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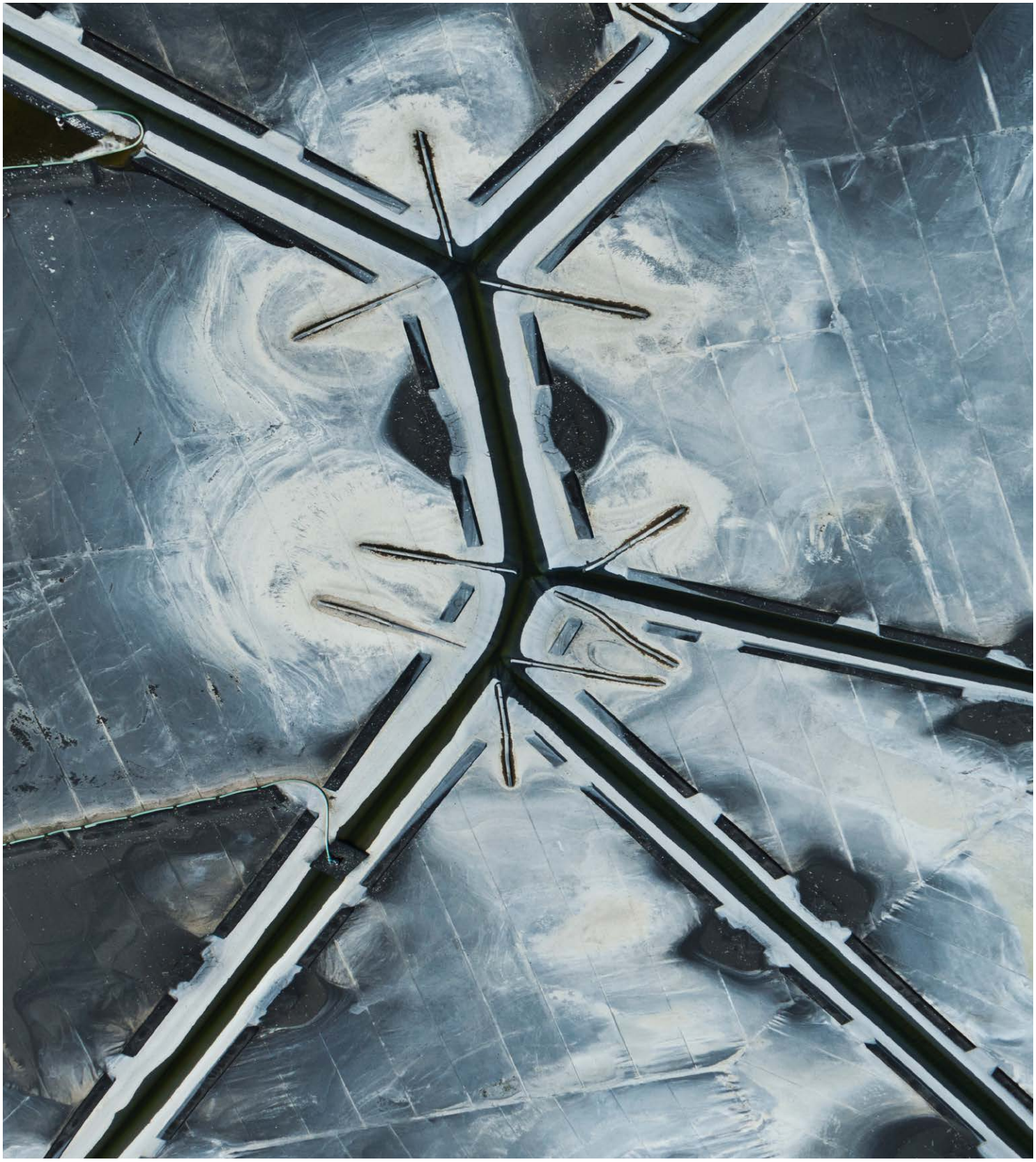
Whitepaper



Is the Water Sector Ready for AI?

Evaluation of the water sector's readiness

By **Andrea DuMont** (Water, Bentley)

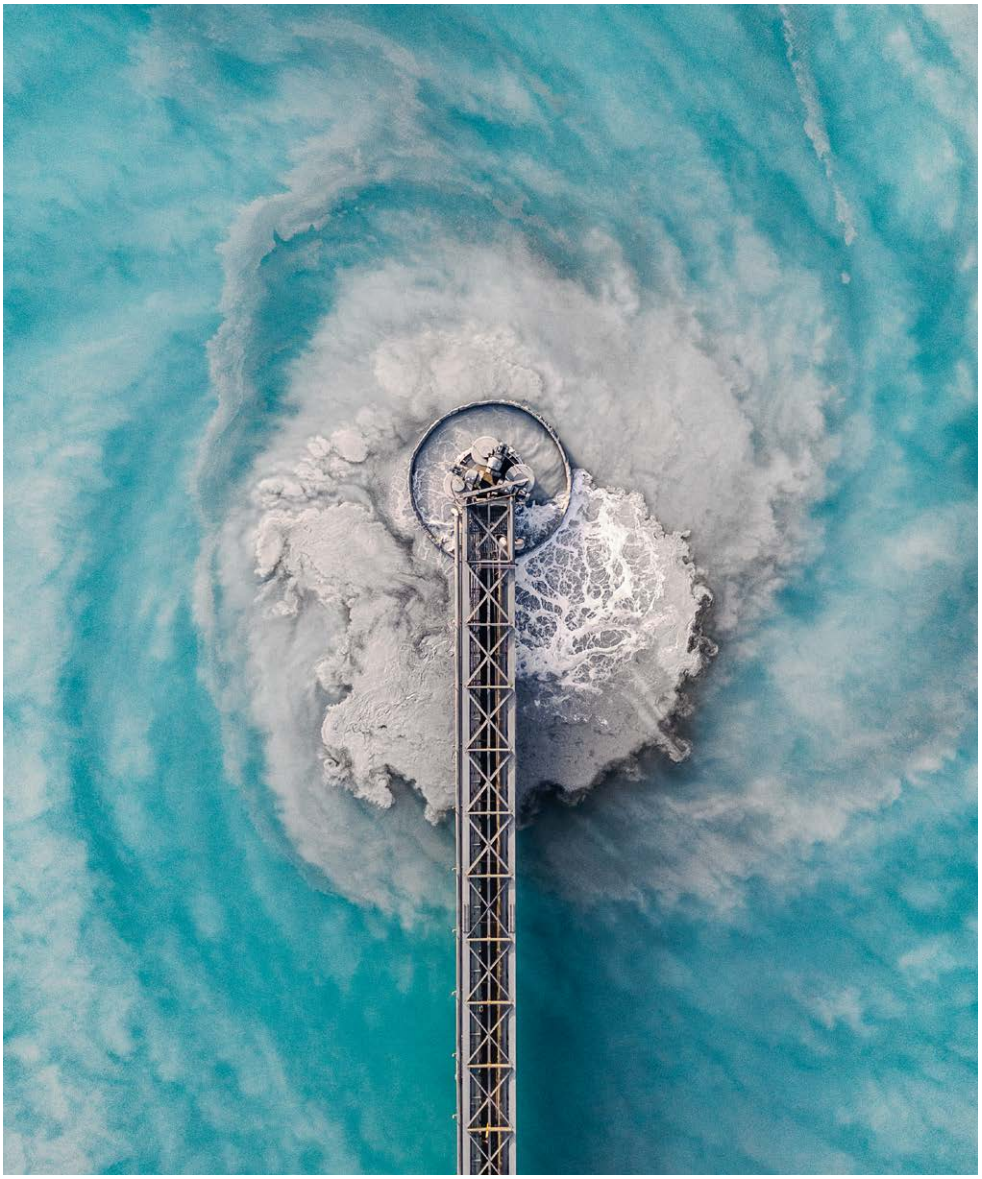
Executive summary

Artificial intelligence represents a transformative opportunity for the water and wastewater infrastructure sector. While predictive modeling solutions have been employed for decades, paving the way to AI integration, recent advancements in digital twins—as well as Internet of Things (IoT) integration and analytics—have broadened the potential of AI for a wide range of water infrastructure organizations.

Despite these promising developments, a new study finds that the water sector's adoption is uneven, with less than 50% primed to take advantage of digital and AI solutions. Survey results revealed that the largest and smallest organizations were more ready for change and that water was in-line with other infrastructure sectors. Water professionals are curious and open but cautious about AI adoption. The biggest barriers to adoption are people and processes, including organizational complexity, workforce resistance, cybersecurity concerns, and the perceived costs of implementing new technologies.

Utilities have addressed these challenges through advanced digital solutions, which demonstrate measurable successes, including increased operational efficiency, cost savings, and sustainability improvements. Prominent examples of successful implementation include Yuba Water Agency's improved dam safety monitoring, Sabesp São Paulo's reduction in wastewater overflows, the EchoWater Project's cost-effective treatment plant construction, and PUB Singapore's advanced anomaly detection capabilities for water supply.

By accelerating adoption, fostering internal champions, and integrating comprehensive digital solutions, organizations can significantly improve their operational and environmental outcomes, ensuring resilient and sustainable infrastructure management into the future.



Introduction

> “The future is already here—it’s just not evenly distributed.”
>
> -William Gibson

Science fiction fans will know the quote on the left. Gibson was talking about the inequity of technology and its prevalence among different classes of people. It alludes to the reality that not all innovations can be accessed in the same way. However, we are starting to see that AI is technology that disrupts this reality.

One finding from a U.S. Bureau of Labor Statistics study on engineering roles is that 33% of new roles are unfilled (Kodey et al., 2023). On top of that, the workforce is aging. These findings highlight a significant gap in the workforce, indicating a need for technological solutions that can augment human resources and streamline operations. Coupled with more data than ever before, professionals are finding new ways to design and operate water infrastructure using AI. Some notable examples include AI for identifying hard or unsafe to inspect locations like dams (DiMatteo 2022) or embracing deep machine learning to identify leaks in a water distribution network (Bentley 2025). There are also plenty of applications in other sectors that can be applied to water projects, such as the use of AI and machine learning (ML) to recreate existing P&IDs (Bentley 2022) at water and wastewater treatment plants.

The introduction of AI, digital twins, and IoT technologies presents an opportunity to bridge the workforce gap by automating routine tasks and enhancing decision-making processes.

Water professionals have been using AI for over 30 years

AI is not new to the water sector. Predictive technology has been used since the late 1980s. In fact, one of the first examples of this is the Darwin Calibrator predictive modeling (now known as OpenFlows™). Over the decades, the integration of AI has evolved significantly. Notably, online search trends for “water” and “AI” have increased 400% since 2023 (Google Trends 2025). This surge in interest sets the stage for an openness to explore new ways of working with AI technology.

Recognizing this potential, Sabesp, Brazil’s largest sanitation company, has successfully reduced sewer overflows and backflows by incorporating AI-embedded predictive hydraulic modeling into a digital twin. In this case, AI is used to forgo the tedious task of calibrating models, but still allows the engineers to have oversight on final decisions by presenting various alternatives (Bentley 2025-2). The coupling of existing AI technology with newer workflows demonstrates how the industry is evolving in more sophisticated ways in recent years.

But there are still concerns despite growing use

In a Bluefield Research study conducted on users worldwide on behalf of Bentley, water modelers were asked questions alluding to their comfort level with AI (Bluefield 2025). Respondents had positive reactions and experience in their personal life with AI-embedded solutions who referenced using ChatGPT or Microsoft Copilot to support administrative tasks (Bluefield 2025). However, in almost all the interviews, respondents said they were reluctant to let AI manipulate water models directly and preferred to see solutions that were not directly tied to decision-making. In particular, they had concerns that new professionals would not have the necessary engineer’s intuition if they had not dedicated significant time to model development.

In line with this finding are other examples of AI tools that support analyses but not final decision-making. HDR employed a combination of off-the-shelf products and in-house software to help locate changes to the condition of Oroville Dam. The digital twin federated different types of data from UAV surveys to traditional rope-access inspections and coupled it with AI/ML to perform predictive analyses for the geotechnical and structural condition of the dam (Camus 2025). The algorithm automatically identifies cracks and spalls, which helps the decision maker improve their targeted maintenance and scheduling, ensuring dam safety.

Similarly, the water supply sector has also made use of anomaly detection. Singapore’s National Water Agency, PUB, is at the forefront with their program to reduce water loss and improve water distribution (Bentley 2025). PUB partnered with Bentley to create a solution that applies hydraulic models recalibrated daily with operational data and adaptive AI technology for leak localization, data assimilation, and deep machine learning. It is now being tested with early adopters for review as an off-the-shelf solution.

AI-powered digital twin technology helped monitor Oroville Dam’s structural health, automatically detecting cracks to guide smarter, safer maintenance decisions. Image courtesy of HDR.

Digital solutions for water

Is the water sector ready yet for AI?

A 2023 poll conducted by ThoughtLab on behalf of Bentley surveyed 500 infrastructure owners and consultants across six sectors in five countries (ThoughtLab 2023). The study's original conclusions were that the most technology-progressive organizations share data with different stakeholders and improve analysis by integrating with other information, such as asset management and digital twins (ThoughtLab 2023).

When evaluated for the water sector, this study revealed that a 70% majority of water and wastewater professionals believe they are on track for "viability in 10 years of meeting stakeholder demands without changing the current approach" (ThoughtLab 2023). And further, that "influence of social license (i.e., need to communicate to stakeholders) in driving adoption" had the single most significant influence on their technology adoption, exceeding operational efficiencies, better technology, and regulatory pressures. Therefore, water professionals are confident in their current systems with little to suggest major changes, despite the challenges in the sector.

People, not technology, are influencing the readiness for AI and technology adoption. Insights derived from AI are valuable only when an organization is sufficiently prepared to leverage these insights. Organizations that are not fully or predominantly digitally transformed are inadequately positioned to benefit from AI capabilities.

Using the data from this study, an evaluation was completed to understand the level of digital transformation of an organization. In this evaluation, it was assumed that the more an organization was able to benefit from automatic collection of data, the more likely that they are to be digitally transformed through their people and processes. Thus, automated data collection was used as an indicator for preparedness for digital transformation, a precursor to AI and innovative technologies.

Of the water, wastewater, and dam organizations (including consultants and asset owners), not even one-half (46%) appeared ready today to take on these new fast-paced technologies. Respondents, ranging from technical staff to CEOs, were optimistic that just over two thirds (68%) would be digitally transformed in two years.

The fear of change still holds back the water sector

Evaluation of the write-in responses for water professionals suggested that the real blocker to digital transformation may be the people and processes, not the technology (ThoughtLab 2023). Because people can be barriers to technology adoption, it is important to not just assess an organization's ability to integrate new technology through their level of digital transformation, but also the barriers to adoption of new technologies.

The chart below is the analyzed categorization of the responses. Some industries, such as dams, showed that the biggest reason to continue with manual collection was to supplement with hands-on human expertise, where operational knowledge and flexibility are important to being agile during an emergency situation.

However, for water and wastewater categories, the largest contributing factors for manual monitoring was the perception that it lacks quality, as well as the lack of capacity to culturally adapt, primarily with organizations that were less than 100 employees.

Of the concerns raised, these ones were generally tagged as "neutral" sentiment, as opposed to "positive" or "negative." Noted concerns ranged across job roles and included "potential for job displacement and unemployment" and "decreased personal engagement." This indicates that even some leaders worry their staff are not ready for upskilling yet.

Utilities that have not undergone digital transformation are more likely to exhibit neutral or negative sentiments toward automation barriers, including fear of change, perception of low-quality data, acknowledgement of cybersecurity risks, and training limitations. Similar concerns with job displacement and the need for upskilling were noted in the water modeler study (Bluefield 2025).

Digital transformation readiness

Factors limiting readiness

More transformed organizations had a preference for technology

As the organizations became more automated, the concerns shifted to those of prohibitive processes or policies (e.g., cybersecurity risks) and a lack of flexibility in the organization. The most automated organizations were more likely to have positive or neutral views, and their responses tended to be about the unexpected value that they realized through automation.

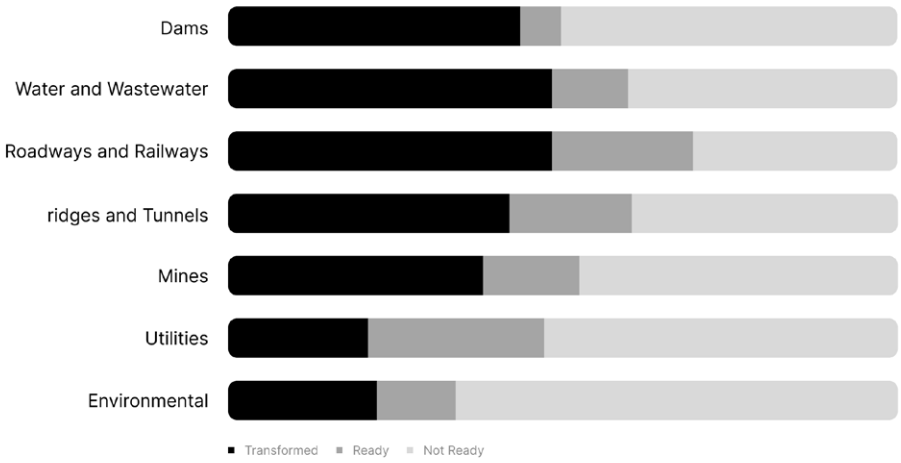
Respondents from the study found success when technology was used to remove human errors or data overwrites. They also suggested that if complacency is a concern in the organization, supplemental monitoring and training of the workforce would be all that is needed to sufficiently keep employees engaged while enabling the benefits of the automation. Across the water sector, owners overwhelmingly responded to the benefits rather than drawbacks, citing "We can execute projects more cost effectively." Far less organizations saw it as an opportunity to "operate with leaner teams/staff," indicating that human workforce is unlikely to be reduced and that the value comes from being able to do more with the current resources.

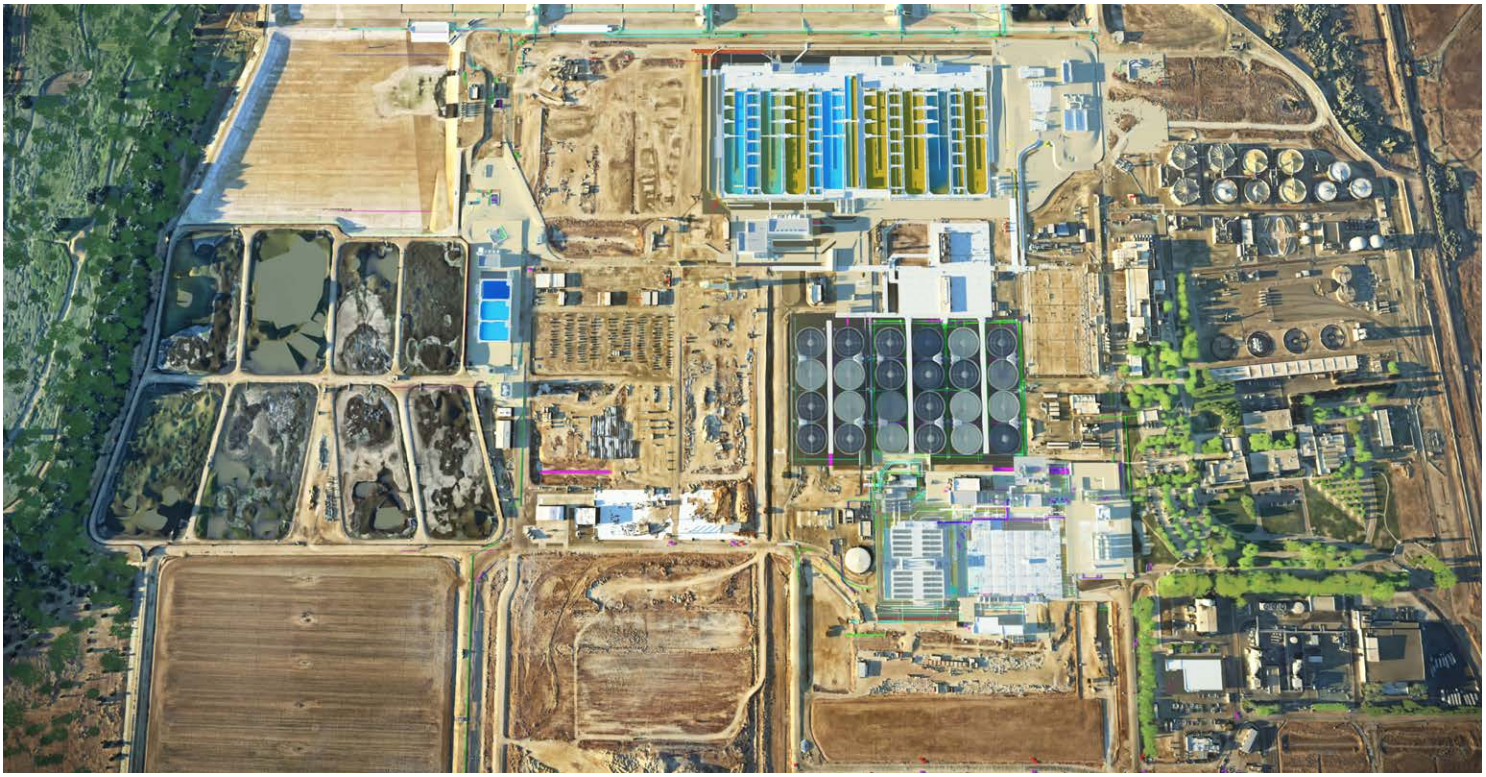
The concerns raised are all solvable problems—they are people problems, not technology problems, that point to a reluctance to change ways even with data pointing toward the value of digital transformation.

Water is in line with other infrastructure sectors

According to ThoughtLab's survey results, in general, water and wastewater sectors outperform other utilities and environmental services in terms of digital transformation. Dam and transportation assets were more ready, which may be due to their simpler daily operations than other utilities. But even in water, these numbers are concerning. Shown in the graph below, the survey found that 46% of water entities are not yet prepared, whereas in transportation, only 35% of entities are inadequately ready. Overall, the infrastructure sectors reported similar levels of technology use.

Digital transformation across sectors





Aerial view of California's wastewater treatment upgrade, where digital twin technology and AI-driven workflows saved $400M through smarter construction management. Image courtesy of Project Controls Cubed.

The future is digital

Despite the positive feedback for those that did use software solutions, there are challenges that hinder widespread adoption. The data showed that only the largest and smallest organizations were digitally transformed more than 50% of the time. Larger organizations, such as HDR or PUB, may have more cashflow dedicated toward technology budgets and access to bulk pricing schemes with software vendors. In contrast, smaller organizations' usage may be attributed to easier procurement processes or more niche services in delivery practices requiring the use of specialized tools.

Users that have seen success in becoming more digitally transformed have had a few similarities in how they approached it: with small steps and through the persistence of digital champions.

Project Controls Cubed (PC3) is an example of a small organization that used off-the-shelf digital twin software, championing a construction digital twin to support the EchoWater wastewater treatment plant project (Bentley 2024). With PC3 as a digital champion, they were able to implement a connected data environment across multiple contractors for situational awareness, construction sequencing, and cost control. The timely situation awareness provided by the digital workflows helped to save USD 400 million from the project budget. As Serelle Corn from PC3 puts it, "AI can tap into that [federated data] information and provide suggestions or enhance decision-making" (Cadalyst 2025).

The use of digital workflows is only as good as its interaction with humans. While we are seeing some barriers to digital transformation, we can be sure that, as organizations continue to face pressures to reduce costs and increase service, technology like AI and digital software will be used to optimize processes and reduce errors. Smaller and medium-sized organizations have the most to gain by having access to democratized AI solutions.

Conclusion

Water professionals have a decree to ensure safety for the public and environment and, therefore, they are not willing to diverge from human intelligence for certain tasks just yet. Some water professionals are cautious about letting computers take over tedious tasks, citing concerns that include complacency and potential job displacement; meanwhile, others are excited to have access to innovative technology so that they can spend their time on higher value decision-making.

Digital transformation will be important to allow organizations to make better use of democratized solutions. An example is how Forte & Tablada used digital twins to model the New Orleans 17th Street Canal stormwater pumping station's health, providing more data points and allowing them to work more efficiently and, ultimately, ensure safe and sustainable operations (Kellner 2025). IoT has also been seen to efficiently provide more real-time data of up to 1,000 times enhancing asset safety, such as the case with Yuba Water Agency (Bentley 2023). These off-the-shelf AI-embedded solutions are a democratized way to make more readily accessible the use of predictive modeling (Bentley 2025-2), anomaly detection (Bentley 2025), and plant design (Bentley 2022)—regardless of company's size or access to software specialists.

The various sector surveys indicate a growing interest in digital solutions and implementing AI. The water sector can be ready for AI and is certainly already using AI offerings to enhance their operational efficiencies, fill workforce challenges, and accelerate value. However, only about half the water sector is primed to do so. To capitalize on this trend, organizations should focus on their cultural and procedural barriers, such as simplifying the procurement process and implementing workflows for digital technologies. Organizations can follow in the footsteps of leaders, such as PUB, PC3, Sabesp, and others in accessing AI-enabled digital solutions across the water sector for water distribution, treatment, wastewater and sanitation collection, as well as across the whole lifecycle from planning and design to construction, operations, and maintenance.

Digital twin technology helps monitor the health of New Orleans' 17th Street Canal Pumping Station, boosting efficiency and ensuring sustainable flood and stormwater management. Image courtesy of Forte & Tablada.

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