Western Regional Trenchless Review

2025

The 19th Annual Western Regional No-Dig Conference, Exhibition, and Training Course

October 14 - 16, 2025 ▪ Scottsdale, Arizona

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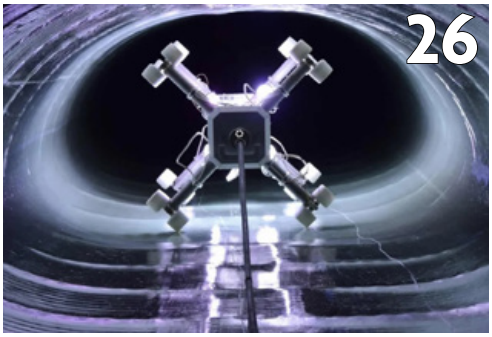

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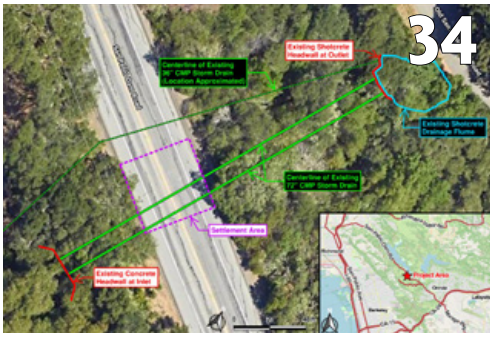

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MESSAGE FROM THE WESTT CHAIR

Michelle Beason, PE, Chair, Board of Directors Chairwoman, WESTT

The WESTT Chapter Board of Directors (BOD) is excited for another year of trenchless education! We have greatly expanded our efforts to encourage our WESTT members and student chapters to get more involved in our organization, and in our industry. Our latest initiative is to encourage more member participation in our chapter committees. We now have active member involvement in our Outreach, Conference, Student Chapter, and Elections committees. All WESTT members are welcome to participate!

The 18th Annual WESTT conference last October at the Kellogg Center within the Campus of Cal Poly Pomona (California Polytechnic State University, Pomona Campus) was one of our best conferences yet. We had over 180 attendees, including students from our Cal Poly Pomona WESTT student chapter, and we sold out on vendor sponsorships.

For our 19th Annual Conference, to be held October 14-16, 2025, we selected Scottsdale, Arizona to be near our other active student chapter at Arizona State University (ASU). The ASU Scottsdale Innovation Center, "Skysong", will host our event and will allow for more accessible student participation at our conference. An optional Axe-Throwing networking event will be held the evening of October 14, with the conference and exhibition on October 15. WESTT will also be presenting NASTT's two 4-hour courses on October 16: Introduction to New Installations and Introduction to Rehabilitation. This conference is a great opportunity for networking and education, and we hope to encourage all members to attend!

One ongoing initiative is to increase coordination and outreach with the student chapters in our region at Arizona State University and at Cal Poly Pomona, and to encourage new student chapters at other universities. We are actively planning student site visits to active trenchless construction sites to provide real-world experience of a career in the trenchless field. We are also looking to provide brown-bag presentations to University students to highlight the variety of projects and careers that fall under the umbrella of trenchless construction. We are always looking to widen our reach, so if you have contacts with Civil Engineering, Geotechnical Engineering, and/or Construction Management programs at universities in the Western region, we would love to have an introduction!

WESTT is currently accepting nominations for new board members through November 21, 2025, so please watch for an email with details, or visit our website for election information. If you wish to get more involved in the organization, I encourage you to run. The current board is filled with passionate individuals who work to advance the practice of Trenchless Technology through education, training, and research. Interested parties should contact our Elections Chair, Cindy Preuss, at **PreussCL@CDMSmith.com**.

> *"Thank you for your continued support of WESTT."*

I would like to thank the WESTT Board of Directors, committee chairs, and other member volunteers for their continued involvement. We have accomplished so much over the past few years, and I look forward to achieving our chapter goals. It has been an honor to work with so many dedicated individuals who share the goal of advancing the practice of trenchless technology through education, training, and research for public benefit.

To stay connected and hear about upcoming events, visit our website (**www.westt.org**) or find us on LinkedIn (*WESTT NASTT*). If you want to get involved in the WESTT committees, I encourage you to please reach out to me or any of our Board members.

Thank you for your continued support of WESTT.

Michelle Beason

Michelle Beason, PE, Chair, WESTT
National Plant Services, Inc.,
a Carylon Company

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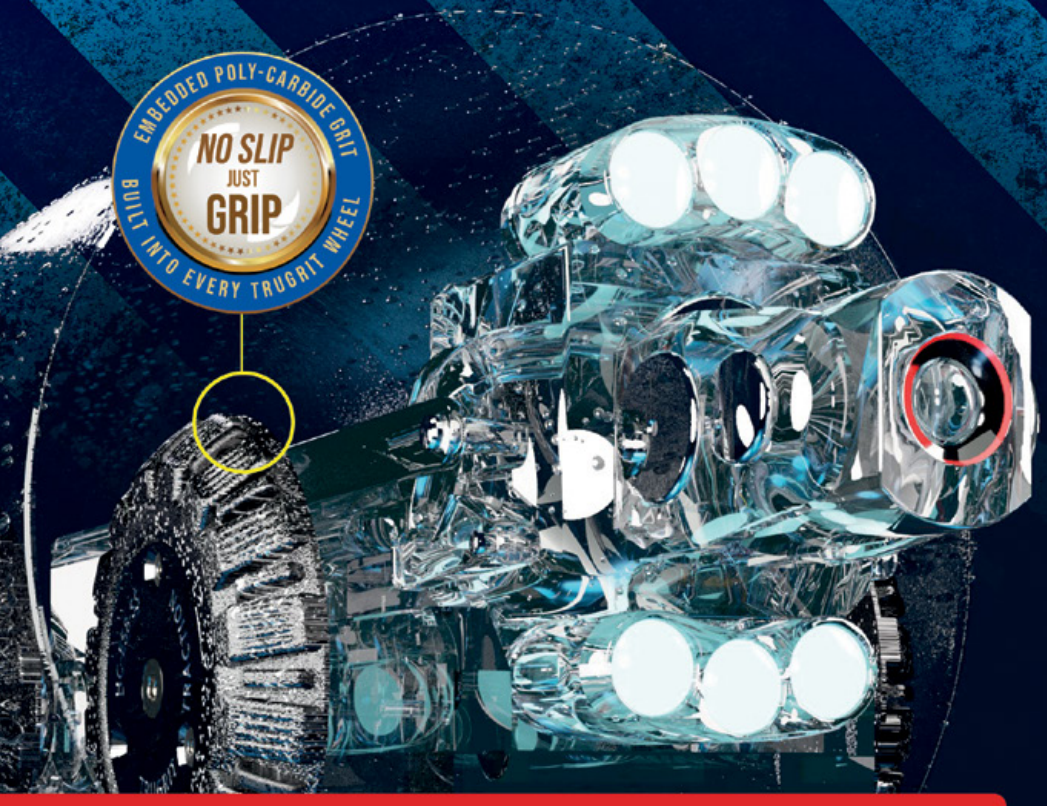


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MESSAGE FROM NASTT CHAIR

Greg Tippett, P.Eng., NASTT Chair

Dear WESTT Members & Supporters

As Chair of the NASTT Board of Directors, I want to take a moment to thank you for your continued commitment to the trenchless industry and your active engagement within your regional community. Our success as a society depends on the strength of our Regional Chapters, and the WESTT region continues to lead by example.

One of the most inspiring aspects of our organization is the dedication of our volunteers. Whether you're serving on a committee, mentoring a young professional, organizing local events, or simply showing up to lend a hand at chapter activities, your time and energy are what make this society thrive. Your expertise, generosity, and passion for trenchless technology are the heartbeat of our mission, and I want to express my deep appreciation for everything you do.

Looking ahead, we're thrilled about the upcoming **19th Annual Western No-Dig Conference and Good Practices Course**, which will be held in **Scottsdale, AZ, October 14-16**. This event is a fantastic opportunity for our local trenchless professionals to connect, learn, and share best practices. The agenda is shaping up with a strong lineup of technical presentations, networking sessions, and regional project spotlights that reflect the ingenuity and diversity of our field. I encourage all members, whether you're a long-time veteran or new to the industry, to attend and take full advantage of what this regional gathering has to offer.

"One of the most inspiring aspects of our organization is the dedication of our volunteers!"

While our regional events are essential to strengthening local networks, NASTT also provides you with opportunities to engage with trenchless leaders on a global scale. First up is the **2025 No-Dig North & ISTT International No-Dig**, taking place in **Vancouver, British Columbia, October 27-29**. This combined conference will bring together trenchless professionals from around the world, offering a unique platform to showcase North American innovation alongside global advancements. It's a rare and valuable chance to learn from international peers and share the outstanding work being done across our region.

Then, in 2026, we'll head to your back yard in the WESTT Region: **Palm Springs, California for the NASTT 2026 No-Dig Show, March 29-April 2**. Palm Springs promises to be an exciting and memorable destination, and our team is already hard at work planning a world-class event with technical sessions, networking opportunities, and the unmatched energy that makes the No-Dig Show such a cornerstone of our industry calendar. If you've ever considered presenting, volunteering, or exhibiting at a national level, now is the perfect time to start planning for your involvement.

These events, local, national, and international, are only made possible by the engagement and leadership of members like you. As we grow and expand our impact, I encourage you to consider how you might get involved in the months ahead. Whether it's submitting a paper, nominating a deserving peer for an award, supporting student and young professional programming, or participating in one of our many outreach initiatives, your voice matters and your presence makes a difference.

On behalf of the entire Board of Directors, thank you for being a valued member of the WESTT region and the larger NASTT family. Your contributions help move our industry forward, one innovative, trenchless step at a time. I hope you'll join the Chapter in Scottsdale this fall, and perhaps in Vancouver or Palm Springs soon after!

Greg Tippett

Greg Tippett, P.Eng.
NASTT Board of Directors Chair

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WESTERN REGIONAL CHAPTER

ELECTED OFFICERS:

MICHELLE BEASON, PE – CHAIR
National Plant Services Inc.

mbeason@nationalplant.com

Michelle received a BS in Civil Engineering from Purdue University, and is a registered California PE with over 32 years of water and wastewater experience. She has worked as a Project Engineer for Black & Veatch, as an Asset Management Engineer with the East Bay Municipal Utility District, she owned her own Engineering & Construction firm, and for the last 15 years has specialized in multi-sensor inspections and trenchless rehabilitation of sewer, storm, and water assets. She is currently the Regional Manager for National Plant Services, Inc., covering the 12 Western States, including Hawaii and Alaska.

Michelle is also active in many industry organizations. In addition to serving as a Board Member of WESTT, she serves on the NASSCO Technical Advisory Council (TAC), and led the workgroup in charge of NASSCO's new PACP/MACP/LACP Version 8.

RACHEL MARTIN - TREASURER
Delve Underground

martin@delveunderground.com

Rachel Martin has 25 years of experience in design and construction management on civil projects focused in the fields of water, wastewater, and hydropower. Her experience includes trenchless and tunnel design, development of contract drawings and specifications, construction management, design and constructability reviews, project controls, quality management, and cost estimating. Rachel has developed designs for microtunneling, pipe jacking, HDD, and sliplining projects throughout the US, Canada, and New Zealand.

MIKE JAEGER – VICE CHAIR
Tanner Pacific, Inc.

mjaeger@tannerpacific.com

Mike is a Principal Co-Founder of Tanner Pacific, Inc., specializing in Construction Management of Water Resource Projects. Mike is the Chief Marketing Officer responsible for all Marketing and Business Development for the Company. He has over 38 years of experience in public infrastructure project/construction management, as well as, over 15 years of Partnering Facilitation. Having spent his early professional years working for the Cities of Fremont and Palo Alto and at the Union Sanitary District, Mike worked on many different types of projects including, roadway improvements, building renovations, landfill closures and large wastewater treatment plant expansions, just to name a few. Mike has managed many large diameter pipeline projects, totaling more than 40 miles of installed pipe. Ranging in size from 30 to 60 inches in diameter, these projects included many miles of open cut, microtunnel, HDD and pipe bursting to traverse under highways, active school sites, active rail lines and sensitive environmental habitats. Mike is a native Californian growing up in San Jose and Campbell and later becoming a graduate of San Jose State University with a BS in Civil Engineering.

JUSTIN LIANIDES – SECRETARY
Mott MacDonald

justin.lianides@mottmac.com

Justin is a licensed engineer with a primary focus on engineering and construction support services for tunnel and trenchless projects. As a principal project manager, he has led design and engineering for numerous trenchless pipeline installations, including horizontal directional drilling, microtunneling, and horizontal auger boring. He regularly participates in industry events, such as those organized by the North American Society for Trenchless Technology (NASTT), Pipeline Users Group (PUG), and ASCE's Geo-Institute. Justin is chair of the Mott MacDonald Trenchless Technologies Working Group.

BOARD OF DIRECTORS & OFFICERS 2025-2026

ELECTED OFFICERS:

KATE WALLIN – PAST CHAIR
Bennett Trenchless Engineers

kate.wallin@bennetttrenchless.com

Kate has been involved with trenchless design since 2005 and has provided design and construction management services on trenchless new installation projects using horizontal directional drilling, microtunneling, pipe ramming, guided boring, and earth pressure balance pipe jacking. She is a contributing author on the 2024 revision of the Horizontal Directional Drilling Good Practices Guidelines. Kate volunteers on the NASTT Student Scholarship Award/Education Committee, the Regional Chapter Committee, the No-Dig Show Technical Program Committee, and serves as a No-Dig session leader. Kate was honored to receive the NASTT Volunteer of the Year award in 2023.

DIRECTORS AT-LARGE:

DAVID HAUG
Black & Veatch

haugd@bv.com

David is a Senior Project Manager with Black & Veatch and has 30 years of experience in the water and wastewater market as a project engineer, construction manager and project manager. His experience ranges from developing plans and specifications for conveyance and distribution systems to preparing environmental documentation and feasibility reports for large capital improvement projects. David worked on projects ranging from rehabilitation of pipes, two-pass tunnel installations, microtunneling, to large diameter tunneling. He also has experience as both a consultant and an owner having worked for a large municipality in Los Angeles County for 19 years.

DIRECTORS AT-LARGE:

JACQUIE JAQUES
Sekisui SPR Americas

jacquie.jaques@sekisui-spr.com

Jacquie Jaques is the Regional Manager for Sekisui SPR Americas for the Western US. Jacquie has over 25 years of industry experience working with manufacturers and contractors specializing in pipeline condition assessment and trenchless rehabilitation solutions.
She started her career working for a technical services company specializing pipeline cleaning and CCTV condition assessment. During that time, she worked with municipalities, FEMA and OES on post-earthquake pipeline condition assessment inspection that enabled agencies to obtain federal funding for projects. With a high demand for cost effective solutions to repair our infrastructure, she became involved with cutting edge trenchless technologies that could meet stringent industry design and performance standards.
Jacquie has been actively involved in numerous industry committees over her career. Early on, she was a member and recording secretary for the "Green Book Pipeline Rehabilitation Task Force" which evaluated new trenchless technologies that were germane to public works construction. This task group wrote the first Part 5 of the "Green Book" "Pipeline System Rehabilitation". Jacquie is still active on the committee today and works with the subcommittee to ensure that the specifications are current and still relevant to public works construction. As a WESTT Board Member, she is the Education Liaison for the university members and conducts the outreach on behalf of the committee. Jacquie has also authored several industry papers and presented at national and regional conferences including NASTT, WESTT, Pipe Users Group and HWEA. She has also authored or contributed to several magazine articles including NASSCO and Trenchless Technology.

BOARD OF DIRECTORS & OFFICERS 2025-2026

DIRECTORS AT-LARGE:

SASHA MESTETSKY
Central Contra Costa Sanitary District
smestets@centralsan.org

Sasha Mestetsky is a Senior Engineer in the Capital Projects Division at Central Contra Costa Sanitary District (Central San) located in Martinez, California. He manages Central San's Collection System Program with an annual fiscal budget of approximately $40 million. Sasha is responsible for the design and construction management of all sewer system replacement and renovation capital improvement projects. Most of these projects utilize various trenchless technologies.

Sasha has over 30 years of experience in design and construction of collection systems projects. He holds a Bachelor of Science degree in Civil Engineering from California State University, Sacramento and is a California-licensed Civil and Mechanical Engineer.

Sasha serves as the At-Large Representative of WESTT Chapter Board of Directors. He is a long time member of Water Environment Federation (WEF), North American Society for Trenchless Technology (NASTT), and Northern California Pipe Users Group (PUG). Sasha is passionate about everything trenchless, enjoys sharing his experiences, and actively promotes trenchless technology education.

DEVIN NAKAYAMA
Carollo Engineers
dnakayama@carollo.com

Devin has over 23 years of geotechnical engineering experience in Hawaii, and has served as a geotechnical and trenchless engineer on projects requiring microtunneling, horizontal directional drilling, and guided bore methods, as well as shallow and deep foundations, rockfall mitigation, deep shaft excavations, and soil stabilization. As Principal Infrastructure Engineer at Carollo Engineers, he has worked on water and wastewater infrastructure projects in Hawaii and on trenchless projects in California and Texas. He obtained his bachelor and master's degree in civil engineering from the University of Hawaii at Manoa, and is a professional civil engineer licensed in Hawaii and California. He has published and presented two papers on trenchless pipe installation at the North American Society of Trenchless Technology No-Dig conferences.

BOARD OF DIRECTORS & OFFICERS 2025-2026

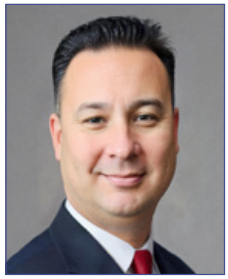
DIRECTORS AT-LARGE:

CINDY PREUSS – CDM Smith

preusscl@cdmsmith.com

Cindy is a registered professional engineer in California and brings 26 years of experience in planning, designing and managing large-scale public water and wastewater projects throughout the West. As Water Conveyance Discipline Leader at CDM Smith, Cindy serves as an internal resource to project teams across the country, providing her insight and knowledge in water and wastewater pipeline rehabilitation and construction. Her expertise with trenchless technology project planning, evaluation, design and inspection has been of particular benefit to those with whom she works, and is a facet of our industry about which she is especially passionate.

Over her career, Cindy has served on the Board of Directors of both NASTT and WESTT, as well as the Northern California Pipe Users Group (Nor Cal PUG). Cindy currently serves on the WESTT Board, the AWWA Condition Assessment Committee, the NASSCO Pressure Pipe Committee, and several national No-Dig conference committees. She also an instructor for NASTT's Trenchless 101 Good Practices Courses.



GREG WATANABE GHD

greg.watanabe@ghd.com

Mr. Watanabe is a Civil Engineer registered in California, Hawaii, Idaho, Oregon, and Guam and has more than 24 years of engineering and construction experience largely focused on trenchless technologies for both rehabilitation and new installations of underground utilities. During this time, he has planned, assessed, and designed over 100 miles of pipelines up to 96 inches for public utility systems. His project experience includes the design and construction via horizontal auger boring, burst and insert, sliplining, HDD, point repairs, Thermal CIPP, Thermal PCIPP, and microtunneling.

He is currently the Collaborative Delivery Leader for GHD's US West Water Market Sector covering Alaska, Arizona, California, Guan, Hawaii, Idaho, Nevada, Oregon, Saipan, and Utah. In this role he oversees the pursuit and delivery of all water/wastewater design-build projects in the region. He is also GHD's managing Principal for GHD's NASTT No-Dig participation across North America.

COMMITTEE CHAIRS:

Budget Committee:
Rachel Martin

Conference Committee:
Michelle Beason

Nominations and Elections Committee:
Cindy Preuss

Social Media Committee:
Greg Watanabe

Student Chapter Liaison:
Jacquie Jaques

WESTT Magazine Committee:
Devin Nakayama

WESTT 2024 CalPoly Pomona Conference Another Success!

2024 WESTT 18th Annual Western Regional No-Dig Conference Wrap-up

Kellog West Conference Center, Cal Poly Pomona campus, site of 18th Annual WESTT Conference

> *The conference continued to showcase the benefit of trenchless technologies to government agencies, engineering consultants, and contractors.*

The 18th annual Western Regional No-Dig Conference was held on the campus of Cal Polytech Pomona in beautiful Southern California. Cal Poly Pomona was an ideal setting for the conference, as their College of Engineering is known for its strong emphasis on hands-on, learn-by-doing education and its close ties with industry.

Building on these industry ties, the WESTT board had a meet and greet with the NASTT student chapter at Cal Poly Pomona prior to the conference. Kate Wallin of Bennett Trenchless gave a presentation on trenchless technologies at the Bronco Student Center, which was followed by a question and answer session. The meet and greet was well-received by the students and provided a great opportunity for WESTT to connect with the engaging student chapter.

Sam Espinoza, Head of Engineering, LACSD, delivers an engaging and insightful keynote address

WESTT Chapter Board Members held a Meet and Greet with the Cal Poly Pomona NASTT Student Chapter

WESTT Board Vice-Chair Mike Jaeger, Tanner Pacific, welcomes delegates to the conference

Sonja Kozak, outgoing President of the Cal Poly Pomona NASTT Student Chapter discussed CIPP and the student chapter

Innovative Products in Trenchless Rehabilitation & New Installation Forum was moderated by WESTT Chair Michelle Beason, National Plant

The WESTT conference was held at the Kellog West Conference Center on the Cal Poly Pomona campus on October 15, 2024. Mike Jaeger of Tanner Pacific, kicked off the conference with a welcome address and exhibitor and sponsor introductions. We were also fortunate to have Sonja Kozak, president the Cal Poly Pomona NASTT student chapter, give a presentation on their engineering department and their student activities.

Sam Espinoza, Head of Engineering of the Los Angeles County Sanitary District, then gave an engaging and insightful keynote address on LACSD's "Century of Service... Reflecting on Our Past but Focused on the Future".

The conference presentations included a wide variety of topics including horizontal directional drilling, microtunneling, rehabilitation, CCTV, pipeline assessment, and trenchless inspection. Michelle Beason of National Plant also led a forum on Innovative Products in Trenchless Rehabilitation and New Installations. Networking breaks between session blocks gave exhibitors the opportunity to share their information on products and services.

Post-conference activities consisted of the NASTT Good Practices Course for New Installations and Rehabilitation Methods, held on October 16. Participants from engineering firms and government agencies attended the 8-hour course to learn more about the benefits of incorporating trenchless technologies into their infrastructure projects.

With almost 200 attendees over 2 days, the conference continued to showcase the benefit of trenchless technologies to government agencies, engineering consultants, and contractors.

Networking and one-on-one access to industry expertise is an integral feature of the annual conference

Conference delegages enjoyed a sumptious luncheon, another networking opportunity

Jennifer Glynn, Woodard & Curran Inc., delivers the NASTT Introduction to Trenchless Rehabilitation Good Practices Course

The 19th Annual Western Regional No-Dig Conference, Exhibition, and Good Practices Courses

Skysong Convention Center, Scottsdale AZ

Tuesday, October 14 – Thursday, October 16

All of the benefits of a national conference in a smaller forum with a personalized touch! This year's conference will be held on the ASU campus at the stunning Skysong Convention Center. This is a great opportunity to mingle with students and other professionals in the region while learning about the latest in trenchless technologies from experts in the field.

Registration for the conference includes an informative one-day technical program with a product exhibition area. On the second day, for an additional fee, attendees may also elect to enroll in two optional NASTT Introduction to Trenchless Technology Courses: 1. New Installations, and 2. Rehabilitation

Earn valuable Continuing Education Units (CEU's)!

Conference Information

WESTT

WESTT (www.westt.org) is the Western regional chapter of the North American Society for Trenchless Technology (NASTT) (www.nastt.org), promoting education and development of Trenchless Technology for public benefit. WESTT is a non-profit organization established in 2004 and includes Arizona, California, Hawaii, Nevada, and New Mexico.

Pre-Conference Networking Event – Tuesday, October 14

Come test your mettle and network with fellow conference attendees before the main conference at the WESTT sponsored Axe Throwing Tournament on Tuesday, October 14, 2025, at BATL Grounds, 7919 E Thomas Rd #102, Scottsdale, AZ 85257 from 6 pm to 8 pm. Attendance for this event requires pre-registration. Registration includes participation in the tournament, one drink ticket, and appetizers.

WESTT Conference Format – Wednesday, October 15

The first day of the conference will feature an informative technical program with eight presentations focused on various aspects of trenchless construction. Welcome addresses and Keynote Address in the morning after sponsored breakfast with Innovative Products Forum just before sponsored luncheon. Attendees will also have several opportunities to interact with exhibitors during sponsored meals, breaks, and a happy hour reception.

NASTT Good Practices Courses – Thursday, October 16

These introductory courses are ideally suited for both newcomers to the industry and anyone who is interested in seeking a refresher course on trenchless technology methods. The New Installation course covers new construction techniques such as microtunneling, HDD, pipe jacking, auger boring and pipe ramming. The Rehabilitation session provides an overview of the methods available to public works and sewer agencies to rehabilitate water, sewer, and gas systems without the need for excavation.

Attendees

The conference and course are both useful to public officials, engineers, utility company personnel, designers, and contractors who are involved with constructing, rehabilitating, and managing underground utilities.

Attendee Registration

Register at: Event Registration (nastt.org)

NASTT members receive a discount for both the conference and course fees. Government Employees are eligible for discounted registration rates for both the conference and Good Practices course.

WESTT 2025 CONFERENCE AGENDA

Wednesday, October 15
Skysong Convention Center, Scottsdale AZ

7:30	Sponsored Breakfast and Registration	
8:30	*Welcome Address, Exhibitor Introductions* Mike Jaeger, Tanner Pacific (2025 WESTT Conference Chair)	
8:55	*NASTT Welcome* Tori Cox, NASTT	
9:10	***Morning Keynote Address: Pipelines, Progress, and Pure Water*** **Nazario Prieto, Assistant Water Services Director, City of Phoenix**	
9:35	Refreshments and Exhibitor Hour	
10:45	Rehab – CIPP	*A Unique Strategy to Rehabilitate Multiple Large Diameter Gravity and Pressurized Sewer Pipelines* Kyle Gourley, Carollo Engineers and Reace Fisher, Carollo Engineers
11:10	New Install – Auger Boring	*You Can Bet on Trenchless: Waterline Replacement on the Las Vegas Strip* Aric Farnsworth, Kimely-Horn, Ryan Pearson, Las Vegas Valley Water District
11:35	Rehab – Manholes	*Structural vs. Non-Structural Manhole Rehabilitation* V. Firat Sever, CDM Smith, Inc.
12:00	Luncheon and Exhibitor Hour	
1:30	***Afternoon Keynote Address: Phoenix's Transmission Main Assessment and Renew Program*** Aimee D. Conroy, Deputy Water Services Director, City of Phoenix	
1:55	New Install – HDD	*A Tale of Two HDDs: Crossing the Harbor Channel and Installing a New Ocean Outfall in Ventura, California* Mary Neher, Bennett Trenchless Engineers and Robert Baretto, City of San Buenaventura
2:20	Rehab – UV CIPP	*Moonlight State Beach Triple 72" Culvert Rehabilitation with UV CIPP* Claudia Law, IMPREG Americas
2:55	Refreshments and Exhibitor Hour	
3:40	Condition Assessment	*Sanitary Sewer Force Main Assessment in Phoenix – Different Solutions for Different Locations* John Malone, Brown and Caldwell
4:05	Rehab – CIPP	*Removing the Mystery around Styrene Effects at Publicly Owned Treatment Works* Michelle Beason, National Plant Services
4:30	Rehab – Sliplining	*Rehabilitating Los Angeles County Sanitation District's Largest Diameter Trunk Sewer – Joit Outfall B Unit 1A – The Saga Continues* Angela Chang – Los Angeles County Sanitation District
4:55	Closing Remarks	
5:00	Cocktail Reception at Fate Brewing (ends at 7:00)	

NASTT Good Practices Courses

Thursday, October 16

Skysong Convention Center, Scottsdale AZ

NASTT's GOOD PRACTICES INTRO TO NEW INSTALLATIONS EST. 2002

The four-hour NASTT Introduction to New Installation Methods Good Practices Course is ideally suited for both newcomers to the industry and for anyone who is interested in seeking a refresher course on the trenchless technology methods that are used to install new utility pipelines. This course provides an overview of various trenchless construction methods and discusses the broad applications and limitations of each method. For each method, the presentation includes a discussion of achievable drive lengths, suitable pipe diameters, anticipated accuracy, required work areas, and appropriate ground conditions. The new construction techniques discussed include HDD, piercing, pipe ramming, auger boring, guided methods, pipe jacking, and microtunneling. For additional training, NASTT also provides a detailed eight-hour course on New Installation Methods Good Practices as well as an in-depth eight-hour HDD Good Practices course.

NASTT's GOOD PRACTICES INTRO TO REHAB EST. 2002

The four-hour NASTT Introduction to Trenchless Rehabilitation Good Practices Course is geared to consultants, municipalities, and contractors and gives a high-level overview of numerous trenchless methods commonly used in North America to rehabilitate existing pipe and conduit. This half day course covers Rehabilitation Project Planning (including pipe and manhole inspection technologies), Watermain Rehabilitation, and Sewer Rehabilitation and offers a brief introduction of technologies such as sliplining, panel lining, spiral wound lining, spray on lining, pipe bursting, cure-in-place lining, lateral lining, and manhole rehabilitation. This course is ideally suited for both newcomers to the industry and anyone who is interested in a refresher course and offers an excellent basis for basic understanding of different trenchless rehabilitation methods currently out in the marketplace. It can be augmented with other more in-depth eight-hour good practices courses offered by NASTT.

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KEYNOTE SPEAKERS:

City of Phoenix Water Services Department

Phoenix Water Services provides high-quality, reliable water to the City of Phoenix, serving over 1.7 million residents. The department is committed to maintaining water quality, promoting sustainability, and ensuring compliance with all local, state, and federal regulations.

Phoenix Water Services is one of the largest utilities in the country with a vast infrastructure including 7,000 miles of water lines, 5,000 miles of sewer lines, eight treatment plants, dozens of pump stations, reservoirs, and wells, 50,000 fire hydrants, and 90,000 manholes serving over 1.7 million water customers and 2.5 million wastewater customers within a 540 square-mile service area.

As the largest potable water provider in Arizona, surface water is treated at one of five water treatment plants, producing 97 percent of the City's water, with the remaining 3 percent from groundwater wells. The wastewater system includes nearly 5,000 miles of sewer lines, 99,000 manholes, and dozens of lift stations and corrosion and odor control facilities in the City's wastewater system. Proactively maintaining critical water and wastewater system infrastructure is key to this service.

KEYNOTE SPEAKER

Nazario Prieto, P.E.
Phoenix Water Services
Assistant Director

Nazario oversees planning, design, and construction of water and wastewater infrastructure for one of the largest municipal systems in the U.S. He leads the engineering team responsible for capital delivery, trenchless innovation, and strategic integration of Pure Water Phoenix infrastructure.

KEYNOTE SPEAKER

Aimée D. Conroy, P.E.
Phoenix Water Services Deputy Director – Water Distribution Division

Aimée manages a team of over 200 staff responsible for the operation and maintenance of more than 7,100 miles of water pipelines. She has 35 years of experience in the water industry and leads Phoenix Water's PCCP asset management and rehabilitation initiatives. She is a licensed Professional Engineer in Arizona and California.

What makes Phoenix Water's mission unique compared to other municipalities?

Conroy: The scale and complexity of our system is significant — over 7,100 miles of water pipelines, 167,000 valves, and 57,000 hydrants, serving more than 1.7 million people. Our department operates as both a utility and a long-range planner, with a focus on infrastructure reliability, water quality, and innovation.

Prieto: Phoenix has also been a national leader in planning for water reuse and resource resilience. Our Pure Water Phoenix program, which integrates trenchless and advanced water purification technologies, exemplifies how we're building infrastructure for future generations in one of the most arid regions in the U.S.

How is trenchless technology integrated into your capital improvement and asset management programs?

Prieto: Trenchless is now a standard part of our project delivery strategy. It allows us to minimize surface disruptions and accelerate delivery timelines in high-impact areas like freeways, airports, and dense urban zones. We're currently using trenchless methods for both rehabilitation and new construction — including microtunneling, HDD, and sliplining — across large-scale corridors such as downtown Phoenix and the TSMC corridor.

Conroy: For our PCCP transmission mains, trenchless solutions are key to reducing risk and community impact. We've used techniques like carbon fiber wrap, sliplining, and external joint sealing to extend the life of these large-diameter, high-pressure lines while keeping neighborhoods and businesses functional during construction.

> *Trenchless allows us to minimize surface disruptions and accelerate delivery timelines.*
>
> *- Nazario Prieto, P.E., Phoenix Water Services Assistant Director*

What are some current or upcoming trenchless projects you're most focused on?

Prieto: We're expanding trenchless work as part of Pure Water Phoenix, which includes constructing new pipelines to convey advanced purified water from the 91st Avenue facility into the existing potable water system. These include critical crossings under highways and canals. We're also rehabilitating high-risk water mains using trenchless methods in urban areas.

Conroy: We're preparing to implement a bundled PCCP rehabilitation project in the coming year. It will combine multiple trenchless technologies and focus on transmission mains that are at the highest consequence of failure, including segments under major roadways and arterial routes.

What are the biggest challenges you face with trenchless implementation?

Conroy: Coordinating large-scale trenchless rehab projects in a legacy system built over many decades is complex. It requires detailed inspection data, skilled contractors, and close collaboration across city departments. Procurement and scheduling can be a challenge when trying to mobilize these projects rapidly.

Prieto: Soil conditions, utility conflicts, and traffic constraints often require adaptive designs. We've responded by investing in advanced condition assessment and geotechnical studies upfront, which has improved constructability and reduced surprises during execution.

> *Trenchless solutions are key to reducing risk and community impact.*
>
> *- Aimée D. Conroy, P.E.*
> *Phoenix Water Services Deputy Director – Water Distribution Division*

How has trenchless benefited Phoenix Water and your ratepayers?

Prieto: Trenchless has reduced construction timelines and traffic impacts, especially in constrained or high-value areas. It also extends asset life without requiring full replacement, which brings down long-term costs and avoids disruptions to customers.

Conroy: It's also enabled us to take a proactive approach with large-diameter assets. Instead of waiting for catastrophic failures, we can plan targeted trenchless interventions based on data. That's safer, smarter, and more cost-effective.

What advice would you offer to agencies pursuing their first trenchless program or project?

Conroy: Invest in your condition assessment. Having high-quality data on your pipe condition and soil environment upfront will drive your trenchless success.

Prieto: Partner with experienced designers and contractors. There's no one-size-fits-all in trenchless — having technical expertise early on helps avoid change orders and improves outcomes.

What role do industry organizations like WESTT and NASTT play in supporting your work?

Prieto: These organizations provide critical forums for information exchange and help us stay current on techniques, materials, and contractor capabilities.

Conroy: WESTT and NASTT also support workforce development and awareness. Sharing lessons learned with other public agencies helps us all deliver better projects and ultimately serve our communities more effectively.

Meet Us in Vancouver

October 27-29 | Vancouver Convention Centre

No-Dig North is the premier annual conference focused on trenchless technology in Canada. Attendees include engineers, contractors, manufacturers, and municipal representatives who seek to learn about and discuss sustainable, cost-effective solutions for infrastructure needs. The 2025 No-Dig North and ISTT International No-Dig conference is coming to Vancouver, BC at the Vancouver Convention Centre, October 27-29, 2025.

Learn more at

nastt.org/no-dig-north

NASTT 35 YEARS
Connecting Trenchless Partners

No-Dig North is owned by the North American Society for Trenchless Technology (NASTT), a not-for-profit educational and technical society established in 1990 to promote trenchless technology for the public benefit. For more information about NASTT, visit our website at nastt.org.

Arizona State University NASTT Student Chapter Report:

Next-Generation of Underground Infrastructure Leaders

ARIZONA STATE UNIVERSITY

By: Samuel T. Ariaratnam, Ph.D., P.E., P.Eng., BC.PLW, F.ISTT, EASA, F.CAE, NAC, Dist.M.ASCE

In 2025, the engineering and construction job market is as competitive as ever. At Arizona State University (ASU), our students often have three to five job offers before they graduate. The challenge is not in placing students – it's in introducing them early to the trenchless technology field, where opportunities are abundant but visibility among students can be limited. That's where the ASU-NASTT Student Chapter plays a critical role.

> *"The impact is lasting."*

A Chapter with Deep Roots

The ASU-NASTT Student Chapter was founded in 2001 following my move from the University of Alberta. Since then, we've developed one of the most active and enduring student trenchless communities in the U.S. Each year, we bring a delegation of students to the NASTT No-Dig Show, where they gain exposure to cutting-edge technologies, network with trenchless professionals, and participate in student competitions that promote both learning and leadership. This past year, six ASU students accompanied me to the 2025 No-Dig Show in Denver, Colorado (Figure 1).

These experiences not only develop technical and presentation skills – they offer direct exposure to a community that consistently demonstrates generosity, mentorship, and a true passion for educating the next generation. The impact is lasting. Many of our students have pursued internships and careers within the trenchless industry as a result.

Figure 1. ASU Student Chapter Members proudly display the ASU "Fork" sign, at No-Dig 2025 in Denver

Two of our members, Jimmy Hanashian (Figure 2) and Chetan Chalumuri (Figure 3), received two of the six NASTT's Argent Memorial Scholarship Awards this year. I am so proud of these young men for receiving such a prestigious award.

Figure 2. ASU Student Chapter member Jimmy Hanashian (right) receives Argent Memorial Scholarship from Tiffanie Mendez, NASTT Officer-at-Large, Sunbelt Rentals (left)

Figure 3. ASU Student Chapter member Chetan Chalumuri (right) receives Argent Memorial Scholarship from Tiffanie Mendez, NASTT Officer-at-Large, Sunbelt Rentals (left)

Industry Mentorship in the Classroom

Each Fall, I teach a Senior/Graduate-level course titled "Trenchless Construction Methods," which introduces students to trenchless design, installation, renewal, and damage prevention. It also addresses geotechnical and utility considerations fundamental to successful trenchless execution.

Crucially, this class includes guest lectures from some of the most respected leaders in our industry. This past year, our students enjoyed lectures from industry experts such as Jeff Boschert (National Clay Pipe Institute), Maureen Carlin (Garver), Aaron Cohen (InEight: A Kiewit Company), Arvid Veidmark III (Specialized Services Company), Mike James (ISCO Industries), Jake Doster (ISCO Industries), Ben Nelson (Michels), and Dr. David Bennett (Mississippi State University/Bennett Trenchless Engineers). These individuals have generously shared their insights and stories, and just as importantly, they've helped students make lasting professional connections.

Beyond the Classroom: Field Learning

In addition to coursework and competitions, we make sure that our Student Chapter members get real-world field exposure. This past year, the students went to see a Horizontal Directional Drilling project in Queen Creek, Arizona (Figure 4). Being on a job site transforms academic interest into professional motivation. Students gain perspective, confidence, and often, a clear sense of how they want to contribute to the industry.

> *"Six former ASU student chapter members are now professors themselves."*

Figure 4. Site visit to HDD project in Queen Creek, Arizona

Impact That Extends Around the Globe

Today, former ASU-NASTT members are working in trenchless design, contracting, and supply roles across the U.S., Canada, and beyond. In fact, six former ASU student chapter members are now professors themselves, teaching trenchless methods and conducting research at universities across North America and globally.

As we look to the future, the ASU-NASTT Student Chapter remains committed to empowering students with the technical foundation, mentorship, and experiences they need to become leaders in the trenchless profession. We are proud to contribute to the next generation of innovators in this essential field.

ABOUT THE AUTHOR:

Dr. Samuel T. Ariaratnam *is a Professor and Sunstate Chair in the School of Sustainable Engineering and the Built Environment at Arizona State University. He serves as the faculty advisor for the ASU-NASTT Student Chapter. He is a former Chairman of the International Society for Trenchless Technology and was the 2012 Trenchless Technology Person of the Year.*

Cal Poly Pomona NASTT Student Chapter Report:

A Remarkable Year

CALIFORNIA STATE POLYTECHNIC UNIVERSITY, POMONA

By: Ricardo Perez (Student Chapter President) and Dr. Jinsung Cho (Faculty Advisor)

Last year was a remarkable one for the Cal Poly Pomona-NASTT student chapter. We had the honor of participating in the "No-Dig Show" in Denver, Colorado, where attending members had the opportunity to engage with industry professionals and expand their knowledge through track sessions and exhibit halls. This year former CPP-NASTT Treasurer, Jessica Vargas-Cabrera, showcased her research as part of the student research poster competition and former President, Sonja Kozak, was recognized for her efforts through a scholarship award.

As a first-time attendee, I left the No-Dig Show feeling incredibly inspired by the accomplishments of my peers and the level of industry engagement I witnessed. The event exceeded every expectation; it was an unmatched opportunity to meet other professionals and fellow students that are looking to be a part of the trenchless community. Because of the networking opportunities provided to me, I was fortunate enough to secure an internship this summer. This experience is something I want to build upon and replicate back at Cal Poly Pomona.

To better understand the goals of our incoming members, I asked both past and incoming members to share their experience and expectations for the upcoming year and their thoughts on participating in NASTT:

Figure 1. Cal Poly Pomona NASTT Student Chapter Group Photo

> *"My goal this term is to build on the momentum created by previous leadership and further showcase trenchless technology."*

Past Members

Q: What have you learned during your time as a NASTT student chapter member?

A: Underground utility and trenchless technology is not commonly taught at CPP and many schools. Almost all of the information and knowledge that I gained as a NASTT member was new. It was a great way to learn about an engineering topic that is not so widely spoken about.

Figure 2. Lunch & Learn with Casey Raines from GHD (right)

Q: What has your experience attending the No-Dig Shows been like?

A: It's been an amazing experience—a great way to network not only with other college students but also with industry professionals who could potentially become future employers. Through the research involved, I developed critical skills that will benefit me greatly in the long run.

Incoming Members

Q: Based on what you have heard from previous members, what are you expecting to gain from the upcoming No-Dig Show?

A: In this upcoming No-Dig Show, I am hoping to meet people within my industry to build various connections. I have previously heard, this event is great for this, and I hope I can expand my network with this event. Apart from this, I have heard the No-Dig Show is big on research presentations, so I am looking forward to gaining more knowledge from other students' research.

Q: What types of activities do you hope to engage in as part of the NASTT student chapter?

A: As a member of the NASTT student chapter, I hope to engage in "Lunch & Learns" throughout the school year. I also hope to attend some field trips to get a better grasp of what the outside world looks like, concerning the engineering industry.

As Chapter President, my goal this term is to build on the momentum created by previous leadership and further showcase trenchless technology and utility construction. I hope to achieve this by leveraging my involvement with the WESTT board to continue increasing student outreach with Lunch & Learns and site walks, the events students consistently express the most enthusiasm for.

ABOUT THE AUTHORS:

***Ricardo Perez** is a student in the Civil Engineering department at Cal Poly Pomona. He currently serves as the President for the NASTT Student Chapter (2025-2026) at Cal Poly Pomona.*

***Dr. Jinsung Cho** is a professor in the Civil Engineering department at Cal Poly Pomona. He has served as the faculty advisor for the NASTT Student Chapter at Cal Poly Pomona for 12 years.*

Leaks to Longevity:

UV CIPP Repairs Transform Alamogordo's 24-Inch Raw Waterline!

By: Michael Rocco, AUI Inc.

Alamogordo NM located in the Southern New Mexico is known for its proximity to White Sands National Park and the New Mexico Museum of space. It is locally known for its great tasting pistachios and claims to have the largest pistachio in the world. The city is located at the base of the Sacramento mountains and borders Holloman Air Force Base. Alamogordo is widely known for its connection with the 1945 Trinity test which was the first ever explosion of an atomic bomb.

Just like every community, water is a precious and natural resource to the livelihood of the city. Alamogordo gets some of its raw water from a Ruidoso, NM at a reservoir named Bonito lake which is located in 62 miles north. The miles of pipeline that carry raw water end up at an underground storage facility. The raw water is stored underground with and covered HDPE to protect it from evaporation. The reservoirs hold over 20 million gallons of raw water. As the raw water is transported into the underground reservoirs there are several junction boxes to control the raw water flow into the different cells to store the raw water. This massive underground water storage facility is vital to the community of Alamogordo because the water is then piped to water treatment facilities for purification and then run throughout the distribution system to businesses and residents.

> *Water is a precious and natural resource to the livelihood of the city.*

Liner ready for installation

The main purpose this of this project was to fix the leaking 24-inch Asbestos Cement (AC) pipeline that ran on the banks of the water storage reservoirs. The 24-inch AC water line was installed in the 1960s and was half exposed, meaning half buried, and continued along to several junction boxes for distribution. The city of Alamogordo started seeing the pipe leaking at the joints in several locations. Their repair method was only temporary and the city was looking for a permanent solution. After visiting the jobsite and the conditions, I recommended UV CIPP – Omega Liner would be a perfect fit to rehabilitate this existing 24 inch AC line. There will be no cutting of the AC pipe which means there will not be a need to bag and tag the AC material and dispose of it properly. Asbestos cement pipe In New Mexico is regulated by the New Mexico environmental department and they have several laws on how to dispose of AC pipe because it is considered hazardous material, which means costing the contractor to dispose of the pipe at an approved remediation facility.

The construction sequence consisted of removing fencing to allow access to the junction boxes. The 24-inch pipeline was cleaned and televised for any deformities and or cracks in the pipeline. The pipeline had a build up on the bottom of the pipe which required high velocity jetting to remove as much as possible. After the pipeline was cleaned and televised we proceeded to install the 24-inch Omega liner into the pipeline.

The project was completed in two Installations or as they like to call them "shots". The first shot was from the flume to vault #1 which was a total of 71 linear feet and the second shot was from vault #1 through vault #2 and ended at vault #3. The total distance for shot #2 was 491 linear feet.

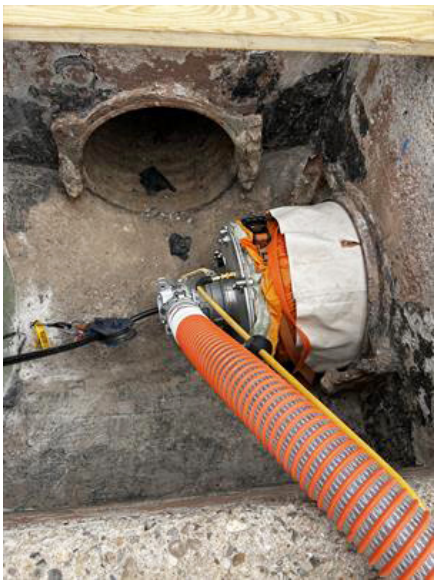
The first shot, which was only 71LF took about one hour to pull the Omega liner through the existing 24-inch AC pipe from vault to vault and about an hour to install the Aluminum and fittings which are used to inflate the liner from both ends. The liner is then inflated and the light train is installed. The first sequence after the UV liner is installed is to pull the light train from one end to the other, the purpose of this is to inspect the liner as it is now inflated but not yet cured. There is a camera on the front and the rear of the light train so as the light train

Liner pulled through to vault, ready for inflation

> *With the liner there is no cutting of the AC pipe, eliminating hazardous waste disposal.*

traverses down the pipeline it inspects from vault to vault in this case the inflated liner.

After the light train has inspected the pipeline and reached the other vault it is now time to cure the inflated UV liner. The light train is turned on and pulled back to its original location at a rate of approximately 3 feet per minute. So the cure time on this



Liner inflated and readied for curing with the light train

Light train UV-cured the liner at a rate of approximately 3 feet per minute

24-Inch Raw Water Main before (left) and after 24-Inch UV CIPP (above right)

Vault rehabilitated with Zebron coating

length was approximately 30 minutes from when the light train was turned on to when it is turned off. Because the light train has a camera on the front and rear of it you can see the pipe cured as you are pulling the light train through the segment. After the light train has arrived at the original vault the aluminum fittings are removed, the light train is removed and the pipe is trimmed to conform to the junction box.

The second shot that was 491 feet long was installed with the same sequence. The only difference was to pull the liner through took about 3 hours and the UV cure time Took about 3 - 1/2 hours to cure. The liner was also cut out of the middle vault. Both shots of Omega Liner were installed in a day from start to finish.

ABOUT THE AUTHOR:

***Michael Rocco** has been employed with AUI, Inc., for over 34 years and works in the estimating, project management and marketing departments. His experience includes rehabilitation of water, storm sewer and sanitary sewer pipelines by Slip-lining, Pipe Bursting and Spiral Pipe Rehabilitation trenchless methods. Mike has well over 35 years' experience with various trenchless applications, and was a long-serving Director on the WESTT Chapter Board of Directors.*

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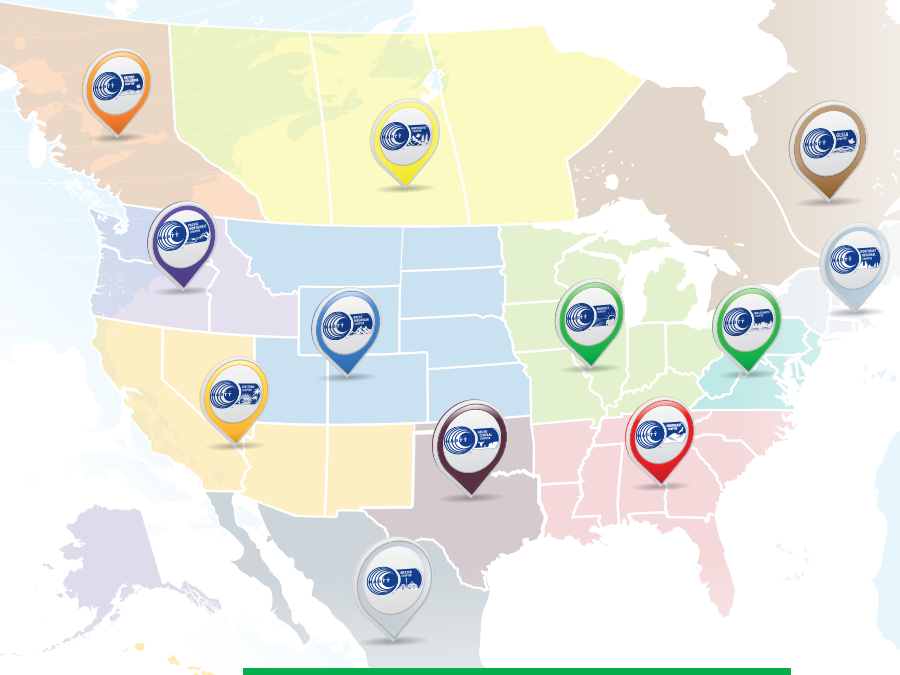

The grassroots of NASTT is a network of 12 Regional Chapters throughout the United States, Canada and Mexico. Regional Chapters network at the local level, share infrastructure challenges and develop new ideas. Regional Chapters hold various events throughout the year, and like NASTT, are dedicated to the advancement of trenchless technologies for the benefit of the public and the environment.

With your NASTT membership you are automatically enrolled not only in the national and international organization, but also in your Regional Chapter. So join today and get to know the "local heroes" that are making their communities better places through the innovative engineering solutions of trenchless technologies.

REGIONAL CHAPTERS

educate • train • research • publish

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nastt-bc.org
British Columbia

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HDPE PE4710 PIPE

The Best Choice for Water Systems

	TOP 10 Features & Benefits	HDPE	D. Iron	Sample References
1	**Applications:** Potable Water (Lead Free), Raw Water, Reclaimed Water, and Wastewater	✓	✓	AWWA C901, C906, C151, and NSF 61 + Health Effects of HDPE Pipes and Fittings for Potable Water Applications, NSF 2024
2	**Open Cut Construction**: Design and install per AWWA Standards and Manuals	✓	✓	AWWA M55, M41 + MAB-3, MAB-6
3	**Trenchless Construction**: Material of choice for HDD, Creek Crossings, Pipe Bursting, Sliplining, and Compression Fit	✓	✗	ASTM F585, F1962, F3508 + MAB-5, MAB-7, MAB-11
4	**Fully Restrained Joint-Free System:** Minimize need for fittings to facilitate horizontal and vertical deflections	✓	✗	AWWA M55, M41
5	**Longevity & Corrosion:** Pipes, Fittings, and Joints have the least potential for corrosion or tuberculation	✓	✗	Durability and Reliability of Large Diameter HDPE Pipe for Water Main Applications, EPA/WRF/WERF 2015 + The Critical Need for Corrosion Management in the Water Treatement Sector, NACE 2019 + PPIPPACE.com + Long-Term Aging of Polyethylene Pipes, UKWIR 2020
6	**Flow Capacity:** New pipes have similar flow capacity per AWWA Standards and Manuals	✓	✓	AWWA M55, C906, M41 + PPIPACE.com
7	**Water & Energy Conservation**: Fused joints have zero allowable water leakage, zero infiltration, and lowest carbon footprint	✓	✗	AWWA M55, M41 + ASTM F2620, F3190, F3565 + MAB-1, MAB-2, MAB-8 + TEPPFA Polyethylene Plastic Pipe Systems vs Ductile Iron Environmental Impact Comparison, TEPPFA EPD Calculator
8	**Cost Effective:** Has the lowest initial cost, lowest life cycle cost, and lowest restoration cost for trenchless installations	✓	✗	Life Cycle Analysis of Water Networks, CSIRO 2008 + Annual Drinking Water Quality Report for 2014, Kittery Water District, 5/31/2015
9	**Resilient**: Ability to resist ground movements due to droughts, freeze/thaw, earthquakes, hurricanes, with ability for flow control/squeeze off	✓	✗	Recent Earthquakes: Implications for U.S. Water Utilities, WRF 2012 + Polyethylene Pipeline Performance Against Earthquake, Kubota 2018 + MAB-9
10	**Permeation/BTEX:** Pipes and elastomeric joints need to be properly engineered for contamined conditions	✗	✗	AWWA C901/C906 and C111/C151, Sec. 4

Additional information including MAB-3 Model Spec Guide can be found at www.plasticpipe.org/mabpubs

MUNICIPAL ADVISORY BOARD

TYPICAL CRITERIA	HDD	Direct Steereable Pipe Thrusting	Microtunneling	Pilot Tube B
Pipe Diameter	2 - 48 inches	30 - 60 inches	30 - 120 inches	4 - 48 inche
Depth Range	15 - 200 feet	25 - 130 feet	15 - 100 feet	8 - 30 feet
Length Range	200 - >10,000 feet	500 - 4,000 feet	200 - 3,000 feet	50 -300 feet
Maximum Length	>10,000 feet	>5,000 feet (7,500 feet maximum)	2,000 feet with intermediate jacking stations	+/- 400 feet
Minimum Depth of Cover	>25 feet	As low as 2X pipe diameter	As low as 2X pipe diameter	As low as 4(
Design Angles	Entry: 8 to 14 degrees / Exit: 8 to 16 degrees	Launch: 0 to 8 degrees / Reception: 2 to 10 degrees	Typically < 2.5%	Typically < 2
Entry/Launch Approach	Surface entry	Near surface launch	Shaft launch	Shaft launch
Min. Install Radii	Governed by installation & operating stresses	Governed by installation & operating stresses	Generally flat or sloped	Generally fl
Pit/Shaft Design	Shallow pit, non-engineered	Engineered shoring for shallow launch pit; shallow, non-engineered reception pit	Engineered shoring for launch & reception shaft	Engineered launch & re
Foundation	Traditional deadman	Engineered for site conditions & anticipated loads	Engineered for site conditions & anticipated loads	Engineered conditions & loads
Pipe Stringing	Typically exit side	Launch side	Pipe segment storage on launch side	Pipe segmer launch side
Installation Stresses	Tension, bending, hydrostatic buckling & combined	Compression, bending, & combined; column buckling	Compression & buckling	Compressio
Annular Pressures	Hydrostatic drilling fluid pressure & cutting transport pressure	Hydrostatic lubricating pressure & slurry over pressure	Hydrostatic lubricating pressure & slurry over pressure	Hydrostatic pressure
Gravel, Cobbles and Boulders	High risk of failure for > ~30-40% gravel	Can negotiate limited rocks up to 1/3 size of the cutterhead, and up to ~30 - 40% gravel	Can negotiate limited rocks up to 1/3 size of the cutterhead, and up to ~30 - 40% gravel	High risk of
Clay Soils	Risk of hydraulic fracture	Low risk of hydraulic fracture	Low risk of hydraulic fracture	Low risk of fracture
Relative Cost	$$	$$$$	$$$$	$$

GY OVERVIEW GUIDE: NEW INSTALLATIONS

Guided Auger oring	Auger Boring	Pipe Ramming	Pipe Jacking	Hand Mining/ Tunneling
s	12-72 inches	12 - 120 inches	42 - 144 inches	42 - 144 inches
	8 - 30 feet	5 - 25 feet	10 - 40 feet	10 - 40 feet
t	50 - 300 feet	50 - 300 feet	200 - 1,000 feet	100 - 600 feet
	+/- 500 feet w/ guidance	+/- 400 feet w/ guidance	1,500 feet with intermediate jacking stations	1,000+ feet
0-inches	As low as 2X pipe diameter	As low as 1X pipe diameter	As low as 2X pipe diameter	As low as 2X pipe diameter
2.5%	Typically < 2.5%	Typically < 2.5%	Typically < 2.5%	Typically < 2.5%
n	Shaft launch	Shaft launch	Shaft launch	Shaft launch
at or sloped	Generally flat or sloped	Generally flat or sloped	Generally flat or sloped	Generally flat or sloped
shoring for ception shaft	Engineered shoring for launch & reception shaft	Engineered shoring for launch & reception shaft	Engineered shoring for launch & reception shaft	Engineered shoring for launch & reception shaft
for site & anticipated	Engineered for site conditions & anticipated loads	Engineered for site conditions & anticipated loads	Engineered for site conditions & anticipated loads	Engineered for site conditions & anticipated loads
nt storage on	Pipe segment storage on launch side	Pipe segment storage on launch side	Pipe segment storage on launch side	Tunnel liner segment storage on launch side
n & buckling	Compression & buckling	Compression & buckling	Compression & buckling	Compression & buckling
lubricating	Hydrostatic lubricating pressure	Hydrostatic lubricating pressure	Hydrostatic lubricating pressure	Hydrostatic lubricating pressure
failure	Can negotiate up to 1/3 size of the cutterhead	Casing can be sized to swallow up cobbles & boulders	Medium risk of failure. Can access tunnel heading for removal of obstructions	Medium risk of failure. Can access tunnel heading for removal of obstructions
hydraulic	Low risk of hydraulic fracture	Low risk of hydraulic fracture	Low risk of hydraulic fracture	Low risk of hydraulic fracture
	$	$$	$$$	$$$

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Replacing Two Failing 72-inch CMP Storm Drains Under San Pablo Dam Road

By: Elizabeth A. Carnogursky, P.E., Delve Underground
Norman A. Joyal, P.E., G.E., Delve Underground
Michael Bianucci, P.E., Mark Thomas

1.0 BACKGROUND

San Pablo Dam Road is a two-lane, bi-directional, 40-foot-high embankment throughfare in the hills east of Oakland, California, across East Bay Municipal Utility District (EBMUD) private lands. In spring 2023, a 2-foot dip in the road surface was noted and deemed to be due to recent heavy rains, which increased flow in two 72-inch-diameter, approximately 205-foot-long corrugated metal pipe (CMP) culverts running through the embankment, as shown in Figure 1-1. The road surface depression was filled in, but following initial culvert assessments, the Contra Costa County Public Works Department (CCCPWD) determined that a long-term solution was needed to repair visually apparent damage to the two culverts. The culverts appear to have been placed at or slightly below the naturally sloping ground at the embankment fill interface when constructed around 1956 with a slope gradient of about 11.5 percent.

The culverts divert flow from the Baden and Spring Creeks west of San Pablo Dam Road to a shotcrete drainage flume on the east side of the road, which eventually drains into the San Pablo Dam Reservoir, an EBMUD drinking water supply. Though the originating streams are ephemeral, and the culverts typically only see flow during the rainy winter months, the CCCPWD is concerned the construction may be designated as "in-water" work by the California Division of Fish and Wildlife (CDFW) during their permit reviews. If that is the case, the construction window for that designation would be June 15 to October 15, with concrete work being completed by September 30. Additional permitting would be required for any work outside the "in-water" construction season.

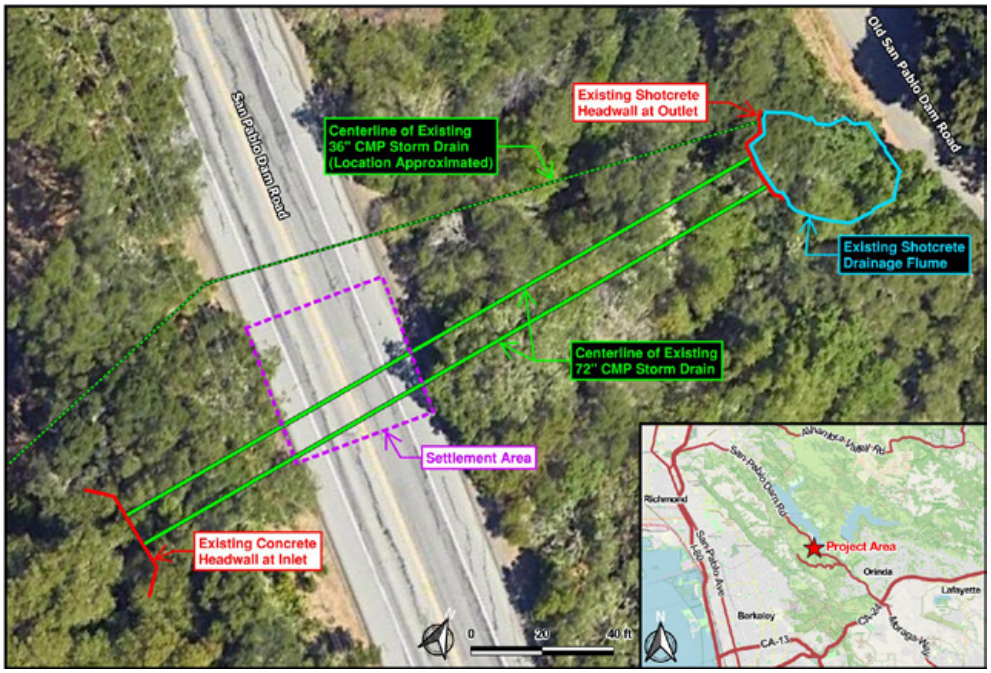

Figure 1-1: Project area and storm drain alignment

2.0 CONSTRUCTION CONSTRAINTS

- A normal single-season construction schedule from April 15 through October 15.
- A shortened construction schedule from June 15 to October 15 if designated "in-water" work by the CDFW.
- One lane of traffic in each direction at all times except when replacing the roadway surface.

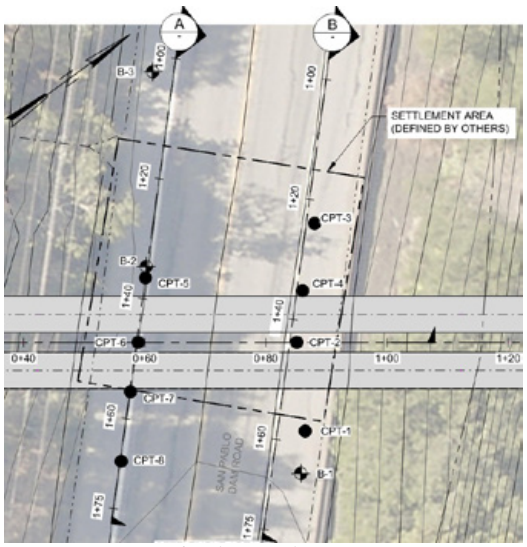

Figure 3-1: Layout of geologic explorations

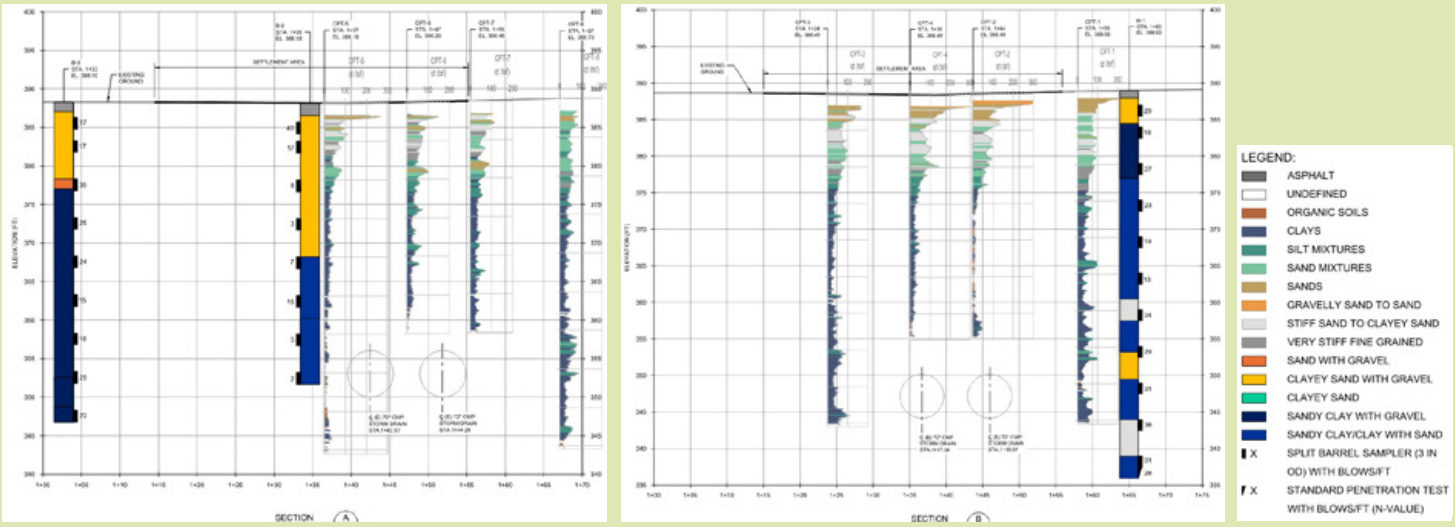

Figure 3-2: Cross-sectional geologic profiles

3.0 GEOTECHNICAL INVESTIGATION

Two phases of geotechnical investigations were undertaken, consisting of three boreholes with standard penetration test (SPT) logging during the initial damage assessment phase, and eight cone penetration tests recommended by Delve Underground during the construction type selection phase. The layout of the tests performed is shown in Figure 3-1.

Geologic profiles were developed to present the ground conditions throughout the settlement zone and are presented in Figure 3-2. Soils in the upper portions of the embankment consisted of denser sands with varying mixes of clay and gravel, while the soils surrounding the CMPs were significantly softer and higher in clay, silt, and possibly organic content. CPT-5, adjacent to the north CMP, indicated a complete lack of tip resistance at the elevation of the CMP, indicating potential voids or very soft soils.

4.0 CMP CONDITION ASSESSMENTS

Delve Underground inspected the conditions of the CMPs in December 2024. This inspection included measurements of pipe sag and ovalization and an assessment of the pipe condition. Both CMPs were found to be in very poor condition with significant sagging, extensive to complete invert corrosion and localized ovalization and voids below the invert which allowed the flow of water below the invert. Extensive invert heave and buckling, with some overlap, were also found in both CMPs. The north CMP was found to be in notably worse condition in all observed categories, with a sag up to 2.75 feet below the theoretical vertical alignment, voids up to 13 inches deep, and holes up to 2 feet by 2 feet large. The south CMP was found to have a sag of up to 1.42 feet below the theoretical vertical alignment. Select photos are presented below to demonstrate the general condition of the CMPs.

5.0 ALTERNATIVES CONSIDERED

Considering the condition and geotechnical findings, it is believed that deterioration of the CMP inverts allowed water to infiltrate, which eroded out soils below and surrounding the CMPs. The eroded basal and surrounding support allowed the CMPs to sag and settlement to propagate up to the surface and express as two feet of road settlement. It is likely that ground loss occurred episodically during historical storm events, with the 2023 winter storms quickly exacerbating the problem.

It was determined that the existing CMPs had exceeded their design lives and could not be rehabilitated and should be replaced, coupled with improving the soft soils surrounding the CMPs to restore their internal strength (not a topic of this article). This article discusses the trenchless methods considered for replacing the CMPs as well as an open cut option.

Figure 4-1: Invert condition photos showing a) overlap, b) buckling and heave, c) corroded holes, d) protrusions, e) voids up to 13" deep, f) sag

5.1 Open-Cut Replacement

San Pablo Dam Road has an average daily traffic (ADT) count of 17,000 vehicles. The inverts of the CMPs are 37 to 42 feet below the roadway surface, making an open trench construction method unfeasible to satisfying the construction constraint of maintaining one lane of traffic in each direction. There is not enough room for staged construction and two lanes of traffic, so a two-month closure of the road would be required during construction.

5.2 Jacked Concrete Box

This alternative involves jacking a large (approximately 24 feet wide by 12 feet high) concrete box culvert around both CMPs, as shown in Figure 5-1. While such an installation would significantly increase the hydraulic capacity of the culvert and provide versatility in future repairs, installation would be very challenging. Segment storage and handling would be cumbersome, require a crane, and lead to greater environmental impacts. The very large forces required to jack such a box without a shaft, even with a cutting shoe, would require a robust reaction system to thrust the boxes forward. A large overcut might be necessary to allow for lubrication, which could lead to settlement issues in the embankment, although that would be rectified by post-construction improvement of the weakened embankment. The sag in the existing CMPs could engage with the bottom of the box culvert and accordion the CMP forward during jacking, though entry into the culvert to manually remove blockages would be possible. The primary drawback of this approach was the perceived high risk associated with meeting the short "in-water" schedule, followed by the high cost.

5.3 Pipe Canopy

This method would involve conventional tunneling using a pipe canopy for pre-support of the weak ground prior to excavation, as shown in Figure 5-2. Robust initial ground support would be required because of the anticipated soft ground conditions indicated by the CPTs. The pipe canopy could be installed across the entire crossing using a pilot tube method, as precise pipe placement is

crucial to ensure adequate support during tunneling to prevent deformations or raveling. Advantages of this method include significantly increased hydraulic capacity, avoiding the significant jacking forces and cumbersome segment handling that would be required for the jacked box method, and avoiding the potential for engaging the sags in the CMP inverts. A disadvantage is the large staging area needed for the work, setting up rig and lagging support for the canopy tubes, installing a permanent lining, and constructing a concrete invert that would need to be completed by September 30.

5.4 Pipe Swallowing

This method would involve pipe ramming an 84-inch (or larger) outside-diameter (OD) steel pipe with a one-inch-thick wall around each of the existing CMPs, as shown in Figure 5-3. The leading pipe segment would have both a cutting shoe and tapered internal fins (see Figure 5-4) to help displace soil, reduce drag, and crumple the old CMP, making it easier to remove. Advantages of this method include a smaller staging area, lower environmental impacts, increased hydraulic capacity of the final pipes, and avoiding a jacking approach that would require a robust reaction system. However, there is a significant risk of accordioning the existing CMPs in front of the steel pipes when the new pipes engage the sagging inverts, impeding advance and requiring personnel entry into the pipes to cut out the obstructing CMP. An additional challenge would be the significant difficulty of maintaining an accurate trajectory with the given conditions. Finally, the vibrations from pipe ramming could induce settlement in the soft soil.

5.5 Pipe Bursting

This method would involve pipe ramming a 66-inch OD steel pipe with one-inch-thick walls inside each of the CMP host pipes and grouting the annular space between the old and new pipes, as shown in Figure 5-5. It would be necessary to prepare the interiors to receive the new pipes by removing any rusted CMP protrusions, filling voids in the invert, and otherwise providing a stable and smooth invert for the steel pipes to advance upon. Rather than a cutting shoe, the leading end of the pipe would have a

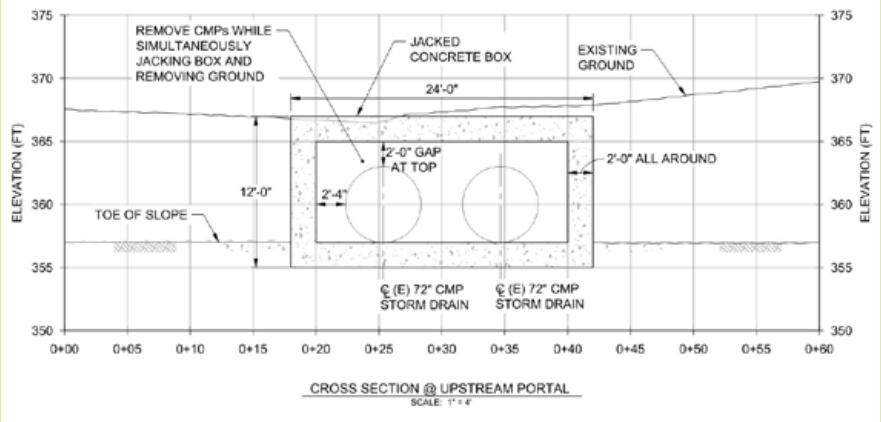

Figure 5-1: Schematic of jacked box alternative

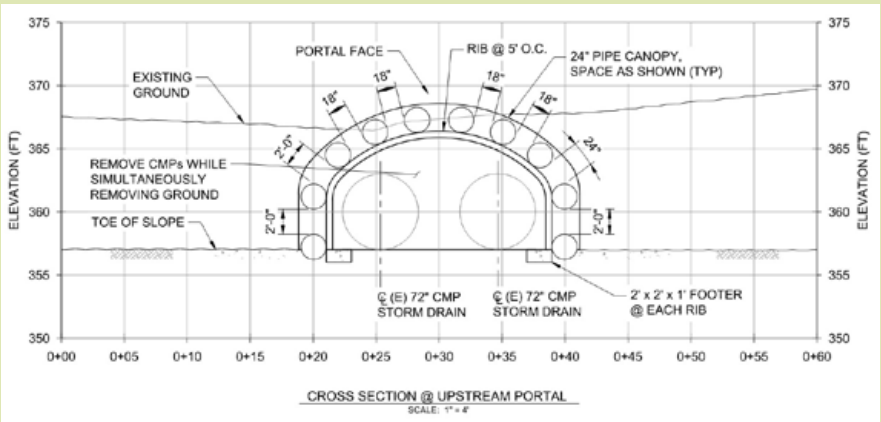

Figure 5-2: Schematic of pipe canopy alternative

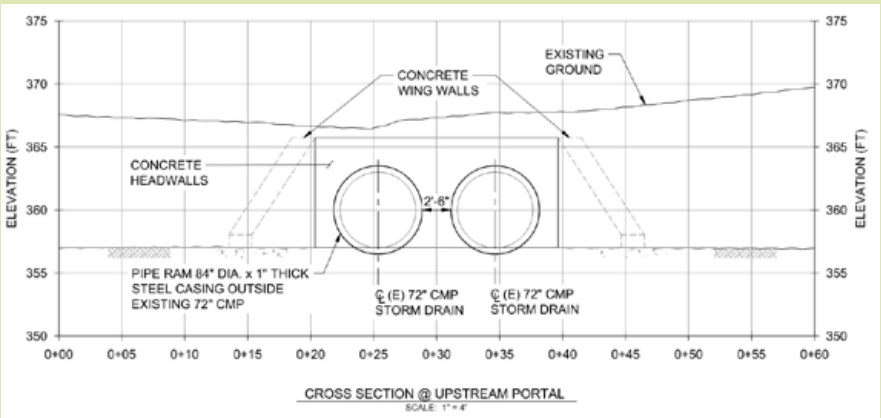

Figure 5-3: Schematic of pipe swallowing alternative

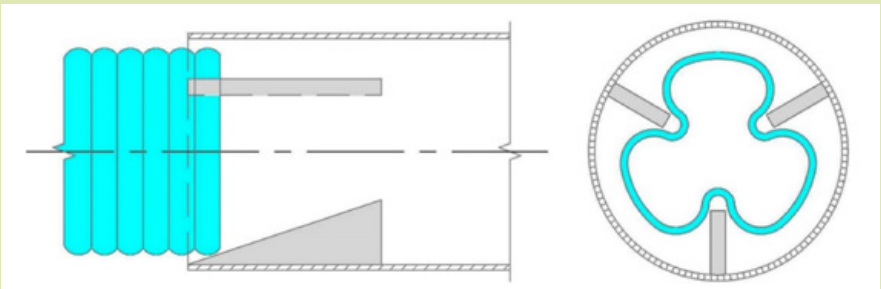

Figure 5-4: Schematic of crimping fins (ASCE, 2020)

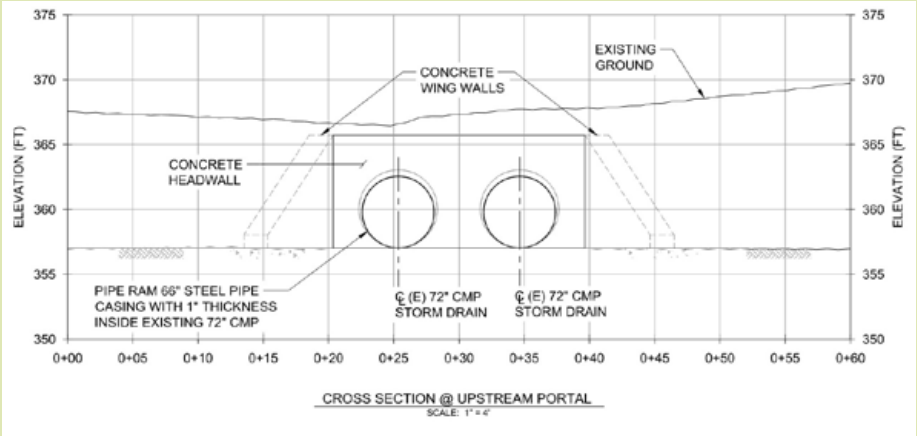

Figure 5-5: Schematic of pipe bursting alternative

cone-shaped head that would assist in the expansion of the CMPs. Additionally, a cable and winch would be added to the leading end of the cone to guide the new pipe through the culvert. This method would have the lowest environmental impact of those previously discussed, though the risk of vibration-induced settlement from pipe ramming would remain. The primary drawback is the reduction in hydraulic capacity of the 66-inch OD pipes requiring the installation of a new 48-inch ID pipe to make up for the reduced hydraulic capacity.

6.0 ALTERNATIVES EVALUATION

It was readily ascertained that the jacked concrete box was the least practical solution because of the disadvantages mentioned, and it would provide a far more robust final product that the funding agency could perceive as a betterment over the two CMPs, thereby shifting some of the cost to the CCCPWD, which was not desirable. Therefore, Class 4 cost estimates were prepared for each alternative method except for the jacked concrete box.

Another determining factor was the ability to meet the construction constraint of completing the "in-water" construction within a single dry season (June 15 to October 15, about 17 weeks) if the project was designated as such by the CDFW.

Both the estimated construction costs and estimated construction duration are presented in Table 6-1.

Note that these values are method-specific and don't include time or cost associated with ground improvement or other project aspects that would be required regardless of method selection, and which may potentially be performed simultaneously with some of the pipe replacement work.

As indicated in the table, a pipe canopy solution would likely take more than one dry season to complete, whereas the two pipe ramming options could conceivably be constructed within the constricted "in-water" construction schedule.

> *"Both pipe ramming options entail risks that are difficult to quantify."*

Open-cut replacement was deemed unacceptable because it would not be possible to maintain one lane of traffic in each direction at all times. There are no suitable temporary alternate bypass routes to replace this crucial throughfare for many commuters.

While both pipe ramming options have more favorable timelines and costs compared to the other alternatives, they also entail operational risks that are difficult to quantify. As pipe ramming is generally non-steerable, the soils are known to be very soft or contain voids, and the existing pipes are sagging significantly, it is difficult to predict the likely trajectory of the new replacement pipes.

For the pipe swallowing option, there is a high risk that the new pipes may veer into the softer ground surrounding the existing CMPs and engage with the invert of the CMP at the sags or the new pipe because of the small separation (less than 2 feet) between the two CMPs. Additionally, the crumpled CMP within the new pipe would make it harder for personnel to enter the pipe if needed. However, there would still be access into the CMP from the downstream end of the CMP.

Table 6-1

Method	Cost Estimate (-50% to +100% accuracy)	Construction Time (+50% to -30%)
Open-Cut Replacement	$5.3M	12 weeks
Pipe Canopy	$7.0M	26 weeks
Pipe Swallowing	$5.0M	16 weeks
Pipe Bursting and new 48"	$4.8M	16 weeks

For the pipe bursting option, the existing CMPs would provide better guidance for the advance of the new pipes, but this may cause issues where the deepest sag is encountered (particularly in the north CMP), as the weakened soil and corroded CMP may not provide enough resistance to direct the new pipe through the sag, potentially leading to difficulty advancing. Therefore, a constant-tension winch between the leading-edge cone and the lower portal would be critical to assist pulling the pipe through the sags. Regardless, it is likely that the new culverts will retain some sag in their final profiles, but this is not expected to present operational issues as the overall slopes of the CMPs (-12 percent) are high enough to still allow unimpeded flow. The new 48-inch culvert pipe will be installed using the same mobilization of pipe ramming equipment with pilot tube guidance, or auger boring also with pilot tube guidance.

7.0 CONCLUSION

The CCCPWD decided to proceed with implementing the pipe bursting option combined with a new 48-inch culvert installation, as it was deemed to have the most favorable combination of lower cost, risks that can be mitigated, and construction schedule which is feasible to complete within a single dry season even if the CDFW deems the work to be "in-water" construction.

8.0 REFERENCES

ASCE. 2020. Pipe Ramming, Manuals and Reports on Engineering Practice No. 115, 2nd Edition, Utility Engineering & Surveying Institute.

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Michael Bianucci, P.E. *has 40 years of experience in the design of bridges and retaining walls. His experience encompasses different types of bridges including concrete box girder and segmental bridges.*

City of Healdsburg – Municipal Recycled Water Pipeline Project Completion Update

Guided Auger Bore under Highway 101

By: Justin Lianides, PE GE, Mott MacDonald

The City of Healdsburg is located 70 miles north of San Francisco on Highway 101 in the heart of Sonoma County. With a population of approximately 11,800 residents, Healdsburg's small-town charm is reflected in its quiet, friendly neighborhoods and traditional Spanish-style plaza. The City's location at the confluence of three valleys—Russian River, Dry Creek, and Alexander Valleys—makes it a scenic and recreationally rich community. The Russian River flows through the City, offering ample opportunities for outdoor recreation, while nearby parks and open space preserves provide miles of trails for hiking, biking, and nature observation.

1. PROJECT OVERVIEW AND COMPLETION

In response to ongoing water supply challenges and the curtailment of surface water rights in 2021, the City of Healdsburg identified a need to provide drought-resilient irrigation for key municipal turf areas, which play a vital role in community recreation. During the 2021 drought, all outdoor irrigation of municipal turf was suspended, impacting public parks and athletic fields that serve residents year-round.

To address this challenge, the City launched the Municipal Recycled Water Pipeline Project (WA004), a visionary effort to expand the City's recycled water pipeline into the City core to irrigate public parks, school athletic fields, the Oak Mound Cemetery, and provide a public fill station. The pipeline both preserves these spaces for community use even during drought conditions and reduces overall demand of the City's potable water system, allowing more potable for other beneficial uses.

With a $7 million grant awarded by the California Department of Water Resources (DWR), the City has successfully completed the design and construction of the project. The project added approximately 2.0 miles of 12-inch recycled water main to the termination of an earlier phase, nearly all of it C900 PVC pipe. Essential to the expansion of the system into the City core, the project successfully crossed under California State Route Highway 101 and the SMART rail line. Additionally, a recycled water bulk fill station was installed to support further non-potable water uses in the community.

The project was planned, designed, and constructed within the required timeline, with all work completed ahead of the grant deadline of September 30, 2025. Originally conceptualized in 2011 with preliminary plans by Winzler and Kelly and based on environmental documentation completed in 2005, the updated project underwent further environmental review and permitting as required under CEQA and other applicable regulations. A map of the recycled water pipeline is provided in Figure 1.

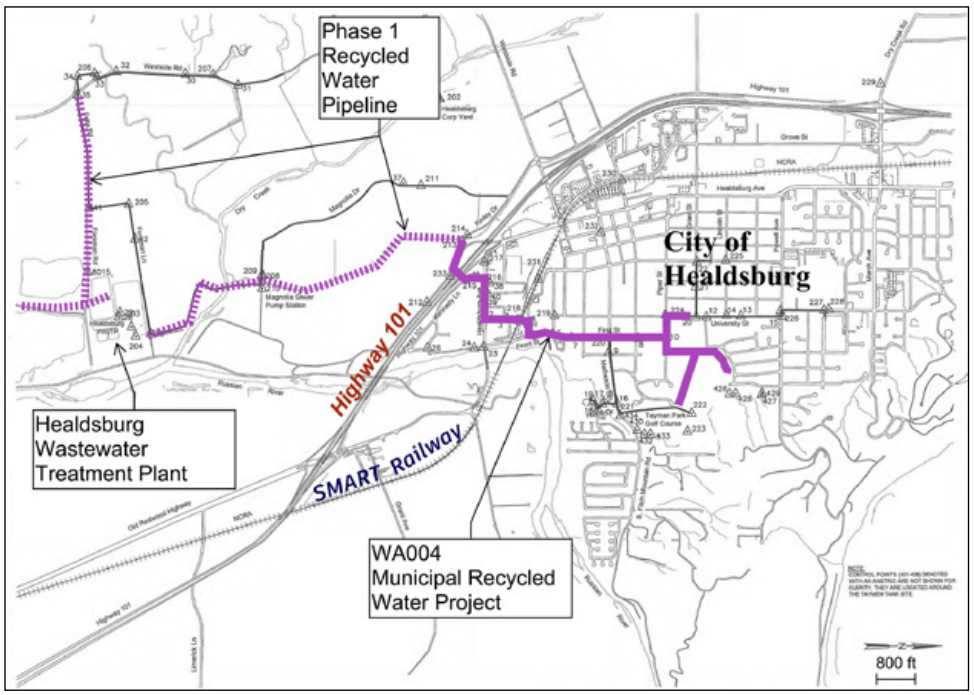


Figure 1: Project map

2. PROCUREMENT

The Municipal Recycled Water Project (WA004) was completed using a design-bid-build procurement strategy. The lead designer was West Yost, who subcontracted Mott MacDonald to provide geotechnical and trenchless engineering. Project bids for WA004 were opened on March 6, 2024. Four bids were received, ranging from $4.8 million to $5.5 million, with Argonaut Constructors being awarded the project as the low bidder. Full Bore, Inc., was listed as their trenchless subcontractor, with a value of $208,290 for the Highway 101 crossing. A notice to proceed was provided to Argonaut to start work on or before May 13, 2024.

3. DESIGN OF THE HIGHWAY 101 UNDERCROSSING

A notable feature of the project was the undercrossing Highway 101, a facility owned and operated by the California Department of Transportation (Caltrans). At the crossing location the highway had four vehicular travel lanes and an offramp, all of which were built upon approximately 8 to 10 feet of embankment fill.

One geotechnical boring was performed at each side of the Highway 101 crossing. Holocene-age stream terrace deposits were found directly underlying the fill, consisting of medium stiff sandy silt and lean clay, and loose clayey sand, each with few amounts of fine to coarse grained gravel (5 to 10 percent by weight). These soil conditions appeared well suited for construction using horizontal auger boring techniques, so long as the installation could be kept below the base of fill and above the groundwater table. The vertical alignment was established two feet below the base of the fill, which resulted in approximately 12 vertical feet of clearance between the top of casing and the top of highway pavement.

The horizontal alignment was initially envisioned to require jacking and receiving pits outside Caltrans right of way and within county and city streets that parallel the highway. Subsequent utility research found that both roads had several utilities, requiring that the design team either pursue utility relocations or shift of the pits to within Caltrans right of way. Moving the pits into Caltrans right of way would require tree pruning and removal and pit construction within the side slopes of the highway embankment. After discussions with Caltrans, it was agreed that the least impactful way to move forward was to place the pits within Caltrans right of way. The resulting alignment required a casing length of 168 feet, a relatively compact 25-foot-long by 18-foot-wide jacking pit, and a more typical sized 18-foot by 18-foot receiving pit. The Caltrans encroachment permit was received during the final stages of design, and the accompanying permitting conditions were incorporated into the contract. A profile of the trenchless alignment is shown in Figure 2.

A Cal-OSHA "Potentially Gassy" tunnel classification was obtained by the City prior to bidding. The classification required gas monitoring and operation of a reversible mechanical ventilation system any time an employee was working in the underground environment.

4. CONSTRUCTION OF THE HIGHWAY 101 UNDERCROSSING

Prior to excavations, geotechnical instrumentation was installed along the trenchless alignment and around the pits. Instrumentation included utility monitoring points, optical survey targets, and pavement monitoring prisms. The geotechnical instruments were baselined then read daily during the excavations. The maximum settlement reading over the duration of construction were 0.36 inches at the rear of the jacking pit and 0.24 inches at the edge of pavement near the retrieval pit.

The jacking and retrieval pits were constructed using slide rail shoring systems. This pit construction technique reduces settlement risk by simultaneously lowering the shoring while excavating the base of the pit. A closeable window within the pits was included at both the entry and exit points of the trenchless installation. The ground visible at the jacking pit window was firm and stable lean clay. The pit inverts were protected with a 1-foot thick layer of crushed rock and there was no visible groundwater infiltration.

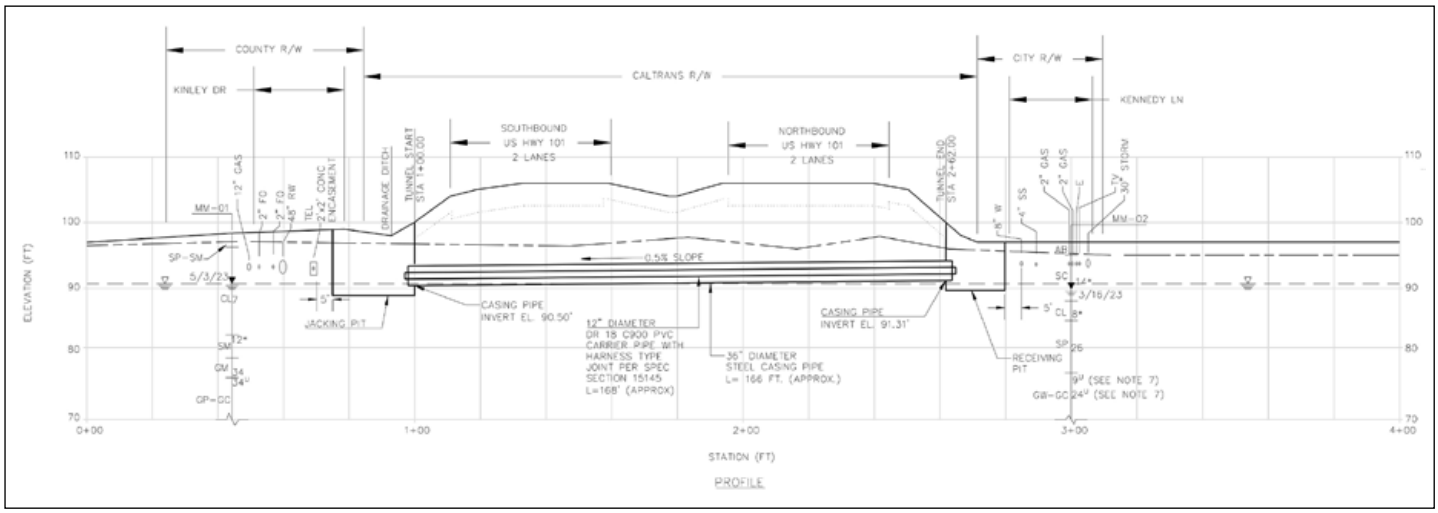


Figure 2: Profile of the trenchless installation

Figure 3: Final configuration of the jacking pit

Figure 4: Launch of the pilot tube

A pilot tube was pushed across the full alignment prior to installation of the casing. The system used was an Akkerman GBM 240A. The full pilot tube process took one day, including set-up, installation and removal of the equipment. The actual push across the highway took 1 hour and 20 minutes. The pilot tube was placed successfully to design line and grade.

A pilot tube casing adaptor piece was then connected to the end of the pilot tube in the jacking pit. The crew then proceeded to weld then jack 10-foot-long by 36-inch diameter steel casing along bore path, beginning with the casing adapter piece. Full penetration circumferential butt welds were utilized for each casing joint. Each casing pipe had a contact grout port and a ½-inch diameter perforated lubrication pipe welded to the external crown of the pipe. The jacking equipment used was a Bor-IT Model 48 "Terminator" and 10-foot-long by 36-inch diameter auger segments within the casing. Spoil was removed from the pit by clamshell bucket. The casing installation took seven workdays, equating to an average production of 24 feet per day. Jacking thrust was relatively constant during the full drive, ranging from 220,000 pounds to 290,000 pounds, suggesting that the 5/8-inch radial overcut was generally stable along the bore path.

Once the casing was pushed across the full alignment, contact grouting was completed during a half day's work. A total of five cubic yards of contact grout was injected into ports within the casing to fill the annular space between the outside of the casing pipe and the excavated ground. This volume was about 66 percent greater than the theoretical overcut volume of three yards.

The final design specified a 12-inch diameter restrained C900 PVC carrier pipe encapsulated by annular space cellular grout backfill. However, during the submittal process there was difficulty in getting the contractor's engineer to supply heat of hydration calculations for the backfill grout placement. The project team wanted confirmation that the heat generated from the cellular grout placement would not soften the PVC carrier pipe. This was not a risk that anyone felt comfortable taking. In response, Argonaut proposed to use ductile iron pipe instead of the specified PVC carrier pipe. This substitution was accepted by the city, and the concern of hydration heat was subsequently dropped.

The ductile iron carrier pipe was centralized within the casing by premanufactured casing spacers and jacked into place using the auger boring machine. Bulkheads were then constructed at each end of the casing and the annular space between the carrier pipe and casing was backfilled with a 500-psi cellular grout mix.

Figure 5: casing installation showing 1/2-inch lubrication pipe

Figure 6: Installation of the ductile iron carrier pipe

Between the start of shaft construction and shaft restoration, the full installation process took place between February 26 and April 2, 2025 (5.5 weeks). A ribbon cutting ceremony for the full project was held on May 29, 2025, attended by city council members, city operations, design and construction representatives, and the members of the community.

5. BENEFITS TO THE COMMUNITY

The completion of the Recycled Water Pipeline Project ensures that Healdsburg's vital public green spaces remain usable and vibrant during both normal and drought years. It supports sustainable water management by shifting non-essential irrigation from potable to recycled water and demonstrates the City's commitment to resilience, environmental stewardship, and long-term planning.

Healdsburg is proud to mark the successful completion of this project and thanks the residents, city staff, engineering consultants, and the DWR for their partnership and dedication in delivering this critical infrastructure improvement.

The author would like to acknowledge Patrick Fuss, P.E., City of Healdsburg Utility Engineering Manager and Acting Utility Director, and Robert Reid P.E., Principal Engineer at West Yost, for their support in preparation of this article.

ABOUT THE AUTHOR:

Justin Lianides, PE GE, *is a principal project manager at Mott MacDonald with 18 years' experience in tunnel and trenchless projects. Justin currently serves as Secretary on the WESTT Board of Directors.*

Seismic Design Criteria for HDPE Pipe Water Mains

Technical Document Important for Utilities in Earthquake Prone Areas

By: Steve Cooper, SCA Communications

A pioneering report provides documentation for the required wall thickness of a fully fused, high-density polyethylene (HDPE) water main pipeline to withstand the lateral spread from an earthquake. Researched and authored by Michael O'Rourke, Ph.D., P.E., F.SEI, M.ASCE Professor Emeritus Civil Engineering at the Rensselaer Polytechnic Institute, the *Design of HDPE Water Mains for the Lateral Spread Seismic Hazard* (MAB-9) can be found at the website of the PPI Municipal Advisory Board: www.plasticpipe.org/MABpubs

> *"Experience suggests that HDPE pipe does very well in earthquakes."*
>
> *- Michael O'Rourke, Ph.D., P.E., F.SEI, M.ASCE Professor Emeritus Civil Engineering, Rensselaer Polytechnic Institute*

"This critically important document provides the criteria for the proper design of an HDPE water main system," stated Camille George Rubeiz, P.E., F. ASCE, co-chair, HDPE Municipal Advisory Board, and senior director of engineering for the PPI Municipal & Industrial Division. "It is the first report of its kind that provides the rationale, data and formulas for determining the proper wall thickness for a fused, highly ductile and highly flexible HDPE water main in a seismically sensitive area, subjected to an induced lateral spread.

"According to the latest United States Geological Survey, nearly 75 percent of the United States could experience an earthquake during the next 100 years that would cause significant damage to underground water mains. Professor O'Rourke's analysis of possible seismic events, lateral spreads and wave propagation hazards with formulas and charts provides the much needed data to help design a resilient water system."

The MAB serves as an independent, non-commercial adviser to the Municipal & Industrial Division of PPI, the major North American trade association representing the plastic pipe industry

The two primary seismic hazards to buried pipelines are wave propagation and permanent ground deformation. Because earthquakes are caused by movement at a fault, the resulting movement results in waves traveling away from the fault. These waves stretch and bend pipeline infrastructure at or near the ground surface and is referred to as the wave propagation (WP) hazard.

"The WP hazard occurs in all earthquakes and is most commonly quantified by the resulting ground strain," O'Rourke explained. "The WP hazard is also transitory in that after the shaking ends, the ground returns to its original pre-quake position. If the earthquake is large, it can also result in permanent offsets at the surface or movements of the ground (lateral spread hazard) both referred to as permanent ground deformation (PGD). The report addresses the lateral spread hazard and the strains due to PGD which are larger and hence more important than those due to WP."

O'Rourke's document contains formulas, calculations, empirical data, and illustrations plus nomenclature and definitions, all of which can be used in designing the HDPE water piping system.

"Experience suggests that high-density polyethylene pipe does very well in earthquakes," O'Rourke said, "but engineers like to have ways to calculate and substantiate their design. Listening to what somebody else says that, 'Oh yes, the pipe is great', but they still are faced with the

The ductility of HDPE pipe provides high resistance to earthquakes and is also an important factor for ease of installation

Heat fusing HDPE pipe sections provides a leak-free joint plus heightened security and protection from seismic events

question of 'what wall thickness do I need?' 'I have this particular diameter pipe and it's going to be buried this far underneath the ground so what wall thickness do I need for some expected seismic event?' The goal is to have HDPE pipe that will be able to withstand the expected earthquake loads on this inherently ductile material. With that in mind, MAB thought it would be useful to develop a document that provides designers with some relationships, tables, formulas, et cetera, that they can use to figure out how thick the wall would need to be for an expected lateral spread. And that's the purpose of the MAB-9.

"HDPE is known as a continuous pipe, which means the pipe segments, which are 40 feet to 50 feet long, are fused together," he continued. "The ductile iron or cast iron pipe has joints every 15 or 20 feet, and the damage from a seismic event frequently occurs at those joints. Continuous pipe, whether it's welded steel or high-density polyethylene, usually does better than segmented pipe in earthquakes. HDPE has the added advantage over steel (and all other materials) in that it is highly ductile, flexible and corrosion resistant and so it can move with the earth as opposed to trying to resist the deformations that the earth is imposing on it."

Rubeiz elaborated, "MAB-9 is essential for many reasons. Proper wall thickness is very important, especially with earthquakes, and ground movement. Plus, there continues to be a dire need to replace the aging infrastructure, especially pipes that are older and brittle that many seismic events will cause them to crack. HDPE pipe and the information contained in MAB-9 will help in those replacement programs to provide a proper and resilient water main system.

"Being intrinsically able to withstand seismic shifts along with corrosion resistance, leak-proof fused joints creating a monolithic HDPE piping system, having a high degree of flexibility, and high ductility, are among the many reasons HDPE pipe is recognized to be the best product used for seismic installations and, of course, trenchless and open cut installations," Rubeiz stated.

"We would also like to thank the other MAB members and supporting engineers who provided their time and expertise to the project - Robert Diamond, P.E., City of Palo Alto, CA; Casey Haynes, P.E., City Utilities, Springfield, MO; Bill Heubach, P.E., M. ASCE, Seattle Public Utilities, WA; Harvey Svetlik, P.E., GPPC, TX; and Gerry Groen, P.Eng., Infra Pipe Solutions, ON."

> *Nearly 75 percent of the United States could experience an earthquake during the next 100 years.*
>
> *- Camille George Rubeiz, P.E., F. ASCE, Co-chair, HDPE Municipal Advisory Board*

RIDGECREST, Calif. - A formerly straight section of pipe broken by shifting earth during a 7.1 earthquake that shook Southern California in July 2019, cracking buildings, breaking roads and causing power outages. The quake, centered 11 miles from the Ridgecrest area, is the largest quake to hit Southern California in at least 20 years. It was followed by a series of large and small aftershocks, including a handful above magnitude 5.0. (Credit: Gene Blevins/ZUMA Wire/Alamy Live News)

Additional information can be found at www.plasticpipe.org/mabpubs or www.plasticpipe.org/municipalindustrial

ABOUT PPI:

The Plastics Pipe Institute, Inc. (PPI) *is the major North American trade association representing the plastic pipe industry and is dedicated to promoting plastic as the materials of choice for pipe and conduit applications. PPI is the premier technical, engineering and industry knowledge resource publishing data for use in the development and design of plastic pipe and conduit systems. Additionally, PPI collaborates with industry organizations that set standards for manufacturing practices and installation methods.*

Riverside Uses FFRPP Rehabilitation for the Magnolia Avenue Sewer Force Main Project

By: Paul Gagliardo, MPH, PE, Gagliacqua Consulting

Riverside is a city in and the county seat of Riverside County, California, in the Inland Empire metropolitan area about 50 miles southeast of Los Angeles.

The city owns and operates a sanitary sewer collection system consisting of over 830 miles of sewer lines ranging in size from 4 inches to over 50 inches in diameter with some more than 120 years old. Treatment is provided at the Regional Water Quality Control Plant (RWQCP), which provides preliminary, primary, secondary, and tertiary treatment for a flow rated capacity of approximately 46 million gallons per day (mgd). In addition to wastewater from the City's collection system, the city also provides domestic and industrial wastewater treatment services for the Community Services Districts of Edgemont, Jurupa, and Rubidoux. The RWQCP comprises two treatment plants and a common tertiary filtration plant, serving a population of almost 400,000 people. At the plant, wastewater is treated to tertiary levels before it is reused for irrigation or discharged to the Santa Ana River.

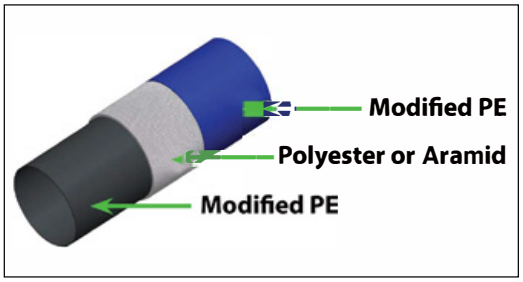
In 2024, the City of Riverside faced a significant challenge in rehabilitating a 2-mile-long, 24-inch concrete-lined and coated steel force main pipeline installed in the 1970s. The forcemain had experienced internal corrosion that affected its structural integrity. Following a failure and major cleanup effort in the early 2000s, the pipeline was decommissioned and left out of service. The city constructed a redundant force main to maintain operations and decided to mothball the original pipeline due to concerns over further failures. However, increasing demands for system redundancy necessitated its rehabilitation.

> *"Rehabilitation methods often cost 50-75 percent less than full pipe replacement."*

The Magnolia Avenue Sewer Force Main Rehabilitation project focused on the repair and rehabilitation approximately 9,845 L.F. of an existing 24-inch Cement-Mortar Lined & Coated (CML&C) steel pipe.

Municipal pipeline rehabilitation using a liner system generally offers significantly greater value compared to a total replacement. This trenchless rehabilitation technique is typically much less expensive, requires less permitting, causes minimal disruption to the community, and takes less time to complete. It can extend the life of existing infrastructure while still maintaining functionality, making it a more cost-effective option for most situations where the pipeline is not severely damaged. Rehabilitation methods often cost 50-75 percent less than full pipe replacement, resulting in substantial savings. Because relining projects only have access pits and not open trenches, the permitting requirements are much lower. This reduces time to completion, cost, and complexity. Properly rehabilitated pipelines can have their lifespan extended by 50 years, delaying the need for complete replacement. Rehabilitation projects usually take less time to complete compared to full replacement, minimizing service disruptions. Project sections can be opened and closed within a day. The interruptions involved with the trenchless method are minimal. When using a Flexible Fabric Reinforced Plastic Pipe (FFRPP)or CIPP pipelining for pressure applications, the restoration takes place from access pit to access pit. Digging to replace pipes will require more time, be more disruptive, and increase expenses. There are also other factors to consider, including diverting traffic away from the area where the contractors are digging. Another factor with the dig and replace method is that surface restoration is also necessary.

Since the city had already constructed a separate force main pipeline to replace the existing one, they were aware of the cost and disruption implications. When it came to increasing capacity and redundancy in the area the obvious choice was to rehabilitate the existing pipe with a trenchless liner system.



BulletLiner™ FFRPP can operate at pressures from 75 psi to 300 psi



BulletLiner™ has a basic three step installation procedure: 1) fold the liner into a U-shape, 2) Pull the liner through the host pipe, and 3) expand the liner

CIPP is a trenchless method for repairing pipes that involves inserting a flexible liner into an existing pipe, inflating it, and then hardening it with heat or ultraviolet light. CIPP is suitable for repairing pipes that do not need to be upsized and can be completed in less time than other methods.

This technology is currently the most common method for gravity pipe rehab applications, but is still in the early developmental stages for pressure pipe applications with many limitations including distances, size, QA/QC limitations on site, and pressure capabilities. The specifications used by the city in the bid process required contractors to bid using the CIPP solution. The bid proposals received exceeded the $7 million budget by over 30 percent. Because the bids received were more than 30 percent over budget the bids were rejected, and an alternative solution was sought.

CPM Pipelines proposed the BulletLiner™ System as an alternative solution to the city. CPM specializes in providing field inspection services for pipeline condition assessment projects and specialty pressure pipe rehabilitation systems and technologies. CPM has executed thousands of projects throughout the United Sates. Innovative cost-efficient systems of this type were first

Liner is very flexible and can be installed through 45 degree bends and 90 degree bends with downsizing

> *Properly rehabilitated pipelines can have their lifespan extended by 50 years.*

Installation requires only two small access pits

FFRPP can be pulled 2000 to 8000 feet between pits

introduced by CPM pipelines in 2013. The BulletLiner System™ was introduced in 2023, and in just two short years has over 50,000 feet of installations.It is a semi-structural Class 3 pipe FFRPP rehabilitation system. It is NSF 61 approved, contains no PFAS and is suitable for the transportation of various liquids including potable water, reclaimed water, wastewater, with drinking water approvals in numerous countries. It is a three layer product including an inner liner made of modified polyethylene (PE), an inner woven pressure layer of polyester or aramid and an outer jacket of modified PE. It can operate at pressures from 75psi to 300 psi.

It is a close fit liner and can be deployed in pipes from 2 inch to 64 inches in diameter. It can be used in many trenchless rehabilitation applications including gas and oil and works independent of the host pipe, or in conjunction with the host pipe dependent upon the specific project design parameters and pressure requirements. This type of system has been internationally proven for over 25 years, and BulletLiner™ for the past 12 years. This method has been used to rehabilitate over 200 pipeline segments totaling over 1000 km of pipe length. The BulletLiner™ has a basic three step installation procedure; 1) fold the liner into a U-shape, 2) Pull the liner through the host pipe, and 3) expand the liner.

There is no connection or bond between the host pipe and liner system, so it allows the liner to flex independently of the host pipe. The slightly rigid liner maintains a round shape inside the pipe even without pressure. It is flexible and can easily be pulled through 45 degree bends.

The liner is flexible, foldable, and light with the material strength of a steel pipeline. Due to the extreme flexibility, it opens up a variety of rehabilitation applications without having to trench and remove pipelines. Installation requires two small excavation pits or access points for rehabilitating a deteriorated section of pipe.

This reduces the conventional pipeline replacement noise, traffic disturbances, time-consuming reconstruction as well as environmental and economic impacts to surrounding landscape and businesses. This system, designed for restoring the structural integrity of aging pipelines, offered several advantages over traditional methods, including requiring less access pits, streamlining installation and providing a similar solution to CIPP at a lower cost. Trenchless rehabilitation techniques require minimal excavation, reducing surface disruption and inconvenience to residents and businesses. FFRPP systems can be pulled 2000 feet or more between access pits depending on size and geometry.

In some cases, when pipe is straight, it can be pulled up to 8000 feet. Minimizing access pits reduces costs and impact on the surrounding community and traffic.

This solution provides a budget-friendly, permanent rehabilitation to aging infrastructure with a 5-year material warranty, and 50-year design life at approximately one-third the cost of dig and replacement.

The city revised its specifications and bid documents to allow for the use of the FFRPP technology. The project was rebid with the BulletLiner™ System specifications, and SAK Construction emerged as the sole bidder, meeting the City's budgetary and technical requirements. By reducing access pits from 20 to 11 and liner installations from 15 to 8, the BulletLiner™ System brought the project back within budget at $6.75 million. Completed in late 2024 the project achieved a renewed pipeline with a 50-year design life with a 5-year warranty.

The City of Riverside has successfully modernized its sewer infrastructure and maintained redundancy while adopting an innovative, cost-effective solution. This project underscores Riverside's commitment to proactive asset management and positions the city as a leader in adopting new technologies to enhance utility performance.

ABOUT THE AUTHOR:

Paul Gagliardo, MPH, PE *is an independent consultant assisting and advising innovative water sector startup companies. He has held leadership positions in the water and wastewater business for over 30 years at the city of San Diego, American Water and multi-national consulting companies. Paul has been a judge for the Imagine H2O Accelerator since its inception in 2009. He is a registered engineer in the state of California and has a Master's Degree in Public Health. He is also the host of The Water Entrepreneur podcast.*

NASTT Municipal & Public Utility Scholarship

APPLICATION DEADLINE: NOVEMBER 1

The NASTT No-Dig Show Municipal & Public Utility Scholarship awards employees of North American municipalities, government agencies and utility owners who have limited or no training funds with a Full Conference and Exhibition registration to the NASTT No-Dig Show (one-day conference registrations are also available). Hotel accommodations for three nights at the host hotel are provided for selected applicants. Recipients have full access to all exhibits and technical paper sessions.

Join us in Palm Springs! Applications should be submitted by November 1, 2025 at nastt.org/no-dig-show

NORTH AMERICAN SOCIETY FOR TRENCHLESS TECHNOLOGY

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DIFFERING SITE CONDITIONS:

Successful Strategies to Cooperatively Resolve Claims

By: Tom Olson, Olson Construction Law

Differing Site Conditions ("DSC") are unfortunately here to stay. Project owners are often either not conducting a subgrade investigation or, if they are, not conducting an *adequate investigation*. And, even an adequate investigation can miss subgrade conditions outside of the borings. The net effect is that since there is nothing a utility contractor can do to stop encountering DSCs, contractors need to successfully identify and implement strategies to cooperatively and fairly resolve DSC claims on the jobsite. Set forth below are some battle-tested strategies. As such, all of these strategies can work for you.

1. WHEN BIDDING, EVALUATE 'RIGHT' TO RELY UPON OWNER'S SUBGRADE INVESTIGATION.

When project owners perform a subgrade investigation, they *intend* that bidders will *rely* upon the investigation in pricing the work and selecting the trenchless method. And yet, engineers regularly include contract language which purports to *limit or bar such reliance*. In response, I offer three pointers:

- First, recognize that as a matter of contract, such limiting or disclaimatory language is normally set forth in the Special or Supplemental Conditions (and sometimes in the Technical Conditions). Contractors must ensure they evaluate all of these conditions prior to bidding to assess whether such language is included.

- Second, even if the contract includes such language, contractors can still rely upon the project subgrade investigation as evidence of Type II DSC (i.e. conditions different than anticipated for the work in the geographic area), instead of a claim for a Type I DSC (i.e. conditions different than indicated in the contract documents).
- Third, as a matter of law, many jurisdictions have held that contract language which limits or bars contractors' reliance on the project subgrade investigation is *unlawful and unenforceable.*

2. WHEN BIDDING AS A SUBCONTRACTOR, STATE THE 'ANTICIPATED' SUBGRADE CONDITIONS.

To help ensure there is no dispute later whether the subgrade conditions you encountered were different than what you anticipated, state what you anticipated in your bid (e.g. full face of hard rock). This is particularly important when the owner has not performed a subgrade investigation. And, negotiate to *have your bid be incorporated into the subcontract*.

3. WHEN BIDDING AS A SUBCONTRACTOR, STATE 'RIGHT' TO PAYMENT FOR 'STAND-BY' COSTS IF DSC ENCOUNTERED

One of the common costs incurred for a DSC is 'stand-by:' waiting for a decision to be made on how to proceed. And, based on my experience, contractors fail to seek payment for stand-by costs. To help ensure a subcontractor is paid for such costs, subcontractors should state the 'right' for such payment in their bids, and then seek to have the bid incorporated into the subcontract. Make sure when negotiating your subcontract that there are not clauses which would negate this, such as a "no damage for delay" clause.

Additionally, most public contracts include such a payment right in the General Conditions. Note that this payment right is sometimes hidden in the "Suspension of Work" clause, which is the normal case when DOT Standard Specifications are used. Further, to help get a DSC claim resolved sooner, when there is a contractual right to payment for 'delay,' a contractor should so advise as part of its initial DSC claim notice. If your iron must remain idle waiting for a decision, it is important that the engineer understand this at the outset.

4. THE CONTRACTOR SHOULD *ALWAYS* PROVIDE WRITTEN NOTICE OF A DSC.

Literally all public construction contracts require written notice if a contractor believes it has encountered a DSC. And, the reality is that much of the communications on site are verbal, not written. As a consequence, I have been involved on many projects *after the fact* where a contractor only provided verbal notice. While I have been successful getting around this notice failure on many occasions, it is risky business. This is true for two reasons.

First, on public construction projects, the inspector is not authorized to waive *any* contract requirements. That means that even if the inspector stated that verbal notice is sufficient, a contractor is not excused from providing written notice. Make certain you are discussing any contract changes with the person authorized to make changes, typically the engineer.

Second, as a matter of law throughout the country, other than on *federal projects*, a contractor is generally deemed to have *waived* its DSC claim absent written notice. That is true regardless if the contractor provided the same notice *verbally* that it would have provided in *written* form.

> *Contractors need to successfully identify and implement strategies to cooperatively and fairly resolve DSC claims on the jobsite.*

5. ENCOURAGE THE ENGINEER TO RE-DESIGN THE UTILITY WORK TO AVOID THE DSC.

Upon written claim notice, per standard DSC clause, a contractor is required to stop work, allow the engineer to investigate and, if the engineer determines there is or may be a DSC, evaluate how to proceed. It is good to be *paid* for DSC extra costs. It is even better to *avoid* incurring the extra costs.

A strategy not typically attempted is to work with the engineer to evaluate whether the affected work can be *re-designed* to avoid being performed in the DSC.

I recently helped a contractor accomplish this. The contractor assisted the owner and engineer to further investigate the subgrade (the contractor performed some excavations while the engineer took additional borings). The investigation revealed the existence of the anticipated subgrade conditions, albeit at different vertical and horizontal locations. The design was subsequently revised to reflect the more preferable location of the utility work. As a consequence, no extra costs were incurred (other than for the additional lineal footage of pipe that was required, for which the contractor was paid).

6. CONTRACTOR SHOULD PERFORM ITS OWN SUBGRADE INVESTIGATION.

Too often, the project engineer will deny a DSC claim, notwithstanding that the engineer did not perform a subgrade investigation. This happened on

a recent project. In response, we helped the contractor perform its own subgrade investigation. We retained a geotechnical engineer to substantiate the existence of a DSC, as well as the impact on the auger bore operations. We also retained the auger bore manufacturer, who confirmed that the contractor's extra costs were not caused by improper construction. The net result was the contractor was paid an acceptable amount, and did not have to pay any liquidated damages for the corresponding delay. All of this occurred on the jobsite.

As a standard business practice, if there is any question re: the existence of a DSC or its impact in time and/or dollars, the contractor should conduct its own subgrade investigation.

7. CONTRACTORS SHOULD SEEK PAYMENT ON A REVISED UNIT BASIS.

My experience is that when an engineer acknowledges that a contractor has or may have encountered a DSC, the contractor subsequently performs the work on a force account basis. This results in the contractor being *underpaid* (e.g. Blue Book equipment rates are too low). Fortunately, contractors have a means available to potentially overcome this problem: seek payment on a *revised unit price basis*. While the engineer may say "no" to such a request, the engineer certainly cannot say "yes" unless the contractor requests this. And, as you should explain to the engineer, it is in the owner's interest to agree to a revised unit price. By doing so, the owner will know *before the work is performed* what is will cost versus waiting until *after the work is performed* to add up all the labor and equipment hours.

8. IF THERE IS A DISPUTE ON THE EXISTENCE OF A DSC OR ITS FINANCIAL IMPACT, A CONTRACTOR SHOULD USE THE *ENGINEER'S ESTIMATE*.

When an engineer alleges that the contractor should have anticipated the subgrade conditions encountered and/or the financial impact, I recommend potential use of the *engineer's estimate*. I have helped contractors successfully utilize this strategy when the engineer's estimate for the DSC work is *lower than or similar to the contractor's corresponding bid amount*. This allows a contractor to powerfully state that since it did not have dollars in it bid for the DSC, then the engineer must not have either. Since neither the engineer nor the contractor had dollars in their bids for the DSC, it is fair to conclude that neither anticipated the subgrade conditions actually encountered. The same comparison can also then help establish the amount of compensable extra costs.

9. IF YOU CAN USE THE MEASURED MILE APPROACH FOR CALCULATION OF YOUR EXTRA COSTS, DO IT.

To prove the financial impact of a DSC, contractors normally compare their planned costs (i.e. what they *bid*) with their actual costs. While this strategy is acceptable, there is a better strategy. If you have successfully performed work *outside* of the DSC (e.g. an earlier crossing), then a contractor can and should use production rates (and hence corresponding costs) from the *outside* area. This strategy is better for two reasons.

First, use of *actual* production rates from an area *outside* of the DSC should eliminate any question of what your production rate could have and would have been *but for the DSC*. By contrast, if you are relying upon your *bid*, the engineer can question if this is a valid baseline since it is *theoretical*, not *actual*. For the same reason, if you can't cooperatively resolve the issue on site, courts prefer use of the Measured Mile Approach when it is possible.

Second, use of actual rates should result in the contractor being paid for more extra costs. My experience is that the contractor's bid rate is normally lower insofar as it typically accounts for the impacts of utility, weather and delays as well as re-work. By contrast, comparison of actual production rates achieved outside of the DSC with those obtained within the DSC should typically be higher (i.e. there will be a greater loss of production, and hence greater extra costs recoverable).

10. A CONTRACTOR CAN SUCCESSFULLY MAINTAIN A DSC CLAIM WHEN IT ENCOUNTERS THE ANTICIPATED 'TYPE' OF SUBGRADE CONDITION WHICH 'REACTS' IN UNANTICIPATED MANNER.

It is considered a standard rule of law that a contractor cannot successfully maintain a DSC unless it encounters a subgrade

condition which is different in 'type' than that shown in the owner subgrade investigation or otherwise anticipated for the work being performed in the geographic area. I am proud to share that I have successfully developed and applied another strategy. We helped a contractor get paid a significant amount of money and not pay a significant amount of liquidated damages when it encountered the anticipated 'type' of soils which 'reacted' in an unanticipated manner. We based this strategy on legal cases which we have collected over a period of decades. Notably, we helped the contractor achieve this result on the jobsite.

11. A CONTRACTOR CAN PROVE THE EXISTENCE OF A DSC ON THE BASIS OF AN *ADVERSE IMPACT TO THE CONTRACTOR'S OPERATIONS.*

Sometimes, a contractor cannot prove actual *physical evidence of* a DSC. This may occur because a contractor cannot collect physical samples of the actual conditions encountered. This would also be the case if, as in the project discussed above, where the contractor encountered the anticipated 'type' of subgrade conditions which 'reacted' in an unanticipated manner. To substantiate the existence of a DSC on this project, we collected evidence of how the contractor's operations were adversely affected: equipment was damaged, larger equipment was required, production rates were abysmal, and the work could not be competed as designed. Like the strategy above, we successfully based this unique strategy on legal cases which we have collected for decades. Having successfully utilized this strategy for the first time, we know it can work elsewhere.

12. IF THE CONTRACT DOES NOT CONTAIN A DSC CLAUSE, A CONTRACTOR CAN STILL POTENTIALLY SEEK PAYMENT UNDER THE EXTRA WORK CLAUSE.

Normally on public construction projects, the contract contains a DSC clause. That clause places the financial risk of DSC on the owner, not the contractor. On private projects, it is not that unusual for a DSC clause to be absent. By contrast, on limited occasions, I have been involved on public projects which did not include such a clause. That was the case on a recent public utility project. Given the absence of the DSC clause, we approached this as *extra work*. We listed the *new items* of extra work (i.e. not included in the contract) as well as the *increased quantities of contract work* (which is also properly characterized as *extra work*). This provided a contractual basis for payment. This is the referenced project on which the owner re-designed the project to avoid the DSC. I believe one important reason we were able to help facilitate this result was because the owner believed that the extra costs which would have bee incurred were compensable under the "Extra Work" clause.

In summary, remember the following:

- Owners regularly fail to adequately investigate the subgrade on trenchless projects.
- As a consequence, contractors will continue to encounter differing site conditions ("DSC").
- Contractors need effective strategies to be paid when they encounter DSC.
- There are a number of strategies which contractors can use to avoid incurring DSC-related extra costs as well as get fairly paid when a contractor does incur such costs.
- Based on the author's personal experience, these strategies have worked to cooperatively and fairly resolve DSC issues on the jobsite.
- As a consequence, each of these strategies can and should produce similar results.

ABOUT THE AUTHOR:

***Tom Olson** has helped utility contractors around the country for decades resolve issues on the jobsite, not in the courtroom. He recently helped edit and author a national trenchless manual.*

EMERGING TECHNOLOGY:

Close Tolerance Pipe Slurrification (CTPS) for Asbestos Cement Pipelines

By: Andrew Costa, Insituform Technologies

There are over 630,000 miles of Asbestos Cement pipe buried across the United States that have reached or will reach the end of their estimated design and useful lives. Like most of our buried infrastructure, the time has come to renovate or replace these systems. Naturally, the focus is on how to accomplish the work most efficiently and economically with the least disruption to the public as necessary. Removing and replacing Asbestos Cement pipe has the additional burdens of complying with NESHAP and OSHA requirements which govern the handling, removal, and disposal of any material containing more than 1 percent asbestos.

On June 10, 2019, the EPA approved an alternative work practice (AWP) for Close Tolerance Pipe Slurrification (CTPS) to replace, rehabilitate, and repair existing buried Asbestos Cement (AC) pipe systems. Subsequently, the EPA has determined that CTPS is an equivalent work practice to open cut pipe replacement for replacing, rehabilitating, and repairing Asbestos Cement (AC) pipe. The CTPS process is the only trenchless technology approved by the EPA for the replacement of AC pipelines, and compliant with the Asbestos NESHAP requirements.

Close Tolerance Pipe Slurrification (CTPS) is a proven "trenchless technology" method used to remove and replace an existing pipeline with minimum amounts of excavation. The CTPS method removes the existing pipe by pulling a rotating cutting head through the existing pipe while simultaneously injecting a bentonite-based lubricating fluid. The cutting head rotates at sufficient speed to grind the existing pipe, surrounding soil, and bentonite-based lubricating fluid into a slurry. This slurry is pigged out of the ground by a pulling head, or forced out of the ground into a receiving pit by the new pipe that is being pulled in behind the cutting head as the entire process is running concurrently. As a result of the CTPS process completion, the existing pipe is removed, the new pipe is installed through the subsequent tight-fitting void, and the slurry containing the existing pipe fragments, soil, and bentonite-fluid is removed from the ground.

> *Municipalities have long sought an EPA approved trenchless method to address the billions of feet of AC pipe.*

When the CTPS process is used to remove and replace Asbestos Cement pipe systems, there are several important components of the process that match extremely well with regulations surrounding AC pipe work. First, the patented process requires the injection of bentonite-based fluid at critical points. This fluid maintains a wet-cutting environment, which is an important requirement for cutting Asbestos Containing Material (ACM). Second, the "close tolerance" sizing of the cutting head, in relation to the new pipe being pulled into place, facilitates the removal of the Asbestos Containing Material (ACM) from the ground. This "close tolerance" sizing creates a scenario where the new product pipe, along with the injection of additional drill fluid, will pressurize the slurry, which is expelled at excavations. The slurry containing the ACM is then removed from the site. Third, any remaining trace amounts of asbestos fiber are encapsulated in the skim coat of slurry remaining around the pipe. This skim coat has the consistency of a light-weight concrete material commonly known as "excavatable flowable fill", until it rehardens to a non-friable state.

Applying the CTPS technology to the removal and replacement of Asbestos Cement pipe systems has the potential for several advantages over the alternatives currently available to the municipalities and utility owners charged with replacing AC pipe systems at the end of their design and useful life cycles. The primary methods currently being implemented for replacing AC pipe systems are "open cut" replacement in the same ditch or "open cut" replace in a

> *CTPS is a proven "Trenchless Technology" method used to remove and replace an existing pipeline with minimum amounts of excavation.*

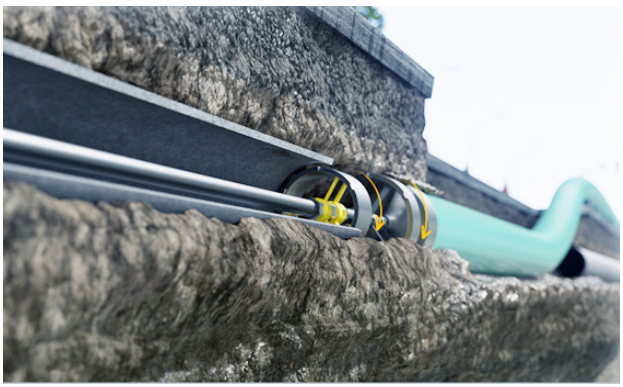


Figure 1. The CTPS process simultaneously grinds the existing host pipe while pulling in new pipe

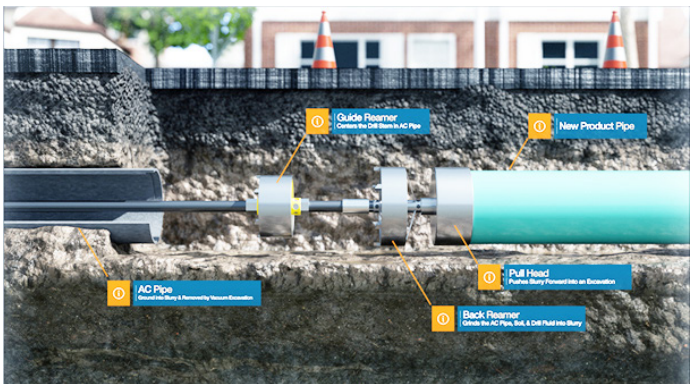


Figure 2. Guide Reamer, Back Reamer (cutting head), and Pull Head components of CTPS installation process

new trench location. Figure 1 represents a visual overview of the process.

The CTPS process starts with two excavations at either end of a pipe segment to be removed and replaced. The horizontal directional drill (HDD) rig sits at the machine pit where the existing pipeline is used as a pilot hole. The horizontal directional drilling (HDD) rods are pushed through the existing pipe from this excavation to another where the cutting head and pipe are attached and pulled into place. The back reamer, or cutting head, is held centered in the existing pipe by a guide reamer so that the back reamer cuts uniformly over the existing pipe as shown in Figure 2.

Thus, the CTPS process will keep the alignment and grade of the existing pipeline. CTPS does not displace the existing pipe fragments into the surrounding soil, but rather cuts the soil ½ inch more than the outside diameter of the new pipe being installed and then blends the soil and existing pipe fragments into a slurry that is forced out by the new pipe being pulled into place. The slurry (consisting of the soil and pipe fragments) is pushed or squeegeed to access points in front of the pipe being installed where it is removed by a vacuum excavator and hauled to a landfill.

> *The CTPS process is the only EPA approved trenchless method for the replacement of AC pipelines.*

KEY COMPONENTS OF CTPS

Bentonite-Based Drill Fluid for "Pipe Slurrification"

The patented process requires the continuous injection of a bentonite-based fluid at critical points throughout the duration of the process. This drill fluid serves several important functions in the CTPS process. Bentonite-based drill fluid is one of the key components of achieving slurrification of the AC pipe and enabling the ability to move the unwanted material to the pits for removal.

First, the drill fluid's lubricating properties are key to mixing the existing pipe and soil into a slurry when the cutting head is rotated at sufficient speed; much like a blender would mix cake batter and water to create a semi-liquid slurry. The blending of the existing pipe material, soil and drill fluid is the essence of the "pipe slurrification" process. Figure 3 shows the slurry created from the mixture of ground AC pipe and drilling fluid.

Fourth, the drill fluid (turned slurry) lubricates the tight-fitting void or opening so that the new pipe can be pulled through the void from one excavation to the other. This lubrication keeps the new pipe from becoming stuck in the tight-fitting void due to surface friction.

Finally, the pipe slurrification process grinds and reactivates the cementitious

Figure 3. Grinding of AC pipe and mixture with drill mud creates the slurrification during the process

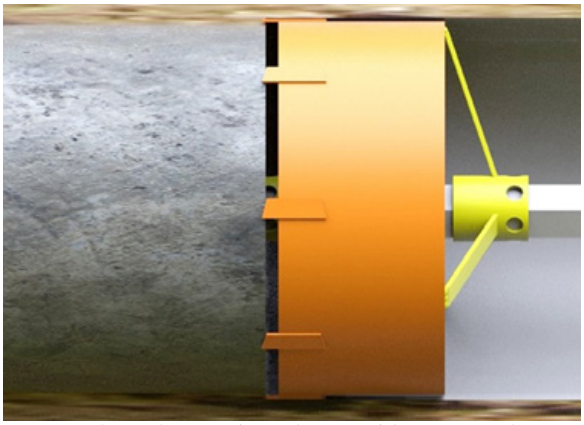


Figure 4. Close Tolerance of ½-inch is one of the important keys to the slurrification removal

properties of the AC pipe; whereas these cementitious particles combine with the slurry to harden into a material with the consistency of a light-weight concrete material similar to excavatable flowable fill. This material fills the ½-inch annular space between the new pipe and virgin soil, forming what the EPA describes as a very thin skim coat around the new pipe. Consequently, any remaining trace amounts of asbestos fiber not removed are encapsulated in this skim coat of slurry remaining around the pipe.

The Importance of "Close Tolerance"

The term "close tolerance" refers to the fact that the cutting head is sized only ¼ inch larger than the outside diameter of the new pipe that will be installed behind the cutting head. Consequently, the cutting head creates a tight-fitting cavity or void only slightly larger than the new pipe being pulled into place. This "close tolerance" of ½ inch is critical so that the pulling head that attaches the new pipe to the cutting head will pig or force the slurry that contains the soil, pipe fragments, drill fluid out of the tight-fitting void while it is pulled through. See Figure 4.

Excavations

As described, the injection of bentonite-based drill fluid, "pipe slurrification, and "close tolerance" sizing of the cutting head creates a scenario where the slurry becomes pressurized when the new pipe is pulled into place. This pressure facilitates the eventual removal of the slurry at strategically located excavations. Often, these are excavations that would have occurred naturally at bends, tees, wyes, valves, etc.

"Close Tolerance" differentiates from traditional HDD practices where the cutting head is sized to 1.5 times larger than the outside diameter of the new pipe to be installed; for example, a 12-inch void would be created to pull in an 8-inch pipe. Consequently, the larger void of traditional HDD allows the new pipe being pulled in place to float through the slurry rather than squeegee the material into an excavation where it can be removed from the site. Thus, with the traditional HDD method the bulk of the slurry is not removed from the underground cavity.

Variance from the combination of "close tolerance" and "pipe slurrification" process in any way will significantly diminish the ability of meeting the intent of the approved Alternative Work Practice (AWP) for Using CTPS for Removing Asbestos Cement Pipe, so it is critical that the CTPS process as a whole incorporates both of these key components.

Safety

To date, two federal agencies have been principally responsible for generating regulations for asbestos control; the U.S Occupational Safety and Health Administration (OSHA) and the U.S. Environmental Protection Agency (EPA). The EPA regulates asbestos through the National Emissions Standards for Hazardous Air Pollutants (NESHAP)

To comply with the Alternative Work Practice (AWP) for Using Close Tolerance Pipe Slurrification (CTPS) to Replace AC Pipe, the pertinent NESHAP and OSHA regulations that affect and govern the removal and replacement of AC pipe must be recognized, understood, and followed. While the EPA regulations are generally concerned with notification, air quality, and disposal requirements that effect the long-term impact of asbestos fibers on the public and the environment, OSHA regulations are generally related to the immediate and long-term safety of the employees working with and around asbestos containing material.

Applications

While it would be possible to use the CTPS method on deeper applications, the excavation where the drill stem enters the pipe would be elongated in relation to the depth of the pipe. This is due to the limited bending radius of the drill stem. Consequently, the economy and value of the method diminishes with depth. For this reason, the CTPS method would be most favorably applied to shallower pipes where long segments of pipe can be replaced in one pull such as in the rehabilitation of potable water mains and force mains. The technical envelope for the CTPS process is from 4- to 24-inch asbestos cement pipe, with the ability to upsize the new product pipe. Particular use cases within the technical envelope revolve around projects

whereby the removal/replacement of AC pipes is not cost effective, carries higher social and restoration costs, and instances where a faster project is preferred. Additionally, open cut projects that are using a new pipe route or alignment involving land or easement acquisition, additionally permitting, etc. are excellent fits for the CTPS method, since it utilizes the existing pipe alignment.

Industry Implications

Currently, the only EPA approved solutions for the replacement of existing AC pipe are dig-and-replace by open trench, or by CTPS. Alternatively, both bursting/breaking AC pipe render the existing pipe friable and do not comply with the requirements of the Asbestos NESHAP. Therefore, municipalities have long sought an EPA approved trenchless method to address the billions of feet of asbestos cement water mains and force mains that have systematically begun to fail. With an EPA Alternative Work Practice (AWP) and a cost advantage over open cut replacement, CTPS instantly becomes the most viable option in these AC pipe replacement projects.

Figure 5. The slurry mix is vacuum excavated from the access pit and hauled away for disposal

ABOUT THE AUTHOR:

***Andrew Costa** has worked in the trenchless water/wastewater industry since 2006. His experience includes positions in the contracting, manufacturing, and distribution sectors. His expertise in the water/wastewater markets includes cementitious/polymer manhole rehabilitation, specialty coatings, cured-in-place pipe (CIPP) rehabilitation, carbon fiber remediation, geopolymer solutions, and concrete corrosion. He is currently a Vice President of Sales for Insituform Technologies - the leading worldwide provider of CIPP and other technologies/services for the rehabilitation of pipeline systems. He is currently on the National NASTT Board of Directors and remains heavily involved with the Southeast NASTT chapter.*

Right the First Time

Core Values Lead to Purchase of GEONEX System

By: Richard Revolinsky, Geonex Inc, (GEO)

In November 2024, after successful completion of their first GEONEX™ project in Boise ID, Utah based contractor Claude H. Nix (C.H.Nix) took the next step in expanding their trenchless capabilities with the purchase of a complete GEONEX™ Horizontal Hammer Boring system (HHB), making them the western-most U.S. based contractor to do so.

C.H.Nix is not new to trenchless construction. For the past 50 years since Claude and Barbara Nix opened their doors in 1974, the company has built a reputation for reliability, professionalism, and a commitment to offering the right solutions for the project. Barbara and Claude believed in doing it right the first time, a core value that lives on today under the leadership of sibling team Stephanie Nix-Thomas and Jon Nix who purchased C.H.Nix in 2002.

C.H.Nix owns and operates a fleet of trenchless equipment for both new installations and rehabilitation that continues to evolve alongside the technological improvements of the trenchless industry. Whether using their GBM equipment, Auger Boring systems, steerable heads, or pipe-rammers, C.H.Nix is willing to invest in the right tools to get the job done right the first time.

Jon Nix recalls when pipe ramming, first came along. "We rented one for the first project and I thought wow, this can really help in some of the areas we get into. We bought one, learned how to use it well, then bought the second, then the third. Adding these tools to our tool box and getting-in on the ground floor allowed us to use the technology to our advantage, getting more work and completing it faster. Where other methods struggled, we were able to be successful. Now there's a lot of pipe ramming contractors out there, and we believe the same thing will happen with GEONEX™. There's just so much tough ground that the system is perfect for, instead of fighting it we'll be confident we can get through like we did in Boise."

> *"Invest in the right tools to get the job done right the first time."*

The Boise project Jon referred to was their first GEONEX™ installation, a 300-foot installation of 24-inch casing under parallel railway and roadway which would ultimately be used for electrical conductors for a new solar project. After previous and unsuccessful attempts by a different contractor, the electrical subcontractor contacted C.H. Nix and other trenchless contractors to investigate what they

Horizontal Hammer Boring offered an alternative solution to what was attempted previously

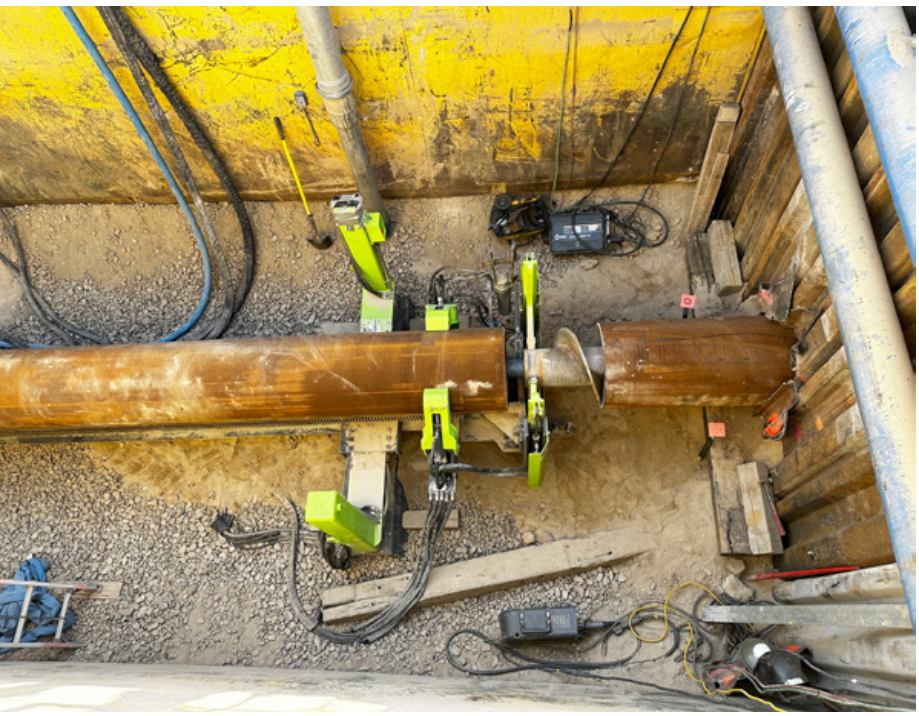
thought would be the best approach. Only C.H. Nix offered an alternative solution to what was attempted previously. "The ground was a hard, compact silty clay that was almost like rock, but if you add water it would quickly lose any form," explained Stephanie Nix-Thomas. "Because of the risk using water would add to possible failure of the railroad, or roadway we had to find a different solution. Pipe-ramming was prohibited and probably wouldn't make the 300-foot length. Auger boring had failed before so they didn't want to try it again, so we thought 'what about GEONEX™ ?'."

C.H.Nix reached out to Geonex who evaluated the potential for success and risk on the project and began preparing documents for C.H.Nix to present to their client. Within a few short weeks C.H.Nix got the green light to proceed.

"It's become a pretty common scenario for us," explained Tuomas Lassheikki, Vice President of GEONEX Inc. "We wind up doing a lot of projects after first attempts with other technologies fail. Projects run into problems with cobbles, hard rock, or something and we get the call asking if our equipment can get through it. We'll look at the installation and situation and discuss the pros and cons, then typically recommend they call one of our clients to do the work." In 2023 GEONEX clients accounted for 10 Units in North America, two years later there are 16. "Not every contractor has the ability to jump across the country to perform an installation when someone needs help, so in 2023 we started to offer a rental. This allows us to help in these situations and also showcase to the industry how HHB can be beneficial."

Horizontal Down-Hole Hammer Boring is a trenchless method for new installations

Pounding the way to success, the installation in Boise was completed to the satisfaction of the General Contractor, the project owner, and to the C.H.Nix team. Having become more familiar with



Project installed 300 feet of 24-inch casing for electrical conductors under parallel road and railway

C.H. Nix is looking at other projects to identify where horizontal hammer boring is best suited

Ground was hard compact silty clay almost like rock

> *We wind up doing a lot of projects after first attempts with other technologies fail.*
>
> *-Tuomas Lassheikki,*
> *Vice President, GEONEX Inc*

the GEONEX™ system and trusting in the feedback from their field crews, Jon and Stephanie started looking at some of their other projects and identifying where they felt horizontal hammer boring would be better suited. "We have work on the books that we think there's a greater opportunity for success by using the GEONEX system, and we've had jobs over the past few years that were just too risky that we passed on. It made a lot of sense to buy our own GEONEX system now," said Jon.

C.H.Nix received their GEONEX HZR610 Drill Machine capable of installations of steel casing up to 30-inch diameter in late February 2024.

ABOUT THE AUTHOR:

***Richard Revolinsky** is the North American Operations Manager for Geonex Inc. He is committed to furthering the Trenchless Construction industry with viable innovative solutions.*

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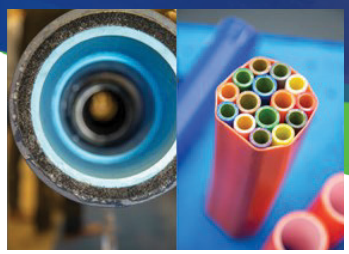

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