klir
making water better

GUIDE

Building the **Utility of the Future**

How Better Software Can Enable Truly
Proactive Utility Management

Table of Contents

Building the Utility of the Future

Executive Summary

Digitization holds a lot of promise for the future of water, but it also poses a challenge for administrators managing the flood of data coming out of our drinking and wastewater systems.

Spreadsheet overload, 'too many apps' and uneven digitization are a big problem, particularly for compliance managers tracking increasingly complicated regulations. Wrangling that data into a workable system is the most important step utilities can take to realize their 20-year digital strategies.

This report builds on interviews with dozens of employees at ten water utilities in the United States, Canada and Australia ranging in size from 20 to 1,000 employees. The utilities did not sponsor the report or pay for inclusion—they were selected because they represent compelling case studies for how software can drive utility management forward.

Showing how getting the 'basics' of data management right can unlock previously unrealized operational powers, we look at how organizations like DC Water are leveraging sound data practices to overcome administrative paralysis and build the utility of the future.

Finally, we survey the next 20 years of water utility management, which promises to be shaped by everything from wastewater surveillance, to PFAS, to biosolids, to direct potable reuse (DPR)—each of which will only make getting compliance data under control more important to securing the future of water.

klir

Foreword

By David Lynch, Founder and CEO of Klir

As someone at the forefront of moving the needle on the future of water, I'm so excited and encouraged by the perspective and findings surfaced in 'Building the Utility of the Future.'

There's an enormous opportunity in our industry for community building and developing a shared understanding of the challenges our sector will face over the next 20 years. I call it an 'opportunity' because communicating our goals to groups outside of the water industry— particularly the legislators responsible for funding and signing the future of water into law—is a missing link that is the critical catalyst for change.

We can talk about green infrastructure, business development, and public private partnerships, and bathe ourselves in greenwashing. But until we find ways to communicate our challenges and criteria for success in a way that's compelling and easy for policymakers to understand, that momentum is not going to happen. Until we clearly articulate the insights powered by integrated data, our sector simply won't be able to secure the funding and goodwill needed to deploy these technologies on a large scale.

Service providers like Klir are the lynchpin of the solution here, because technology is only one leg of the stool—managing the change of people & process in this new way of working is the prerequisite for success.

It's not that we are short on data as an industry, rather short of the right access to the right data at the right time with the right volume and quality. Only then can we turn up the heat to articulately demand what is needed to fix the wicked challenges facing water and run a successful utility over the next 20 years.

> Until we clearly articulate the insights powered by integrated data, our sector simply won't be able to secure the funding and goodwill needed to deploy these technologies on a large scale.

As it stands now, our industry is fragmented, few of us have a clear and compelling vision for modernization beyond engineering schematics, and most leaders are focused on technical challenges with little appetite for salesmanship or storytelling. We need to be able to connect the dots, legislate certain outcomes, and commit to making decisions about our capital infrastructure for the fiscal year based on sound data.

Cementing these standards will be impossible without a shared understanding of what our utilities must look like in the future. 'Building the Utility of the Future' is a crucial step towards that goal, shedding light on the various data management tools and strategies that the world's largest utilities are using to bring water into the 21st century.

Building the Utility of the Future

Sunlight Zone

Twilight Zone

Midnight Zone

The Abyss

The Trenches

klir
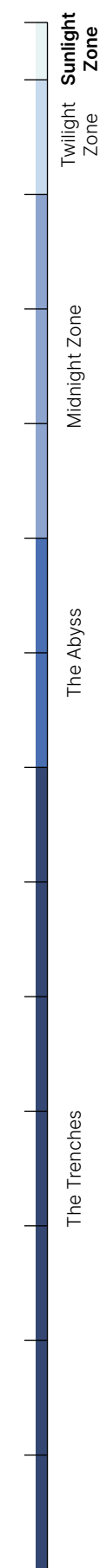
From Administrative Paralysis to Self Service: Why Compliance Is the Ideal Starting Point for Digital Transformation

Software and the internet have transformed the way we work. Even smaller rural water utilities that lack sophisticated IT systems now use digital tools to communicate, manage tasks and report sampling results to regulators.

There's just one problem: while other sectors have forged ahead and embraced purpose-built solutions, water utilities have been slow to adopt. It can take decades before a proven technology is considered "mainstream" enough, forcing staff to come up with their own solutions and leading to uneven digitization. Before Denver Water underwent an IT audit and consolidation six years ago, Chief Operations

and Maintenance Officer Tom Roode says the utility had struggled with "too many" point software solutions popping up across the organization for decades.

"For example, Maximo: it got started in one area, say our trades shop, or one treatment plant. And then over a 20 year period people would adopt it at a different treatment plant, or in the pump stations, and it kind of organically grew."

This "organic" approach to choosing work or asset management software can create problems, especially when the solution your trades shop picks (Maximo) is different from the one your IT department and fleet staff pick (Workfront).

For Compliance Managers who rely on data from virtually every other department to do their jobs, the resulting patchwork of tools is particularly frustrating to work with—worse, even, than the piles of paper that used to clutter their desks.

But there's a silver lining to the fact that so much data is piling up in our compliance departments: it also makes them the perfect entry point for real, strategic digital transformation initiatives.

NPDES Significant Noncompliance (SNC) Violation by Source, 2018-2019

- 10% Missed Schedule
- 21% Effluent Violation
- 69% DMR Non-receipt
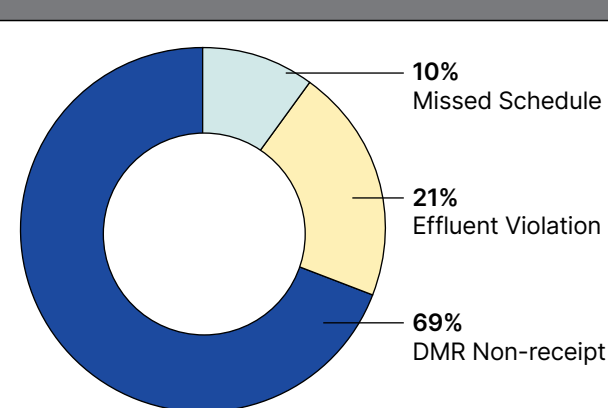
Source: EPA

Fighting Administrative Paralysis

As new criteria and guidance are constantly revised around issues like PFAS and LSLs, compliance managers find themselves sifting through more data than ever before.

Lacking a dedicated system to manage all of the deadlines, tasks and data her staff were responsible for, one Compliance Manager we spoke with at a mid-sized California utility took matters into her own hands and built an elaborate Excel "cheat sheet"—a monumental task at an organization that had more than 300 construction projects on the go at the time.

Cheat sheets are a popular stopgap at water utilities today, but using a spreadsheet as a database is time consuming, creates a silo around the individual responsible for it, and can be outright dangerous if anything ever slips through the cracks.

"It's so hard being just one person with all the knowledge," the Compliance Manager said. "Every project is different because they have different needs. Each project was trying to do it on their own, [but] they didn't know regulatory compliance. There were knowledge-sharing gaps between departments."

Data Icebergs

While it's popular to blame silos, the iceberg might offer an even better analogy for what's going on at utilities today.

Some crucial data might be visible at the surface, but a vast majority of the most valuable information is below the water line, hidden from view and ready to cause problems.

Icebergs aren't limited to large organizations either. General Manager Piret Harmon, who manages a team of about 20 people at the Scotts Valley Water District (SVWD), which serves 10,700 customers across 4,200 service connections, routinely finds herself frustrated by data icebergs.

"The water consumption data is here, the water billing data is here, the production data is here, and water quality data is here. And every week there's another report due, and it's up to me or another person to sit down again and sort through it all. It's a very manual process."
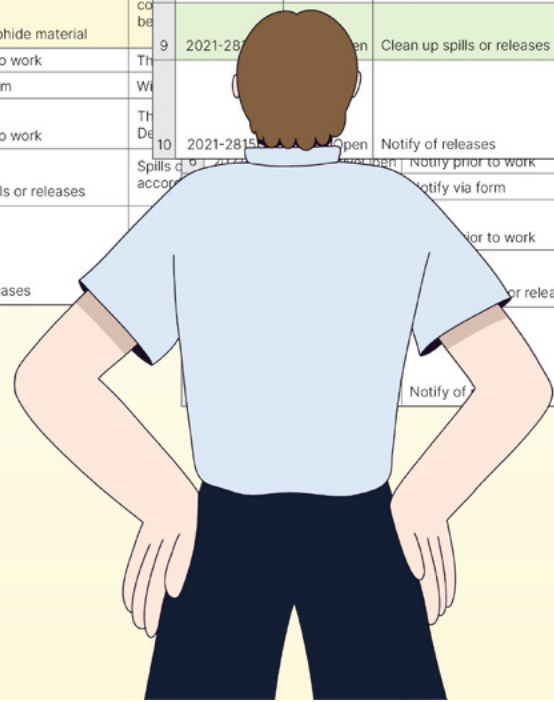
At a large utility responsible for thousands of different permits, that can leave Compliance Managers overloaded by paperwork and constantly firefighting. Any single data point might be buried in:

- Spreadsheets, created by individual personnel and saved locally on their computers
- Outdated printouts kept on file
- Emails saved in an individual's inbox
- Handwritten log sheets kept onsite
- Customer information systems

"I just couldn't put my arms all around it, especially at the beginning of the year when it gets busy with permit renewals," said another Compliance Manager we spoke to.

"I'd have to let our lab managers know, 'Hey, sorry, my bad. I usually give you two weeks' notice that I need this data, but I need it tomorrow.'"

Meet Mike. Mike's job at the utility is to stay on top of hundreds of different permits covering everything from air quality to hazardous waste, to above ground fuel storage tanks.
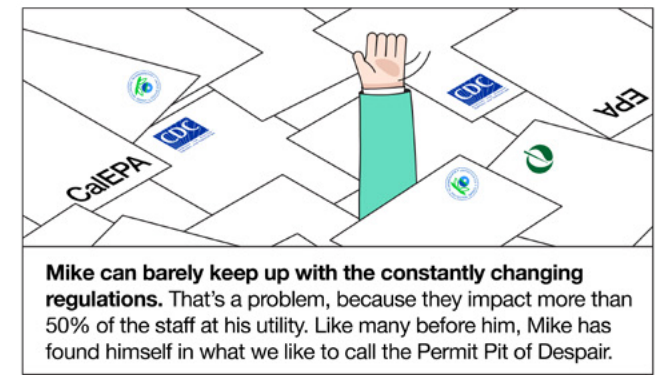
Mike can barely keep up with the constantly changing regulations. That's a problem, because they impact more than 50% of the staff at his utility. Like many before him, Mike has found himself in what we like to call the Permit Pit of Despair.
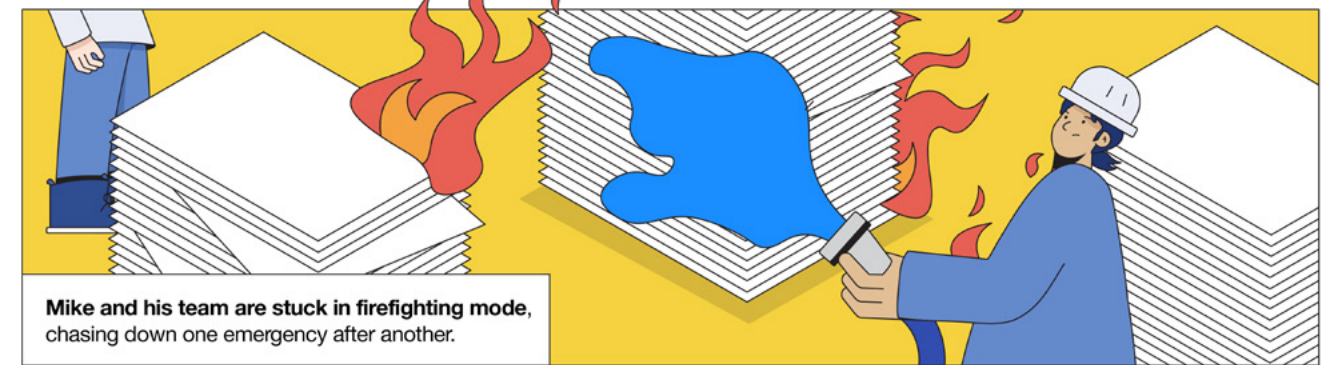
Mike and his team are stuck in firefighting mode, chasing down one emergency after another.

One day, Mike discovers the Klir platform: an all-in-one water operating system for water that brings together all of the data his team needs when they need it.

Proactively managing compliance is impossible. Why? **Because the data Mike needs to do his job is siloed** across numerous departments, applications and recordkeeping systems.

Mike now has more time to pay attention to the big picture, stay ahead of regulations, and deliver safe, clean drinking water to his customers.

klir

#1 Moving Towards Self-Service

Utility customers and workers alike already live in a world filled with internet-enabled self-serve platforms—to consume their media, communicate with colleagues, and order groceries.

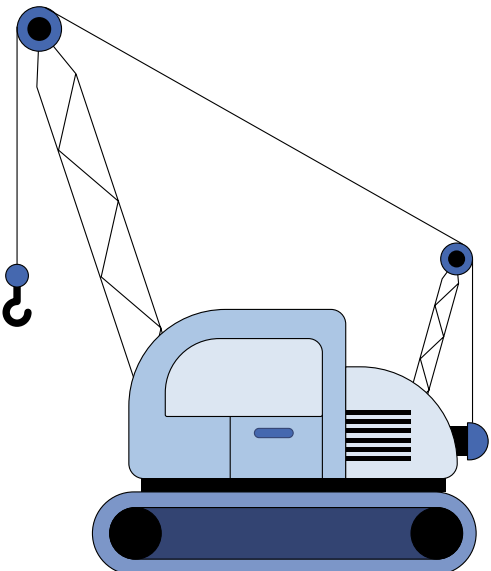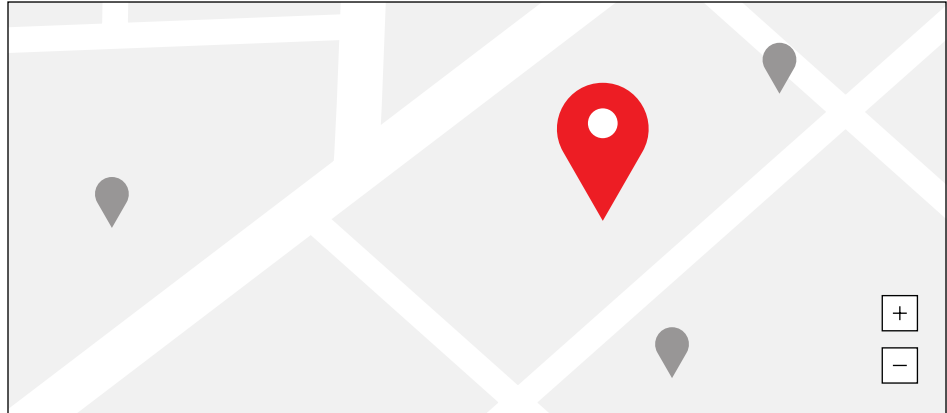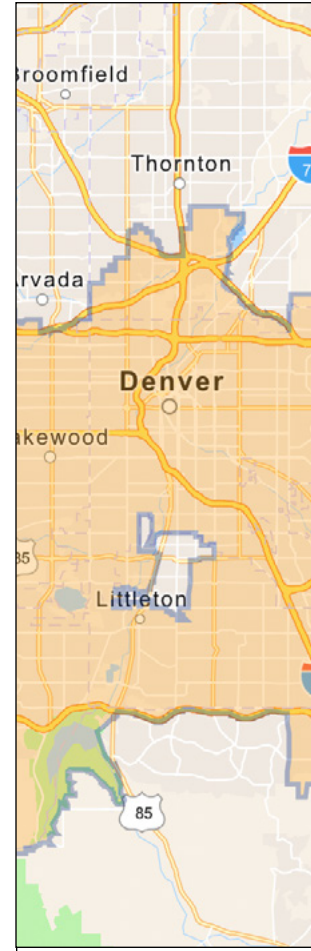As Piret Harmon from SVWD points out, utilities are under increasing pressure to build experiences that are as easy to use and intuitive as the ones we encounter when ordering toilet paper on our smartphones.

"We are trying to actually empower our customers to get more things done without us. For example, why do people have to call us so we can find a piece of paper for them? Why can't it be like, 'no, go and browse for it yourself?'"

#2 Bracing for the 'Gray Tsunami'

Water utilities across North America face huge personnel crises as a generation of experienced workers prepare for retirement, with institutional knowledge walking out the door with them.

As workers prepare to retire, it's more important than ever for utilities to document processes and institutional knowledge so new employees can train for the job properly.

"I've got people about to retire, and also recent college grads. I've somehow gotta get these people ready for very technical positions very quickly," one Compliance Manager told us.

#3 Getting New Infrastructure Funded and Built

The less time a compliance department spends chasing down regulatory information, the more time they have to serve internal customers and help them usher large-scale projects through complicated regulatory processes.

"[I want to] be able to serve our other customers, like Engineering. They constantly need regulatory work. And we don't always have the time to give it to them," said one Compliance Manager.

"If we could free up some of our time, that would allow us to give them the consultation that they need to navigate new permits for new projects. We could be a better service and have more time to help them navigate all of those regulations."

#4 Responding to Water Quality Issues Quickly and Building Trust

When customers' water quality is threatened and regulatory bodies are demanding up-to-date information, time is of the essence.

"We're just beginning to dive into the world of letting customers report with web mapping applications," says Adam McKnight, a former analyst with Halifax Water.

In the event of a water main break, rather than solely relying on calls from customers, McKnight's department has given residents the ability to file their own reports online. It's faster and more efficient than before.

"They pin the dropper point on the map, and we can go out and we can investigate," says McKnight. "That becomes a part of our water main break response. That's one emergency situation where it's really beneficial having all the data right there."

Denver Water's Lead Service Line Map Project

Recently singled out by EPA for its "remarkable" progress, Denver Water attributes the success of its lead service line (LSL) replacement initiative in part to a digital tool it built that serves simultaneously as an LSL inventory and a publicly-accessible real time map used for community engagement initiatives.

#5 Bringing Utility Management Into the 21st Century

Overstretched Compliance Managers might have it the worst when it comes to administrative overload, but important data is pooling across every department.

A single large wastewater treatment plant (0.8-3 million population served) can generate upwards of 30,000 data points, most of which pile up in data graveyards: employee hard drives, OneDrive, the utility's servers, etc.

When managers look out across their organizations today, they see the tops of numerous icebergs with no way of knowing what's underneath.

To move forward with some of the more exciting innovations in water technology like AI and predictive analytics, large utilities will need to do the hard work of taming these icebergs with a sound data management strategy. And developing objective metrics for utility performance will be crucial as utilities approach state and federal governments for more funding.

Sunlight Zone

Twilight Zone

Midnight Zone

The Abyss

The Trenches

klir

Sunlight Zone
Twilight Zone
Midnight Zone
The Abyss
The Trenches

Building the Utility of the Future

SECTION TWO

From Asset to Event Management: Turning Software Into an Essential Operations and Maintenance Tool

Operations and maintenance leaders at water utilities are faced with a seemingly impossible task: maintain massive, complex and at times century-old drinking, waste and stormwater infrastructure, often with limited resources and a shoestring budget.

In many cases infrastructure is breaking down faster than it's being renewed, while economic and population growth puts further stress on existing systems, leading to frustrating situations for utility leaders.

As Piret Harmon from SVWD puts it, "Why are you building if you're asking me to conserve? How is that even in the same sentence?"

With a problem so deeply rooted in physical infrastructure and engineering challenges, taming a utility's data might not be the first solution that comes to the minds of utility leaders.

In many cases infrastructure is breaking down faster than it's being renewed, while economic and population growth puts further stress on existing systems.

That is until you look at the way leading utilities like DC Water are managing their data—not just to cut down on administrative work, but to make the job of the operator easier, drive real change in their physical systems, and anticipate and fix asset risks before they become asset disasters.

Klir

has been a big priority for DC Water's IT lead Tom Kuczynski—and a big achievement.

While DC Water's shiny, futuristic <u>HQO headquarters</u> has a mailroom, it might not need one for long: 70,000 of the utility's customers have signed up for online accounts, and about 50,000 currently receive an e-bill.

Thanks to the <u>'Report a Problem'</u> app, customers can submit issues online even if they don't have an online account.

Dispatching plumbers for inspections is also now an entirely digital process handled through the Plumber Portal, which automatically generates and sends work orders to Maximo.

"It's a lot more efficient for us to manage any information, and it integrates better with our core systems. So if you need a meter installed or a service connection completed, you can send us requests that automatically generate a work order in our system," says Kuczynski.

## At-a-Glance: Utilities Featured in the Report

Denver Water Department

Location: Denver, CO, United States
Service area: 2,560,000 acres
Customers: 321,417
Employees: 803
Water mains: 3,000 miles
Formed: 1918

Why they're a utility of the future:
They used software to engage with the community and build one of the most effective LSL replacement programs in the country.
Source: Denver Water

Scotts Valley Water District
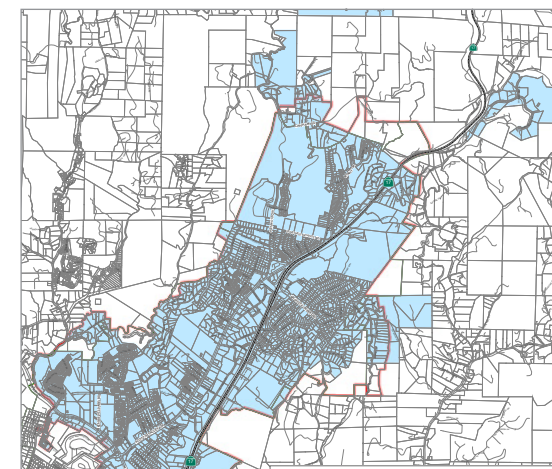
Location: Scotts Valley, CA, United States
Service area: 4,000 acres
Customers: 10,700
Employees: 18
Water mains: 60 miles
Formed: 1961

Why they're a utility of the future:
They pursued forward-thinking recycled water initiatives, infrastructure improvements, and efforts to create a more open and transparent organization.
Source: Santa Cruz LAFCO

The Typical Utility 'Stack'

In addition to operating one of the world's most advanced wastewater treatment plants at <u>Blue Plains</u>, DC Water has made significant strides in bringing all of their work into the digital sphere properly.

The utility has methodically built and adopted systems to help it decrease administrative workload, create processes that are more self-serve, and lay the groundwork for more sophisticated technologies like predictive analytics.

Like many similarly-sized utilities, DC Water sorts its systems into three general buckets:

1. Its **Core Underlying Systems** that manage assets and track internal work using IBM Maximo and ArcGIS, as well as payroll and finance which is handled by Oracle.
2. Its **Customer Information Systems**, through which it manages 130,000 metered connections.
3. Its **Third Party Portal**, nicknamed the 'Plumber Portal,' a collection of contractor-facing applications through which the utility manages programs like Backflow Inspections and Grease Abatement.

Getting as many contractors, employees and customers plugged into and using this system

Sunlight Zone
Twilight Zone
Midnight Zone
The Abyss
The Trenches

Klir

The Disaster Response Challenge

DC Water's IT systems faced a new challenge in September of 2021 when Northeastern DC experienced a "microburst"—an extreme climate-change fuelled weather event concentrated in one area.

"It didn't rain at all here [in the south], but we had six inches of rain in northeast DC that caused major flooding in the area," recalls Kuczynski.

The utility's 24/7 helpline and 'Report a Problem' apps immediately lit up as numerous customers' homes flooded during the microburst, and DC Water's crews had to respond quickly. Suddenly there were three groups of people sitting in three different locations who had to work closely together:

1. The **pumping operations** crew who sit in the pumping station right outside of HQO and run the sewer system.
2. The **plant workers** four and a half miles away at Blue Plains WWTP, where all of the water pumped through the system eventually ends up.
3. The customer service crews on the third floor of HQO who monitor the help line and dispatch crews.

Communication between the three groups became tricky when multiple work orders were generated for the same neighborhood or geographical area.

All three would have to rely on a fourth party, the foreman in that area, to know that those work orders were all related to the same problem and avoid sending multiple crews. "We didn't really have a comprehensive understanding of what was really happening across our physical collection system and our customer system: none of those systems talked to each other back before September. We needed a better way to manage that event in a more comprehensive way," says Kuczynski.

Photo Credit Alex Brandon / Associated Press

Enter the Events Management System

Working with a local vendor, DC Water set out to build an application that would knit the information in its Core Systems and Customer Systems together into one seamless, real-time emergency response dashboard.

The result was the Events Management System, an <u>award-winning</u> dashboard-based application that gave operators sitting in the DC Water war room access to:

- Real-time feeds that they can use to monitor the severity of an incident.
- An incident tracking tool that integrated with the utility's call center and customer information system.
- Information about all crews and vehicles in the field, making it easier to allocate resources to an event quickly.

"This one pane of glass now gives you all of that information in a single view," says Kuczynski. In the event of another microburst, crews could be dispatched and managed seamlessly using a single user interface.

"So they can say, 'These five work orders and incidents can all go to one crew.' And they circle and drag them (on screen) to create a work order. They can literally do what they did before in seconds compared to minutes."

In an emergency situation where five new calls might come in by the time you're done attending to one, that's a game changer.

Proactive Utility Management in Action

DC Water's experience with the EMS is a concrete example of how sound data management and connecting disparate data sets can unlock new levels of efficiency, responsiveness and insight at a water utility.

It shows how there's a direct line between the less glamorous aspects of digital transformation—pushing customers to sign up for online accounts and building a reliable customer database, for example—and the more exciting, transformational technologies like the EMS.

Take Pipe Sleuth, another application DC Water built with an external vendor, which uses neural networks and advanced image processing to analyze photos of pipes to grade them based on condition and report potential pipeline defects.

Kuczynski says the ability to better predict main breaks could be a game changer for the utility, from both a service and a cost standpoint.

"You eliminate service interruptions to customers, you eliminate street closures, but you also reduce the cost of a repair—$50,000 for a small break vs. up to $1,500,000 to fix a 36-inch transmission main."

> "You eliminate service interruptions to customers, you eliminate street closures, but you also reduce the cost of a repair—$50,000 for a small break vs. up to $1,500,000 to fix a 36-inch transmission main."

Building the Utility of the Future

klir

Sunlight Zone
Twilight Zone
Midnight Zone
The Abyss

Using Better Data To Tackle The Resource Recovery Challenge

Getting rid of data icebergs and leveraging compliance and operational data for insights will be crucial for bringing utilities into the digital age properly. But how does better data management fit into the broader transformation that's going on at water utilities today?

Let's stick with the DC Water example a bit longer. Their push to squeeze every last bit of value out of every asset there hasn't stopped with faster emergency response times.

Blue Drop, a nonprofit LLC spun out of the utility by Kuczynski, has recently started generating revenue by renting out the utility's headquarters for events, leasing surplus cell tower space, licensing its EMS and PipeSleuth software to other utilities, and selling a Class A biosolids fertilizer product called Bloom.

"You can't keep raising prices, right? There gets to be a point in time where the cost of service exceeds the ability of the customers to pay. So you've got to figure out ways to do it better, faster, cheaper," says Kuczinsky.

It's an unavoidable fact that most utilities are going to have to start looking for additional cost savings and sources of revenue to offset rate increases. For most, that means aggressively pursuing resource recovery: the process of extracting and recycling as much of what passes through a wastewater system as possible.

Building the Utili

Recycled Waste Heat

Event Venue Rentals

Leased Cell Tower Space

Wastewater surveillance data sharing agreement with local health authorities enables faster responses to public health issues.

Research Partnerships with Local Universities

Selling Class A Biosolids

Reverse osmosis-enabled direct potable reuse (DPR) operation reduces stress on watershed and eliminates need to import water.
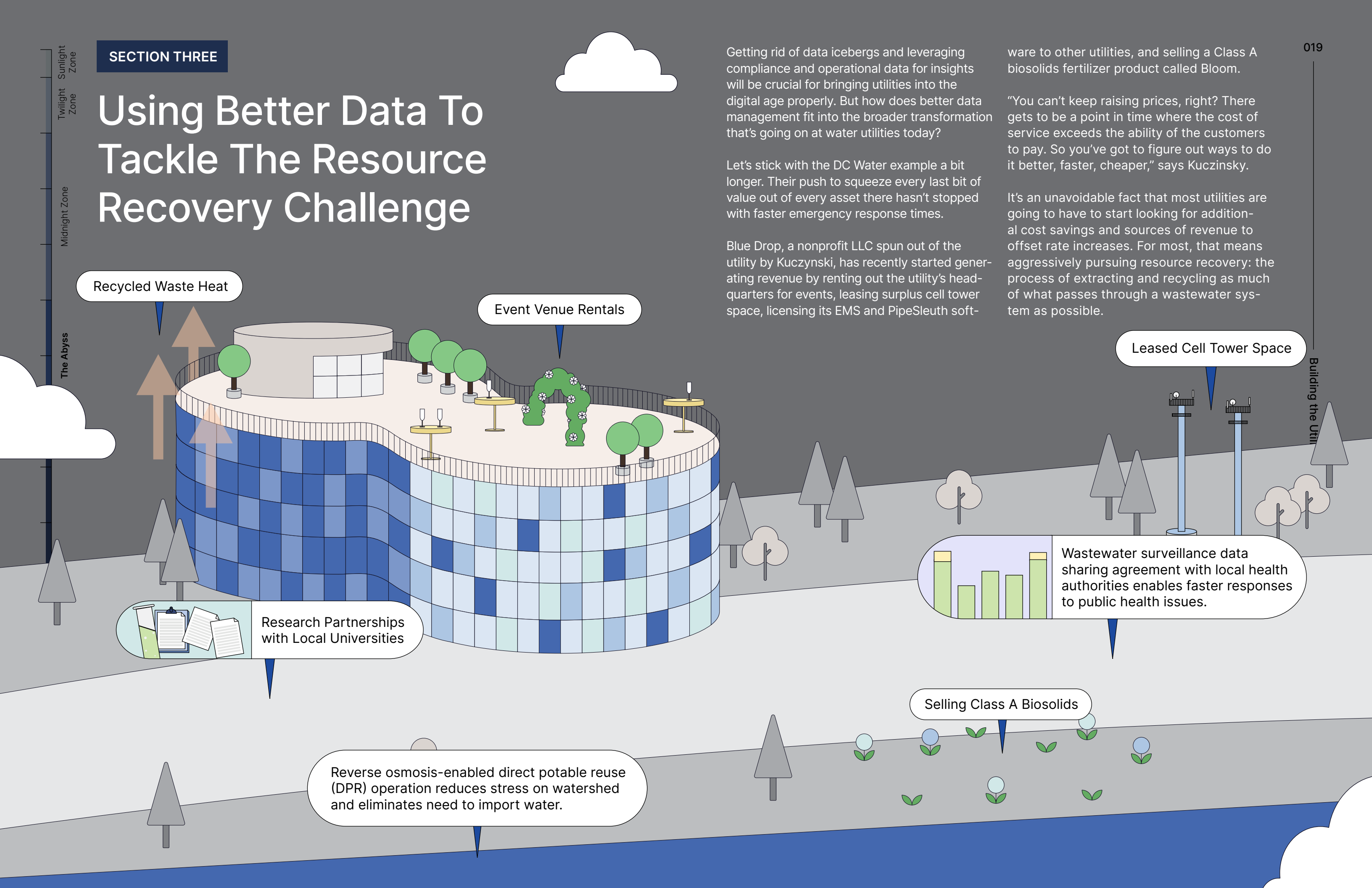
Photo Credit Australian Water Association

Better Biosolids With Better Data

Disposing waste sludge is an expensive process, and getting **better at biosolids**—by reducing the amount of biosolids that are thrown out and increasing the amount of Class A material that can be sold—is a huge cost-saving and revenue opportunity for utilities.

According to Urban Utilities General Manager of Resource Recovery Peter Donaghy, mapping out our water and wastewater systems and developing a better understanding of how they work using better data is one of the most effective methods we have to improve the biosolids process.

His team recently used real-time analytics to discover that the way effluent moves through the system's pumping stations could affect biosolids quality. As they worked through 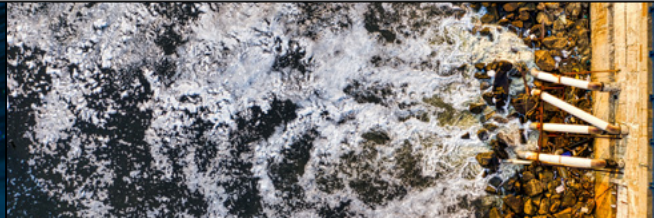the biosolids system with a fine-toothed comb, they realized sewer network operators could have a massive role in biosolids quality.

"As soon as we saw [a contaminant] coming in at the head of a treatment plant, there were a certain number of pump stations we could inhibit that could slow that process and give us time to react."

By allowing the pumping station to slowly fill up, Donaghy's team could buy themselves an hour or two to send a worker to that pump station to test it for undesirable effluent and potentially stave off contamination.

"Inhibiting a pump station is not something you'd think is part of managing biosolids, it's way off in the network. Some of the guys managing those pump stations wouldn't even know what biosolids are."

> "Mapping out our water and wastewater systems... using better data is one of the most effective methods we have to improve the biosolids process."

Direct Potable Reuse at a Glance

32 billion gallons per day is the daily wastewater discharge in the U.S..

20 billion gallons per day of wastewater could be re-entering drinking sources downstream.

Photo Credit Veolia

December 31, 2023 is the deadline for the California State Water Board's Division of Drinking Water (DDW)'s uniform water recycling criteria for DPR.

0 reports of illness linked back to the Windhoek DPR treatment plant, first opened in 1968.

Direct Potable Reuse: The 'Holy Grail' of Resource Recovery

While generating additional revenue from a utility's assets and recycling biosolids waste is a step in the right direction, recycled water continues to loom on the horizon as the biggest resource recovery prize.

Less than a fraction of a percent of all of our wastewater is 'officially' recycled back into the drinking water system today. But cities like Atlanta, Philadelphia, New Orleans, and Washington D.C. already draw their drinking water downstream from wastewater treatment plants.

In fact, of the 32 billion gallons of wastewater discharge the U.S. produces every day, the National Research Council estimates that up to 20 billion might already be re-entering drinking sources downstream.

And as utilities in Colorado, Florida and California take concrete steps towards implementing direct potable reuse (DPR) technologies and new research suggests that treated water might be cleaner than conventional sources, recycled drinking water will play an increasingly large role in the future of water.

Take Los Angeles Sanitation's 'Hyperion 2035' plan, which aims to transform its Hyperion Wastewater Treatment Plant—one of the largest in North America—into a fully DPR operation by 2035.

Hyperion is a colossal 144-acre facility, with a sprawling network of streets that officials often describe as a city unto itself. To move to DPR, close to half of the existing footprint of the plant will need to be rebuilt or overhauled in some way with a raft of technologies like microfiltration and ultrafiltration, new biological processes and reverse osmosis.

But to hear LA Sanitation officials describe it, Hyperion 2035 is just as much about new treatment technologies and engineering challenges as it is about building (and in some cases, rebuilding) trust in recycled drinking water.

klir

Sunlight Zone
Twilight Zone
Midnight Zone
The Abyss
The Trenches
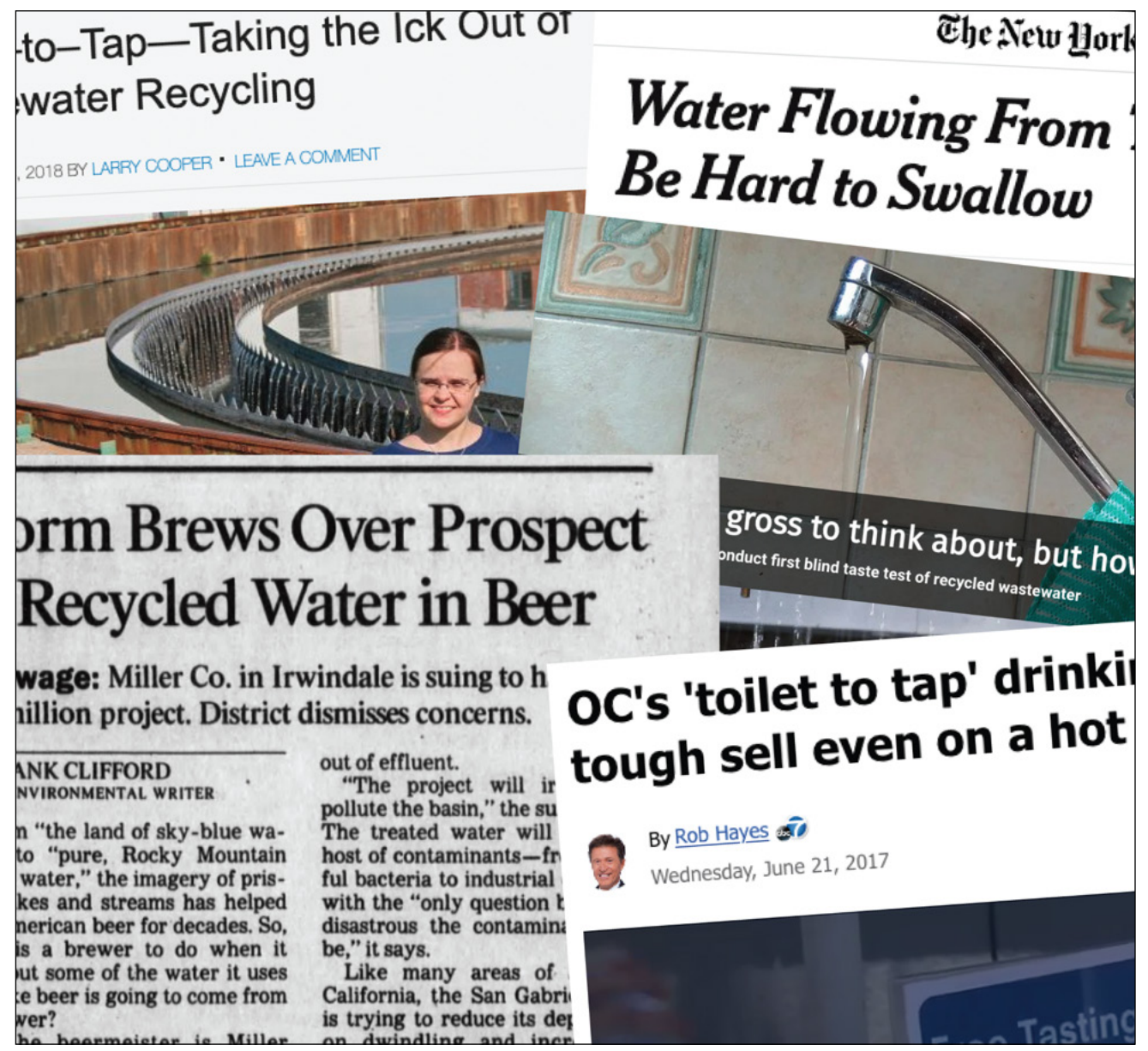
DPR's Compliance Challenge

As utilities pursue DPR, the legacy of anti-potable reuse sentiment and California's doomed efforts to start introducing DPR in the 1990s looms large in the minds of utility leaders and regulators.

It's clear that the margin for error with DPR will be razor-thin, and building confidence in water quality and compliance data will be more important for DPR projects than it ever was for traditional water and wastewater utilities.

"The whole issue of public confidence is that very, very fragile link that keeps the system going. That's something we are very aware of

and try very hard to maintain," says Pierre van Rensburg, strategic executive for urban and transport planning at Windhoek, Namibia.

That city built the world's first DPR plant in 1968, which today produces purified water for the city's 400,000 residents. Van Rensburg says that no illness has ever been directly linked to its operations in the decades since its opening.

"I think if there is ever one incident that could be linked back to the plant, the public would lose all confidence and simply refuse to use water from that source and that would severely taint our supply options."

CONCLUSION

The Future of Water is Compliance

So what does this all mean for utilities? Firstly, it confirms something we've suspected for a long time at Klir: that many water utilities are struggling with digitization 'basics,' and they won't be able to move forward with their ambitious 20 year strategies before they get them right.

As EPA and states make big strides to tackle issues like PFAS, LSLs, drought and increasing pressure on water systems, keeping up with regulations is only going to become a more burdensome process using existing tools.

At the same time, as utilities pursue efficiencies and more ambitious resource recovery projects while recycling or reclaiming more of their water, trust in the integrity of their data is only going to become more important, not less.

So how can utilities decrease the margin of error and build trust in their data? It all comes back to those 'basics:' building a single source of truth for regulatory data, breaking down

icebergs and building certainty around a utility's compliance data.

Wrangling water quality and permit data into a workable system and empowering Compliance Managers with better software tools might seem like a purely administrative challenge today. But it could very well turn out to be the single most important step utilities take in their digital transformation journey.

> "Utilities are struggling with digitization 'basics,' and they won't be able to move forward with their ambitious 20 year strategies before they get them right."

ⓞ klir

Break Down Your Data Icebergs for Good

Free your data and put it to work with Klir, the all-in-one operating system for water.

Klir gives drinking and wastewater utilities the tools they need to stay compliant and plan for the future while:

🚀 Fighting Administrative Paralysis
🏗️ Getting Work Done Faster
🤝 Building Trust with Regulators and Customers

Book a demo at klir.com today to see how Klir can help you.