Western Regional Trenchless Review 2022

The 16th Annual Western Regional No-Dig Conference, Exhibition, and Training Course

November 7 - 8, 2022 ▪ Concord, California

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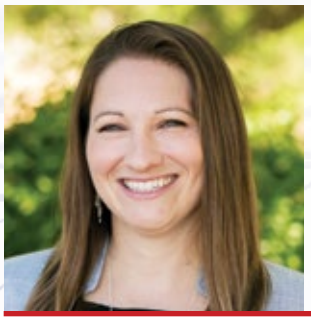

MESSAGE FROM THE WESTT CHAIR

Kate Wallin, Chair, WESTT

As many in our industry continue to transition to a post-pandemic work environment, the WESTT Chapter Board of Directors (BOD) has been working hard on key initiatives that will benefit our membership. We are very excited about returning to our in-person conference, exhibition, and course this November 7 and 8. The networking opportunities of a live event cannot be imitated in a virtual event and we hope to have a great turnout. WESTT is partnering with the Northern California Pipe Users Group (NorCal PUG) to host NASTT's New Installation Methods Good Practice course on the second day of the conference. This will be the first time that WESTT has presented the New Installations course and we look forward to bringing new content to our membership.

One initiative that WESTT has been pursuing over the past year is to strengthen our relationship with the student chapters in our region: Arizona State University and Cal Poly Pomona. Our goal is to increase trenchless educational opportunities for students and to work on generating interest in pursuing careers in the trenchless industry. We are also reaching out to additional universities within our region to see where WESTT could provide valuable knowledge that is often not provided in a collegiate setting and to get more young engineers excited about trenchless!

The WESTT board has embraced the lessons learned over the past few years of remote work and has begun hosting our chapter meetings virtually to encourage attendance from a larger percentage of our membership. Our next chapter meeting will be held in January. Attending the Chapter Meeting is a great way to get involved. We will discuss the activities of the various WESTT committees, plans for the upcoming 2023 No-Dig Show, student chapter news, and possible locations for the 2023 WESTT Conference. Please see our webpage for registration details in December.

WESTT is currently accepting nominations for new board members through November 11, so keep an eye out for an email with details. If you wish to get more involved in the organization, I encourage you to run. Even if you miss the nomination period there are other ways to get involved. The current board is filled with passionate individuals who work to advance the practice of Trenchless Technology through education, training, and research. I am truly honored to get to work with this very talented group of individuals. Interested parties should contact our Election Chair, Devin Nakayama, at devin@yogikwong.com.

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 continuing to pursue our ambitious plans for the future of the chapter. It has been an honor to work with so many invested individuals who share the goal of advancing the practice of trenchless technology through education, training, and research for public benefit. A special thank you to Michelle Beason as my Vice Chair; her work to re-establish our conference and get the gears moving again has been immensely helpful.

"Thank you for your continued support of WESTT."

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

Thank you for your continued support of WESTT.

Kate Wallin

Kate Wallin, Chair, WESTT
Bennett Trenchless Engineers, LLP

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MESSAGE FROM NASTT CHAIR

Alan Goodman, NASTT Chair

In Person Events are Back and Better than Ever!

Hello WESTT Chapter Members. It feels like we are embarking on a fresh start now that restrictions are lifting across North America. We are excited as we look forward to the future! We're riding high on the success of the NASTT 2022 No-Dig Show held earlier this year in Minneapolis. We hosted over 1,700 attendees and more sponsors than ever before. The trenchless industry is ready to be back to in person with networking and education leading the way.

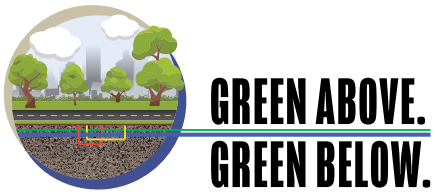
In the coming months we have many events planned to bring the underground infrastructure community together. This fall we hope you will join us in Toronto for the 2022 No-Dig North conference, October 17-19. No-Dig North is hosted by the Canadian Chapters of NASTT and offers two full days of training, education and networking. This is a must-attend event for trenchless training and networking in Canada. Visit www.nodignorth.ca for details!

We are excited for the WESTT Chapter be able to hold your 16th Annual Western Regional No-Dig this year! Your chapter has experienced significant longevity and plays a vital role in the strength of the trenchless industry in the region. I hope you will all be able to join us in Concord, CA, November 7-8 for two days of trenchless training, education, and networking opportunities. Visit www.westt.org for details!

> *"Riding high on the success of the NASTT 2022 No-Dig Show!"*

Be sure to mark your calendars and save the date for the NASTT 2023 No-Dig Show in Portland, OR, April 30 – May 4. The city of Portland is a perfect location for our industry to come together to celebrate and educate with the theme, ***Green Above, Green Below***. It is important that our industry is a steward of our precious natural resources, and we welcome the opportunity to provide a forum to learn about the latest in innovative trenchless products and services. Learn more at www.nastt.org/no-dig-show.

If you or your company has attended a NASTT Conference (National or Regional) you may leave that conference wondering how you could get more involved. I ask that you consider getting engaged in one of the many NASTT committees that focus on wide variety of topics. Everything from Publications Committee, Good Practice Course Committee, No Dig Planning Committee with many others for you to consider. With education as our goal and striving to provide valuable, accessible learning tools to our community, one of the things of which we are most proud at NASTT is that we have been able to grow. In keeping with our mission of education and training, we are offering our Good Practices Courses in a live, virtual format throughout the year. For the latest information on upcoming events, visit our website at: **www.nastt.org/training/events**.



For more information on our organization, committees, and member benefits, visit our website at www.nastt.org and please feel free to contact us at info@nastt.org.

We look forward to seeing you at a regional or national conference or training event soon!

Alan Goodman

NASTT Chair

WESTERN REGIONAL CHAPTER

ELECTED OFFICERS:

KATHRYN WALLIN – CHAIR
Bennett Trenchless Engineers

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Kate Wallin is a Senior Scientist with Bennett Trenchless Engineers, located in Folsom, CA. She has been involved with trenchless design since 2005 and has provided design and construction management services on projects using horizontal directional drilling, microtunneling, pipe ramming, guided boring, and earth pressure balance pipejacking. Kate has cultivated relationships with owners, engineers, permitting agencies, contractors, and manufacturers for new installations using trenchless technology to improve the standard of practice in the field. She is a coauthor on the 2017 revisions of the Horizontal Directional Drilling Good Practices Guidelines and Presentation as well as the 2018 Trenchless 101 – New Installations course and book. Kate was very honored to be the recipient of the 2011 Trent Ralston Young Trenchless Achievement Award.

MICHELLE BEASON, PE - VICE 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 30 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 for 5 years, and for the last 12 years has specialized in CCTV and 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 is a Board Member of NASSCO, and is Chair of the NASSCO Infrastructure Assessment Committee which manages all revisions to NASSCO's PACP/MACP/LACP coding.

MIKE JAEGER – SECRETARY
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 30 years of experience in public infrastructure project/construction management, as well as, over 10 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 30 miles of installed pipe. Ranging in size from 30 in. to 60 in. 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. Currently Mike is the Project Manager on the $206 M Progressive Design Build Tunnel Project for Silicon Valley Clean Water (SVCW) in Redwood City. Mike grew up in the bay area and later became a graduate of San Jose State University with a BS in Civil Engineering. Mike is a native of California and the SF Bay area growing up in San Jose and Campbell.

TIM TAYLOR – TREASURER
Carollo Engineers

ttaylor@carollo.com

Tim is currently the National Infrastructure Practice Director and a Senior Vice President with Carollo Engineers. He has been working on water and wastewater infrastructure projects for over 37 years. Tim has been heavily involved in the planning, design, construction and project management of projects for water distribution systems, wastewater gravity sewer collection systems, large and small pump stations, storage reservoirs, as well as incorporating trenchless construction techniques for projects across the nation. He has also worked on pipeline condition assessment and rehabilitation projects for many clients.
Tim is registered to practice Civil Engineering in multiple states and has been working for Carollo Engineers for over 27 years.

BOARD OF DIRECTORS & OFFICERS 2022-2023

ELECTED OFFICERS:

RACHEL MARTIN - TREASURER-IN-TRAINING
McMillen Jacobs Associates

martin@mcmjac.com

Rachel Martin has over 20 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.

BRIAN AVON – PAST CHAIR
Carollo Engineers

bavon@carollo.com

Brian Avon is an Associate Vice President and Trenchless Technology Practice Lead at Carollo Engineers, Inc. Brian earned his B.S. in Business Administration and Management from the University of Southern California and his B.S. in Civil Engineering from the University of the Pacific. He has more than 15 years of experience in the planning, design, and construction management of water and sanitary sewer pipelines, with extensive experience in the condition assessment of pipelines and design of CIPP, pipe bursting, horizontal directional drilling, auger bore, and microtunnel projects.

DIRECTORS AT-LARGE:

JENNIFER GLYNN
Woodard & Curran Inc.

jglynn@woodardcurran.com

Jennifer Glynn is a Senior Technical Practice Leader and Senior Principal for Woodard & Curran out of their Sacramento, California office. Jen has 26 years of experience in project management and pipeline planning, design, and construction with an expertise in Condition Assessment and Trenchless Pipeline Rehabilitation.
Jen has been authoring papers and presenting at conferences both domestically and internationally for the past 20 plus years. She is a past Executive Board Member for NASTT and is currently an NASTT training course instructor for two classes: Introduction to Trenchless Rehabilitation and Pipe Bursting Good Practices. She is also a member of the AWWA Water Main Rehabilitation and Water Main CIPP Standards Committees.

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,

BOARD OF DIRECTORS & OFFICERS 2022-2023

DIRECTORS AT-LARGE:

JACQUIE JAQUES – CONT'D

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.

SASHA MESTETSKY
Central Contra Costa Sanitary District

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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 25 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.

COMMITTEE CHAIRS:

WESTT Mini No-Dig Conference Committee:
Michelle Beason

WESTT Social Media Committee:
Greg Watanabe

WESTT Trenchless Review Magazine Committee:
Devin Nakayama

WESTT Board Elections Committee:
Devin Nakayama

Student Chapter Liaison Chair:
Jacquie Jaques

DEVIN NAKAYAMA
Yogi Kwong Engineers, LLC

devin@yogikwong.com

Devin has over 20 years of geotechnical engineering experience, and has served as a Geotechnical and Trenchless Engineer on projects requiring microtunneling, horizontal directional drilling, and guided bore methods, as well as deep foundations, rockfall investigation, and shoreline protection. He is a licensed Professional Civil Engineer in Hawaii, and obtained his Bachelor and Master's Degree in Civil Engineering from the University of Hawaii at Manoa. For the past 17 years, he has been at Yogi Kwong Engineers, a geotechnical engineering and construction management firm in Honolulu, Hawaii, where he worked his way from Project Engineer to Principal of the company.

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 20 years of engineering experience of which the last 10 years have been largely focused on trenchless technologies for both rehabilitation and new construction. During this time, he has planned, assessed, and designed over 100-miles of pipelines up to 96" for public utility systems. His project experience includes alternative construction and rehabilitation methods including horizontal auger boring, burst and insert, HDD, point repairs, CIPP, PCIPP, and microtunneling.

He currently manages the Linear Infrastructure business (which includes the Tunneling and Trenchless services sector) for GHD's US West region consisting of California, Arizona, Oregon, Washington, Hawaii, Guam, and Saipan. He is also GHD's managing Principal for the firm's NASTT No-Dig participation across North America. Mr. Watanabe manages a dedicated team of trenchless engineers throughout the US West who have been involved in over 100 trenchless construction projects installing over 250,000 feet of pipelines throughout North America.

KEYNOTE SPEAKER: Greg Norby

San Francisco Public Utilities Commission (SFPUC)

SFPUC Assistant General Manager of Wastewater Enterprise Greg Norby shares his thoughts on the history and mission of the organization and its relationship with the trenchless technology industry. Greg is delivering the Keynote Address during the 16th Annual Western Regional No-Dig Conference November 7 in Concord CA.

The San Francisco Public Utilities Commission is a public agency of the City and County of San Francisco that provides water, wastewater, and electric power services to the city and an additional 1.9 million customers within three San Francisco Bay Area counties.
Greg Norby is the Assistant General Manager of the Wastewater Enterprise. His professional background includes more than a decade in water and wastewater utility management and 14 years in the private sector, providing civil and water resources engineering solutions to utilities throughout California.
He served for five years at the Ross Valley Sanitary District, where he led a comprehensive modernization of the operations and maintenance systems and practices, capital program, infrastructure asset management systems, competency-based training and certification, and organizational structure refinement.
He also spent 14 years at CH2M HILL, where his duties included conveyance systems design, strategic planning, hydraulic modeling of wastewater and stormwater systems, integrated water resource planning, and project team management for local, state, and federal water clients.
Greg earned a BS in civil engineering from CSU Chico and a Master's degree in water resources engineering from Utah State University. His professional affiliations include WEF, CWEA, AWWA, CASA, ASCE, and ACWA.

What makes SFPUC's mission unique compared to those of other regions?

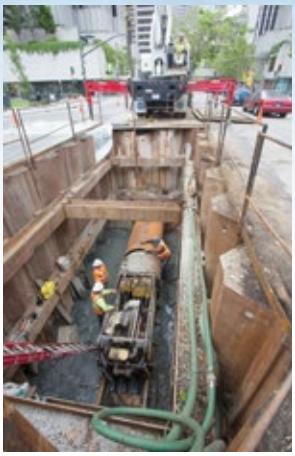
SFPUC is unique in several ways. First, San Francisco's service area is 49 square miles, just 7 miles by 7 miles, but has the second highest population density of any city in the US, behind only New York City. SFPUC operates one of only two major combined wastewater and stormwater systems in the western US, Seattle being the other. The same network of 1,000 miles of conveyance pipes under the city that carry dry weather sewage flows also has to handle extreme short term peaks in wet weather stormwater flows. The City's drinking water supply system is a marvel of engineering, stretching from Hetch Hetchy Reservoir high in the Sierra Nevada range, across California's central valley, under several local mountain ranges, and under San Francisco Bay to supply the City with some of the highest quality drinking water in the nation. Much of the City also has a unique separate firefighting water supply system, complete with gravity storage on the highest parts of the city, cisterns for local pumping, and a massive emergency backup sea water supply pumping station, all due to lessons learned from the destructive fire that followed the 1906 earthquake that leveled much of the city. The natural setting of the city includes challenges such as highly variable geology, from ancient sand dunes under the Sunset neighborhood and Golden Gate Park on the west side to late 1800s era landfill underlying much of the eastern city waterfront.

Trenchless technology is reducing the cost to rehabilitate and repair SFPUC wastewater, stormwater, and water lines

> *"The City's drinking water supply system is a marvel of engineering."*

What is the most underappreciated impact of SFPUC that the public may not be aware of?

The public may not be aware that prior to the construction of the modern combined sewer and stormwater system in the 1970s and 80s, the scenic and widely celebrated waterfront around


Trenchless applications reduce the disruptive impacts of the massive amounts of construction going on in the city's dense and busy corridors

the city was much more polluted, bereft of much aquatic life, and often unusable due to pollution. The City now captures and treats nearly 90 percent of all of the stormwater that falls within the city, compared to zero percent for nearly all other cities in California. In addition to drinking water and combined wastewater/stormwater utility service, SFPUC provides clean, renewable electricity to most of the City using hydropower, solar, wind, and new large scale battery storage facilities, with local distribution provided by PG&E.

What was your first experience with trenchless technologies?

As a newly-minted civil engineer lucky enough to land my first job with a dedicated conveyance design and construction group in the Redding office of CH2MHILL. We had one engineer who, back in the early 1990s, was our go-to person for the new technology of CIPP/Insituform, and she helped the other engineers understand the benefits and technical issues of CIPP. My first major trenchless project was in the late 1990s, leading design of an approximately 1,300-foot HDD installation of a 48-inch welded steel pipeline under the Pajaro River in Watsonville, along with several bore-jack crossings of major roads and railroad corridors.

How has trenchless technologies benefited SFPUC and their end users?

Trenchless technology is benefiting SFPUC and our customers in two simple but impactful ways. First, it is lowering the cost to rehabilitate and repair our wastewater, stormwater, and water lines. In this emerging era of affordability challenges for basic utility services, these savings make a huge difference by saving our customers $100Ms over the next decade. Second, it is lessening the disruptive impacts of the massive amounts of construction going on in the city, as we rehabilitate major trunk lines under dense and busy corridors ranging from the Mission to the Financial District and invest over $600M in new flood conveyance tunnels over the next 10 years.

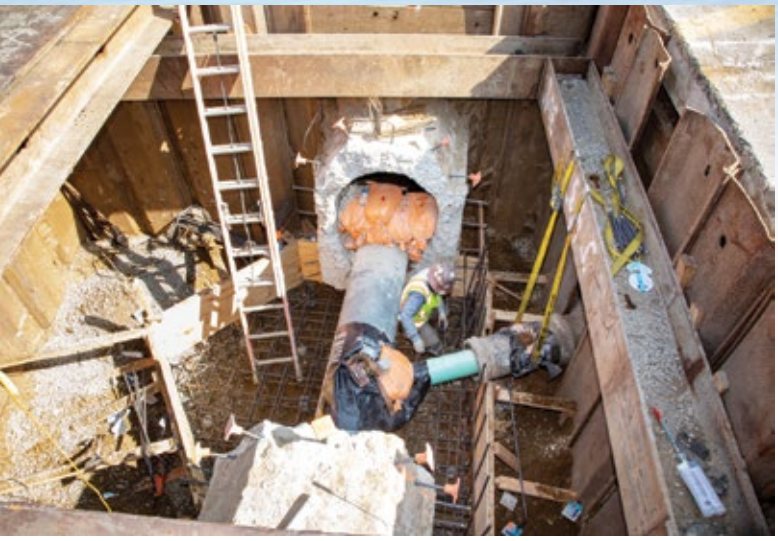
> *Trenchless technology is benefiting SFPUC and our customers.*

What trenchless projects are upcoming at SFPUC?

Major new projects coming along at SFPUC include replacing approximately 1 to 1.5 miles per year of old brick sewer trunk lines, typically 3 x 5 feet or larger; a transition over the next 5 years to complete about 10 miles of our 15 miles per year small diameter gravity sewer rehab/replacement work using trenchless construction; new addition of trenchless spot repair for small diameter gravity sewer (almost exclusively open cut now, on short term emergency basis) to include up to 700 trenchless spot repairs in pre-planned locations; two major tunnels for stormwater conveyance, ranging from 7 to 12 feet in diameter.

What trends are SFPUC seeing in trenchless technologies, and where would you like to see it go?

We see trends towards trenchless lateral replacement as a major new beneficial area for utilities, given SFPUC has over 150,000 sewer laterals and approximately as many water laterals; the use of AI algorithms to rapidly process miles of inspection videos (Sewer AI company as example) will reduce labor costs and processing of digital inspection data from field to risk assessment and prioritization of repair locations; greater use of autonomous inspection platforms that provide a steady flow of continuous condition assessment data; drone operation platforms with multiple sensors and without a wireless signal tether to navigate large underground assets; anything that lessens public impacts of the construction activity.



15 miles per year small diameter gravity sewer rehab/replacement work using trenchless construction

Major projects include replacing approximately 1 to 1.5 miles per year of old brick sewer trunk lines

What is the one lesson learned that you would share with those starting on their first trenchless project?

Don't make the mistake of thinking anything is cookie cutter. The industry has gathered lots of hard lessons learned, from design through construction and quality control specs. Make sure you get input from experts with wide range of recent practical experience.

What is the most important role that professional and trade organizations such as NASTT, WEF, AWWA serve to SFPUC?

These organizations keep us connected to industry trends, peer utility standards and best practices, and offer a wealth of valuable lessons learned we don't have to repeat at the expense of our rate payers. They also help represent our needs and priorities to state and federal agencies that may have major influence of funding, policy, and regulatory drivers.

What SFPUC program have been most influential on the advancement of STEM programs, and secondary and post-secondary education?

SFPUC's Project PULL has provided summer internships to underserved youth in San Francisco for many years. SFPUC sponsors local teachers for summer internships to learn about the utility industry and then share with their students. Lastly, SFPUC hires dozens of college graduates for 1 to 3 years under our fellowship program, which has been the source of many high quality long term hires.

What was the most impactful initiative from SFPUC in response to the COVID pandemic?

Moving our office-based staff to a hybrid work environment that provides a level of resiliency we could only imagine before Covid; long term wastewater epidemiology monitoring in cooperation with Stanford, Cal Berkeley, and with state/federal agencies to track and forecast Covid rates in the community ahead of individual testing trends.

> *"We see trends towards trenchless lateral replacement as a major new beneficial area for utilities."*

How has SFPUC addressed the most recent industry-wide supply-chain issues?

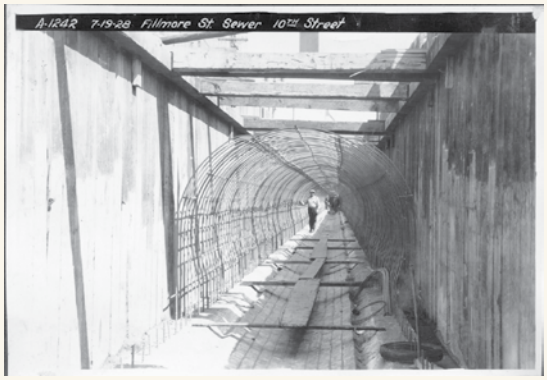
We have had major stresses to supply chain, and worked to streamline and consolidate our bulk purchasing for common goods like feedstock chemicals for water and wastewater treatment.

Has the ongoing "Great Resignation" impacted SFPUC? If so, what steps have SFPUC taken to train the future workforce as the industry experiences labor shortages?

Yes, SFPUC has seen a sharp jump in retirements and separations, with loss of much talent in the process. SFPUC has many established apprentice programs for our technical trades, and works with regional workforce teams such as BayWorks and JVC to help place interested hires onto entry level career paths.

Historic Combined Wastewater/Stormwater Trunk Construction

Lincoln Way Storm Relief 1945



Fillmore Street Sewer 1928

Alemany Storm Drain 1930

Park Merced Sewer 1942

What has been your most memorable experience so far since you joined Wastewater and Stormwater Enterprise at SFPUC in 2018?

Covid and all it has turned upside down, since that strangely quiet day on Monday March 16th, 2020 when I drove across an empty Golden Gate Bridge at 7 AM, to an empty city and an empty SFPUC headquarters. I sort of assumed nothing was ever going to be the same, kind of like those of us who remember the morning of 9/11...

What challenges do you foresee for SFPUC, and how will SFPUC adapt?

How to deliver $10B worth of capital program work over the next decade in the face of labor shortages, inflationary pressures, and affordability limits to rates for our customers. We will adapt by using the most efficient delivery methods, seeking maximum rate payer value in every major capital program decision, partnering with other city departments for efficient delivery of common projects, and seeking the lowest possible borrowing rate through WIFIA and SRF programs.

> *"Over $600M in new flood conveyance tunnels over the next 10 years."*

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

Concord, California

Monday – Tuesday, November 7th and 8th • Hilton Hotel - Concord, California

All of the benefits of a national conference program in a smaller forum with a personalized touch! Come to California and learn about the latest in trenchless technology from experts in the field. Registration for the conference includes an informative one-day technical program and product exhibition area.

Conference Information

What are WESTT and NASTT?

WESTT is a regional chapter of the North American Society for Trenchless Technology (www.nastt.org) which is affiliated with the International Society for Trenchless Technology (www.istt.com). WESTT is a non-profit organization established in 2004 and includes Arizona, California, Hawaii, Nevada, and New Mexico. The purpose of WESTT, NASTT, and ISTT is to promote education and development of Trenchless Technology for public benefit.

What is the Conference Format?

Registration for the first day of the conference includes an informative technical program of papers. Attendees will have several opportunities to interact with the many exhibitors during sponsored meals, breaks, and a reception that evening. On the second day of the conference, the 8-hour NASTT New Installations Good Practices Course will be offered. Attendees may participate in either or both days of the conference (see rates on registration form).

Course Description: New Installation Methods Good Practices

This course covers best practices for design and construction of projects using auger boring, pipe ramming, pipe jacking, and pilot-tube guided auger boring. The course provides the information needed to determine which methods are best to use in various ground conditions and project limitations. Discussion of each method includes length and diameter capabilities, guidance and steering accuracy, advantages and limitations, equipment options. Case studies are used to illustrate how design considerations were applied to actual projects.

Who should attend?

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. Government employees receive a special discounted registration rate for the conference and Good Practices Course.

Earn valuable Continuing Education Units (CEU's)!

Attendee Registration Discounts:

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

The Western Society for Trenchless Technology Presents

THE SIXTEENTH ANNUAL

Western Regional No-Dig Conference Exhibition and Course

Monday & Tuesday, November 7th - 8th, 2022 • Hilton Concord • Concord, CA

7:30	Sponsored Breakfast and Registration
8:30	*Welcome Address and Exhibitor/Sponsor Introductions,* by Michelle Beason, National Plant (2022 WESTT Conference Chair)
8:55	*NASTT Welcome,* by Jenna Hale, NASTT
9:10	*Keynote Address,* by Greg Norby, Assistant General Manager of Wastewater and Stormwater Enterprise, San Francisco Public Utilities Commission
9:35	*66-in. Trunk Sewer Rehabilitation Through Environmentally Sensitive Habitat in Napa Valley*, California, by Jennifer Glynn, Woodard & Curran
10:00	Refreshments in Exhibit Area
10:45	*Comparison of Observed and Predicted Settlements: City of Dubuque Bee Branch Parallel 101" Microtunnels under Canadian Pacific Railyard*, by Dave Bennett, Bennett Trenchless Engineers
11:10	Forum: *Navigating Impacts of Supply Chain Issues to Project Cost and Schedule*
12:00	Luncheon in Exhibit Area
1:30	*Restoring the Little Thompson River to Muggins Gulch in Colorado,* by Andrew Finney, Jacobs
1:55	*Beverly Hills 18-in and 24-in Transmission Main Slipline Rehabilitation,* by Brett Fornelli, Underground Solutions
2:20	*Trenchless through Miocene-age Bedrock in the Central California Coast Range*, by Dru Nielson McMillen Jacobs Engineering
2:55	Refreshments in Exhibit Area
3:40	*Thinking Outside the Box on VWD's Interceptor Phase II Triple Box Culvert Crossing*, by Sarah King, Kennedy/Jenks Consultants, Inc.
4:05	*Optimal Use of Pipe Bursting and Trenchless Methods for Replacing 9,000 ft of Water and Sewer Pipelines in the City of Eureka, California,* by George Mallakis, TT Technologies, Inc.
4:30	*Emergency in El Paso – Frontera Forcemain Replacement,* by Carl Pitzer, Thompson Pipe Group
5:00	Raffle/Reception in Exhibit Area

Northern California Pipe Users Group (PUG)

Sharing Technologies Together

Pipe Users Group (PUG) of Northern California is a non-profit organization founded in 1992 comprised of local agencies, municipalities, consulting engineers, product suppliers, and industry related professionals. PUG's mission is **"Sharing Technologies Together"** and is dedicated to providing its members with current technical information and training opportunities to stay up to date with industry news and technology.

31St Annual Sharing Technologies Seminar

On February 16, 2023, we are planning to bring everyone back together for an in-person event for our 31st Annual Sharing Technologies Seminar in Concord, CA. We are especially excited for this seminar as it will be the first in-person annual seminar since February 2020. The seminar is a great opportunity for us to share both our successful construction experiences and our lessons learned with others in the industry. We are currently accepting abstracts for presentations focused on new technologies, installation methods, project obstacles, challenges, and successes.

We Meet Again

PUG has recently transitioned back to in-person monthly meetings at Brown and Caldwell's Walnut Creek office after holding virtual meetings since April 2020. We look forward to seeing everyone at our upcoming in-person meetings and encourage you to visit the PUG website for future presentation topics.

Thank you!

Thank you to our members both past and present for continuing to support PUG's main goal which is to share information; the more participation we have, the more effective our group can be.

Join us for an Upcoming Meeting

- **November 10th:**
  Uni-Bell PVC Pipe Association on Best Practices for Specifying and Inspecting PVC pipe
- **December 8th:**
  Sewer AI will describe their NASSCO AutoCoding and Inspection Management Software

For more information, check out our website: **www.norcalpug.com**
Or drop us a line: **pugnorcal@gmail.com**

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NO-DIG SHOW 2023

GREEN ABOVE. GREEN BELOW.

THE NASTT 2023 NO-DIG SHOW MUNICIPAL & PUBLIC UTILITY

Scholarship Program

The NASTT No-Dig Show Municipal & Public Utility Scholarship Award has been established to **provide education and training** for North American municipalities, government agencies and utility owners who have limited or no travel funds due to restricted budgets.

Selected applicants will be awarded **complimentary full conference registration** to the NASTT 2023 No-Dig Show in Portland, Oregon, April 30 – May 4, 2023. One day conference registrations will also be available. Registration includes **full access to all exhibits and technical paper sessions**… all you have to do is get yourself to the conference! Selected applicants will also be eligible to receive **overnight accommodations**. Selection based on responses to the application as well as need.

APPLY TODAY! Application deadline is November 1, 2022.

NETWORKING EVENTS | EXHIBIT HALL | TECHNICAL SESSIONS

Visit **nodigshow.com** to learn more

The No-Dig Show 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.

Guided Bore with Thermal Grouting under Historic Railroad Tracks

By: Devin Nakayama, P.E., Yogi Kwong Engineers, LLC
Steven H. Sakai, P.E., Ronald N.S. Ho & Associates, Inc.
Deepak Parmar, Geotherm USA, LLC

Located within the former Barbers Point Naval Air Station in the Ewa District on the island of Oahu, the Kalaeloa Community Development District encompasses approximately 3,700 acres of land owned by various Federal, State, and County agencies and several private landowners. To support the continued development of the area, the Hawaii Community Development Authority secured State legislative funding for construction of underground electric and telecommunications infrastructure along Fort Barrette Road / Enterprise Avenue, and crossing under the historic railroad tracks within the Oahu Railroad and Land Company right-of-way (OR&L R/W) (Figure 1)

The OR&L R/W was originally under the jurisdiction of the Federal Highways Administration (FHWA). When ownership was conveyed to the Hawaii State Department of Transportation (HDOT), the conveyance document included provisions that required the project proponent to secure written approval for the proposed action from the FHWA and the State Office of Historic Preservation (SHPD). At the time of the project, HDOT was in the process of developing a Programmatic Agreement for FHWA's approval, which would have delineated the steps, approvals, and timelines required to secure construction permits for construction work within the OR&L R/W. An environmental assessment was also conducted, and permits were sought from HDOT for construction.

During the processing of these permits and the environmental assessment, comments received from HDOT and SHPD indicated that since the Programmatic Agreement was not in place, the project should propose construction methods that would minimally impact the existing rails, ties, and railroad bed.

Figure 1. Approximate project location

HISTORY OF THE RAILROAD

In 1888, King David Kalakaua granted a charter to Benjamin Dillingham for the right to purchase, lease, and develop lands to establish a railway. Dillingham, a sailor who arrived in Hawaii 23 years prior and subsequently became an influential businessman on Oahu, established the Oahu Railway and Land Company (OR&L) in 1889. In 1890, Dillingham developed the Ewa Sugar Plantation, and by 1895, his railroad track traversed the Ewa plain to the Waianae

coast. The railroad tracks served as an important conduit for the sugar cane transport from the numerous plantations to Honolulu Harbor, as well as carrying people, mail, and food. During World War II, OR&L carried munitions, supplies, troops, and defense workers 24 hours a day.

Passenger traffic was already decreasing prior to World War II, and automobile use and roadway improvement continued the decline of train use. In 1947, the last passenger train ran from Kahuku to the depot downtown, whereupon all operations outside of Honolulu ceased.

The railroad tracks crossing over the proposed alignment are part of what remains of Hawaii's railroad system. The remaining stretch of track from Ewa to Nanakuli is listed on the State of Hawaii Historic Preservation list and the National Register of Historic Sites. The nonprofit Hawaiian Railway Society restored about 6.5 miles of the remaining track, as well as vintage operational diesel locomotives. The Hawaiian Railway, the operating arm of the Hawaiian Railway Society, now operates the only active historical railway on Oahu, scheduling weekend train rides for the public from their museum in Ewa and along the restored portion of the train tracks.

CROSSING UNDER THE RAILROAD

The trenchless method would have to facilitate the installation of the new utility corridor consisting of six 5-inch conduits for electrical lines. In addition to the railroad tracks, the trenchless methods would also need to have minimal impact to overlying existing critical utilities including 36-inch and 42-inch sewer lines, fuel lines, drain culverts, and waterlines. The trenchless method would need to have minimal impact to the overlying historic and active railroad tracks, as well as the existing critical utilities. Because the roadway needed to be open during non-work hours, the trenchless method would have to allow for mobilization and demobilization off the road each day. Finally, consideration needed to be given to dissipation of heat generated from the electrical lines.

After discussion with the project design team, and with the trenchless subcontractor FV Coluccio Construction Company

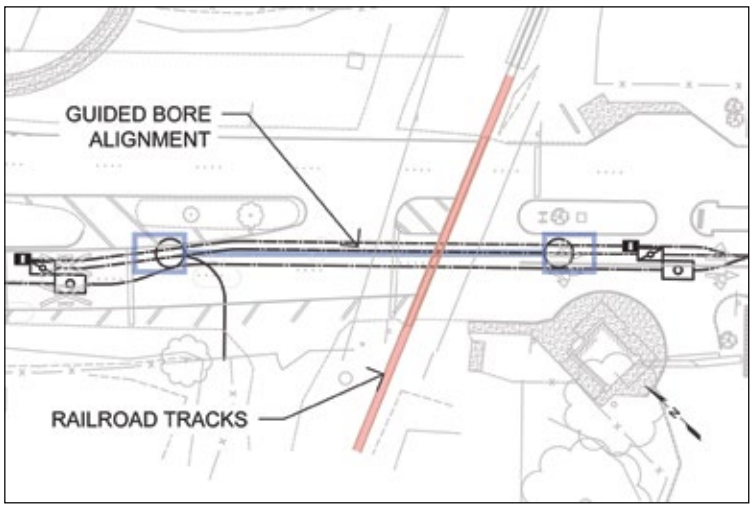

Figure 2. Guided bore alignment

> *"The thermal grout helps to dissipate the heat generated by the energized cables."*

(FVCCC), guided boring was selected as the installation method. The guided bore alignment was approximately 125 feet long (Figure 2), with jacking and receiving shafts about 22 feet deep to provide the profile enough clearance below the existing critical utilities and minimize potential surface settlement.

JACKING CASING PIPE

High voltage underground power cables are normally installed in HDPE or PVC conduits in reinforced concrete jackets that are directly buried in trenches. The guided bore methods would involve the installation of a jacking casing pipe with the conduits installed inside on casing spacers. Tremie pipes of various lengths would also be installed on the casing spacers to facilitate thorough annulus grouting. The casing with annulus grout would provide protection of the conduits in lieu of a reinforced concrete jacket (Figure 3).

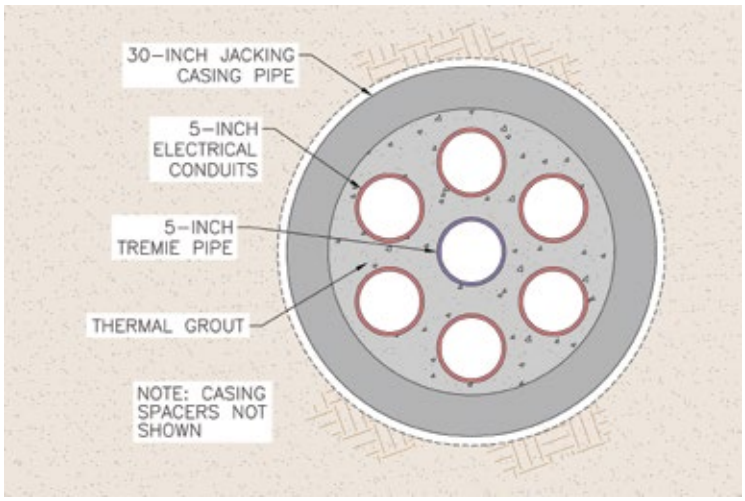

Figure 3. Conduit configuration inside jacking casing pipe

The casing must also provide a thermally stable environment for the cables and conduits, and the pipe material should have no adverse impact on the cable rating (di-electric component). Glass fiber reinforced (GFR) pipe specifically made for jacking applications was available in the size required for this project. To confirm its suitability, a sample section of the GFR pipe was tested by Geotherm to determine its thermal resistivity. Although its thermal resistivity was significantly higher than that of a steel pipe, the dielectric losses were negligible when compared to those of the steel casing, and GFR pipe was allowed as the jacking casing pipe.

Figure 4. Geotechnical drilling

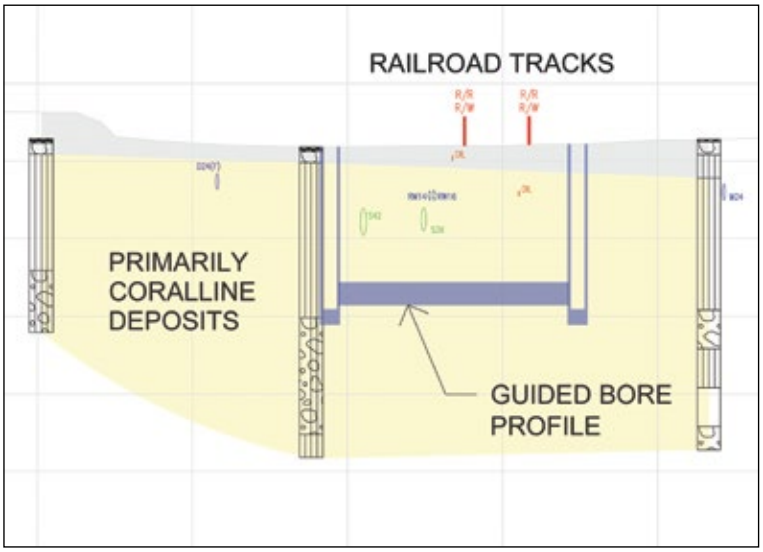

Figure 5. Geologic cross-section along guided bore profile

FIELD INVESTIGATION

Three geotechnical borings were drilled along the guided bore alignment (Figure 4), and relevant laboratory testing included gradation, specific gravity, hardness, and abrasivity. In-situ thermal resistivity and temperature measurements were also conducted by Geotherm at each boring location to avoid having to use assumed values for thermal design.

The project site is underlain primarily by sediments and sedimentary rock formation deposited in a marine and reef environment. The coral reefs were worked by waves, breaking up cemented coral chunks and reef limestones into gravel, cobbles, and boulder-sized fragments, some of which were further re-worked into coralline detritus and beach sand. In the fore-reef environment, waves winnowed and worked coralline debris/detritus, resulting in open-work, highly porous coralline deposits.

The marine-coral reef depositional environment is always highly complex, with intricate interfingering of coral reef limestone layers and masses with coralline detritus layers. As a result, the vertical and lateral variations of the thick masses, and extent of these deposits, are usually highly variable and in all directions. The degree of cementation within these deposits will also change with time, depending on changes in the environment.

The medium dense to dense coralline sands and gravels encountered along the guided bore alignment (Figure 5) were anticipated to exhibit running ground conditions. The running ground conditions could lead to local loss of ground or ground heave if spoil intake through the reaming head and auger casings were not properly monitored.

Mixed face conditions were also anticipated at cemented zones and where coralline cobbles and boulders are encountered within the sandy coralline deposits. The mixed face conditions could potentially deflect the pilot tube bit and reamers off-line-and-grade and could also cause a chimney effect or sinkhole occurrence due to excessive removal of the running sands while the pilot tube bit, reamers, and auger casings excavate hard obstructions.

The potentially complex ground conditions required experienced and skillful work crews with appropriate equipment and methods. Contract specifications included specialty work crew qualifications, settlement marker surveys during work, and submittal of guided bore work plans.

Figure 6. Material sampling and flow cone test

Figure 7. Jacking shaft set-up

THERMAL DESIGN

Thermal resistivity of the material surrounding the power cable conduits has significant impact on the rating (power transfer efficiency) of the cables. To create a low thermal resistivity environment for the cables, the air space in the annulus of the casing must be filled with a low thermal resistivity material. Air has a very high thermal resistivity of ~4000 °C-cm/W and extremely low heat capacity. Therefore, its heat transfer efficiency is extremely poor even when it circulates within the casing by natural convection. The thermal grout helps to dissipate the heat generated by the energized cables and keep them within the limiting temperatures under all operating conditions. A pumpable thermal slurry (grout) with low thermal resistivity of about 65°C-cm/W has been used successfully on several previous projects.

The thermal grout design takes into consideration the total length and the type of casing (concrete, HDPE, steel, fiber

Figure 8. Powered cutterhead with GFR casing pipe

Figure 9. Thermal resistivity testing

reinforced concrete, GFR), number and dimensions of cable conduits, type of conduit material, dimensions, number and opening in the spacers, number of grout pipes, limiting pumping pressures, and most importantly, the thermal and flow characteristic of the grout. Every component within the casing resists the flow of grout because of the wall friction. Although the spacers have openings to accommodate grout pipes and for ease of flow of grout, they are perpendicular to the direction of flow and therefore offers high resistance to flow.

Two types of thermal grouts are commonly used for such applications – bentonite-based and cement-based. For bentonite-based grouts, thorough dispersion and full hydration of bentonite is very critical. For cement-based grout that sets hard, the time and rate of hardening as well as the 'heat of hydration' should be taken into consideration. Importantly, lightweight and air-entrained cement-based grouts using high percentage of air should not be used since they exhibit very high thermal resistivity. In addition, 'gel-time' and segregation or settlement of components such as sand should be taken into consideration. Common ingredients of a typical cement-based thermal grouts are sand, fly ash, and cement. These components are mixed thoroughly with water to yield a low thermal resistivity and pumpable slurry. In cases where high flow characteristic is required, sand is replaced with silica flour (ground silica). For a very low thermal resistivity grout, select materials and/or additives may be required. There is no generic mix design of thermal grouts because each project requirements may differ significantly and so does the intrinsic thermal resistivity of the component materials available in the area.

For this project, the time of efflux of the grout was to be no higher than 30 seconds as measured by the flow cone method (ASTM C939). The thermal resistivity (IEEE Standard 442) was to be no higher than 70°C-cm/W in set hardened condition. The 28-day compressive strength was aimed at ~750-psi.

Preliminary mix designs were conducted by Geotherm using readily available concrete sand, cement, and fly ash; sourced from a local ready mix concrete supplier, Island Ready Mix (Figure 6).

Several trial mixes were conducted to optimize the thermal, mechanical, and flow characteristic of the grout. As a result of the relatively 'poor' thermal (intrinsic thermal resistivity) and mechanical (gradation) characteristic of the sands, the thermal and flow requirements for the project could not be met. The thermal resistivity was higher than what was specified, and the excessive settlement/segregation resulted in a non-pumpable slurry. A new set of trial mixes were conducted at the Geotherm laboratory using 'Dune Sand' imported from the island of Maui, and 'Silica Sand' imported from the mainland U.S.

Samples of the final mix design were prepared and re-tested at the Island Ready Mix batch plant to confirm they met the specs and for pre-approval of the grout design prior to its installation. These tests included the measurement of slurry density (by weight/volume method), flow characteristic – time of efflux, and the thermal resistivity. Thermal resistivity measurements were made in different stages – in slurry state as well as in hardened (set) condition and dry condition. Air content tests were not conducted since no admixtures were used in the design.

GUIDED BORE CONSTRUCTION

The open excavations for FVCCC's jacking and receiving shafts encountered coralline deposits and coral reef limestone below the existing pavement structure and were supported with a combination of trench shields and steel plates with internal bracing. Set-up of the Akkerman guided bore equipment followed shortly after (Figure 7).

Pilot tube drilling was accomplished using a 5-inch steering head and a theodolite camera and LED-illuminated target guidance system. Subsequent reaming was performed using 11-inch auger casings. Installation of the 24-inch GFR casing pipe was accomplished with a 24-inch powered cutterhead following the auger casing reaming (Figure 8). Guided bore spoils throughout the reaming and pipe installation stages consisted primarily of tan coralline sand and gravel, and jacking forces were within the allowable loads for the casing pipe and the jacking shaft thrust block and excavation supports.

Figure 10. Conduit setup inside casing pipe with bulkhead

ANNULUS GROUTING

Geotherm was requested to be at the site to observe the entire grouting process, assist if any modification of the grout formulation was required, and keep records of the volume of grout and the pumping pressures. Prior to delivery of the first truckload of the grout to the project site, tests were conducted again at the batch plant to confirm that the slurry density, time of efflux and thermal resistivity were well within the specs (Figure 9). Prior to pumping the grout, a few gallons of water were pumped through the grout pipe to clean, flush out any dirt, and to minimize the wall friction of the grout pipe.

The 'time of efflux' determined by the 'flow-cone method' used in the laboratory and in the field does not result in a 'direct relationship to the pumping pressure' for a specific installation. There are numerous variables such as the diameter, length, and number of the grout pipe(s), change in elevation, increase in backpressure, etc. that make it difficult to come up with a simple formula. At the start of the pumping (Figure 10), the pressure gauge registered pressure that was higher than the anticipated value, so about 5 gallons of water was added to the load in the truck to increase the fluidity. The change in the slurry density and the thermal resistivity from the added water were very small.

The pumping pressure remained steady and well within the operating limit for the rest of the operation. Field samples were collected for thermal resistivity measurements by Geotherm, and compressive strength by FVCCC's subcontracted testing laboratory. When grout was noticed to flow out of the standpipe connected at the other end of the casing, the pumping operation was stopped. The total volume of grout installed matched the net calculated volume, confirming a voids-free installation.

LESSONS LEARNED

The historic railroad tracks are a National Monument, and temporarily removing the tracks to open trench across was not an option. A trenchless solution was required, and guided bore methods provided the means to cross with minimal disturbance to the still-active tracks and existing critical utilities.

The selection of the jacking casing pipe and annulus grout typically requires collaboration across several disciplines, and for electrical conduit applications, it is critical that this collaboration include the electrical engineers and thermal consultants.

On a previous trenchless project involving electrical line installation, minor adjustments to the thermal grout had to be made onsite prior to the start of pumping grout. For this project, a few gallons of water were added to modify the flow characteristic in order to lower the pumping pressure for the given rate of pumping. This confirmed the importance of the client's field engineer and the grout designer to be present at the site to communicate with the supplier and installer in the event minor modifications need to be made on very short notice.

ABOUT THE AUTHORS:

YKE YOGI KWONG ENGINEERS

***Yogi Kwong Engineers, LLC**, established in 2005, is a nationally recognized, Hawaii-based geotechnical engineering firm offering a full spectrum of Geotechnical and Trenchless Engineering, Construction Management, and Drilling services in Hawaii and across the Pacific. Our firm employs a diverse team of seasoned geo-professionals with extensive experience, which is represented by our prestigious local and national awards.* **www.yogikwong.com**

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ELECTRICAL ENGINEERING

***Steven Sakai, P.E.**, is a Vice President with Ronald N.S. Ho & Associates, Inc. (RNSHA). Established in 1978 and based in Hawaii, RNSHA provides professional electrical engineering services throughout the State of Hawaii. RNSHA provides a wide range of services, including experience with Relocation of Electrical Utilities; Traffic Signal Systems; Electrical Infrastructure Systems; Power, Data and Telecommunications Distribution Systems; Water, Wastewater, and Sustainable Systems. www.rnsha.com*

Geotherm USA

***Geotherm USA, LLC** Geotherm Inc., started out 28 years ago in Canada offering test instruments and services for the measurement and analysis of thermal parameters using state of the art technology. The soil is of particular importance in view of the modern trend in utilizing the subsurface for many purposes. www.geothermusa.com*

COVID Put a Halt to a Lot of Things, but it Never Stopped the Sewer!

Big Challenge Overcome in Prescott AZ

By: Michael Rocco, AUI Inc.

Prescott's sewer system is just like many other small, mid-size or large cities throughout the US, its experiencing sewer backups, sewer breaks and sewer problems due to aging infrastructure. The city of Prescott originally began expanding the sewer system in the 1960s thru the 1980s. Most of the sewer pipes installed at this time were 6-inch vitrified clay pipe (VCP). In those days 6-inch VCP was acceptable as a typical manhole to manhole open cut installation according to the City of Prescott. Typically, on a 300 lf manhole-to-manhole run, up to 5 residents were tapped into the sewer main, however due to the growth and expansion of this popular high desert community the same sewer run, now has 12 to 14 sewer taps connected to the same run. As you can imagine 6-inch inside diameter pipe does not have the capacity for this type of sewer volume. The main problem with undersized pipes is sewer backup due to clogged lines from roots and broken pipe. An inspector told me he has even seen the sewer backed up due to a 2-liter bottle being stuffed in a pipe that must have got there thru a manhole. The City of Prescott has determined that Pipe Bursting to up size these existing 6-inch VCP lines with new 8-inch HDPE pipe is a proven trenchless technology for rehabilitation. Although the new inside diameter of the pipe will be increased by only 2 inches, the overall flow capacity increases approximately 50 percent.

In November of 2021, AUI was approached to rehabilitate 4,300 LF of existing old 6-inch VCP sewer lines and

8-Inch Bursting Head

Bursting Head with 8-Inch HDPE Pipe

MH Invert Rehabilitation after burst

> *"The City of Prescott has determined that Pipe Bursting...is a proven trenchless technology for rehabilitation."*

pipe burst to a new 8-inch HDPE DR 17 pipe. The project also consisted of reconnecting the existing 4-inch and 6-inch sewer service to the new HDPE pipe. A total of 58 residences and businesses were reconnected after the installation of the new pipe. The City of Prescott elected to use CES Procurement method to bid the job. The project also included the removal and replacement of existing asphalt, manhole invert rehabilitation and new manhole ring and covers. Although we were working in Arizona, the winters in Prescott were pretty cold, the elevation is over 5,000 lf and snow fell in December, January and February. The only thing you have to be careful about is pipe fusion in cold weather and replacement of asphalt.

Pipe bursting is a proven trenchless process that breaks the existing 6-inch VCP and forces the broken pieces into the surrounding soil while simultaneously pulling in the new 8-inch HDPE. The HDPE pipe is pulled with a constant tension winch before the pipe bursting process begins. The existing sewer line must be cleaned and televised for inspection. The City of Prescott maintenance crews cleaned and televised for this projects approximately 2 to 4 weeks before the bursting process was to take place. The reason this is so important is the video camera locates exactly where the sewer services are connected to the main sewer service line. Once the distance of the sewer service was marked on the surface, AUI excavated a 4x4-foot pit to expose the

> *The main problem with undersized pipes is sewer backup due to clogged lines from roots and broken pipe.*

Bursting old VCP with new HDPE

Insertion Pit for 8-Inch HDPE pipe

sewer services. This sewer service was temporarily connected before the pipe bursting process and then permanently reconnected after the pipe bursting process. One of the advantages of the pipe bursting technology is residents do not have to have their services interrupted and normal sewer usage is unchanged.

AUI did notice on this project that with a lot of people working from home that the individual service varied drastically. It is common to get peak flows in residential neighborhoods from 6AM to 8AM and then from 5PM – 8PM. However, with a lot of people home during COVID the flows were more consistent throughout the day.

The job site locations for pipe bursting in Prescott were in 12 different areas throughout the city, mostly in residentials or commercial areas. One of the job site locations was in North Prescott where the existing line was 10-inch PVC and the city wanted to upsize this to a 12-inch HDPE. AUI accomplished the bursting expansion of the existing pipe by installing cutting fins welded to the pipe bursting head. The sewer was approximately 12 feet deep and upsizing to 12 inches did not cause any surface heaving. All of the segments were successfully replaced with the Pipe Bursting method and the city of Prescott intends to release a yearly contract for this trenchless technology.

LESSONS LEARNED

AUI learned that when reconnecting 4-inch services to the new 8-inch pipe the grade of the existing tie in would change. What we found was when a 4-inch service connected to the existing 6-inch sewer line at the 3 o'clock or 9 o'clock position is where the challenge begins. When the 6-inch line is upsized to 8 inches the invert of the incoming 4-inch service line is now at the invert of the new 8-inch line. The solution to this problem was to expose approximately 20 feet of the old 4-inch sewer line and adjust the slope accordingly.

Pipe Fusion of 8-Inch HDPE

Typical Winch Set Up

Winch in Woods

PROJECT SUMMARY:

-6-inch VCP Pipe Burst to New 8-inch HDPE -	3,402 LF
-8-inch PVC Pipe Burst to New 10-inch HDPE -	959 LF
-Sewer Service Reconnections -	52 EA

SPECIAL THANKS TO THE FOLLOWING WHO MADE THIS TRENCHLESS PROJECT A SUCCESS!

AUI Project Manager: Andre Houle PE

AUI Project Superintendent: Archie Lucero Sr

AUI Foreman: Chris Benavidez

ABOUT THE AUTHOR:

Michael Rocco has been employed with AUI, Inc., for over 30 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 30 years' experience with various trenchless applications, and was a long-serving Director on the WESTT Chapter Board.

Rebuilding of Paradise Counts on HDPE Pipe

California Town Conquering Massive Conflagration

By: Camille George Rubeiz, P.E., F. ASCE, Plastics Pipe Institute, Inc. (PPI)

The rebuilding of the Town of Paradise that was destroyed by the Camp Fire focused on the rapid replacement of water service lines. "When we're done, there will be about 315,000 feet of new HDPE service lines," stated Kevin Phillips, Town Manager for the Town of Paradise.

Prior to the 2018 fire, the town had a population of 26,000. During 17 days starting on November 8, 2018, the fire destroyed some 150,000 acres and nearly 19,000 homes and buildings.

The Paradise Irrigation Department is replacing all water service lines using high-density polyethylene (HDPE) PE 4710 pipe in diameters of one to two inches. The pipe, PolyFlex™ CTS potable water service tubing from Advanced Drainage Systems, Inc. (ADS) (NYSE: WMS), is resistant to rot and corrosion, can be easily installed and is consistent with industry specifications for potable water.

"This SDR 9 PolyFlex tubing from ADS is produced in accordance with AWWA Standard

C901, and meets NSF 14 and 61 standards," explained Camille George Rubeiz, P.E., F. ASCE, co-chair, HDPE Municipal Advisory Board and senior director of engineering, Municipal and Industrial Division of the Plastics Pipe Institute, Inc. (PPI). "This means that the pipe is certified for potable water systems because it meets or exceeds the requirements for health effects in drinking water components, and also the performance criteria of plastic piping components as stipulated by NSF. PE 4710 compounds offer an excellent level of performance for trenchless and open cut installations. The PE 4710 HDPE pipe can be used with increased flow capacities plus increased resistance to surge events and fatigue. The ANSI/AWWA C906-15 standard includes PE 4710 for sizes up to 65 inches and recognizes the increased durability and reliability of HDPE pressure pipe used in water systems."

After the fire, accusations were made that sections of burnt plastic pipe found above ground created benzene, which found its way into the Paradise water system. The Plastics Pipe Institute, the major North American trade association, investigated.

"These claims are patently false," stated David Fink, PPI president. "There has been no evidence that plastic pipes are responsible for the production of benzene or any other contaminant due to the heating of the pipes during the Camp Fire. It's clear that the contamination was from the millions of tons of the fire-ravaged environment that got sucked into water system."

According to Phillips, "What the district saw was that the contamination from the fire was not associated with any particular pipe material and that even the galvanized and copper pipes that were in the ground saw the same amount of contamination as the polyethylene. There was a similar percentage of contaminated service laterals with those other materials as there was with polyethylene. So, we decided to continue to use polyethylene because of the ease of use and the cost being the best on the market. We felt it would be the best choice for the rebuilding of Paradise.

"This town was built during many, many decades. When they first started building it, the pipes in the ground were actually lead. During the boom in the 1950s, most of the pipes that went into the ground

Kevin Phillips, Town Manager, Town of Paradise, "It is clear that the contamination was from the burned-out environment that got sucked into pipes. Pipes of all materials were found to be contaminated."

The Paradise Irrigation District will eventually replace 315,000 feet of water service lines using high-density polyethylene (HDPE) tubing

> *"There has been no evidence that plastic pipes are responsible for the production of benzene or any other contaminant."*
>
> *- David Fink, President, PPI*

Displaced and new residents are part of the rebuilding of Paradise

were galvanized steel. There were issues with corrosion so the district moved to copper pipe which, at that time, was the industry standard. Again, there were flexibility and corrosion issues especially with the acidic soil conditions. And so, the district finally moved to polyethylene because of the durability and made that our standard. We felt it would be in the ground for many, many years. Even after the fires, we found the buried polyethylene was undamaged from direct contact with heat. The issue we found was contamination in the majority of service laterals which served burned structures,

regardless of material type so, we needed to replace those service lines. It (the HDPE pipe) also gave us the ability to come back and upsize those service lines to support the rebuild and meet with customers' requirements for their meters and fire service. PE seems to be the best product to meet those needs. Seismically, it's flexible and can handle the movement up here. It's easy to pull in trenchless which makes it beneficial for the rebuild process.

"We felt the best form of protection for our service laterals was not the material itself but just putting in backflow protection to reduce the chance of contamination entering the system during a depressurization event. Again, we believe the occurrence of contamination wasn't associated with the material of the piping, it was associated with the depressurization, contamination being drawn into the system and how long the system was disconnected to allow that contamination to adsorb into the pipe walls."

Phillips estimates that the new Town of Paradise will take nearly 20 years to be back to where it was prior to the Camp Fire.

"It takes a long time to build homes," he said. "We have had a huge surge of building permits issued in the Town of Paradise. There is a ton of pressure on getting new water service to those new rebuilds. And with polyethylene, it has created efficiencies so that we can get out there and get a service line in within an hour or two of that request. Once we get there and onsite it's very easy to get in that water line because of the use of polyethylene.

"By use of the polyethylene and the ability for us to get it in without a lot of problems and be able to get it in the street and work around issues that might be there, such as rocks and other services that are coming underground. It makes the rebuild process and getting the water service back a lot easier than it would be if we had to bore through with a steel or copper (pipe). PE is our standard moving forward and throughout the rebuild process."

Additionally, large diameter N-12® corrugated HDPE pipe from ADS is being used on several stormwater drainage projects in Paradise. These include the Paradise tennis courts and the Paradise softball field.

As a service to the industry, the PPI recently published its analysis of benzene contamination found at the site of the 2018 Camp Fire catastrophe in and around Paradise. The 13-page report, PPI Document TR-51 *"Investigation of Benzene in Drinking Water Following the "Camp Fire" in Paradise, CA"*, is available free at the PPI website -- https://plasticpipe.org/pdf/ppi-tr-51-2020.pdf

ABOUT THE AUTHOR:

PPI Plastics Pipe Institute The Voice of an Industry.

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.*

Pipeline Replacement at Depth

By: David Gill, Logan Clay Products LLC

The City of Santa Rosa, CA needed to replace an 1,800 foot section of their North Trunk Sewer Main in a heavily traveled area of the city near the courts, administrative offices, and the environmentally sensitive Paulin Creek Reserve. Emergency access to the area needed to be maintained at all times. A dramatic topography meant that some of the homes were 40 feet below the road surface.

A complete study of possible alignments at various depths, the use of lift stations and the geotechnical conditions was conducted. While the use of a lift station was explored, the risk of a failure in this area and the ongoing maintenance costs were undesirable. In the project areas that required installation at greater depths, trenchless installation with a small footprint and reliable on-target drives was effectively the best solution. The Pilot Tube Method (PTM) of guided boring does all those things well.

Alex Culick, the Project Manager from GHD described the solutions recommended: "We investigated a number of options for the specific challenges faced on this project. There was a section of the project where open-cut installation was the right solution. But in the areas that required installation at depth, given the geotechnical conditions, grades as flat as .0015, and a narrow available workspace, we identified the Pilot Tube Method as the appropriate trenchless installation. We used this combination approach to give the City the best value."

Using the PTM would mean they could avoid using a lift station and prevent its associated ongoing costs by installing the new line 45 feet below the road surface. To avoid even more extreme depths, the slope was kept to a minimum. The area with a slope of only .0015 meant maintaining the flow rate needed would require upsizing some of the existing lines.

NO-DIG Pipe in one-meter lengths is specifically designed to enable smaller shafts in tight construction zones

"Even with the minimal footprint of a PTM project, maintaining traffic flow and emergency access to all of the residences was a challenge," according to Steven Gallyer of Pacific Boring, the trenchless contractor on this project.

Remote-controlled traffic signals were placed at each residential driveway to

> *Some of the homes were 40 feet below the road surface.*

facilitate traffic management in case of an emergency. The crew from Pacific Boring worked an overnight shift to minimize disruptions in an especially challenging area.

A total of six shafts were constructed at an average depth of 30 feet with the deepest being 45 feet. The jacking shafts were 12 feet in diameter and the reception shafts were 8 feet in diameter. They were designed to allow for the installation of 1-meter lengths of 8-, 15-, or 18-inch NO-DIG vitrified clay jacking pipe (VCP-J). The 1-meter pipe length is preferred for especially tight working conditions.

The Akkerman Guided Boring Machine (GBM) 4800 system used for this project includes a digital theodolite with an integrated camera mounted independent of the jacking frame, a battery-powered LED illuminated target housed in the slant-faced steering head and a computer monitor screen. This guidance system gave the operator a "real-time" view of the location and steering head orientation of the pilot tubes. This "real-time" view, together with the ability to continuously make adjustments during the entire pilot tube drive, results in pinpoint accuracy. In a

Shaft diameters of 12 feet or less and depths of up to 40 feet made this installation possible

A mature area of the central city made limiting the size of the job site footprint critical

> *Emergency access to the area needed to be maintained at all times.*

three-step installation process, driving the pilot tube to the next shaft is step one.

In the second step, a reaming head matching the Outside Diameter (O.D.) of the carrier pipe is fastened to the last pilot tube. Thrust (auger) casings advance the pilot tubes and reaming head. The spoils (displaced ground around the pilot tubes) are transported by the auger to the jacking shaft for removal. During this process, the pilot tubes and reaming head are advanced to the reception shaft for disassembly and removal.

Step three is installation of the pipe. Taking advantage of the average compressive strength of VCP-J (18,000 psi) means that no casing is needed in the final installation. The pipe itself can resist the high jacking forces generated as the pipe is thrust through the ground replacing the temporary casings and augers, and eliminating the need for an external casing pipe.

This project also included a new alignment for the water distribution lines. Once the PTM process was complete, the water lines were installed, all equipment was removed, and the shafts were converted to manholes. After the new line was placed in service, the pre-existing lines were filled with Cell-Crete® and abandoned in place in accordance with the City's standards. Filling the lines and abandoning them in place also helped to preserve the environmentally sensitive area.

"An active community outreach program by the City, keeping the area residents and commuters informed as to progress, the expected timeline, and results were unique and helped to keep everyone engaged," said Culick. "When the job was completed, the City held a ribbon-cutting event to commemorate the new sewer and improvements. The City Manager, a representative from the Board of Public Utilities, and community members were all in attendance, at this unusual celebration of a project completion. In addition, when they went out of their way to say thank you to me and the contractor, it was unique."

ABOUT THE AUTHOR:

***David Gill** has more than 30 years of experience in the sewer pipe industry. He has been involved with countless open-cut, pilot tube, and pipe bursting projects. David speaks annually at the Colorado Tunneling Short Course and regularly presents educational information to municipalities and consulting firms.*

NO MAN'S LAND: CROSSING THE SAVANNAH RIVER

By: Tyler Price, Underground Magnetics

UMagHDD.com

With a few techniques borrowed from oil diggers, Martin Cherrington may very well be the first contractor to bore under a river, and he did so without any electronic guidance. Cherrington and his crew did the unthinkable when they crossed the Pajaro River, drilling approximately 500 ft in one month. Jobs such as this paved the way for generations of HDD contractors to come.

Fortunately, boring under a river is no longer considered "no man's land" and the introduction of electronic guidance systems like HDD locators as well as advancements in drilling equipment have made jobs like this more practical and efficient.

In July of this year, Sirman's Underground, out of Homerville, Georgia, was contracted to bore approximately 1800 ft across the Savannah River. Due to the reconstruction of the Houlihan Bridge in Port Wentworth, a new fiber line was required and going under the river was the best option. Faron, of Sirmans Underground, chose to use a combination of the Ditch Witch JT40 and the Underground Magnetics Mag 9 locating system paired with the Echo 90 transmitter to tackle the project. With that, they were able to locate to depths of 65 ft, while also using the Underground Magnetics' "drill-to" function to track and guide the drill head from the receiver 90 ft out in front of the head.

Coupled with the expertise of the Sirmans crew, the Mag 9 locating system played a pivotal role in ensuring the accuracy and completion of this project. It enabled them to not only locate, but also adjust as needed to ensure a straight and efficient bore path. Trusting the capabilities of your equipment is one of the key components when considering taking on a project like this. While accuracy is a requirement, efficiency is what enables your business and the horizontal directional drilling industry as a whole, to grow.

With today's advancements, Sirmans drilled approximately 1800 ft and located to depths of 65 ft. The Savannah River crossing took roughly one week to drill and pull back a 2" steel pipe. We appreciate the opportunity to provide hard-working contractors like Sirmans Underground with state-of-the-art equipment and congratulate their crew on a job well done!

Tyler Price is the marketing director at Underground Magnetics Inc.

Job Details
Total length of bore: 1800 feet (1500 ft of water)
Product pulled back: 2" steel

Deepest depth: 60ft
Furthest distance out in front of drill to: 90ft
Drill: JT40

Locator: Mag 9
Transmitter: Echo 90
Company: Sirmans Underground
Contact: Faron Sirmans

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San Diego County Water Authority Evaluates Trenchless Technology Options for Relocation and Long-Term Resiliency of the Second Aqueduct Pipelines Crossing at an Environmentally Sensitive Creek

By: Mahmood Khwaja, PE, CDM Smith
Anjuli Corcovelos, San Diego County Water Authority
William Brick, PE, PMP, BCEE, CDM Smith

The Second Aqueduct is part of the San Diego County Water Authority's (Water Authority) conveyance system that delivers water to twenty-four member agencies in San Diego County. The Second Aqueduct pipelines consist of Pipeline No. 3 (a 72-in steel welded pipe), Pipeline No. 4 (a 90-in precast concrete pipe), and Pipeline No. 5 (a 96-in precast concrete pipe). The three pipelines are aligned within a right-of-way (ROW) that extends from just south of Riverside County in the north, to Lower Otay Reservoir in the south. Along the alignment, the Second Aqueduct pipelines remain buried while traversing through canyons and crossing below several creeks. A substantial portion of the pipelines are constructed using pre-stressed concrete cylinder pipe (PCCP). See Figure 1 for an aerial view of the study area.

Figure 1 – Project Study Area

In the unincorporated community of Bonsall, the pipelines traverse steep terrain on each side of a canyon. Over the last several years, the pipelines have begun exhibiting vulnerabilities including steel pipe pitting and bend yielding in the steel segments, as well as longitudinal and circumferential cracking and joint separation in the PCCP pipes. In addition, over the decades since the pipelines were installed, high intensity storms and increased urbanization of the watershed have caused erosion of the soil cover and scouring of the streambed to expose sections of the pipelines. To provide interim protections, the separated joint was repaired, creek stabilization was installed to protect against moderate flows, and carbon fiber reinforced polymer repairs were installed at the bends in Pipeline 4 and Pipeline 5; however, this is a temporary solution.

CURRENT VULNERABILITY

A condition assessment was conducted in 2019 to determine the probable causes of the damage and distress. The soil erosion and scouring has led to an overstressing of the pipelines where the surrounding soil is not fully supporting the pipelines, particularly at the joints with high angle bends. The pipe overstressing is further exacerbated when the local alluvial soil is saturated and displaced. In the event of an earthquake, the alluvial soil has the potential to liquify, which would result in the structural support of the pipeline invert being compromised for long lengths. This would greatly increase the risk of significant damage to, or a rupturing of,

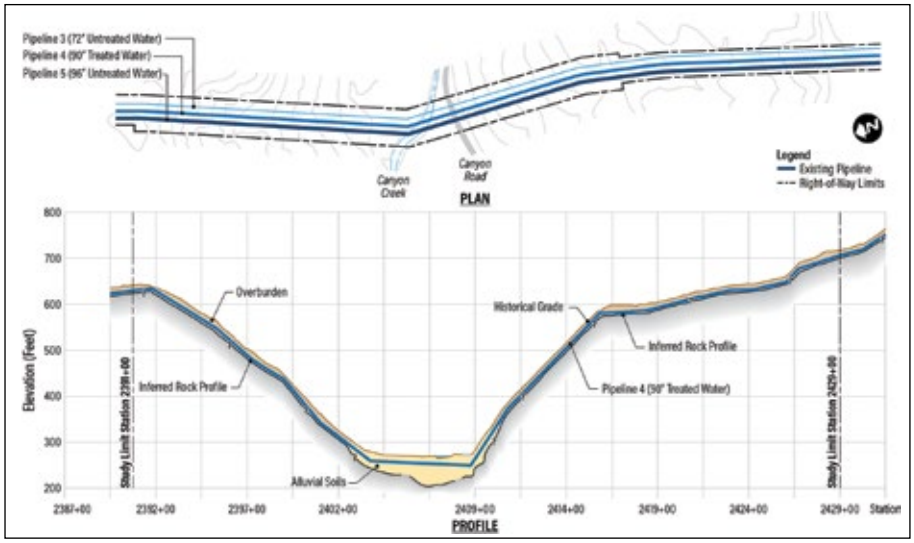


Figure 2 – Representative Plan and Profile of Pipelines Nos. 3, 4, and 5 within the Study Area

the pipe. Figure 2 shows a schematic representation of the pipeline plan and profiles.

The Second Aqueduct pipelines are critical to regional water supply, as a failure of any one of the three pipelines would be a major disruption to the Water Authority's twenty-four member agencies. Previous and current studies have shown that the pipelines are highly vulnerable due to the continued scouring of the streambed crossing, the liquefaction and lateral spread due to seismic events, and the potential instability of the canyon slopes. Figure 3 shows a view of the Canyon bottom from the slope, and Figure 4 shows a view of the Canyon slope from the bottom.

SCREENING OF ALTERNATIVES

The Water Authority engaged CDM Smith to undertake a planning level study to evaluate various alternatives to rehabilitate, replace, relocate and/or upgrade the Second Aqueduct pipelines. An alternatives screening evaluation process was conducted by CDM Smith and the Water Authority to determine the best long-term solution to mitigate these vulnerabilities over a planning horizon of 75 years or greater. The evaluation began with a coarse screening approach that distilled several preliminary repair and replacement alternatives down to three preferred alternatives that were advanced to the fine screening stage. See Figure 5 for a schematic of this high-level screening approach.

The three highest ranking options included:

Alternative No. 1 – Reline Existing Pipelines in Canyon Bottom

This alternative includes performing internal or external spot repairs to the steel Pipeline No. 3 in selected locations along the canyon bottom to address the areas of advanced degradation. This alternative also includes relining (steel slip-lining) the PCCP Pipelines Nos. 4 and 5 with steel cylinders, grouted on the outside and cement mortar lined on the inside, to provide a robust system capable of withstanding significant ground movement. This alternative also includes improved streambed stabilization, deep foundations to the bedrock to support the pipelines, and anchors at the horizontal bends to mitigate seismic and scour risks. See Figure 6 for the existing streambed stabilization.

Alternative No. 2 – Replace Using Open Cut Construction in Canyon Bottom

Within the canyon bottom, the pipelines would be replaced with new piping, using open-cut construction, that is designed to mitigate seismic and liquefaction risks. The new pipelines would be either thicker-walled steel piping or specialized seismic-resilient piping, depending on future analyses. The new pipelines would be constructed using deep open-cut excavation at elevations below the 500-year scour depth of the creek. The pipelines at the bottom of the

Figure 3 – Canyon Bottom View

Figure 4 – Canyon Slope View

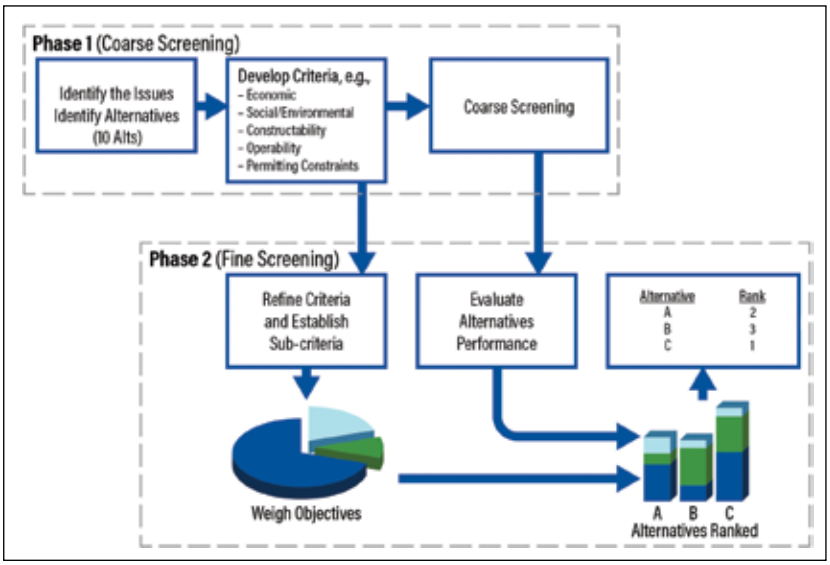


Figure 5 – Schematic Representation of the Screening Process

canyon would be constructed adjacent to the existing pipe alignments while the existing water supply operations are maintained. The new piping would be supported on deep foundations or have special seismic steel pipes (SSSPs) designed for seismic resiliency. This alternative also includes improved streambed stabilization and anchors at the horizontal bends.

Alternative No. 3 – Replace with Tunnels in Canyon Bottom

Within the canyon bottom, this alternative includes excavating, on each side of the canyon bottom, shafts to below the 500-year scour depth and constructing a tunnel between the shafts, using either conventional or mechanized tunneling methods. The depth of the tunnel would be just above the bedrock depth to mitigate liquefaction issues. Each pipeline would be evaluated for seismic and other slope stability concerns on the canyon slopes and pipe stabilization measures would be used on the existing pipelines if necessary. Groundwater control measures for shaft and tunnel construction would be needed. For the shafts, lowering the groundwater table, or using an impermeable excavation support system with a grout plug at the bottom of the shaft, may be viable. The use of microtunneling would help mitigate the construction risk associated with groundwater control and stabilize the weak ground below the groundwater table. In this alternative, construction would remain outside of the creek channel, therefore, no streambed stabilization or restoration would be needed and the existing armoring would remain as-is, with continued monitoring in the future.

FINE SCREENING ACTIVITIES

The three alternatives were further analyzed and ranked using the following criteria:

Reliability/Resiliency

Comparatively, Alternatives Nos. 2 and 3 were evaluated to be more resilient than Alternative No. 1 with respect to seismic risks, stream erosion concerns, and unbalanced thrusts forces within the canyon bottom. Further refinement of the evaluation ranked Alternative No. 3 as the most preferred with respect to resiliency and reliability.

Operations and Maintenance

Alternative No. 1 is an in-place rehabilitation at a depth below the creek, which would continue to be threatened by scouring. This alternative would require periodic, and potentially extensive, monitoring and repairs of the improved stream stabilization system, which would increase the overall maintenance and operational costs, without improving the reliability of the pipelines. Alternatives Nos. 2 and 3 reconstruct the pipelines within the canyon bottom, which provides an opportunity to fully redesign the pipelines through the canyon bottom to optimize operational needs.

Social, Environmental and Permitting Impacts

All alternatives require that some form of armored channel protection remain following the completion of all construction, however, only Alternative No. 3 allows the existing channel armoring to remain as-is both through and after construction. The environmental impacts, mitigations and permitting requirements for implementation are anticipated to be the least for Alternative No. 3.

Alternative No. 2 is expected to potentially have the greatest environmental impacts due to the construction of shoring systems, open cut excavations, and pile supported anchor blocks, dewatering and treatment efforts, and additional stream stabilization enhancements. Alternative No. 2 requires complete removal of the existing armoring and three full trenches; it also involves the most dewatering. The level of future additional geotechnical

Figure 6 – Existing Streambed Stabilization

investigations and engineering analysis is anticipated to be greater for Alternatives Nos. 2 and 3.

Constructability

Alternative No. 1 offers the least constructability concerns, but would require close coordination for extended water supply shutdowns for rehabilitation of the existing pipelines. Alternatives Nos. 2 and 3 would be constructed adjacent to the existing pipelines and require temporary system shutdowns to make the connections – potentially a shorter duration impact. Alternatives Nos. 2 and 3 are anticipated to have increased construction risk due to the nature of the construction methods and will require adequate ground investigation to help mitigate and/or manage the risks.

SUMMARY

All three alternatives were anticipated to require approximately eight years for project execution from conceptual design through construction and commissioning. The alternative with the highest score was Alternative No. 3 - Replace with Tunnels in Canyon Bottom. This alternative was selected by the Water Authority to move forward to the design phase of the project. The primary points that had the greatest influence in the selection of Alternative No. 3 as the preferred alternative include the following:

- The added value of risk mitigation associated with seismic hazards, stream bed erosion, and unbalanced thrust forces within the canyon bottom through a relocation outside the threat zones.
- The lowest construction and lifecycle cost.
- It eliminates the need to work within or restore the creek channel and eliminates the need to replace or upgrade the existing channel armoring.
- It eliminates construction activities within the creek.
- The option of maintaining or increasing pipe size and reducing headloss across the canyon bottom.

ABOUT THE AUTHORS:

Mahmood Khwaja *is a Vice President, and the National Discipline Leader - Tunnels, at CDM Smith. His 30+ years of experience includes planning, design management, and construction oversight of small to large scale tunnelling projects for the conveyance and transportation market sectors.*

Anjuli Corcovelos *is a Senior Water Resources Specialist in the Facilities Planning division at the San Diego County Water Authority. She has worked over 12 years in the public and private sector, delivering water, wastewater, stormwater, and energy projects. She has worked on several large-scale planning and design projects delivering drinking water infrastructure for the San Diego County Water Authority, West Basin Municipal Water District, Los Angeles Department of Water and Power, among several other agencies throughout Southern California.*

William Brick *has been with CDM Smith for over 27 years and is a Senior Project Manager and technical lead on conveyance projects throughout the Western US. His project work has included new pipeline designs and construction, pipeline rehabilitation, potable water pump stations and storage facilities, groundwater facilities, and recycled water use planning projects.*

NMDOT Culvert Reline under I-40: Jamestown, NM

By: Joe Menicucci, Contech Engineered Solutions

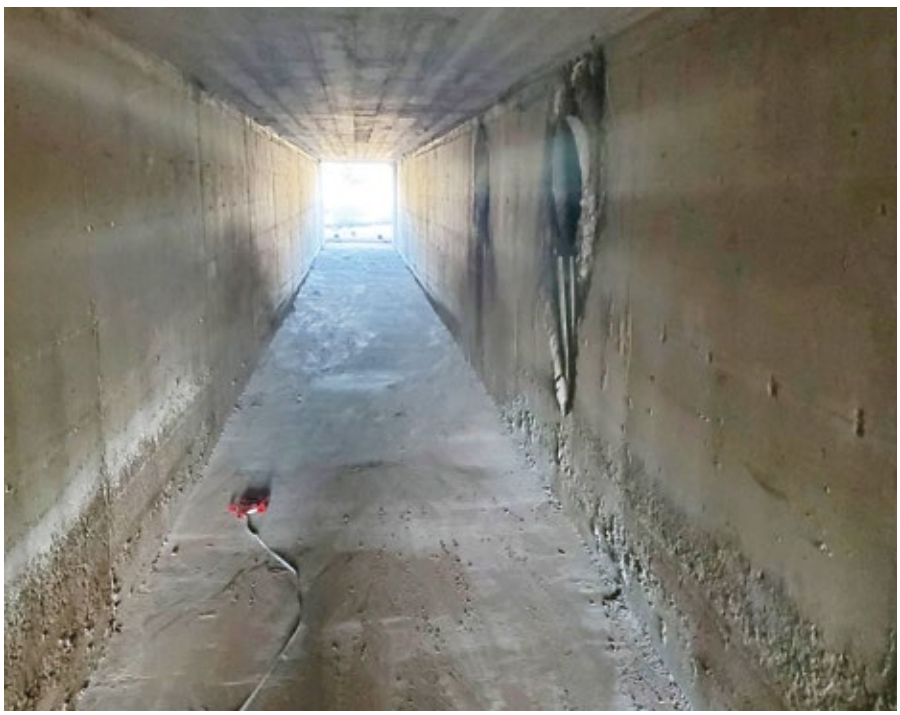
Technical Description:

• **Product: ULTRA FLO® Polymer-Coated, 16 GA Spiral Rib Pipe | Diameter: 47-inches | Length: 360 LF**

A major east-to-west route of the interstate highway, I-40 (U.S. Route 66) runs through several counties in the state of New Mexico connecting Southern California and Arizona to Texas and Oklahoma with traffic counts exceeding 20,000 cars and trucks per day, per a 2017 NMDOT Report. As such a heavily trafficked route, the New Mexico Department of Transportation (NMDOT) makes it a priority to ensure it is a safe and efficient transportation system for the traveling public.

CHALLENGE

During a routine inspection on a section of I-40 running through McKinley County, the NMDOT noted an existing concrete box culvert (CBC) extending under both east and west bound lanes of the heavily traveled I-40 had begun



Box culvert had failing concrete and exposed rebar

Unique spiral rib profile of the pipe met the hydraulic requirements for the project

Pipe is so light the contractor was able to use a medium-sized front-end loader to move each segment

to fail and was in need of either repair or replacement.

In the course of inspecting the 345 LF (50-inch rise x 72-inch span) CBC, the NMDOT noted concrete failing and rebar exposed throughout the culvert. Due to the location of the structure, just one mile from a critical offramp that services a refinery and travel center, an open-cut and replacement solution was not an option. In an effort to avoid shutting down the heavily trafficked corridor and diverting traffic for a prolonged period of time, the NMDOT looked to alternate solutions.

Given the current condition of the existing culvert, a simple, spray-on repair was not an option. Rather, a fully structural repair of the existing structure was required. They determined that relining the structure would be the most efficient method. However, the new pipe selected would need to match the existing structure as closely as possible to ensure the dimensions, waterway area and flow characteristics would not be negatively impacted. The new pipe must also be able to withstand local geotechnical challenges as native soil and water conditions were somewhat brackish.

The pipe was easily pushed into place using skid rails

Twelve 30-foot-length segments totaling 360 LF were pushed into the existing culvert

> *A fully structural repair of the existing structure was required.*

SOLUTION

Ultimately, the NMDOT selected a 16 GA, polymer-coated ULTRA FLO® spiral rib pipe with an outer diameter (O.D.) of 47-inches and inner diameter (I.D.) of 45.5-inches manufactured by Contech Engineered Solutions to reline the existing host pipe. The ULTRA FLO® liner was manufactured using custom outside diameter control with exact dimensions to ensure a proper fit and alignment with the host pipe. ULTRA FLO® is the only reline pipe in the marketplace that can customize its dimensions to meet client needs.

The final solution involved twelve 30-foot-length segments for a total of 360 LF that would be pushed into the existing culvert. The polymer coating would ensure that the design service life would be met within the known brackish conditions, while the unique spiral rib profile of the pipe would provide a Manning's "n" of 0.012 that would meet the hydraulic requirements for the project.

The pipe included polymer-painted angle iron skids welded to the bottom of the pipe at the 5 and 7 o'clock positions, increasing the ease of installation for the contractor, AUI, Inc.

Because ULTRA FLO® weighs less than 10 percent of concrete pipe, the contractor

Grouting required two days

> *Due to the location of the structure under the heavily traveled I-40, an open-cut replacement was not an option.*

was able to use a medium-sized front-end loader to set each liner pipe into the insertion pipe one at a time. The same loader was used to push each segment into the host pipe. The welded skid rails along the bottom of the new liner pipe ensured that the pipe would be easily pushed into place. AUI Inc. was able to push the ULTRA FLO® liner pipe via skid rails to facilitate proper placement of the line pipe sections, including blocking and bracing as required. As each segment was butted together, the contractor would enter the pipe and install the polymer-coated internal coupling bands. The same procedure was followed until all twelve segments were pushed into place and jointed. The ease of installation allowed the complete pipe installation to take place in just one and a half days.

AUI Inc. provided the grout plan that allowed the entire annular space between the pipe and the host culvert to be grouted from the headwall at the inlet. A free-flowing cellular grout was pumped from one entry port at the headwall of the inlet while monitoring was conducted throughout the multistage grouting process to ensure balanced filling on all sides and a reduction in any buoyant force of the fluid grout. The grouting required two days. Once complete, the final installation resulted in a fully structural and hydraulically efficient solution that would yield an estimated service life of 100+ service years. The NMDOT was extremely pleased with a solution that was not only cost-effective but also fully structural while allowing the interstate to remain open throughout the entire process.

ABOUT THE AUTHOR:

Joe Menicucci is the Contech Sales Engineer for New Mexico. Prior to joining Contech, Joe worked in various roles as a Superintendent, Construction Engineer, Project Manager and Estimator in the utility and petroleum industry, as well as a sales representative for polyethylene pipe. He earned his B.S. degree in Business Administration from the University of Phoenix. Joe is a member of the National Underground Contractors Association of New Mexico. Joe can be reached at joe.menicucci@conteches.com.

Sekisui Spiral Wound Liners Take on Las Vegas Clark County Water Reclamation District

By: Jacquie Jaques, Sekisui SPR Americas

INTRODUCTION: CLARK COUNTY WATER RECLAMATION DISTRICT

Las Vegas is a city that never sleeps. With that comes certain challenges especially when construction projects are involved. Case in point is how to rehabilitate sewers that are located on main thoroughfares where the flow cannot be diverted and temporary bypass pumping is an impossibility. This was the dilemma for Clark County Water Reclamation District. The District is the largest wastewater treatment agency in Southern Nevada. Their service district includes parts of the Las Vegas Strip, and many local communities including Laughlin, Indian Springs, Moapa Valley, Blue Diamond, and unincorporated parts in the Las Vegas Valley. With over 2,200 miles of sewer pipelines in their system, the District is committed to the health of this underground infrastructure through their routine maintenance, Capital Improvement plans, and repair programs to maintain system reliability and longevity.

LAS VEGAS STRIP SEWER REHABILITATION PROJECT

Located on Flamingo Road, under the I-15 Freeway in front of the Rio Hotel, Clark County was faced with a challenge on how to rehabilitate 900 feet of 15-inch VCP. Several rehabilitation methods were evaluated but they required flow by-passing, or a sizeable construction footprint. Clark County contacted SEKISUI SPR Americas to learn more about Spiral Wound lining solutions. With its many constructability advantages, Clark County decided that SPR™EX was the optimal solution that Clark County could consider for this location.

SPR™EX METHOD

SPR™EX is structural rehabilitation solution for gravity pipelines including sanitary sewers, storm drains and culvert. Standard profiles are available for 6 to 42 inches in diameter. SPR™EX liners can be installed in live flow typically without the need for bypassing; this being a key feature due to the constraints for this specific project. Flow levels of up to 30 percent full pipe can be managed. If flow

levels are higher, the use of temporary plugs can be utilized.

PROJECT EXECUTION

Under the watchful eyes of Penn and Teller, SEKISUI licensed contractor Nuline Technologies of Vista, California performed the sewer rehabilitation over two nights from 9 pm to 5 am. Traffic control was set up in the center lane which did not impede traffic to the casinos.

First, the lines were pre-cleaned, and video inspected before rehabilitation. Nuline utilized plug and release methods during the CCTV inspection, however, the lines were rehabilitated without any flow management. After verifying the pipe condition, the contractor was ready to set up the SPR™EX installation equipment.

The mechanical installation process begins by lowering the winding machine into the access chamber. The PVC strip is fed into the winding machine and the liner is constructed within the host pipe. SPR™EX liners are typically installed from the downstream to the upstream manhole however reverse set-ups are possible.

The pipe liner is constructed and pushed towards the upstream chamber. Once the liner reaches the termination manhole or structure, the liner is restrained, then expanded creating a customized, tight fit liner. The liner can adjust for offset joints and protrusions in accordance with ASTM F-1741-18.

Once the SPR™EX liner reaches the upstream manhole, the liner is torsionally restrained. Once secured, the operator will then expand the liner. The expansion process begins when the wire positioned between the primary and secondary (or sacrificial lock) is retracted, severing the secondary lock. This allows for successive wraps of PVC profile to expand, creating a customized tight fit liner against the inside of the host pipe.

As the wire is pulled, the liner continues to expand. The operator will continue to feed additional profile into the host pipe until the entire pipe segment is lined. Once the liner is expanded, the ends are sealed then the operator can immediately reinstate laterals using industry standard robotic equipment.

CONCLUSION

SPR™EX PVC Spiral Wound liners provided Clark County with a fully structural, stand-alone liner capable of withstanding all applied loads. This was all achieved without major site disruption due to Nuline installing during overnight hours and the limited above-ground construction footprint of the technology utilized. Furthermore, as there are no chemicals as part of the installation process, there were no complaints from businesses or residents regarding odors from the construction site.

ABOUT THE AUTHOR:

SEKISUI SPR
Leading-Edge Trenchless Solutions

SEKISUI SPR Americas, LLC *provides Spiral Wound liners for trenchless pipeline rehabilitation. Spiral wound involves constructing PVC liners inside existing pipelines utilizing machinery. SEKISUI SPR is based out of Atlanta, GA with representatives on the East and West Coast U.S.*

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