

# currents



## HOUSTON NEWPP EXPANSION

The Largest Progressive  
Design-Build Delivery in  
the United States

PLUS —

AWIA Highlight  
- Are You Ready?

Alternative Delivery Methods:  
Carollo's Design-Build Group

Napa Earthquake: Installation  
of Trenchless Water Pipelines

Carollo's EPIC®  
Group Highlights

Oak Harbor Facility Receives  
APWA 2019 Award



THIS ISSUE'S Editorial

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Happy belated New Year and welcome to Volume 1 of the 2020 *Currents* publication! In this issue, you'll find a wealth of information on the America's Water Infrastructure Act (AWIA): compliance requirements, deadlines, and key references to help you through the process. We also take you on a Sparknotes tour (Cliffsnotes for those who graduated high school prior to 2000) through our alternate delivery and EI&C portfolios and introduce you to the 2019 American Public Works Association Public Works Project of the Year. Next, we spend a little time in wine country recounting how Carollo used horizontal directionally drilled fusible PVC pipelines to restore the City of Napa's water service following a 6.0-magnitude earthquake. Finally, our feature story highlights the City of Houston's Northeast Water Purification Plant Expansion, a project that includes, among other things, 108-foot diameter dual pipelines feeding the plant, 17,400 lbs/day of ozone capacity, over 55,000 square feet of filtration area, 700,000 dry pounds per day of solids dewatering capacity, and 52,000 gpm of filter backwash capacity...it is Texas after all! As always, I hope you enjoy this issue, and please let me or the primary authors know if you have any questions or comments!

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AWIA:  
EVALUATING  
RISK AND  
PLANNING FOR  
RESILIENCE!

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**Water is critical to public health, safety, and welfare.** The events of the last decade have demonstrated the need for a holistic, “all-hazards” approach to water system resilience—one that doesn’t merely focus on a terrorism threat basis but incorporates a variety of other potentially malevolent and natural hazard-based threats to our water infrastructure. The recent passage of the America’s Water Infrastructure Act (AWIA) in October 2018 reflects the importance of protecting our nation’s water supplies — and it requires action now!

AWWA STANDARDS AND THEIR  
INTERDEPENDENCIES DECODED

With the adoption of the AWIA, the Environmental Protection Agency (EPA) established a much needed holistic, all-hazards approach to water system resilience. The Act requires communities serving more than 3,300 customers to complete a comprehensive risk and resilience assessment (RRA), followed by updates to their emergency response plan (ERP). If qualifying utilities do not complete the RRA and ERP by the designated dates (shown in Table 1), they can incur significant fines enforceable by the EPA. To avoid this penalty, utilities must complete the required evaluations and submit a certified letter to EPA acknowledging completion of their associated RRA and ERP prior to the noted deadlines.

Table 1. EPA Deadlines for Water Systems to Confirm Completion of RRAs and ERPs by Certified Letter

Utility Size	Risk & Resilience Assessment	Emergency Response Plan
>100k	March 31, 2020	September 30, 2020
50k-100k	December 31, 2020	June 30, 2021
3.3k-50k	June 30, 2021	December 30, 2021

The American Water Works Association (AWWA) previously published a series of standards, including J100, G300, G430, and G440, which provide guidance on addressing potential risks to water systems assets and operations. While these standards form an excellent baseline for completing various aspects of the evaluation, the holistic nature of the regulation requires additional approaches, tools, and processes to ensure all applicable aspects of risk and resilience are addressed. In addition to physical security, the RRA and ERP updates must consider and address source water resilience, operational security, cybersecurity (for both process and business systems), source water and distribution system contamination, insider threats, and a variety of natural hazards. Each of these areas requires specific expertise, which must be combined with a thorough understanding of water resources, treatment, as well as delivery and system operations, to develop reasonable and defensible recommendations to reduce risk and increase resilience.

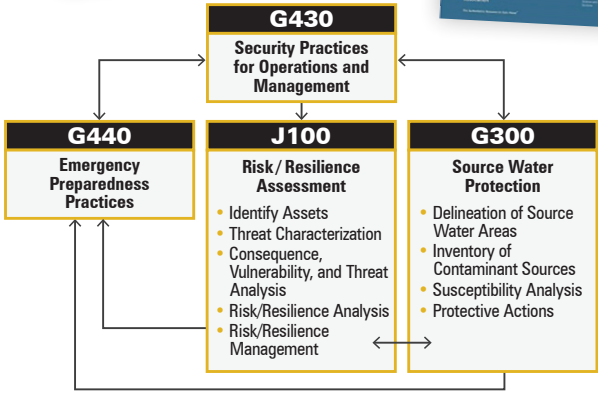
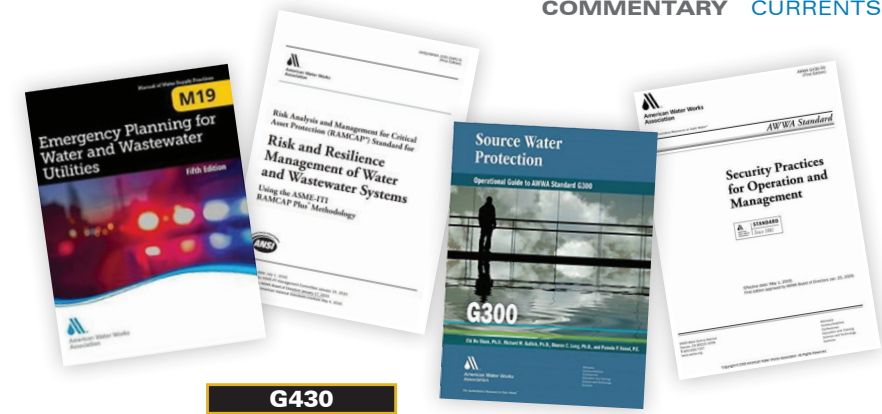


Figure 1. These AWWA resilience-related standards provide guidance on addressing potential risks to water system assets and operations for inclusion in the RRA and ERP updates.

MAXIMIZING THE VALUE OF YOUR AWIA EXPERIENCE

Being required to complete an unfunded federal mandate can be frustrating, but that doesn’t mean the effort can’t be beneficial and productive. The AWIA process, if completed correctly, not only improves the resilience of your system, but also offers many opportunities to add value throughout the process. The inherent lack of specificity in the regulation allows utilities to focus efforts on areas of greatest need. Additionally, the efforts required as part of the AWIA often coincide with similar activities completed on a local or regional level, such as hazard mitigation plans and water resource planning. These planning activities can be coordinated with the required AWIA tasks, reducing overall effort and maximizing the integration of the plans. Many utilities are also choosing to complete supplementary tasks, which can further enhance the value of the AWIA efforts. For instance, including more in-depth cybersecurity evaluations, distribution system water quality monitoring analyses, and desktop or full-scale ERP validation exercises can significantly reduce a utility’s risk while promoting more resilient systems. In addition, generating RRA and ERP implementation plans that are closely aligned with the utility’s capital improvement budget promotes management of risk without impacting on-going business objectives. When completed in conjunction with the AWIA tasks, these activities add value with minimal increases in effort.

While compliance with the AWIA can be a daunting task, the right mindset and approach can generate reductions in risk, increases in resilience, and add value that will help a utility continue to meet their mission of reliably delivering safe, high quality water to their customers.



A JOURNEY OF A THOUSAND MILES begins with a single step, and sometimes that first step is taken in faith, trusting that the route forward will become clear and the journey’s end achievable. Carollo began such a journey in 2011, when Houston chose us as their project advisor/technical consultant for the Northeast Water Purification Plant’s (NEWPP) expansion. At the time, none of us dreamed that the project would ultimately become the largest progressive design-build delivery in the United States water market, costing nearly \$2B for 320 mgd of capacity.

EARLY CHALLENGES

The fee for our first work order was \$386,000. This was a modest fee, since the City, while optimistic of Carollo’s ability to deliver on our promises, needed proof we could serve as their trusted advisor, having never worked with the City before. To foster trust, we spent the next 6 months working closely with their staff and leadership to gain understanding, solve problems, overcome constraints, and cast a vision for the project, building a roadmap for the path ahead. More importantly, we earned the trust of our client while forging professional and personal relationships that have persisted through the ensuing 8 years of trials and triumphs.

Two early crises shaped future decisions for expanding the existing 80-mgd NEWPP. Storms in February and July 2012 severely degraded water quality in Lake Houston, and the plant was forced to shut down for several days. In both cases, plant staff worked around the clock to restore production, narrowly averting boil water notices due to falling system pressures. Carollo worked alongside staff during each shutdown, providing treatment and operational advice. These events demonstrated the need for robust, reliable, and resilient facilities for the expansion. Losing 80 mgd of production is a problem, but losing 320 mgd of water supplying over 2 million people would be catastrophic.

MAKING PROGRESS

The next couple of years were spent evaluating the condition of the existing facilities and refining treatment, capacity, schedule, and delivery requirements for the expansion. Simultaneously, the City negotiated with four water authorities who eventually partnered on the project. To help guide the partnership toward a delivery decision, Carollo led a series of workshops. Visits to Denver Metro and Colorado Springs Utilities—two clients of Carollo that were early adopters of progressive design-build—provided real-life feedback. In the end, an accelerated schedule, coupled with risk considerations for this mega project, led the partners to select a progressive design-build delivery.

HOUSTON NEWPP EXPANSION

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Procurement of a design-builder consumed most of 2015. Since progressive design-build had never been used in the Texas municipal market, Carollo worked closely with the City’s Legal and Public Works teams to develop an approach that conformed to Texas statutory requirements and Houston procurement rules while providing the ability to select a design-

builder on the basis of qualifications plus cost. Procurement culminated with selecting CDM Smith and Jacobs as the joint-venture provider of design-build services.

Carollo also performed 18 months of pilot testing to establish design parameters that would help the new plant reliably treat water under the full range of challenging raw water conditions. The tests showed how ozone could be used to enhance treatment by providing primary disinfection, mitigating taste and odors, and improving filter performance. The tests also demonstrated that high-rate settling of the fragile floc, formed by the addition of copious amounts of coagulant, was achievable. Chlorine dioxide testing revealed that bromate formed during ozonation could be mitigated while also reducing dissolved manganese below secondary standards.

Key Project Facts	
108	Diameter of dual raw water pipelines supplying plant
17,400	Ozone generation capacity (pounds per day)
48,160	Number of lamella settling plates in eight basins
55,200	Filtration area of 24 filters (square feet)
42,000	Total pumping power (motor horsepower)
700,000	Solids dewatering capacity (dry pounds per day)
14	Applied chemicals
52,000	Filter backwash rate (gallons per minute, equivalent to 75 mgd)
>200	Number of Carollo personnel who have worked on the project



The project is well underway. Approximately 23% of the nearly \$2B project budget has been allocated through January 2020.

Preliminary services, which included permitting, design, and construction of early work packages, stretched from 2016 through 2019. Collaboration between Carollo, Houston, Authority partners, and the design-builder was the key to progressing the expansion from initial concepts to the early construction of critical path facilities. Hundreds of meetings and workshops served as guideposts along the way, providing stakeholders the opportunity to make decisions with the benefit of cost, schedule, and risk considerations. After 9 months of negotiations, this phase of the project concluded with the execution of the Guaranteed Maximum Price (GMP) that fixed the final price, schedule, and scope of work.

LOOKING AHEAD

While we’ve journeyed far these last 8 years, much remains to be accomplished before we reach the goal of final completion in 2026. Throughout the project, countless Carollo employees contributed their time and talent to help our local team serve Houston. When the journey ends in 6 years, we will all look back with pride and gratitude at the role we played in helping deliver this world-class project.



When completed in 2026, the Northeast Water Purification Plant will be capable of treating 320 mgd, 365 days a year.

PROJECT MILESTONES

9/2011	Houston selects Carollo as Project Advisor/Technical Consultant.
2/2012, 7/2012	Plant shutdown due to severe storms that degraded water quality in Lake Houston. <b>Carollo service:</b> Treatment and operational advice.
2013-2014	<b>Carollo service:</b> Condition evaluation of existing facilities. Refined treatment, capacity, schedule, and delivery requirements for the expansion.
2014	<b>Carollo service:</b> Evaluated and presented delivery options to help guide the team towards a delivery decision.
2015	Procurement of a Design-Builder. <b>Carollo service:</b> Prepared RFQ and RFP, collaborated on contract development, provided technical support for evaluations of proposers.
2015	Selection of CDM Smith and Jacobs as the joint-venture provider of design-build services.
2015-2016	<b>Carollo service:</b> 18 months of pilot testing to help the new plant treat water under a full range of water conditions.
2016-2019	<b>Carollo service:</b> Served as Houston’s advisor during permitting, design, and construction of early work packages.
2019-2026	<b>Carollo service:</b> Providing construction auditing, project controls services, technical validation, start-up & commissioning oversight, and close-out support.
2026	Final project completion.



# MEETING THE CHANGING DELIVERY METHODS OF WATER AND WASTEWATER PROJECTS

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The number of water and wastewater projects being delivered by alternative project delivery methods is increasing each year. As our clients are increasingly using alternative delivery methods, Carollo has expanded its expertise to serve our clients from planning through construction and operation. Our experience and expertise cover all types of alternative delivery:

- Progressive Design-Build (PDB)
- Fixed-Price Design-Build (FPDB)
- Design-Build-Operate (DBO)
- Construction Management at Risk (CMAR, CM/GC)

Carollo has been providing collaborative delivery services to our clients for over 15 years. As our clients have been increasingly using design-build and design/CMAR delivery methods, Carollo has gained expertise serving as the lead for delivering these types of projects. Since 2014, we have completed more than 12 design-build water/wastewater projects as the prime design builder, and more than 75 projects as the lead designer, for a combined construction value of more than \$1.1 billion.



Clifton Water District, CO, Microfiltration/Ultrafiltration Water Treatment Facility.

Our performance as a design-builder has been recognized through multiple project awards granted by the Design Build Institute of America, and the American Council of Engineering Companies. As a prime design-builder, we make sure our clients' projects are delivered on budget and on schedule. As the lead designer, we have applied our unwavering commitment to the water industry for alternative delivery projects across the United States. We understand that the design of design-build projects requires a specialized approach focused on providing best value to our clients.

Carollo's water and wastewater expertise extends beyond its industry-leading planning and design to leading progressive Design-Build and Fixed-Price Design-Build projects. Our collaborative project delivery mindset, alternative delivery expertise, and being a national leader in the water and wastewater industry brings unique expertise and project understanding to our clients.

We have collaborated with all the major water/wastewater contractors in the US on alternative delivery projects and traditional delivery projects.

Our design-build staff includes seasoned design-build managers, cost estimators, procurement agents, and schedulers, all with extensive experience designing, constructing, and commissioning water/wastewater facilities. Through their design-build experience, our staff has earned accreditations as designated design-build professionals, project management professionals, and certified construction managers.



Full-Scale Fixed-Bed Biological Perchlorate Destruction Water Treatment Plant, West Valley Water District, CA.

# POST-DISASTER TRENCHLESS INSTALLATION OF CITY OF NAPA HIGHWAY 29 WATER MAIN REPLACEMENT

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On August 24, 2014, the 6.0-magnitude South Napa Earthquake struck Napa, becoming the largest earthquake to hit the Bay Area since the Loma Prieta earthquake in 1989. The earthquake caused an estimated \$1 billion in damage and over 240 water pipeline breaks. Several breaks were beneath Highway 29 and limited the City's ability to convey potable water across the highway, which bisects the City's water distribution system.

To restore water service, Carollo designed four new highway crossings at strategic locations using horizontal directionally drilled pipelines with fusible PVC pipe. Each crossing was designed with a 12-inch diameter water pipeline within a 16-inch diameter casing pipeline so the same drilling equipment could be used at each location, reducing installation time and cost. Geotechnical borings confirmed the soil was mostly silty sand, suitable for directional drilling, and did not include high-risk geology such as cobbles, boulders, and flowing sands.

Due to site constraints, two of the four crossings were designed with a complex compound horizontal and vertical curve instead of a single vertical curve. To reduce risk during construction, these crossings included large curve radii, to provide construction flexibility, and drilling contractors were required to

be prequalified. Prequalification also facilitated a good working relationship with the drilling contractor during construction that expedited decision making for minor adjustments to the drilling path. The pilot bore and pipeline operations went very smoothly.

This project was presented at the 2018 North American Society for Trenchless Technology (NASTT) No-Dig Show, the largest trenchless technology conference in North America, and was featured in the 2019 *Western Regional Trenchless Review Journal*.



Beginning pipeline pullback on Old Sonoma Road.



Utility worker inspecting earthquake damage.

# The Equation is Simple:

ELECTRICAL + PROGRAMMING + INSTRUMENTATION + CONTROL = EPIC® SOLUTIONS

JEFF MARTIN (jmartin@carollo.com) ■ MONTE RICHARD, PE

Our EPIC® team of over 125 engineers, designers, and programmers is dedicated to serving our water and wastewater clients' electrical, programming, instrumentation, and controls needs.

The world of electrical power, instrumentation, and control is constantly changing—given this context, innovation is the key to remaining ahead of the curve. Automation and a reliable power system are critical to the success of any utility, allowing for simplified, reliable, and efficient operations and maintenance.

EPIC® provides a one-stop shop for an array of electrical, programming, instrumentation and control services from planning to design to implementation, allowing us to design effective solutions for operational resiliency, efficiency, safety, and sustainability. EPIC® offers our clients the following benefits:

- **BEST-IN-CLASS SOLUTIONS.** EPIC® combines Carollo's El&C design group with its programming services to find reliable power and control solutions customized to client needs.
- **El&C INNOVATION.** From high performance HMI to holistic power-saving techniques, our EPIC® team is focused on optimizing the efficiency of our clients' operations and maintenance staff.
- **COLLABORATIVE APPROACH.** The El&C systems we design are ultimately our clients' responsibility to operate and maintain. Thus, our approach is focused on listening to our clients' needs and customizing solutions around them. Soliciting stakeholder input through workshops and field investigations is paramount to designing a system that our clients can be proud to operate.

## OAK HARBOR CLEAN WATER FACILITY Receives American Public Works Association 2019 Public Works Project of the Year Award

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**The American Public Works Association (APWA) Public Works Project of the Year Award is given to infrastructure projects that promote excellence in construction management.**

Carollo worked closely with the City of Oak Harbor, Washington, to replace two treatment facilities in an environmentally sensitive area with a single membrane bioreactor facility. The Clean Water Facility (CWF) project presented several technical challenges from the start, including a site that had 2,000 years of human habitation, physical constraints, liquefiable soils, large seismic differential settlement, and corrosive soils. Carollo provided effective solutions to these challenges, laying out

a facility that "built in" future expansion to accommodate a land-locked site surrounded by commercial interests and a beloved waterfront park.

As part of the CWF project, the park directly adjacent to it had to be updated. However, due to early project successes, City Council was able to significantly redesign most of the park with public support. In the words of our client: "The

project driver was a wastewater treatment plant, but the goal was to achieve a community vision. Many talented professionals applied their skills and commitment to the City of Oak Harbor. That dedication, teamwork, and understanding resulted in an outstanding project."

Due to its location on Puget Sound, the CWF is becoming a benchmark water quality project, and will help guide Washington State regarding forthcoming nutrient regulations.

