

# currents



## From Data to Decisions

### An Engineering-Led Approach to Digital Water

PLUS —

Sound Strategies  
for Project Funding

A Practical Guide to  
Building Resilient Utilities

Water's Role in the  
Data Center Boom

Preparing for the Microbial and  
Disinfection Byproducts Regulations

## EDITORIAL

**DIANA LEONARD** (dmleonard@carollo.com)



This issue's feature story highlights CarolloDIGITAL and its role in developing engineering-led solutions to help clients tackle challenges across the water industry—such as making data accessible to a digital twin that helps a Texas client maintain situational awareness throughout its large, complex water distribution system.

We also break down today's competitive funding environment and offer sound strategies to integrate funding support into project delivery to advance projects with less risk and fewer delays, and we look at building a culture of resilience to prepare utilities for unexpected events, one step at a time.

This issue also explores the role of water in the current data center boom and details how a well-designed water strategy can reduce consumption and build trust with clients and the community. Finally, we outline the upcoming microbial and disinfection byproducts regulations, what utilities can expect, and how they can prepare for compliance.

From successful strategies to innovative solutions, we hope you enjoy this issue. Please reach out to me or our authors with your thoughts. We'd love to hear from you!

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### CONTENT EDITOR

Diana Leonard / dmleonard@carollo.com

### COPY EDITOR

Mary Ann Mavrogianes

### GRAPHIC DESIGNER

Silvia Higuera-Backlund

# PATHWAYS TO SUCCESS: SOUND STRATEGIES FOR PROJECT FUNDING

**ERIKA DONAGHY** (edonaghy@carollo.com)

**EMILY PLATT**

**JENNIFER VANIER**

**MADDY NOAH**

**SUSAN CANNON**

Water, wastewater, and stormwater agencies face an enormous investment challenge. The US Environmental Protection Agency's (USEPA) 2025 Report Card for America's Infrastructure estimates that approximately \$1.7 trillion will be needed by 2033 to modernize and improve the nation's aging water, wastewater, and stormwater infrastructure. The scale of this need has created a funding environment that is both active and highly competitive.

In practice, securing outside funding is rarely just about identifying available dollars. It requires aligning project scope, eligibility, delivery approach, schedule, procurement requirements, and reporting—often across multiple programs and agencies. Carollo's funding experts work alongside utilities to navigate this process so they can continue to provide excellent service to their customers.

## What Funding Looks Like Right Now

Despite recent funding reductions at the federal level, significant funding is still available for water, wastewater, and stormwater infrastructure projects. The main source is low-interest loans—offering below-market rates between two and four percent—from the Water Infrastructure Finance and Innovation Act (WIFIA), the US Department of Agriculture, and State Revolving Fund (SRF) programs.

The US Bureau of Reclamation (USBR) is one of the largest sources of grant funding for water infrastructure in the western United States, especially for water efficiency and recycled water projects. Many previously paused USBR funding programs are opening back up for applications this year.

## The Benefits of Integrating Funding Support into Project Delivery

As competition increases and programs evolve, utilities that treat funding as part of project delivery as opposed to an add-on are better positioned to advance critical infrastructure with fewer delays and less risk. Early planning, clear alignment with program requirements, and disciplined follow-through can change funding from a constraint to a catalyst for progress.

# What Utilities Often Underestimate, and Why it Matters

Four issues routinely complicate funding efforts. If not addressed early, they can delay projects, increase costs, or jeopardize funding eligibility. Anticipating them up front helps utilities pursue funding with clearer expectations and fewer surprises.



## Cash flow can make or break a schedule.

Many programs reimburse costs

after they're incurred, so utilities must plan for front-end cash—or risk delays when invoices and disbursements don't align.



## Requirements can affect costs and procurement.

Federal funding

procurement and sourcing requirements can dictate material or contractor selection and impact costs and timelines.



## Competitiveness depends on strict alignment with scoring criteria.

Programs typically

prioritize projects that improve infrastructure condition and resilience. Positioning matters.



## Timing is critical.

Funding can take more than a year from application to agreement. Early

scheduling reduces the chance of mismatched timelines and associated project delays.



## East County Advanced Water Purification Project

The East County Advanced Water Purification (AWP) Project is a multi-agency effort to create a local, reliable, and drought-proof water supply for eastern San Diego County through advanced treatment and reuse of wastewater. Overseen by the East County AWP Joint Powers Authority (JPA), the program is a \$1 billion-plus capital investment delivered through five progressive design-build packages—an approach that adds complexity to the project's execution and funding strategy.

Carollo is supporting the JPA as owner's advisor and has prepared loan and grant disbursement requests, reporting, funding applications, and the final budget approval for multiple packages and funding programs. These include support for a \$383 million California Clean Water SRF loan, a \$388 million WIFIA loan, a \$6 million California Department of Water Resources grant, several USEPA community grants, and an additional WIFIA loan application. Managing multiple funding sources with overlapping funding timeframes and eligibility requirements has added to the overall funding complexity. As this project has evolved, Carollo's services have adapted to help secure funding for each portion of the project at the appropriate time.



## City of Winter Springs Water and Wastewater System Improvements

Carollo provided Winter Springs, Florida, with engineering and funding application support for an array of projects. These include:

- Receipt of \$1.17 million in grant funds from Florida's FY25-26 budget for a valve addition, a reclaimed water main extension, and potable water tray aerator improvements.
- Funding applications from Florida's FY26-27 budget for water treatment plant improvements to secure \$5.4 million in low-interest SRF loans for both its East and West Wastewater Treatment Facilities.
- Help securing approximately \$19.167 million from Florida's Department of Environmental Protection as part of a Supplemental Appropriation for Hurricanes Helene and Milton to disaster-affected areas.
- Help securing an additional \$600,000 for stormwater improvements for the East Wastewater Treatment Facility through the Nonpoint Source Management Program.

# HOW RESILIENT IS YOUR UTILITY?

## A Practical Guide to Understanding Where You Stand and How to Move Forward

**SHAWN CORRIGAN** (sccorrigan@carollo.com)

Operational resilience is the ability to mitigate, prepare for, react to, and recover from unexpected events with minimal impact to normal operations. It's becoming increasingly important, especially as hazards become more prevalent, costly, and likely to stem from supply chain disruptions or staffing constraints. However, resilience isn't achieved through a single project or investment. Instead, it is the culmination of many coordinated decisions across planning, engineering, operations, and leadership.

If you're among the thousands of utilities in the United States that serve more than 3,300 people, you've not only completed a risk and resilience assessment (RRA) and an emergency response plan (ERP), but you've also recertified (or are recertifying) those plans. These are important steps. It's one way that your utility has identified risks and vulnerabilities and has developed a plan to respond to emergencies. It's important, though, to treat this compliance as a milestone, not a destination.

Building and managing a culture of resilience might seem like a difficult mountain to climb. But taking even a few steps in the right direction can reverberate positively across a utility and its operations.

What follows is a practical roadmap for reaching the next goalpost on the road to resilience, no matter where your utility is starting from.

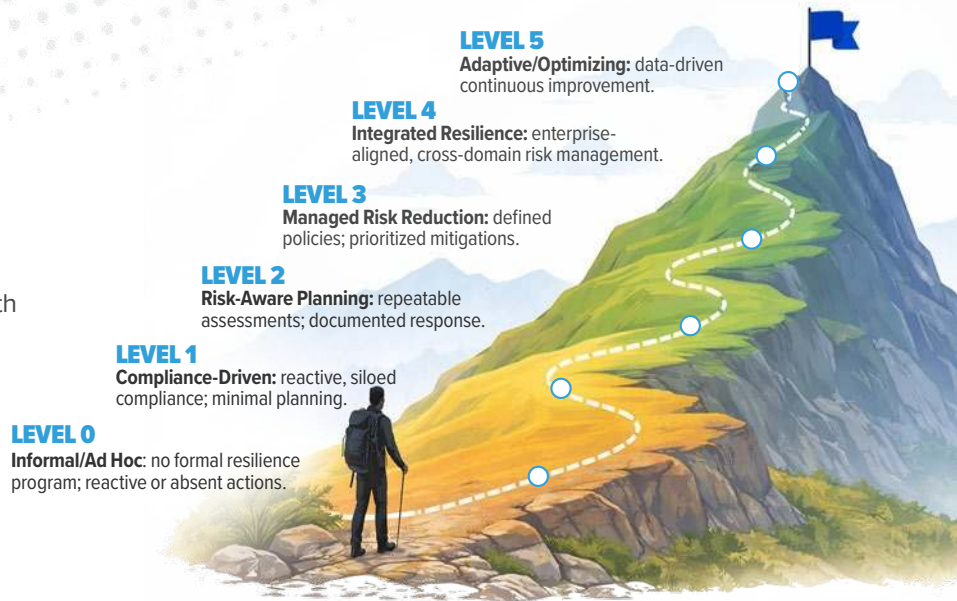


## The Stages of Resilience

This guide uses a resilience maturity model, which recognizes that resilience develops gradually. Growth on this path can be categorized into stages.

- **Level 0 - Low Resilience: Informal/Ad Hoc.**  
In this stage, utilities often address operational risk informally. They don't tie risk to capital improvement and rely on individual experience rather than documented procedures during emergencies.
- **Level 1 - Early Resilience: Compliance-Driven/Reactive.** Here, utilities begin to identify and prioritize hazards and develop compliance-based response plans, but they remain reactive to operational risk and do not revisit their resilience plans until required to.
- **Level 2 - Risk-Aware: Focused on Cataloging and Planning.** Here, utilities identify single points of failure, maintain a list of risks across organizations and disciplines (not just critical infrastructure, but also key business functions), and develop scenario-specific plans and procedures.
- **Level 3 - Prepared: Prioritized on Managed Risk Reduction.** In this stage, utilities actively work to reduce vulnerabilities through preparation and mitigation engineering. Examples include installing backup generators at critical pump stations, adding flood protection to low-lying facilities, or strengthening cybersecurity controls. Exercises become routine, and lessons learned inform future planning.
- **Level 4 - Active: Marked by Enterprise-Wide/Integrated Resilience.** Here, utilities integrate resilience into enterprise management processes, such as capital improvement plans that reflect operational risk priorities and cross-functional teams that coordinate infrastructure protection and emergency planning. Mitigation and preparedness become embedded in how the organization operates.
- **Level 5 - Adaptive: Driven by Learning, Growing, and Optimizing.** In this stage, utilities constantly adapt and optimize their plans, and implement change based on new experiences and new information.

Utilities move through these stages as they build on their previous work. The maturity model focuses on how consistently utilities incorporate resilience across different levels of decision-making, rather than simply measuring how many planning or compliance projects they have completed.



## Where Most Utilities Are Today

Your utility is probably already on the path to resilience. Regulatory drivers like America's Water Infrastructure Act (AWIA) have compelled drinking water utilities to prepare and certify RRAs and ERPs that identify hazards such as flooding, cyber intrusions, and seismic events. While wastewater utilities are not yet governed by AWIA, they are often driven by state regulations, discharge permit conditions, or local emergency planning requirements to develop strong operational awareness. Other risk, resilience, and sustainability projects, like asset management assessments, climate adaptation studies, and hazard and operability studies, are also important contributors.

This means that regulated drinking water utilities and many wastewater utilities have reached at least the early resilience stage, and many have reached higher levels of maturity.

## Progress Happens One Step at a Time

Your utility doesn't have to climb mountains to become more resilient. Achievable steps might look like:

- Convening leadership to review the findings of an RRA and briefing a governing board.
- Considering cost to benefit during planning and funding discussions.
- Implementing a project tied to a high-priority risk, like installing a generator at a critical pump station.
- Integrating operational risk considerations into capital planning.

The more actions you take, the more preparedness becomes ingrained in your culture and decision-making. These steps allow your utility to scale the mountain of resilience one step at a time.

# From Data to Decisions

## An Engineering-Led Approach to Digital Water

JENNIFER STEFFENS, PE (jsteffens@carollo.com)  
SHAWN DENT, PE

Today utilities are collecting more data than ever—from supervisory control and data acquisition (SCADA) systems, geographic information systems (GIS), hydraulic models, and asset management platforms. But in practice, **more data does not always lead to more clarity**. Digital technologies are often deployed without a clear connection to how utilities actually plan, operate, and respond. Information exists across multiple platforms, requires specialized expertise to interpret, or arrives too late to support day-to-day decisions. Too often, digital water initiatives fall short.

The challenges driving this gap are familiar: aging infrastructure, increasing regulatory expectations, workforce transitions, and rising operational complexity. The tools exist. What's often missing is an approach that connects them to the decisions utilities actually need to make.

“

*The best digital solutions are integrated into engineering workflows, not just layered on top.”*

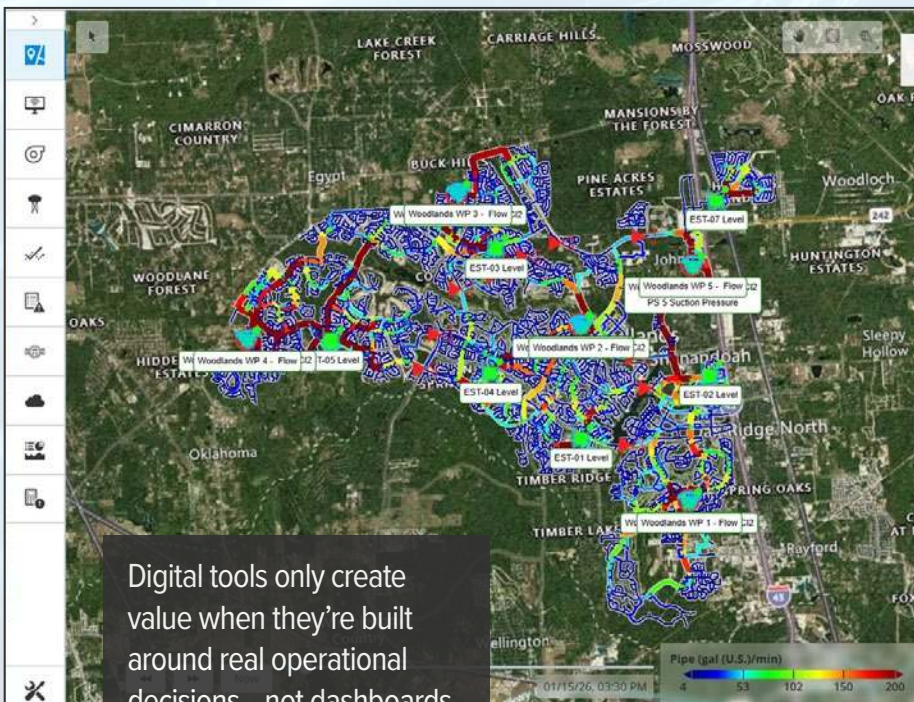
Jennifer Steffens  
CarolloDIGITAL Director



### A Practical Point of View on Digital Water

Digital water succeeds when it starts with engineering. Water systems are physical, regulated, and risk-sensitive. Models must reflect how systems actually operate. Analytics must account for hydraulic reality. And the outputs must be usable by the people responsible for performance and compliance. That is why digital solutions should begin with the problem the utility is trying to solve, whether that is optimizing treatment, improving asset management, or gaining better visibility across a complex system. The digital tools come after the engineering foundation is in place.

When technology is treated as the goal instead, digital initiatives tend to stall. Dashboards may be built and data integrated, but organizations still struggle to answer basic questions: What is happening right now? What is likely to happen next? What should we do about it? An engineering-led approach keeps the focus on outcomes, not tools.



Digital tools only create value when they're built around real operational decisions—not dashboards for dashboards' sake.

### Engineering-Led, Not Software-Led

CarolloDIGITAL begins every solution with the utility's operational context and decision-making needs, not a technology platform. Digital tools can then be applied throughout the life of its systems, from long-range planning and asset risk evaluation to real-time operations.

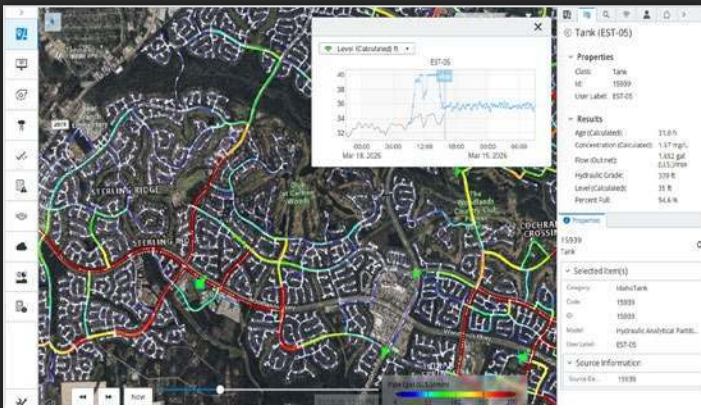
The focus is on helping utilities make better planning, investment, and operational decisions with the information they already have. The result is a more connected view of system performance and risk—where decisions in one area inform and strengthen the others.

# Digital Solutions in Practice

## Thinking Big in Texas

The San Jacinto River Authority (SJRA) operates a large, complex water distribution system that includes five treatment plants, six elevated storage tanks, and dozens of sensors throughout the network.

At this scale, it's difficult to maintain real-time situational awareness through traditional monitoring alone. Staff needed earlier warnings of anomalies like pipe breaks and water quality issues, as well as access to hydraulic and asset information, without having to navigate multiple specialized systems.



*SJRA managers, engineers, and operators can use the web-based digital twin to make data-driven decisions that optimize system performance.*

Carollo built the foundational elements to make data accessible to a digital twin for SJRA. This digital twin integrates hydraulic modeling, GIS asset data, and real-time SCADA information into a single environment. Near-real-time sensor readings (flows, pressures, chlorine residuals, pump operations, and storage levels) are pulled every 15 minutes and dynamically linked into the platform. Further, the digital twin's users include both operators and other SJRA staff, adding to the platform's versatility.

At the core of the system is a continuous comparison between measured sensor data and modeled system behavior. When a deviation between the two exceeds defined thresholds, operators are alerted to potential upset conditions, such as pipe breaks, earlier than traditional monitoring would allow.



*The tool can also examine what-if scenarios, such as identifying which customers will be affected when certain valves are closed within the system.*

The platform also models chlorine residual concentrations across the distribution network, enabling staff to identify areas where levels may trend toward unacceptable conditions before a water quality issue develops.

The digital twin's development focused on usability. Through web-based dashboards, users can view key system information without relying on specialized modeling tools or switching between multiple platforms.

The digital twin aligns system operation with how staff works and makes decisions—giving SJRA a practical tool that supports continuous monitoring, predictive analysis, and data-driven decision-making, not only for day-to-day operations, but also for longer-term planning and engineering evaluations.

# WATER THE OVERLOOKED CONSTRAINT IN THE AI DATA CENTER BOOM

JOHN RYDZEWSKI, PE (jrydzewski@carollo.com)  
JACK MALACE, PE

**As gigawatt-scale projects surge across the US, “doing water right” can determine whether communities see opportunity—or risk.**

Scrolling through LinkedIn, it feels like a new gigawatt-scale data center project is announced somewhere in rural America every week. Texas, Ohio, Oregon, Virginia, Oklahoma—the list goes on and on. Billions of dollars are being invested in power, semiconductor manufacturing, and real estate, all in the name of artificial intelligence.

Between 2025 and 2030, capital spending to enable AI infrastructure, including data centers, semiconductor manufacturing, power plants, water infrastructure, and their supply chains is expected to reach roughly \$5 trillion, or around 3 percent of gross domestic product. The last time the country invested in infrastructure at that scale was during the railroad boom of the 1800s. Then, railroads reshaped commerce, accelerated industrialization, and permanently altered how the nation functioned. Today’s AI-driven buildout may not look like steel rails stretching west—but its economic and societal impact could be just as transformative.

## A Surge of Investment—and Rising Community Concern

In the communities where data centers are proposed, enthusiasm is often mixed with skepticism. In 2025, an estimated \$65 billion in data center investments were delayed or abandoned due to local opposition. Among the most common concerns are water use, water and air quality, and power demand, including potential impacts on local infrastructure, user rates, and the environment. Because water is integral to both cooling systems and power generation, these concerns are often interconnected.

Water decisions shape data center site selection, permitting, community trust, and long-term operating costs and should be addressed early in project planning.

For some rural communities, the skepticism is deeply rooted. Many have lived downstream of heavy industry for decades and are wary of new development that could stress already constrained infrastructure or introduce additional environmental risk. Others question whether local ratepayers should subsidize water, wastewater, and power system upgrades that primarily serve private facilities. In response, some states and municipalities are considering moratoriums or outright bans on new data center construction.

These concerns cannot be dismissed. They are rational, experience-based, and increasingly influential in project outcomes.

## Cooling Technology is Reshaping Water Demand

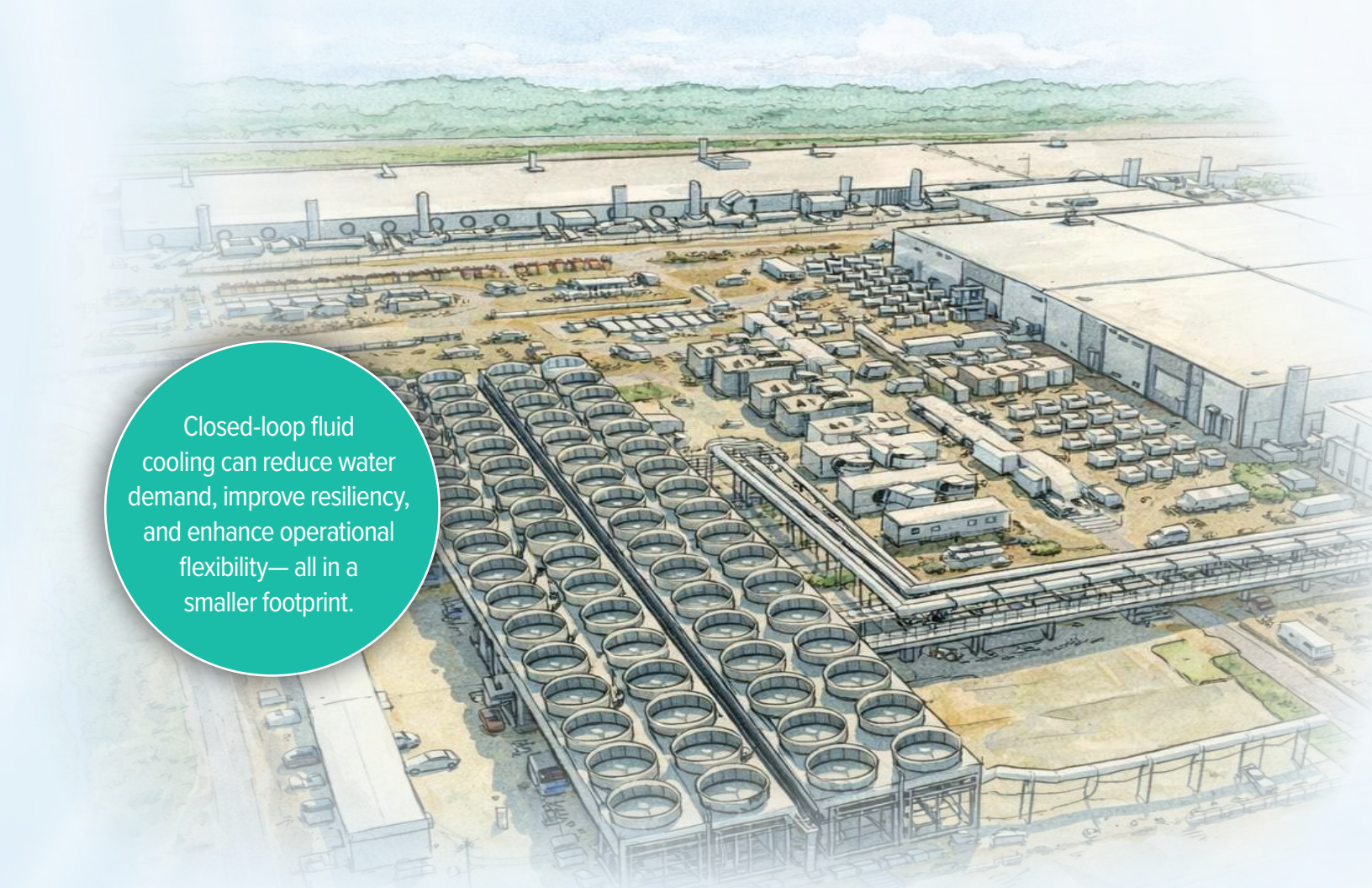
As computing density increases, equipment becomes more complex, and facilities expand in square footage, traditional air cooling is no longer sufficient or economical.

Older data centers commonly relied on water-intensive evaporative cooling towers. Newer facilities increasingly use closed-loop fluid coolers, which function much like automobile radiators, moving large volumes of air over large surface areas to dissipate heat.

## The Three-Legged Stool: Water, Power, and Land

Data centers ultimately rely on three foundational resources: water, power, and land. Public discourse tends to focus on land acquisition and grid capacity. Water, by contrast, is often treated as a secondary issue until late in the project lifecycle, when it becomes an expensive and highly-visible constraint.





Closed-loop fluid cooling can reduce water demand, improve resiliency, and enhance operational flexibility— all in a smaller footprint.

As a result, many owners are moving toward these closed-loop strategies for most of their cooling needs, while using limited evaporative cooling only during the hottest days of the year. Liquids are far more effective than air at carrying heat, enabling higher performance in smaller footprints.

Cooling systems also raise questions about chemical use and environmental risk. In reality, the treatment approaches used in closed-loop systems closely resemble those long employed in hospitals, universities, and advanced manufacturing facilities. By adopting proven practices, such as tighter containment, automation, and monitoring, chemical and environmental risks can often be reduced significantly.

Much of the industry is transitioning to closed-loop strategies for the vast majority of cooling needs.

## What “Doing Water Right” Really Means

New construction is only part of the story. Thousands of existing data centers still rely on evaporative cooling towers, and many owners are actively seeking ways to reduce water consumption and improve resiliency.

In 2025, Carollo completed a cooling tower blowdown reclaim project for a data center client focused on maximizing water use while minimizing freshwater withdrawals. The project demonstrated that existing facilities can often be retrofitted using commercially available technologies, resulting in reduced water demand and improved operational flexibility.

A well-designed water strategy does more than reduce consumption; it builds trust. Doing water right means:

- Minimizing total and peak-seasonal water use.

- Planning for startup and upset conditions.
- Protecting source water and downstream water quality.
- Being transparent with impacted communities.
- Aligning economic development with environmental outcomes.

Importantly, water impacts extend beyond the data center fence line. Power generation can carry significant water implications of its own, reinforcing the need to evaluate water and power together.

When water is done right, data centers can operate with minimal water resource impacts and a clearer path to community support. When it's not, water becomes a public relations crisis and a reason that projects are delayed or built elsewhere.

# MICROBIAL AND DISINFECTION BYPRODUCTS REGULATIONS

## Paving the Way for Efficient Compliance

**ALAN ROBERSON, PE** (aroberson@carollo.com)  
**CAROLINE RUSSELL, PHD, PE**  
**KATHRYN LOPEZ, PHD**

Given the ongoing regulatory activity in the water industry, it's hard to imagine another major drinking water rule on the horizon. But the US Environmental Protection Agency (USEPA) is planning revisions to the microbial and disinfection byproducts (MDBP) regulations.

MDBPs are unintended chemical compounds formed when disinfectants like chlorine or ozone react with organic matter in water. Proposed regulatory changes are anticipated in the summer of 2027, with finalization in mid-2028, and compliance expected in mid-2031.

Carollo is focused on helping utilities prepare for these changes with minimal disruption to their operations. While the scope of revisions is still evolving, utilities can benefit from understanding these potential changes now and evaluating how they could affect distribution system operations, staffing, and capital planning in the future.

### What Changes are Most Likely?

The USEPA is using three of the thirteen recommendations from the National Drinking Water Advisory Council (NDWAC) MDBP final report as a starting point for these revisions. Given the data gaps in the other ten recommendations, it's likely to focus on revisions to secondary disinfectant residuals, compliance monitoring, and storage tank inspections.

The USEPA is likely to focus on revisions to secondary disinfectant residuals, compliance monitoring, and operational oversight.



SCAN FOR A DETAILED SUMMARY OF USEPA'S POTENTIAL MDBP REVISIONS.



SCAN TO VIEW NDWAC'S MDBP FINAL REPORT.

### LIKELY MDBP REGULATION CHANGES

| REGULATORY ENDPOINT                                    | CURRENT REGULATIONS                                              | LIKELY REVISIONS                                                                                                                                                   |
|--------------------------------------------------------|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Minimum secondary disinfectant residual                | Detectable (greater than 0) in 95 percent of compliance samples. | Numeric residual in 95 percent of compliance samples, likely 0.2 mg/L for free chlorine and total chlorine.                                                        |
| Residual compliance sampling locations                 | Representative of the distribution system.                       | Revision of secondary disinfectant compliance sampling plans to include locations currently used for DBP compliance.                                               |
| DBP monitoring at entry points for consecutive systems | No regulatory requirement.                                       | Revision of compliance sampling plans to include monitoring for total trihalomethanes (TTHMs) and haloacetic acids (HAA5) at entry points for consecutive systems. |
| Storage tank inspections                               | No regulatory requirement.                                       | Periodic inspection and maintenance of finished water storage tanks.                                                                                               |

What Other Issues are Under Consideration?

**Range of numerical residuals.** For the minimum secondary disinfectant residual, USEPA could propose a range of numerical residuals, or it could propose different numerical residuals for free chlorine and total chlorine.

**Range of numerical percentage for compliance.** The agency could also propose a range of percentages for the minimum secondary disinfectant residual (> 95 percent).

**New consequences for repeat low residuals.** USEPA could propose operational consequences for repeat low residuals at a single compliance sampling location, even if the system meets the percentage requirement. Low-residual events could trigger required actions, such as flushing or operational adjustments, and may lead to non-compliance if they recur.

**Nitrification action plans for chloramines.** The agency is also considering requiring nitrification action plans for systems that use chloramines. These plans would likely need to be approved by primary agencies and would require DBP compliance sampling whenever free chlorine is used, such as during chlorine conversion periods.



SCAN FOR GUIDANCE ON NITRIFICATION ACTION PLANS.



SCAN TO REVIEW STRATEGIES TO MAINTAIN SYSTEM RESIDUALS.

What Changes are NOT Expected?

Revisions to existing maximum contaminant levels (MCLs) or any new MCLs for additional DBPs are not expected in the proposal in 2027 due to gaps in health effects, occurrence, and treatment data.

Early Actions Can Prepare Utilities for Compliance

Although the proposed revisions are a few years away, utilities can begin preparing by:

- Evaluating current distribution system residual performance.
- Identifying areas vulnerable to low residuals or DBP formation.
- Reviewing staffing, sampling, and data management capacity.
- Considering whether modeling or planning tools could help assess future compliance scenarios.



LOOKING AHEAD

While the scope of the MDBP revisions is still evolving, the direction is clear: greater emphasis on numeric residuals, expanded monitoring, and proactive distribution system management. Utilities that begin evaluating these potential impacts now will be better positioned to adapt efficiently once the proposed rule is released in 2027.

EARLY ACTIONS UTILITIES CAN CONSIDER

| REGULATORY ENDPOINT                                    | ACTIONS AND EVALUATIONS TO CONSIDER                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Minimum secondary disinfectant residual                | <ul style="list-style-type: none"><li>■ Analyze ongoing disinfectant residual compliance data to determine potential problematic sampling sites with residuals between zero and 0.2 mg/L.</li><li>■ Evaluate whether operational changes will achieve compliance for the problematic sampling sites.</li><li>■ Evaluate whether booster disinfection stations would be required in portions of the disinfection system.</li></ul> |
| Residual compliance sampling locations                 | <ul style="list-style-type: none"><li>■ Collect residual samples at some DBP compliance sites and determine how many are between zero and 0.2 mg/L.</li><li>■ Evaluate the number of additional residual compliance sampling locations and potential workload increases for sampling, reporting, and data management.</li></ul>                                                                                                   |
| DBP monitoring at entry points for consecutive systems | <ul style="list-style-type: none"><li>■ Collect DBP sampling at some of the entry points to determine if the consecutive system can stay in compliance.</li><li>■ Evaluate whether operational changes will achieve compliance for the consecutive systems.</li></ul>                                                                                                                                                             |
| Storage tank inspections                               | <ul style="list-style-type: none"><li>■ Review existing tank inspection records to assess the past history of the exterior and the conditions and extent of past tank repairs.</li><li>■ Evaluate the increased costs for regular exterior and interior inspections and, depending on what is found, increased costs for tank repairs.</li></ul>                                                                                  |

**Innovation**  
is just a *buzzword*.

A high-speed photograph of a smooth, brown stone hitting a body of water. The impact has created a large, dynamic splash with water droplets frozen in mid-air. The background is a soft-focus sunset with warm orange and yellow light filtering through dark silhouettes of trees. The entire scene is reflected in the calm water in the foreground.

**Until it has proven impact.**

Talk is easy. Impact is earned. At Carollo, we approach innovation as something to be built, tested, and proven in the field, not just imagined. From breakthroughs like XBAT, Blue Plan-It®, and I-FLOAT® to integrated AI/ML solutions, we focus ingenuity where it matters most: solving water challenges for our clients and communities. The result is progress you can measure in real terms—protecting public health, strengthening ecosystems, and delivering resilience that lasts. **That's Carollo Innovation.**

800.523.5826 / [carollo.com](https://www.carollo.com)

