

The State of Water Infrastructure:

Trends, Challenges and How to Be
Proactive Amidst Constant Change



Building a Better World
for All of Us®

INTRODUCTION

The State of Water Infrastructure

In this eBook, we explore **industry trends, challenges and the proactive steps** you can take for better drinking water, wastewater and stormwater systems.

The American Water Works Association's (AWWA) *2022 State of the Water Industry* report indicates growing concern over issues such as extreme weather events, supply chain delays and emerging contaminants like PFAS. However, the report also spotlights a sustained optimism – the result of profound resilience shown by communities in response to the pandemic, as well as historic funding from the Infrastructure Investment and Jobs Act (IIJA).

U.S. water infrastructure has reached a watershed moment. Change is happening. Yet, much work needs to overcome the aging and at-risk infrastructure in our communities.

Short Elliott Hendrickson Inc. (SEH®) is a multidisciplinary, professional services firm made up of 800+ engineers, architects, planners and scientists who provide complex solutions to clients throughout the U.S. SEH focuses on improving mobility, improving infrastructure, engineering clean water and creating better places. We are guided daily by our core purpose of Building a Better World for All of Us®.

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**Registered Professional Engineer in CA, CO, IA, MN, VA*



KATHY CROWSON, PE*

Kathy leads SEH's water and wastewater practice in Minnesota, North Dakota, South Dakota, Iowa, Nebraska, Texas and Virginia. With more than three decades in the industry, clients value her insights as an experienced wastewater engineer who also specializes in maintenance and operations. This win-win combination ensures well-built facilities with a strategic and long-term operational focus.

**Registered Professional Engineer in MN, VA*



BRAD WEISS, PE*

Brad is a water treatment project engineer whose primary focuses include process design, treatment plant rehabilitation and onsite engineering. Brad's passion for water engineering began as a very personal one; prior to joining SEH, he served as a Peace Corps volunteer for the non-profit's Water, Sanitation & Hygiene program in Peru.

**Registered Professional Engineer in MN, TX, VA, WI*



BRAD WOZNAK, PE*, PH, CFM

Brad is a senior water resources engineer and certified floodplain manager with 25+ years of experience. Certification as a floodplain manager means a proven level of dedication and expertise, a deep understanding of the National Flood Insurance Program, and the ability to help communities of all sizes practically and strategically improve their floodplain management efforts.

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Damon is a senior economic development professional with 35+ years of experience in water utility financing. Damon's economic development and financing knowledge brings confidence and security to the clients he serves – from evaluating feasibility to how communities can realistically and efficiently finance critical operations and maintenance activities.



8

Trends & Challenges in Water Infrastructure

Water infrastructure must be built, renovated and maintained in a way that empowers the precious resource to perform its critical roles.

The following eight trends look closely at how the industry has changed in recent years, what hasn't changed and what needs to be done for your infrastructure to continue executing at the level your community needs.



1

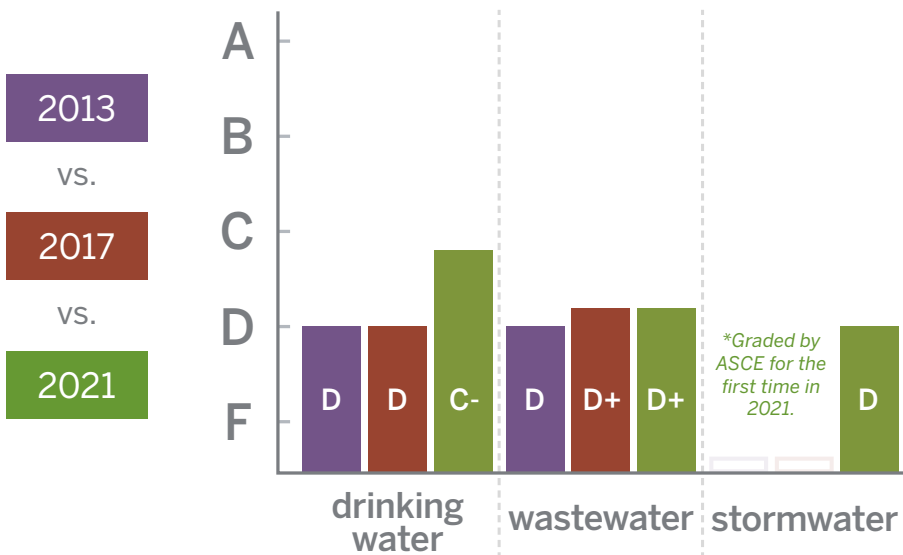
U.S. Water Infrastructure Earns **D+** Grade

Every four years the American Society of Civil Engineers (ASCE) releases its *Infrastructure Report Card*.






In 2021, U.S. infrastructure received a C- grade.

This is the first time our country's infrastructure as a whole has been above a D since the turn of the century. The collective progress is encouraging, but an important subset of our nation's infrastructure – water infrastructure – still falls in the D+ range.

ASCE INFRASTRUCTURE REPORT CARD



Why the D+ average?

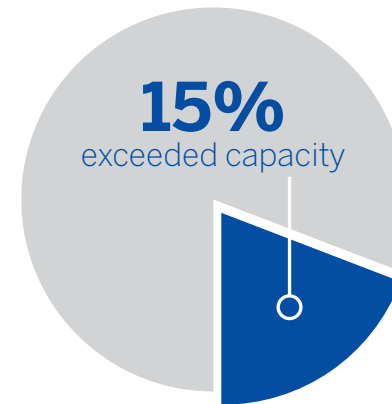
-  Aging water and wastewater pipes and facilities that are nearing or past capacity
-  Lagging operations and maintenance procedures, plans
-  Expansive migration from metro areas to suburbs where water infrastructure is not yet equipped to handle an influx of residents and businesses
-  Funding challenges; confusion around how to secure what's available
-  Ever-evolving, complex regulations



How will this impact your projects?



According to ASCE, the nation's 16,000+ **wastewater treatment plants** are functioning at an average of 81% capacity. 15% (nearly 2,500) have reached or exceeded capacity.



In addition to aging infrastructure, **drinking water utilities** are having to keep up with rapidly changing regulations specific to emerging contaminants like per- and polyfluoroalkyl substances (PFAS), lead and other chemicals.

Stormwater performance has declined due to an expanding funding gap, complicated ownership structures, stringent water quality regulations and climate projections.

Our nation's water infrastructure is in critical need of investment to support today's demands and set communities up to succeed for the next several decades. Projects need to move forward, but they need to be strategic with long-term plans in mind.

STEPS YOU CAN TAKE



IDENTIFY

Evaluate the state of your infrastructure.

The next section, **7 Signs Your Wastewater Facility Needs a Condition Assessment**, shares proactive ways to uncover whether your systems are in need.

ALIGN

Align all water infrastructure efforts with your strategic goals.

PLAN

Build water infrastructure needs into your comprehensive, master, floodplain management and other long-term plans.



*Positive change starts by gaining a clear understanding of your infrastructure. Identify problems and plan for timely fixes, but make sure they **align with your long-term goals and plans.***

SUSAN DANZL
WASTEWATER MARKET LEAD



2

Capital Funding Gap Continues to Expand

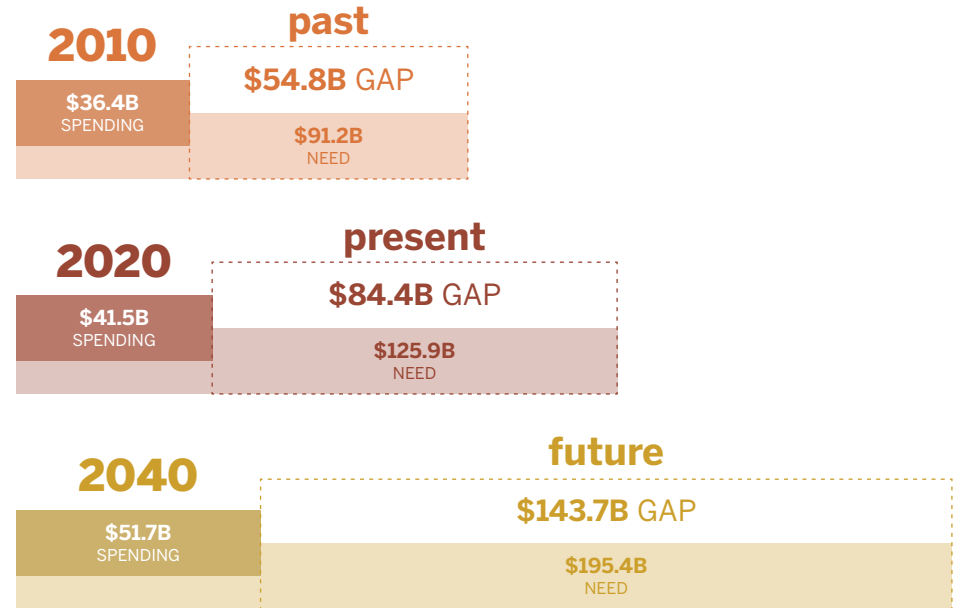
In 2020, the **cost of the capital investment** required – federal, state and locally – to maintain and upgrade U.S. drinking water and wastewater treatment systems was about **\$126 billion**.

Just 33% of this was funded, creating a capital funding gap of nearly \$85 billion. The Environmental Protection Agency (EPA) believes this will expand to more than **\$140 billion by 2040**.



How will this impact your projects?

ANNUAL CAPITAL FUNDING GAP FOR WATER INFRASTRUCTURE



If the gap continues to expand, your ability to make strategic decisions will be limited and the industry’s cycle of short-term fixes will perpetuate.



Monitor funding sources closely to keep tabs on new funding eligibility and timing.

Most importantly, gain an understanding of the state of your infrastructure (as touched on in **Trend 1**), and secure your fair share of funding – then use it wisely.

STEPS YOU CAN TAKE



IDENTIFY FUNDING OPTIONS

Be vigilant in uncovering your funding options and **reach out to local and state representatives** to let them know your project needs.

The IJJA is an infusion of \$55 billion in federal funding to municipal and state budgets – a transformative shift in the funds available to improve our nation’s water infrastructure.

The IJJA funds a range of projects through two primary programs, both overseen by the EPA. -->

1 Drinking Water State Revolving Fund (DWSRF)

Targets lead service-line replacement projects, drinking water projects and PFAS; *(more on PFAS in Trend 4).*

2 Clean Water State Revolving Fund (CWSRF)

Provides grants for water pollution and emerging contaminant programs.

EXPLORE BOND OPPORTUNITIES

Look closely at the projects identified in your capital improvement plan (CIP) and determine if you may have any bond-worthy projects.

Many states issue bonds – such as direct payment bonds and tax-exempt bonds – for major infrastructure projects that impact people and/or the economy.

EXAMINE EXPERIENCE FROM CONSULTANT

When partnering with a consultant, explore their experience with finding federal, state and local funding opportunities, securing grants and understanding regulations.

You're more equipped to benefit from timely funding opportunities and leverage funding sources with matching dollars if you and your partners fully understand your infrastructure needs and potential solutions.

Need help uncovering your funding options?
Use SEH's FundStart™ and receive free guidance from an SEH specialist.

Try FundStart™

3

Population Migration from Cities to Suburbs

Many in the U.S. are migrating from larger cities to smaller suburbs and non-metropolitan areas, seeking **more green space, open air, parks and trails.**

In fact, major metro areas experienced significant population loss in 2020 and 2021. According to the U.S. Census Bureau, this is the first time these areas recorded negative annual growth since 1990. Conversely, growth rates in smaller metropolitan areas climbed, while non-metropolitan counties experienced their highest annual growth rate in over a decade.



How will this impact your projects?



Many communities are approaching capacity and will need to increase their infrastructure's ability to meet **new growth demands.**

With limited time and money, and unless strategic plans are in place, communities are having to make tough decisions on how to spend their money – such as clean water or safer roads, more affordable housing developments or a new park, among other investments.



STEPS YOU CAN TAKE



NOTE THE TRENDS

Look closely at the recent past, present and expected growth trends in your community and surrounding areas.

PLAN FOR THE LONG TERM

Use these trends to ensure the plans and projects you're developing meet the needs of today but also help your community thrive long term.



AWWA reports that **U.S. water systems need \$1 trillion in improvements** over the next 25 years. With 90-95% of spending on public water infrastructure coming from the local level, the urgency to be strategic and proactive with your project decisions cannot be overstated.

BRAD WEISS
WATER TREATMENT PROJECT ENGINEER

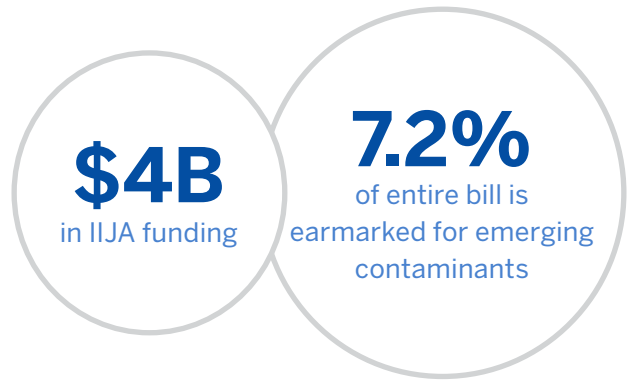


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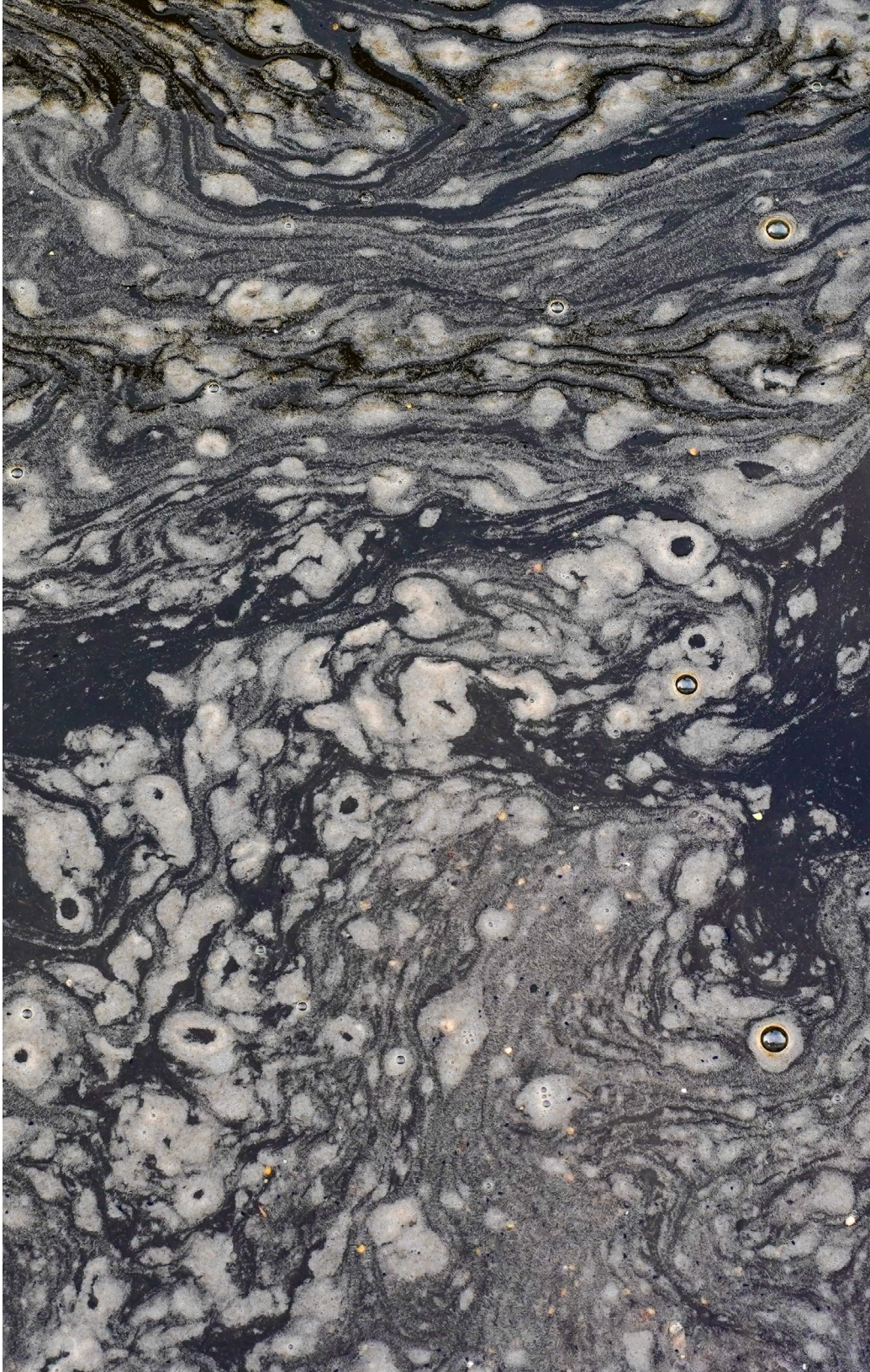
Emerging Contaminants and Evolving Regulations

Chemicals not previously detected, or chemicals found in far lesser concentrations, are sometimes discovered in a community's water supply. These are known as **"contaminants of emerging concern"** or simply emerging contaminants.

Emerging contaminants are a priority because they pose significant risk to public and environmental health. However, the risk is not yet fully understood. Federal agencies are investing heavily in research and into improving the methods used to test, measure and identify removal technologies.



PFAS ARE AT THE TOP OF THE LIST OF CHEMICALS OF EMERGING CONCERN





What are PFAS?



PFAS are a group of manmade **chemicals** used in a vast number of consumer and industrial products.

They're often referred to as “**forever chemicals**” because **they do not break down** when released into the environment and continue to accumulate over time.

PFAS have been detected in water near manufacturing facilities, military bases, airports and firefighting training facilities where foam containing PFAS is used, among other areas.

PFAS CAN BE FOUND IN:



Drinking Water



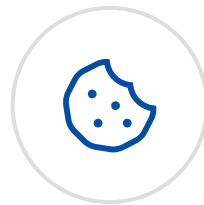
Soil & Water at/
Near Waste Sites



Firefighting
Foam



Food
Packaging



Non-Stick
Cookware



Paints, Varnishes
& Sealants



Personal Care
Products



Biosolids
*(e.g., fertilizer
from wastewater
treatment plants)*



How will this impact your projects?



There are many ways **PFAS** can penetrate a community's drinking water or impact aquatic life by contaminating lakes, rivers and streams.

One way is when PFAS-containing products are spilled onto the ground. PFAS can move through the ground, getting into groundwater that may supply drinking water.

PFAS can also enter surface waters through wastewater treatment plants and can be released into the air where they are taken up by rain or snow, ending up in rivers and lakes.

The Center for Disease Control (CDC) and EPA note "widespread exposure" to PFAS has been found in the U.S. population. This exposure is leading to more testing, new monitoring plans and policies, and other timely efforts that will provide communities with critical guidance.

Monitoring, and in some cases treatment, will likely be required by state law. Yet, many questions remain about methods, timing and who is responsible.

STEPS YOU CAN TAKE



RESEARCH YOUR STATE

Research applicable state agencies to learn about upcoming plans and policies.

EXAMPLE

The Minnesota Pollution Control Agency issued a **PFAS 101 report** that shares important water quality criteria requirements for local communities.

JOIN A STATEWIDE ORGANIZATION

Membership with organizations like the [Virginia Municipal Drinking Water Association](#) or the [Association of Missouri Clean Water Agencies](#) gives you access to key resources, news and regulation alerts, and information-sharing events.

RESEARCH NATIONALLY

In addition to state-specific reports, the EPA's **PFAS Strategic Roadmap: EPA's Commitment to Action 2021-2024** lays out timelines, policies and where you can begin.

MONITOR PFAS EXPERIENCE

Explore the experience of your consultants who work with technologies that treat and remove PFAS.

With PFAS and other emerging contaminants becoming a central focus, it's important to know you're in good hands with the team(s) leading your water infrastructure projects.



Invest in gaining an understanding of PFAS and what your levels are, but most importantly do not panic or react too quickly. Guidance and regulations will arrive in time; with these in hand you can make the most strategic decisions about your infrastructure.

SUSAN DANZL
WASTEWATER MARKET LEAD



5

Strategic Asset Management Improving Drinking Water Infrastructure

More than **2.2 million miles** of underground pipes deliver water across the country, and an estimated **6 million gallons of water are lost annually** due to breaks in these pipes.

Though eye-popping figures, water utilities have shown significant progress in addressing drinking water issues as evidenced by ASCE's **2021 Infrastructure Report Card**.

Strategic asset management is playing a key role in the improvements seen in our nation's drinking water infrastructure.



How will this impact your projects?

DRINKING WATER INFRASTRUCTURE



According to ASCE,
33%
of all water utilities
have a robust asset
management plan
in place.

Up from
20%
in 2017.



Strategic asset management involves documenting the age, condition and capacity of water infrastructure, then developing a formal plan for operations, maintenance and replacement.

Asset management can help utilities maximize the value of their infrastructure, operations and maintenance dollars, and provide invaluable CIP insight. Asset management ensures you have a finger on the pulse of your systems and a proactive and strategic plan in place when project needs arise.

STEPS YOU CAN TAKE



LEARN THE BASICS

What is an asset?
What should your plan include?
Who needs to be involved?

The EPA's **Asset Management: A Best Practices Guide** provides practical insight and where to begin.

EVALUATE YOUR ASSETS

Key steps for asset management include making an inventory of critical assets then evaluating their condition and performance.

From here, you can develop a plan to maintain, repair and replace your assets, and fund these activities.

CONSIDER THE ROLE OF TECHNOLOGY

Tools like drones, high-definition webcams and 3D laser scanning give you the ability to capture and report data in real-time. Embedded sensors can help you understand the performance of your infrastructure.

Dig deeper in this SEH article: **Technology's Rising Role in Key Project Phases**

IMPLEMENT YOUR PLAN

Implement and use your asset management plan to continuously evaluate asset condition and risk, and ultimately to make more informed CIP and operations and maintenance decisions.



Talk with your A/E consultant, long before shovels hit the dirt, about how project data will 'live on' after it's completed. Make sure your consultant can capture the data you need.

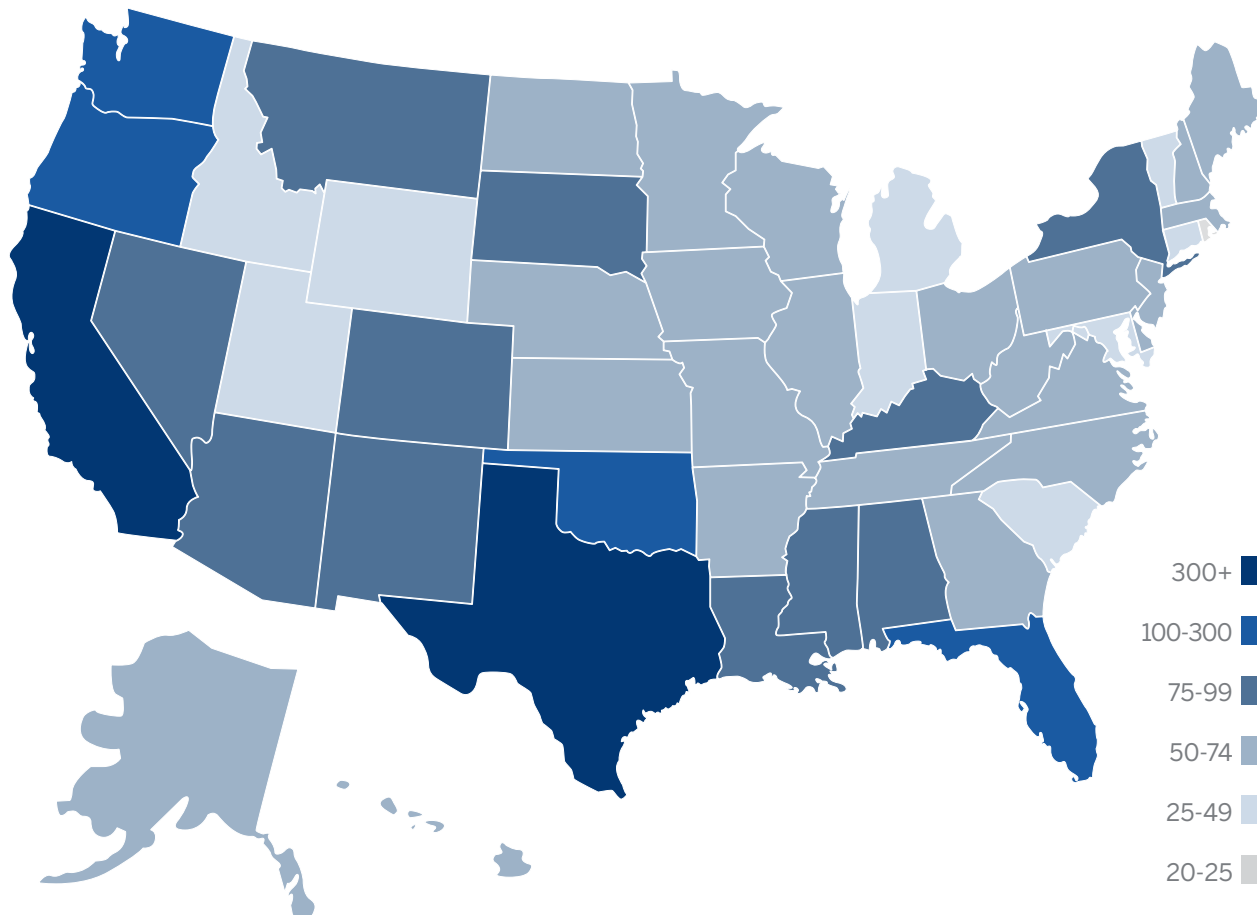
BRAD WEISS
WATER TREATMENT PROJECT ENGINEER



6

Climate Resiliency Through Hazard Mitigation

FEMA DISASTER DECLARATIONS BY STATE (1953-2019)



In 2021, more than **40%** of Americans lived in counties that were hit by climate disasters.

Natural disasters have become more frequent and costly; communities are no longer planning for the 100-year event. Water utilities are integrating climate resilience into their Federal Emergency Management Agency (FEMA)-approved hazard mitigation plans to identify risks associated with natural disasters, then developing long-term strategies to protect their people, property and infrastructure from future events.

FEMA-approved hazard mitigation plans are also a prerequisite for certain types of non-emergency disaster assistance, including funding for mitigation projects.



How will this impact your projects?



Disasters can cause loss of life, damage infrastructure and have devastating economic, social and environmental consequences.

Developing a hazard mitigation plan as a strategic effort opens your community to potential funding, helps you remain proactive in the face of erratic climate and weather-related events, and ensures you're protecting and nurturing the health of your people, property and water infrastructure.

Recognizing the urgency to support resilience, the IIJA includes expansive funding for hazard mitigation and flooding.

TWO EXAMPLES



FEMA's **Building Resilience Infrastructure and Communities** program received \$1 billion for communities undertaking hazard mitigation.



FEMA's **Flood Mitigation Assistance** program received \$3.5 billion for communities with projects to reduce or eliminate the risk of repetitive flood damage.

STEPS YOU CAN TAKE



STRATEGIC PLANNING

Integrate hazard mitigation efforts into your comprehensive or master planning processes, regulations and policies. This can help break the cycle of reactive fixes.

RESEARCH

Looking for a place to begin?
Created in 2021, FEMA offers a step-by-step **Mitigation Planning Program Resource List**.

PRACTICAL EXAMPLES

The **6 Keys to Long-Term Flood Resiliency** section of this eBook provides a practical example of an approach to resilience and hazard mitigation planning.



*As climates remain unpredictable and critical funding comes available, **communities are placing a greater emphasis on resilient infrastructure** – that is, infrastructure that creates the ability to absorb and thrive amidst climate disturbances and weather events.*

BRAD WOZNAK
SENIOR WATER RESOURCES ENGINEER



7

Resilience Through Smart Technology

Leaders in the water industry are relying on **smart technologies** to create resiliency. *(i.e., automated, intuitive and self-monitoring)*



TWO EXAMPLES

1 Cellular and Wireless Networks

Networks like 5G and LTE – and the water utilities that rely on them – often recover and come back online following a storm significantly faster than traditional non-wireless networks. This is critical when supporting emergency response efforts.

2 Advanced Metering Infrastructure (AMI)

AMI connects smart grids to water, gas, oil and electric utilities. Power companies, consumers and first responders have real-time wireless control through an infrastructure of sensors that monitor important variables – including water quality, temperature, pressure and rate of consumption.

This data empowers better and more timely decision making, can predict potential risks, and creates open communication between the system and its operators.

How will this impact your projects?

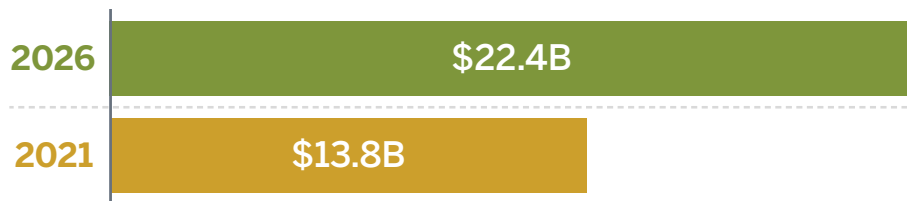


Water utilities are embarking on digital transformation – developing innovative smart water technologies.

Examples include leak detection, digital twins, cybersecurity systems, seismic resilient pipes, smart water quality monitoring and real-time data sensors, among many other initiatives.

These technologies improve resilience by allowing utilities to respond to changing climate conditions, improve efficiency of operations by reducing water losses, and deliver real-time data that allows for interactive decision making.

GLOBAL SMART WATER MANAGEMENT MARKET GROWTH



The global smart water management market is **expected to nearly double by 2026**, reports Research and Markets.



STEPS YOU CAN TAKE



CONSIDER THE OPTIONS

Consider technology's role as you plan upcoming water infrastructure projects.

Ask your A/E consultants if they have undertaken recent innovations that might fit well within your next upgrade.

LEARN FROM YOUR NEIGHBORS

Keep a close eye on the technology trends being discussed throughout the industry and used in neighboring communities.

RESILIENCE WITHOUT TECHNOLOGY

Resilience is still possible without smart technology.

EXAMPLE

Some cities are replacing traditional asphalt in alleys with permeable surfaces that redirect stormwater away from overtaxed sewer systems. These "green alleys" capture and filter up to 15,000 gallons of rainwater every storm, sending only clean water into rivers and lakes.

Learn more in this SEH article:
Igniting Economic Development Through Green Alleys and Alleyway Renovation



*The IIJA gives state and local governments a historic opportunity to reshape the water sector from one that is cautious and status quo, to **an industry marked by innovation and greater efficiency.***

KATHY CROWSON
REGIONAL LEADER, WATER AND WASTEWATER ENGINEERING



8

Water Reuse to Offset Growing Demand

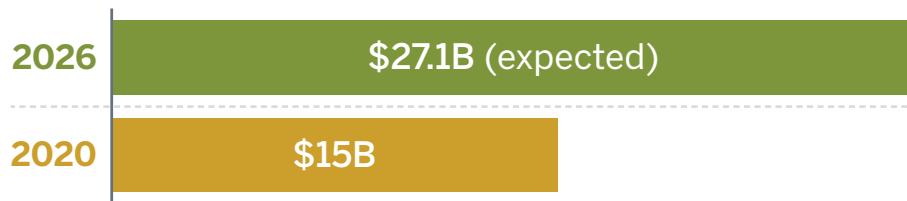
The priority to **recycle water**, offset growing demand, preserve water amidst limited supplies and save valuable dollars has perhaps never been higher.

This is driving the development and implementation of water reuse policy and regulatory decisions across the country. As public support increases and advancing technologies become more affordable, the treatment and recycling of wastewater and stormwater for potable or non-potable uses continue to expand.



How will this impact your projects?

GLOBAL WATER MARKET FOR WATER RECYCLING AND REUSE TECHNOLOGIES



As of 2021, the U.S. water market was **\$4.4 billion, accounting for 27% of the global market.** The need for water and wastewater recycling is driving the demand.



The major impact of this trend is the opportunity to **do more with less.**

With limited water supplies in certain parts of the country, limited funding and flexibility, finding creative ways to reuse available or nearby water can help communities save in a multitude of ways.

Source: Water Reuse and Reuse Technologies – Global Market Trajectory & Analytics, Research and Markets

CASE STUDIES

Two creative **examples** of water reuse:



1 Friedën Development Dual Stormwater Basin Recycles Effluent

The Friedën Development, a 250-acre master planned community in Fredericksburg, Texas, offers single-family, custom-built modern farmhouses and features 4+ miles of walking trails, 3 spring-fed lakes and a 12-acre park.

Specifically designed for the climate and geography, the development's innovative dual stormwater basin is one of the first in the state and serves as both stormwater management and irrigation storage. The 3-acre basin captures stormwater runoff from the development and filters it into the pond. At the same time, the pond serves as a 6-million-gallon irrigation tank – storing treated effluent discharged from the City's wastewater system which can be drawn from to irrigate the development.



[Watch Video](#)

2 Northern Metal Recycling Reduces Potable Water Purchases

Northern Metal Recycling's steel shredder in the City of Becker, Minnesota, is one of the largest shredders in the U.S. The shredder separates waste from recyclable products using some of the most sophisticated technology and programming available.

As part of the project to develop the new shredder site, SEH's strategic site grading design helped avoid the use of underground piping. This approach keeps all stormwater on paved surfaces and contained within a lined 7-million-gallon stormwater pond.

The design allows the reuse of stormwater for dust control – saving money as it reduces the amount of potable water purchased from the City.



[Watch Video](#)



7 Signs Your Wastewater Facility Needs a Condition Assessment

Facility condition assessments play an integral role in your ability to identify problems before they arise.

They uncover the structural condition of your assets, empowering you to calculate lifespans and risks, prioritize repair and replacement projects, plan for the future and prevent emergencies.

While water, sewer and stormwater services use different components, the infrastructure systems are similar – they involve piping systems, use of water resources and utility management structures. This section speaks to wastewater facilities, yet the signs also apply to most water infrastructure systems.

Here are seven signs your wastewater facility or other water, sewer and stormwater infrastructure may be in need of a condition assessment. You'll also find considerations around whether to renovate or rebuild once problems are identified.





1

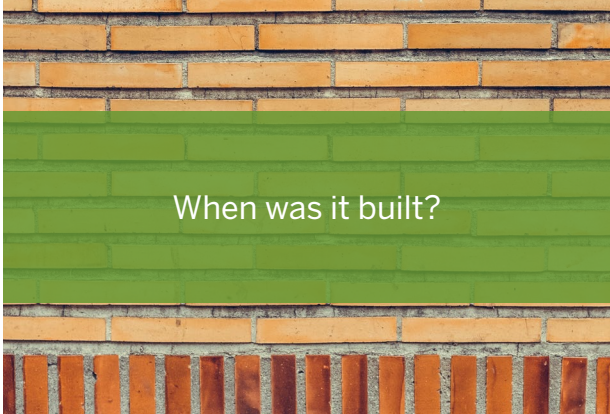
AGE

It's important to remember that wastewater infrastructure and equipment often **wears out** much faster than other water infrastructures, primarily because of the extreme conditions found at most plants.

Age is one of the most important ways to uncover whether you should undertake a renovation or build from scratch. However, it needs to be coupled with numerous other factors before you make any major decisions. The most sensible place to start is by uncovering the actual age of your infrastructure.

Questions you should be asking:

The cracks, gaps and discoloration found on this aging digester reveal critical evidence of leaks.



When was it built?



What population size was it built to serve?



Have there been significant additions to the facility or upgrades to the foundational infrastructure?

2

CORROSION

Effective wastewater treatment improves water quality by reducing toxins that cause harm to humans, and pollute rivers, lakes and oceans.

As a result, corrosion and deterioration can have serious and expensive ramifications.

The presence of exterior corrosion or deterioration is the most obvious sign you need a condition assessment. Sometimes it's purely cosmetic; discoloration and rusting are going to happen. However, if you see exposed aggregate or reinforced steel on a concrete structure, close examination of the infrastructure is likely needed.

Water conveyance facilities and pipes often require special attention. These facilities can be the most difficult and expensive to access for inspection, but they are often the most susceptible to corrosive damage.

The risks associated with corrosion and deterioration are high and can result in structural collapse and endangerment to your personnel. If either are present and more than cosmetic, consider your options carefully – patchwork rarely heals a festering issue and only hides it until the deeper structural issues arise.





3

LEAKAGE

Every day, nearly **6 billion gallons** of treated drinking water are lost due to leaking pipes – with an estimated 240,000 water main breaks occurring each year in the U.S.

Equipment age, corrosion, deterioration and many other factors can cause these breaks and leaks.

Three signs of leakage:



Liquid Leakage

Keep an eye out for free-flowing process liquid from pipes, tanks and structures, as well as recurring alarms from sensors in your secondary containment systems.



Aeration Piping Leakage

The loss of process efficiency or an increase in air demand might be indicative of present aeration piping leakage.



Gas Leakage

Check and double check your anaerobic digesters for methane gas leaks. The importance of doing this on a routine basis cannot be overstated.

If not properly assessed, the minor leakage shown in this concrete tank tunnel can lead to major leakage without warning.



Close evaluation can help you uncover whether repairs or a full rebuild are needed.

One client had an 80-year-old anaerobic digester leaking biogas. We were sure a rebuild was needed at first glance, but our condition inspection found the concrete to be in great shape.

Making only repairs saved this city a lot of money.

SUSAN DANZL
WASTEWATER MARKET LEAD

4

EXCESSIVE REPAIR

Occasional equipment **repair is expected** and part of any treatment facility's operations and maintenance strategy.

However, mechanical equipment has a limited useful life – oftentimes just **15-20 years**. Eventually you reach a point where your time and resources are better spent elsewhere. Certain types of repair and repair frequencies can serve as signs it's time for an upgrade or total rebuild of your infrastructure.

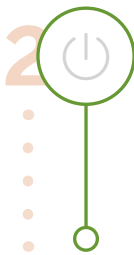


Four examples to consider:



Frequent Bearing Replacement

If the bearings on your wastewater equipment require frequent replacement, such as every 2-3 months, consider replacing this infrastructure altogether.



Gate and Valve Failures

Have you noticed excessive gate and valve actuator failures? These repairs can be costly; getting stuck in a cycle of reactive fixes can zap your budget and limit your ability to look long term.



Recurring Electrical Faults

Consistent electrical faults – for example, failure of electrical breakers and components, evidence of arcing or issues with unstable power supply – are clear indicators that routine maintenance won't be enough to cure these ills from happening again.



Extended Closures

Certain pieces of equipment taken out of service (i.e., "locked out" or "tagged out") for extended periods are critical signs your infrastructure is nearing or at the end of its functional lifespan.





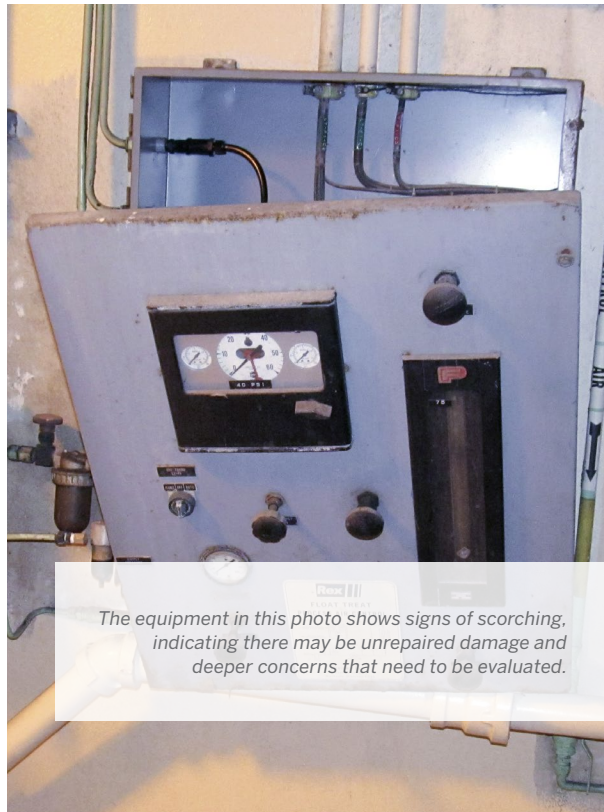
*The more prevalent use of asset management plans has enabled **62% of surveyed utilities to proactively manage** wastewater infrastructure maintenance rather than reactively respond to pipeline and equipment failures needed by 2032 to meet future treatment needs.*

**2021 INFRASTRUCTURE
REPORT CARD**
ASCE

5

UNREPAIRED DAMAGE

There are a number of telltale signs that water infrastructure damage has gone unrepaired, potentially even ignored. Unrepaired damage can **cause permanent corruption** at any moment.



The equipment in this photo shows signs of scorching, indicating there may be unrepaired damage and deeper concerns that need to be evaluated.

Six signs you may have infrastructure or equipment that has gone unrepaired:



Recurring sinkholes near buried pipes and structures, or wet patches on the ground indicating a possible break.



Burns or scorch marks on electrical equipment and switchgears.



Certain valves are locked into closed, sometimes impossible to move positions.



Interior piping with cracked and peeled coatings (corrosion).



Evidence of water damage inside, such as a leaking roof or damaged piping and tanks.



Sand in the water disruption system (e.g., a filter at a water plant failing).

6

PERFORMANCE

Questions you should be asking and **five signs** of poor performance:



The infrastructure's ability to achieve effluent limits has become more challenging or feels like it's working against itself.



Your pumps aren't pumping nearly as many gallons per minute as usual or cannot achieve enough pressure to be effective.



Your aeration blowers use more kilowatts of power than usual to maintain the same aeration basin dissolved oxygen content.



Your anaerobic digesters aren't producing the amount of gas expected or needed.



The sludge dewatering process isn't achieving the expected or needed percentage of sludge cake solids.



*While reduced performance can be expected as infrastructure ages, this can also **signify the need** for a more thorough investigation.*

BRAD WEISS
WATER TREATMENT
PROJECT ENGINEER



*Prioritize your repairs and replacements using a **risk-based asset management** approach. This accounts for processes and equipment that have the greatest probability of failure, and helps you determine the most dire consequences if they do fail. Stated more simply: **Probability of Failure x Consequences of Failure = Risk Exposure.***

KATHY CROWSON
REGIONAL LEADER,
WATER AND WASTEWATER
ENGINEERING

7

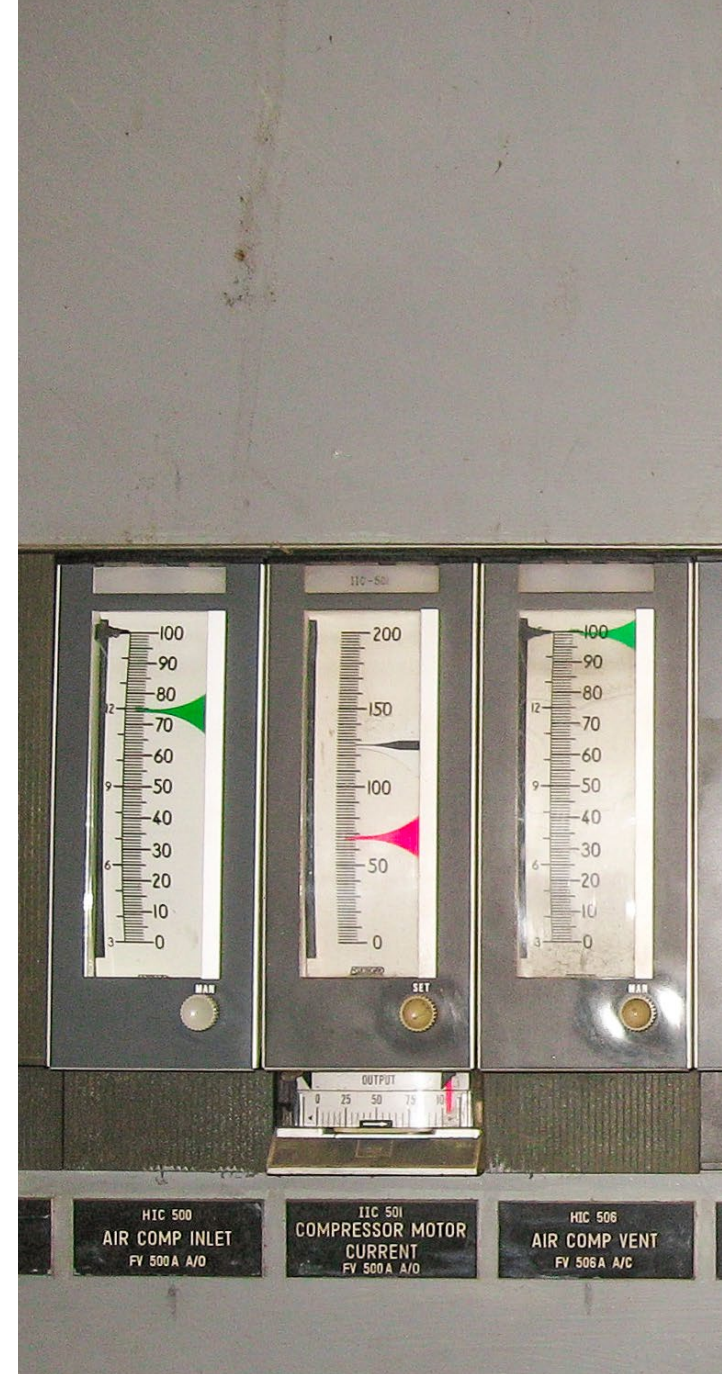
DIFFICULTY FINDING SPARE PARTS

Outdated Equipment Can Be Hard to Fix

Repair components may no longer be available on the market, difficult to find or challenging to install. Outdated equipment can also be more expensive. Ask yourself if the costs and timelines associated with repairing an aging control panel, valve actuators or large butterfly valves, for example, offer the return needed as you factor in your long-term water infrastructure plans.

Protect Your Assets

Condition assessments that identify early indicators of deterioration are one of the most effective and proactive ways to protect your assets and future generations. They help you prioritize improvements, evaluate risks through a combination of consequences and probability of failure, identify feasible replacement or rehabilitation alternatives, and glean potential construction costs.



Finding suitable replacement parts for this outdated control panel might be more challenging and costly than replacing it entirely.

An aerial photograph of a residential neighborhood situated along a river. The houses are mostly single-story with various roof colors. A road curves through the area. In the foreground, a large dam structure is visible, with water flowing over it. The surrounding landscape includes trees and some snow patches, suggesting a late autumn or winter setting.

6 Keys to Long-Term Flood Resiliency

In the **8 Trends and Challenges in Water Infrastructure** section, we explored the rise of resilience planning in light of erratic climates and increasing natural disasters. Flooding is a prime example of an ever-present threat to safety and infrastructure, one many communities face year after year.

Resiliency and preparedness are proactive measures essential to avoiding reactive, disorganized cleanups after storm events, protecting and informing your community, and ensuring your long-term viability.

Here, we share six keys to flood resiliency and gaining deeper knowledge of a critical issue.





1

RESEARCH

In the U.S., we typically consider areas as **floodplains** only if they are shown on a FEMA Flood Map or if they are located in low-lying areas along a river or lake.

The level of flood risk increases in the areas identified as floodplains or those that have flooded in the past. However, areas that have never flooded or aren't listed in a floodplain are experiencing flooding – making the importance of careful research and understanding your community's standing increasingly important.

Whether identified on a flood map or not, uncover your community's flood risk and/or the areas that are most susceptible to flooding. Understanding the trends, risks and likelihoods will help you proactively define your course of action. Deeper understanding also empowers you to educate local businesses, residents and other stakeholders – leading to greater trust and buy-in community-wide.

1.13-SQUARE-MILE RADIUS



EXAMPLE

SEH and the City of La Crosse, Wisconsin, used a flood event to capture new, more accurate data by distributing surveys to landowners within a 1.13 square-mile region near the floodplain.

Past modeling showed that 90 homes should have been inundated because of the flood event, but they weren't.

Data showed the FEMA mapping did not appropriately represent the underlying flood risk to these homes. As a result, instead of being mandated to purchase flood insurance, homeowners now had the ability to choose whether they wanted it.

2

PLAN

Flood damage to businesses, residents and critical facilities has a **lasting impact**.

EXAMPLE

Businesses may move away or decide to avoid opening in flood-prone communities. In addition, damage to residential areas can negatively impact the social fabric of a community by discouraging new residential and retail developments, thereby stunting confidence and limiting growth potential.

Strategic communities are incorporating **hazard mitigation and flood planning** into their comprehensive planning efforts. They're doing so by bringing local government emergency response personnel, the community floodplain manager, the state hazard mitigation officer and the department of public works into the planning process.

Other ways these communities are incorporating proactive, **pre-disaster mitigation measures** include:



Acquiring flood-prone lands and easements for emergency overflows of flood water



Adopting more restrictive floodplain regulations



Incorporating green infrastructure into local hazard mitigation plans

Even if flooding occurs, working this effort into your long-term plans empowers you to bounce back more quickly and move toward measuring recovery time in hours of receding floodwaters – rather than days or weeks. Long-term planning also positions you for future pre- and post-disaster grant applications.









*Remain strategic by **incorporating hazard mitigation and flood planning** into your comprehensive or master planning efforts, and bring key personnel into the planning process.*

BRAD WOZNAK
SENIOR WATER RESOURCES
ENGINEER

3 IMPLEMENTATION

Once you have researched where flooding occurs most and which areas are most vulnerable, begin to implement your plan to mitigate flood risks and increase the resiliency of affected areas.

Plan implementation should include a variety of strategies, including:

-  Property acquisition and relocation
-  Stabilizing river and stream banks
-  Green infrastructure improvements
-  Installation of flood warning systems
-  Flood response practice drills
-  Structural and non-structural flood mitigation measures

FEMA's National Flood Insurance Program (NFIP) Community Rating System (CRS) is a valuable place to begin. This voluntary incentive program encourages community floodplain management activities that exceed the minimum NFIP requirements.

If your community takes part and the following **three goals** are achieved, FEMA discounts flood insurance premium rates to reflect the reduced flood risk.

- 1** Reduce flood damage to insurable property
- 2** Strengthen and support the insurance aspects of the NFIP
- 3** Encourage a comprehensive approach to floodplain management

The *U.S. Climate Resilience Toolkit* is a **free online resource** created by the National Oceanic and Atmospheric Administration (NOAA) that is dedicated to walking communities through the CRS. The *Toolkit* offers steps to resilience, case studies, and tools tailored to specific topics and regions of the U.S.

U.S. Climate Resilience Toolkit

4

INVOLVE

Take every opportunity available to **engage** businesses, residents and other key stakeholders.

Obtain and track feedback, ask questions, and partner with them when seeking to develop or beginning to implement your flood resiliency plans. Promote an active discussion and help educate your stakeholders about the benefits of your community's short- and long-term project solutions.

This may sound like an obvious and straightforward step, but the impact is significant. Transparency creates trust which reverberates throughout your projects' timelines, budgets and buy-in.

Make sure your stakeholders never lose sight of the community's **primary objectives**:



INCREASE
RESILIENCY



SAFETY



ECONOMIC
VIABILITY FOR ALL



Emergency management is centered around people ... A 'Whole Community' approach attempts to engage the full capacity of the private and non-profit sectors in conjunction with the participation of state, local, tribal, territorial, and federal governmental partners.

2022-2026
FEMA STRATEGIC PLAN





More than 90% of spending on water infrastructure comes from the local level, emphasizing the importance of strategic and proactive planning. This is a challenge, but also an opportunity to build a better future.

BRAD WOZNAK
SENIOR WATER RESOURCES
ENGINEER

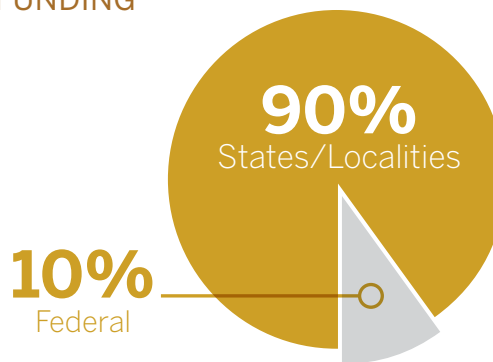
5 FUND

Funding for flood mitigation projects can take many forms and largely depends on the project being pursued.

EXAMPLE

Over 50% of levees in the U.S. are locally owned – placing a large financial burden on our communities. More than 50% of all dams in the U.S. are owned by private entities; the federal government owns just 4% of them.

STATES/LOCALITIES WATER INFRASTRUCTURE FUNDING



In brief, funding your projects is complex and carries significant consequences if not put to best use. Explore federal avenues, such as the FEMA Hazard Mitigation Grant Program, but also carefully examine state grant opportunities and low-interest loans.

In light of spending often falling to localities, many communities earmark funds in their CIPs, funds from sales tax revenue, or sales tax levies and special assessments. Because of the complexities involved in funding and fundraising efforts, in most cases you will need review and approval by the applicable governing agencies. However, you will also need to secure project buy-in from area businesses and residents.

6

SHARE

The **benefits** of resilient, sustainable infrastructure and flood mitigation efforts are practical and long lasting.

It's incumbent on you to communicate them to area businesses, residents and community stakeholders during outreach and buy-in efforts – but also to follow up and share results once projects are completed so these parties see and feel the results of their investments.



Seven **benefits** of resilient planning and action:

- 1  Noticeable reduction in flood damage
- 2  Improvements in community safety
- 3  Improvements to infrastructure and aesthetics
- 4  Increases community pride and peace of mind
- 5  Greater economic and social stability
- 6  More resilient commercial and residential development
- 7  Increased tax base and quality of life





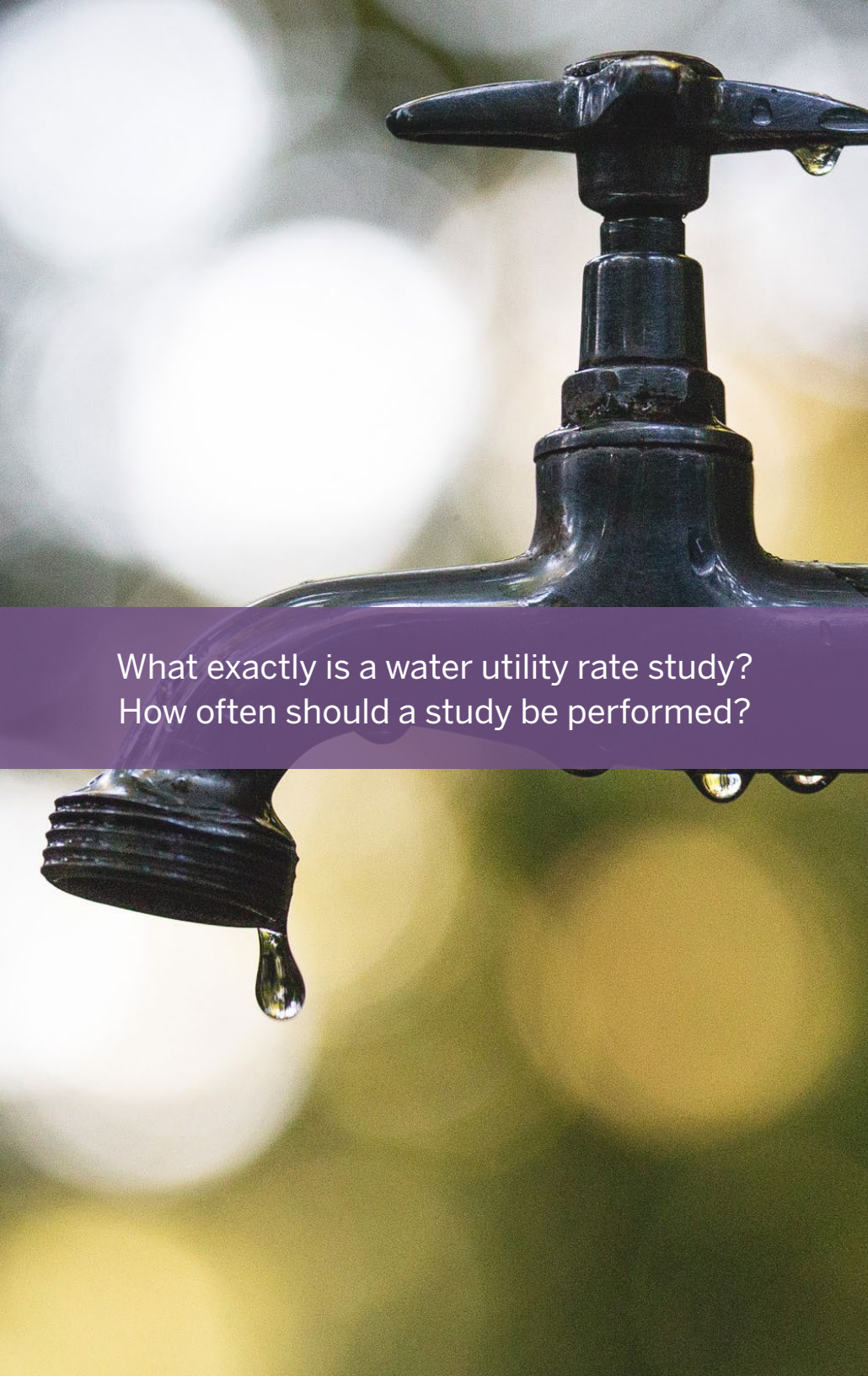
4 Ways Your City Benefits from a Water Utility Rate Study

One of the most pressing challenges for water utilities involves updating and approving equitable (i.e., fair and balanced) water rates to ensure sufficient revenues are being generated.

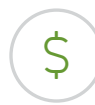
For your utility to be well run and financially sound, the revenue you generate from water utility sales, services and other sources must meet all operating and non-operating expenses.

Water utility rate studies offer a practical and highly effective solution to offer equitable rates that generate sufficient revenue.





What exactly is a water utility rate study?
How often should a study be performed?



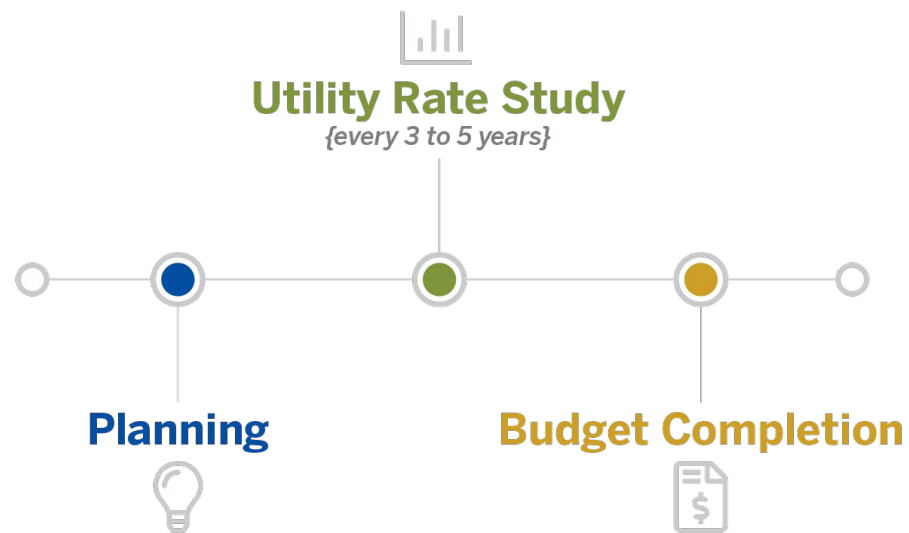
A utility rate study is a **financial review** of a water utility that projects future revenue and expenses, usually for the next five years.

The purpose of a water utility rate study is to determine whether your operating revenues are sufficient to meet your expenses, the cost of operations and maintenance, upcoming or needed replacements and debt service, and to help you fund capital improvements.



A community's first utility rate study is often performed **after planning but before completion** of its public works budget.

Ideally, one should be performed every 3-5 years and coincide with that year's public works budgeting process. If you complete a rate study outside of this window, users will likely experience a significant rate spike to meet the water utility's expected needs.





A **water utility rate study** relies on past and present data, your public works budget and other key pieces of information to project the next several years of rate needs for your water utility.

The rate study process is complex, detailed and includes a strategic implementation plan – developed specifically to supplement your CIP.

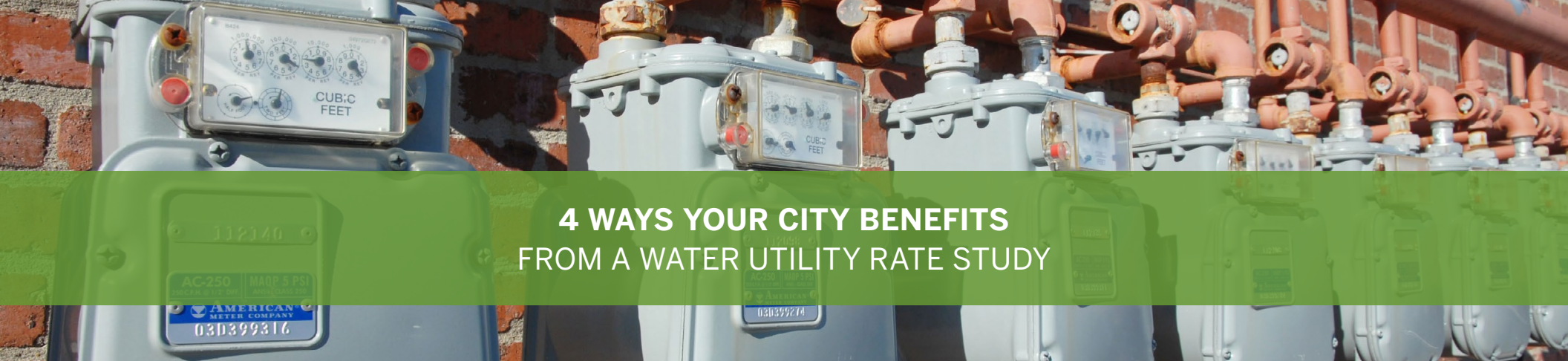
WATER BASE PROPOSED FEE

Base Charge (Monthly Fee)	2020 (Current)	2021 (Current)	2022 (Proposed)	2023 (Proposed)	2024 (Proposed)	2025 (Proposed)
<i>Single-Family</i>						
0.625 inches	\$10.10	\$10.10	\$12.00	\$14.00	\$16.00	\$18.00
0.75 inches	\$10.10	\$10.10	\$12.00	\$14.00	\$16.00	\$18.00
1.0 inches	\$14.14	\$14.14	\$16.80	\$19.60	\$22.40	\$25.20
1.5 inches	\$18.18	\$18.18	\$21.60	\$25.20	\$28.80	\$32.40
2.0 inches	\$29.29	\$29.29	\$34.80	\$40.60	\$46.40	\$52.20
3.0 inches	\$111.10	\$111.10	\$132.00	\$154.00	\$176.00	\$198.000
4.0 inches	\$141.40	\$141.40	\$168.00	\$196.00	\$224.00	\$252.00
6.0 inches	\$212.10	\$212.10	\$252.00	\$294.00	\$336.00	\$378.00
8.0 inches	\$292.90	\$292.90	\$348.00	\$406.00	\$464.00	\$522.00

Summary of a 5-year rate structure developed by SEH on behalf of a Midwest community (population ~13,000) as part of a 72-page water utility rate study.

WATER COMMODITY PROPOSED FEE

Monthly Commodity Charge	2021 (Current)	2022 (Current)	2023 (Proposed)	2024 (Proposed)	2025 (Proposed)
<i>Residential</i>					
Up to 5,000 gallons	\$3.78	\$3.80	\$3.80	\$3.80	\$3.80
Over 5,000 gallons	\$4.73	\$4.75	\$4.75	\$4.75	\$4.75
<i>Small Commercial</i>					
Up to 9,000 gallons	\$3.40	\$3.42	\$3.42	\$3.42	\$3.42
Over 9,000 gallons	\$3.74	\$3.76	\$3.76	\$3.76	\$3.76
<i>Large Commercial</i>					
Up to 100,000 gallons	\$3.40	\$3.46	\$3.46	\$3.46	\$3.46
Over 100,000 gallons	\$3.74	\$3.81	\$3.81	\$3.81	\$3.81
<i>Industrial</i>					
Up to 556,000 gallons	\$2.98	\$3.08	\$3.08	\$3.08	\$3.08
Over 556,000 gallons	\$3.14	\$3.25	\$3.25	\$3.25	\$3.25
<i>Municipal</i>					
Up to 53,000 gallons	\$3.75	N/A	N/A	N/A	N/A
Over 53,000 gallons	\$4.70	N/A	N/A	N/A	N/A



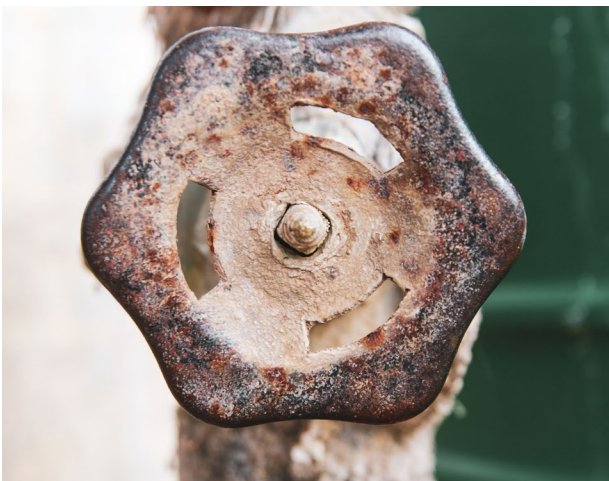
4 WAYS YOUR CITY BENEFITS FROM A WATER UTILITY RATE STUDY



1 Helps You Identify the Rates Needed to Pay for Various Projects/Improvements

Determining a municipal water utility's revenue requirement is foundational to setting the overall level of utility rates that need to be applied and charged to users.

This also provides your municipal water utility with adequate and sustainable funding levels for operations, maintenance and capital improvement expenses, as well as a basis for annual budgeting.



2 Provides Revenue Stability and Predictability

Revenues are the lifeblood of every municipal water utility. Without adequate revenues, quality of service often deteriorates due to a lack of proper maintenance and system improvements. A lack of revenue also makes it extremely difficult for a water utility to be financially and operationally sustainable.

Conversely, revenue stability and predictability prepare your municipal water utility for long-term success. A water utility rate study provides an accurate financial understanding of fixed assets, inventory and the processes required to meet your utility's distribution needs. Revenue stability and predictability also help identify when you should act to meet these needs, consistent with your CIP.

Related SEH article: ***10 Ways to Prioritize Your CIP During Economic Uncertainty***



3 Ensures Fairness in the Distribution of Total Costs of Service Among Different Ratepayers

Utility rate studies result in a more equitable cost-allocation methodology. Developing an equitable and actionable strategy designates the costs of providing water service to customers of all types by user categories, such as businesses, residents and residential property owners.



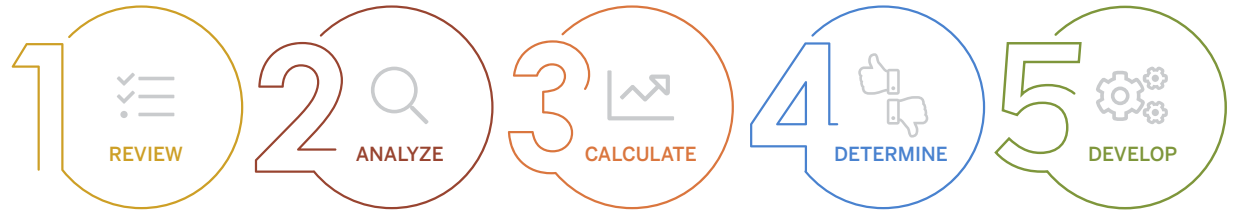
4 Plays an Instrumental Role in Utility Rate Design

Utility rate studies make it possible for utility managers and board members to review your current water rate structure and provide a rate design that is cost based, justifiable to the public and meets the specific rate design objectives needed to maintain and grow your utility.



PROCESS OVERVIEW

WHAT DOES A WATER UTILITY RATE STUDY INVOLVE?



1

Review Water Utility's Current Rate Structure

At SEH, when conducting a utility rate study, our economic development, utility finance and utility engineer professionals review your water utility's current rate structure, historical financial information, median household income, planned capital improvements and debt obligations.

We then factor in inflation to uncover and recommend a five-year cost estimate for your water utility based on various maintenance and growth scenarios. Next, we work with you to develop a five-year implementation plan to align with and supplement your CIP.

2

Analyze Current Rate Structure Ability to Generate Revenue

After determining projected costs associated with the implementation plan for your water utility system, SEH professionals analyze the current rate structure's ability to produce sufficient revenue in order to fund improvements during the five-year implementation period.

Depending on these results, **we work with your water utility to adjust the rates** or recommend an alternative rate structure that will meet the needs of the implementation plan.



3

Calculate Utility Rates

Utility rates are calculated based on the revenue your water utility will require to meet its financial obligations and anticipated expenses, plus the funds needed to maintain sufficient cash reserves.

There are several possible rate structures that will be considered during a water utility rate study. Each of the following structures have advantages and challenges; uncovering which is right for your utility depends on your individual needs and the political environment, and requires detailed exploration.

EXAMPLE

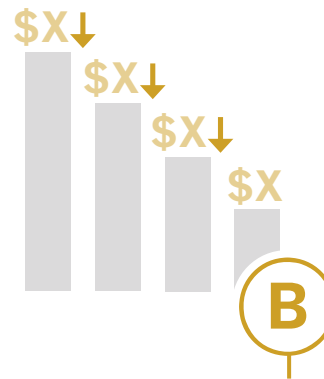
It's important to consider how a particular rate structure will affect your billing procedures and the diverse demographics of your utility users – senior residents, businesses and non-profits, among other types of users.

COMMON RATE STRUCTURES INCLUDE:



UNIFORM RATES

Constant unit price for all metered volumetric units of water consumed on a yearly basis. Uniform rates require metered service and can be applied to all customer classifications.



DECREASING BLOCK RATES

Rate structure in which the unit price of each succeeding block of usage is charged at a lower unit rate than the previous block(s). The number of rate blocks and the size and pricing of each block vary by utility.



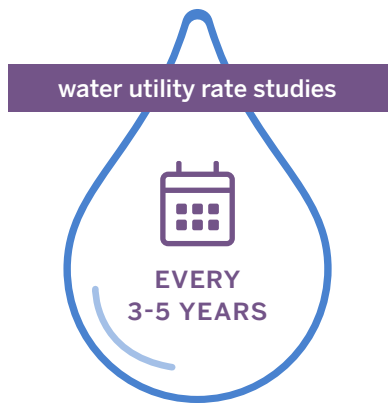
INCREASING BLOCK RATES

Volumetric chargers, meaning the rate per unit of water increases as the volume of consumption increases. Increasing block rates require metering and defining consumption blocks over which rates increase.

4

Determine if Operating Revenues are Sufficient

The primary goal of a water utility rate study is to determine whether your operating revenues are sufficient to meet your current, upcoming and potential expenses, and help you make capital improvements during the implementation plan period.



Typically, water utility rate studies should be performed **every 3-5 years**.

However, timing depends on what is right for your utility and your service area. Some utilities raise rates annually to keep up with inflation and minimize the shock to its ratepayers; others opt for a larger increase every few years.

5

Develop a Financial Plan and Cost-Based Rates

Raising rates and asking for more from the community is never the goal yet often unavoidable.

It's important to help your customers understand how rates are developed, why costs may need to increase, and how their dollars are used to provide an uninterrupted supply of safe, healthy, potable and reasonably priced water while maintaining sound and sustainable finances.

Utility rate studies provide the transparency and research you need to help your customers understand.



Ultimately, water utility rate studies ensure you have the financial resources needed to meet your budget, maintain your infrastructure, grow your distribution system, explore new technologies and implement your CIP.

DAMON TSOUKLIS
 SENIOR ECONOMIC
 DEVELOPMENT PROFESSIONAL

CONCLUSION

A photograph of a water treatment plant with various tanks and pipes, overlaid with a blue semi-transparent filter. The text is centered over this image.

**Be proactive.
Seek knowledge.
Take control.**

As U.S. water infrastructure continues to age, critical funding is available and regulations keep evolving, knowledge and control are key to remaining proactive – knowledge of what you have, what you need and what has/hasn't worked in the past. Take control of and re-shape your future by capitalizing on the opportunities at hand.

Would you like to discuss any of the trends or solutions explored in this eBook?
Do you have water infrastructure at or nearing capacity but are unsure where to begin?
Are you seeking to transition from traditional to innovative with the amount of funding available? We welcome the opportunity to have a conversation about your needs.

Let's Connect

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