



**STORMWATER
SOLUTIONS**

**WASTEWATER
DIGEST**

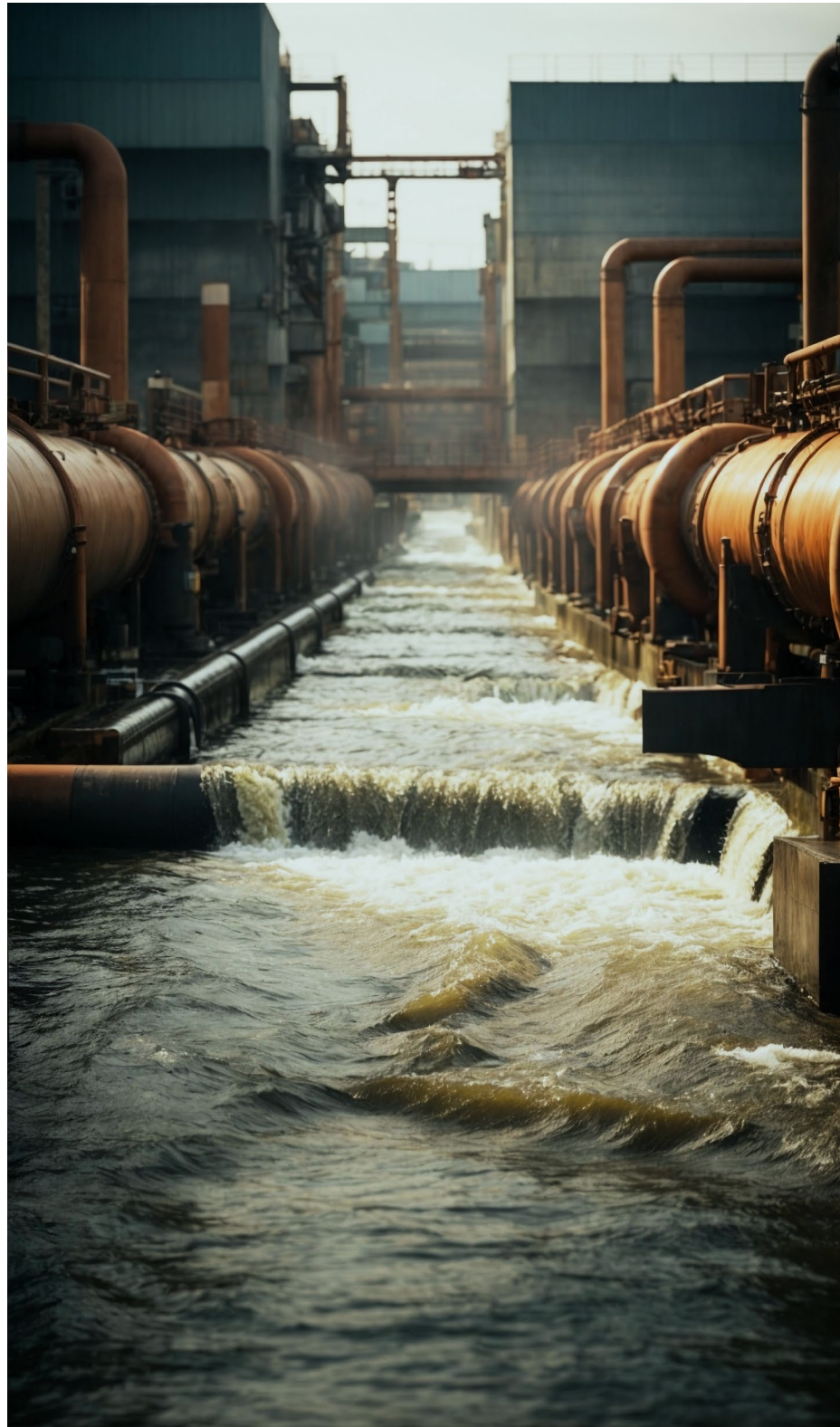
2023 State of the Market Report

Resiliency to Climate Change

SURVEY FINDING: Climate change is accelerating mitigation of infrastructure challenges

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Executive Summary

Increasing climate change is leading to intense droughts, water scarcity, severe fires, rising sea levels, flooding, melting polar ice, catastrophic storms, and declining biodiversity. All these matters directly impact future planning and construction considerations for stormwater and wastewater municipal managers in order to build resiliency to climate-driven events.

The cost of repairing and replacing stormwater and wastewater infrastructure is a top concern for municipal managers, and the aforementioned climate variation paired with population growth is stressing capacity of these systems.

Severe weather planning has become more critical and climate change is a significant driving factor in design considerations. Actions to address these issues will be based on confidence in the system and its budget, pinpointing effective outreach methods, and leveraging trusted information sources for public outreach.

This survey examines the condition of stormwater and wastewater infrastructure throughout the United States; assesses concerns relating to climate variation, weather events, water quality, and resource impacts; and pinpoints effective mitigation strategies for the existing and emerging challenges.

Survey respondents represent decision-makers and influencers for climate change response. The majority of survey respondents work for a municipal, county, state, or federal government agency. Others are engineers, consultants, contractors, and people who work at construction firms, government agencies dealing with surface water quality, non-government enterprises, and utilities.

Municipally-owned and operated organizations as well as private and investor-owned operations represent the largest percentage of places in which respondents work, while industrial and other entities comprise the workplaces of the other respondents. Most of the respondents serve a medium-sized population base of 10,001 to 100,000, followed by small areas of up to 10,000, large areas of 100,001 to one million, and metropolitan areas of more than one million.

The following report examines infrastructure challenges, the impact of climate change and weather events, present-day responses to those challenges, and mitigation strategies.

Infrastructure Challenges

The age and life of stormwater and wastewater infrastructure is top of mind for those responsible for its construction, operation, and preventative and corrective maintenance. A significant number of systems in the U.S. are nearing or have surpassed their end-of-life design.

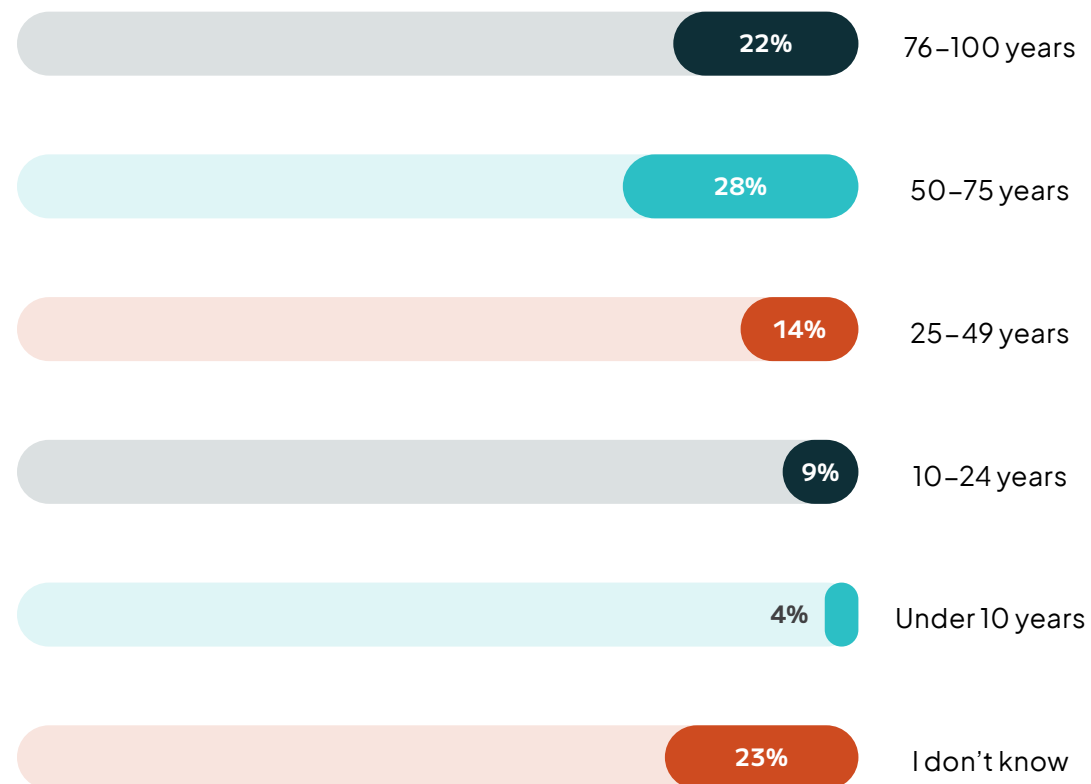
Consider that the American Society of Civil Engineers (ASCE) in its 2021 report card gives the U.S. stormwater system a “D” grade, while it gives the U.S. wastewater system a “D+.” In issuing its grades, the ASCE considers condition and capacity, operations and maintenance, funding and future need, public safety, and resilience and innovation. Of particular importance to ASCE is the age of U.S. stormwater and wastewater infrastructure in issuing its grades.

Half of this survey’s respondents indicated the system that supports their infrastructure was designed 50 or more years ago, adding that they consider the end of life for the design to be an average of 49 years. The average age of systems in the areas in which respondents work is 56 years. This timing appears to align with the establishment of the Clean Water Act in the 1970s, which injected millions in funding to build these systems. In 2021, the Infrastructure Investment and Jobs Act (IIJA) did the same, becoming the largest single source of funding for water and wastewater infrastructure since the Clean Water Act was established.

Age and Life of Infrastructure

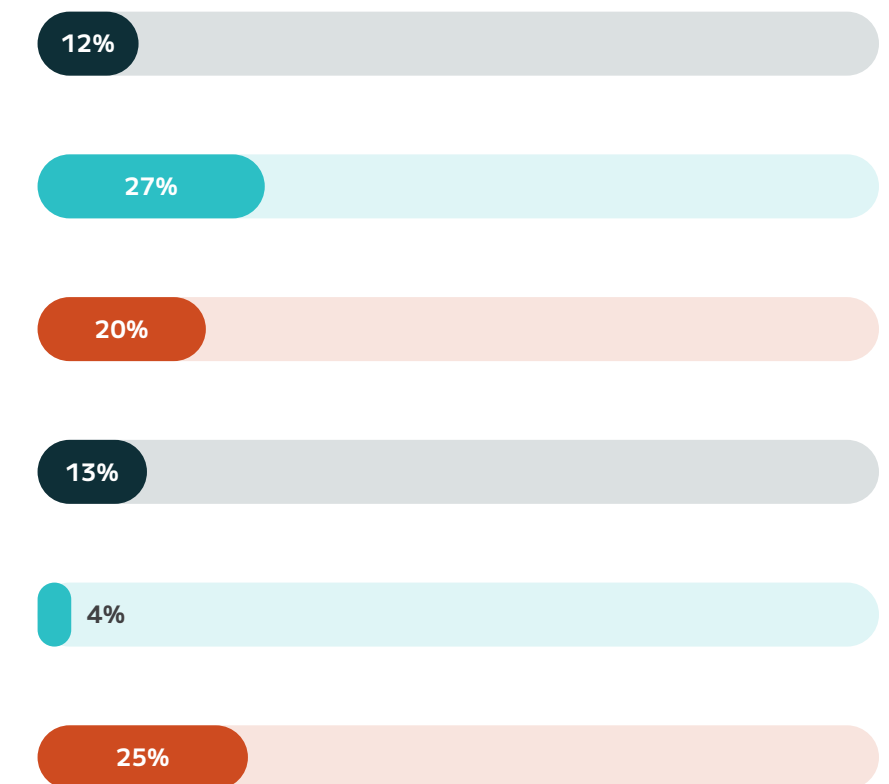
Half of respondents indicate the system that supports their water infrastructure was designed 50 or more years ago. The average age is 56 years. Under the current water infrastructure, respondents consider the end of life for the design to be an average 49 years.

HOW LONG AGO WAS THE SYSTEM THAT SUPPORTS YOUR WATER INFRASTRUCTURE DESIGNED?



Base: All respondents (n=253).

UNDER YOUR CURRENT WATER INFRASTRUCTURE, WHAT DO YOU CONSIDER YOUR END OF LIFE FOR THE DESIGN?



Base: All respondents (n=255).

Despite the passage of IIJA, the majority of respondents (57%) indicated that funding is a top concern with the ability to maintain water infrastructure properly and routinely as it pertains to the risk of climate variation. The cost of infrastructure rehabilitation (40%) and taxpayer understanding and support (40%) are also top concerns.

As municipalities enter new fiscal years, it is critical to employ as many methods as possible to educate ratepayers on the importance of supporting rate or tax increases or stormwater fees to ensure the resiliency of water and stormwater infrastructure for years to come. That is especially vital in areas that are experiencing significant development and population growth, which will place greater demand on systems.

Public outreach and communications have gained considerable traction in the wastewater and stormwater industries in the past two years. As regulations become more nuanced and concerns with aging infrastructure arise, industry leaders from American Water Works Association and Water Environment Federation have noted the “Era of the Silent Utility” is over.

Comprehensive publicly-facing education campaigns on the true costs, savings, risks, and avoided hazards associated with stormwater infrastructure investments must be conducted, with the details disseminated through broadly accessible platforms, including social media, news outlets, and other means.

Top Infrastructure Concerns

The majority of respondents indicate that funding is a top concern with the ability to properly and routinely maintain water infrastructure as it pertains to the risk of climate variation. The cost of infrastructure rehabilitation and taxpayer understanding and support are also top concerns.

WHAT ARE THE TOP CONCERNS ABOUT YOUR ORGANIZATION’S ABILITY TO PROPERLY AND ROUTINELY MAINTAIN ITS WATER INFRASTRUCTURE AS IT PERTAINS TO THE RISK OF CLIMATE VARIATION (I.E., FLOODING)?

Funding

57%

Infrastructure rehabilitation is cost prohibitive

40%

Taxpayer understanding and support

40%

Labor force’s lack of specialized knowledge

35%

Lack of time to assess and address the entire system

30%

Equipment

29%

Other

8%

Base: All respondents (n=256); multiple answers allowed.



Impact of Climate Change and Weather Events

Respondents' climate concerns focus on their impact on aging assets and infrastructure and the funding required to create resiliency.

Climate Concerns

Aging assets and infrastructure and the funding required to create resiliency are the top climate concerns among respondents.

PLEASE RANK THE TOP FIVE CLIMATE CONCERNS AFFECTING YOUR AREA, STARTING WITH ONE (1) AS THE TOP CONCERN, DOWN TO FIVE (5) AS THE LEAST OF THE CONCERNS.

Top concern ← ① ② ③ ④ ⑤ → Least concern

Aging assets and infrastructure



Funding needed to create resiliency



Complicated governance and ownership structures



Stringent water quality regulations

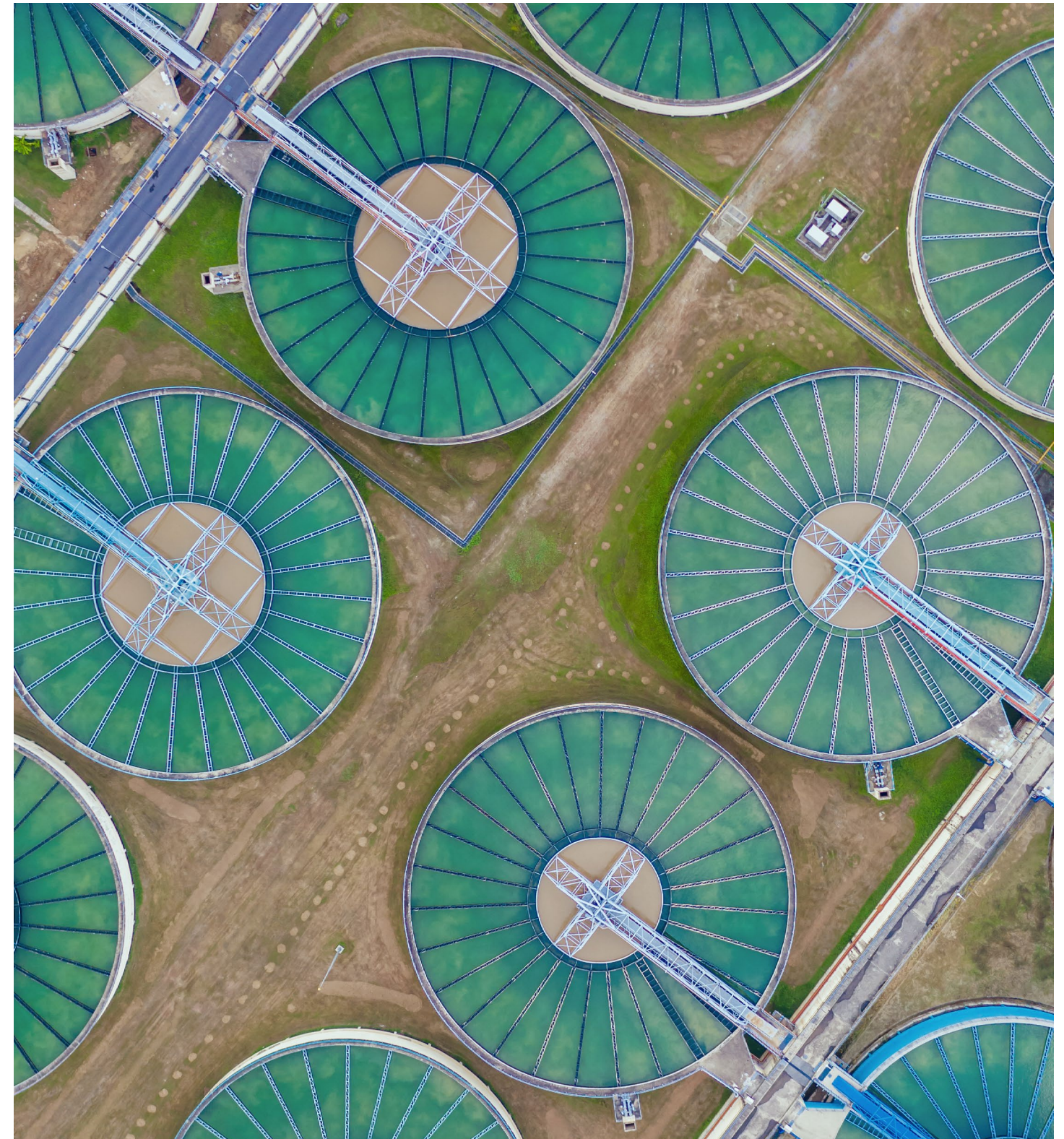


Climate change projections



Base: All respondents (n=231).

*Analyst note: Respondents were not required to rank all five concerns



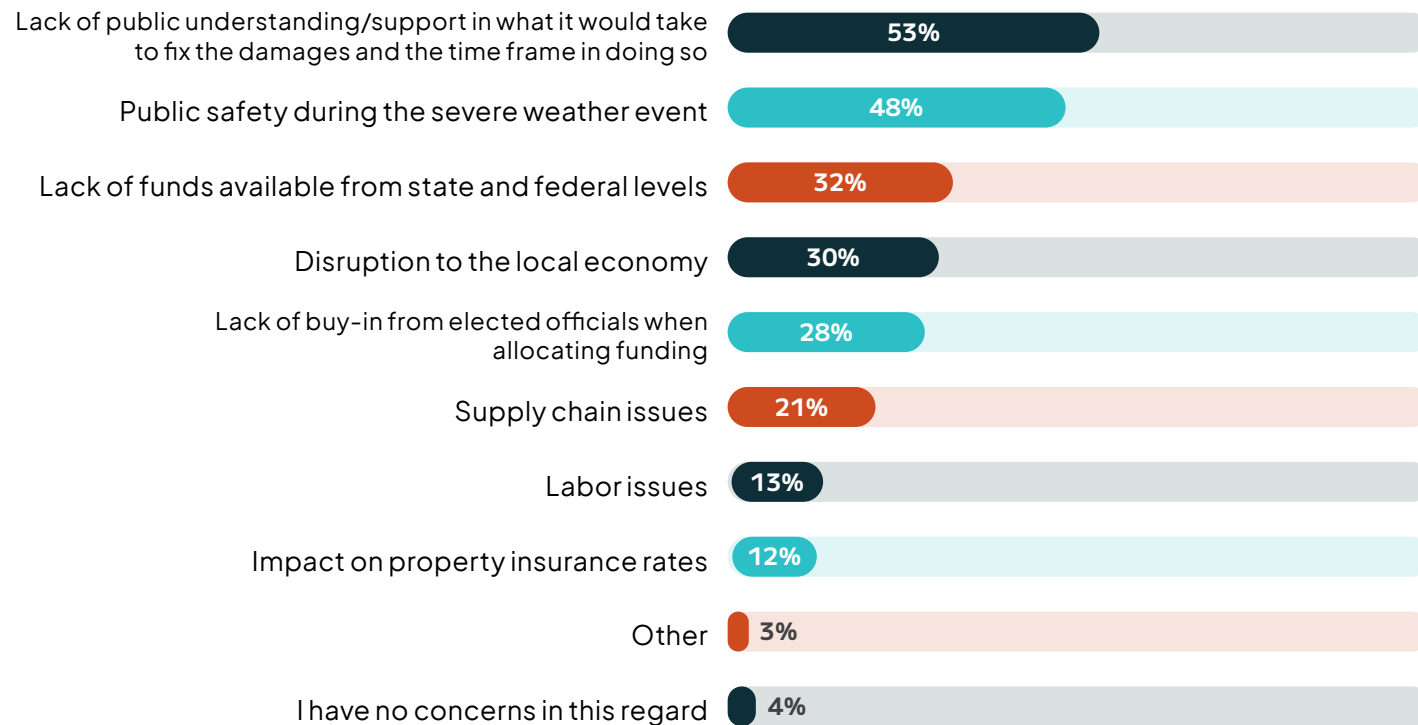
Top Concerns of Impact of Severe Weather Event

In the case of a severe weather event, respondents' top concerns are the lack of public understanding of time and effort required for repair, the safety of the public during the event, and the lack of funds available.

The responses echo the ongoing and widespread concern for the need for buy-in from elected officials and those who pay property taxes are uppermost in mind when it comes to those charged with operations and maintenance as well as planning for future needs.

That will rely on the public-facing educational campaigns as suggested by industry leaders and communications professionals throughout the wastewater and stormwater industry.

WHICH OF THE FOLLOWING ARE YOUR TOP CONCERNS WHEN IT COMES TO THE IMPACTS RESULTING FROM A SEVERE WEATHER EVENT?



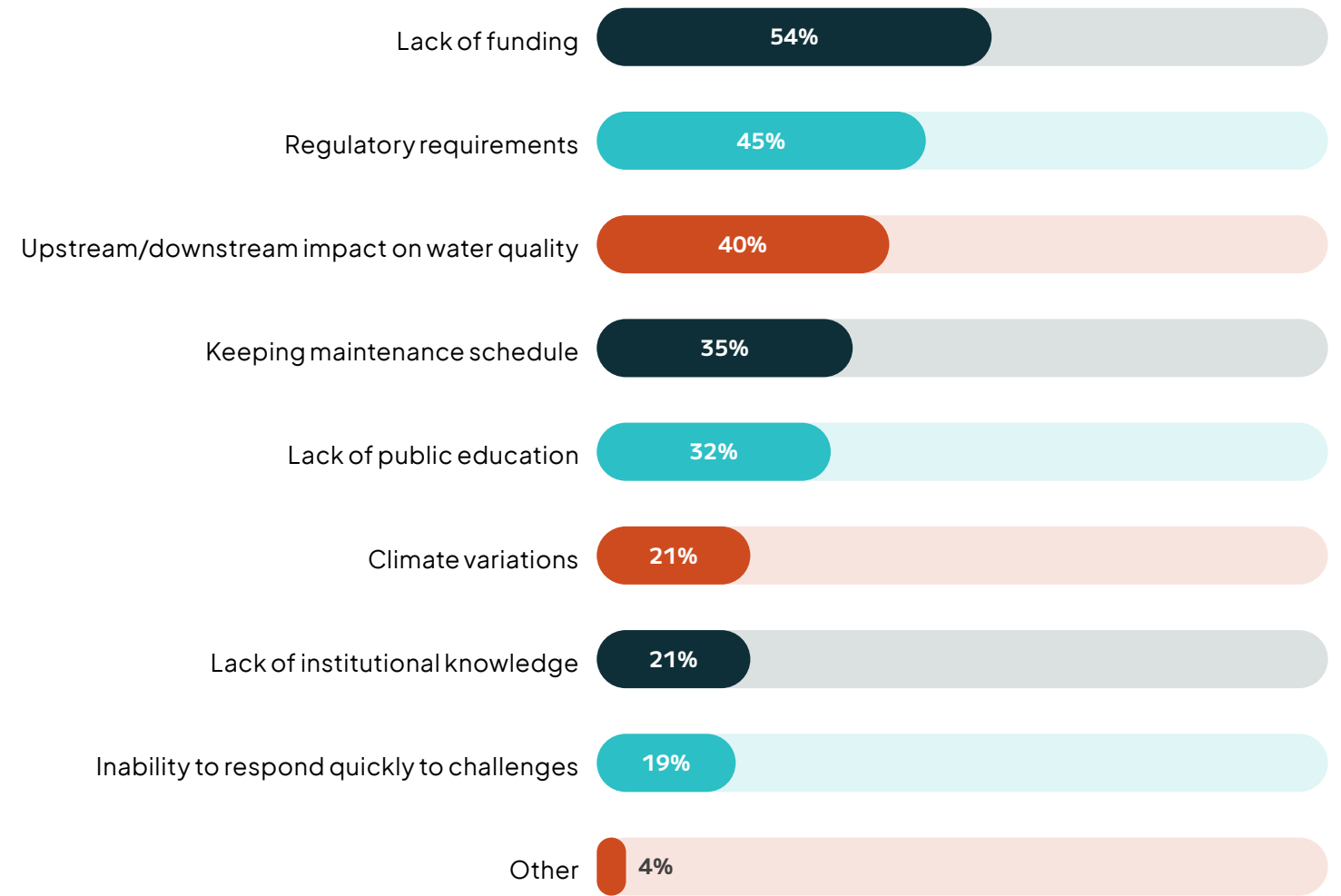
Base: All respondents (n=256); multiple answers allowed.

Water Quality Concerns

A lack of funding, regulatory requirements, and upstream/downstream impacts are the top three concerns regarding water quality.

Not only are water resources a concern, but so is the quality of the water, with funding, regulations, and upstream/downstream impacts having a significant influence.

WHAT ARE YOUR TOP THREE CONCERNS REGARDING WATER QUALITY?



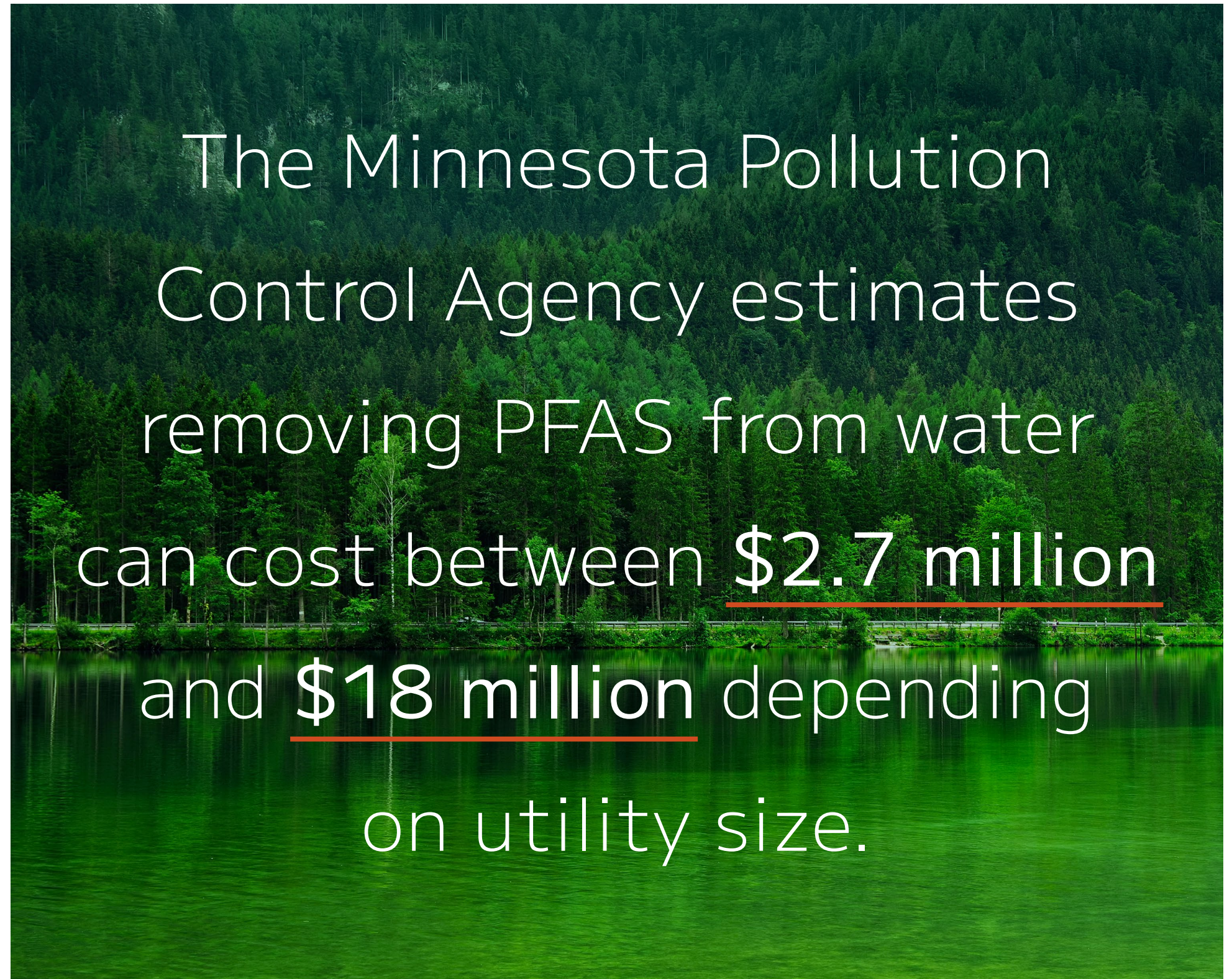
Base: All respondents (n=256); multiple answers allowed.

The top three areas of concern for water quality were lack of funding (54%), regulatory requirements (45%), and upstream/downstream impact on water quality (40%). While there are numerous reasons why these rise to the top, one issue in particular ties all three together: per- and polyfluoroalkyl substances (PFAS).

PFAS are a significant concern, so much so that in March 2023, the U.S. Environmental Protection Agency announced the proposed National Primary Drinking Water Regulation (NPDWR) for six PFAS chemicals, with two in particular having Maximum Contaminant Levels of 4 parts per trillion. The Minnesota Pollution Control Agency estimates removing PFAS from water can cost between \$2.7 million and \$18 million depending on utility size.

In an interview with Wastewater Digest, EPA Assistant Administrator Radhika Fox noted the agency is conducting a risk assessment of PFAS in biosolids, the solid byproduct created at the end of a wastewater treatment process.

Whether land applied as fertilizer or disposed in a landfill, concerns arise when storms roll in, creating stormwater runoff likely laden with PFAS chemicals that ultimately re-enter local waterways or groundwater aquifers. It is issues like PFAS that are multi-layered and multifaceted that push issues like funding, regulatory requirements, and water quality to the top of concerns.



Response to Challenges

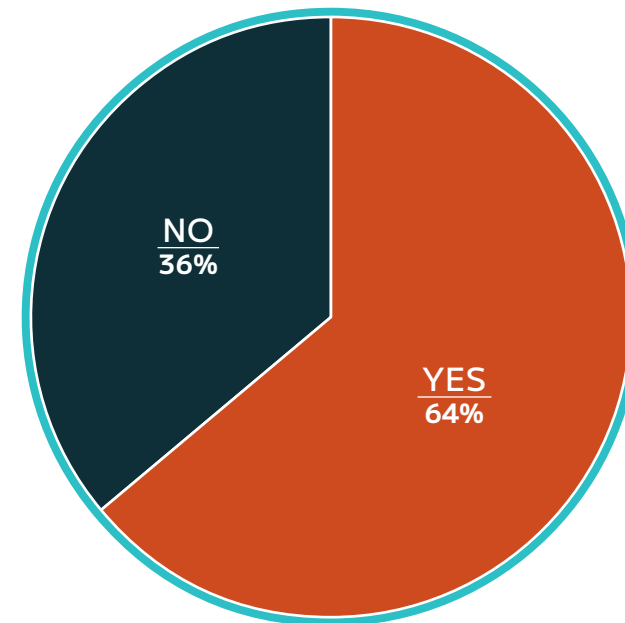
Effective responses to challenges will entail design considerations, collaborative efforts, and determining who will take the lead, as well as the establishment of confidence in the system and budgetary matters. In design considerations, 64% of respondents plan to factor climate change into future weather infrastructure design. Eighty-two percent agree that additional rainfall/stormwater input due to major weather events poses a growing threat to system capacity and public safety. In strengthening mitigation efforts through collaboration, respondents are most likely to collaborate with engineering (58%) and public works (55%) departments with respect to weather resilience concerns.

One area in which this has become notable is project delivery. The Design-Build Institute of America's recent market analysis notes that 42% of all construction now uses a design-build project delivery method. Utilities are ditching the traditional design-bid-build model in favor of progressive delivery options because they offer differing levels of collaboration and utility commitments to get projects across the finish line given the resources available.

Impact of Climate Change and Weather Events

Sixty-four percent of respondents plan to factor climate variability due to changing climate conditions into future weather infrastructure design. Eighty-two percent agree that additional rainfall/stormwater input due to major weather events poses a growing threat to system capacity and public safety.

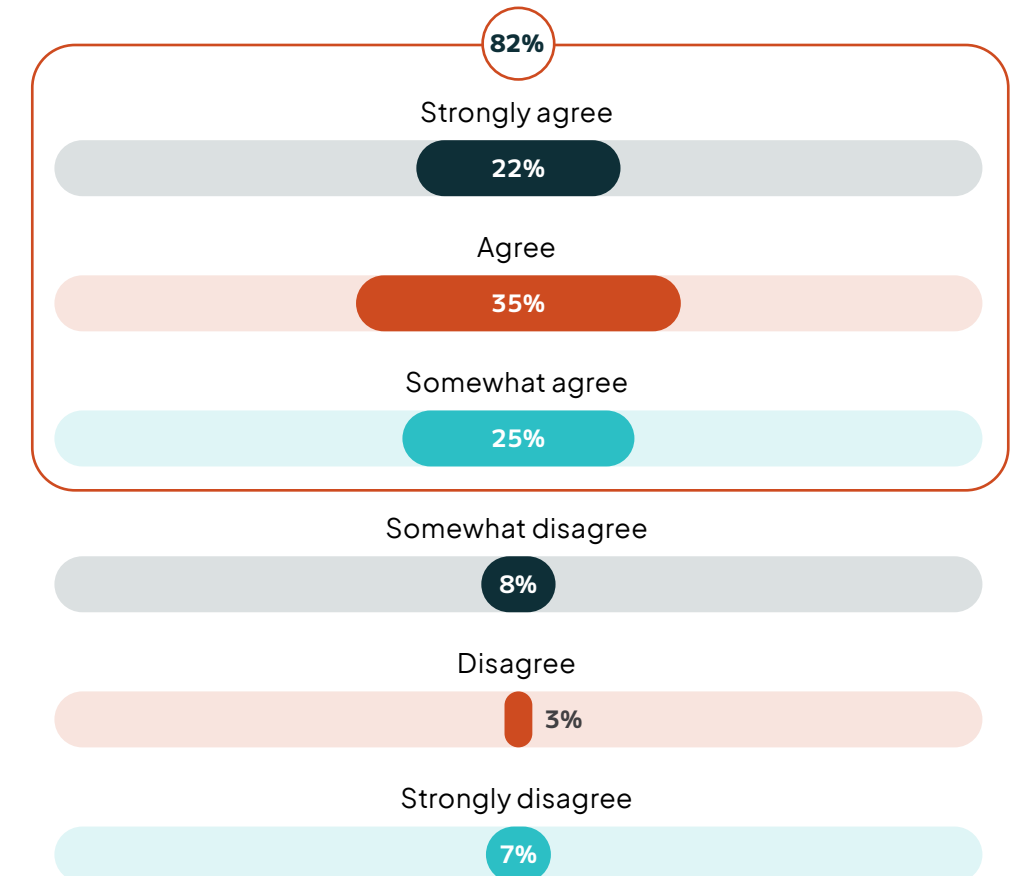
BASED ON THE CHANGES YOU ARE SEEING WITH CLIMATE VARIABILITY; DO YOU PLAN ON FACTORING THAT IN YOUR FUTURE WATER INFRASTRUCTURE DESIGN?



Base: All respondents (n=255).

TO WHAT EXTENT DO YOU AGREE OR DISAGREE WITH THE FOLLOWING STATEMENT:

"ADDITIONAL RAINFALL/STORMWATER INPUT DUE TO MAJOR WEATHER EVENTS POSES A GROWING THREAT TO SYSTEM CAPACITY AND PUBLIC SAFETY."

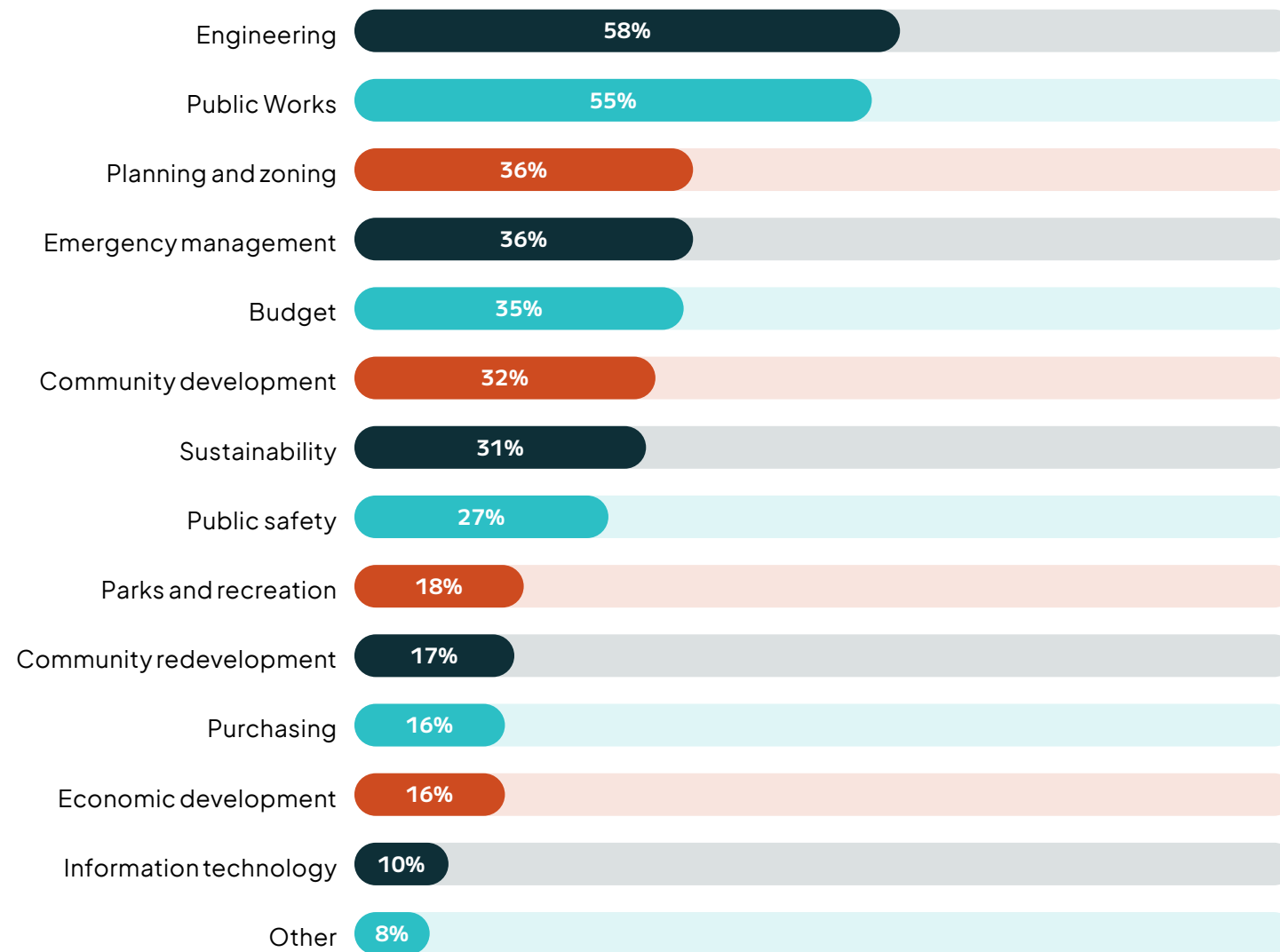


Base: All respondents (n=255).

Collaborating Departments

Respondents are most likely to collaborate with engineering and public works departments with respect to weather resilience concerns.

WITH WHICH OF THE FOLLOWING DEPARTMENTS DOES YOUR ORGANIZATION HAVE A COLLABORATIVE RELATIONSHIP WITH RESPECT TO WEATHER RESILIENCE CONCERNS?



Base: All respondents (n=250); multiple answers allowed.

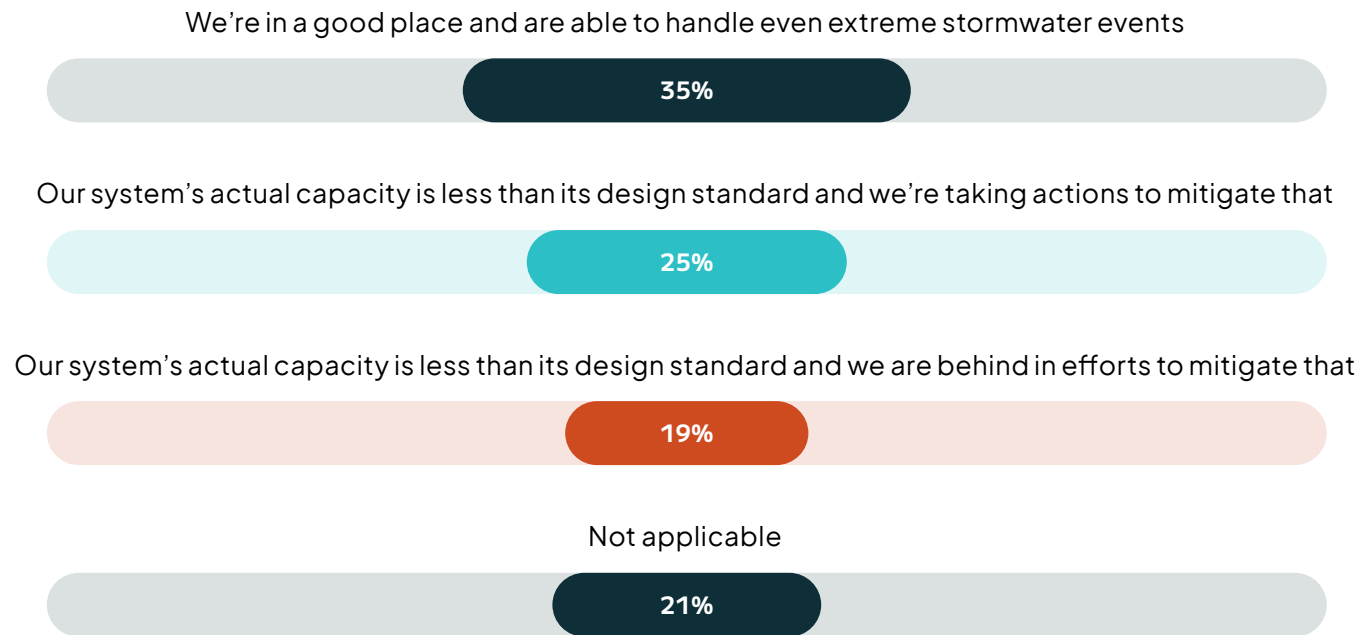
Additional comments from respondents indicate citizen complaints help drive severe weather planning — their support has the potential to serve as a driving factor to get buy-in for additional funding.



Confidence in System and Budget

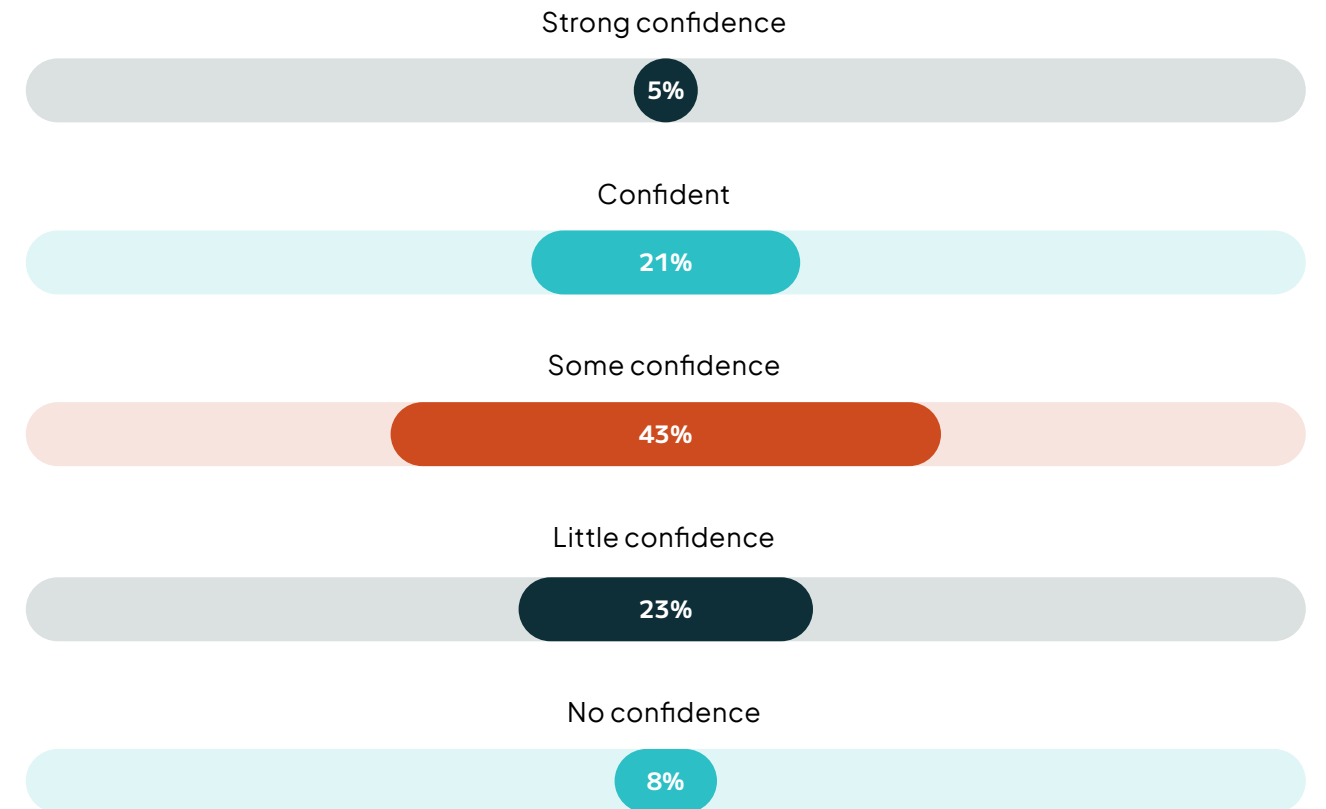
Respondents are likely to believe that their organization is currently in a good place to handle extreme stormwater events or that they are taking action to mitigate current weaknesses. Respondents are less confident in the level of budget committed for climate risk mitigation as only 26% indicate they are confident or strongly confident that the planned budget is at the correct level.

HOW CONFIDENT ARE YOU IN YOUR ORGANIZATION'S SYSTEMS WITH REGARD TO FLOW, CAPACITY, AND STORAGE?



Base: All respondents (n=254).

HOW CONFIDENT ARE YOU THAT THE CORRECT LEVEL OF BUDGET IS PLANNED OR COMMITTED FOR CLIMATE RISK MITIGATION IN YOUR ORGANIZATION?



Base: All respondents (n=252).

Getting stakeholders on board is crucial. Respondents find that committees including both citizens and elected officials to address questions and concerns (59%) are considered the most effective outreach method for educating all stakeholders. Half of the respondents consider social media posts effective.

What people do not see underground they do not understand. System tours and case studies illustrating best management practices — and those that are ineffective — are among the messaging opportunities to raise awareness and funds.

Write-in responses suggest using direct data sources such as NOAA as well as the U.S. Environmental Protection Agency and environmental protection departments; engineering studies; printed communications such as direct mailers defining problems and solutions; fact sheets and case studies and even teaching schoolchildren.

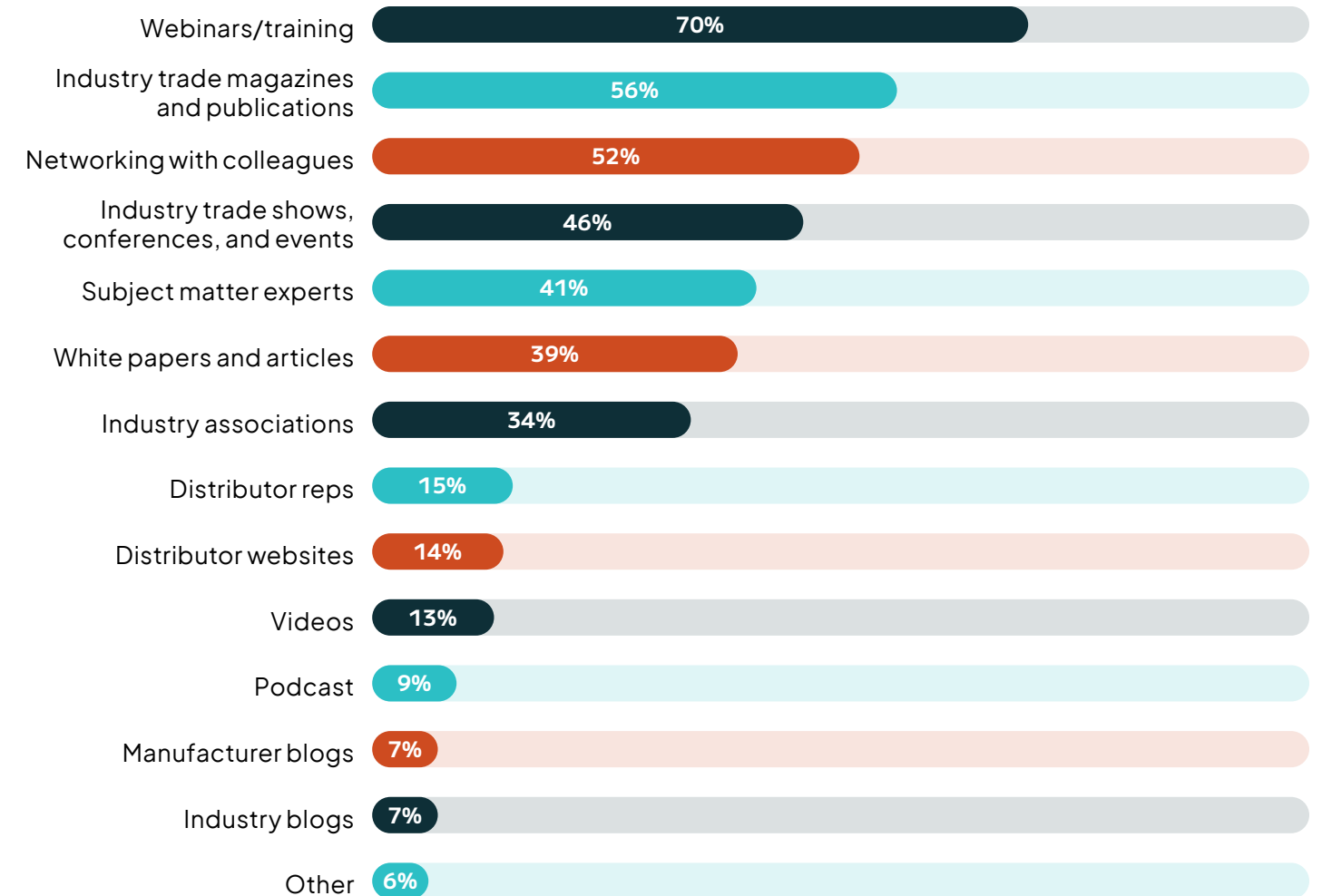




Information Sources

Webinars/training, industry trade magazines and publications, and networking with colleagues are each used by a majority of respondents to make informed decisions regarding mitigation plans.

WHAT SOURCES DO YOU CONSULT FOR TRUSTED INFORMATION UPON WHICH TO MAKE INFORMED DECISIONS REGARDING MITIGATION PLANS?



Base: All respondents (n=252); multiple answers allowed.

Mitigation Strategies

Identifying funding opportunities for data-driven decision-making (44%) and climate variation mitigation (41%) are the top two strategies for mitigating risks due to climate variations.

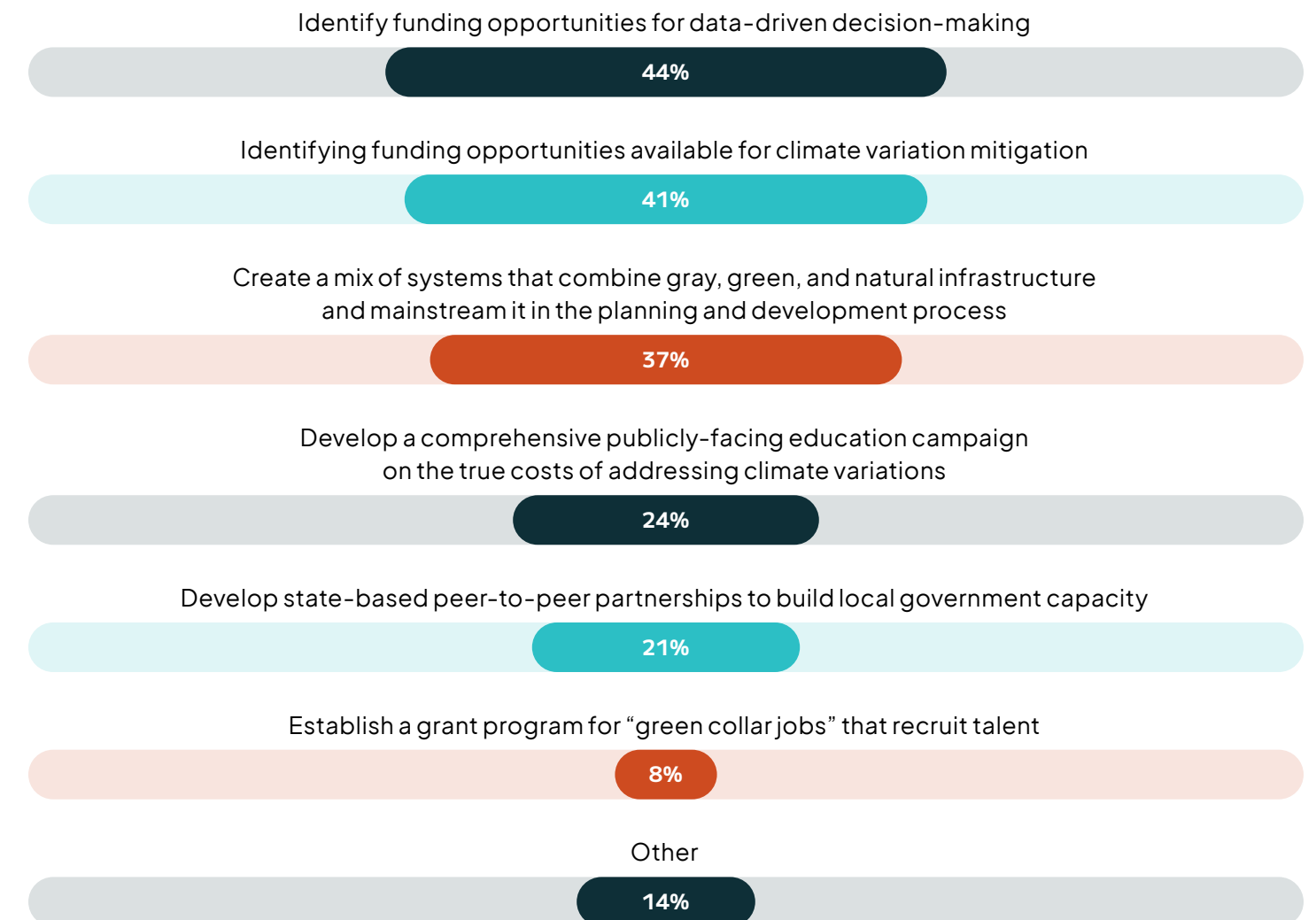
That entails a deep dive into being cognizant of opportunities on the federal, state, county, and local levels. In the stormwater sector, that may entail levying a stormwater utility fee as a special assessment that reflects the true cost of treating and handling stormwater runoff.



Top Strategies for Mitigating Climate Variation Risks

Identifying funding opportunities for both data-driven decision-making and for climate variation mitigation are the top two strategies for mitigating risks due to climate variations.

WHAT ARE YOUR ORGANIZATION'S TOP STRATEGIES FOR MITIGATING RISKS DUE TO CLIMATE VARIATIONS IN YOUR AREA?

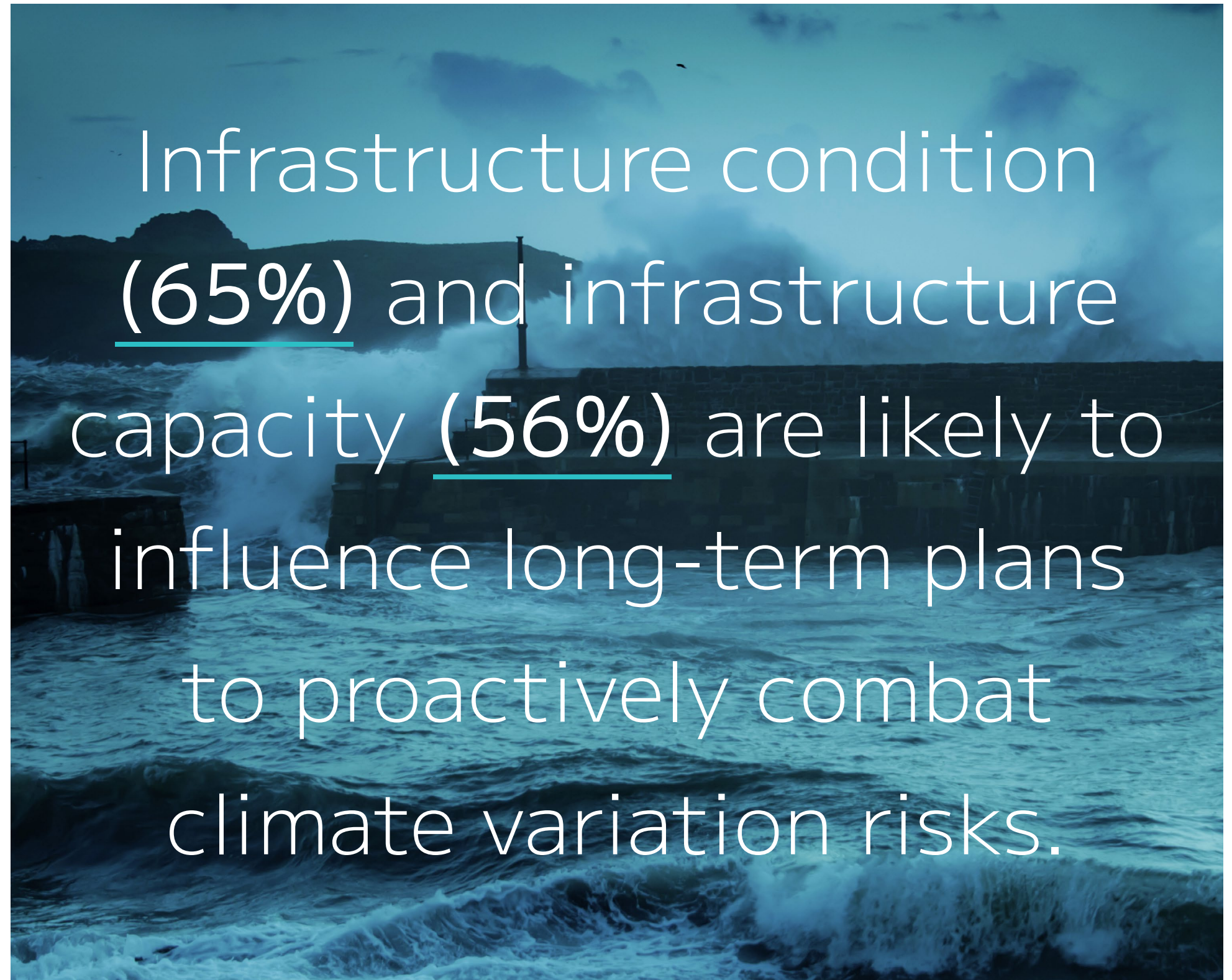


Base: All respondents (n=250); multiple answers allowed.

Respondents are engaged in short-term and long-term plans to combat climate variation risks. In the short term, most respondents are currently strengthening maintenance efforts to mitigate the effects of severe weather events (54%). Federal funding opportunities (38%) and/or infrastructure risk assessment (36%) also are included in short-term plans. Other plans include increased fees or taxes, and general obligation bonds.

Infrastructure condition (65%) and infrastructure capacity (56%) are likely to influence long-term plans to proactively combat climate variation risks.

Getting there will take leveraging technology and mining it for historic and current data for proper infrastructure planning and risk identification. Other strategies holding potential include green infrastructure advocacy and non-stop education efforts through a variety of platforms to increase awareness and education.

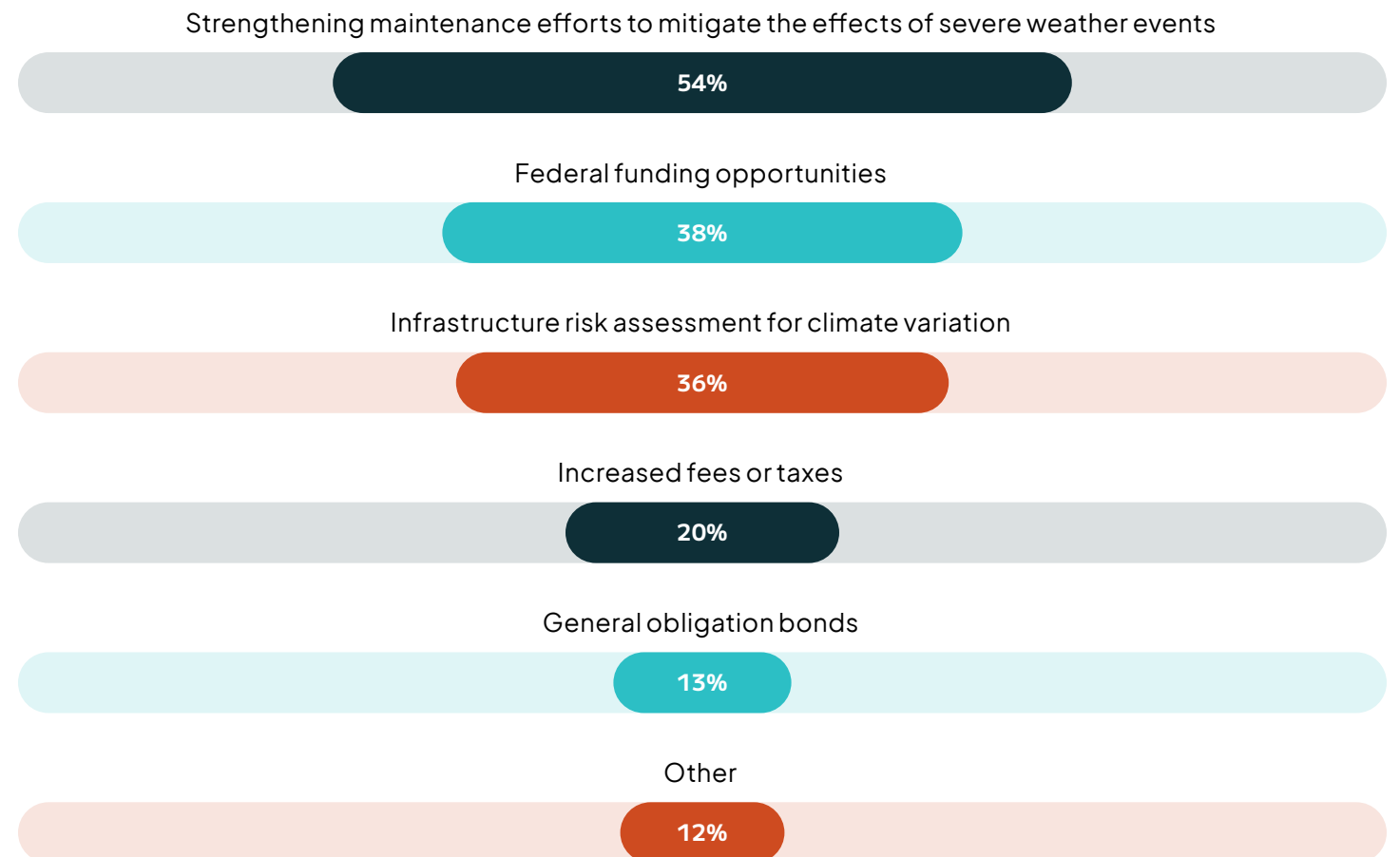




Short-Term Plans to Combat Climate Variation Risks

The majority of respondents are currently strengthening maintenance efforts to mitigate the effects of severe weather events. Federal funding opportunities and/or infrastructure risk assessment are also included in short-term plans for over one-third of respondents.

WHICH OF THE FOLLOWING IS INCLUDED IN YOUR ORGANIZATION'S CURRENT SHORT-TERM PLAN TO COMBAT YOUR AREA'S CLIMATE VARIATION RISKS?



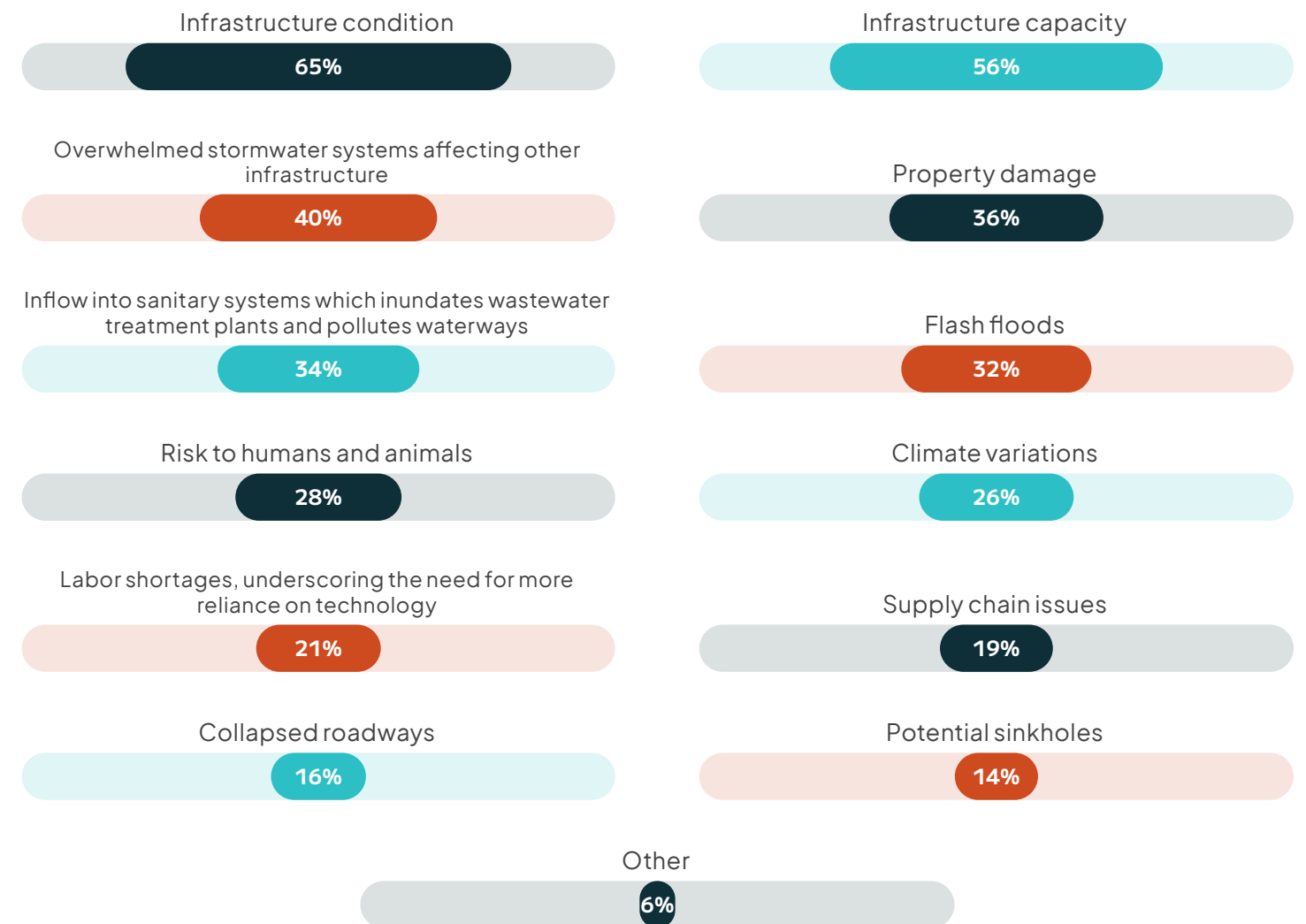
Base: All respondents (n=249); multiple answers allowed.



Elements Influencing Long-Term Plans

Infrastructure condition and infrastructure capacity are likely to influence long-term plans to proactively combat climate variation risks.

WHAT ELEMENTS ARE INFLUENCING YOUR ORGANIZATION'S CURRENT LONG-TERM PLAN TO PROACTIVELY COMBAT YOUR AREA'S CLIMATE VARIATION RISKS?



Base: All respondents (n=256); multiple answers allowed.

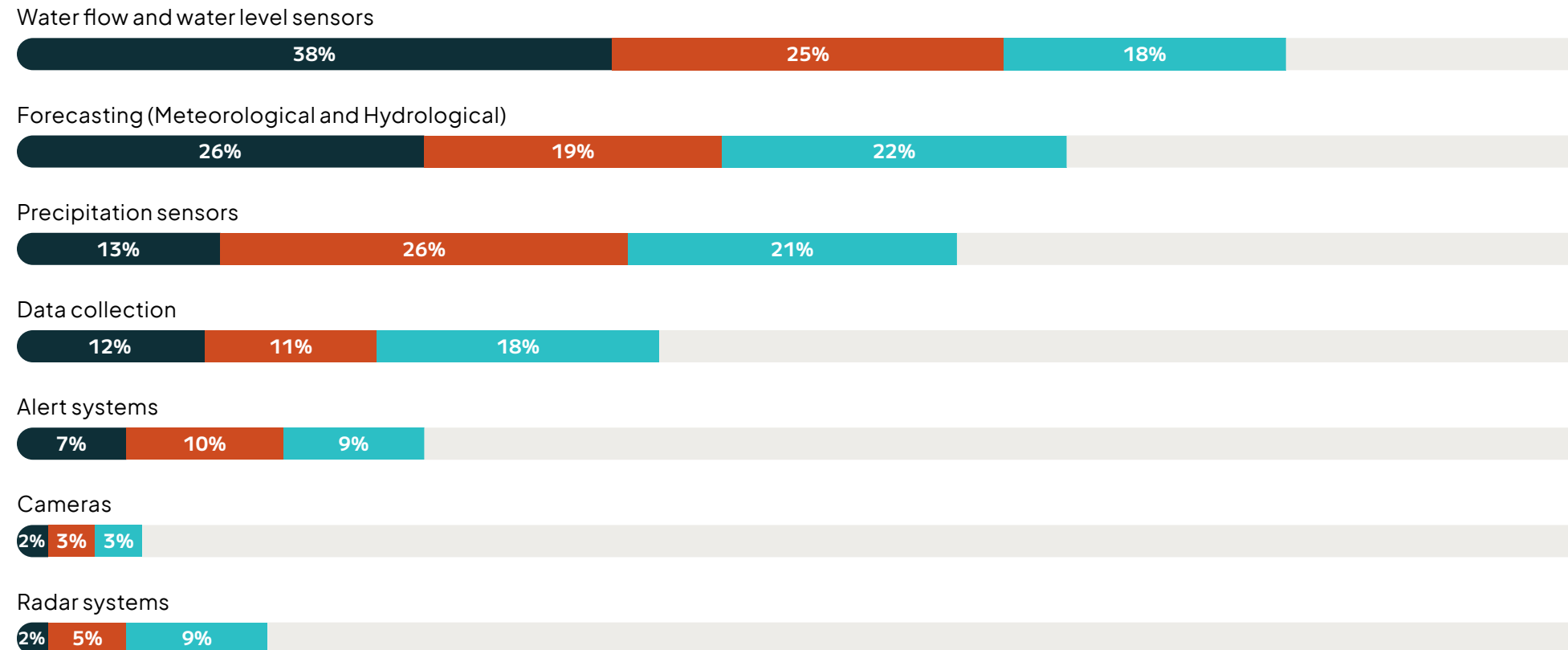
Importance of Weather Technologies

Weather technologies are critical in helping to gather data and respond accordingly. Water flow and water level sensors, meteorological and hydrological forecasting tools, and precipitation sensors are the most critical technologies that respondents currently use or plan to use.

These “smart” technologies help shore up resilience by enabling utilities to respond to climate change, improve efficiencies by minimizing water loss, and enable real-time decision-making.

RANK THE IMPORTANCE OF WEATHER TECHNOLOGIES YOU CURRENTLY USE OR PLAN TO USE, WITH '1' BEING THE MOST IMPORTANT, '2' BEING THE SECOND MOST IMPORTANT, AND SO ON.

● First choice ● Second choice ● Third choice



Base: All respondents (n=237).



Key Takeaways for Short- and Long-Term Water and Stormwater Climate Mitigation



Now is the time to leverage funding opportunities for data-driven decision-making and climate change resiliency, particularly as portions of water and stormwater systems age and population growth introduces more capacity needs.



Without a solid plan, the response to climate change essentially becomes a “pay now or pay more later” situation. While employing innovations and technologies entails upfront costs, the return on the investment will go a long way to shore up condition and capacity and decrease reactive maintenance. The impact on public safety cannot be understated. Much of how stormwater and wastewater are handled is dictated by federal laws such as the Clean Water Act and state and local laws — a failure to adhere to those laws means stiff penalties.



In setting up for the successful mitigation of challenges brought on by climate variation, parties responsible for water and stormwater systems are currently strengthening efforts to alleviate severe weather event consequences while also seeking federal funding opportunities and infrastructure risk assessment.



Weather technologies such as water flow and water level sensors, meteorological and hydrological forecasting tools, and precipitation sensors are the most significant technologies being used proactively or in long-term plans for climate variation mitigation, as infrastructure conditions and capacity are being closely monitored.



Decision-makers and stakeholders have become more cognizant of the need for measuring data through sensors and software, but there remains a gap between ‘knowing’ and ‘doing.’ What is needed going forward is an end-to-end approach from a solution provider that understands the entire event cycle.

About the Survey

On June 21, 2023, Stormwater Solutions and Wastewater Digest sent email invitations to their audiences requesting participation in the survey with reminder mailings sent to non-respondents on June 26, 2023. By July 8, 2023, Endeavor Business Intelligence had received 256 completed responses to the survey. The majority of respondents work for a government organization, including municipal (36%), county (10%), state (8%), and federal (1%). One in four respondents (25%) works for an engineering/consulting firm. Nearly half of respondents indicate their organization is municipally owned and operated. Thirty-seven percent of respondents receive funding from the municipal government tax base, and 34% through utility-based billing. Respondents are located across the United States, with the highest concentrations in North Central (21%), Middle Atlantic (20%), and South Atlantic (18%) states. Respondents serve a variety of population sizes and hold diverse job functions, including engineering and design staff (18%), stormwater management (14%), and engineering and operations management (13%). Principal activities are likely stormwater management (29%) or water and wastewater systems and plants (26%).

About the Sponsor

AEM is combining global technology leaders to empower communities and organizations to survive and thrive in the face of escalating environmental risks. By deploying intelligent sensing networks, operating a secure and scalable data management infrastructure, and delivering high-value analytics through a suite of end-user applications, AEM serves as the essential source for environmental insights. These technologies enable positive outcomes, helping reduce environmental impact and creating a safer world. For more information, visit <https://aem.eco>.

