BLACK & VEATCH

2023

Water Report

About This Report

Eleven years since Black & Veatch first launched its annual analysis, the U.S. water sector leader's latest overview of the industry shows it embracing opportunities to modernize against a litany of challenging headwinds.

Based on a survey of roughly 450 U.S. water industry stakeholders for Black & Veatch's *2023 Water Report*, aging infrastructure remains the top concern in the sector, compounded by the pitfalls of an aging workforce and the pursuit of hiring qualified staff. Utility budgets remain tight, and the regulatory landscape continues to evolve, illustrated in March by the U.S. Environmental Protection Agency's (EPA) release of its long-expected plan to regulate a new category of toxins in drinking water.

Extreme weather events manifested by climate change continue to test the industry's infrastructure and assets. Despite a federal influx of billions of dollars for system upgrades, funding and rate issues linger along with questions about the robustness of utility cybersecurity postures meant to defend against disruption-minded keyboard predators.

Yet opportunity abounds in this sector in which "sustainability" — what we define as the ability to meet the needs of the current generation without compromising the needs of future generations — continues to be a critical strategic focus among two-thirds of survey respondents.

Data continues to hold great promise in helping utilities do more with less with infrastructure well past its prime, though it's still not utilized to its full potential in heightening resilience and sustainability.

Amid the need for greater investment in water systems, help is there for willing water utilities with the resources and knowledge required to pursue it.

This year's report dives into these issues and many more, giving an overview of what's changed — and what has not — in an industry with enormous potential to accelerate innovation in strategy, operations and funding.

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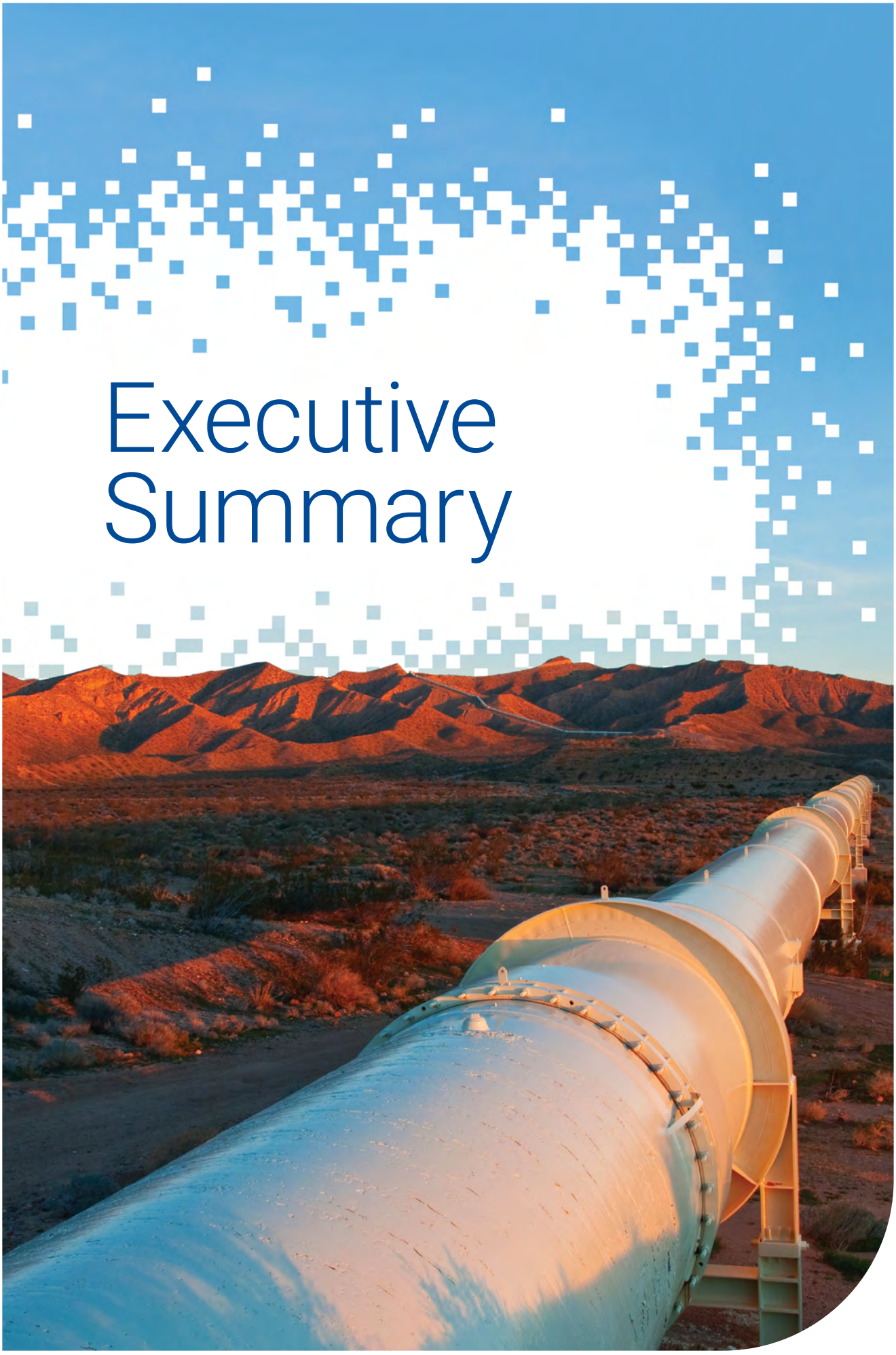


An Evolving U.S. Water Sector: A Push for Sustainability, Robust Technology Amid Challenges, Opportunities

About the Author

Mike Orth *is president of Black & Veatch's governments and environment business. Before that 2021 appointment, Orth served as executive vice president and managing director of Black & Veatch's water business in the Americas. He has guided the company's growth efforts in supply, storage, treatment and conveyance by delivering projects for clients through both traditional methods and alternative solutions such as design-build, performance contracting and public-private partnerships.*

Chronically aging infrastructure. Lurking cybersecurity threats, budget tightropes and the quest for sustainability. Mounting external pressures for more resilience against the menace of climate change's fallout. An evolving, shifting regulatory landscape stoking uncertainty. Workforce staffing headaches and broad public misperceptions about rates and the value of water.

Never has the U.S. water, wastewater and stormwater sectors confronted so much. Yet Black & Veatch's *2023 Water Report* also finds a wealth of opportunity, most clearly in digital technologies and innovations that help operators make better decisions and get the most of their assets.

Integrated water solutions also provide a wealth of opportunities. With the providing of reliable, safe water at the core of every utility's mandate and mission, these dynamic times are helping reshape the water sector that is increasingly — and promisingly — adopting integrated solutions that achieve sustainable development and system resilience. Contributing to that is a widening embrace of a "One Water" approach based on accepting that all forms of water — from drinking water to wastewater, stormwater, reclaimed water, indirect and direct potable reuse, and groundwater — are a singular resource to be managed sustainably.

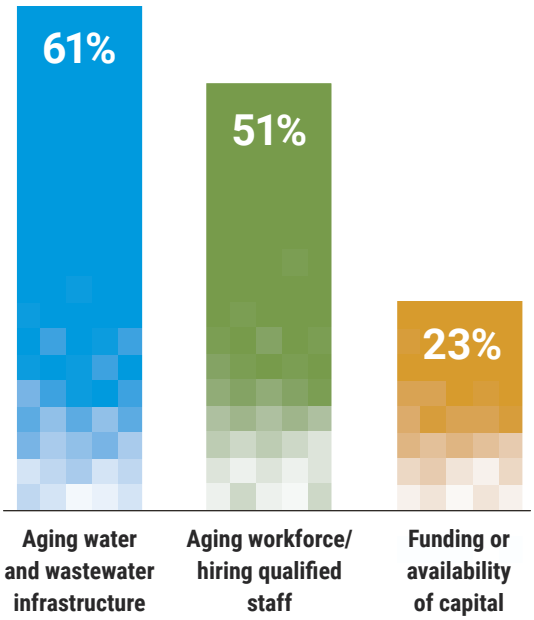
Based on expert analyses of a survey of roughly 450 U.S. water sector stakeholders, the *2023 Water Report* takes the pulse of the industry on these topics and more, dissecting the pain points, the trends and opportunities facing water utilities today.

To no surprise, it's a conversation that begins with the white elephant in the room: the critical infrastructure that gets older by the day — and the complexities involved in addressing aging infrastructure among many other competing interests.

Figure 1

From your perspective, what are the most challenging issues facing the water, wastewater and stormwater industry today? (Select the top three most challenging issues)

Source: Black & Veatch



Increasing/expanding regulation	22%
Climate adaptation & resilience	21%
Justifying capital improvement programs and/or rate requirements	19%
Managing capital costs	19%
Regulatory requirements	18%
Managing operational costs	17%
Water conservation	13%
Integrated water planning	9%
Data collection and management	8%
Decarbonization	5%
Treatment technology	5%

Pipes and Peers: The Nagging Challenges of Age

Much as was the case a decade ago, respondents to Black & Veatch's latest survey ranked aging water and sewer infrastructure as the industry's foremost concern, with six in 10 putting the issue at the top of the list *(Figure 1)*.

Not far behind — at 51 percent, again No. 2 for the second consecutive year — survey respondents cited the issue of aging workforce and the challenges of hiring qualified staff as the second most challenging issue. Although this response dropped 13 percent from 2022, this trend has led to the increasing adoption of automation and outsourcing to fill the gaps, given a shortage of qualified candidates who have more options and bargaining power in a competitive job market. Fewer people appear to be showing interest in water utility work, and recruitment has turned into a bidding war, putting a strain on utilities with limited financial resources, especially the smaller ones.

From there, the rankings of challenges underscore the competing priorities among water utilities, running the gamut of issues from availability of capital to regulation, managing capital costs, water conservation, decarbonization and integrated planning.

The Quest for Sustainability

As the sustainability section of this report bears out, sustainability means different things to different people. But we see it as the need to serve the current generation while safeguarding the needs of future generations.

None of that is lost in this year's sampling of the water industry, where two-thirds of respondents — nearly mirroring last year's 65 percent — consider sustainability to be a critical strategic focus sector *(Figure 2)*. Three-quarters of larger utilities — those serving a population of more than half a million — hold that view.

Drilling a bit deeper, roughly half of respondents report that their utility has sustainability goals and the means to measure them. Larger utilities are leading the way on this; 67 percent of utilities who serve more than 500,000 customers, compared with 44 percent of their smaller counterparts, report they have sustainability goals and associated performance metrics.

These goals and metrics almost universally (91 percent) include energy efficiency efforts, followed by water reclamation (62 percent), water recycling (56 percent) and carbon mitigation (48 percent). Along the way, utilities asked to rank the climate mitigation or adaptation strategies they are pursuing or planning to pursue put water loss mitigation and water conservation — along with implementation of energy efficiencies — at the top of the list, followed by the biggest mover: conversion of their fleets to electric vehicles. Cited among 48 percent of respondents, that approach was up nearly 20 percent from 2022.

While most utilities and municipalities promisingly appear to have some sort of sustainability blueprint, the frequent lack of coordination between those two entities means cost-saving and process optimization opportunities are being missed.

Figure 2

What is the importance of sustainability within the water utility industry? (Select one)

Source: Black & Veatch

Digital Water: Opportunity Knocks

Leveraging the full potential of data — what we refer to as "digital water" — can be demonstrably powerful in an asset-intensive, rate-restricted industry that requires informed decision-making to effectively balance capital investment and rising operational expenses with resistance to rate increases. The payoff is getting the most out of aging assets through actionable, resilience-enhancing information that also can tip off operators to potentially looming failures, not to mention the upside of analytics in helping fill the void during staffing challenges.

Our latest survey shows promising evidence that the industry is continuing to undergo a digital transformation, with utilities having a digital water strategy in place and clear objectives defined. Two-thirds of respondents reported positive results when asked to what extent their company's data or digital solutions strategy is achieving objectives.

That said, there remains a lot of remaining opportunity, given that precisely harnessing data — and broader artificial intelligence technologies — can provide a holistic view of the water system, enhancing efforts to track consumption, drive efficiencies, save energy and prioritize investment dollars. More than half of respondents stated that while they are collecting data, they are not leveraging it effectively, a slight increase from 49 percent last year.

Uncle Sam and the Fight for Funding

With outdated infrastructure entrenched year after year as the biggest issue that keeps the industry up at night, trying to mitigate that challenge is a matter of money. In a landscape where utility budgets are tight and fixing the frailties of assets carries a steep price tag that ratepayers aren't overly receptive to helping cover, roughly half of survey respondents believe funding for capital infrastructure projects for their organization will be sufficient or merely meet the requirement. Thirty-seven percent say funding simply will not be enough.

Uncle Sam has stepped in with the Infrastructure Investment and Jobs Act (IIJA) — or the Bipartisan Infrastructure Law (BIL) — signed into law in late 2021 as the largest federal investment in water in U.S. history, committing tens of billions of dollars to the sector. The intended purposes are diverse, including funds for water infrastructure, resiliency, lead service line replacements and contaminant removal.

The money — more of a lifeline to the industry than a panacea — carries promise at a time of rising urgency in remediating lead service lines and evolving regulation. Most recently, that includes the U.S. Environmental Protection Agency's release in March of its long-expected plan to regulate a new category of toxins in drinking water: per- and polyfluoroalkyl substances (PFAS), commonly known as "forever chemicals."

So, are U.S. water utilities seizing the moment? The short answer is perhaps not. Slightly more than one-quarter of respondents say their enterprise has applied for or will go after IIJA funding, while more than four in 10 haven't explored it nor have plans to pursue it.

Much of that appears attributable to perceived red tape. Nearly half of respondents — 46 percent — deem the process administratively burdensome, with a nearly identical number viewing it as too restrictive, with both of those replies up considerably from 2022. Others acknowledge they lack awareness about the programs (36 percent) or aren't clear about how to pursue the funds (30 percent).

Long story short, the survey finds, U.S. water utilities are prioritizing investments – whether supported by new funding programs or not – in water reliability and resilience (61 percent), asset rehabilitation and renewal (56 percent), cybersecurity (50 percent) and regulatory compliance for PFAS (49 percent) as their top investments for their utility or municipality over the next decade.

It's a short list of well-placed priorities. As the industry evolves — steadying and in many cases better positioning itself against headwinds showing no signs of easing — U.S. water utilities either independently or with expert outside consulting advice can find the footing needed to take positive steps that these times demand.

Elsewhere in This Report

Climate Change Resilience

Given the growing awareness of climate change and the resulting extreme weather that stresses the U.S. water sector's infrastructure often well past its prime, where exactly does the industry stand on addressing the threat through such things as predictive modeling, risk mitigation and investment in asset hardening? As climate adaptation and resilience continue their ascension in relevance, the short answer is that the results are mixed.

Cybersecurity

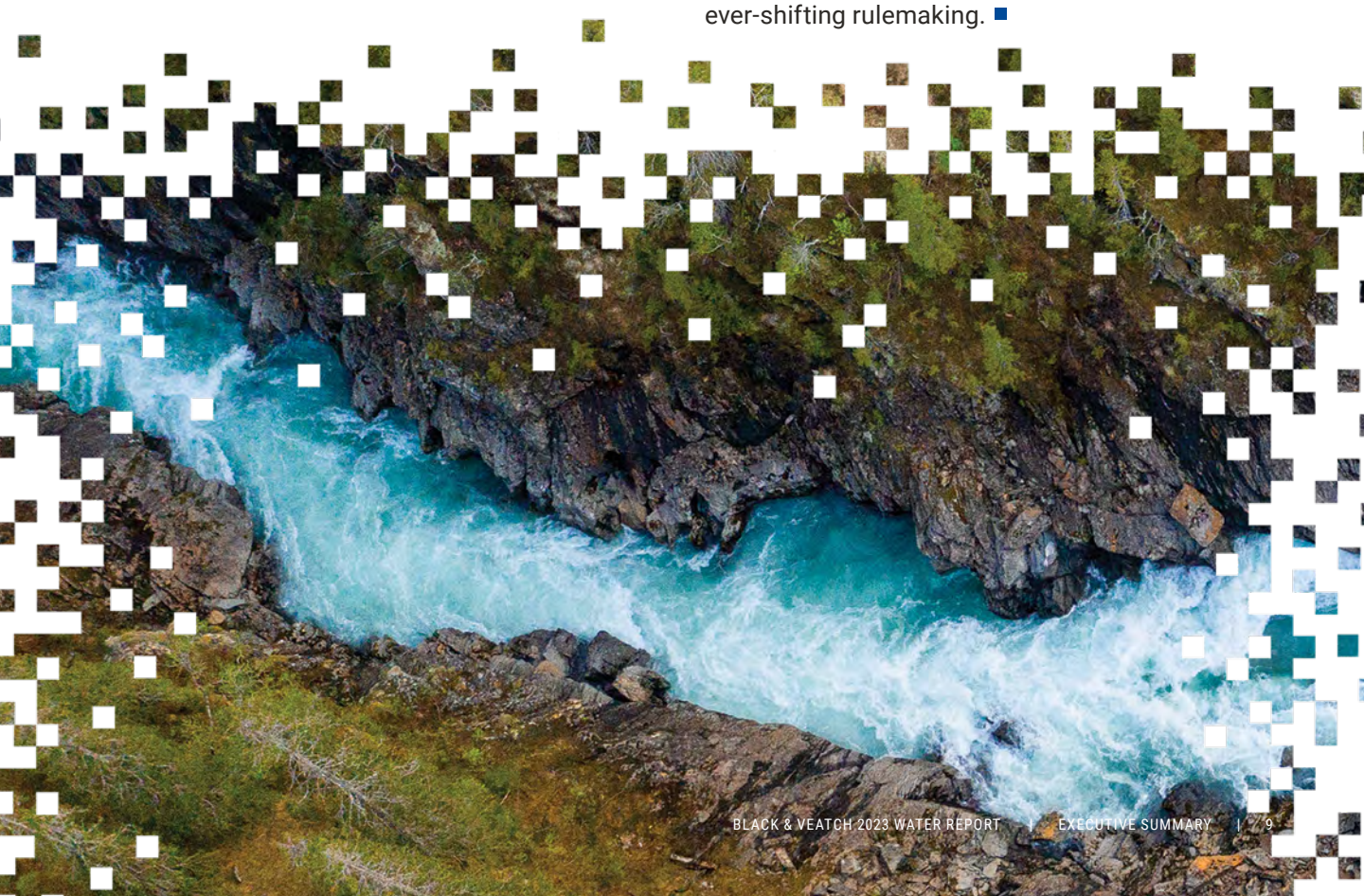
When it comes to safeguarding the cybersecurity of utilities, the wolf is always at the door. The U.S. water sector gets it, overwhelmingly demonstrating great awareness about the importance of and need for cybersecurity postures as they harden their systems against such attacks. The big takeaway: Eight in 10 of our survey respondents report that cybersecurity is the most important investment in the security of their assets. But only 57 percent believe physical security — a prerequisite for cybersecurity — is the most critical investment. That gap could jeopardize both.

Rates

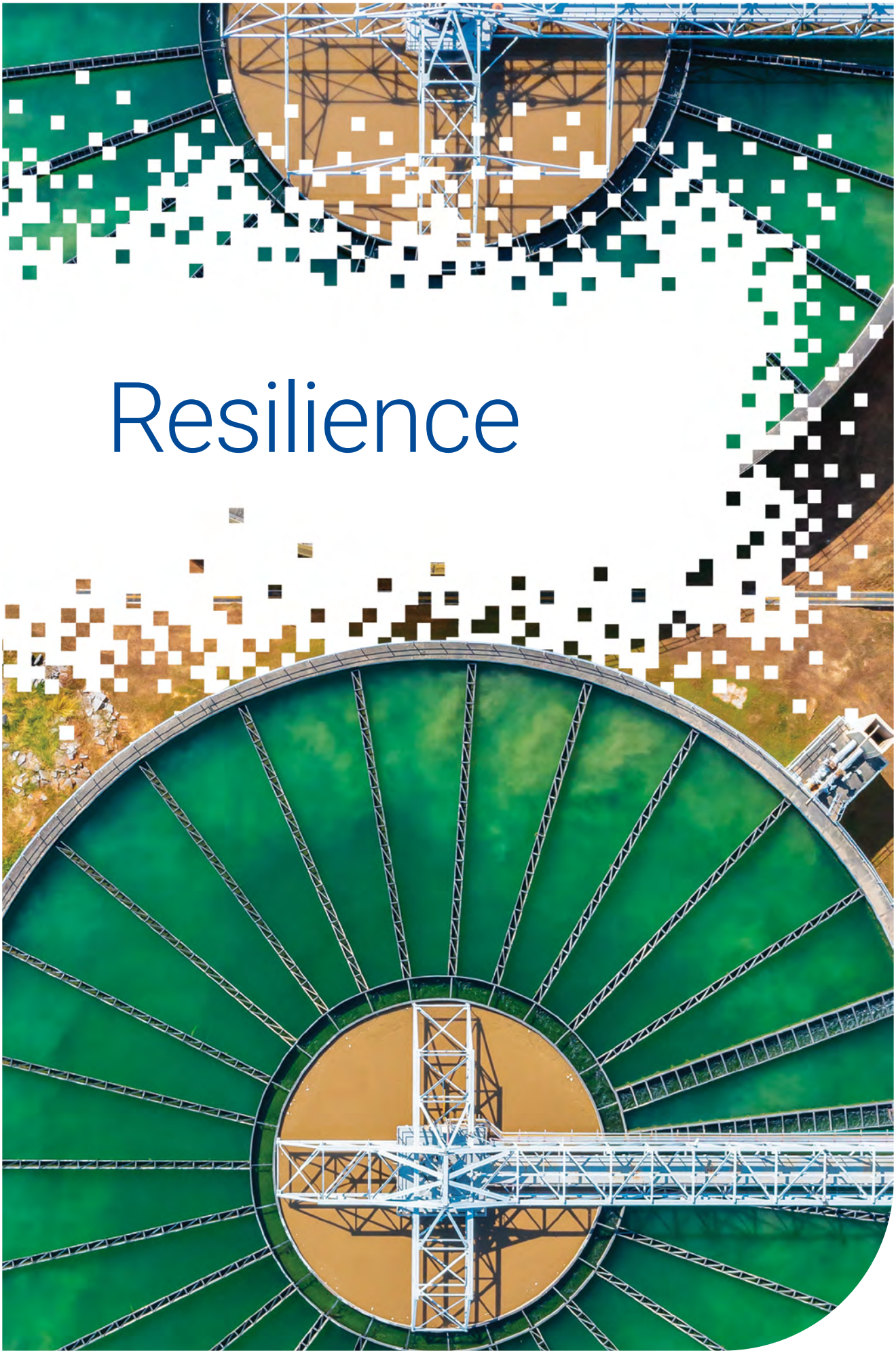
True to their calling, water utilities almost universally have provided clean, affordable drinking water, never mind the chronic and costly need to upgrade infrastructure. Consumers often oblivious to decaying assets they can't see — out of sight, out of mind — bristle at prospects of paying more for something they seemingly take for granted or expect to be subsidized as a necessity for health and safety. It's a nagging disconnect over the true cost of water, pitting utilities working within their rate structures against cost-conscious consumers footing the tab with little appetite for higher monthly bills.

Contaminants

In March, the U.S. Environmental Protection Agency announced its long-expected National Proposed Drinking Water Rule (NPDWR) to regulate a new category of toxins in drinking water — a half dozen per- and polyfluoroalkyl substances (PFAS) — commonly known as "forever chemicals." Taken in tandem with rules involving lead and copper, the EPA's move presents an unprecedented moment in the U.S. water industry grappling with how to respond to ever-shifting rulemaking. ■



Resilience



Sustainability: The Definition May Vary, But the Opportunity Doesn't

Contrary to many perceptions, water is a finite thing, and as the world's population continues to grow and urbanize, the strain on existing water resources intensifies. More frequent extreme weather events — and the major droughts and floods that result — further emphasize the criticality of sustainable water management strategies.

It's a global concern, exemplified by the central theme of the 2022 United Nations Climate Change Conference: "Securing a Resilient and Sustainable Future for All." The key focus: water's role in achieving the U.N.'s sustainable development goals (SDGs).

So where are water utilities in their journey towards sustainability? And how can water utilities deploy sustainable strategies amidst multiple and competing priorities?

Relying on expert analyses of survey data gathered from roughly 450 U.S. water sector stakeholders, Black & Veatch's *2023 Water Report* found that while most respondents agree that sustainability is important, utilities big and small are battling cost escalation and competing priorities.

What's Sustainability?

Sustainability means different things to different people. But regardless of how it's defined, most agree that we must meet the needs of the current generation without compromising the needs of future generations. And according to the survey, water utilities are taking the matter seriously.

When polled about the importance of sustainability within the water utility industry, two-thirds of respondents — 66 percent — agree it is a critical strategic focus, a response virtually unchanged from last year's feedback. When these results were broken down by utility size, three-quarters of larger utilities (for purposes of this report, those serving a population of more than half a million) considered sustainability to be a critical strategic focus for the sector *(Figure 3)*.

Figure 3

What is the importance of sustainability within the water utility industry? (Select one)

Source: Black & Veatch

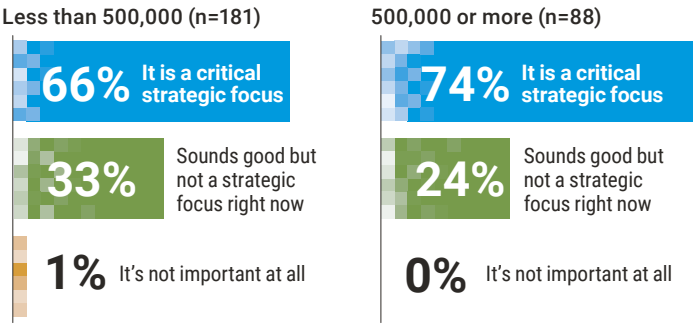
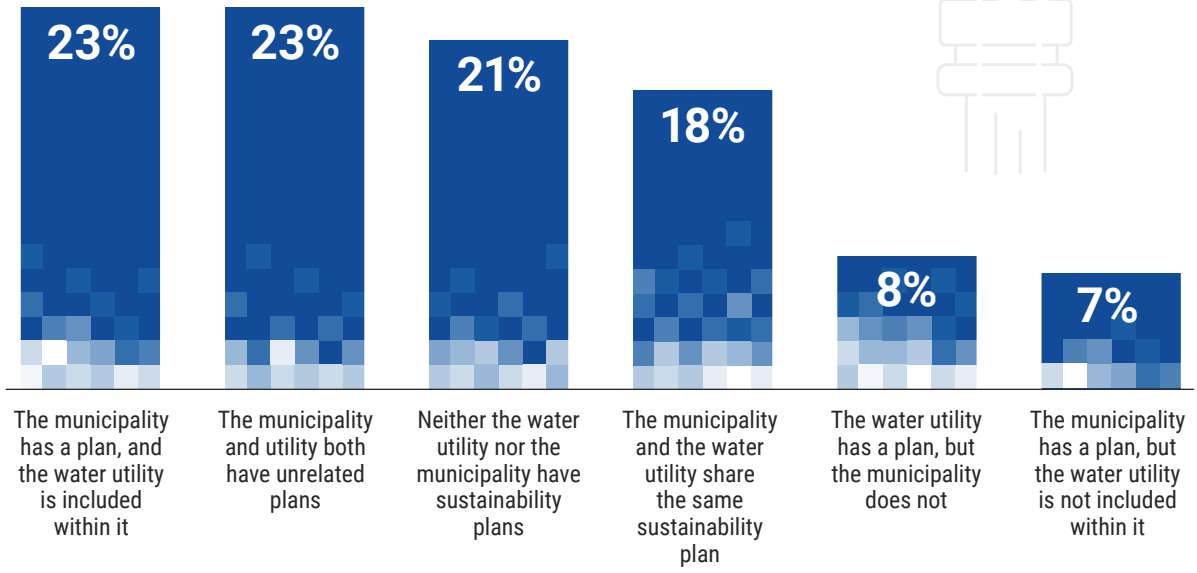


Figure 4

Which of the following situations best describe sustainability planning for your municipality and the water utility? (Select one)

Source: Black & Veatch



Disconnect Between Utilities, Municipalities

When it comes to sustainability planning, one survey question revealed a disconnect between water utilities and their local municipalities. A combined 41 percent of respondents stated that both the utility and the municipality share the same sustainability plan or that the municipality's plan included the utility; the remaining 59 percent stated that they are unaligned with unrelated plans or no plans at all *(Figure 4)*.

These percentages were slightly higher when considering just the larger utilities; for example, 21 percent say they share the same sustainability plan with their local municipality. That makes sense, considering that larger utilities typically have more robust budgets to put towards sustainability initiatives.

While it's great that most utilities and municipalities seem to have some sort of sustainability plan, the lack of coordination means cost-saving and process optimization opportunities are being missed. Notably, roughly one-fifth of respondents — 21 percent — have not yet gotten started on their sustainability plans, either through their utility or municipality. Given that the water industry increasingly is pressed about — and focusing on — its environmental impact and water stewardship, it's critical to create clear plans that demonstrate commitment and alignment.

Obstacles to Sustainability

Water utilities continue to juggle many competing demands, needing capital investments to address chronic aging infrastructure while also being under pressure to keep rates low for their customers.

While it's encouraging to see most of those surveyed believe they have public support, two-thirds — 67 percent — cited affordability as their biggest hurdle in achieving sustainability strategies *(Figure 5)*. Most respondents separately said their organizations are very willing to take advantage of funding programs, though nearly half — 46 percent — view the process as too administratively burdensome. The upshot: while most utilities are aware of the existence of funding options — and by extension, opportunity — they're challenged by the complexity and cautious about what kind of strings are attached. A deeper analysis is outlined in the funding section of this report.

No 'One-Size-Fits-All' Approach

An organization's sustainability goals differ depending on region, regulatory requirements, finances and a myriad of other factors, making their approach to achieving these goals relatively unique. Fortunately, there is a wide range of strategies available with other innovations emerging on the horizon.

Figure 5

What are your biggest hurdles in achieving your sustainability strategy?
(Select all that apply)

Source: Black & Veatch

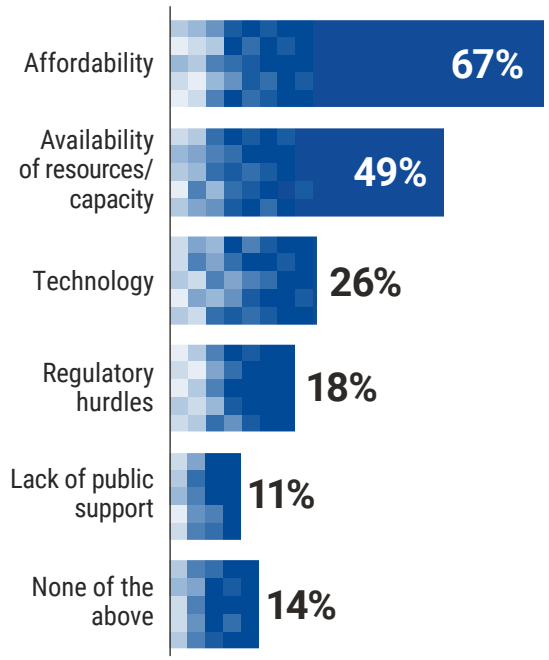
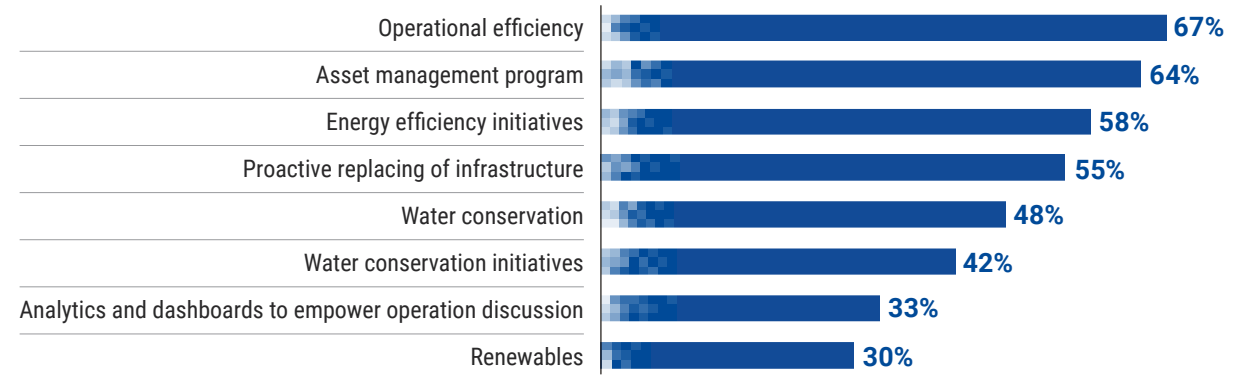


Figure 6

What efforts are your utility practicing to enhance sustainability? (Select all that apply)

Source: Black & Veatch



New user rate structures	29%	Stormwater as part of the water supply portfolio	12%
Nutrient removal	26%	Solid waste	10%
High quality wastewater as apart of the water supply portfolio	25%	Carbon sequestration	7%
Green energy initiatives	23%	Zero liquid discharge strategies	7%
New personnel training approaches	21%	New financial models	7%
Industrial and commercial implementation of water reuse	19%	None of the above	4%
Carbon neutral policies	18%		

When it comes to the top sustainability efforts that utilities are implementing, operational efficiency (67 percent) and asset management programs (64 percent) lead the way, followed by energy efficiency initiatives (58 percent), proactive replacement of infrastructure (55 percent) and water conservation (42 percent) *(Figure 6)*. These results are understandable from a financial standpoint — infrastructure replacements often are covered by funding programs, and the other four practices double as cost-saving optimizations in addition to achieving sustainability objectives.

An Integrated Approach to Sustainable Infrastructure

The complex and interconnected nature of challenges facing water resource management requires integrated solutions that involve various stakeholders including government, utilities and the private sector. A well-aligned strategy combined with the right engineering philosophy and approach can accelerate progress toward sustainability.

As highlighted in our corporate *2022 Sustainability Report*, Black & Veatch adheres to the Institute for Sustainable Infrastructure's Envision rating system (highlighted below) that uses a proactive, quantifiable approach to evaluate civil infrastructure projects. Utilizing Envision and/or LEED sustainability frameworks was identified as a top priority for survey respondents, with more than six in 10 — 62 percent — planning to implement these frameworks in the next one to two years. For utilities, finding synergies with private sector players who are also declaring corporate water stewardship goals provides opportunities to share costs, find efficiencies and achieve goals collectively.

Without question, finding the right approaches and funding sources for each water utility is a highly individualized effort; what works for "Utility A" won't necessarily work for "Utility B." And while most agree that sustainability is important, utilities big and small are battling cost escalation and competing priorities.

Correctable missed opportunities abound, from the lack of collaboration between utilities and municipalities to confusion about funding alternatives and misconceptions about the lifestyle impacts of adopting sustainable strategies.

The path to sustainability is a journey, and it's essential to acknowledge complexity when seeking solutions that integrate strategy, technology and stakeholder management. Utilities must evaluate all facets of their organization including capital planning, operations, construction, supply chain, disaster response, climate adaptation and community engagement to develop a roadmap for sustained, incremental improvements to achieve their goals. Even baby steps are progress in the right direction.

Envision:
A Road Map to Sustainability

As highlighted in its *2022 Sustainability Report*, Black & Veatch joined the Institute for Sustainable Infrastructure in 2014 and adheres to its Envision rating system, which uses a proactive, quantifiable approach to score environmental, social and economic aspects of infrastructure projects to achieve increasing sustainability. Black & Veatch has more than 100 professionals certified for Envision and the U.S. Green Build Council's Leadership in Energy and Environmental Designs (LEED) program, enabling the company to design and certify these types of projects for its clients.

Meant to identify and foster sustainable approaches to civil infrastructure projects, Envision includes roughly five dozen criteria that help incorporate sustainability options and gauge improvement over the project's planning, design, construction and maintenance phases through eventual asset deconstruction. Categories of measurement run the gamut from quality of life, natural world, and climate and resilience considerations to leadership and resource allocation.

Not only is Black & Veatch executing and helping certify Envision projects for its clients, but the company also strives to develop project guidance that utilizes the core principles of the Envision system and apply them to all the projects that Black & Veatch does to put sustainability at the forefront of design. ■

A Florida Community's Multi-Sector Plan for Resiliency, Sustainability

Sustainability and resilience are complementary objectives. Creating solutions that meet today's needs without hurting future generations (sustainability) requires the ability to manage volatility, disruptions and shock while adapting to change and continuing to grow (resilience).

Resilience has been likened to a "muscle." To build its muscle for the sustainability's sake, Miami-Dade County's island village of Key Biscayne turned to Black & Veatch.

In 2022, Black & Veatch was selected to lead a multi-sector infrastructure program with a goal of stemming the effects of coastal erosion and sea-level rise that threatens the island's highly valued shoreline and properties, along the way supporting the village's future economic investment.

The program is focused on five areas or "levels of effort." They are shoreline protection, stormwater system enhancements, roadway improvements, utilities resilience and protection, and planning, zoning building and regulatory actions. Black & Veatch is providing the guiding strategy plus a project development and integration roadmap along with program and construction management services.

> **We selected Black & Veatch to help us realize our vision of a more resilient village because they share our passion for environmental, social and economic stability.**
>
> - **Steven Williamson**
> Key Biscayne's Village Manager

Water Industry Headwinds Put Supply Resilience on Center Stage

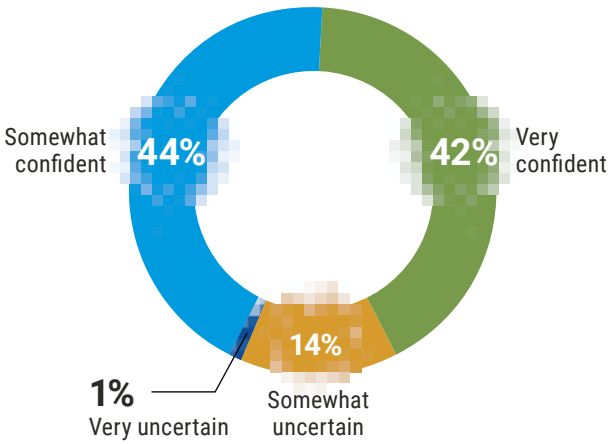
Against the prevailing public perception — in truth, the misconception — that their water supply is bottomless, U.S. water utilities behind the scenes increasingly are grappling with a steady stream of challenges that test their resilience.

Climate change manifests itself in persistent, historic droughts amid widening, deep concerns about the health of the environment and sustainability of our livelihoods, combined with the rapidly growing urban centers, old and new. The growth of water-intensive industries such as giga-scale data centers, along with a heightening competition for resources, exacerbates these concerns.

Figure 7

How confident are you in the resiliency of your water supply? (Select one)

Source: Black & Veatch



When it comes to water supply, Black & Veatch's *2023 Water Report* suggests, the U.S. water sector figures it has it all in hand — at least for now. Among some 450 respondents to the global critical infrastructure leader's yearly survey of the industry's stakeholders about key water topics, roughly four in 10 — 42 percent — rated themselves as "very confident" about the resilience of their water supplies. An additional 44 percent of respondents assessed themselves as "somewhat confident," adding to the 59 percent of respondents expressing levels of uncertainty *(Figure 7)*.

Those numbers appear to indicate a positive outlook. But is absolute confidence in a provider's water supplies founded in the current state today? Maybe not, and it's not the central point anyway. More beneficial, as the survey results indicate, are the ensuing questions: What are the risks affecting provider's confidence, and what's being done to mitigate them?

Not One Thing

More than 200 years since Benjamin Franklin opined that nothing is certain except death and taxes, the public would have you believe that "water" should join the list. It's expected to be available on demand anywhere, any time, and when it isn't, for whatever reason, it's major news. The cause as well as public health and safety implications — along with the long-term community development and economic growth ramifications — can be significant.

It's a reminder of the value of water and the criticality of resiliency.

Supply risk has the attention of utilities and municipalities. Nearly 60 percent of survey respondents say their water utility had performed a vulnerability study, and eight in 10 say they had considered their water supplies in that assessment. Water reliability and supply resilience also top the list of major investments that survey respondents expect to make during the next decade.

The "why" is clear. Multiple factors can negatively affect supply reliability, and no single issue has primacy. Increasing urbanization, demographic changes and business growth — including businesses related to the internet of things such as data centers, or electrification such as large-scale battery production — are intensifying demand. Older, simpler water systems are open to purposeful, malicious disruptions, from supply contamination to cyberattacks potentially damaging and risking the public health of the communities. Operations can be severely tested by developments such as global market conditions and the COVID-19 pandemic that compromise supply chains.

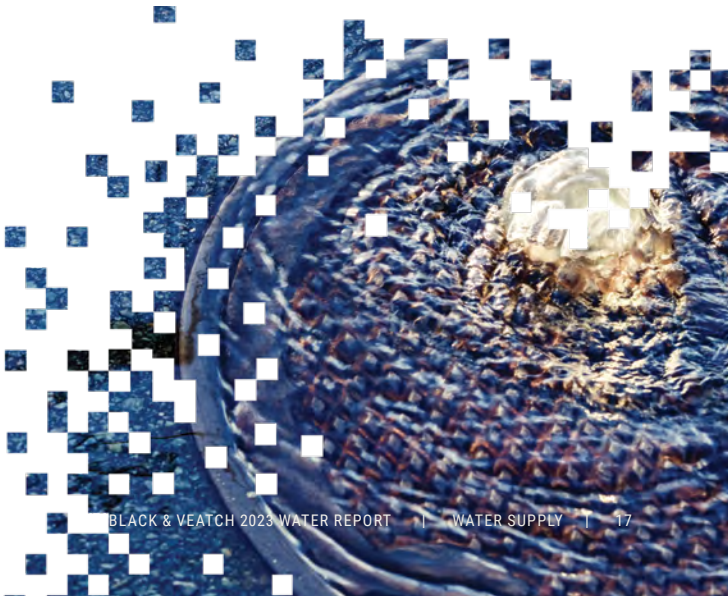
Adding to the vulnerability are the impacts from climate change. More frequent, stronger storms are increasing devastation from flooding, which along with fires can knock out water systems in different ways. Less snowpack and shifting rainfall patterns are spreading drought and limiting supplies across regions while more intense heat waves are escalating water use.

As the saying goes, all water is local; every place has its own relationship with water. Each faces water stress in its own way, including the factors above that can hurt supply reliability in different ways. As groundwater resources become overused and surface water levels decrease, availability of freshwater resources can deteriorate. Quality can suffer from pollutants, eutrophication and saltwater intrusion. Older facilities and out-of-date technologies can't keep pace with the evolving conditions.

The supply stress facing respondents is reflected in their survey answers, particularly in the alignment between perceived vulnerabilities and expected investment over the next decade. For example:

- Yet again, respondents cited aging infrastructure as the most challenging issue facing water, wastewater and stormwater systems. In turn, asset rehabilitation/renewal is the second highest anticipated area of investment by utilities and municipalities.
- Cybersecurity was the top issue among respondents that had studied their vulnerability, and it's the third highest area where all respondents expect to see major investment.
- Of the respondents that had performed a vulnerability study, more than half pointed to regulations as a concern. Whether involving per- and polyfluoroalkyl substances (PFAS) — commonly known as "forever chemicals" — nutrients, biosolids, or lead and copper lines, respondents expect significant investment in regulatory compliance.
- Respondents also identified stormwater as an area for improved resiliency. The capture of stormwater for control of flooding, management of water quality and augmentation of supplies is viewed as another major area of investment.

Borrowing from the 2023 Oscar best picture winner at the Academy Awards, the challenges to providers' supplies involve practically "everything everywhere all at once," depending of course on their individual situations.



Steps Toward Water Supply Resilience

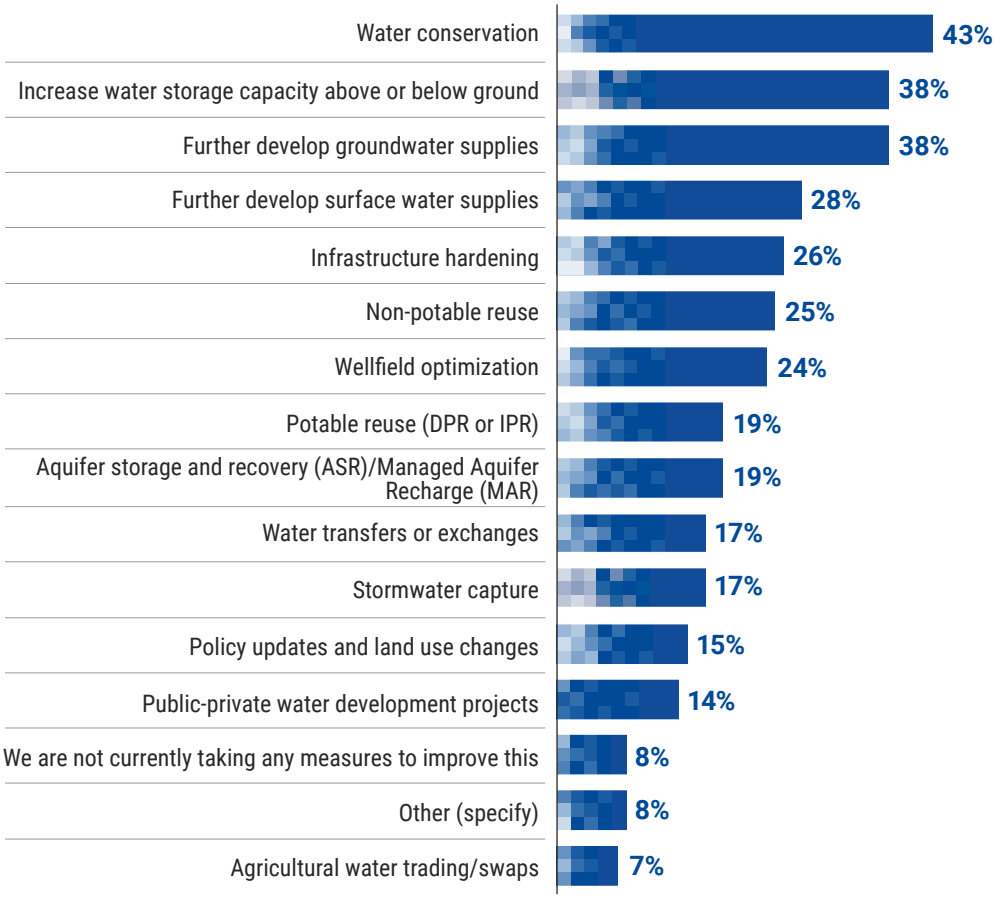
To mitigate their supply risks, utilities and municipalities are taking an array of actions. They can be organized loosely by tier.

The top tier includes "must-take" steps. Water conservation (43 percent), increasing above- or below-ground water storage (38 percent), and developing groundwater supplies (38 percent) comprise the actions most respondents said they were working on or considering to improve their water supply resiliency *(Figure 8)*.

Figure 8

What actions are you taking or considering to improve the resiliency of your water supply? (Select all that apply)

Source: Black & Veatch



Actions in the second tier of respondent selections include some notable results:

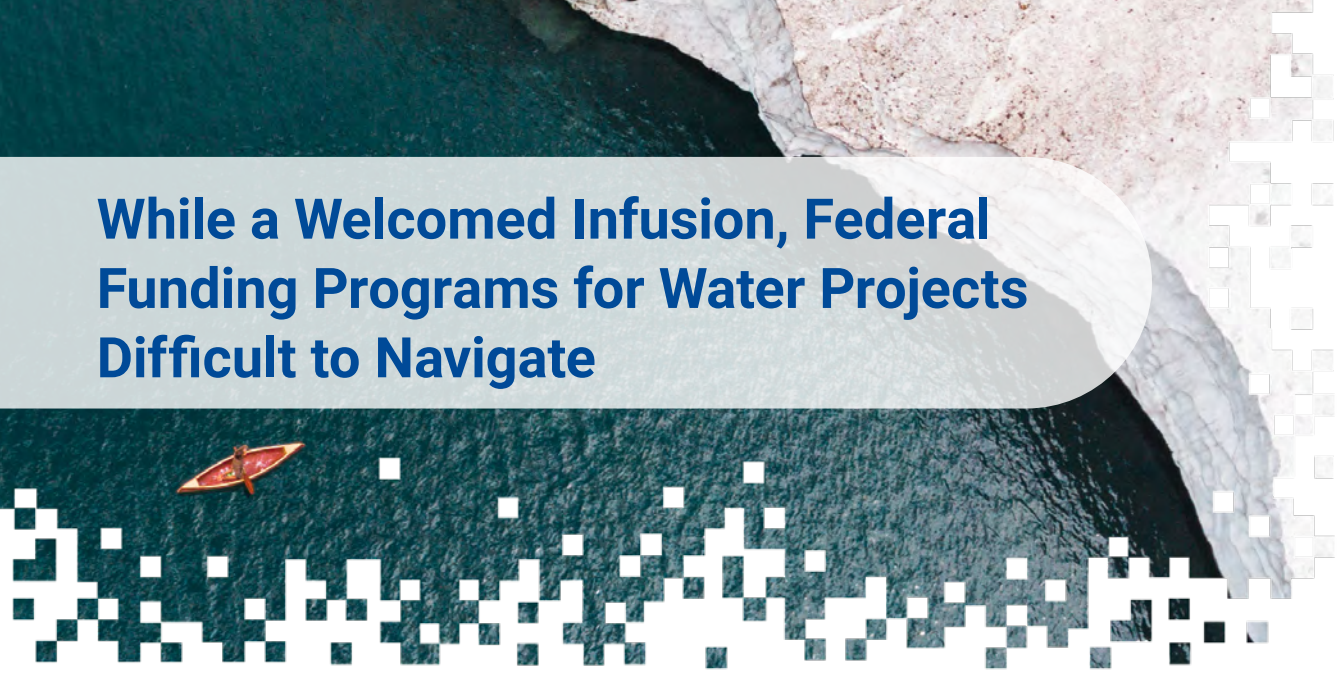
- A quarter chose infrastructure hardening as something they were actively doing or considering, apparently motivated by the potentially catastrophic consequences of failure.
- Reuse — including non-potable and direct- and indirect-potable reuse — garnered greater interest compared to survey results from previous years. Interestingly, the primary drivers that respondents selected for considering alternative water supplies were improved supply reliability, capacity and quality, much more so than effluent management and regulations.

Not One Water?

As the survey results show, more utilities than not have some level of uncertainty regarding the resiliency of their water supply. The uncertainty stems from not a single or a handful but a myriad of challenges — all of them integrated. In terms of tackling them, again, respondents are taking or considering an array of mitigation approaches.

However, in this case, their planning doesn't seem integrated. Asked whether they have developed a "One Water" plan, integrated water supply plan or an integrated water management plan, only 18 percent answered yes. An additional 17 percent said no but saw a need to do so sometime in the future. The response could be indicative of a sector where solutions are typically or historically siloed or not holistic and well-integrated across the operational silos of the organization to drive greater synergies and quicker, efficient outcomes.

Primarily, the industry is missing an opportunity. "One Water" with integrated water solutions make sense, and they can be tailored to the unique challenges utilities and municipalities face, delivering the resource quality, efficiency and productivity they seek. It's at that point — with thoughtful planning, flexibility and innovation pointing the way forward — that true confidence in the resilience of their water supplies would be achieved. ■



While a Welcomed Infusion, Federal Funding Programs for Water Projects Difficult to Navigate

Signed into law in late 2021, the Infrastructure Investment and Jobs Act (IIJA) — or the Bipartisan Infrastructure Law (BIL) — was hailed as a golden moment for the U.S. water industry, promising tens of billions of dollars in federal funding for the sector that for decades has grappled with chronically aging infrastructure.

With more than $50 billion noted as the largest federal investment in water in U.S. history, the funding measure was heralded as a long-overdue way to upgrade and replace a labyrinth of old, worrisome and often failing drinking water, wastewater and stormwater infrastructure. This is all happening at a time of rising urgency in remediating lead service lines, addressing and reporting regulatory compliance with constrained resources and mitigating other issues associated with outdated systems. It's tough for utilities to sort through this funding and determine what can best be leveraged for their specific needs.

So, more than a year and a half later, are water utilities benefiting from these government funding opportunities, or are there obstacles impeding the path to progress? Black & Veatch's *2023 Water Report*, based on expert analyses of a survey of some 450 U.S. water sector stakeholders, shows an industry welcoming federal help, but not yet taking full advantage of it for various reasons.

Barriers to Participating in Funding Programs

Encouragingly, a combined 83 percent of survey respondents either are very likely or somewhat likely to use the available funding programs — results consistent across utilities of all sizes. But a huge disconnect exists between enthusiasm for this funding and actual implementation.

While most water utilities appear willing to take advantage of government funding mechanisms, nearly half of respondents — 46 percent — find the process administratively burdensome, with a nearly identical number viewing it as too restrictive. Only a few states have well-defined processes to apply for and distribute the funds, but many still are working on the "how" process of this new money, even though it is flowing through the existing state revolving fund (SRF) programs. These barriers aren't limited to just IIJA funds; we're also seeing some American Rescue Plan Act (ARPA) funds that haven't been obligated, even with the approaching deadline.

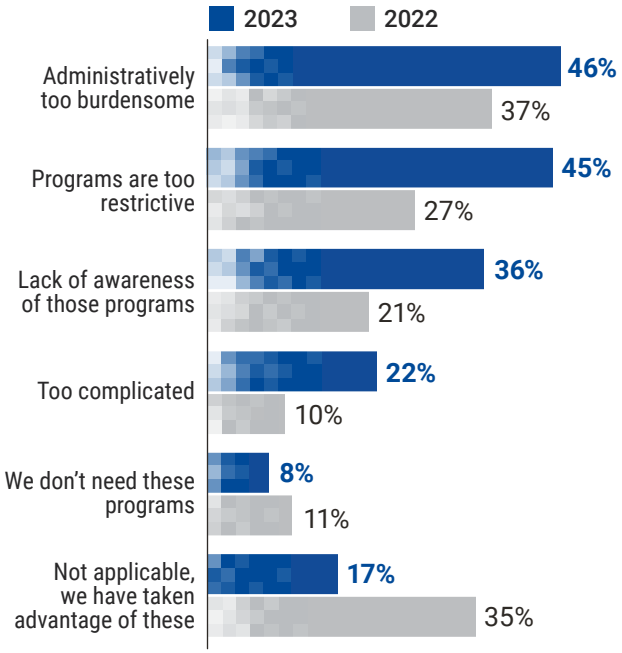
Viewing this through the prism of utility size, smaller utilities — those serving a population of less than half a million — are encountering even more funding obstacles than larger utilities. More than half — 52 percent — of smaller utilities say funding programs are administratively too burdensome. In comparison, 48 percent lack awareness of these programs and 36 percent know about the programs but don't know how to pursue the funds. This makes sense, given that larger utilities with at least 500,000 customers typically have more sophisticated processes in seeking funding and greater staff capacity to pursue the funds.

When comparing this year's survey results to those of 2022, such frustrations are exacerbated; for example, in 2022, only 27 percent of survey respondents said that the programs were too restrictive, but that figure jumped to 45 percent this year *(Figure 9)*.

Figure 9

What are the main reasons why your organization has not taken advantage of some of the above programs? (Select all that apply)

Source: Black & Veatch



Note: Only options shown in both 2022 and 2023 are shown here

Greater Constraints on IIJA Funding

As part of the IIJA, the "Buy America, Build America Act" (BABAA) requires that any infrastructure project receiving federal funding as of May 2022 must procure iron, steel, manufactured products and construction materials from within the United States.

Most trade association lobbies strongly opposed BABAA and have lobbied for amendments and waiver options since its passage. More than one in five respondents — 22 percent — said they anticipate BABAA will increase project costs by 11 to 20 percent, while 35 percent said they were unsure of the percentage but were concerned about it. Only 1 percent said they don't think it will affect costs *(Figure 10)*. The data reveals the water sector's uncertainty around the future cost and schedule impact of BABAA. This is particularly true given the broader market trends of higher inflation and supply chain issues, which could be exacerbated by BABAA. Regardless, many utilities are feeling discouraged by these "strings attached" to receiving federal funding.

Figure 10

How much do you anticipate the "Buy America, Build America Act" (BABAA) will result in increased costs for your project? (Select one)

Source: Black & Veatch

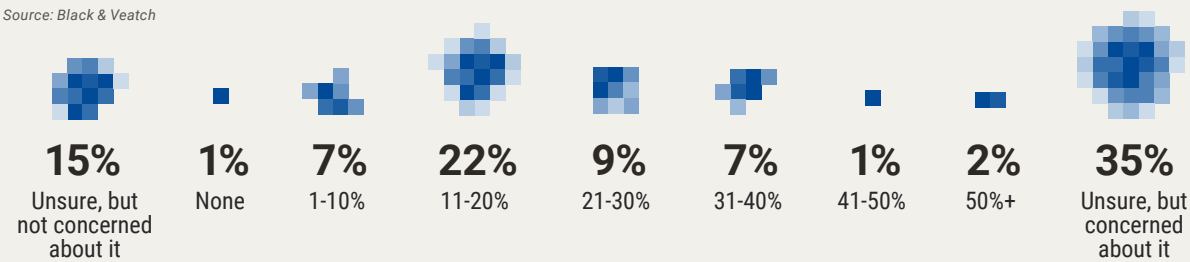
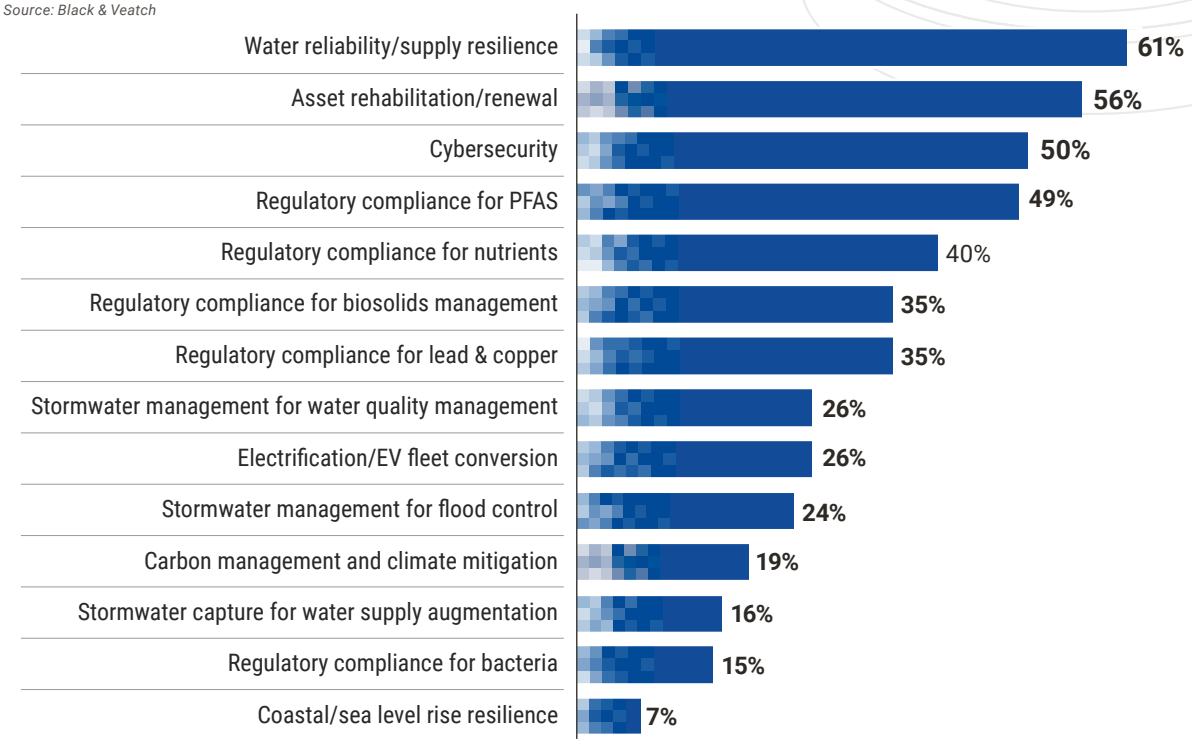


Figure 11

Which of the following areas do you see as major investments for your utility or municipality over the next decade? (Select all that apply)

Source: Black & Veatch



Major Investments in Several Key Areas

Regardless of whether they will leverage federal funding, water utilities and local municipalities intend to make major investments in various categories over the next decade.

Most survey respondents identified water supply reliability (61 percent), asset rehabilitation (56 percent) and cybersecurity (50 percent) as their top priorities *(Figure 11)*. It's worth noting that when comparing 2023 and 2022 results, emphasis on cybersecurity, regulatory compliance for lead and copper, electric vehicle (EV) fleet conversion and resilience to sea level rise dropped significantly.

The slight increase in polyfluorinated substances (PFAS) aligns with the U.S. Environmental Protection Agency's (EPA) latest National Primary Drinking Water Regulation (NPDWR); priorities have certainly shifted from lead and copper to these so-called "forever chemicals," especially as a result of the IIJA's $10 billion in PFAS funding.

The decrease in regulatory compliance for lead and copper is slightly puzzling, given the IIJA's $15 billion still allocated for lead pipe replacement, but may be explained by the higher focus on lead service lines in 2022 with the passage of the EPA's Lead and Copper Rule (LCR) in December 2021. The decreased investments in sea level rise resilience perhaps could be attributed to the geographic locations of those surveyed; utilities located outside of coastal areas have far less reason to be concerned about that matter. Similarly, PFAS and lead service lines don't apply to all geographies, while cybersecurity does.

Navigating the Funding Process

The bottom line: there's a lot of money on the table, but perceptions remain that the money is hard to reach and comes with constraints.

Taking full advantage of federal funding — whether in the form of grants, low-interest loans or tax credits — requires an understanding of the wide array of available options. In the past, government funding had very specific categories for water infrastructure, but utilities now may consider additional funding such as renewable energy or electric vehicle tax credits. It's time to think beyond water — power, telecommunications, cybersecurity and disaster recovery play a huge role in utility operations as well.

Over the past couple of years, the water sector has seen high enthusiasm and equally high expectations for new funding opportunities. As implementation of these programs progresses, utilities and municipalities are approaching them with caution and confusion, especially regarding project cost increases associated with BABAA.

Many water utilities and local municipalities are reaching for help to navigate the complexities of identifying available funding and how to tap it, seeking out trusted, expert advisors versed in optimizing the potential catalytic impact the new funding infusion presents.

When Black & Veatch began identifying funding options for a California utility client, for instance, the project design already was complete and ready for bid, and financing needs were the only barrier to moving ahead. Black & Veatch helped the utility secure a $50 million Water Infrastructure Finance and Innovation Act (WIFIA) loan and apply for a $45 million Federal Emergency Management Agency (FEMA) grant for a large dam replacement project.

Another Black & Veatch client in the Midwest recently sought to finance a capital improvements program (CIP) integrating stormwater, sewer and green infrastructure elements to mitigate flooding, make critical repairs and improve water quality. Without alternative funding options, that client would have to scale back its scope heavily; instead, Black & Veatch is helping secure WIFIA and SRF loans for this $150 million CIP.

As demand remains high for such funding, water utilities should aggressively look to satisfy their big appetites for growing and accelerating infrastructure improvements that positively impact their communities and customers' quality of life. ■

Rates: Customer Engagement, Proactive Plans for Financial Resilience Hold the Key

Even before the U.S. Environmental Protection Agency unveiled in March its long-expected proposed rule to regulate a new category of toxins in drinking water, putting the likely cost on ratepayers and the utilities, the U.S. water sector was navigating a tightwire over rates, services and competing demands for investment.

True to their calling, water utilities almost universally have provided clean, affordable drinking water, never mind the chronic and costly need to upgrade aging infrastructure well past its prime. On the other end of the tap, consumers often oblivious to decaying assets they can't see — out of sight, out of mind — bristle at prospects of paying more for something they seemingly take for granted or expect to be subsidized as a necessity for health and safety.

Such is the nagging disconnect over the true cost of water, pitting utilities working within the confines of their rate structures against cost-conscious consumers footing the tab with little appetite for higher monthly bills in a high-inflation economy.

Black & Veatch's *2023 Water Report* illustrates that divide, with a survey of some 450 U.S. water sector stakeholders painting a picture of an industry that, among other things, can and should do a better job of public messaging about the benefits of water as a precious resource – and where ratepayer money goes.

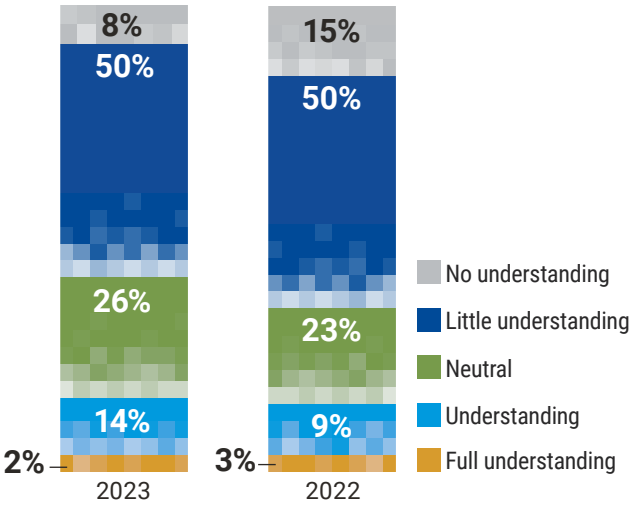
Water 101: The Need for Ratepayer Education

Against the backdrop of customer misperceptions that drinking water supplies are endless, the survey underscores the need for water utilities to better inform ratepayers about the value of what they're getting. Identical to 2022's results, half of the respondents reported that consumers had little understanding between the cost of producing safe water and the current rates they pay, with only about one-quarter each year having at least a basic understanding *(Figure 12)*.

Figure 12

How well do consumers understand the gap between safe water production costs and the current rates consumers pay? (Select one)

Source: Black & Veatch



Call it a narrative disconnect or dissonance in the perceived or real value of water relative to the charges customers pay, begging the question: what is the logical outcome of that pervasive lack of understanding?

In the water sector, charges often may not align with the true cost of service; given political pressures and funding inadequacies, rates and charges may not sufficiently recover the revenue, effectively underpricing water. Shortcomings in consumer knowledge about what they pay may undermine their water utilities' efforts to win their support for rate increases for long-overdue infrastructure upgrades.

Nevertheless, survey responses show that utilities are taking a laudable, diverse and balanced approach to push out information meant to bridge the education gap, ranging from leveraging social media updates (21 percent) to website FAQs (19 percent), consumer outreach (17 percent), newsletters (15 percent) and public workshops or open houses (14 percent). Just 8 percent said they're doing nothing.

The Importance of Cost-of-Service Analysis

When it comes to what their rate structures help address, more than three-quarters — 77 percent — cited revenue stability, punctuating that they understand its value that indicates a potential decrease in the reliance on the volumetric portion of revenues — the premise that revenue rises with the amount of water consumed, and vice versa *(Figure 13)*. The takeaway is that many utilities that answered affirmatively here probably have a good balance of fixed and volume charges.

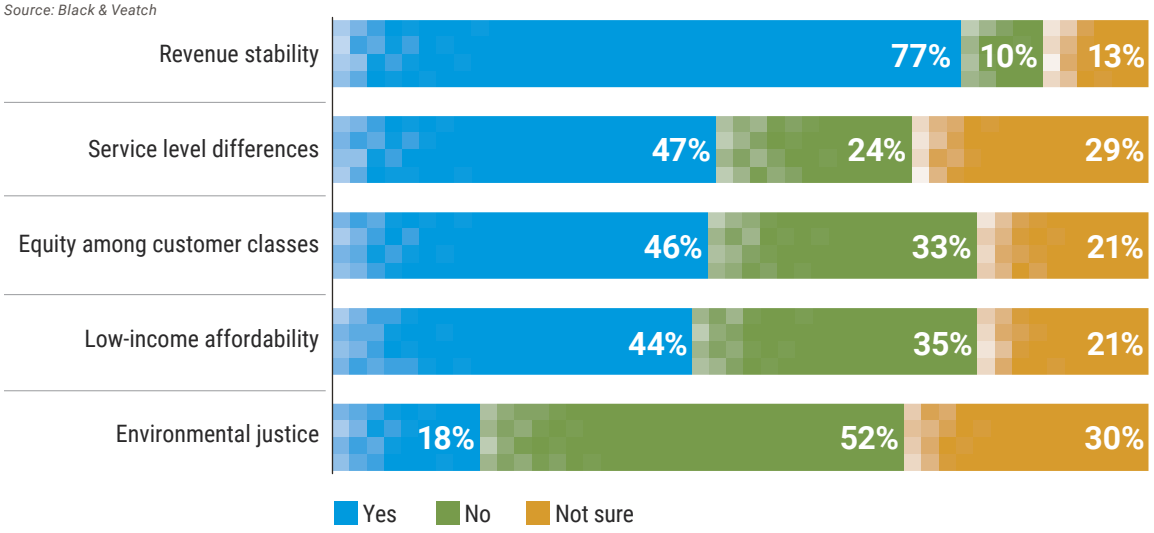
Other uses for the existing rate structure were tightly bunched, with respondents also citing service level differences (47 percent), equity among customer classes (46 percent), and low-income affordability (44 percent). Put another way, not enough utilities are doing a cost-of-service analysis — a technical next step — accounting for the fact that not all customer classes, from residential to industrial, commercial and agricultural, put the same burden on the system and should be charged accordingly.

Fifty-six percent also have no proactive affordability reflected in their rate structure at a time when affordability is increasingly important in the industry, and inflationary pressures continue to squeeze customers. And more than half of respondents don't address environmental justice in their rates, with just 18 percent saying they do.

Figure 13

Does your current rate structure help address one or more of the following? (Select one for each)

Source: Black & Veatch



Of respondents who said they have an affordability program for customers in need, nearly two-thirds said they include low-income discounts, while 44 percent said they offer markdowns for senior citizens. Such discounts for those two demographics reflect very traditional thinking by utilities. In the absence of general fund contributions, rate revenues (68 percent) are the favored source of the affordability programs, followed by customer donations (28 percent) and grants (24 percent).

As promising as these results sound, the question remains about whether these programs reach enough customers in need. Black & Veatch's "50 Largest Cities Water and Wastewater Rate Survey" provides a comparison of affordability measures for some of the nation's largest utilities. However, when examining poverty levels in many of these cities, addressing the needs of economically disadvantaged customers is a challenge. For example, the city of New Orleans has one of the nation's highest poverty rates but has a very limited customer assistance program, and efforts to move towards a more substantive program are meeting resistance.

Financial Resilience and the Path Forward

Across the United States, much of the talk in the water world is about resilience, generally in the context of asset hardening. But it's also about financial resilience, and the survey shows a promising embrace of it. Roughly three-quarters of respondents (73 percent) cited capital program prioritization as their top strategy addressing financial durability, followed closely by annual or multi-year rate adjustments at 75 percent. That was true regardless of the utility's size, reflecting a unified approach *(Figure 14)*. Among all utilities, leveraging low-cost federal or state loans – a competitive, often administratively cumbersome process – and integrated financial planning drew slightly less than 50 percent.

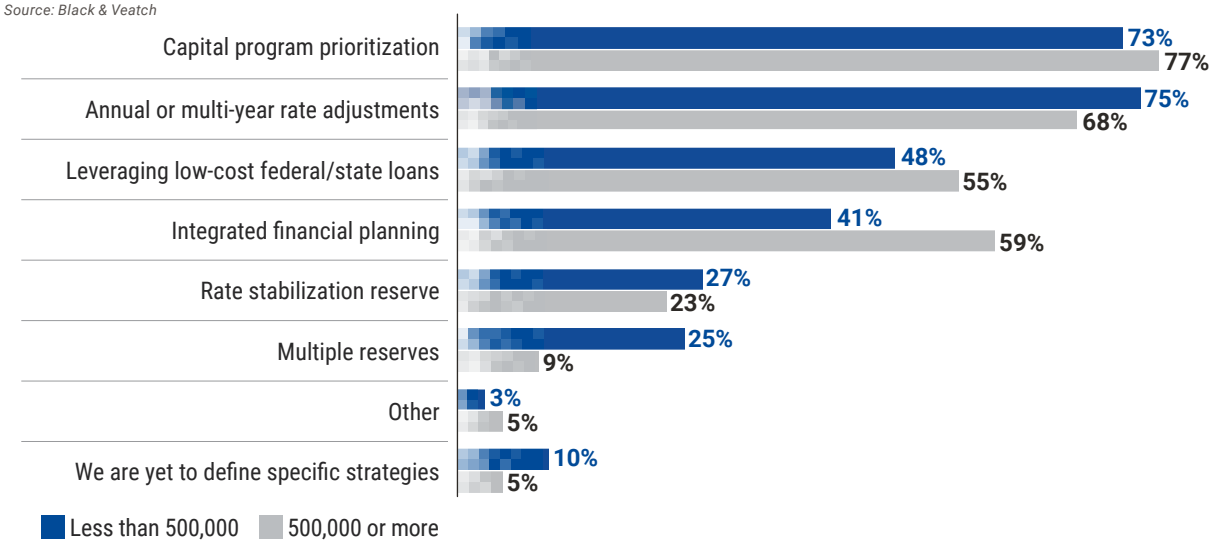
The importance of financial resilience — and the roadmap to get there — cannot be understated. Without a proactive strategy for addressing customer affordability, especially in an inflationary environment, it will limit your ability to build financial resilience. Moreover, not looking out for the low-income ratepayers could give those deciding your next rate increase request the grist to deny it.

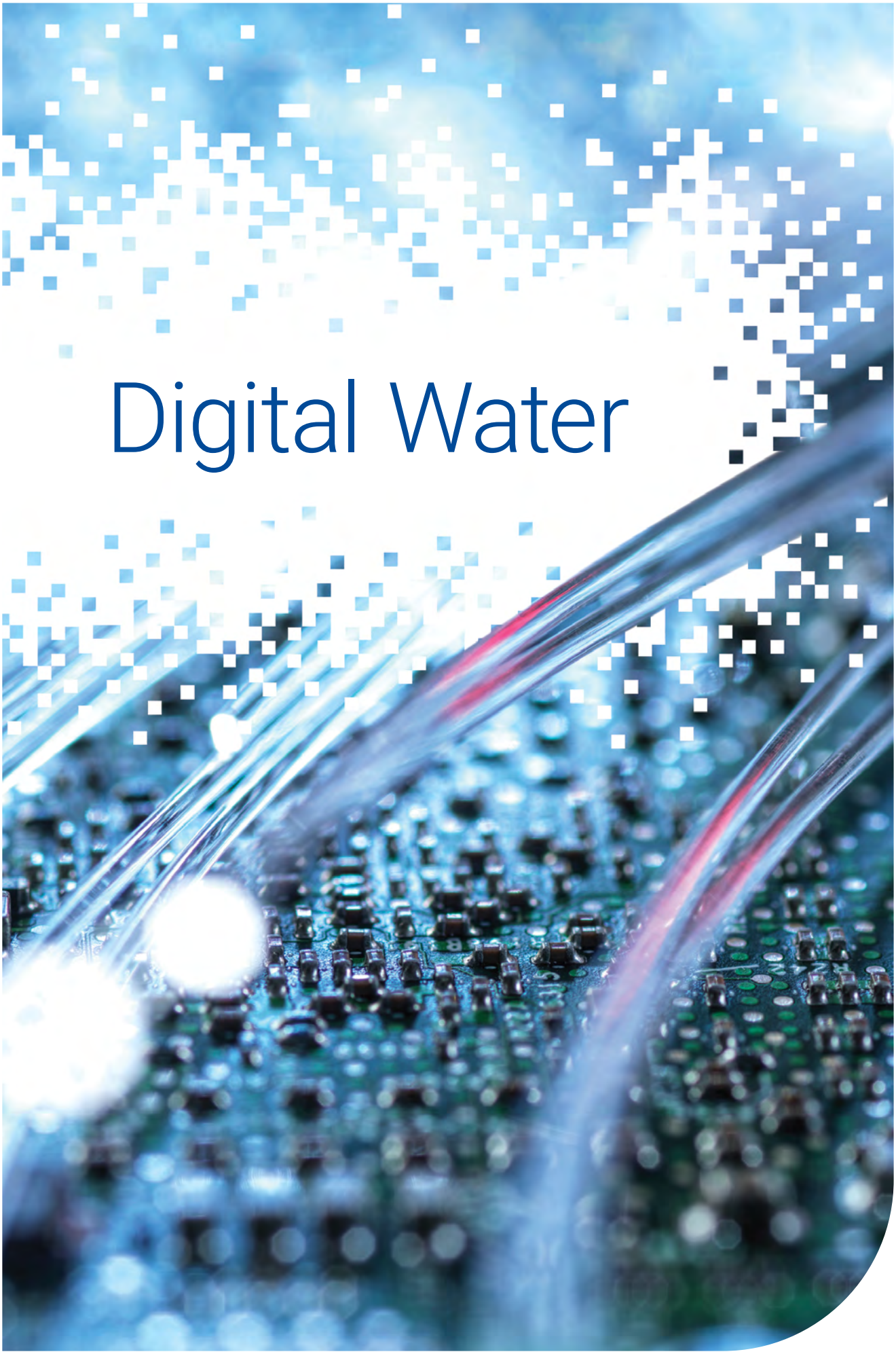
With all that said, the water report survey offers a big-picture assessment, starting with the rising need for a holistic approach to building rate resilience and an amplified engagement and education of ratepayers that propagate their knowledge about the true value of their water. In short, it's about having a better, more-sophisticated alignment between the cost of water and rate structures. ■

Figure 14

What are your current strategies for addressing financial resilience? (Select all that apply)

Source: Black & Veatch




Digital Water

Digital Water: The Golden Opportunity for Utilities

The increasing pressure on water networks is real: over-allocation, increased demand, consequences of climate change, chronically aging infrastructure and an ever-aging workforce, and a shifting regulatory landscape continue to challenge water utilities and the communities and businesses they serve. Enter the promise and opportunity of digital water solutions, which have the power to transform the water sector, putting to use technology that provides new digital capabilities to meet these needs.

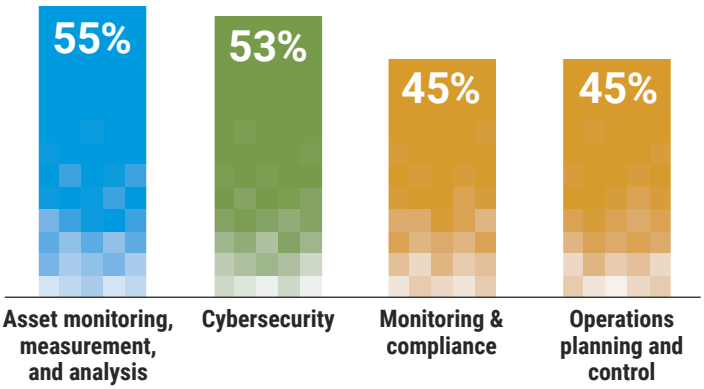
Utilities that maximize digital solutions are better equipped to transform data into actionable knowledge, achieve a higher return on investment and make better business decisions, getting the most out of their aging assets in the interest of resilience. While acknowledging that there's a learning curve to navigate, seizing the opportunity begins with knowing what's possible with technology.

Black & Veatch's *2023 Water Report*, based on a survey of roughly 450 U.S. water sector stakeholders, shows encouraging evidence that the industry is undergoing a digital transformation, with utilities having a digital water strategy in place and clear objectives defined. Top objectives of data and digital solutions among respondents include asset monitoring, measurement and analysis (55 percent), cybersecurity (53 percent), monitoring and compliance (45 percent) and operations planning and control (45 percent) *(Figure 15)*. Utilities are potentially seeing immediate benefit from the application of digital solutions in these areas.

Figure 15

What are the top objectives for your data or digital solutions strategy? (Select up to three)

Source: Black & Veatch

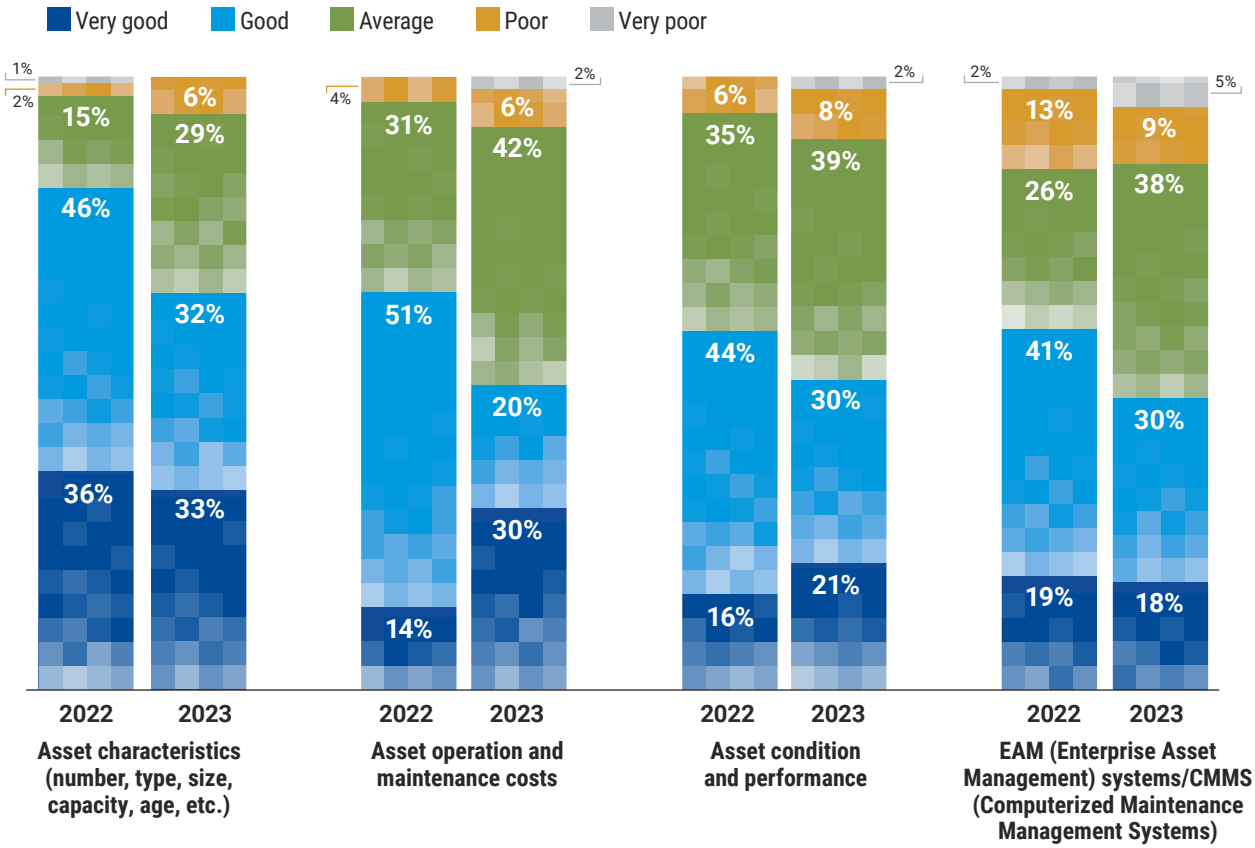


Improve communication and collaboration 23%
System resilience 20%
Workforce enablement 18%
Financial stability 14%
CIP development/optimization 11%
Other 3%

Figure 16

How would you describe the quality of the information that your utility has on the assets that it owns and operates? (Select one for each row)

Source: Black & Veatch



Drilling deeper into the survey's data, when asked to what extent their company's data or digital solutions strategy is achieving objectives, two-thirds of respondents — 65 percent — reported positive results. Forty-two percent stated they are achieving some strategic objectives, while one in five respondents said they are meeting most strategic objectives. Just 3 percent reported they are meeting all their strategic goals.

When it comes to data management practices, more than half — 54 percent — of respondents stated that while they are collecting data, they are not leveraging it effectively, a slight increase from 49 percent last year.

Even amid the lag in optimizing use of their data, respondents asked to characterize the veracity of the information their utility has on its assets offered a mixed picture. Half assessed their data about their asset operation and maintenance costs as very good or good — down from 65 percent in 2022 — while categorization of such numbers tied to asset condition and performance were 51 percent, 9 percentage points lower than the previous year. Respondents who assessed their information as average increased appreciably year over year *(Figure 16)*.

Elsewhere on the technology front, when asked to rate their level of expertise with different types of digital solutions, the top four responses involved solutions that have been in existence for some time — geographic information systems, customer data and information, computerized maintenance management systems, and automated meter reading or advanced metering infrastructure. This could illustrate that these continue to be the predominant forms of digital solutions in practical application within the industry. Unsurprisingly, utilities report a low level of expertise around next-generation digital solutions such as building information modeling, data science, artificial intelligence (AI) and digital twins. Or it could indicate they either aren't aware of other technologies and don't have resources to help, or they're not putting enough emphasis on technology that could have a profound impact, given that it isn't as familiar.

When asked what is holding them back from adopting new digital solutions, resources (48 percent), the use of legacy data and systems (45 percent), funding (35 percent) and leadership or guidance (35 percent) topped the list *(Figure 17)*. Until these facets are in place, utilities will not unlock the true value of digital that utility industries and other industries have.

While there's no denying the perceived complexities of these solutions, utilities are missing out on opportunities by not leveraging them. In fact, the next-generation digital solutions that utilities report the lowest level of expertise hold the most significant promise for improvements in areas they ranked of high importance, including asset management and monitoring. This illustrates a gap in education and awareness around these solutions and its capacity to help utilities successfully deploy and leverage them.

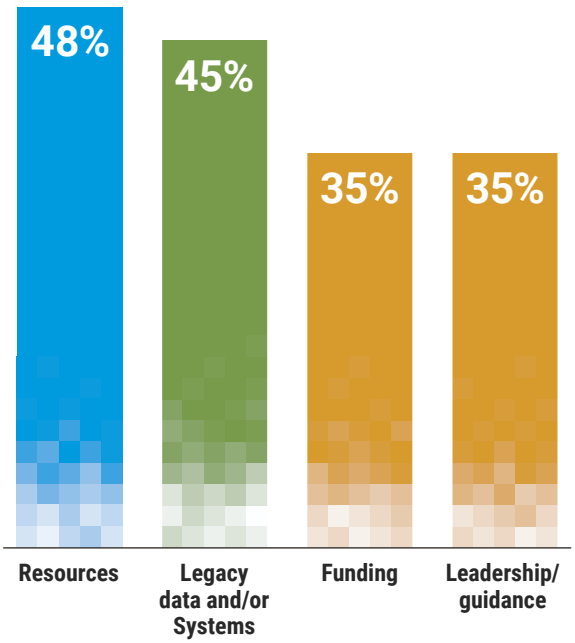
For many public providers and private industries, digital water represents a path to achieving financial, community and sustainability objectives, though the path isn't always clear. Opportunity abounds for tomorrow's workers to become experts in the digital water technologies that hold the most sway in transforming the sector.

When utilities further develop their plans and capabilities to do more with their data through digital solutions, they can exploit this knowledge into more efficient decision-making to face the difficulties of resilience, sustainability, and aging infrastructure and workforce. And the time for that is now. ■

Figure 17

Which of the following constraints impair or preclude your utility from adopting digital solutions? (Select up to three)

Source: Black & Veatch



Access to enabling technologies 15%
Infrastructure 14%
No constraints 14%

Cybersecurity: In World of Risks and Ransomware, Readiness Holds the Key

In March 2023, the U.S. Environmental Protection Agency (EPA) announced a new plan to improve the digital defenses of public water systems, with the EPA's assistant administrator for water putting the gravity of the issue in clear but stark terms.

"Cyberattacks against critical infrastructure facilities, including drinking water systems, are increasing, and public water systems are vulnerable," Radhika Fox wrote in the EPA's official announcement. "Cyberattacks have the potential to contaminate drinking water, which threatens public health."

That recent warning involving an industry where there's no one-size-fits-all approach to addressing vulnerabilities in operations and assets offers a backdrop to today's conversation about cybersecurity in Black & Veatch's *2023 Water Report*, based on survey responses from roughly 450 U.S. water sector stakeholders.

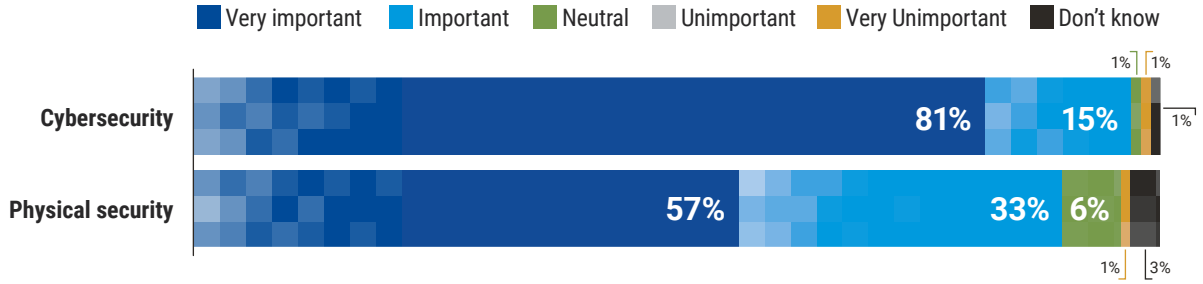
Among the key findings: utilities overwhelmingly demonstrate great awareness about the importance of and need for cybersecurity as they continue to make progress in hardening their systems against such attacks. Eight in 10 respondents reported that cybersecurity is the most important investment in the security of their assets. While that's certainly positive, only 57 percent believe physical security — a prerequisite for cybersecurity — is the most critical investment *(Figure 18)*.

That gap in prioritization may result in vulnerabilities in one — or both — of these areas. While it's encouraging that such a high percentage of respondents are addressing the need for strong — or *stronger* — cybersecurity practices, there's opportunity for more collaboration among cybersecurity and physical security professionals to take a more holistic approach to their security programs.

Figure 18

How important is the investment in the security of your assets? (Select one for each row)

Source: Black & Veatch



Taking the data a step further, when asked about the strength of their cybersecurity program, nearly half (46 percent) reported that they have a formal, robust cybersecurity program, down from 59 percent in 2022 *(Figure 19)*. Why are fewer utilities today feeling confident about the strength of their cybersecurity program? One explanation for the drop-off may be the fact that water utilities are undergoing a change in their worker profile — a younger workforce might be more in tune with today's cybersecurity risks and feel less inclined to say they have a robust program.

Risks, Ransomware and Regulation

As hackers relentlessly prod and probe systems for vulnerabilities to exploit, what exactly are today's most pressing cybersecurity risks that utilities are facing? The 2022 "Verizon Data Breach Investigations Report" points to ransomware as the most frequent, accounting for one-quarter of all breaches — and utilities are taking note.

When asked by Black & Veatch to identify which efforts their utility needs most to mitigate cybersecurity risks, six in 10 respondents cited continuous monitoring — one of the best ways to detect malicious activity. Other top replies included IT/OT modernization (54 percent), network segmentation (45 percent) and assessments (37 percent).

Similarly, having a clear remediation plan is gaining more sway among utilities, with roughly one-quarter — 24 percent — of respondents casting having such a clear corrective roadmap as important, up from 9 percent just a year earlier.

Figure 19

Which statement best reflects the security of your IT/OT systems and networks? (Select one)

Source: Black & Veatch

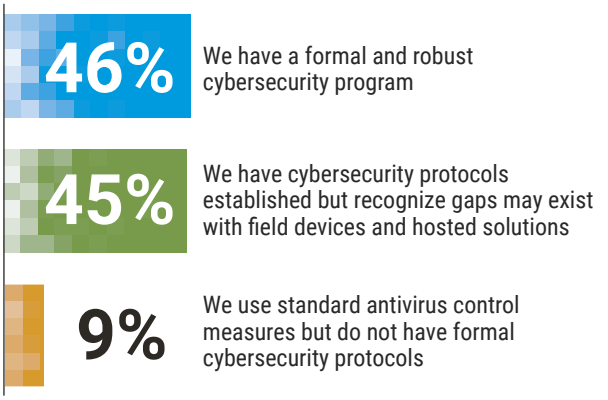
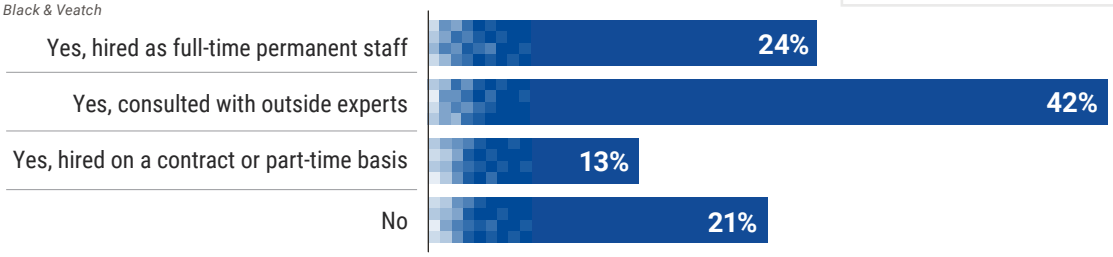


Figure 20

Has your utility hired or consulted with cybersecurity experts or information security engineers? (Select all that apply)

Source: Black & Veatch

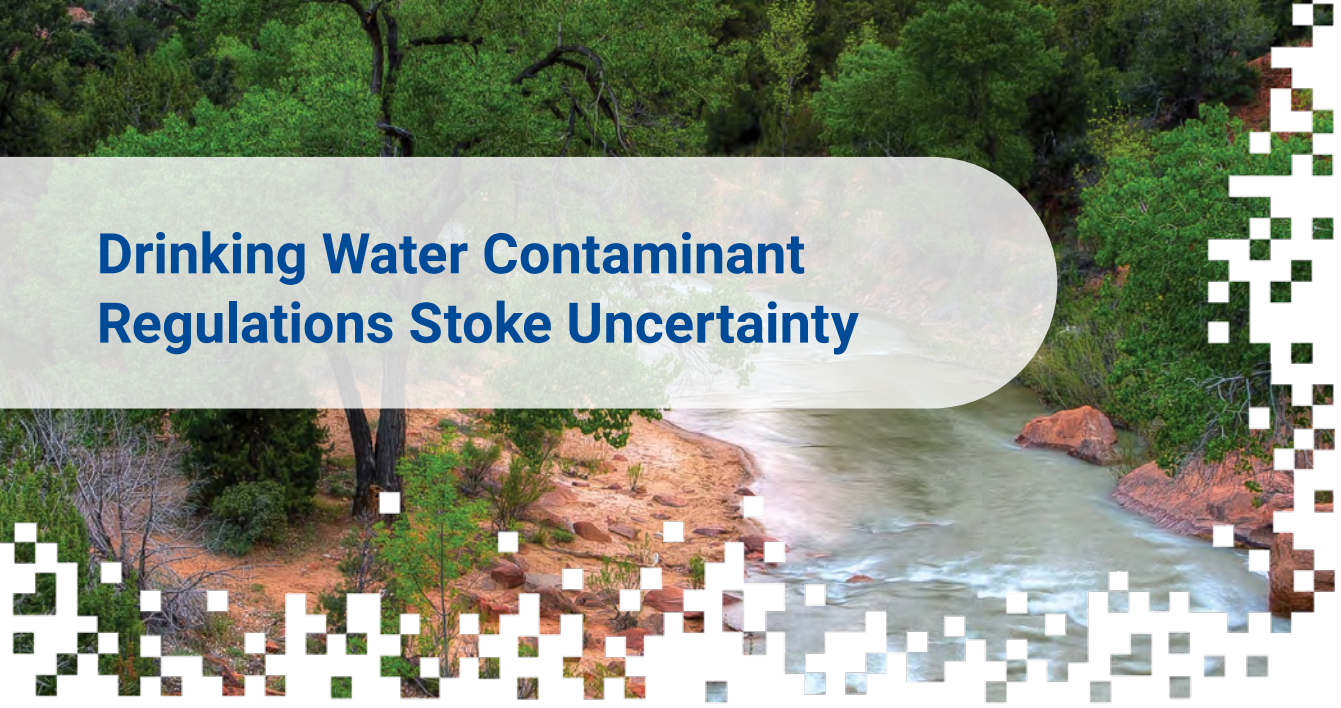


That said, utilities prefer to be trusted to go it alone with their cybersecurity without governmental oversight. Seven in 10 respondents (72 percent), when asked if they would prefer cybersecurity to be regulated and have a compliance standard or prefer it to be self-governed by the utility, chose the route of independence. Given the high cost of complying with federal regulations observed in other sectors — as well as competing needs for limited utility funds — utilities simply may see a cost benefit in managing cybersecurity without federal oversight, regardless of the security implications that may result.

That's not to say they don't desire or enlist outside help; nearly 80 percent of respondents say they've hired or consulted with cybersecurity experts or information security engineers — whether it's having full time staff, consulting with external experts or hiring on a part time or contract basis *(Figure 20)*.

The bottom line, according to Black & Veatch's survey: utilities have strong efforts in place to mitigate against today's biggest security threats. While competing interests and limited resources create even more headwinds, U.S. water utilities appear to have the foundation — and no shortage of expert consultants such as Black & Veatch to help them navigate complexities — to continue building strong, robust cybersecurity programs to protect such undeniably critical human infrastructure. ■

Regulation



Drinking Water Contaminant Regulations Stoke Uncertainty

Already challenged by the breadth and cost of removing lead pipes posing health risks, the U.S. water sector in March braced against another headwind: the U.S. Environmental Protection Agency's long-expected proposal to regulate a new category of toxins in drinking water.

The proposed National Primary Drinking Water Regulation under the Safe Drinking Water Act calls for setting enforceable regulations for a half dozen per- and polyfluoroalkyl substances (PFAS) — commonly known as "forever chemicals." With a price tag in the billions of dollars, this new regulation includes requirements for regulatory limits, monitoring, public notification and treatment.

Welcome to a time of unprecedented change in the U.S. water industry grappling with how to respond to ever-shifting rulemaking. Complicating matters is that the EPA's machinations are providing an impetus for states, advocacy groups, courts and the media to pressure utilities to respond.

Through expert analyses of a survey of roughly 450 U.S. water sector stakeholders — shortly before the EPA's proposed regulation was released — Black & Veatch's *2023 Water Report* shows an industry at a historic pivot point when it comes to contaminants in drinking water.

Utilities are Well-Informed

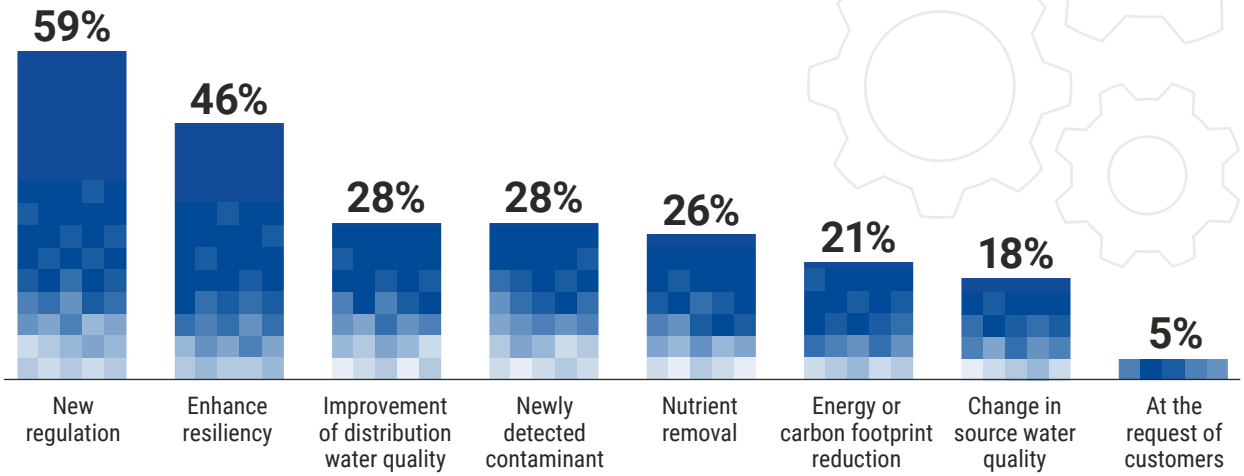
Perhaps taking into account the evolving regulations, both on the state and federal levels, more than half of the survey respondents envision investing in additional treatment processes or significant new treatment technologies, though their time horizons for that vary. Twenty-three percent said that'll happen within the next two years, with 21 percent expecting it in the next five years. Twelve percent anticipate it coming in the next decade.

A majority of respondents are looking to new processes and technologies chiefly because of new regulations (59 percent) and enhanced resiliency (46 percent), followed by improvement of distribution water quality and a newly detected contaminant, each drawing 28 percent. *(Figure 21).* Such results appear overwhelmingly positive, demonstrating that utilities have a lot of needs, are well-informed and know where their priorities lay.

Figure 21

What reasons do you expect to add a new process or technology? (Select all that apply)

Source: Black & Veatch



To meet the proposed EPA standards for PFAS, the American Water Works Association (AWWA) industry trade group said in March, more than an estimated 5,000 water systems will have to develop new water sources or install and operate advanced treatment. An additional 2,500 water systems in states with existing standards will need to adjust current PFAS treatment systems.

In March, the AWWA released a cost model study done on its behalf by Black & Veatch that found that the estimated national cost for water systems to install treatment processes to remove PFOA and PFOS to levels required by the EPA proposal would surpass $3.8 billion a year.

Change is Coming

When asked if PFAS has been detected in their water supply, one-fifth of respondents answered "yes, but we are not treating to remove it because levels are below regulatory limits." Additionally, roughly three-quarters — 74 percent — either don't know, have not tested for it, or tested and didn't not detect it. Just 6 percent say they do have detectable amounts and are treating the water supply to remove it.

These percentages undoubtedly will change over the course of the next two to three years as results of the Unregulated Contaminant Monitoring Rule (UCMR 5) are made public. UCMR 5 requires more than 10,000 water supply utilities to perform quarterly monitoring for 29 PFAS compounds using ultra-low detection limits. UCMR 5 results, paired with the new EPA and state regulations prohibiting PFAS compounds in drinking water above low part per trillion levels, will drive significant new planning and treatment process investment levels.

> The vast majority of these treatment costs will be borne by communities and ratepayers, who are also facing increased costs to address other needs, such as replacing lead service lines, upgrading cybersecurity, replacing aging infrastructure and assuring sustainable water supplies."
>
> **- American Water Works Association**

As time wears on, regulatory uncertainty has continued to grow. In 2023, in fact, 48 percent of respondents answered that regulatory uncertainty was their greatest limiting factor in addressing PFAS in their water, up from 39 percent just a year earlier *(Figure 22)*.

These results reaffirm that utilities are unsure about regulations and need more clarity. However, since the EPA's draft regulations were made public, the 48 percent who answered "regulatory uncertainty" as their greatest hurdle in addressing PFAS might be ready to address that now that the MCLs are out. It is expected that while some of this uncertainty will clear up as the proposed federal standards are finalized, UCMR 5 data will result in yet another round of regulatory activity.

LCRR Compliance Still a Challenge

When it comes to the federal Lead and Copper Rule Revisions (LCRR) — and their perceived biggest challenges to compliance — half of the respondents cited staffing availability, while homeowner response to communications, and lead service line replacement, each drew 43 percent. It's perhaps noteworthy that compared with 2022, the concern about staffing availability rose while worries about homeowner response and service line mapping decreased. Year over year, roughly one-quarter of respondents cited funding as worrisome.

Under the LCRR, the EPA is requiring utilities to start identifying their unknown service lines to confirm whether they're lead. The EPA's pending Lead and Copper Rule (LCR) improvements are expected to require utilities to start replacing their lead service lines even if their corrosion control treatment has kept lead levels below the action level. Utilities may be unaware of this; when asked whether they plan to apply for Infrastructure Investments and Jobs Act funds to replace lead service lines, roughly half of respondents — 51 percent — said they would not because there are no required replacements. *(Figure 23)*.

Figure 22

What's the greatest limiting factor for your utility addressing PFAS in your water? (Select one)

Source: Black & Veatch

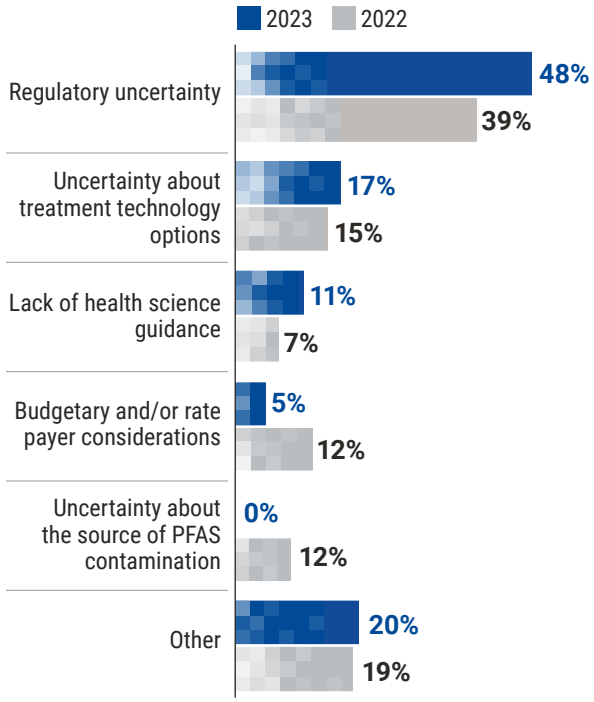
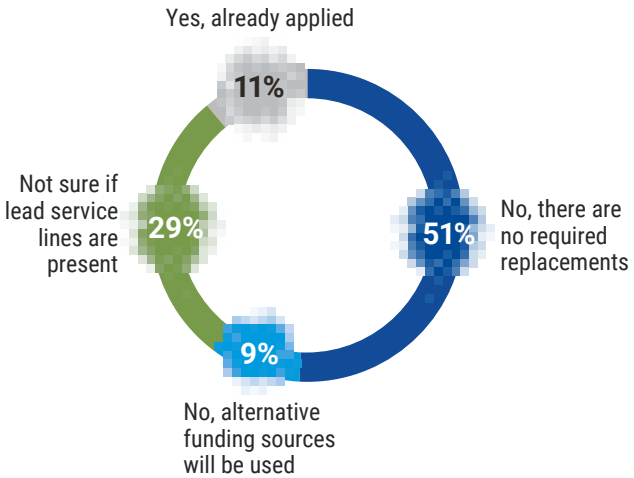


Figure 23

Do you plan to apply for Infrastructure Investments and Jobs Act (IIJA) funds to replace lead services lines? (Select one)

Source: Black & Veatch

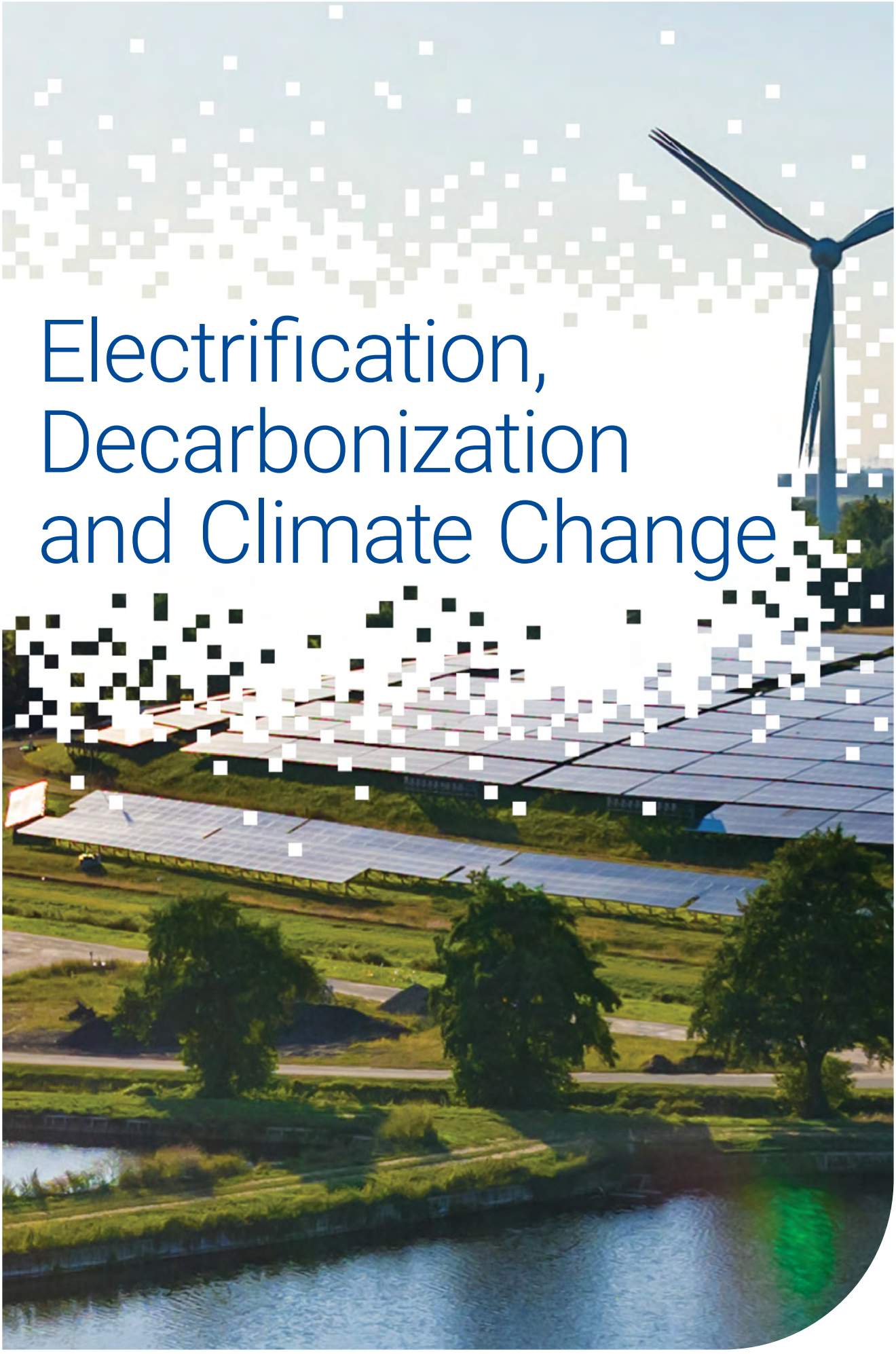


Contaminants are Ever-Changing

The issue of contaminants continues to evolve. With historical regulations being set forth, utilities should consider outside guidance as they face the complexities of it all in a sector rife with uncertainty.

Black & Veatch — a global leader in critical human infrastructure solutions — stands poised to partner with utilities to cut through the clutter of the uncertain contaminants landscape and the opportunities that available federal funding presents. ■

Electrification, Decarbonization and Climate Change



Climate Change: As Weather Impacts Turn More Severe, Planning is Paramount

In a column last December for the World Economic Forum, Austin Alexander — vice president of sustainability and social impact for Xylem, a leader in water technology solutions — pressed water utilities to proactively get greener and bolster their resilience and sustainability against the growing threat of climate change. Through innovation, Alexander wrote, "the sector can be a powerful example for other industries looking to pick up the pace in the race to net-zero."

That impassioned advocacy for action came as the U.S. water sector continues awakening to the challenges of climate change and the more frequent and severe droughts, wildfires and flooding it presents, testing the resilience of water systems.

Consider this: When Black & Veatch first launched its annual assessment of the U.S. water industry in 2012, there were no mentions of climate change or "decarbonization," the effort to lower carbon footprints. Now — in this year's report, based on a survey with more than 450 responses from U.S. water industry stakeholders — climate adaptation and resilience continue their ascension in relevance, closing out the sector's top five perceived top challenges behind only aging infrastructure, the workforce, funding and regulation.

Given that growing awareness, where exactly does the industry stand on addressing climate change through such things as predictive modeling, risk mitigation and investment in asset hardening? Black & Veatch's *2023 Water Report* shows those results as mixed.

Climate Change: The Inescapable Reality

As the U.S. Environmental Protection Agency (EPA) submits, effects of climate change on water quality and availability are far-ranging, considering the impacts of increasing pollutant and sediment runoff as well as the potential of lowering water supplies due to drought and saltwater intrusion.

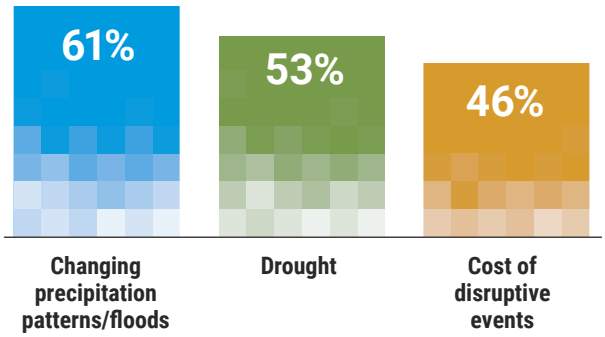
From extreme flooding in coastal areas to wind-driven wildfires and soil-parching droughts in the West, evidence of destructive climate change abounds. And the industry appears to understand it.

According to Black & Veatch's survey, six in 10 respondents (61 percent) asked to rank their top three concerns about the impact of climate change cited changing precipitation patterns and floods, followed by drought (53 percent), the cost of disruptive events (46 percent) and aging infrastructure (42 percent) *(Figure 24)*. Rising temperatures drew a distant 17 percent of the responses, slightly ahead of wildfires (16 percent) and sea level rise (12 percent).

Figure 24

What are your top three concerns about the impact of climate change? (Select up to three)

Source: Black & Veatch



Aging infrastructure	42%
Rising temperatures	17%
Customer expectations	16%
Wildfires	16%
Sea level rise	12%
Urbanization	11%

Drought certainly was top of mind for California Gov. Gavin Newsom, who in February signed an executive order meant to safeguard the state's water supplies after a string of heavy, drenching winter storms gave way to unseasonably dry conditions across the nation's most populous state. Among other things, the order was intended to help expand the state's capacity to capture storm runoff during wet years by accelerating groundwater recharge projects.

"The state can expect continued swings between extreme wet and extreme dry periods that can present risks of severe flooding and extreme drought in the same year," Newsom said in the order. "California must adapt to a hotter, drier future."

Two months later, in April, catastrophic floods caused by atmospheric rivers caused levee breaches and significant property damages, elevating the concern that flood preparedness efforts have tended to focus narrowly on meeting minimum federal standards, underestimating the magnitude of increasing risk.

Hence the need for forward thinking.

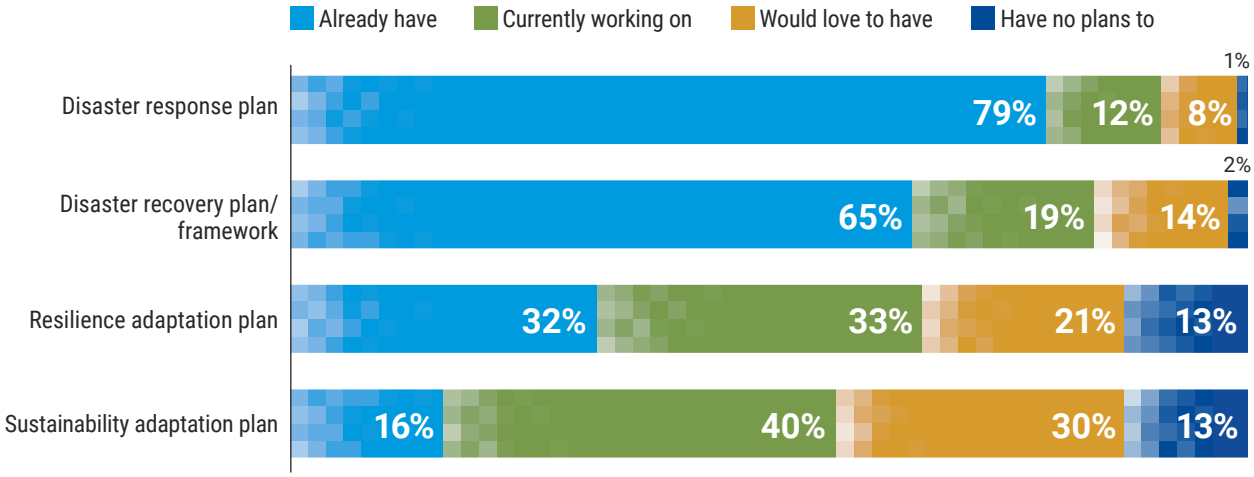
Climate Analytics: A Model Approach

Utilities looking to truly plan for climate adaptation understand that it's not only about investing in protecting assets but also optimizing operations and maintenance while enhancing the levels of service, including leveraging nature-based systems.

Figure 25

What is the status for your utility for each of the following? (Select one for each)

Source: Black & Veatch



Along the way, forward-thinking utilities can and should embed climatic modeling and analytics into their investment and maintenance strategies to plan for resilient systems, appreciating the mantra that "if you can't measure it, you can't manage it." Six in 10 of the survey respondents reported they don't use a climate analytics platform for future predictions.

Granted, climate models still hold uncertainties. The only thing that is clear is that the weather stops for nothing and no one, making long-range planning — and understanding potential risks — crucial.

Conversations around planning — whether about sustainability, adaptation or resilience — center on the assumption that future climate predictions are being made. The sustainability planning is focused more on reducing greenhouse gas (GHG) emissions, while resilience and adaptation planning ties in closely with building stronger regions, communities and ecosystems that have the capacity to effectively manage disruptive events.

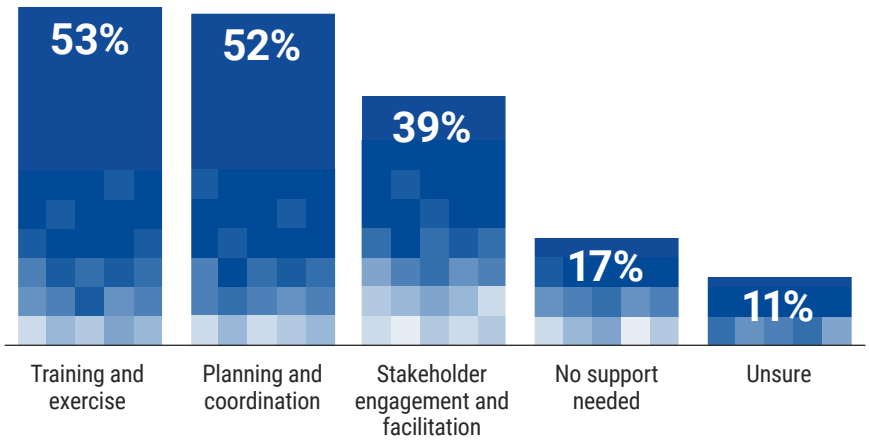
On the planning front, a majority of respondents — 91 percent — say they have a disaster response plan in place or are working on one. An additional two-thirds of respondents report having a disaster recovery plan. One-third say they have a resilience adaptation framework, and 16 percent have a sustainability adaptation roadmap *(Figure 25)*.

To adequately gauge how utilities can move forward in their response planning, survey respondents were asked what support is needed to advance a disaster response blueprint. The results may be unsurprising as slightly more than half — 53 percent — are seeking training and exercise and 52 percent are seeking planning and coordination *(Figure 26)*.

Figure 26

What support does your utility need to support your disaster response plan? (Select all that apply)

Source: Black & Veatch



The key takeaway to all of this: water utilities, while keenly aware of disruptive nature of climate change in the form of intensifying weather events, haven't been as proactive as necessary when it comes to addressing the issue, for several reasons. Perhaps it's because trying to see weather through a crystal ball is tough. Perhaps existing planning frameworks are not designed to deal with high impact or low likelihood events and uncertainties associated with climate change. Even as managing and maintaining aging infrastructure certainly continues to be a high priority, staffing and funding challenges of today may continue to take precedence over long-term planning.

One thing is clear: looking at past events to guide your decisions may be misguided, often leading to reactive approaches that don't resolve the issue. Tools such as climate analytics platforms that help foster reasonable, smarter and more forward-looking decision making about capital investments or asset hardening are out there.

Use them, and plan accordingly.

Flood-Prone, Seaside Charleston Pursues Next-Generation Water Plan, Enlisting Black & Veatch

Idyllically perched on a harbor inlet of the Atlantic Ocean, Charleston — with 157,000 residents, South Carolina's biggest city and rapidly growing — has a rich, deep history that includes a long pattern of flooding becoming more pronounced with climate change.

And that 155-square-mile community is taking action by commissioning its first citywide flood-prevention strategy in nearly four decades, turning to global water solutions leader Black & Veatch to guide their way to greater resilience.

Facing the threats of sea level rise and the impacts of high and king tides prominent along coastal seaboards, Charleston has enlisted Black & Veatch to draft a comprehensive, integrated flood mitigation roadmap that will help the city understand, plan for, prioritize, manage and adapt to current and future flood risks. The 25-year framework will include flood-mitigating strategies for near- and long-term community resilience.

Often battered by hurricanes and the deluges they bring, Charleston looks to develop a carefully crafted plan to address its coastal threats and provide a blueprint for other coastal communities to advance their own resilience strategies.

Black & Veatch brings to the effort in-depth local knowledge about Charleston, given the global critical human infrastructure leader's vast experience in leading the city's most significant water-related plans and projects over the past two decades. The company's service offerings include best-in-class national expertise from the water management, coastal and civil engineering, nature-based design and community planning fields.

"Demonstrating its aspirational and bold vision, Charleston is among the coast's first cities to begin innovative, forward-looking planning for and management of flooding, taking seriously the realities of climate change impacts that include sea rise and tidal surges," said Stephen O'Connell, a Charleston-based project manager for Black & Veatch. "Charleston is steadfast in ensuring that its population and its guests continue to enjoy all that that scenic, historic city has to offer, and Black & Veatch will leverage its time-tested expertise to make that happen."

For more information about Black & Veatch's water solutions involving flood risk management, flood protection, resiliency and other topics, click here. ■

Decarbonization Pushes for More Footing Within Sustainability

Amid the rising drumbeat of pressures to bolster sustainability and resilience in their complex operations, U.S. water utilities in an evolving sector are increasingly aware of the challenges and opportunities of going greener against the backdrop of climate change.

Evidence of that shifting mindset is abundant as water and wastewater utilities sort out how decarbonization — any approach that directly cuts greenhouse gas emissions and energy use — fits inextricably into their sustainability goals.

Black & Veatch's *2023 Water Report*, based on expert analyses of survey responses from roughly 450 U.S. water sector stakeholders, illustrates headway in adopting or at least seriously considering ways in which the sector can and should lower its carbon footprint.

And yet, progress isn't as bold as some may have hoped, given that much of the emphasis appears to be on other sustainability targets, at least for now.

Decarbonization drivers that act as catalysts for the utilities — especially among the larger utilities serving populations of at least half a million — include a desire to be a good citizen, building resiliency, regulations, and stakeholder mandates. Being a good citizen lends itself to some positive public relations opportunities locally, not to mention that decarbonization widely is viewed as simply the right thing to do.

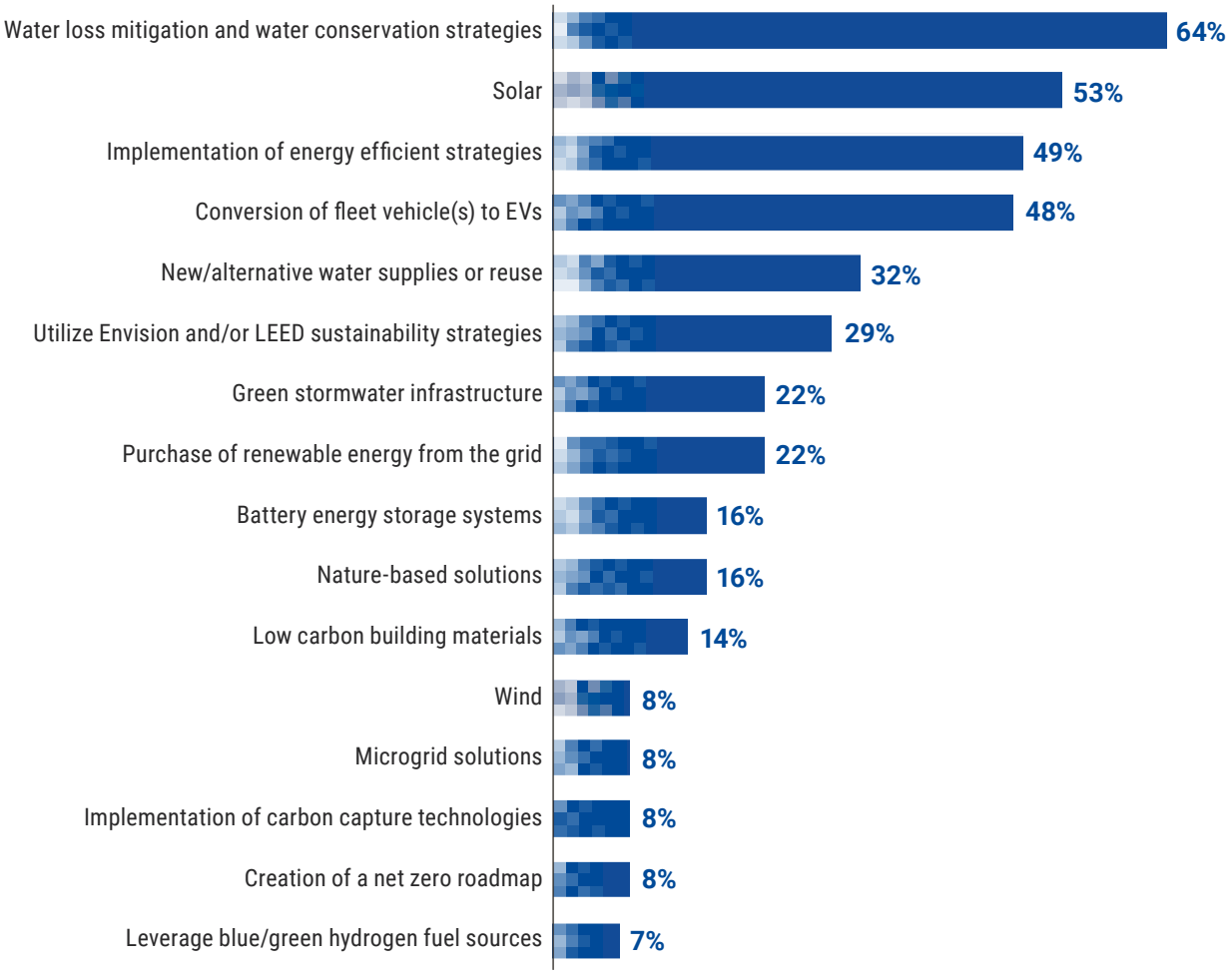
Along this journey, water and wastewater utilities are taking various steps to reduce their energy use and cut greenhouse gas emissions. Fifty-three percent of respondents say they are pursuing or planning to pursue solar energy as an alternative. Electric vehicles (EVs) are drawing more attention from utility management, as 48 percent said they were looking at converting to electrified fleet vehicles — up appreciably from last year's 29 percent response — with two-thirds of larger utilities falling into that category. But such migrations to EV fleets doesn't appear to have the needed immediacy; 63 percent see those conversions as three to 10 years away.

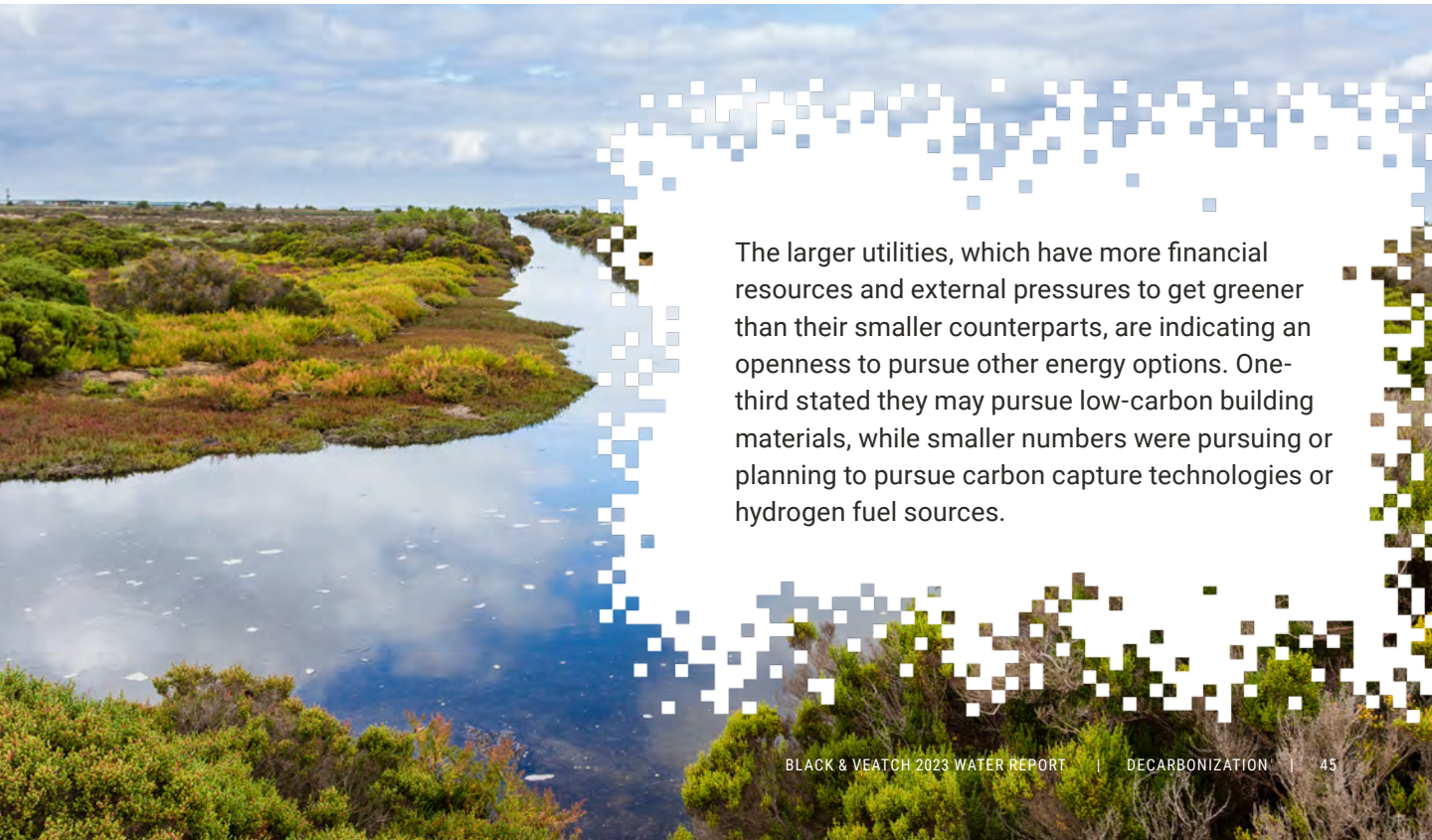
Purchasing renewable energy from the grid also increased significantly in this year's survey, with 22 percent responding positively, up from just 13 percent last year. Utilizing Envision and/or LEED sustainability strategies posted a strong gain, with 29 percent indicating an interest, compared with just 12 percent a year ago. Sixteen percent of all respondents said they were pursuing or planning to pursue battery energy storage systems *(Figure 27)*.

Figure 27

What climate mitigation or adaptation strategies is your utility pursuing or planning to pursue? (Select all that apply)

Source: Black & Veatch





The larger utilities, which have more financial resources and external pressures to get greener than their smaller counterparts, are indicating an openness to pursue other energy options. One-third stated they may pursue low-carbon building materials, while smaller numbers were pursuing or planning to pursue carbon capture technologies or hydrogen fuel sources.

Carbon Neutrality Not on the Drawing Board

While there are some specific actions in place or in the planning stages to lessen their carbon footprints, most water utilities — when asked when they expect to achieve carbon neutrality — aren't clear. Two-thirds — 67 percent — said they simply didn't know, while 22 percent said they don't expect to reach that goal within 15 years. On this question, there was no significant disparity between the larger and smaller utilities *(Figure 28)*.

A full 60 percent of respondents replied "no" to whether they were experiencing pressure from their community or from regulatory agencies to adopt related sustainable practices. This corresponds with a separate survey question about their utility's biggest drivers for pursuing decarbonization plans, with a mere 15 percent of respondents citing a stakeholder mandate. Plans to create a net zero roadmap garnered only an 8 percent response.

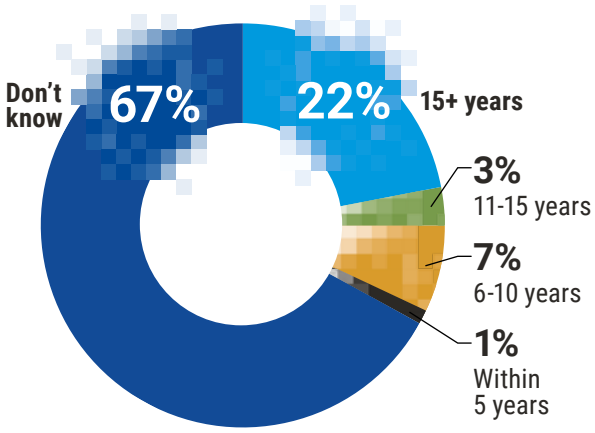
All of this suggests that while water utilities view sustainability as a crucial component, they primarily are looking at it from a water usage and water stewardship perspective, rather than an energy perspective. That's equivalent to their electric and natural gas utility counterparts focusing on energy usage, rather than water conservation measures.

When it comes to specific decarbonization strategies, some four in 10 — 41 percent — of respondents said they do not have a decarbonization roadmap, although much of that is concentrated in utilities serving less than half a million. For those serving populations above that threshold, three-quarters — 74 percent — indicated they indeed had a decarbonization plan in place, demonstrating that the larger utilities acknowledge the importance of reducing their energy consumption and are taking appropriate actions.

Figure 28

When do you expect to be carbon neutral? (Select one)

Source: Black & Veatch



Backup Power Generation: Fuels Still Rule

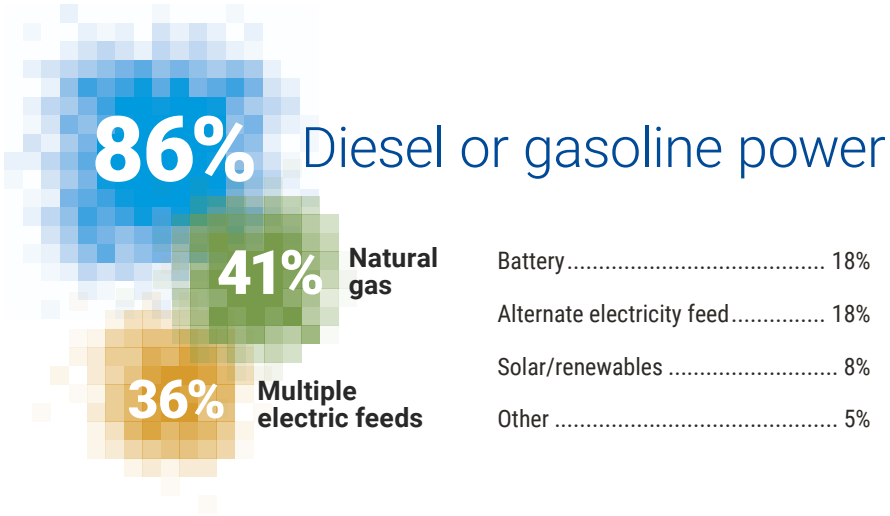
On the power side, the vast majority of the nation's roughly 50,000 water utilities and 16,000 wastewater utilities have backup power capabilities — a requirement for dealing with unplanned outages and keeping communities safe and healthy. But carbon maintains its grip on these backup sources in a sector that consumes massive amounts of energy; similar to 2022, 86 percent of respondents say they continue to rely on diesel or gasoline power for backup. Since these backup systems see very limited use, generally only during emergencies, utilities may find it hard to justify the cost of alternatives even if those alternatives are greener, making it difficult for alternative backup resources to gain ground.

Even so, alternatives do have some footing in the market. Nearly one in five respondents — 18 percent — say they would utilize battery backup resources, consistent with 2022. More conventional backup resources, such as natural gas and multiple electric feeds, garnered a higher usage, at 41 percent and 34 percent, respectively *(Figure 29)*.

Figure 29

Which of the following backup power sources would your utility rely on in the event of an unplanned outage?
(Select all that apply)

Source: Black & Veatch



Forward-thinking utilities should realize that it's possible to deploy a blend of alternative methods that combine sustainability, resiliency and a lower carbon footprint. For instance, utilities could incorporate a combination of onsite generation, such as coupling renewable energy, biogas as a byproduct of wastewater treatment, and battery storage, thereby using assets that provide a continuous value. Even hydrogen potentially could be on the drawing board.

Landmark Legislation Makes Little Impact So Far

Well over a year since the historic Infrastructure Investment and Jobs Act (IIJA) — also known as the Bipartisan Infrastructure Law — became law in November 2021, nearly three-quarters of respondents — 73 percent — said it had not had any impact on decarbonization, with just 14 percent reporting a slight positive impact. This low response likely is due to the perception that funding via the IIJA is perceived as too cumbersome of a process, combined with the fact that water utilities are not sufficiently focused on decarbonization.

Still, one of the biggest complaints utilities have about implementing any sort of sustainability strategy is the price tag. Two-thirds of all respondents pointed to affordability as the biggest hurdle in achieving sustainability targets, with the larger utilities coming in at 89 percent on that topic. Nearly one-half of all respondents cited availability of resources or capacity as being another major obstacle.

Decarbonization as Part of Sustainability

Most utilities have expanded their options when it comes to significantly reducing their carbon footprint, though they are on a wide scale when it comes to the maturity of those solutions. It requires a thorough study of their assets, a willingness to "think green" and the determination to turn those solutions into reality.

Larger utilities clearly have deeper pockets and are feeling more of the pressure to get greener with their energy usage, and it will take more time for the smaller water utilities to embrace meaningful decarbonization, given that much of their attention is on using and optimizing their current resources.

For now, purchasing renewable energy is an easy, responsible solution, but there are so many more options for water and wastewater utilities to examine. Well-structured plans that incorporate technical, strategic and financial considerations with expert input can position utilities to optimize across their resilience, efficiency and sustainability objectives. As these plans are implemented by the larger utilities, they will — over time — filter down to the smaller counterparts. Water utilities clearly understand the need and benefits of decarbonization and its linkage to sustainability, and with time they'll make the reduction of energy usage and the cutting of greenhouse gas emissions a stronger component of their overall strategies. ■

About the Authors

Laura Adams is Black & Veatch's community and ecosystem solution Lead. A 17-year veteran of the company, Adams leads a multi-disciplinary team with deep experience in program development and planning, design and construction, and the maintenance of nature-based solutions. The team is creating innovative solutions to revitalize communities, restore natural resources and address climate resilience.

Michael Borchers is a solutions director for strategic growth initiatives for Black & Veatch's governments and environment business sector. In this role he is responsible for developing and implementing strategies and solutions for water, wastewater and other governmental clients to increase their overall resilience and become more sustainable through the use of renewable energy sources, zero-emission vehicles and other technologies that balance operational performance with reduced carbon impact. Borchers has more than 20 years of experience in the water industry, including time in utility management, as well as management consulting where he has focused on helping clients develop and implement business strategies to provide quality water service to customers in an affordable manner.

Ann Bui is a senior managing director who leads Black & Veatch's Global Strategic Advisory rates and regulatory market business. Besides providing clients with strategic financial management strategies, her responsibilities include driving growth and innovation to water, electric and gas utilities in financial and advisory planning, advanced metering, sustainability issues, asset integrity and enterprise risk management services. Bui has more than 30 years of experience with clients in North and South America, Europe, and Asia.

Amanda Canida is a process engineer who supports regional utilities in Ohio, Indiana, Michigan and Kentucky, as well as multiple national utilities. With 13 years of experience and since joining Black & Veatch, she has assisted with projects related to taste and odor, enhanced coagulation, disinfection/disinfection byproduct formation, and emerging regulations such as cyanotoxins and PFAS with project scopes ranging from regulatory compliance assessments to detailed engineering. Canida has been involved in desktop, bench-scale, pilot-scale, and full-scale process optimization, in addition to process commissioning/startup efforts.

Jeff Cornell is a Black & Veatch expert about PFAS technology, regulatory matters and stakeholder engagement. A retired U.S. Air Force (USAF) environmental engineer, Cornell has 38 years of experience in water and wastewater treatment and in the remediation of contaminated groundwater and soil, especially related to emerging contaminates such as PFAS. He managed the USAF's environmental technology cost and performance testing program, and later led the development of the Defense Department's response to emerging contaminant issues such as perchlorate and PFAS.

Zeynep Erdal is the director of integrated water solutions for Black & Veatch, overseeing the development and deployment of holistic solutions that include planning, asset management, treatment and digital transformation. She drives solutions to public and private sector with a goal of achieving resilient and sustainable connected communities. Erdal serves on the board of directors of the Water Research Foundation, working with utilities to set strategy and develop solutions for future-ready communities.

Adam Feffer has 18 years of drinking water experience focusing on surface water treatment optimization, disinfectant byproduct management, treatment of emerging contaminants (including PFAS), drinking water compliance, and distribution system monitoring. He is skilled in process design and project management and is a proven leader of teams and champion of new ideas. Feffer has become one of Black & Veatch subject matter specialists for PFAS. He is passionate about bringing efficiency and innovation to the drinking water industry for the purpose of benefiting public health domestically and abroad.

Susan Herman is Black & Veatch's digital water leader. For more than 30 years, she has delivered digital solutions to clients across the government sector, including in the energy, water and education markets. Partnering with clients to drive best-fit digitalization efforts, Herman develops forward-looking solutions that enhance resilience, sustainability, quality, safety, security and transparency. She joined Black & Veatch in 2021 after decades of digital and automation product and service innovation at companies such as Schneider Electric, Invensys and Texas Instruments.

Ryan Hoye is a cybersecurity specialist and instrumentation and controls engineer at Black & Veatch. He specializes in the design of water and wastewater control systems with a focus on cybersecurity. Hoye's cybersecurity experience includes performing assessments of both control system and enterprise networks for water utilities, development of new cybersecurity policies and procedures, and consulting water clients on best practices for vendor and operator remote access methods. Hoye has trained in the Consequence-driven Cyber-informed Engineering methodology at Idaho National Labs.

Jo Ann Jackson leads Black & Veatch's National One Water Planning Practice. She brings nearly 40 years of experience developing integrated solutions to wastewater, stormwater and water supply projects across the U.S. Her experience includes six years in the public sector, where she helped implement Florida's first direct potable reuse pilot and served as a utility representative on Florida's Potable Reuse Commission.

Rick Kaiser is Black & Veatch's federal market leader and president of BV Special Projects Corp. and a retired U.S. Army major general. Kaiser's 36- year career in the military and engineering and construction fields included Army service as the deputy chief of the 36K U.S. Army Corps of Engineers executing a $46-billion construction portfolio, with prior duty commanding USACE's Mississippi Valley and earlier the Great Lakes/Ohio River division. Rick joined Black & Veatch in 2020 and served as the federal growth officer with focus on expanding cybersecurity, master planning and resilience offerings for clients.

Ajay Kasarabada is a Black & Veatch associate vice president and director of the company's environmental solutions services. A 23-year Black & Veatch veteran, Kasarabada brings experience in air quality and greenhouse gas emissions, distributed generation and renewable energy, electrification and decarbonization road mapping. He has helped deliver resilient, sustainable and cost-effective energy solutions to energy clients, water and wastewater utilities, transit districts and critical infrastructure facilities. He is a member of the board of the U.S. nonprofit Transportation Energy Partners, which brings Clean Cities Coalition leaders together with the clean transportation energy to work on increasing the use of sustainable fuels and sub-committee chair at U.S. Commerce Department's Environmental Technologies Trade Advisory Committee (ETTAC).

Jason Kirk is Black & Veatch's federal solutions director and vice president of BV Special Projects Corp. and a retired Army colonel. Kirk's 30-year career in engineering and construction included leadership roles with the USACE's Jacksonville, Charleston and New Orleans districts, multiple Army combat units and the private sector in aerospace/defense and water utilities markets. The common thread in Kirk's diverse experience is planning, programming, designing and constructing resilient infrastructure. Kirk has specific experience deploying Cybersecurity Maturity Model Certification (CMMC) within private-sector firms.

Sean Lammerts is director of strategic growth at Black & Veatch, where he scales and shapes the services that clients need to transition them to the future. Lammerts, who joined the company in July 2022, is driven by a passion for clean, safe environments. He also leads the emerging contaminant practice within Black & Veatch, where his team looks for innovative solutions to solve the problems of tomorrow that align the goals of the client with their risk tolerance.

Craig Lichty has 40 years of experience in planning, design and program management of integrated water resource solutions that often include conjunctive use strategies involving surface water, groundwater and water recycling elements. He currently serves as the president of the WateReuse Association and is involved in several potable reuse projects being delivered using traditional, design-build and P3 delivery method.

Prabha Kumar is a managing director at Black & Veatch Management Consulting. She has more than 23 years of experience providing financial planning and cost of services studies, business transformation, and utility development and implementation consulting services to water, wastewater, and stormwater utilities. Kumar is also a national practice leader at Black & Veatch for stormwater utility services and funding development and implementation services.

Francesca McCann is a business development director with the InfraManagement Group at Black & Veatch. She leads the company's alternative funding and financing practice and works to develop community-based partnerships (CBPs). A leader in the U.S. water industry with expertise in investments, public-private partnerships and project development, McCann served as CEO for Abengoa Water USA, where she successfully led the $3.4-billion Vista Ridge Project in San Antonio, Texas.

Brian Melton is a technology innovation lead at Black & Veatch, where he helps embrace digital transformation and new technology in support of continued improvement for the delivery of projects. During his 23 years at Black & Veatch, Melton has had the opportunity to be a part of some of the largest infrastructure projects around the globe, including mining, hydropower, and water and wastewater treatment, conveyance and storage. He has an extensive background in building information modelling (BIM) with respect to infrastructure projects. Melton often leads first-of-a-kind solution prototyping and helps support implementation of next-generation digital solutions for project delivery.

Joanne Milo is a senior project manager with the Black & Veatch Special Projects Corp. and a retired U.S. Army Corps of Engineers, Army civilian, where she served as an engineer, project manager, program manager, deputy division chief and deputy for programs and project management in the Chicago and Louisville district offices, as well as during three separate assignments while deployed to Iraq and Afghanistan. Over her more than 33-year career, she has been responsible for execution of engineering and construction for civil works and military facilities, and she has served as an infrastructure advisor to military units.

Jeff Neemann is the West Region managing director for Black & Veatch. He has more than 25 years of experience in potable and water reuse planning, design and operation around the world. He is a recognized expert in treatment technologies, focusing on advanced treatment and disinfection technologies, as well as digital water solutions that incorporate advanced monitoring and diagnostics for water treatment and supply.

Amanda O'Dell is the corporate sustainability manager for Black & Veatch. She leads the companies' corporate sustainability program, ensuring we are setting, tracking and meeting our environmental, social, and governance goals. She provides leadership and diverse analytical support for clients', and Black & Veatch's, sustainability programs. She focuses on industry-specific approaches to implementing continuous improvement programs in support of companies' sustainability commitments.

Mike Orth is president of Black & Veatch's governments and environment business. Before that 2021 appointment, Orth served as executive vice president and managing director of Black & Veatch's water business in the Americas. He has guided the company's growth efforts in supply, storage, treatment and conveyance by delivering projects for clients through both traditional methods and alternative solutions such as design-build, performance contracting and public-private partnerships.

Ahmet Ozman is a planning and asset management leader for Black & Veatch's water and wastewater infrastructure projects. A 25-year veteran of Black & Veatch, Ozman provides expertise in life cycle asset management, asset management programs, PAS55/ISO 55000 standards, condition assessment, risk assessment, risk-based capital prioritization, optimization studies, resilience assessments and planning.

Deepa Poduval is a Black & Veatch senior vice president and the company's sustainability leader, responsible for continuing to implement the company's sustainability strategy while further shaping sustainability as part of the company's next-generation strategy. She also leads the global advisory practice within Black & Veatch, providing executive leadership for the company's strategic and digital advisory services. Poduval and her team partner with a wide variety of clients spanning governments, and electric, water, oil and gas, commercial, industrial and financial sectors who seek integrated solutions related to their critical infrastructure as they pursue goals around sustainability, growth and resilience.

Ed Rectenwald is the hydrogeology national practice lead for Black & Veatch's water business. With 28 years of technical and management experience, he successfully has managed projects and teams across the globe related to design, permitting, construction, expansion and operation for wellfields, Class V aquifer storage and recovery (ASR), managed aquifer recharge (MAR) and Class I injection well systems.

Cynthia Rolli is the resilience practice leader for Black & Veatch. Leveraging her experiences across the United States, Caribbean and the Pacific in hydrogeology, hazard mitigation planning and disaster recovery, Rolli supports a holistic approach to resiliency planning. She helps organizations integrate across planning efforts to maximize project benefits, develop transparent decision frameworks and implement projects that improve community resilience.

James Schlaman is the director of planning and water resources for Black & Veatch's governments and environments sector and serves on the One Water Council for the U.S. Water Alliance. During the past 20 years, he has worked across the country on all types of planning and water resources projects, including water supply and reuse/alternative water supply evaluations, integrated planning and water quality studies, and stormwater/ flood control planning and design projects.

Jim Schultz is a senior operational technology cybersecurity consultant with Black & Veatch and has more than 30 years of experience with utility and federal projects aimed at improving operational technology and reducing cybersecurity risk to critical infrastructure. Throughout his career, Schultz has been engaged in the planning, design, implementation and support of operational technology and information technology projects in the water, wastewater, manufacturing, electric utilities and federal sectors.

Mark Steichen is the water process group and treatment solutions leader at Black & Veatch. He has more than 30 years of experience in municipal wastewater treatment plant design and specializes in biological nutrient removal. Steichen leads a highly specialized group of water and wastewater treatment process engineers that deliver tailored treatment solutions for clients throughout the U.S. and globally.

Emily Tummons is a process engineer and the national lead and copper practice leader at Black & Veatch. She has seven years of experience designing and managing corrosion control evaluations for municipal drinking water treatment facilities, including desktop water quality modeling, bench-scale evaluations, and pipe loop testing. She is the technical leader for all lead and copper rule related projects.

James Welp is the planning, partnerships and strategy director for the governments and environment sector of Black & Veatch. He has served as managing director of water business lines, managing director of Water Central Region, and client director for many large projects.

Will Williams has extensive experience in asset management planning, including asset failure analysis, risk assessment, performance benchmarking, maintenance optimization, business planning, serviceability assessment, whole life costing, operational efficiency, business change management and infrastructure rehabilitation. Before joining Black & Veatch, he was vice president and global director of asset management for water and power for Halcrow. He previously was director of asset management and planning at the UK Water Research Centre. He is a committee member of the International Water Association Asset Management Specialist Group.

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