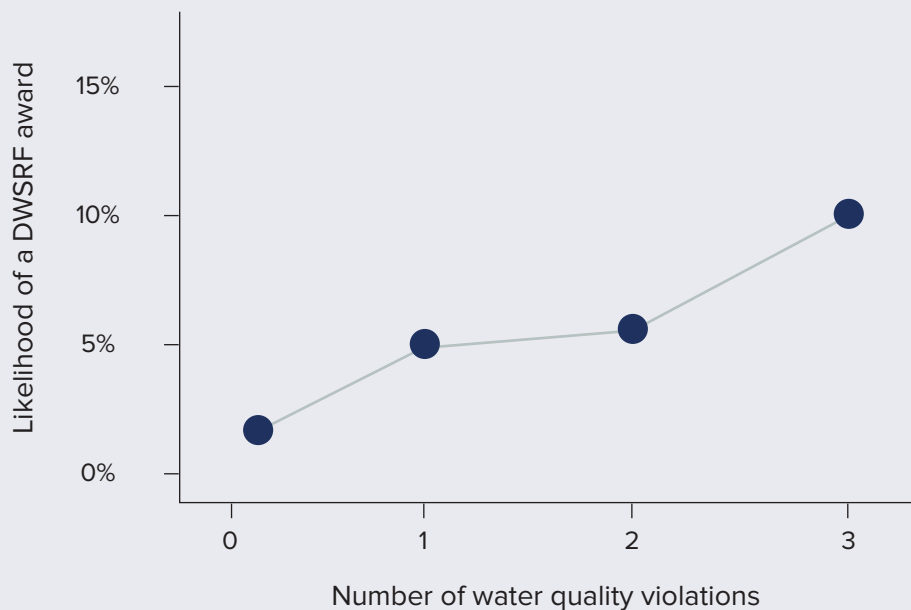


Figure 5. Relationship between water quality violations and likelihood of receiving DWSRF assistance in 10 states, 2011–2020

Low-income communities are more likely to receive DWSRFs

The DWSRF program aims to assist water systems with limited financial capacity in providing safe drinking water. However, systems serving low-income communities may not be aware of the program or have the capacity to apply.

One measure of the extent to which DWSRF resources are reaching low-income communities is tracking allocations to DACs (as states define them). We analyze allocations to DACs using nationwide data from NIMS. We find that DACs accounted for 15.6 percent of the population served by DWSRF recipients and received 37.5 percent of the awards and 29.9 percent of the total funding between 2011 and 2020 (Table 2). By population served by DWSRF recipients, DACs receive a disproportionate number of awards and amount of assistance. However, we expect that the total population of DACs (rather than by DWSRF recipients) is higher than 15 percent, though these data are not readily available.

Table 2. Total population, number, and amount awards by type of community, 2011–2020

Type of community	Population served by DWSRF recipients ²⁹		Number of awards		Dollar amount of awards	
	#	%	#	%	\$	%
Disadvantaged communities	9.96M	15.6%	3,028	37.5%	\$7.31B	28.9%
Non-disadvantaged communities	54.0M	84.4%	5,053	62.5%	\$18B	71.1%

²⁹ Reported as average annual population served

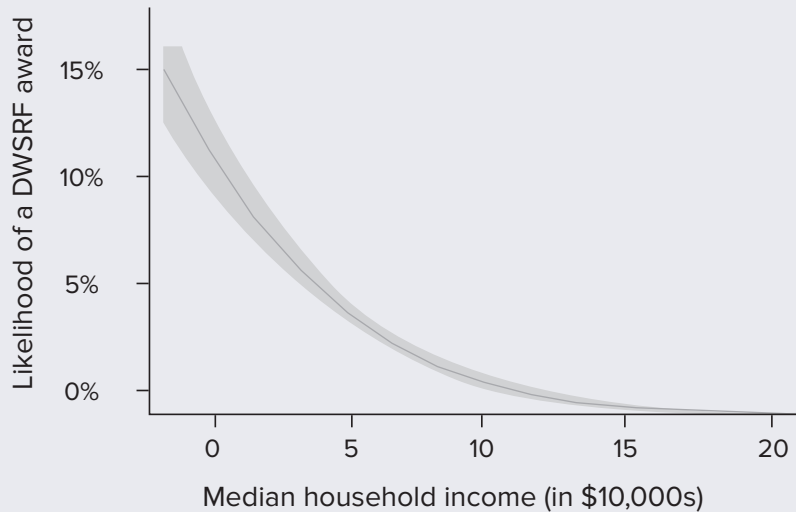


Figure 6. Relationship between MHI and likelihood of receiving DWSRF assistance in 10 states, 2011–2020

Looking more closely at the allocation of DWSRF assistance in 10 states with finer-grained data, we find the likelihood of receiving DWSRF assistance decreases as the median household income (MHI) of a community increase (Figure 6). The average likelihood of receiving an award is 5.9 percent. An additional \$10,000 in median household income is associated with a 1.4 percentage point lower likelihood of receiving assistance on average.

Larger communities are more likely to receive DWSRFs

Distributing resources among communities of different sizes can also enhance equity in the allocation of DWSRF. Small drinking water systems have a smaller revenue base, which can pose greater challenges to funding infrastructure. We analyze the distribution of DWSRF awards based on the population size of communities served using nationwide data from SDWIS and NIMS (Table 3). We find that systems serving larger populations receive a disproportionate number of DWSRF awards.

Table 3. Total population, number, and amount of awards by population size, 2011–2020

Size of systems	Number of eligible systems		Number of awards	
	#	%	#	%
Less than 501	47,269	66%	1,608	20%
501–3,300	15,518	22%	2,554	33%
3,301–10,000	5,002	7%	1,437	18%
10,001–100,000	3,846	5%	1,683	21%
Over 100,000	435	1%	567	7%



Figure 7: Relationship between population and likelihood of receiving DWSRF assistance in 10 states, 2011–2020

Assessing the allocation of DWSRF assistance in 10 states with finer-grained data, we also find that the likelihood of receiving DWSRF assistance increases as the population size served by the system increases (Figure 7). Increasing from a population of less than 500 to a population of between 501 to 3,300 is associated with a 1.9 percentage point higher likelihood of receiving assistance on average.

Drinking water systems serving smaller communities might be less likely to receive DWSRFs due to limited capacity to apply for assistance or take on debt. Smaller drinking water systems tend to have less staff and technical expertise; limited capacity constrains the ability of small systems to apply for assistance and manage projects.³⁰ Funding capital projects may also be more burdensome for smaller communities. With fewer ratepayers to share the high fixed costs, drinking water systems serving smaller populations do not benefit from economies of scale.³¹

Communities with larger proportions of white residents receive more DWSRFs

Finally, the distribution of resources among communities with different racial/ethnic compositions is important for the equitable allocation of DWSRF resources. Previous research has consistently shown that cities with a higher proportion of white residents have more accessible, higher quality, and more

³⁰ McGuire, M., Rubin, B., Agranoff, R., & Richards, C. (1994). Building development capacity in nonmetropolitan communities. *Public Administration Review*, 426–433.

³¹ Simonsen, B., Robbins, M. D., & Helgeson, L. (2001). The influence of jurisdiction size and sale type on municipal bond interest rates: An empirical analysis. *Public Administration Review*, 61(6), 709-717.

affordable water service,³² as well as greater public investments in infrastructure.³³ Recent drinking water contamination in Flint, Michigan and Jackson, Mississippi underscores the vulnerability of BIPOC communities to underinvestment and a lack of state protections.³⁴ Whether intentional or not, notions about race can lead policymakers to frame the problems facing high-minority communities as a product of their own failings.³⁵ Policymakers may subsequently view investments in high-minority communities as financially riskier than those in otherwise similar communities.

Assessing the allocation of DWSRF assistance in 10 states with finer-grained data, we find that communities with larger white populations are slightly more likely to receive DWSRF assistance (Figure 8). Increasing the proportion of community residents that are white by 10 percent is associated with a .41 percentage point increase in the likelihood of receiving DWSRF assistance on average.

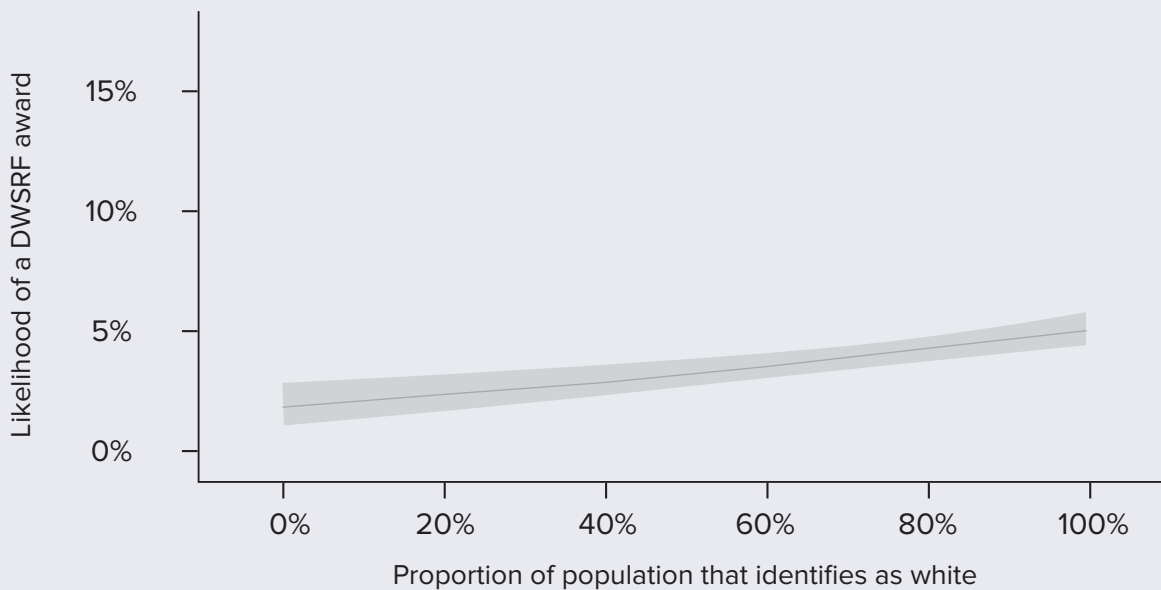


Figure 8. Relationship between race and likelihood of receiving DWSRF assistance in 10 states, 2011–2020

³² Allaire, M., et al. (2018).

Butts, R., & Gasteyer, S. (2011). Environmental Reviews & Case Studies: More cost per drop: Water rates, structural inequality, and race in the United States—The case of Michigan. *Environmental Practice*, 13(4), 386-395.

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Swain, M., et al. (2020)

Switzer, D., & Teodoro, M. P. (2017).

³³ US Water Alliance. (2020). Water rising: Equitable approaches to urban flooding. <http://www.uswateralliance.org/sites/uswateralliance.org/files/publications/Water%20Rising%20paper.pdf>.

University of Maryland, College Park, & Texas A&M University. (2018). The growing threat of urban flooding: A national challenge. <https://today.tamu.edu/wp-content/uploads/sites/4/2018/11/Urban-flooding-report-online.pdf>.

³⁴ Hughes, S. (2020). Flint, Michigan, and the politics of safe drinking water in the United States. *Perspectives on Politics*, 1-14.

³⁵ Spence, L. K. (2020). The neoliberal city and the racial idea. In Dilworth, R., & Weaver, T. (eds.), *How ideas shape urban political development*. University of Pennsylvania Press.

Hackworth, J. (2020). Manufacturing decline: The conservative construction of urban crisis in Detroit. In Dilworth, R., & Weaver, T. (eds.), *How ideas shape political development*. University of Pennsylvania Press.



4

**POLICY RECOMMENDATIONS:
ALLOCATING DWSRFs TO
ENHANCE DRINKING WATER
EQUITY**

In this report, we examine the extent to which DWSRF assistance enhances drinking water equity.

We find that a small percentage of drinking water systems benefit from the program. State DWSRF programs are typically not reaching federal ceilings on technical assistance or additional subsidies, such as principal forgiveness or grants. While low-income communities have been more likely to receive DWSRF support, smaller systems and those serving communities with larger proportions of people of color have been less likely. Congress, the EPA, and states could pursue several steps to further equity in the allocation of DWSRF funding.

🕒 Increase technical assistance to help systems with limited capacity

The EPA and state administrators could do more to ensure that communities have equitable access to DWSRF assistance by providing more technical assistance to potential applicants and engaging third parties to increase access to the program.

Provide more assistance to systems with limited capacity to apply

DWSRF applications can be lengthy and difficult to complete. Applicants must know the eligibility requirements and complete needs assessments, project designs, and preliminary environmental reviews. These studies are expensive to conduct. The process is challenging for drinking water systems with limited technical, managerial, and financial capacity. We recommend:

- States set aside more funds for technical assistance to help systems apply for DWSRF funds, either through their DWSRF programs or other funding sources such as California's SAFER program. Congressional appropriations can also provide additional resources for technical assistance.
- States improve technical assistance to reduce the burden on DACs. For example, Iowa has used DWSRF set-asides to fund staff to complete environmental reviews for all SRF projects, reducing applicants' responsibilities.
- States support multi-year funding. Systems need to plan, design, and finance projects. By providing multi-year support, states can help DACs successfully apply and secure support.
- States offer more planning, design, and engineering grants or principal forgiveness to help DACs develop projects. For example, the Colorado DWSRF program offers up to \$10,000 in planning grants to assist water systems serving DACs.

Engage third parties to advocate for communities and broker agreements

Navigating the application process for intergovernmental aid and managing awards can overwhelm drinking water systems. Following Heather Himmelberger at the Southwest Environmental Finance Center, we recommend that states pursue a funding navigator model to help communities. As a community advocate and financial broker, a funding navigator could:

- Help communities navigate the process of applying and managing awards.
- Evaluate the advantage of various financing options (e.g., length of the loan and the interest rate).
- Connect communities with the resources they need to apply for and manage awards.

↑ Increase the amount of additional subsidies allocated to very low-income and high-poverty communities

Drinking water systems serving low-resource communities may be hesitant to accept loans due to affordability concerns. Low-resource communities can benefit significantly from assistance that does not need to be repaid, such as grants and principal forgiveness. We recommend policies to increase the amount of additional subsidies available to very low-income and high-poverty communities.

Raise or remove the federal ceiling on additional subsidies for disadvantaged communities

The EPA sets a ceiling on the amount of subsidized assistance states can provide to disadvantaged communities through grants, principal forgiveness, and loans with negative interest rates. The ceiling is 35 percent of the amount a state receives through its annual federal capitalization grant. We recommend that Congress or the EPA:

- Increase DWSRF funding.
- Raise or remove the ceiling on the amount of subsidized assistance that states can provide.
- Encourage states to base additional subsidies on the total available funds rather than the federal capitalization grant. This would require statutory change. As states offer more assistance with leveraged funds, principal and interest repayments, the federal contribution is an increasingly small percentage of available funds.

Set a higher floor on additional subsidies for disadvantaged communities

On average, states provide 26.7 percent of capitalization grants as additional subsidies. We recommend that Congress set a higher floor on these allocations, requiring states to provide more assistance as additional subsidies to disadvantaged communities.

Target the type of assistance by financial capacity

The type of assistance drinking water systems benefit from the most varies with the resources in the communities they serve. To better target assistance, we recommend that states use poverty rates (in addition to MHI) to identify DACs. Poverty rates and MHI indicate the level of resources at the household and community level to fund drinking water systems. The proportion of the population living below the federal poverty line is an indicator of the ability of households to pay. MHI is an indicator of the financial capacity of drinking water systems. With both measures, states can better target different types of assistance. Our recommendations on how to target types of assistance are summarized in Figure 9.

Specifically, we recommend that states:

- Provide grants and principal forgiveness to systems that serve low-income, high-poverty communities. These drinking water systems have very limited capacity to fund capital projects through service fees alone.
- Provide low-interest rate loans to systems serving low-income, low-poverty communities. These systems stand to benefit from the DWSRF program and have relatively more revenue to repay loans and benefit from low-interest rates. The majority of DWSRF recipients are in this quadrant.
- Expect systems serving high-income, low-poverty communities to self-finance infrastructure investments since providing DWSRF assistance to these communities has fewer benefits. During the application process, states could ask additional questions to systems with high financial capacity to inform them how receiving a DWSRF will increase equity.

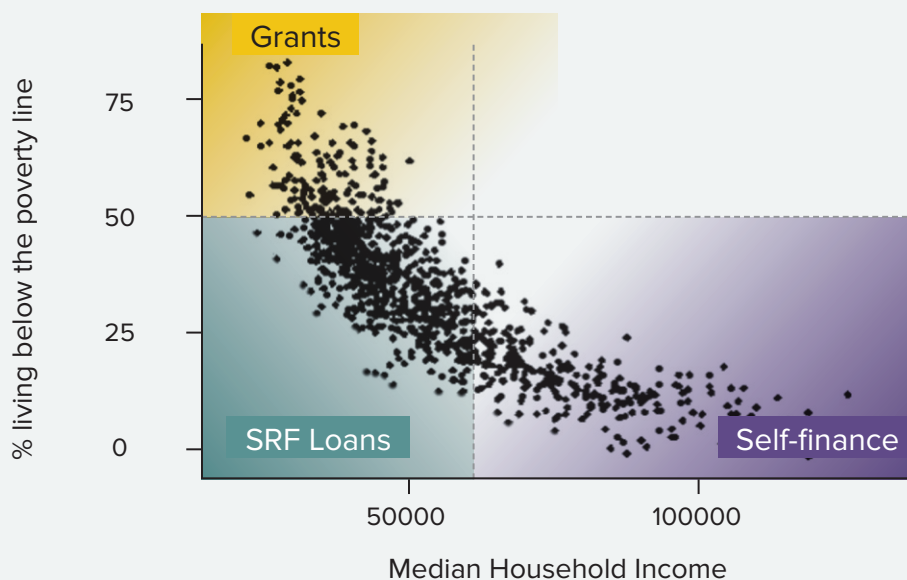


Figure 9. Recipients of DWSRF awards by MHI and proportion of the population living below twice the federal poverty line in 10 states, 2011-2020. We recommend using MHI and poverty to determine the type of assistance to provide communities.

© Prioritize communities with high poverty rates

Communities with high poverty rates have the least ability to equitably raise rates to fund infrastructure and stand to benefit significantly from access to subsidized federal financial assistance. State-determined criteria and definitions of disadvantaged communities serve to identify those communities with limited financial capacity and channel resources to them. States develop strategies for those communities designated as DACs.

Include poverty rates in state definitions of DACs

We recommend that states include poverty rates in their identification of DACs to better target communities that would benefit most from access to DWSRFs. We reviewed 13 state DWSRF programs to understand this variation in DAC definitions (see Appendix C for a full summary of these definitions).³⁶ Of those states, Michigan was the only one that explicitly incorporated poverty rates into its DAC evaluation criteria. Most states use MHI or population size as the primary criteria for identifying DACs during the application process. While these are valuable metrics to assess a drinking water system’s capacity, they do not always capture communities with the greatest level of need where affordability and access are likely to be compromised if providers raise water rates.

Assign priority points to DACs

We recommend that states prioritize those communities that have been designated as DACs. In the states we reviewed, there were often no formal mechanisms during the project application ranking process to prioritize or assign weight to communities that met DAC criteria. The exceptions were Michigan, New Jersey, and Texas where communities that qualify as DACs are awarded an additional 50 priority points in the application ranking. In order for DWSRF outcomes to reflect state equity goals, scoring criteria must allocate points significant enough to help DACs succeed in the application process.

³⁶ Arizona, Arkansas, California, Colorado, Connecticut, Kansas, Michigan, Mississippi, Missouri, New Jersey, Pennsylvania, Texas, and Washington

Develop equity criteria for non-DAC communities

It is possible that drinking water projects in non-DAC communities can forward equity goals by investing in neighborhoods or populations that have been historically neglected. For such communities with relatively high MHI and low poverty rates, we recommend that states demonstrate how the project would promote equity in order to be eligible for DWSRF assistance.

i Track the demographics of communities served by DWSRF projects

Our findings show racial disparities in who is receiving DWSRF resources. Communities with larger white populations are more likely to receive funds. These findings reinforce prior studies that have found racial disparities on every dimension of drinking water service, including safety, affordability, and accessibility. Drinking water infrastructure is only one of many infrastructure systems in minority communities that have seen disproportionate underinvestment, which can magnify the economic, social, and health effects of high water bills or aging water infrastructures. Access to capital is also a persistent challenge for minority communities. The drinking water system disparities in minority communities reflect myriad social, economic, and political forces, and administrative rules and processes may serve as effective tools for reversing historical trends. While Congress cannot require that states allocate resources based on race, many of the recommendations presented here can help historically underinvested communities better access the resources needed to invest in drinking water systems. In addition, states and the EPA can track the demographics of DWSRF recipients more efficiently to assess the extent to which program design and program changes serve to more equitably distribute resources across communities of varying racial compositions.

Drinking water infrastructure is only one of many infrastructure systems in minority communities that have seen disproportionate underinvestment.

Require states track the demographics of beneficiaries of DWSRF-financed projects

We recommend that states be required to track the demographics of the communities and populations in communities that are the beneficiaries of DWSRF-financed projects. Understanding these distributions is the first step toward ensuring that historically underinvested and racial minority communities are able to benefit from DWSRF resources. Such an effort would mirror the Biden administration's Justice40 Initiative that aims to deliver 40 percent of the benefits of federal investments to disadvantaged communities and tracks the progress toward that goal. Establishing a similar threshold—40 percent—could help give states a concrete target to work toward and evaluate themselves against.

Tracking and reporting demographics can help both state and federal administrators continually evaluate the water equity achievements of the DWSRF program.

Require states report on efforts to achieve proportionate allocation of funding

Beyond tracking distributions, we also recommend that states be required to report on their organizational and administrative efforts in order to achieve more just distributions of funding allocation. Patterns of investment and program administration can take time and energy to change. As states take steps to improve technical assistance, identify and prioritize DACs, and track their recipients' demographics, they can report these efforts and maintain eligibility. That type of reporting can also help state and federal administrators learn about the effectiveness and challenges of various approaches.

5

CONCLUSION



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Closing the gap in drinking water affordability, access, and safety requires thoughtful and targeted investment and support of communities in greatest need.

Federal resources have a large role to play in providing these communities with access to capital and financing they may not otherwise have. Low-interest loans and grants can also help drinking water systems keep rates affordable. We find there is still progress to be made in targeting DWSRF funds to communities with the greatest need and offer a number of policy recommendations that could help move the program toward a more equity-centered model. Given similar commitments from the Biden administration to such goals, there may be new opportunities to reform the DWSRF program and use those resources as one tool for forwarding water equity in the United States.

There is still progress to be made in targeting DWSRF funds to communities with the greatest need.

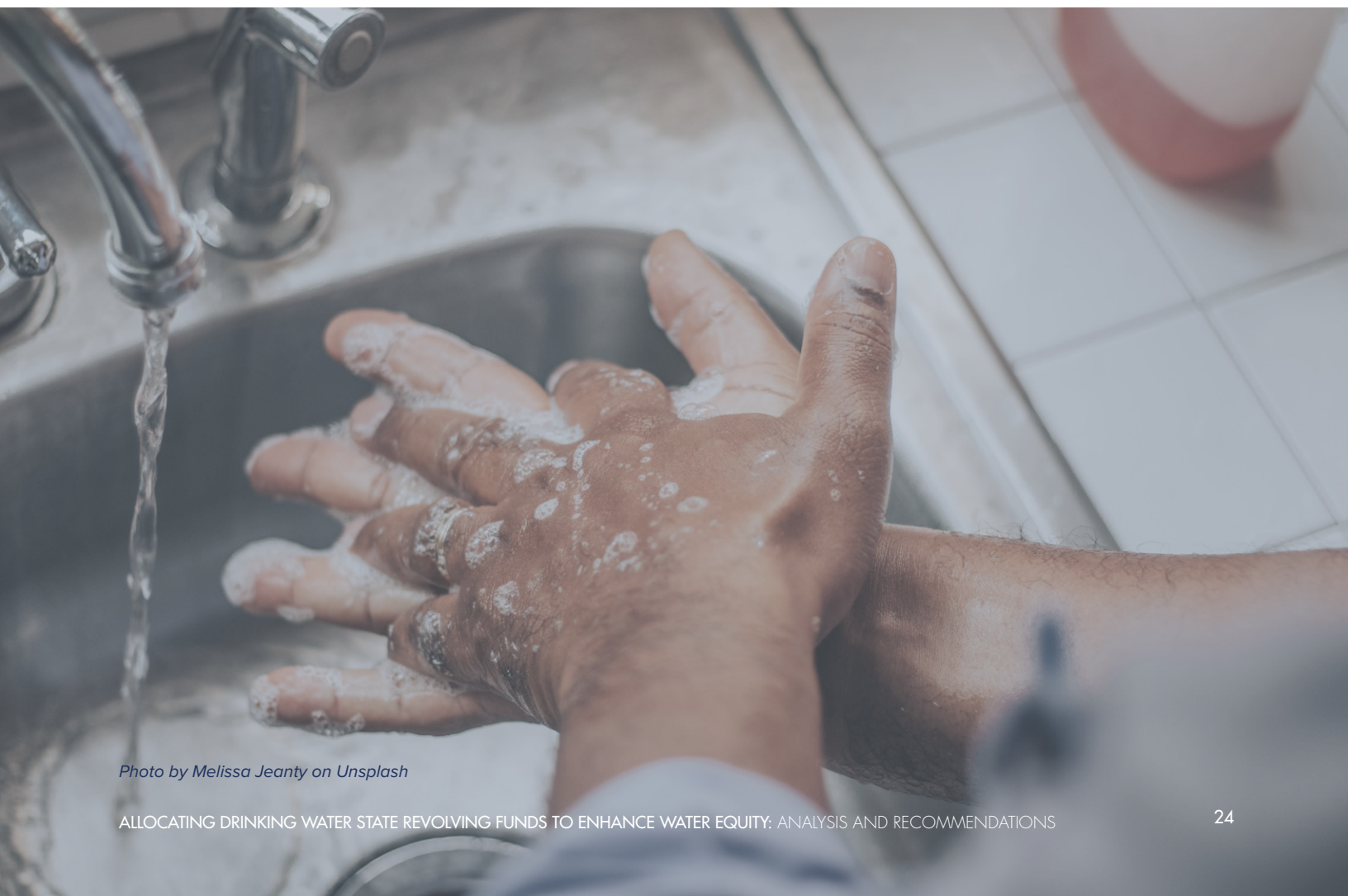


Photo by Melissa Jeanty on Unsplash

Appendices

Appendix A: Detailed Data and Methods

We compiled data from several sources to assess the allocation of DWSRFs (Table 1). First, we collected data on water system awards and water quality violations. The data on DWSRF awards are from a database called the Project Benefits Reporting (PBR) system. The EPA compiles DWSRF assistance data from annual reports submitted by state agencies in the PBR database. We obtained the PBR data from the EPA. We compiled data on health-based water quality violations from the EPA's Safe Drinking Water Information System (SDWIS). We also collected data on the total population, median household income (MHI), poverty provenance, and race/ethnicity of the communities drinking water system serve. The population and race/ethnicity data, reported by block, are from 2010 decennial census. The MHI and poverty data, reported by the block group, are from the 2008--2012 American Community Survey (ACS).

Table 1. Data sources

Variable	Data source
DWSRF Awards	Project Benefits Reporting (PBR) system
Health-based water quality violations	Safe Drinking Water Information System (SDWIS)
	Community water system (CWS) service area maps
Population	US Census
Median household income	US Census
Poverty	US Census
Race/ethnicity	US Census

We aggregated the census data to estimate the demographic characteristics in the community served by a drinking water system in three steps. First, we collected statewide shapefiles of drinking water system service areas.³⁷ Second, we used spatial packages in R to calculate the portion of each block group that fell inside a service area. Third, we calculated the population, population-weighted average MHI and poverty prevalence, and proportion of residents who identify as a certain racial/ethnic group

³⁷ Most states do not have shapefiles of drinking water system service areas. Among the states with statewide maps of drinking water system service areas, none of the shapefiles have complete data.

for each drinking water system service area based on the overlap of the block group and service area. We assume the population distribution within each block group is homogenous. For example, Figure 10 shows the MHI of block groups around the drinking water system serving State College, Pennsylvania. The population-weighted MHI of the State College service area is \$47,817.

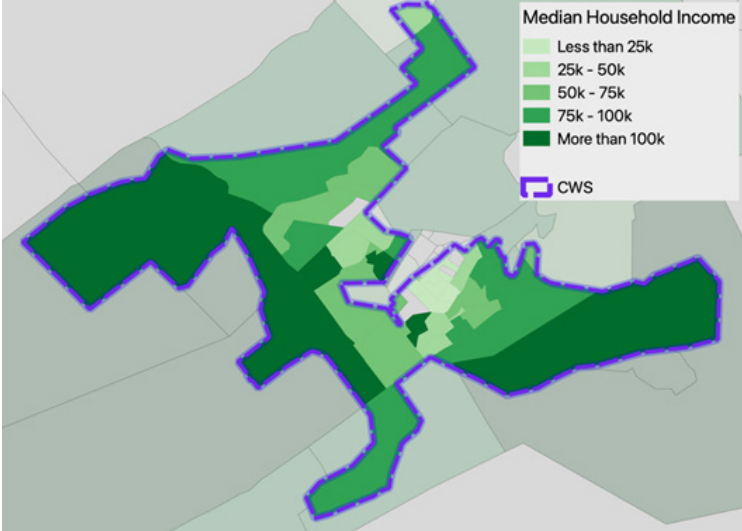


Figure 10 drinking water system service areas and block groups around State College, Pennsylvania. Data: PA map and 2008--2012 American Community Survey.

Appendix B: Probit Model Results

	Recipient
1 violation	0.24 ^{***} (0.05)
2 violations	0.30 ^{***} (0.07)
More than 2 violations	0.54 ^{***} (0.04)
MHI	-0.12 ^{***} (0.01)
Total population (log)	0.19 ^{***} (0.01)
Percent white	0.35 ^{***} (0.08)
FE for State	X
Observations	14,478

*Probit regression model estimates. Standard errors clustered by state. *p<0.1; **p<0.05; ***p<0.01*

Appendix C: State definitions of disadvantaged communities

Table 4. State definitions of disadvantaged communities³⁸

State	DAC definitions and criteria
Arizona	An applicant may be designated a DAC if (1) “the community is designated a ‘colonia’ community through the federal government, or (2) the community received 60 or more Local Fiscal Capacity points on the DWSRF priority project list.” Local Fiscal Capacity points measure a community’s MHI, user rates, and the system’s outstanding and proposed debt.
Arkansas	A DAC is defined as any community with a MHI below that of the Arkansas state MHI. The Arkansas state MHI is “the average of the most recent three years of available data on the American Community Survey five-year estimates provided by the University of Arkansas at Little Rock.”
California	A DAC is defined as “the entire service area of a Community Water System (CWS) in which the MHI is less than 80 percent of the statewide MHI.” A severely disadvantaged community (SDAC) is defined as “the entire service area of a CWS in which the MHI is less than 60 percent of the statewide MHI.” A small disadvantaged community is defined as “a community with a population less than 10,000 persons and with a combined MHI less than 80 percent of the statewide MHI.” A small severely disadvantaged community is defined as “a community with a population less than 10,000 persons and whose combined MHI is less than 60 percent of the statewide MHI.”
Colorado	A DAC is “defined by having a population of 10,000 or less and by meeting certain primary, or a combination of primary and secondary factors.” Colorado’s primary factors include (P1) “reliable MHI less than or equal to 80 percent of the state MHI, (P2) reliable median home value (MHV) less than 100 percent of the state MHV, and (P3) unemployment rate greater than state rate plus one percent or loss in total jobs over 10 year period.” Colorado’s secondary factors include (S1) “reliable MHI less than or equal to 80 percent of the state MHI, (S2) community has lost population over a 10 year period, (S3) community’s total assessed value is less than the median Colorado municipality, (S4) current and projected DWS debt per tap to MHV is greater than that of the median Colorado municipality, and (S5) DWS full-cost per tap is greater than that of the median Colorado municipality or required revenue per tap is greater than that of the median Colorado municipality.” To qualify for DAC eligibility, an applicant must meet one of three scenarios that utilize the primary and secondary factors. The eligibility scenarios then determine if the applicant is a Category 1 or Category 2 DAC, which dictates an applicant’s potential loan terms and interest rates. Colorado also integrates a suite of affordability criteria into its priority scoring model, including information related to a system’s MHI, user fees, project water debt per tap compared to MHV, population, and assessed value per household.
Connecticut	Not applicable. No DAC program offered.
Kansas	A DAC is defined as “any municipality that serves a population of 150 or less.” Kansas also integrates MHI information into its project rating procedure.

³⁸ Direct quotes are from the state’s most recent Intended Use Plan, available on the websites of the state agencies that administer the DWSRF program or the Southwest Environmental Finance Center’s switchboard.

Michigan	An applicant may qualify for DAC status if (1) “the community meets the definition of ‘municipality’ found in Part 54 of Act 451,” (2) “the updated median annual household income (MAHI) of the area to be served is less than 120 percent of the state’s updated MAHI,” and (3) “the costs of the project area are borne by the customers in the service area.” Once these conditions are met an applicant must also meet one of the following criteria to be awarded DAC status: (1) “more than 50 percent of the area to be served by the proposed project is identified as a poverty area by the U.S. Census Bureau, (2) the updated MAHI of the area to be served is less than the most recently published federal poverty guidelines for a family of four in the contiguous United States, (3) the updated MAHI is less than the updated statewide MAHI and the annual user costs for water supply exceed 1 percent of the service area’s MAHI, or (4) the updated MAHI is more than the updated statewide MAHI and the annual user costs for water supply exceed 3 percent of the service area’s MAHI.”
Mississippi	A small community or DAC is defined as (1) a community “that the state determines to be a DAC under SDWA section 1452(d)(3) or may become a DAC as a result of carrying out a project of activity;” or (2) a community “with a population of less than 10,000 individuals that does not have the capacity to incur debt sufficient to finance a project to comply with the SDWA.”
Missouri	A DAC is defined as “any applicant serving a population of 3,300 or fewer based on the most recent decennial census, whose average user rates for 5,000 gallons will be at or above 2 percent of the recipient MHI, and the recipient MHI is at or below 75 percent of the state average as determined by the most recent decennial census.” Missouri also includes affordability in its Priority Points Criteria, which evaluates an applicant’s annual MHI compared to the state annual MHI.
New Jersey	A DAC is defined as “a municipality whose MHI is equal to or less than 65% of the state’s MHI.”
Pennsylvania	Pennsylvania uses a financial capability analysis to compare community demographic data to similar communities across the state to determine the percent adjusted MHI available to pay for water in that applicant’s community. An applicant is considered a DAC if the percent of a community’s adjusted MHI that should be available to pay for water is higher than similar Pennsylvanian communities, which is generally greater than 2 percent of a community’s MHI. Pennsylvania separately integrates affordability into its application ranking framework.
Texas	To qualify as a DAC, the applicant must meet Texas’ affordability criteria based on income, unemployment rates, and population trends. The applicant must (1) have “an annual median household income (AMHI) that is no more than 75 percent of the state MHI” and (b) have a Household Cost Factor that is “greater than or equal to 1 percent if only water or sewer service is provided or greater than or equal to 2 percent if both water and sewer service are provided.”
Washington	Washington uses a water system affordability index to determine an applicant’s DAC status. The affordability index is a ratio of an applicant’s average monthly water rate to MHI.